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UNITED STATES
DEPARTMENT OF THE INTERIOR

FINAL
ENVIRONMENTAL STATEMENT
VOLUME 2 OF 3

OIL AND GAS DEVELOPMENT IN THE SANTA BARBARA CHANNEL OUTER CONTINENTAL SHELF OFF CALIFORNIA

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PREPARED BY THE
UNITED STATES GEOLOGICAL SURVEY
DEPARTMENT OF THE INTERIOR

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(Director)

CONVERSION FACTORS FOR READER INFORMATION

Gravity in degrees API (^{o}API) = $\frac{141.5}{\text{Sp. gr.}}$ - 131.5 Example: Water = 10^{o} API

1 nautical or geographical mile = 6,076.12 feet = 1,852.00 meters

1 statute mile = 5,280 feet = 1,609.35 meters

1 knot = 1 nautical mile per hour = 1.151 statute miles per hour
= 1.69 feet per second (ft/sec)

1 cubic meter = 264.2 U. S. gallons = 35.31 cubic feet

1 cubic foot = 7.48 U. S. gallons

1 oilfield barrel = 42 U. S. gallons = 159 liters

Parts per million (ppm) = milligrams per liter (mg/L)

Parts per thousand (ppt) = milligrams per milliliter (mg/mL)
= grams/liter (g/L)

1 grain = 0.064798918 grams

1 grain per gallon (gpg) = 17.118 milligrams/liter (mg/L)
= 17.118 parts per million (ppm)

1 metric ton (M ton) = 1,000 kilograms = 2,204.62 pounds avoirdupois

1 U. S. standard pound avoirdupois = 453.592 grams

1 kilogram = 2.205 U. S. standard pounds avoirdupois

Weight of fresh water at 4^{o} C = 62.43 pounds per cubic foot
= 8.346 pounds per gallon

Average specific gravity of sea water = 1.025

Average weight of sea water at 4^{o} C = 63.99 pounds per cubic foot
= 8.555 pounds per gallon

1 megawatt (MW) = 1,000,000 watts (W) = 1,340 horsepower (hp)

1 British Thermal Unit (BTU) = heat required to raise the temperature of one pound of water at its maximum density 1^{o} F.

1 horsepower (hp) = 42.418 BTU per minute = 746 watts

1 kilowatt-hour (kwh) = 1,000 watt-hours (wh)
= 1.341 horsepower-hours (hph)
= 3,413 BTU

CONVERSIONS

DEPTH	TEMPERATURE	OIL GRAVITY
meters feet	degrees Fahrenheit / degrees Celsius	°API / specific gravity @ 60°F

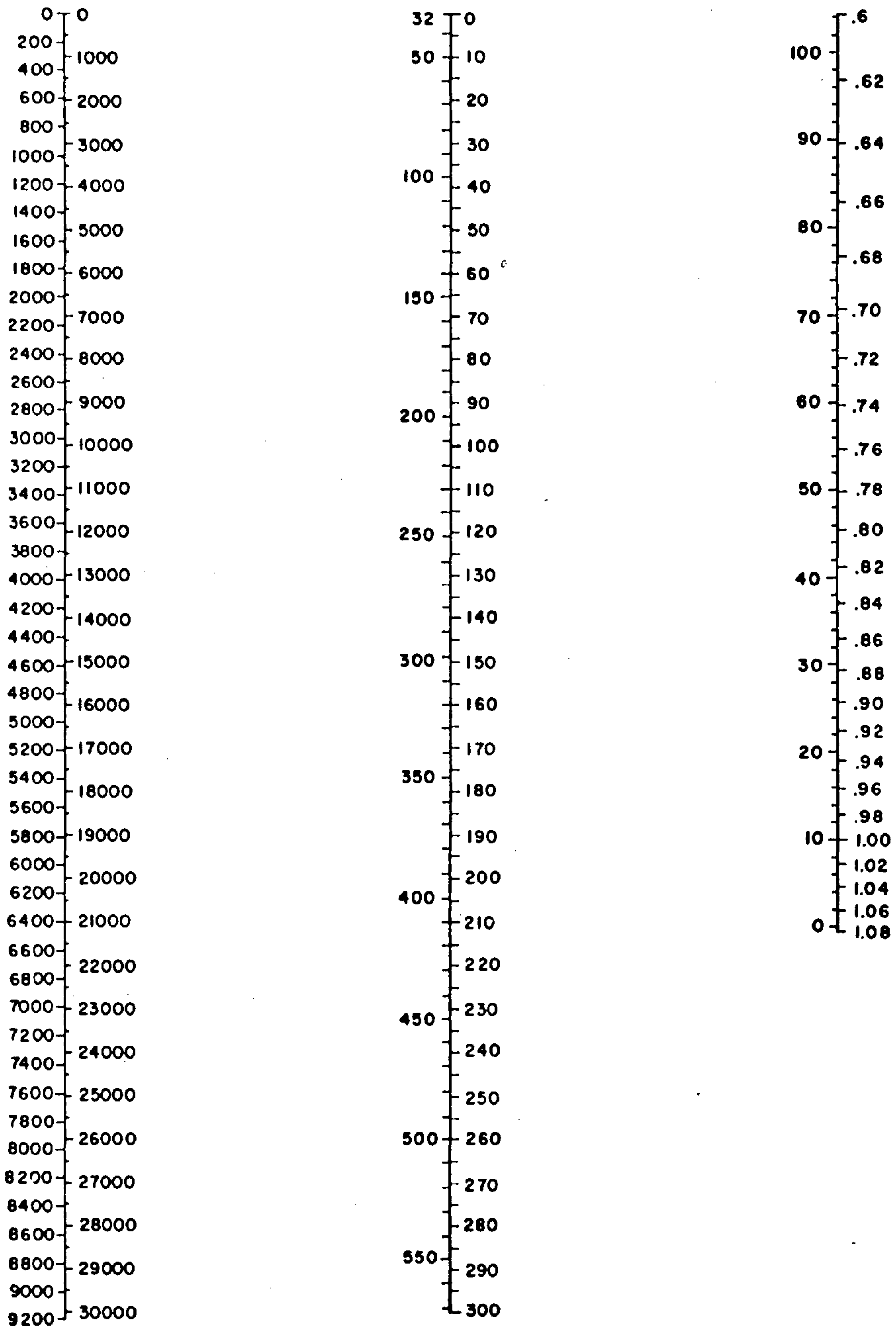

TABLE OF CONTENTS
VOLUME 2 OF 3

Page

Page

Page

Page

Page

LIST OF PLATES

(Plates in Separate Envelope)

LIST OF ILLUSTRATIONS

VOLUME 2 OF 3

II. Description of the Environment

Figure

Figure		Page

III. Environmental Impact of Santa Barbara Channel Oil and Gas Development

LIST OF TABLES

VOLUME 2 OF 3

II. Description of the Environment

NOTE: Tables III-11, 12, 13, 14, and 15 are non-existant.

E. Biology

1. Terrestrial Biology[1]

The purpose of this subsection is to provide broad scope coverage of the Santa Barbara Channel area including considerations and concerns. Emphasis is placed on Santa Barbara and Ventura Counties coastal area (shore line to five miles inland, or the crest of the Santa Ynez range), between Point Conception and the Los Angeles County line; the surface waters of the channel itself (aquatic birdlife); and the four northern Channel Islands. Material discussed is intended to provide background data for possible impacts from construction and operation of production facilities. In the event of a definite proposal (such as construction of an onshore facility or installation of a pipeline) detailed site specific studies would be required.

All data concerning terrestrial vertebrate faunas are current as of May 1974. Source material drawn upon is primarily federal and state published reports; current ongoing vertebrate data collection programs of the Los Angeles County Museum of Natural History and the University of California at Los Angeles; and current on-area biological reconnaissance.

NOTES: Tables are presented at the end of the Terrestrial Biology Subsection following II.E.1.e.

Rare and endangered species are listed in section II.E.1.e., and the reader is referred to this list if in doubt a species is so categorized.

Table II-11 summarizes typical Biotic Communities of the South Coast Subprovince, with emphasis on the Santa Barbara Channel coastline, tables II-12 through II-16 list vertebrate faunas of the Northern Channel Islands; tables II-17 through II-19 list vertebrate faunas of Santa Barbara and Ventura Counties Coastal Areas (tables II-12 through II-19 compiled by K. E. Stager).

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[1] Consultant: Kenneth E. Stager, Ph.D., Senior Curator of Birds and Mammals, Los Angeles County Museum of Natural History.

a. Santa Barbara County Coastline

The 110 miles of County coastline consists of 24 miles of rocky shores and 86 miles of beaches. Existing State, County and City parks and beaches are discussed under section II.F.2, "Recreation." Important bays, marshes and streams are listed and indicated in figure II-33; also shown is acreage of wetland and upland habitat.

(1) Wildlife Habitat and Species Abundance[1]

Uplands

Sand dune areas comprise the only unique upland habitat in the coastal zone. With the exception of two stretches of sand dunes in the northern part of the county, the upland habitats of the coastal zone are not of significant importance in the maintenance of upland game and big game species in the county.

The sand dunes south of the Santa Maria River and fronting Vandenberg Air Force Base provide excellent habitat for quail and rabbits where exceptionally high populations of those species are found. A small colony of least terns (endangered and rare) use uplands adjacent to the Santa Ynez River as a nesting site.

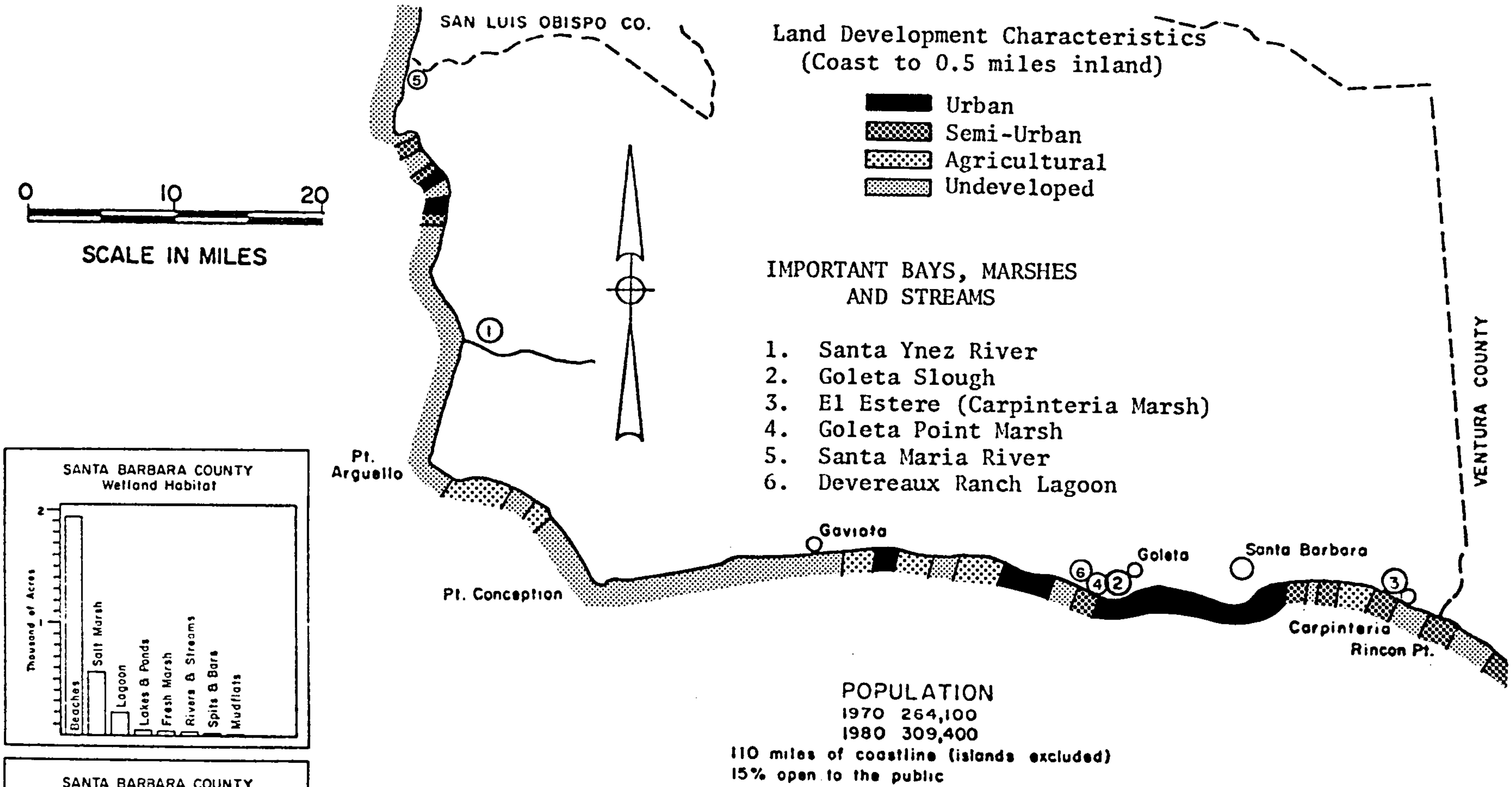
Wetlands

Significant numbers of shorebirds, waterfowl and a variety of other water-associated birds are dependent on Santa Barbara coastal wetlands for survival. The County possesses a scant 900 acres of such wetlands, 80 percent of which are located at Goleta Slough and Carpinteria Marsh and on the Santa Ynez River. The Department of Fish and Game, in August 1970, published a report on "The Natural Resources of Goleta Slough." The slough is used by 51 species of water-associated birds. The Department estimated that the slough supports 400,000 bird days of use annually.

Carpinteria Marsh (El Estero), a 200-acre wetland, provides an estimated 170,000 bird days' use annually. Bi-weekly counts in 1966-67 showed that the marsh was used by 44,000 ducks. Wildlife use of the Santa Ynez and Santa Maria Rivers taken on an acre-for-acre basis is comparable to that of Carpinteria Marsh.

Goleta Slough, Carpinteria Marsh, and the mouth of the Santa Ynez River, comprising 80 percent of the county's wetlands are of major importance to the maintenance of numerous wildlife species. Goleta Slough, the largest of the three wetland areas, received much attention from conservation groups and individuals following freeway plans that would have required the filling

[1] Quoted with minor editorial changes from California Department of Fish and Game, August 1973, p. 176, 177, 181.



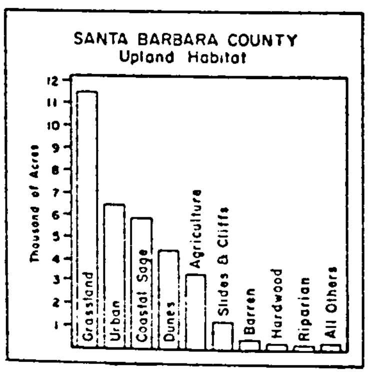


FIGURE II-33

SANTA BARBARA COUNTY - COASTAL SYNOPSIS
Modified from California Department of Fish and Game, 1973, p. 174

(Land Development Characteristics from California Comprehensive Ocean Area Plan, 1971, p. 280-283) of a portion of the slough. Opponents of the freeway succeeded in preventing the freeway crossing in Goleta Slough following a coast guard hearing on the matter. Public ownership of Goleta Slough by the City of Santa Barbara provides an excellent opportunity for maintaining its natural assets.

Carpinteria Marsh, in recent years, has been the subject of efforts by its private landowners to relinquish ownership to the state in return for ecological preservation of the area and low level use. The present owners greatly value the contribution of the marsh in providing seclusion. Efforts should continue to place this area in public ownership for nonappropriative or passive recreational activities and scientific studies. Present management of the marsh, which includes keeping the channel open to the sea to allow for continuous tidal flushing, has maintained its high quality.

The mouth of the Santa Ynez River, possessing some 160 acres of wetlands, is within Vandenberg AFB. A Fish and Wildlife Plan, prepared jointly by the Department of Fish and Game and the Bureau of Sport Fisheries and Wildlife has been approved by the military and serves as a guide for management of the wildlife resource. The plan places emphasis on the value of the marsh and provides for its proper management. The management plan now being carried out for this wetland area should be continued.

In addition to the wetlands of Goleta Slough, Carpinteria Marsh and the Santa Ynez River, there are about 170 acres found adjacent to other streams and lagoons of the county.

The alteration of natural streamflow in the county is responsible for a loss of many wetland areas, and other human activities have effectively destroyed other wildlife support systems, making the remaining areas take on increased importance. These habitats are essential to the continued existence of some 150 species of water-associated birds, providing the necessary life requirements to thousands of migratory and resident birds in the Pacific Flyway. All development proposals for the above listed areas should include information on the impact brought about by such plans on the wildlife resources.

WETLANDS OF SANTA BARBARA COUNTY POSSESSING
WILDLIFE HABITATS OF CRITICAL IMPORTANCE

Area	Type of Habitat in Acres
Goleta Slough	Marsh, 260
El Estero (Carpinteria Marsh)	Marsh, 150; mudflat, 35; water, 15
Santa Ynez River	Marsh, 110; water, 50
Goleta Point Marsh	Marsh, 25; water, 35
Santa Maria River	Marsh, 50; water, 15
Devereaux Ranch Lagoon	Marsh, 15; water, 30

Type	Total Acres	Percent
Marsh	610	77.2
Mudflat	35	4.4
Water	145	18.4

Sandy Beach

. . . . About 67 percent of Santa Barbara's sandy beach is privately owned, but most remains undeveloped. The 14 miles of federally owned sandy beach is mostly within the boundary of Vandenberg AFB. Low human use of these beaches is conducive to undisturbed use by the dependent bird species. Some shorebirds that are supported by this habitat type for feeding or nesting include snowy plover, semi-palmated plover, American golden plover, black-bellied plover, whimbrel, sanderling, marbled godwit and the western willet.

The 9.5 miles of state and county owned beaches receive nearly 750,000 visitors annually. Such heavy use precludes nesting activities on the beach; however, during the off-season for bathers and during early morning and late evening hours of the summer the beaches are utilized by shorebirds.

Rocky Shoreline

About 26 miles (24 percent) of the Santa Barbara County coast is classified as rocky beach and rocky headlands. The precipitous cliffs and rocky shore provide nesting and feeding habitat for the black oystercatcher, black turnstone, ruddy turnstone, spotted sandpiper, surfbird, wandering tattler, and western gull. About half of this habitat type remains in public ownership. Lion Rock and rocks at Point Arguello have been classed as nonbreeding-roosting sites and as such are of less importance to seabirds than the nesting rocks of central and northern California.

(2) Wildlife Utilization

The County coastal zone does not contribute significantly to the appropriative use of upland and big game species. Most of the 2,700 ducks and 100 geese taken in the 1969-70 season were from in the coastal zone.

The majority of non-appropriative use of coastal wetlands and uplands is comprised of birdwatching, photography, and scientific study. Of wetland areas Goleta Slough receives the most use throughout the year for bird observation. Educational use is discussed under section II.F.4. "Education." (California Department of Fish and Game, August 1973, p. 177)

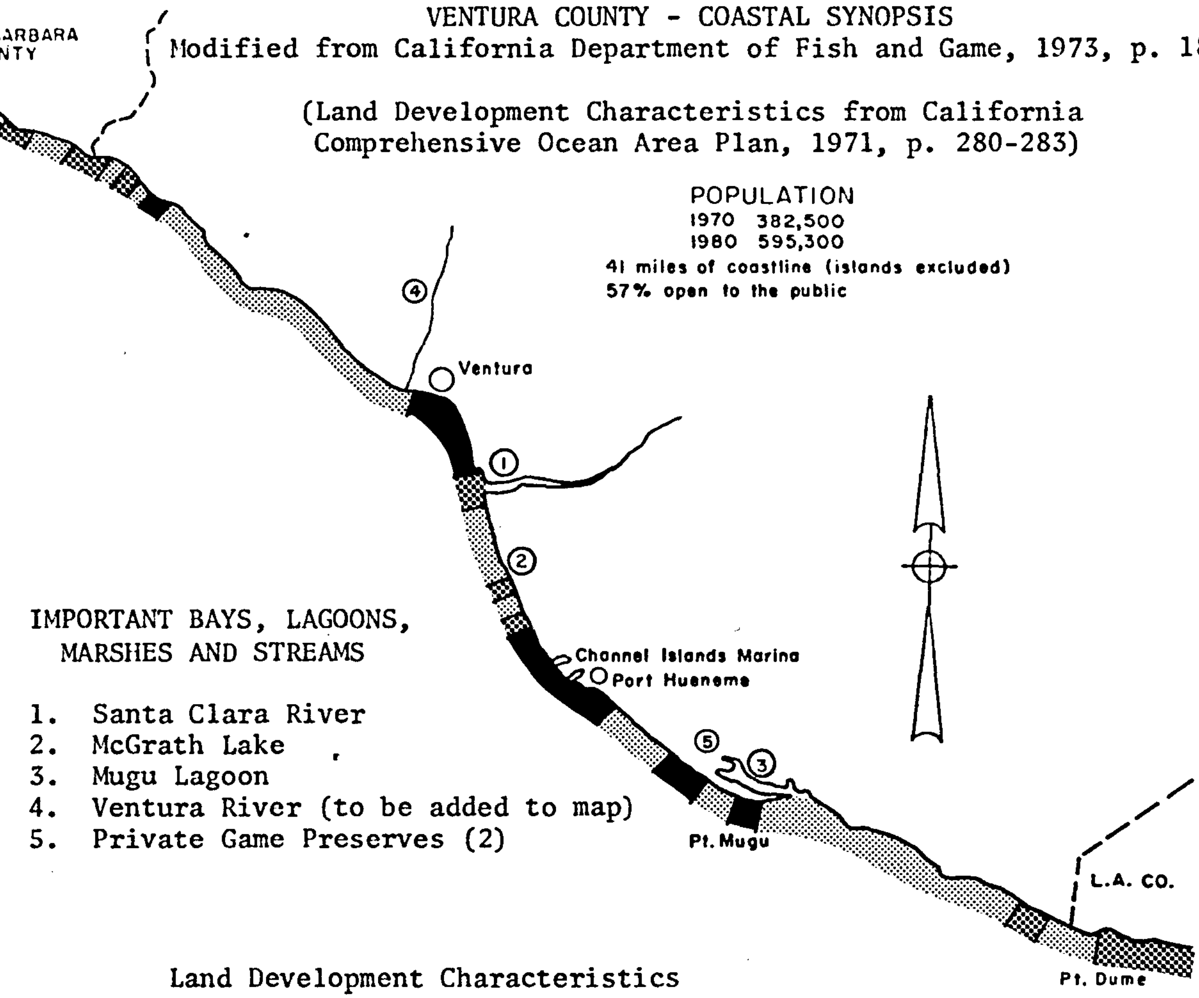
b. Ventura County Coastline

The County's 41 miles of coastline consists of 3 miles of rocky shores and 38 miles of beaches. Figure II-34 identifies important

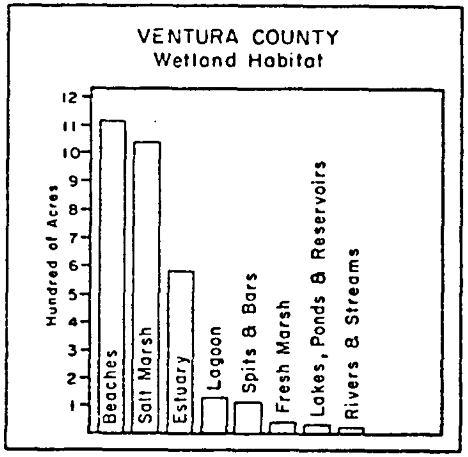
FIGURE II-34

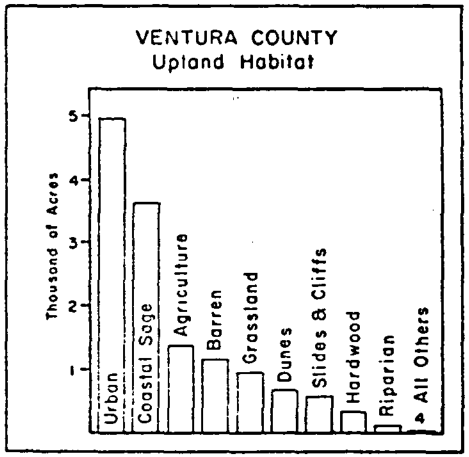
VENTURA COUNTY - COASTAL SYNOPSIS
Modified from California Department of Fish and Game, 1973, p. 187

(Land Development Characteristics from California Comprehensive Ocean Area Plan, 1971, p. 280-283)



POPULATION
1970 382,500
1980 595,300
41 miles of coastline (islands excluded)
57% open to the public





IMPORTANT BAYS, LAGOONS, MARSHES AND STREAMS

1. Santa Clara River
2. McGrath Lake
3. Mugu Lagoon
4. Ventura River (to be added to map)
5. Private Game Preserves (2)

Land Development Characteristics
(Coast to 0.5 miles inland)

- Urban
- Semi-Urban
- Agricultural
- Undeveloped

bays, lagoons, marshes, and streams, as well as acreage of wetland and upland habitats. Section II.F.2."Recreation" contains data on existing national, State, County and City Parks.

(1) Wildlife Habitat and Species Abundance[1]

Uplands

Most of the upland habitat types found in Ventura County's coastal zone also occur in inland areas of the county and none are singularly significant in the maintenance of the county's upland and big game species. Without the necessary habitat, however, those upland animals and birds now found in the coastal zone would disappear.

Wetlands

Shorebirds, waterfowl and a number of other water-associated birds are dependent on the county's coastal wetlands for survival. Some 2,290 acres of marsh and mudflat habitats are found at Mugu Lagoon, Santa Clara River, Ventura River, and McGrath Lake. Mugu Lagoon itself contains 95 percent of the county's wetlands. It is estimated that in excess of 120 species utilize the marsh and mudflats of Mugu Lagoon and other wetlands of the county. The light-footed clapper rail[2], a species now in danger of extinction, is found at Mugu Lagoon, one of the few remaining areas in California supporting clapper rails. The degree of bird use on Ventura County's wetlands has not been documented. However, it is estimated that such use is comparable, acre for acre, to that occurring in the wetland areas of neighboring counties. The 360 acre Goleta Slough in Santa Barbara County, for instance, receives in excess of 400,000 bird days' use and/or 1,100 bird days' of use per acre.

WETLANDS OF VENTURA COUNTY POSSESSING WILDLIFE HABITATS OF CRITICAL IMPORTANCE

Area	Type of Habitat in Acres
Mugu Lagoon	Marsh, 1420; mudflat, 500; water, 250
Santa Clara River	Marsh, 40; water, 20
McGrath Lake	Marsh, 5; water, 15
Ventura River	Marsh, 5; water, 5

Type	Total Acres	Percent
Marsh	1,470	65
Mudflat	500	20
Water	290	15

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[1] Quoted from: California Department of Fish and Game, August 1973, p. 189, 190, 194. (Some additional data supplied)

[2] Endangered and rare species.

The wetlands, located at Mugu Lagoon, are considered the most important in the county, comprising some 95 percent of the total. A fish and wildlife plan was prepared jointly by the Department of Fish and Game and the Bureau of Sport Fisheries and Wildlife for the military installation at Mugu Lagoon. The plan places emphasis on the value of the marsh and provides for its proper management.

The other county wetlands, while comprising only five percent of the total are extremely important due to the generally arid nature of the adjacent area.

The limited extent of the California estuarine habitat, especially that found in southern California, makes the remaining areas take on increased importance. These habitats are essential to the continued existence of some 150 species of water-associated birds, and provide the necessary life requirements to thousands of migratory and resident birds in the Pacific Flyway. All planned development proposals for the above listed areas should include data on the impact brought about by such modifications on the wildlife resources.

An area of considerable importance to the wetland resources of Ventura County, but seldom mentioned, is the 720 acres of fresh water ponds provided by two private game preserves in the Pt. Mugu area. The largest preserve of the two is the Ventura County Game Preserve with a total of 500 acres of ponds, 100 acres of which are permanently flooded and 400 acres are annually flooded from July 1 to April 1 (nine months). The second preserve is the Pt. Mugu Game Preserve with a total of 220 acres of ponds, 20 acres of which are permanently flooded and 200 acres flooded annually from July 1 to April 1 (nine months). Not only do these two private preserves provide feeding and resting areas for thousands of migratory waterfowl, but desirable and much needed fresh water marsh habitat for large numbers of shorebirds and non-game species as well. These two preserves provide the major fresh water habitat of coastal Ventura County, exceeding the total acreage (90 acres) of Santa Clara River, McGrath Lake and Ventura River by 620 acres.

Sandy Beach

About 38 miles (93 percent) of the Ventura County shoreline is classed as sandy beach. Of this amount, 28 miles (74 percent) is in public ownership. For the season of 1968-69 the Department of Parks and Recreation estimated that its beaches in Ventura County accommodated over one million visitors. This use occurs primarily during the summer months which would preclude successful nesting success by species utilizing sandy beaches for this activity. However, during the winter migration of shorebirds and waterfowl, the beaches provide feeding areas for semi-palmated plover, American golden plover, black-bellied plover, whimbrel, sanderling, marbled godwit, western willet, western sandpiper, and the least sandpiper. Any future county plans for beach utilization should include data for the requirements of nesting species for this habitat.

Rocky Shorelines

A little over three miles of the Ventura shoreline is classed as rocky beach. The precipitous cliffs and rocky shore provide nesting or feeding habitat for the black oystercatcher, black turnstone, ruddy turnstone, spotted sandpiper, surfbird, wandering tattler and western gull. About half of this habitat type remains in public ownership. However, Bass Rock and rocks off Point Mugu have been classified as non-breeding roosting sites and as such they are of minor importance to sea birds.

(2) Wildlife Utilization

Appropriative use of game species in the coastal zone includes the common snipe, 35,400 ducks (1969-70 season), and 500 geese (1969-1970 season). The coastal zone is relatively insignificant to the use of upland game and big game species. While nonappropriative use has not been documented by the California Department of Fish and Game, wildlife of the coastal zone undoubtedly add to the experience of persons living in or visiting the area. Days attributed to outdoor recreational activities are therefore one measure of the nonappropriative use of wildlife resources. See section II.F.2., "Recreation" and section II.F.4., "Education" for further discussion of nonappropriative use.

c. Selected Coastal Areas of Natural Values and Features

(1) Point Arguello to Point Pedernales Area (Santa Barbara County)

The area of 4 square miles is owned by Vandenberg Missile Base, U. S. Air Force. The area extends from Point Pedernales south to Cañada Aqua Vina (Transverse Ranges, Santa Barbara County).

National Park Service (NPS) themes include seashores, lakeshores, islands and sculpture of the land. Although not necessarily of natural landmark caliber the area is not discounted for eligibility as a natural landmark.

Biotic Communities

Grasslands and coastal sage communities cover most of the area; this vegetation appears to be in a fairly natural condition. Colorful wildflower displays dominate the flat terrace grasslands during the spring months.

(2) Point Conception (Santa Barbara County)

The 1½ square mile area contains the NPS themes of seashores, lakeshores and island, and eolian (sand dune) landforms. Although doubtful that this site would be eligible for natural landmark status, the possibility is not excluded. Biotic communities are not specified in NPS literature, however, the broad region is considered as the transition point between flora and fauna typical of southern California and those typically northern or central.

(3) Mugu Wetlands (Ventura County)

The 1,800 acres are under the ownership of the U. S. Department of Defense (U.S. Navy).

A portion of the Mugu Wetlands is eligible for inclusion in the Registry under the themes: Special Ecosystems, Coastal Salt Marsh Strand, Chaparral, Coastal Sage Scrub, and Special Interest Species.

The shallow sunlit waters and mud flats of such estuarial systems generate food supplies for higher trophic levels at remarkable productivities which belie their small size. Due to a unique combination of nutrient status, temperature regime, moisture relations, and insolation coastal wetlands are among the most productive ecosystems known. The wide clean beach, large lagoon, and extended inland slough are prime examples of the beauty that used to accompany the mouths of many drainages along the coast of southern

California. Coastal strand plants include: *Abronia maritima, Franseria chamissonis,* and *Atriplex leucophylla*. Coastal salt marsh plants include: *Salicornia virginica, Suaeda californica, Distichlis spicata,* and *Atriplex lentiformis ssp. breweri*. Coastal sage scrub plants include: *Coreopsis gigantea, Eriogonum cereum, Artemesia californica, Encelia californica, Haplopappus ericordes*.

Endangered Species and Unique Values

Endangered and rare animal species of the area include: clapper rail, peregrine falcon, and Belding savannah sparrow.

Surface features are recent alluvium and beach sand. These wetlands are: the southeasternmost corner of the Oxnard-Camarillo Plain, an alluvial outwash from the higher lands to the north. The beach is large and active; the tidal exchange in the lagoon is considerable. The wetlands are bordered on the east by cliffs of Miocene sandstones and shales against which some sand dune formation has taken place. The Mugu Wetlands are unique in southern California. Other wetlands have been filled, channeled, drained, developed for recreation, and otherwise encroached, and continue to be diminished. Naval security restricts the ravages of public use, and government ownership can curtail any further degradation of this vital link in the Pacific Flyway by a strict policy. Bird students from the entire U. S. visit Mugu Wetlands because of its prolific wildlife, especially birds. Over 175 species of birds, including the rare clapper rail, have been documented in the area. (See National Park Service, March 1973, p. 325-327.)

Special Concerns

Along the east a Navy rifle firing range has been installed on the beach at Point Mugu. Heavy equipment tracks are sometimes visible in marshy areas around the lagoon. Upstream from the marsh the streams have been channelized, the plains are under intensive cultivation, and accessory wetlands have been drained. For the most part, the lagoon itself and surrounding marsh is undisturbed. Building programs which require filling operations or encroach on the slough, operation of machinery in the wetlands (landing craft, bulldozers, etc.), or the presence of large numbers of people in these areas may drive away the rather timid animals and bird residents and visitors, and render the area unsuitable for their use. The U. S. has treaty obligations with Mexico and Canada to protect and provide suitable areas for migratory wildlife. These are one of the few remaining, relatively undisturbed wetlands of any size between the Oceanside San Diego area and the Morro Bay.

(4) Point Dume (Los Angeles County, T. 1S., R. 18W., S.B.M.)

The 275-acre site is under the ownership of Los Angeles County and various private landowners. Current land use is recreation. Portions of the area have been suggested for consideration for inclusion in the Registry of Natural Landmarks.

Point Dume represents many natural communities where the land meets the sea. Crashing surf, rocky shore, sea cliffs, coastal strand and sandy beach, and marine terraces clothed with strand and coastal sage scrub vegetation. Biotic communities include benthic marine and kelp beds, coastal strand, coastal bluff, coastal sage scrub. Surf-beaten rocky beach, shore, and sea cliffs. Intertidal plants are surf grasses *(Phyllospadix torreyi, P. scouleri)*, sea lettuce *(Ulva lactuca)* and numerous red, brown and green algae. Invertebrates are acorn barnacle *(Balanus tintinnabulum, B. glandula)*, beach flea *(Orchestoidea columbiana)*, isopod *(Lygida occidentalis)*, lined shore crab *(Pachygrapsus crassipes)*, limpets, abalones, sea urchins, rock oysters, sea anemones, sea slugs, sea cucumbers. Sandy coastal and coastal strand. Sandbur

(Franseria chamissonis bipinnatisecta), white-leafed saltbush *(Atriplex leucophylla)*. On the coastal bluffs and marine terraces are found the giant coreoopsis *(Coreopsis gigantea)*, purple sage *(Salvia leucophylla)*, bladderpod *(Isomeris arborea)*, coyote brush *(Baccharis pilularis* sp. *coneanguinea)*, California sagebrush *(Artemisia californica)*, lemonade brush *(Rhus integrifolia)*, laurel sumac *(R. laurina)*, California Encelia *(Encelia californica)* and California buckwheat *(Eriogonum fasciculatum)*. Strand plants are: ice-plants *(Mesembryanthemum nodiflorum, M. crystallinum, M. chilense)*, lupine *(Lupinus chamissonis)*, *Haplosappus ericoides, Lathurus litoralis, Abronia maritima, A. umbellata, Oenothera cheiranthifolia, Poa douglasii*. Mammals include: harvest mouse *(Reithrodontomys megalotis)*, deer mouse *(Peromyscus maniculatus)*, raccoon *(Procyonlotor)*. Temporary animal populations include surfbirds, wandering tattler, black oystercatcher are restricted to the rocky coastal habitat. Snowy plover is restricted to undisturbed sandy beaches for nesting, a rarity in southern California. Endangered and rare animal species found here are: brown pelican, and peregrine falcon.

Special Considerations

With proper management the area will retain its biological integrity. However, threats to the area are development, marinas, pollution, urbanization, heavy foot traffic on the beach, indiscriminate collecting and human disturbance.

The area represents these Natural History themes: Chaparral, Coastal Sage Scrubs, Special Ecosystems, Coastal Strand, Special Interest Species, and Benthic tidal communities. (See National Park Service, March 1973, p. 333-336.)

(5) Point Hueneme Dune Locality (Ventura County)

The 2½ square mile coastal strip extends from the Santa

Clara River southward to Hollywood Beach.

The best areas appear to be at the northern end of the site around McGrath Lake and the sand spit just to the north of Point Mugu.

Consideration of the site for natural landmark status is questionable but not excluded. McGrath Lake is an example of a Freshwater Marsh and considered a high quality occurrence over which the California Resources Agency has expressed concern for existing landscape protection.

(6) Carpinteria Asphalt Deposits and Tar Pits (Santa Barbara County)

Located within the boundaries of Carpinteria State Park, the National Park Service theme of Golden Age of Mammals (Pleistocene fossil locality) is noted as a significant fossil site second only to the La Brea deposits. In an unusual manner the tar seeps, many of which are still active, cement seaweed, pebbles, and rock into a firm conglomerate, thus forming present day "fossils." Detail on fossil flora and fauna are available in Correa, Lipps, and Zumvalt (no date).

(7) Areas of Special Biological Significance

Areas of Special Biological Significance and their status are discussed under section II.G.2.b.(2) Water Quality.

d. Northern Channel Islands

The Channel Islands are the most significant islands in the region and comprise one of the most significant areas under the National Park Service category, "Landforms of the Present", to be found within the South Pacific Border natural region. The 2 smallest islands, Santa Barbara and Anacapa, comprise the Channel Islands National Monument; many proposals have been considered to include several other Channel Islands along with these two small islands and create a new national park. Certainly many of the islands have sufficient scenic and natural values to be eligible for national park status, but many complex and delicate political issues and difficulties arise when considering these areas for national park sites.

According to the National Park Service, nowhere else in the South Pacific Border natural region are so many important natural history themes found at individual sites and are so inter-related with one another. The geologic history has been most important in retaining the many unique animal and plant species found on the islands. The vegetation of the islands is different from that found anywhere else in the U. S.; this has resulted due to the restriction of an extremely mild and maritime climate which once covered much of the western U. S. and is now confined to the Channel Islands. The majority of the Channel Island vegetation was derived from what has been termed the Madro-Tertiary geoflora; this geoflora was originally composed of woody plants and included many of the species now found in the present closed cone pine forest, oak pine woodland, chaparral and the thorn forest vegetation now found growing in Mexico and the southwestern U. S. As the climate became drier and more intemperate throughout California during the Miocene and Pliocene, this community gradually became isolated and restricted to more maritime conditions. Eventually many species were eliminated from the coast and now survive only in the extremely maritime Channel Islands. Thus the California insular forest resulted from the restriction of climate in which these communities could survive. It appears doubtful that geologic isolation was essential or needed for the development of the many endemics found in the islands.

Geologically, the Channel Islands may be most conveniently grouped into the Northern Channel Islands (Anacapa, Santa Cruz, Santa Rosa, and San Miguel), and Southern Channel Islands (Santa Catalina, San Clemente, Santa Barbara and San Nicholas).

The 4 Santa Barbara Channel Islands are considered by the National Park Service and other State and Federal Agencies to be of national significance. In addition to the geologic and geomorphic features, prime values include marine mammals (section II.E.2.a(8)) and marine- and shore-associated birds (table II-12). See also tables II-13 through II-15 for Terrestrial Birds, Terrestrial Mammals, and Reptiles and Amphibians of the Northern Channel Islands. The Santa Barbara Channel area including the channel mainland shoreline, and four offshore islands support a wide variety of marine-associated bird life. Aerial surveys and beach transects of the area in 1969 recorded a total of 51 species in the following groups: loons and grebes, pelagic species, cormorants and the brown pelican, waterfowl, water-associated birds, shorebirds, gulls and terns. The surveys indicated a bird population of about 12,000 in the 1,075 square miles surveyed during January 28 to March 31, 1969. Similar surveys conducted during April 1 to May 31, 1969 recorded a bird population of about 85,000. These fluctuations in population levels are to be expected as the birds migrate along this portion of the Pacific Flyway. Peak numbers of birds are expected in the fall and spring.

(1) Anacapa Island

(Ventura County, National Monument, 700 acres, 11 miles of shore.) Biotic communities: Coast Sagebrush, South Coast Grasslands.

"Except for an introduced grove of eucalyptus on Middle Anacapa, the vegetation on Middle and East Anacapa is less than five feet high and is dominated by grassland, *Coreopsis, Opuntia, Dudleya, Haplopappus,* and *Rhus integrifolia*. West Anacapa has in addition some taller Coreopsis on the high mesa, and three gullies with trees up to 40 feet tall (oak, toyon, island cherry)." (Diamond and Jones, 1970)

(2) Santa Cruz Island

(Santa Barbara County, privately owned, 62,000 acres, 45 miles of shore.) Biotic communities: Maritime Pine Forest, Oak Woodland, Coast Sagebrush, Chaparral, South Coast Grasslands.

"This is the largest, and vegetationally the richest, island. Native trees up to 60 feet high are the oaks of the Central Valley, two areas of pine forest, and a grove of cottonwoods in a gully of the Central Valley, plus planted groves of 150-foot eucalyptus. There are large expanses of arborescent chaparral sufficiently dense as to resemble a closed low woodland, dominated by oaks, manzanita, mountain mahogany, chamise, island cherry, *Ceanothus insularis, Rhus integrifolia,* and toyon. Much of the rest of the island is grassland." (Diamond and Jones, 1970)

(3) Santa Rosa Island

(Santa Barbara County, privately owned, 55,000 acres, 45 miles of shore.) Biotic communities: Maritime Pine Forest, Oak Woodland, Coast Sagebrush, South Coast Grasslands.

"The best developed vegetation consists of trees 30 feet high: the grove of Torrey Pine on the coast east of the ranch; oaks, toyon, willows, and island cherry in Lobo Canyon; oaks, toyon, island cherry, ironwood, and pine on the north slopes of Black Mountain; and willows and eucalyptus near the ranch. There are also considerable areas of scrub up to four feet high (sage, scrub oak, chamise, *Baccharis pilularis, Opuntia, Rhus integrifolia,* toyon, *Coreopsis).* Much of the island is grassland or barren, perhaps due in part to former overgrazing. As on San Miguel, wind is strong." (Diamond and Jones, 1970)

(4) San Miguel Island

(Santa Barbara County, U. S. Navy administered, public not allowed ashore, 9,000 acres, 24 miles of shore.) Biotic communities: Coast Sagebrush, South Coast Grasslands, Coastal Strand. Sheep and cattle were introduced to the island over 100 years ago and thus much of the native vegetation has been depleted.

"All vegetation is less than four feet high except for some *Baccharis pilularis* bushes six feet high. The best developed scrub is in Ranch Canyon, Willow Canyon, and around Cuyler Harbor. There are trickles of fresh water in Ranch and Willow Canyons and at several points around the coast, and Willow Canyon has a small cattail swamp. The high winds characteristic of San Miguel are a limiting factor for both birds and vegetation." (From Diamond and Jones, 1970)

e. Rare and Endangered Species

The Santa Barbara Channel area under consideration in this statement harbors a number of animal species officially designated as endangered and rare on State, Federal, or International lists. Seven species of endangered and rare birds make up the list as follows:

California Condor - *Gymnogyps californianus*

Southern Bald Eagle - *Haliaeetus leucocephalus leucocephalus*

California Brown Pelican - *Pelecanus occidentalis californicus*

American Peregrine Falcon - *Falco peregrinus anatum*

Light-footed Clapper Rail - *Rallus longirostris levipes*

California Least Tern - *Sterna albifrons brown*

Belding Savannah Sparrow - *Passerculus sandwichensis belding*

Two species of birds and one species of mammal appear on the rare list as follows:

Birds

Black Rail - *Laterallus jamaicensis coturniculus*

Yellow-billed Cuckoo - *Coccyzus americanus occidentalis*

Mammals

Island Fox - *Urocyon littoralis*

There are no officially listed endangered or rare reptiles, amphibians, or freshwater fish known to occur in the area under consideration.

Considerable confusion exists in the minds of many concerned persons as to what constitutes a rare or endangered animal species. Actually there are three official lists concerned and none of the three totally agree with one another. The three designating sources are as follows:

(1) State of California (California Department of Fish and Game)

Pursuant to the California Endangered Species Act of 1970, the Fish and Game Commission periodically declares threatened species of California animal life as rare or endangered. All of the previously listed species of birds and mammals appear on the State list.

(2) United States Department of the Interior (U.S. Fish and Wildlife Service)

The federal Endangered Species Protection Act of 1966 (80 Stat. 926) and its amended versions (including the Endangered Species Act of 1973 (16 U.S.C. §§ 1531-1543) designates only endangered species and omits the category of rare. The first six of the seven species of endangered birds previously listed are found on the Federal list, but the Belding savannah sparrow is omitted.

(3) I.U.C.N. "Red Book List" (International Union for Conservation of Nature and Natural Resources located at Morges, Switzerland)

This international list is of broader scope and lists both categories of Endangered and Rare. Only two of the previously listed species occur in the IUCN Red Book list, however. These are: California Condor (Endangered) and Southern Bald Eagle (Rare).

The State of California and the U. S. Department of Interior designations are the most important insofar as the endangered animal life is concerned, as they provide the protective legal support for the preservation of these vanishing species.

Current Status (Endangered and Rare Species)

California Condor - *Gymnogyps californianus*

No impact on this species as far as this study area is concerned. This large vulture seldom forages into this region. A single individual was observed on the Sudden Ranch north of Point Conception in 1973.

Southern Bald Eagle - *Haliaeetus leucocephalus leucocephalus*

Formerly abundant on the Channel Islands, but now extirpated there since 1960. Occasional vagrant wintering birds appear in the area, the latest recorded sighting was at the Santa Barbara Bird Refuge in 1971.

California Brown Pelican - *Pelecanus occidentalis californicus*

Formerly nested abundantly on all of the four Northern Channel Islands, but now decreasing rapidly. The only remaining breeding colonies in southern California are on Anacapa Island and Scorpion Rock, off Santa Cruz Island. The viability of the present colonies, due to chlorinated hydrocarbon residues, is in doubt.

"In 1970, West Anacapa Island was the site of the only brown pelican rookery off the California coast. There were about 550 nesting attempts in two colonies on the island, but only one known young was produced. Reproductive failure was attributed to thin eggshells, which collapsed during incubation. In 1972, another study of pelican colonies revealed that 26 young were produced from 150 nests on West Anacapa, and 31 nestlings were found in 112 nests on an island off Santa Cruz Island. Although this is an apparent increase in nesting success over 1970, substantial nesting failure was still evident. Many nests containing addled, broken, and thin-shelled eggs were found."

(See California Department of Fish and Game, August, 1973, p. 190.)

Latest reports indicate that in 1973 Brown pelicans had 235± nests on West Anacapa and raised 34 young. No pelicans nested on Scorpion Rock, off Santa Cruz Island in 1973. 1974 nesting attempts on Anacapa Island are currently underway.

American Peregrine Falcon - *Falco peregrinus anatum*

Formerly an abundant species in the study area, but now extremely rare. It is estimated that there are now less than five viable nests in the entire State of California. Recent sightings are Pt. Mugu, Ventura, Goleta Slough and Santa Rosa Island (November 1973).

Light-footed Clapper Rail - *Rallus longirostris levipes*

Formerly abundant in salt marsh areas, the clapper rail is becoming very rare. The only reported sightings since 1959 are of one bird at Goleta Slough (September 1969) and two birds at Pt. Mugu marsh (March 1971).

California Least Tern - *Sterna albifrons brown*

Formerly an abundant species when it nested in large colonies on Santa Barbara and Carpinteria beaches, but recently only near the mouth of the Santa Clara River. Human population pressure and use of nesting beaches by increasing numbers of humans are the causal factors for this species' decline.

Belding Savannah Sparrow - *Passerculus sandwichensis belding*

Numbers of this species are declining in direct proportion to the continuing loss of salt marsh habitat. For additional information relative to this species see section III discussion, "Conservation Considerations and Concerns."

Black Rail (Rare) - *Laterallus jamaicensis coturniculus*

A very shy and elusive species that is difficult to detect. Numbers of individuals present in Santa Barbara and Ventura Counties are small and decreasing in proportion to loss of salt marsh habitat. The only bird sighted since about 1939 was a single individual at McGrath State Park, Ventura County (May 1971).

Yellow-billed Cuckoo - *Coccyzus americanus occidentalis*

Formerly fairly abundant in dense vegetation along Santa Barbara and Ventura County rivers, but now extremely rare. Recent records are Montecito (June 1963),Santa Barbara (June 1967 and June 1971).

Island Fox - *Urocyon littoralis*

"The island fox is presently found only on San Miguel, Santa Rosa, Santa Cruz, Santa Catalina, San Clemente, and San Nicholas Islands off the southern California coast. Classified as a rare mammal, the take, possession, and sale of this animal is prohibited by State law. Although present population size is not known, it is judged that any appreciable reduction in its range or habitat would cause it to become an endangered species. Remoteness of the Channel Island and access controlled by military and private landowners, at present, provide protection to the island fox." (California Department of Fish and Game, August 1973, p. 182.)

INTRODUCTION TO TABLE II-11
TYPICAL BIOTIC COMMUNITIES OF THE SOUTH COAST SUBPROVINCE

The California Resources Agency cites 16 distinctly different biotic communities of California ranging from the dense, lush forest of the north to the semi-arid, desert communities of the south. The Agency subdivides the coastal province into: (1) North, (2) South, and (3) South Coast Subprovinces. The Santa Barbara Channel lies within the South Coast Subprovince, which is defined from Point Conception to Mexico. Eleven of these biotic communities occur in the South Coast Subprovince.

Biotic communities of the South Coast Subprovince are:

(1) Maritime Pine Forest

(2) Oak Woodland

(3) Coast Sagebrush

(4) Chaparral

(5) South Coast Grasslands

(6) Coastal Strand

(7) Freshwater Marsh

(8) Coastal Salt Marsh

(9) Sandy Intertidal Zone

(10) Rocky Intertidal Zone

(11) Near Shore Zone

TABLE II-11

BIOTIC COMMUNITIES OF THE SOUTH COAST SUBPROVINCE ("TERRESTRIAL")

(Compiled from California Department of Parks and Recreation with some modification, (Reprinted November, 1972), 1971, pp. 33-38 and 50-51).

Examples represent high quality occurrence over which the California Resources Agency has expressed concern for existing landscape protection.

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1. Maritime Pine Forest

Description

Rather dense interrupted forest from Mendocino plains southward, near the immediate coast. Low to medium tall needleleaf evergreen trees. Found on the seaward side of the redwoods in barren soil.

Location and Examples

Public ownership: (none listed)

Private ownership: Santa Rosa Island, Santa Cruz Island

Characteristic Plants

Trees: Bishop pine *(Pinus muricata)*, shore pine *(Pinus contorta)*, Gowen cypress *(Cupressus goveniana)*, Monterey pine *(Pinus radiata)*, Monterey cypress *(Cupressus macrocarpa)*.

Shrubs: Dwarf manzanitas *(Arctostaphylos spp.)*, Labrador tea *(Ledum glandulosum)*, elk grass *(Xerophyllum tenax)*.

Characteristic Animals

Birds: Pygmy owl *(Glaucidium gnoma)*, Pygmy nuthatch *(Sitta pygmaea)*. (Species does not occur in Maritime Pine Forest of Santa Barbara County, however), Vaux swift *(Chaetura vauxi)*.

Invertebrates: Western pine engraver *(Ips plastographus)*, Monterey pine aphid *(Essigella californica)*, Monterey pine midge *(Thecodiplosis pini-radiatae)*.

2. Oak Woodland

Description

Medium tall or low broadleaf evergreen or semi-deciduous forest occurring on the foothills and valley borders of the south coast range

as far south as northwestern Los Angeles County. This community varies
as far south as northwestern Los Angeles County. This community varies
from dense to open forest, with trees ranging 15 - 75 feet high.

Location and Examples

Public ownership: Leo Carrillo SP, Gaviota SB, Pt. Mugu SP, El Capitan SB.

Private ownership: Gaviota Area, Santa Cruz Island

Characteristic Plants

Trees: Coulter pine *(Pinus coulteri)*, digger pine *(Pinus sabiniana)*, coast live oak *(Quercus agrifolia)*, canyon live oak *(Q. chrysolepis)*, blue oak *(Q. douglasii)*, valley oak *(Q. lobata)*.

Shrubs: Gooseberry *(Ribes menziesii)*, sugarbush *(Rhus ovata)*, lemonadeberry *(R. integrifolia)*, squaw bush *(R. trilobata)*, bigberry manzanita *(Arctostaphylos glauca)*.

Other: Wild oats *(Avena fatula)*, wild mountain sunflower *(Helianthus gracilentus)*.

Characteristic Animals

Mammals: Mule deer *(Odocoileus hemionus)*, raccoon *(Procyon lotor)*, gray fox *(Urocyon cinereoargenteus)*, western gray squirrel *(Sciurus griseus)*, dusky-footed woodrat *(Neotoma fuscipes)*, California mouse *(Peromyscus californicus)*, brush mouse *(P. boylii)*, Coyote, bobcat.

Birds: Screech owl *(Otus asio)*, horned owl *(Bubo virginianus)*, acorn woodpecker *(Melanerpes formicivorus)*, scrub jay *(Aphelocoma coerulescens)*, plain tit-mouse *(Parus inornatus)*, common bushtit *(Psaltriparus minimus)*, band-tailed pigeon *(Columba fasciata)*.

Reptiles: Western fence lizard *(Sceloporus occidentalis)*, skinks *(Eumeces skiltonianus, E. gilberti)*, California mountain kingsnake *(Lampropeltis zonata)*, red rattlesnake *(Crotalus ruber)* (San Gorgonio Pass southward).

Invertebrates: Sister *(Limenitis brewdowi)*, callippe silverspot *(Speyeria callippe)*, ringlet *(Coenonympha tullia)*, sylvan satyr *(Cercyonis silvestris)*, California hairstreak *(Strymon californica)*, California oak moth *(Phryganidia californica)*, brown ctenucha *(Cienucha brunnea)*, snowy tree cricket *(Oecanthus niveus)*, California timema *(Timema californica)*.

TABLE II-11 (Continued)

3. Coast Sagebrush

Description

Usually dry rocky, gradual slopes, on the Transverse Peninsula and southern coastal ranges from San Luis Obispo County to Baja California. Mostly below 3,000 feet, between the sea and the rather abruptly rising mountainous, chaparral covered slopes. Shrubs 1 to 5 feet tall, forming a more open community than chaparral.

Location and Examples

Public Ownership: Leo Carrillo State Beach, Refugio State Beach, Anacapa Island (Fed.-NPS), Santa Barbara Island (Fed.-NPS), Pt. Mugu SP, Leo Carrillo SP, Pt. Mugu (Fed.-Navy), San Miguel Island (Fed.-Navy).

Private Ownership: Santa Rosa Island, Santa Cruz Island, Gaviota Area.

Characteristic Plants

Shrubs: California sagebrush *(Artemisia californica)*, white sage *(Salvia apiana)*, black sage *(S. mellifera)*, California buckwheat *(Eriogonum fasciculatum)*, lemonadeberry *(Rhus integrifolia)*, encelia *(Encelia farnosa)*, eriophyllum *(Eriophyllum confertiflorum)*.

Other: Prickly pear *(Opuntia spp.)*, our Lord's candle *(Yucca whipplei)*.

Characteristic Animals

Mammals: California ground squirrel *(Citellus beecheyi)*, Pacific kangaroo rat *(Dipodomys agilis)*, desert wood rat *(Neotoma lepida)*, California mouse *(Peromyscus californicus)*, California pocket mouse *(Perognathus californicus)*, deer, rabbits, bobcat, fox.

Birds: Costa's hummingbird *(Calypte costae)*, cactus wren *(Campylorhynchus brunneicapillus)*, lazuli bunting *(Passerina amoena)*, wrentit *(Chamaea fasciata)*, brown towhee *(Pipilo fuscus)*, sage sparrow *(Amphispiza belli)*, rufous-crowned sparrow *(Aimophila ruficeps)*, dove, quail, raptors.

Reptiles: Western fence lizard *(Sceloporus occidentalis)*, striped racer *(Masticophis lateralis)*, western rattlesnake *(Crotalus viridis)*.

Invertebrates: Ringlet *(Coenonympha tullia)*, common checkspot *(Euphydryas chalcedona)*, leanira checkerspot *(Melitaea leanira)*, bramble hairstreak *(Callophrys dumetorum)*, Mormon metalmark *(Apodemia mormo)*.

4. Chaparral

Description

Dense cover of shrubs up to 15 feet high and ranging from southern California to Mexico. The chaparral plant community contains many evergreen shrubs, often with thick leathery leaves; many shrubs have fire-resistant seeds, and sprout quickly from the roots after fires. The best examples are found on the coastal side of the dry slopes and ridges in southern Monterey, San Luis Obispo and Santa Barbara Counties.

Location and Examples

Public Ownership: Gaviota State Beach, Pt. Mugu SP, Leo Carillo SP.

Private Ownership: Santa Cruz Island.

Characteristic Plants

Characteristic plants: Chamise *(Adenostoma fasciculatum)*, scrub oak *(Quercus dumosa)*, foothill ash *(Fraxinus dipetala)*, mountain mahogany *(Cercocarpus betuloides)*, wild lilacs *(Ceanothus cordulatus, C. greggii, C. leucodermis, C.megacarpus, C. crassifolius,* etc.), holly-leafed cherry *(Prunus ilicipolia)*, bear brush *(Garrya fremontii)*, quinine bush *(G. flavescens)*, manzanitas *(Arctostaphylos pungens, A. pringlei, A. glauca, A. glandulosa,* etc.), toyon *(Heteromeles arbutiofolia)*, sugarbush *(Rhus ovata)*.

Characteristic Animals

Mammals: Mule deer *(Odocoileus hemionus)*, coyote *(Canis latrans)*, gray fox *(Urocyon cinereoargenteus)*, bobcat *(Lynx rufus)*, brush rabbit *(Sylvilagus bachmani)*, dusky-footed wood rat *(Neotoma fuscipes)* Pacific kangaroo rat *(Dipodomys agilis)*, California pocket mouse *(Perognathus californicus)*, California mouse *(Peromyscus californicus)*.

Birds: Mountain quail *(Oreortyx pictus)*, scrub jay *(Aphelocoma coerulescens)*, wrentit *(Chamaea fasciata)*, poor-will *(Phalaenoptilus nuttallii)*, bewick's wren *(Thryomanes bewickii)*, California thrasher *(Toxostoma redivivum)*, rufous-sided twohee *(Pipilo erythrophthalmus)*, orange-crowned warbler *(Vermivora celata)*, raptors.

Reptiles: Western fence lizard *(Sceloporus occidentalis)*, southern alligator lizard *(Gerrhonotus multicarinatus)*, coast horned lizard *(Phrynosoma coronatum)*, striped racer *(Masticophis lateralis)*, western rattlesnake *(Crotalus viridis)*, side-blotched lizard *(uta stansburiana)*.

Invertebrates: Ceanothus silk moth *(Platysamis euryalus)*, another silk moth *(Saturnia walterorum)*, gray hairstreak *(Strymon adenostomatis)*, hedge-row hairstreak *(S. saepium)*, arota copper *(Lycaena arota)*, callippe fritillary *(Speyeria callippe)*, a flat-headed borer or buprestid *(Acmaeodera mariposa)*, California timema *(Timema californica)*.

5. South Coast Grasslands

Description

This plant community has substantially changed as a result of overgrazing and has been replaced by annual species. This community ranges from Monterey County south, ascending to about 4,000 feet. Subtropical type of open treeless grassland with winter rains and hot dry summers, and rich displays of flowers in wet spring.

Location and Examples

Public Ownership: Pt. Mugu SP, Gaviota SB, San Miguel Island (Fed.-Navy), Anacapa Island (Fed.-NPS).

Private Ownership: Santa Rosa Island, Santa Cruz Island, Gaviota Area.

Characteristic Plants

Characteristic plants: Spear grass *(Stipa pulchra)* needle grass *(S. cernua) (Aristida divaricata) (Elymus glaucus)*, beardless wildrye *(E. triticoides)*, California poppy *(Eschscholtzia californica)*.

Characteristic Animals

Mammals: Mule deer *(Odocoileus hemionus)*, ground squirrels *(Citellus beecheyi)*, pocket mice *(Perognathus californicus)*, meadow mice *(Microtus californicus)*.

Birds: California quail *(Lophortyx californica)*, mourning dove *(Zenaidura macroura)*, raptors, horned lark *(Eremophila alpestris)*, western meadowlark *(Sturnella neglecta)*.

TABLE II-11 (Continued)

6. Coastal Strand

Description

Vegetation low or prostrate, often succulent woody perennials; on sand and dunes scattered along the entire coast. The composition of this community varies considerably from north to south. Some species reach their southern limit at Cape Mendocino, some at Monterey Peninsula, and some at Point Conception. A number of other species, however, exemplify the continuity of the community by extending the entire length of the province.

Location and Examples

Public Ownership: San Miguel Island (Fed.-Navy).

Private Ownership: Santa Rosa Island, Santa Cruz Island.

Characteristic Plants

Shrubs: White-leafed saltbush *(Atriplex leucophylla)*, lupine *(lupinus chamissonis)*.

Ground cover: Ice plants *(Mesembryanthemum crystallinum, M. chilenese, M. nodiflorum)*, shore sandbur *(Franseria chamissonis bipinnatisecta)*.

Characteristic Animals

Birds: Western gull *(Larus occidentalis)*, sanderling *(Crocethia alba)*, snowy plover *(Charadrius alexandrinus)*, least tern *(Sterna albifrons)*.

Invertebrates: Sand crab *(Emerita analoga)*, rove beetle *(Thinopinus pictus)*, beach fleas *(Orchestia traskiana)*, square-spotted blue butterfly *(Philotes battiodes)*.

7. Freshwater Marsh

Description:

These marsh areas, found scattered along the entire coast, generally are back of the sandy areas, below an elevation of 500 feet. These marshes may be fed by springs or slow flowing rivers.

TABLE II-11 (Continued)

Location and Examples

Public Ownership: McGrath SB, U. C. Santa Barbara.

Private Ownership: McGrath Lake, private game preserves.

Characteristic Plants

Characteristic plants: Common tule *(Scirpus actus)*, California bulrush *(S. californicus)*, cat-tails *(Typha latifolia, T. angustifolia)*, spike rushes *(Eleocharis spp.)*, pondweeds, *(Potamogeton spp.)*, sedges *(Carex spp.)*.

Characteristic Animals

Birds: Pied-billed grebe *(Podilymbus podiceps)*, common gallinule *(Gallinula chloropus)*, American coot *(Fulica americana)*, long-billed marsh wren *(Telmatodytes palustris)*, redwinged blackbird *(Agelaius phoeniceus)*, yellow-throat *(Geothlypis trichas)*, ducks.

Reptiles and Amphibians: Garter snake *(Thamnophis couchi)*, western pond turtle *(Clemmys marmorata)*, Pacific treefrog *(Hyla regilla)*.

Invertebrates: Great variety of aquatic or semi-aquatic insects, including predaceous diving beetles *(Dytiscus spp.)*, giant water bug *(Lethocerus americanus)*, toadbug *(Gelastocoris variegatus)*.

8. Coastal Salt Marsh

Description

A narrow strip of tidal lagoons and salt marshes, including intertidal mudflats, with low herbs or shrubs, often succulent, and a few perennial grasses. The main environmental factor that distinguishes the salt marsh biota from the open sea biota is the absence of the pounding surf.

Location and Examples

Public Ownership: Pt. Mugu (Fed.-Navy)

Private Ownership: Gaviota Area, Goleta, El Estero, Santa Ynez River areas, mouths of Ventura and Santa Clara Rivers.

TABLE II-11 (Continued)

Characteristic Plants

Shrubs: Inkweed *(Sueda californica)*, pickleweeds *(Salicornia spp.)*, sea heath *(Frankenia grandifolia)*.

Grasses: Salt grass *(Distichlis spicata)*, cord grass *(Spartina foliosa)*, eel-grass *(Zostera marina)*.

Characteristic Animals

Mammals: Ornate shrew *(Sorex ornatus)*, harvest mouse *(Reithrodontomys megalotis)*, California vole *(Microtus californicus)*, Norway rat *(Rattus norvegicus)*, house mouse *(Mus musculus)*.

Birds: Clapper rail *(Rallus longirostris)*, common egret *(Casmerodius albus)*, snowy egret *(Leucophoyx thula)*, marsh hawk *(Circus cyaneus)*, Savannah sparrow *(Passerculus sandwichensis)*, American avocet *(Recurvirostra americana)*, willet *(Catoptrophorus semipalmatus)*, western sandpiper *(Calidris mauri)*, waterfowl and many other shorebirds.

Fish: Spotted sand bass *(Paralabrax maculatofasciatus)*, California halibut *(Paralichthys californicus)*, California barracuda *(Sphyraena argentea)*, deepbody anchovy *(Anchoa compressa)*, topsmelt *(Atherinops affinis)*, round stringray *(Urolophus halleri)*.

Invertebrates: Wandering skipper *(Panoquina l. c. panoquinoides errans)*.

TABLE II-12

MARINE AND SHORE-ASSOCIATED BIRDS OF THE NORTHERN CHANNEL ISLANDS
(Compiled by K. E. Stager, May 1974)

		ANACAPA	SANTA CRUZ	SANTA ROSA	SAN MIGUEL	OFFSHORE	LITTORAL	WOODLAND	GRASSLAND	
Family GAVIIDAE - Loons										
Gavia immer	Common Loon	W	W	W	W	*				Uncommon
Gavia arctica	Arctic Loon	W	W	W	W	*				Common
Gavia stellata	Red-throated Loon	W	W	W	W	*				Uncommon
Family PODICIPEDIDAE - Grebes										
Podiceps auritus	Horned Grebe	W	W	W	W	*				Rare most years
Podiceps caspicus	Eared Grebe	W	W	W	W	*				Common
Aechmophorus occidentalis	Western Grebe	W	W	W	W	*				Common
Family DIOMEDEIDAE - Albatross										
Diomedea nigripes	Black-footed Albatross	S	S	S	S	*				Rare
Family PROCELLARIDAE - Shearwaters										
Fulmarus glacialis	Fulmar	W	W	W	W	*				Sometimes common
Puffinus puffinus	Manx Shearwater	W	W	W	W	*				Irregular - sometimes common
Puffinus creatopus	Pink-footed Shearwater	S	S	S	S	*				Some present all year
Puffinus griseus	Sooty Shearwater	S	S	S	S	*				Sometimes abundant
Family HYDROBATIDAE - Petrels										
Oceanodroma leucorhoa	Leach's Petrel	S	S	S	S	*				Rare at sea
Oceanodroma homochroa	Ashy Petrel	R	R	R	R	*				Breeds on San Miguel Island
Loomelania melania	Black Petrel	S	S	S	S	*				Common
Family PELICANIDAE - Pelicans										
Pelecanus occidentalis	Brown Pelican	R	R	R	R		r			Breeds on West Anacapa Bred on Santa Cruz (Scorpion Rock) in 1972
Family SULIDAE - Boobies										
Sula leucogaster	Brown Booby				V		r			Prince Islet, 1 record
Family PHALACROCORACIDAE - Cormorants										
Phalacrocorax auritus	Double-crested Cormorant	R	R	R	R		r			Common
P. penicillatus	Brandt's Cormorant	R	R	R	R		r			Common
P. pelagicus	Pelagic Cormorant	R	R	R	R		r			Fairly common
Family ARDEIDAE - Herons										
Ardea herodias	Great Blue Heron	V	V	V	V		r			
Butorides virescens	Green Heron		V				r			
Casmerodius albus	American Egret			W			r			
Leucophoyx thula	Snowy Egret			W			r			
Family ANATIDAE - Ducks and Geese										
Branta canadensis	Canada Goose		W	W		*				Rare
Branta nigricans	Black Brant		W	W						Occasional
Anser albifrons	White-fronted Goose			W		*				Irregular
Chen hyperborea	Snow Goose	W	W	W		*				Irregular and rare
Anas carolinensis	Green-winged Teal		W	W		*				Mouth of creek (Santa Cruz)
A. cyanoptera	Cinnamon Teal		W	W		*				
A. platyrhynchos	Mallard		W			*				
A. discors	Blue-winged Teal		W	W		*				Rare
Mergus serrator	Red-breasted Merganser	W	W	W	W	*				Fairly common
Oidemia nigra	Common Scoter				W	*				Rare
Melanitta perspicillata	Surf Scoter	W	W	W	W	*				Common
M. deglandi	White-winged Scoter	W	W	W	W	*				Common
Family RALLIDAE - Rails										
Fulica americana	Coot		R				*			*Marsh at Prisoner's Harbor
Family HAEMATOPODIDAE - Oystercatchers										
Haematopus palliatus	American Oystercatcher	V	V				r			Rare
H. bachmani	Black Oystercatcher	R	R	R	R		r			Common
Family CHARADRIIDAE - Plovers										
Charadrius semipalmatus	Semipalmated Plover	W	W	W	W		s			Also migrant - uncommon
C. alexandrinus	Snowy Plover		R	R	R		s			Fairly common
C. vociferus	Killdeer Plover		R	R			*			*Near fresh water

(Table continued on next page)

TABLE II-12 (Continued)

		ANACAPA	SANTA CRUZ	SANTA ROSA	SAN MIGUEL	OFFSHORE	LITTORAL	WOODLAND	GRASSLAND	
C. montanus	Mountain Plover				W				*	Now extirpated
Pluvialis squatarola	Black-bellied Plover	W	W	W	W		s			Common
Aphriza virgata	Surfbird		M		M		r			Rare
Arenaria interpres	Ruddy Turnstone	W	W	W	W		r			Rare
A. melanocephala	Black Turnstone	W	W	W	W		r			Abundant
Family SCOLOPACIDAE - Sandpipers & Snipe										
Numenius americanus	Long-billed Curlew				V				*	Rare
N. phaeopus	Whimbrel	W	W	W	W		s		*	Common
Actitis macularia	Spotted Sandpiper	W	W	W	W		r			Uncommon
Heteroscelus incanus	Wandering Tattler	W	W	W	W		r			Common
Catoptrophorus semipalmatus	Willet	W	W	W	W		s			Common
Tringa solitaria	Solitary Sandpiper	M	M				*			Freshwater areas, rare
Totanus melanoleucus	Greater Yellowlegs		M	M			s			Rare
Calidris minutilla	Least Sandpiper	W	W	W	W		s			Saltwater ponds, fairly common
Calidris alpina	Dunlin	W	W		W		s			Uncommon
Calidris alba	Sanderling	W	W	W	W		s			Common
Family PHALAROPODIDAE - Phalaropes										
Phalaropus fulicarius	Red Phalarope	M	M	M	M	*				Common - spring and fall
Lobipes lobatus	Northern Phalarope	M	M	M	M	*				Common - spring and fall
Family STERCORARIIDAE - Jaegers										
Stercorarius parasiticus	Parasitic Jaeger	M	M	M	M	*				Most common in winter
Family LARIDAE - Gulls and Terns										
L. glaucescens	Glaucous-winged Gull	W	W	W	W		r			Uncommon
L. occidentalis	Western Gull	R	R	R	R		r		*	Breeds on all islands
L. argentatus	Herring Gull	W	W	W	W	*	r			Uncommon
L. californicus	California Gull	W	W	W	W	*	r			Common
L. delawarensis	Ring-billed Gull				W	*	s			Rare
L. philadelphia	Bonaparte Gull	W	W	W	W	*	s			Uncommon
L. heermanni	Heermann's Gull	W	W	W	W	*	s			Common, July to March
Xema sabinii	Sabine Gull	M	M	M	M	*				Rare
Thalasseus maximus	Royal Tern	V	V	V	V					Most records fall and winter
Family ALCIDAE - Auks										
Uria aalge	Common Murre	W	W	W	W	*	r			Bred on San Miguel (Prince Islet), irregular
Cepphus columba	Pigeon Guillemot	R	R	R	R	*	r			
Endomychura hypoleuca	Xantus' Murrelet	S	S	S	R	*	r			San Miguel only known breeding island at pres.
Ptychoramphus aleuticus	Cassin's Auklet	W	W	W	R	*				San Miguel only known breeding island at pres.
Cerorhinca monocerata	Rhinoceros Auklet	W	W	W	R	*				At times abundant
Lunda cirrhata	Tufted Puffin	EX	EX		EX	*				Extirpated from former breeding islands
Family ALCEDINIDAE - Kingfishers										
Megacerle alcyon	Belted Kingfisher	W	W	W	W		r			Also as migrant

M - Migrant
R - Resident
S - Summer visitant
V - Vagrant
W - Winter visitant
EX - Extirpated
r - Rocky shore
s - Sandy beach

TABLE II-13

TERRESTRIAL BIRDS OF THE NORTHERN CHANNEL ISLANDS
(Compiled by K. E. Stager, May 1974)

		ANACAPA	SANTA CRUZ	SANTA ROSA	SAN MIGUEL	OFFSHORE	LITTORAL	WOODLAND	GRASSLAND	
Family ACCIPITRIDAE - Hawks and Eagles										
Circus cyaneus	Marsh Hawk	V	V	V					*	Rare
Accipiter striatus	Sharp-shinned Hawk		W	W	W			*		Occasional
A. cooperii	Cooper's Hawk		W	W	W					May have formerly bred on Santa Cruz
Buteo jamaicensis	Red-tailed Hawk	V	R	R	V			*	*	
B. swainsoni	Swainson's Hawk	M	M		M				*	Rare
Haliaaetus leucocephalus	Bald Eagle	EX	EX	EX	EX		*			Extirpated since 1960
Family PANDIONIDAE - Ospreys										
Pandion haliaetus	Osprey	EX	EX				*			Extirpated since 1935
Family FALCONIDAE - Falcons										
F. peregrinus	Peregrine Falcon	EX	EX	*	EX		*			*1 bird present Nov. 1973. Extirpated 1959.
F. columbarius	Merlin		M	M				*		Rare migrant
F. sparverius	Kestrel	R	R	R	R				*	Common
Family PHASIANIDAE - Quail & Pheasants										
Lophortyx californicus	California Quail		I	I				*	*	Introduced - breeding
Phasianus colchicus	Ring-necked Pheasant		I						*	Introduced
Family COLUMBIDAE - Pigeons & Doves										
Columba fasciata	Band-tailed Pigeon		V		V			*		Winter
Columba livia	Rock Dove (Domestic pigeon)	V	V	V	V				*	About habitations
Zenaidura macroura	Mourning Dove		R	R					*	Common
Family TYTONIDAE - Barn Owls										
Tyto alba	Barn Owl	R	R	R	R			*	*	
Family STRIGIDAE - Owls										
Speotyto cunicularia	Burrowing Owl		R	R	EX				*	Extirpated on San Miguel since 1915
Asio otus	Long-eared Owl			V				*		One record
Aegolius acadicus	Saw-Whet Owl		R					*		Possibly breeding
Family CAPRIMULGIDAE										
Phalaenoptilus nuttallii	Poor Will	W	W					*		Possibly migrant
Chordeiles acutipennis	Lesser Nighthawk	M	M						*	Uncommon
Family APODIDAE - Swifts										
Chaetura vauxi	Vaux's Swift		M	M					*	Observed in air
Aeronautes saxatilis	White-throated Swift	S	S	S	M		r			Breeding, possibly resident
Family TROCHILIDAE										
Calypte costae	Costa's Hummingbird	M			R			*		Common on San Miguel
Calypte anna	Anna's Hummingbird	V	R	V				*		Resident away from streams
Selasphorus sasin	Allen's Hummingbird	R	R	R	R			*		Common
Family PICIDAE - Woodpeckers										
Colaptes auratus	Common Flicker	V	R	EX	V			*		Extirpated on Santa Rosa
Melanerpes formicivorus	Acorn Woodpecker	V	R	V				*		
Asyndesmus lewis	Lewis Woodpecker		V					*		Rare
Sphyrapicus varius	Yellow-bellied Sapsucker		W	W				*		Occasional
Family TYRANNIDAE - Flycatchers										
Tyrannus verticalis	Western Kingbird	M	M	M				*		Occasional, spring and fall
T. vociferus	Cassin's Kingbird	M	M					*		Uncommon, spring and fall
Myiarchus cineraseens	Ash-throated Flycatcher	M	S					*		Breeds on Santa Cruz
Sayornis nigricans	Black Phoebe	W	R	R	W				*	
S. saya	Say's Phoebe	W	W	W	W				*	Small numbers
Empidonax traillii	Willow Flycatcher	M	M					*		Regular - spring and fall
E. difficilis	Western Flycatcher	S	S	S	M			*		Breeding
Contopus sordidulus	Western Wood Pewee	M	M		M			*		Regular - spring and fall
Family ALAUDIDAE - Larks										
Eremophila alpestris	Horned Lark	EX	R	R	R				*	Common. Extirpated on Anacapa

(Table continued on next page)

TABLE II-13 (Continued)

		ANACAPA	SANTA CRUZ	SANTA ROSA	SAN MIGUEL	OFFSHORE	LITTORAL	WOODLAND	GRASSLAND	
Family HIRUNDINIDAE - Swallows										
Tachycineta thalassina	Violet-green Swallow	M							*	Single record
Stelgidopteryx ruficollis	Rough-winged Swallow		M						*	Two spring records
Hirundo rustica	Barn Swallow	S	S	S	S		r			Nests in sea caves
Petrochelidon pyrrhonota	Cliff Swallow	M	M						*	Spring and fall. Uncommon
Family CORVIDAE - Crows and Jays										
Aphelocoma coerulescens	Scrub Jay		R					*		Common
Corvus corax	Raven	EX	R	R	EX				*	Extirpated on San Miguel and Anacapa
Nucifraga columbiana	Clark's Nutcracker		W						*	1919-20, 1972-73
Family PARIDAE - Titmice										
Psaltriparus minimus	Bushtit		R					*		
Family SITTIDAE - Nuthatches										
Sitta canadensis	Red-breasted Nuthatch		W		W			*		Irregular, uncommon. Has nested on Santa Cruz
Family TROGLODYTIDAE - Wrens										
Troglodytes aedon	House Wren	M	M	M	M			*		Uncommon. Fall and winter
T. troglodytes	Winter Wren	V	V					*		3 records, fall and winter
Thryomanes bewickii	Bewick's Wren	R	R	R				*		Common
Telmatodytes palustris	Long-billed Marsh Wren		W					*		Occasional
Catherpes mexicanus	Canyon Wren		V					*		2 records
Salpinetes obsoletus	Rock Wren	R	R	R	R		r			Rocky areas. Rarest on Santa Cruz
Family MIMIDAE - Mockingbirds										
Mimus polyglottos	Mockingbird	V	R	R				*		Most habitats
Toxostoma bendirei	Bendire's Thrasher	V							*	One record
Oreoscoptes montanus	Sage Thrasher			V	V				*	Rare - spring and fall
Family TURDIDAE - Thrushes										
Turdus migratorius	Robin	W	W	W				*		Irregular. Sometimes in large flocks
Ixoreus naevius	Varied Thrush		W	W				*		Rare and irregular
Hylocichla guttata	Hermit Thrush	W	W	W	W			*		Uncommon
Hylocichla ustulata	Swainson's Thrush		M	W				*		Occasional spring and fall
Sialia mexicana	Western Bluebird		W						*	Occasional
Sialia currucoides	Mountain Bluebird		W	W					*	Occasional
Myadestes townsendi	Townsend's Solitaire	M	M	M				*		Rare - 3 records
Family SYLVIIDAE - Old-World Warblers										
Regulus calendula	Ruby-crowned Kinglet	W	W	W				*		Uncommon
R. satrapa	Golden-crowned Kinglet		W					*		Rare - 1 record
Polioptila caerulea	Blue-Gray Gnatcatcher		R	W	W			*		Uncommon to rare
Family MOTACILLIDAE - Pipits										
Anthus spinoletta	Water Pipit	W	W	W	W				*	Occasional
Family BOMBYCILLIDAE - Waxwings										
Bombycilla cedrorum	Cedar Waxwing	W	W		W			*	*	Regular
Family LANIIDAE - Shrikes										
Lanius ludovicianus	Loggerhead Shrike	R	R	R	R				*	Modest numbers
Family STURNIDAE - Starlings										
Sturnus vulgaris	European Starling		R	R	R			*		Modest numbers but increasing
Family VIREONIDAE - Vireos										
Vireo huttoni	Hutton's Vireo	R	R	R				*		Arrived on Anacapa 1973-74
V. gilvus	Warbling Vireo	M	M	M				*		Spring and fall
V. solitarius	Solitary Vireo		M					*		Occasional

(Table continued on next page)

TABLE II-13 (Continued)

		ANACAPA	SANTA CRUZ	SANTA ROSA	SAN MIGUEL	OFFSHORE	LITTORAL	WOODLAND	GRASSLAND	
Family PARULIDAE - New-World Warblers										
Vermivora celata	Orange-crowned Warbler	R	R	R	R			*		Abundant
V. ruficapilla	Nashville Warbler		M					*		1 record - rare
V. virginiae	Virginia's Warbler		V					*		1 fall record
Dendroica petechia	Yellow Warbler	M	M	M	M			*		Uncommon, spring and fall
D. magnolia	Magnolia Warbler		V							1 spring record
D. coronata	Myrtle Warbler		W	W				*		Rare
D. auduboni	Audubons Warbler	W	W	W	W			*		Common
D. nigrescens	Black-throated Grey Warbler	M	M		M			*		Occasional - spring and fall
D. townsendi	Townsend's Warbler	M	M	M	M			*		Uncommon, spring and fall
Oporornis tolmiei	MacGillivray's Warbler	M	M					*	*	Uncommon, spring and fall
Geothlypis trichas	Yellow Throat	M	M	M	M			*	*	Infrequent, spring and fall
Wilsonia pusilla	Wilson's Warbler	M	M	M	M			*	*	Common, spring and fall
Setophaga ruticilla	American Redstart		M		M				*	Occasional spring and fall
Family PLOCEIDAE - Weaver Finches										
Passer domesticus	House Sparrow		EX	EX						Formerly, but now extirpated
Family ICTERIDAE - Blackbirds										
Sturnella neglecta	Western Meadowlark	R	R	R	R				*	Common
Xanthocephalus xanthocephalus	Yellow-headed Blackbird	M	M		M				*	Occasional spring and fall
Agelaius phoeniceus	Red-winged Blackbird		R	V				*		Marsh at Prisoner's Harbor
Icterus cucullatus	Hooded Oriole	M						*		Uncommon, spring and fall
Icterus bullockii	Bullock's Oriole	M	M	M	M					Regular, spring and fall
Euphagus carolinus	Rusty Blackbird			V					*	1 record
E. cyanocephalus	Brewers Blackbird		M		M			*		Uncommon
Molothrus ater	Brown-headed Cowbird	V	V	V	V				*	Fairly common
Family THRAUPIDAE - Tanagers										
Piranga ludoviciana	Western Tanager	M	M	M	M			*		Regular, spring and fall
Family FRINGILLIDAE - Finches and Sparrows										
Pheucticus melanocephalus	Black-headed Grosbeak	M	S		M			*		Breeds on Santa Cruz - uncommon
Guiraca caerulea	Blue Grosbeak		M					*		1 spring record
Passerina amoena	Lazuli Bunting	M	M		M				*	Uncommon, spring and fall
Carpodacus purpureus	Purple Finch		W	W				*		Irregular
Carpodacus mexicanus	House Finch	R	R	R	R			*	*	Common except for Anacapa
Spinus pinus	Pine Siskin	W	W	W				*		Irregular
S. tristis	American Goldfinch			V					*	1 record
S. psaltria	Lesser Goldfinch		R	S				*		Occasional, breeds on Santa Rosa
S. lawrencei	Lawrence's Goldfinch		M	M					*	Uncommon and irregular
Loxia curvirostra	Red Crossbill		S					*		Flocks breeding in 1920, now absent
Pipilo erythrophthalmus	Rufous-sided Towhee	V	R	R	V			*	*	Common
Passerculus sandwichensis	Savannah Sparrow	W	W	W	W				*	Also migrant
Pooecetes gramineus	Vesper Sparrow		V						*	Occasional spring and fall
Chondestes grammacus	Lark Sparrow		W						*	May formerly have bred
Aimophila ruficeps	Rufous-crowned Sparrow	R	R						*	Common in scrub
Junco oreganus ;	Oregon Junco	W	W	W	W				*	Uncommon
Spizella passerina	Chipping Sparrow	R	R	R	M			*		Common except on San Miguel
S. breweri	Brewer's Sparrow		M						*	Occasional fall
S. atrogularis	Black-chinned Sparrow		W							Rare, 1 record
Zonotrichia leucophrys	White-crowned Sparrow	W	W	W	W			*	*	Abundant
Zonotrichia atricapilla	Golden-crowned Sparrow	W	W	W	W			*	*	Common
Passerella iliaca	Fox Sparrow	W	W	W	W			*	*	Fairly common
Melospiza lincolnii	Lincoln Sparrow		W		W				*	Uncommon
Melospiza melodia	Song Sparrow	V	R	R	R				*	Abundant except for Anacapa

EX - Extirpated
I - Introduced
M - Migrant
R - Resident
S - Summer Visitant
V - Vagrant
W - Winter Visitant
r - Rocky Shore (Cliffs)

TABLE II-14

TERRESTRIAL MAMMALS OF THE NORTHERN CHANNEL ISLANDS*
(Compiled by K. E. Stager, May 1974)

		ANACAPA	SANTA CRUZ	SANTA ROSA	SAN MIGUEL
Bats					
Myotis evotis	Big-eared Myotis		*		
Myotis californicus	California Myotis		*	*	
Eptesicus fuscus	Big Brown Bat		*		
Plecotus townsendi	Lump-nosed Bat		*		
Antrozous pallidus	Pallid Bat		*		
Tadarida brasiliensis	Free-tailed Bat		*		
Rodents (Mice)					
Peromyscus maniculatus	Deer Mouse	*	*	*	*
Reithrodontomys megalotis	Harvest Mouse		*		
Fox					
Urocyon littoralis	Island Fox		*	*	*
Skunks					
Spilogale gracilis	Spotted Skunk		*	*	

* Modified from Von Bloeker (1967)

TABLE II-15

REPTILES AND AMPHIBIANS OF THE NORTHERN CHANNEL ISLANDS*
(Compiled by K. E. Stager, May 1974)

		ANACAPA	SANTA CRUZ	SANTA ROSA	SAN MIGUEL
Salamanders					
Batrachoseps pacificus	Pacific Slender Salamander	X	X	X	X
Batrachoseps relictus	Island Salamander		X		
Frogs					
Hyla regilla	Tree Frog		X	X	
Lizards					
Uta stansburiana	Side-blotched Lizard	X	X		
Sceloporus occidentalis	Western Fence Lizard		X	X	X
Gerrhonotus multicarinatus	Alligator Lizard	X	X	X	X
Snakes					
Coluber constrictor	Racer		X		
Pituophis melanoleucus	Gopher Snake		X		
Hypsiglena torquata	Night Snake		X		

*Modified from Savage (1967)

Note:

As of this date, no species of freshwater fish are known to occur on any of the Channel Islands mentioned in this statement.

TABLE II-16

MARINE AND SHORE ASSOCIATED BIRDS OF SANTA BARBARA AND VENTURA COUNTIES COASTAL AREAS
(Compiled by K. E. Stager, May 1974)

		OPEN CHANNEL	SANDY BEACH	ROCKY SHORE	TIDAL ESTUARIES	FRESH WATER PONDS	
Family GAVIIDAE - Loons							
Gavia immer	Common Loon	W					Common
Gavia arcfica	Arctic Loon	W					Common
Gavia stellata	Red-throated Loon	W					Common
Family PODICIPEDIDAE - Grebes							
Podiceps auritus	Horned Grebe	W					Common
Podiceps caspicus	Eared Grebe	W					Common
Aechmophorus occidentalis	Western Grebe	W					Common
Podilymbus podiceps	Pied-billed Grebe	W			W	R	Common
Family PROCELLARIDAE - Shearwaters							
Fulmarus glacialis	Fulmar	W					Occasionally common
Puffinus creatopus	Pink-footed Shearwater	S					Common
Puffinus griseus	Sooty Shearwater	S					At times abundant
P. puffinus	Manx Shearwater	W					Occasionally common
Family HYDROBATIDAE - Petrels							
Oceanodroma homochroa	Ashy Petrel	S					Common
Loomelania melania	Black Petrel	S					Common
Family PELICANIDAE - Pelicans							
Pelecanus occidentalis	Brown Pelican	R			R		Formerly common
Family PHALACROCORACIDAE - Cormorants							
Phalacrocorax auritus	Double-crested Cormorant	R		R	R		Common
P. penicillatus	Brandt's Cormorant	R		R			Common
P. pelagicus	Pelagic Cormorant	R		R			Fairly common
Family ARDEIDAE - Herons							
Ardea herodias	Great Blue Heron			R	R	R	Common
Butorides virescens	Green Heron					R	Common
Florida caerulea	Little Blue Heron				W		Uncommon
Bubulcus ibis	Cattle Egret					R	Uncommon, but increasing
Dichromanassa rufescens	Reddish Egret				S		Uncommon
Casmerodius albus	American Egret				R		Common
Leucophoyx thula	Snowy Egret				R	R	Common
Nycticorax nycticorax	Black-crowned Night-Heron				R	R	Common
Botaurus lentiginosus	American Bittern				R	R	Common
Family THRESKIORNITHIDAE - Ibises							
Plegadis chihi	White-faced Ibis					V	Uncomon
Family ANATIDAE - Waterfowl							
Branta canadensis	Canada Goose				W	W	Common
B. nigricans	Black Brant				W		Uncommon - mostly transient
Anser albifrons	White-fronted Goose					W	Uncommon
Chen caerulescens	Snow Goose					W	Uncommon
Anas platyrhynchos	Mallard					W	Common
A. strepera	Gadwall					W	Uncommon
A. acuta	Pintail				W	W	Abundant
A. crecca	Green-winged Teal				W	W	Common
A. discors	Blue-winged Teal				W	W	Uncommon
A. cyanoptera	Cinnamon Teal					R	Common
A. americana	American Widgeon				W	W	Common
A. clypeata	Northern Shoveler				W	W	Common
Aix sponsa	Wood Duck					W	Rare
Aythya americana	Redhead				W	W	Uncommon
A. collaris	Ring-necked Duck				W	W	Uncommon
A. valisineria	Canvasback				W	W	Uncommon
A. affinis	Lesser Scaup	W			W	W	Common
Bucephala clangula	Common Goldeneye	W			W		Uncommon
B. albeola	Bufflehead				W	W	Common
Melanitta deglandi	White-winged Scoter	W			W		Common
M. perspicillata	Surf Scoter	W			W		Abundant

(Table continued on next page)

TABLE II-16 (Continued)

		OPEN CHANNEL	SANDY BEACH	ROCKY SHORE	TIDAL ESTUARIES	FRESH WATER PONDS	
M. nigra	Black Scoter	W			W		Rare
Oxyura jamaicensis	Ruddy Duck				R	R	Common
Mergus merganser	Common Merganser				W		Uncommon
M. serrator	Red-breasted Merganser	W			W		Common
Family RALLIDAE - Rails and Gallinules							
Rallus longirostris	Clapper Rail				R		Uncommon, numbers dwindling
R. limicola	Virginia Rail				R	R	Common
Porzana carolina	Sora Rail				W	R	Common
Lateralius jamaicensis	Black Rail				R		Rare, some are migratory
Gallinula chloropus	Common Gallinule					R	Uncommon
Fulica americana	American Coot				R	R	Abundant
Family HAEMATOPODIDAE - Oystercatchers							
Haematopus bachmani	Black Oystercatcher			R			Common. Also occurs on offshore rocks.
Family CHARADRIIDAE - Plovers							
Charadrius semipalmatus	Semipalmated Plover				W		Common
C. alexandrinus	Snowy Plover		R				Common
C. vociferus	Killdeer					R	Also occurs in cultivated areas. Abundant
C. montanus	Mountain Plover			W			Cultivated areas in winter. Uncommon
Pluvialis dominica	Golden Plover				W		Uncommon. Also in irrigated fields.
P. squatarola	Black-bellied Plover		W	W	W		Common
Aphriza virgata	Surfbird			W			Common
Arenaria interpres	Ruddy Turnstone		W	W	W		Common
A. melanocephala	Black Turnstone		W	W			Common
Family SCOLOPACIDAE - Sandpipers and Snipe							
Capella gallinago	Common Snipe					W	Moist fields. Common
Numenius americanus	Long-billed Curlew				W		Also occurs on grasslands. Uncommon
Numenius phaeopus	Whimbrel		W		W		Short grass areas near water. Common
Actitis macularia	Spotted Sandpiper			M	M	M	Spring and fall. Common
Heteroscelus incanus	Wandering Tattler			W			Common
Catoptrophorus semipalmatus	Willet		W	W	W		Common
Tringa solitaria	Solitary Sandpiper					M	Spring and fall. Uncommon
Tringa melanoleucos	Greater Yellowlegs				W	W	Common
Tringa flavipes	Lesser Yellowlegs				M	M	Spring and fall. Uncommon
Calidris canutus	Red Knot				M		Common
C. acuminata	Sharp-tailed Sandpiper				V		Rare. 1 record (Goleta)
C. melanotos	Pectoral Sandpiper				M		Uncommon in fall, rare in spring
C. bairdii	Baird's Sandpiper				M		Rare in fall, very rare in spring
C. minutilla	Least Sandpiper				W	W	Abundant
C. alpina	Dunlin				W		Abundant
C. mauri	Western Sandpiper				W	W	Abundant
C. alba	Sanderling		W	W	W		Abundant
Limnodromus griseus	Short-billed Dowitcher				W		Common
L. scolopaceus	Long-billed Dowitcher					W	Common
Tryngites subruficollis	Buff-breasted Sandpiper				V		Rare
Limosa fedoa	Hudsonian Godwit		W		W		Common
Family RECURVIROSTRIDAE - Avocets and Stilts							
Recurvirostra americana	American Avocet				R	R	Common
Himantopus mexicanus	Black-necked Stilt				S	S	Common
Family PHALAROPODIDAE - Phalarop.							
Phalaropus fulicarius	Red Phalarope	M			M	M	Common in spring and fall
Steganopus tricolor	Wilson's Phalarope				M		Uncommon. Spring and fall.
Lobipes lobatus	Northern Phalarope	M			M	M	Common. Spring and fall.
Family STERCORARIIDAE - Jaegers							
Stercorarius pomarinus	Pomarine Jaeger	M					Spring and fall. Very common in fall.
S. parasiticus	Parasitic Jaeger	M			M		Common spring and fall, often close to land.
S. longicaudus	Long-tailed Jaeger	M					Uncommon to rare

(Table continued on next page)

TABLE II-16 (Continued)

		OPEN CHANNEL	SANDY BEACH	ROCKY SHORE	TIDAL ESTUARIES	FRESH WATER PONDS	
Family LARIDAE - Gulls and Terns							
Larus glaucescens	Glaucous-winged Gull		W		W		Common. Often visits garbage dumps.
L. occidentalis	Western Gull	R	R	R	R		Abundant
L. argentatus	Herring Gull	W	W	W	W		Common
L. californicus	California Gull	W	W	W	W	W	Abundant. Frequents coastal towns and cities.
L. delawarensis	Ring-billed Gull	W	W	W	W	W	Abundant. Urban areas and irrigated fields.
L. canus	Mew Gull	W	W		W		Common
L. pipixcan	Franklin's Gull				M	M	Uncommon. Most records during spring and fall.
L. philadelphia	Bonaparte's Gull	W	W		W	W	Abundant
L. heermanni	Heermann's Gull	W	W	W	W		Abundant
Rissa tridactyla	Black-legged Kittiwake	W	W	W	W		Irregular, but sometimes abundant
Xema sabini	Sabine's Gull	M					Common - spring and fall
Sterna forsteri	Forster's Tern	W			W		Common
S. hirundo	Common Tern	M			M		Spring and fall. Most abundant in fall.
S. albifrons	Least Tern		S		S		Breeding populations declining. Endangered.
Thalasseus maximus	Royal Tern	W			W		Most birds depart for south at end of January.
T. elegans	Elegant Tern	W			W		Common in late summer and fall. Increasing.
Hydroprogne caspia	Caspian Tern				M		Perennial visitor but commonest in spring and fall.
Family ALCIDAE - Alcids							
Uria aalge	Common Murre	W					Uncommon
Endomychura hypoleuca	Xantus' Murrelet	S					Common. Absent from channel in winter.
Synthliboramphus antiquus	Ancient Murrelet	W					Uncommon and irregular
Ptychoramphus aleuticus	Cassin's Auklet	R					Common in channel
Cerorhinca monocerata	Rhinoceros Auklet	W					Common
Cepphus columba	Pigeon Guillemot	S		S			Rare. Breeding at Pt. Conception (May 1974)
Family ALCEDINIDAE - Kingfishers							
Megaceryle alcyon	Belted Kingfisher			R	R	R	Common

M - Migrant
R - Resident
S - Summer Visitant
V - Vagrant
W - Winter Visitant

TABLE II-17

TERRESTRIAL BIRDS OF SANTA BARBARA AND VENTURA COUNTIES COASTAL AREAS
(Compiled by K. E. Stager, May 1974)

		TIDAL MARSH	FRESHWATER MARSH	GRASSLAND	SOFT CHAPARRAL	CHAPARRAL	RIPARIAN WOODLAND	OAK WOODLAND	CULTIVATED AREAS	
Family CATHARTIDAE - Vultures										
Cathartes aura	Turkey Vulture			S	S				S	Common
Gymnogyps californianus	California Condor			V	V					Endangered. Pt. Conception area 1973
Family ACCIPITRIDAE - Kites, Hawks and Eagles										
Elanus leucurus	White-tailed Kite			R			R		R	Formerly rare - now increasing
Accipiter striatus	Sharp-shinned Hawk					W	W	W	W	Common
A. cooperii	Cooper's Hawk					R	R	R		Common
Buteo jamaicensis	Red-tailed Hawk			R	R	R		R	R	Common
B. lineatus	Red-shouldered Hawk						R	R		Formerly common - now decreasing
Circus cyaneus	Marsh Hawk	R	R	R					R	Common
Aquila chrysaetos	Golden Eagle			R	R	R				Common
Haliaeetus leucocephalus	Bald Eagle		W							Formerly along seacoast - now rare
Family PANDIONIDAE - Ospreys										
Pandion haliaetus	Osprey	M								Uncommon spring and fall
Family FALCONIDAE - Falcons										
Falco peregrinus	Peregrine Falcon	R		R						Very rare - endangered
F. columbarius	Merlin			W	W					Uncommon
F. sparverius	Kestrel			R	R	R		R	R	Abundant
Family PHASIANIDAE - Quail, Partridge and Pheasants										
Lophortyx californicus	California Quail				R	R	R		R	Common. South slope of Santa Ynez Mts.
Oreortyx pictus	Mountain Quail					R				Common
Phasianus colchicus	Ring-necked Pheasant			R	R				R	Uncommon - Introduced
Family MELEAGRIDAE - Turkeys										
Meleagris gallapavo	Wild Turkey						R	R		Introduced - Santa Ynez Mts., Santa Barbara Co.
Family COLUMBIDAE - Pigeons and Doves										
Columba fasciata	Band-tailed Pigeon					R		R	R	Common to abundant
Columba livia	Rock Dove (Domestic Pigeon)								R	Abundant - Introduced
Zenaida macroura	Mourning Dove			R	R		R		R	Abundant
Streptopelia chinensis	Spotted Dove								R	Common - Introduced
Family CUCULIDAE - Cuckoos and Roadrunners										
Geococcyx californianus	Roadrunner				R	R			R	Common
Coccyzus americanus	Yellow-billed Cuckoo						S		S	Rare. Four records since 1963
Family TYTONIDAE - Barn Owls										
Tyto alba	Barn Owl	R	R	R	R		R	R	R	Abundant
Family STRIGIDAE - Owls										
Otus asio	Screetch Owl						R	R		Common
Bubo virginianus	Horned Owl					R	R	R	R	Common
Speotyto cunicularia	Burrowing Owl			R	R				R	Formerly abundant - now uncommon
Strix occidentalis	Spotted Owl						R	R		
Asio otus	Long-eared Owl						R	R		Uncommon
A. flammeus	Short-eared Owl	W	W							Uncommon
Glaucidium gnoma	Pygmy Owl							R		Uncommon
Family CAPRIMULGIDAE - Goatsuckers										
Phalaenoptilus nuttallii	Poorwill				S	S				Common
Chordeiles acutipennis	Lesser Nighthawk			S	S					Common
Family APODIDAE - Swifts										
Cypseloides niger	Black Swift			M	M	M				Uncommon - spring and fall
Chaetura vauxi	Vaux's Swift		M	M					M	Common - spring and fall
Aeronautes saxatilis	White-throated Swift			R	R	R				Common

(Table continued on next page)

TABLE II-17 (Continued)

		TIDAL MARSH	FRESHWATER MARSH	GRASSLAND	SOFT CHAPARRAL	CHAPARRAL	RIPARIAN WOODLAND	OAK WOODLAND	CULTIVATED AREAS	
Family TROCHILIDAE - Hummingbirds										
Archilochus alexandri	Black-chinned Hummingbird						S	S		Common
Calypte costae	Costa's Hummingbird			S	S	S				Common
C. anna	Anna's Hummingbird				R	R	R		R	Abundant
Selasphorus rufus	Rufous Hummingbird					M		M		Common, spring - early fall
S. ⌐⌐in	Allen's Hummingbird				S	S	S		S	Common
Family PICIDAE - Woodpeckers										
Colaptes cafer	Red-shafted Flicker				R		R	R	R	Abundant
Melane-pes formicivorus	Acorn Woodpecker							R		Abundant
Sphyrap...s varius	Yellow-bellied Sapsucker					W	W		W	Common
Dendrocopos pubescens	Downy Woodpecker						R			Common
D. nuttallii	Nuttall's Woodpecker						R	R	R	Common
D. villosus	Hairy Woodpecker						W	W		Uncommon
Family TYRANNIDAE - Flycatchers										
Tyrannus verticalis	Western Kingbird			S	S		S	S		Common
T. vociferans	Cassin's Kingbird			S	S					Common
Myiarchus cinerascens	Ash-throated Flycatcher				S	S	S			Common
Sayornis nigricans	Black Phoebe		R				R		R	Abundant
S. saya	Say's Phoebe			R	R				R	Common
Empidonax traillii	Traill's Flycatcher						S			Common
E. griseus	Gray Flycatcher						W		W	Uncommon
E. difficilis	Western Flycatcher						S			Common
Contopus sordidulus	Western Wood Pewee						S	S		Common
Nuttallornis borealis	Olive-sided Flycatcher					S				Uncommon
Pyrocephalus rubinus	Vermilian Flycatcher			V	V	V	V			Uncommon
Family ALAUDIDAE - Larks										
Eremophila alpestris	Horned Lark			R					R	Abundant
Family HIRUNDINIDAE - Swallows										
Tachycineta thalassina	Violet-green Swallow			M	M	S		S		Common
Iridoprocne bicolor	Tree Swallow	S	S			S	S	S	S	Common
Riparia riparia	Bank Swallow			S					S	Common - need soft banks and bluffs for nest
Stelgidopteryx ruficollis	Rough-winged Swallow			S					S	Common - need soft banks and bluffs for nest
Hirundo rustica	Barn Swallow		S				S		S	Common
Petrochelidon pyrrhonota	Cliff Swallow		S	S	S				S	Abundant
Progne subis	Purple Martin						S		S	Common
Family CORVIDAE - Jays and Crows										
Cyanocitta stelleri	Steller's Jay					R		W	W	Uncommon
Aphelocoma coerulescens	Scrub Jay					R	R	R	R	Abundant
Pica nuttalli	Yellow-billed Magpie			R				R	R	Common
Corvus corax	Common Raven			R	R	R				Common
Corvus brachyrhynchos	Common Crow			R			R		R	Abundant
Family PARIDAE - Titmice										
Parus inornatus	Plain Titmouse							R		Abundant
Psaltriparus minimus	Bushtit				R	R		R	R	Abundant
Family SITTIDAE - Nuthatches										
Sitta carolinensis	White-breasted Nuthatch					R	R	R		Common
Sitta canadensis	Red-breasted Nuthatch					W		W		Uncommon - sometimes abundant
Family CERTHIIDAE - Creepers										
Certhia familiaris	Brown Creeper					W		W		Uncommon
Family CHAMAEIDAE - Wrentits										
Chamaea fasciata	Wrentit					R				Abundant

(Table continued on next page)

TABLE II-17 (Continued)

Species	Common Name	TIDAL MARSH	FRESHWATER MARSH	GRASSLAND	SOFT CHAPARRAL	CHAPARRAL	RIPARIAN WOODLAND	OAK WOODLAND	CULTIVATED AREAS	Remarks
Family CINCLIDAE - Dippers										
Cinclus mexicanus	Dipper						R			Uncommon in coastal area
Family TROGLODYTIDAE - Wrens										
Troglodytes aedon	House Wren					R	R	R		Common
T. troglodytes	Winter Wren						W			Uncommon
Thryomanes bewickii	Bewick's Wren				R		R			Common
Campylorhynchus brunneicapillus	Cactus Wren				R					Common in cactus-filled washes of Ventura Co.
Telmatodytes palustris	Long-billed Marsh Wren		R							Common
Catherpes mexicanus	Canyon Wren					R	R			Fairly common in rocky canyons
Salpinctes obsolefus	Rock Wren			R	R					Common
Family MIMIDAE - Mockingbirds and Thrashers										
Mimus polyglottos	Mockingbird			R	R		R		R	Abundant
Toxostoma redivivum	California Thrasher						R		R	Abundant
Oreoscoptes montanus	Sage Thrasher					W			W	Rare
Family TURDIDAE - Thrushes										
Turdus migratorius	Robin				W	W	W	W	W	Common to abundant
Ixoreus naevius	Varied Thrush					·	W	W	W	Uncommon and irregular
Hylocichla guttata	Hermit Thrush					W	W	W	W	Common
H. ustulata	Swainson's Thrush						S	S		Common
Sialia mexicana	Mexican Bluebird					S	S	S	S	Common
Sialia currucoides	Mountain Bluebird			W	W				W	Uncommon
Myadestes townsendi	Townsend's Solitaire							W		Uncommon
Family SYLVIIDAE - Gnatcatchers and Kinglets										
Polioptila caerulea	Blue-Gray Gnatcatcher					R	R	R		Common
P. melanura	Black-tailed Gnatcatcher				V					Rare and irregular
Regulus satrapa	Golden-crowned Kinglet						W	W	W	Rare and irregular
R. calendula	Ruby-crowned Kinglet						W	W	W	Common
Family MOTACILLIDAE - Pipits										
Anthus spinoletta	Water Pipit								W	Common. Also along sandy beaches
Family BOMBYCILLIDAE - Waxwings										
Bombycilla cedrorum	Cedar Waxwing					W	W	W	W	Common - often abundant
B. garrulus	Bohemian Waxwing					W	W	W	W	Rare and irregular
Family PTILOGONATIDAE - Silky Flycatchers										
Phainopepla nitens	Phainopepla					S	S	S	S	Fairly common to uncommon
Family LANIIDAE - Shrikes										
Lanius ludovicianus	Loggerhead Shrike			R	R				R	Common
Family STURNIDAE - Starlings										
Sturnus vulgaris	European Starling				R		R	R	R	Abundant - increasing rapidly
Family VIREONIDAE - Vireos										
Vireo huttoni	Hutton's Vireo						S	S		Common
V. bellii	Bell's Vireo							S		Rare
V. solitarius	Solitary Vireo						S	S		Fairly common
V. gilvus	Warbling Vireo					S	S	S		Common

(Table continued on next page)

TABLE II-17 (Continued)

		TIDAL MARSH	FRESHWATER MARSH	GRASSLAND	SOFT CHAPARRAL	CHAPARRAL	RIPARIAN WOODLAND	OAK WOODLAND	CULTIVATED AREAS	
Family PARULIDAE - New World Warblers										
Mniotilta varia	Black and White Warbler						M	M		Rare - most records in fall
V. celata	Orange-crowned Warbler					R	R	R	R	Abundant
V. ruficapilla	Nashville Warbler						M	M		Fairly common in spring and fall
Dendroica petechia	Yellow Warbler						S		S	Abundant
D. auduboni	Audubon's Warbler			W	W	W	W	W	W	Abundant from Sept. until May
D. coronata	Myrtle Warbler						W	W		Uncommon
D. nigrescens	Black-throated Gray Warbler						S	S	S	Common
D. townsendi	Townsend's Warbler						W	W		Fairly common migrant
D. occidentalis	Hermit Warbler						M	M		Uncommon
D. palmarum	Palm Warbler						M		M	Rare fall migrant
Oporornis talmiei	MacGillivray's Warbler						M		M	Uncommon spring and fall migrant
Geothylpis trichas	Common Yellowthroat		R				R			Common
Icteria virens	Yellow-breasted Chat						S			Common
Wilsonia pusilla	Wilson's Warbler						S		S	Common
Family PLOCEIDAE - Weaver Finches										
Passer domesticus	House Sparrow								R	Abundant in urban areas
Family ICTERIDAE - Blackbirds and Orioles										
Sturnella neglecta	Western Meadowlark			R			R		R	Common
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		W	W					W	Uncommon
Agelaius phoeniceus	Red-wing Blackbird		R	R			R		R	Common
A. tricolor	Tricolored Blackbird		R	R			R		R	Fairly common
Icterus cucullatus	Hooded Oriole							S	S	Common in urban areas
I. bullockii	Bullock's Oriole						S	S	S	Common
Euphagus cyanocephalus	Brewer's Blackbird						R	R	R	Abundant
Molothrus ater	Brown-headed Cowbird			R					R	Common
Family THRAUPIDAE - Tanagers										
Piranga ludoviciana	Western Tanager			M	M	M	M	M	M	Common spring and fall
Piranga rubra	Summer Tanager						W	W		Rare and irregular
Family FRINGILLIDAE - Finches										
Pheucticus melanocephalus	Black-headed Grosbeak						S	S	S	Common
Guiraca caerulea	Blue Grosbeak						S			Uncommon
Passerina amoena	Lazuli Bunting			S			S		S	Uncommon
Carpodacus purpureus	Purple Finch						W	W		Common
Carpodacus cassinii	Cassin's Finch					W		W		Uncommon
C. mexicanus	House Finch			R	R	R	R	R	R	Abundant
Spinus pinus	Pine Siskin						W	W	W	Uncommon and irregular
S. tristis	American Goldfinch			R			R		R	Common
S. psaltria	Lesser Goldfinch			R			R	R	R	Common
S. lawrencei	Lawrence's Goldfinch			S		S	S	S		Uncommon
Pipilo erythrophthalmus	Rufous-sided Towhee					R	R	R	R	Common
P. fuscus	Brown Towhee				R	R	R	R	R	Abundant
Passerculus sandwichensis	Savannah Sparrow	R*		W	W		W			Endangered Belding Savannah Sparrow restricted to salt marshes.
Ammodramus savannarum	Grasshopper Sparrow			W						Rare and irregular
Pooecetes gramineus	Vesper Sparrow			W						Uncommon
Chondestes grammacus	Lark Sparrow			R				R	R	Common
Aimophila ruficeps	Rufous-crowned Sparrow				R					Common
Amphispiza belli	Sage Sparrow				R	R				Common
Junco oreganus	Oregon Junco					W	W	W	W	Common
Junco hyemalis	Slate-colored Junco					W	W	W	W	Uncommon
Spizella passerina	Chipping Sparrow						W	W	W	Common
Zonotrichia leucophrys	White-crowned Sparrow			W	R*	W	W	W	W	Abundant winter visitant. One subspecies breeds south to Pt. Conception.
Z. atricapilla	Golden-crowned Sparrow			W	W	W	W	W	W	Common
Passerella iliaca	Fox Sparrow					W	W	W	W	Common
Melospiza lincolnii	Lincoln's Sparrow						W		W	Uncommon
M. melodia	Song Sparrow		R				R		R	Abundant

M - Migrant
R - Resident
S - Summer Visitant
V - Vagrant
W - Winter Visitant

TABLE II-18

TERRESTRIAL MAMMALS OF SANTA BARBARA AND VENTURA COUNTIES COASTAL AREAS
(Compiled by K. E. Stager, May 1974)

Family DIDELPHIDAE - Opossums	
Didelphis marsupialis	Opossum
Family SORICIDAE - Shrews	
Sorex ornatus	Ornate Shrew
Sorex trowbridgii	Trowbridge Shrew
Notiosorex crawfordi	Gray Shrew
Family TALPIDAE - Moles	
Scapanus latimanus	Broad-footed Mole
Family VESPERTILIONIDAE - Vespertilionid Bats	
Myotis yumanensis	Yuma Myotis
Myotis evotis	Long-eared Myotis
Myotis volans	Long-legged Myotis
Myotis californicus	California Myotis
Pipistrellus hesperis	Western Pipistrelle
Eptesicus fuscus	Big Brown Bat
Lasiurus borealis	Red Bat
Lasiurus cinereus	Hoary Bat
Plecotus townsendi	Lump-nosed Bat
Antrozous pallidus	Pallid Bat
Family MOLOSSIDAE - Free-tailed Bats	
Tadarida brasiliensis	Free-tailed Bat
Eumops perotis	Greater Mastiff Bat
Family LEPORIDAE - Rabbits and Hares	
Sylvilagus bachmani	Brush Rabbit
*Sylvilagus audubon**i***	Cotton-tail Rabbit
Lepus californicus	Black-tailed Jackrabbit
Family SCIURIDAE - Squirrels and Chipmunks	
Eutamias merriami	Merriam's Chipmunk
Sciurus griseus	Western Gray Squirrel
Spermophilus beecheyi	Beechey's Ground Squirrel

(Table continued on next page)

TABLE II-18 (Continued)

Family GEOMYIDAE - Pocket Gophers	
Thomomys bottae	Smooth-toothed Pocket Gopher
Family HETEROMYIDAE - Heteromyid Rodents	
Perognathus californicus	California Pocket Mouse
Dipodomys agilis	Agile Kangaroo Rat
Dipodomys heermanni	Heermann's Kangaroo Rat
Family CRICETIDAE - New World Rats and Mice	
Reithrodontomys megalotis	Harvest Mouse
Peromyscus eremicus	Cactus Mouse
Peromyscus californicus	California Mouse
Peromyscus maniculatus	Deer Mouse
Peromyscus boylii	Brush Mouse
Neotoma lepida	Desert Wood Rat
Neotoma fuscipes	Dusky-footed Wood Rat
Microtus californicus	California Vole
Family MURIDAE - Old World Murid Rodents	
Rattus rattus	Black Rat
Rattus norvegicus	Norway Rat
Mus musculus	House Mouse
Family CANIDAE - Coyotes and Foxes	
Canis latrans	Coyote
Urocyon cinereoargenteus	Gray Fox
Family URSIDAE - Bears	
Ursus americanus	Black Bear
Family PROCYONIDAE - Raccoons and Ringtails	
Bassariscus astutus	Ringtail
Procyon lotor	Raccoon
Family MUSTELIDAE - Weasels, Skunks, etc.	
Mustela frenata	Long-tailed Weasel
Taxidea taxus	Badger
Spilogale gracilis	Spotted Skunk
Mephitis mephitis	Striped Skunk

(Table continued on next page)

TABLE II-18 (Continued)

Family FELIDAE - Cats	
Felis concolor	Mountain Lion
Lynx rufus	Bobcat
Family CERVIDAE - Cervids	
Odocoileus hemionus	Mule Deer

TABLE II-19

REPTILES AND AMPHIBIANS OF THE SANTA BARBARA AND VENTURA COUNTIES COASTAL AREAS
(Compiled by K. E. Stager, May 1974)

Family PLETHODONTIDAE - Lungless Salamanders	
Taricha torosa	California Newt
Ensatina eschscholtzi	Ensatina
Batrachoseps attenuatus	Slender Salamander
Aneidea lugubris	Arboreal Salamander
Family BUFONIDAE - True Toads	
Bufo boreas	Western Toad
Family HYLIDAE - Tree Frogs	
Hyla regilla	Pacific Tree Frog
Hyla cadaverana	California Tree Frog
Family RANIDAE - True Frogs	
Rana aurora	Red-legged Frog
Rana catesbeiana	Bullfrog
Family TESTUDINIDAE - Water Turtles	
Clemmys marmorata	Western Pond Turtle
Family IGUANIDAE - Iguanid Lizards	
Sceloporus occidentalis	Western Fence Lizard
Uta stansburiana	Side-blotched Lizard
Phrynosoma coronatum	Coast Horned Lizard
Family ANGUIDAE - Alligator Lizards	
Gerrhonotus multicarinatus	Alligator Lizard
Family ANNIELLIDAE - Legless Lizards	
Anniella pulchra	California legless lizard
Family LEPTOTYPHLOPIDAE - Blind Snakes	
Leptotyphlops humilis	Western Blind Snake

(Table continued on next page)

TABLE II-19 (Continued)

Family COLUBRIDAE - Colubrid Snakes

Diadophis punctatus	Ringneck Snake
Coluber constrictor	Racer
Masticophis flagellum	Coachwhip
Masticophis lateralis	Striped Racer
Pituophis melanoleucus	Gopher Snake
Lampropeltis getulus	Common Kingsnake
Lampropeltis zonata	California Mountain Kingsnake
Thamnopis sirtalis	Common Garter Snake
Thamnopis couchi	Western Aquatic Garter Snake
Hypsiglena torquata	Night Snake
Tantilla planiceps	Western Black-headed Snake

Family VIPERIDAE - Vipers

Crotalus viridis	Western Rattlesnake

TABLE II-19a

SUMMARY OF THE FISHES OCCURRING IN THE COASTAL DRAINAGES OF SANTA BARBARA AND VENTURA COUNTIES[1]
(Compiled by K. E. Stager, Oct. 1975)

SPECIES	COMMON NAME	[2]Primary River Drainages: Santa Maria	San Antonio	Santa Ynez	Ventura	Santa Clara	Calleguas	[2]Minor Drainages: Gaviota Creek	Refugio Creek	Mission Creek
Lampetra tridentata	Pacific Lamprey	AN	AN	AN	AN	AN				
Salmo gairdneri	Rainbow Trout	AX	AX	AX	AX					
Carassius auratus	Goldfish						I			
Pimephales promelas	Fathead Minnow			I		I				
Gila orcutti	Arroyo Chub	IC	IC	IC	IC	IC		IC		
Hesperoleucas symmetricus	California Roach	N								
Gambusia affinis	Mosquito Fish	I		I		I	I			
Gasterosteus aculeatus microcephalus	Three-spine Stickleback	N	N	N	N	N		N		
Micropternus salmoides	Largemouth Bass	I		I		I				
Micropternus dolomieui	Smallmouth Bass			I						
Lepomis cyanellus	Green Sunfish	I			I	I				
Lepomis machrochirus	Bluegill									
Leptocottus armatus	Staghorn Sculpin					N				
Cottus asper	Prickly Sculpin							N		
Eucyclogobius newberryi	Tidewater Goby					N	N	N		

A - Anadromous
N - Native
I - Introduced
X - Hatchery Supplemented
C - Common

[1]Modified from Wells and Diana (1975)

[2]Mouth to 5 miles upstream

2. Marine Biology

The data in the "marine biology" subsection is compiled from the most recent available to the U. S. Geological Survey. Site specific data, where appropriate, would be required for assessment of any specific proposal.

a. Marine Organisms of the Santa Barbara Channel Region

The truly marine organisms may be divided by their marine habitat on the first order by whether or not they are closely associated with the bottom. Benthic animals are those which are either attached to, or burrow into, or lie on the bottom and are mostly incapable of leaving the bottom. Pelagic (open sea) animals move about freely in the water column. The demersal (bottom) fishes have been arbitrarily grouped into the latter category because they are capable of leaving the bottom even though in some cases they may spend most of their time lying on the bottom or even partially covered by the sediments.

These general habitats can be further broken down on the basis of proximity to shore, depth, and nature of substrate presence of light, among others.

(1) Benthic Habitat

Several publications give data on distribution and abundance of benthic organisms in the Santa Barbara Channel area (Allan Hancock Foundation, 1965; Straughan, 1971; Southern California Water Research Project (SCCWRP), 1973; Emery, 1960; and others).

Benthic plants are limited in depth distribution by light necessary for photosynthesis. In general, plants have no net production where light levels are less than about one percent of surface values. The depth to which one percent of the light remains varies directly with water transparency, which is diminished principally by suspended sediments and plankton. Generally, the photic zone is only about 100 m thick, therefore, producing benthic plants are limited to the littoral (intertidal) and sublittoral zones. The turbid nature of these zones, however, usually produces an actual limit of about 35 m.

(2) Littoral (Intertidal) Zone

In general, most of the mainland coastline consists of sandy beaches with many rocks rarely interrupted by rocky headlands and usually backed by steep bluffs. The northern shores of the Channel Islands contain many seacliffs, rocky headlands, and pebble beaches. For detailed local descriptions, see Eleventh Coast Guard District Coastal Survey, 1972.

(3) Sandy Beaches

The general character of sandy beaches along coastal southern California is described in the quotation from Fay et al. (1972).

Semi-open Coast, Intertidal and Surf Zones

"Beaches found on the semi-open coast of southern California are very dynamic in terms of physical stability for they either accrete or erode on a seasonal basis. The natural extent of the mobility of the shoreline will vary locally, annually, and on longer time cycles; this mobility may be further affected by artificial influences to either increase or reduce stability. In the natural circumstance, the instability or mobility of the beaches is unfavorable for the development of a diverse biological community with a high biomass of organisms as compared with a rocky shore or estuary. Sedentary forms are excluded as they would either be eroded away or buried as the surf line migrated landward or retreated seaward.

"Sand beaches are, however, a long term component of the geological structures of the shoreline; they offer a niche for a number or organisms and evolution has provided mobile forms to occupy this habitat. High in the intertidal one finds the beach hoppers and rock runners which scavenge the debris cast upon the shore. These forms are active beach cleaners, albeit at their own pace and often not sufficiently rapid to displace the kelp flies which also come to feed on the wrack cast upon the shore at each high tide.

"Sand crabs (or mole crabs), *Emerita analoga,* are locally and seasonally abundant organisms which inhabit the surf zone and swash line on the beach. These organisms employ filtering mechanisms to feed upon plankton and suspended organic particles carried by the sea water. They migrate landward with the increasing sea level that results when the tide is flooding and retreat seaward as the tide ebbs. These organisms may be present in extraordinary abundance and can provide a supply of food for several species of fishes such as corbina, perch, shovelnose sharks and others which elect to feed principally upon the sand crabs. It is the mobility of the sand crabs which permit them to flourish in this zone where the survival of sedentary forms of life is precluded. The bean clam *(Donax)* may also be found here in large numbers . . . .

"Beach sand in the intertidal zone is not sterile, however, and a highly diverse, specialized biota, the interstitial fauna, exists in the microworld amongst the sand grains. These are tiny converters of larger hunks of organic matter into smaller pieces which in turn are the grist of the microbes that ultimately convert soluble organic molecules into mineralized forms ready for incorporation by the plants of the marine environment.

"At depths beyond the surf zone, a number of larger organisms may be found, in suitable circumstances, to form a community which is based upon large aggregations of the sand dollar, *Dendraster excentricus*. In some locations, one may find large populations of clams in this zone either with or without sand dollars being locally abundant. When sand dollars are found, they extend from a depth of about 15 feet out to depths of about 35 feet. Living with sand dollars are a variety of forms, including sea pansies, hermit crabs, shrimp, worms, crabs, cucumbers, snails, clams, starfish and fish. The crabs, starfish and fish either feed directly upon the sand dollars or upon other organisms which may be found with the sand dollars, or find refuge among the sand dollars. The pismo clam, with its heavy shell for anchorage, and special filter to keep swirling sand out of its body, is especially adapted to this habitat.

"A number of crabs, fishes, and rays migrate through this zone under suitable conditions at certain seasons and into the surf zone when wave action is light. These include some crabs, the surf perch, corbina, shovelnose shark, thornback ray, stingray and others.

"At depths beyond which one finds sand dollars, from 35 feet down to about 60 feet, the bottom slopes gently seaward except in the local region of submarine canyons Hueneme, Mugu, Dume . . . where steep slopes are found. This gently sloping bottom is the habitat of a variety of clams, snails, worms, crabs, sea pens, flatfishes, rays, perch, croakers, and organisms associated with these animal communities. Organisms occurring in the next depth zone from 60 to 600 feet are typical of cold waters, and sandy to muddy bottoms where water motion is generally not directly affected by storm waves. These soft bottoms are relatively stable structures where sedimentation occurs at slow rates. Animals found here include sea pens, nudibranchs, sea cucumbers, starfish, sea urchins, brittle starfish, worms, crabs, clams, brachiopods (locally), snails, echiuroids (locally), shrimp, and the fishes which come to prey upon these animals or upon one another. The carnivores include crabs, snails, starfish, many flatfish (turbot, sole, halibut), poaches, cottids, combfishes, croakers, perch, baby rockfish, cusk eels, sharks, rays, and occasionally whales and sea lions.

"An important component of the biota of shallow sandy beaches includes many organisms which are of temporary, accidental occurrence. These are mainly forms which migrate or drift through the sandy areas or have been torn from adjacent rocky areas and transported into the sandy zone by waves and currents. These organisms (e.g., mussels, tunicates) may fail to survive passage through this zone and thus provide food for the endemic scavengers of the sandy bottoms (crabs, starfish, fish). In some areas, patches of eel grass *(Zostera)* or red algae *(Myrogramme)* may be found growing on the sand. These plants offer food and refuge to fishes and invertebrates as well as sites for the attachment of opportunists or grazers such as the dove snail *(Mitrella)*. These plants may also function as repositories for the eggs of those species which require a fixed surface upon which to deposit their incubating offspring and later as a nursery where larval or juvenile forms find protection. In other locations, on soft bottoms, the isolated rock, shell, or debris cast by man serve as functional sites for the receipt of deposited eggs. Sandy beaches are also the specific spawning habitat for the grunion, which spawn here just after high spring tides. The eggs incubate in the sand, hatch, and are washed into the sea one month later, during the next high spring tide."

(4) Rocky Shores

The general characteristics of southern California rocky shores are quoted from Fay, 1971.

"Rocky shores offer an increase in the number of niches available to organisms since the number of surfaces is increased over that found on the planar surface of sand or mud to tops, sides, undersides, crevices, holes, gravel and pebble underneath, and ledges or caves. In addition to the stability of the substrate, increase in surface area, and variation in the distribution of that area in form and orientation, the organisms which adhere to these surfaces themselves become surfaces upon which other organisms can attach; thus, the complexity of the biota of rocky shores can increase by many orders of magnitude from that found on sedimentary bottoms. There will be variations between the biota found on rocky shores depending upon the type of rock (sedimentary, metamorphic, or igneous), its location along the shoreline (exposed, semi-protected, protected), the size of the rock (cobble, boulder, rock walls), and the adjacent type of shoreline (rock, gravel, sand, mud).

"Rocky shores or rock features on the shoreline are of both natural and artificial origin along the coastline . . . . The natural features include the cobble beds found at the mouth of some of the tributary streams . . . shale reefs . . . breccia rocks and igneous rocks . . . . The unnaturally placed rocks are found as groins, jetties, and breakwaters throughout the length of the shoreline of the three counties. Either granite or breccia rocks are used for this type of construction which may be locally cemented together with concrete. Piers and bulkheads also offer rock-like concrete surfaces generally of shear vertical orientation.

"Vertical zonation through a rock habitat is clearly evident to any visitor at the shore. The zone most infrequently subjected to salt water is referred to as the splash zone at the top of the tidal range. This is succeeded by the high intertidal zone, a low tide zone, and then the zones which are never exposed by tidal action and always remain covered by sea water. Each of the niches in the individual zones has species of organisms selectively adapted to the particular niche and the degree of exposure to salt water (submergence) or to the air (desiccation). Some forms range through the full extent of the tidal zone (shore crabs) being capable of tolerating long periods of exposure or continued submergence.

"Those creatures inhabitating the splash zone are principally scavengers *(Ligia, Pachygrapsus, Orchestia)* which feed upon the flotsam cast upon the shore during periods of high tides. The zone which is wetted by the highest tides supports a film of diatoms and organisms which graze upon the diatoms (periwinkles and limpets) as well as barnacles which filter plankton from the water.

"In the mid-tidal zone the variety of organisms increases significantly as more snails, mussels, chitons, barnacles, sea anemones, algae, and worms are found. Under the rocks and in the crevices one finds worms, shrimp, snails, chitons, clams, isopods, amphipods, and occasionally a cling fish. Pools may occur among the rocks where cottid and blenny fishes keep sharp eyes on visitors to the region or dart to refuge under the rocks.

"Deeper Rocks. Rocks in the ocean in the photic zone are predominantly covered by plant growths of one type or another . . . . Along the shoreline, rocks are predominantly covered by algae in the intertidal and sub-tidal zones down to a depth of about 150 feet. This is about the lower compensation depth for benthic algae on the local shoreline (a few species may be found at slightly greater depths on the Channel Islands where the water may be clearer than on the mainland). Historically, all rocks of any appreciable size in the inshore area of southern California except those inundated with fresh water, supported dense growths of marine plants. As conditions of water quality changed, these plants died or succumbed to other ecological imbalances wrought by man (extirpation of sea otter, over fishing of abalone, increased abundance of sea urchins). Now in some areas where giant kelp formerly flourished, solid surfaces which could be expected to support such growth remain free of this important plant.

"Rocks at any depth are a natural attractant to fishes (any large solid object on the bottom such as sunken boats, automobiles, airplanes, street cars will attract fish). Rocks found at depths of 150 to 600 feet and deeper attract fishes which frequent the particular depth zones to which they are adapted. These fishes come to the rocks for refuge and to feed upon plankton or other fishes. Fishes found at more shallow depths will feed upon benthic algae, plankton, invertebrates, and other fishes.

"Rocks at all depths, of course, are covered with a broad variety of organisms which in turn support an attached or associated biota. This epifauna includes corals, anemones, sponges, bryozoans, worms, clams, snails, octopuses, starfish, sea urchins, crinoids, brachiopods, crabs, barnacles, shrimp, tunicates and others. The majority of these organisms on rocks feed on plants (phytoplankton or benthic algae), and the rest feed on the sessile animals or one another. All of this interaction among the organisms of a rocky area at any depth results in a marvelously complex and interrelated situation which no one has yet been able to describe adequately by any approach so far advanced. Rocky areas which are depauperate in algae are much more complex than sedimentary bottoms but in general are still much simpler than rocky bottoms where kelp beds can survive. Rocks even below the depths where kelp can flourish are still productive, complex and interesting as a type of marine habitat.

"Life increases in both abundance and complexity in the lower intertidal zone with the appearance of fleshy red and brown algae together with surf grass *(Phyllospadix)*. The gamut of marine life includes nearly everything except large fishes and marine cetaceans, being found here some time at one location or another. The lushness of this zone is succeeded by the zone which is always covered by water where those forms which require continual submersion may be found.

"This narrow span from the lower intertidal to a depth of about 100 feet can be the most biologically productive region on earth especially on an upwelling shoreline. No other type of habitat supports a quantity and diversity of life equal to that found in this zone . . . ."

Variations in biota are produced by differences in: exposure to water/air, water/air temperature, exposure to waves, light intensity, hours of shade, drying, kind of rock, and other variables. Emery (1960, p. 145) utilizes a zonation classification as follows:

Top-zone - about 5.0 feet above mean lower low tide level (spray and wave zone mostly above high tide)

High-tide zone - between 5.0 and 2.5 feet

Midtide zone - between 2.5 and 0.0 feet

Lowtide zone - below 0.0 tide, exposed only during minus tides.

Representative biota on southern California rocky shores are indicated in table II-20. Not all species listed could be anticipated at any one location. Species of northern flora and fauna may be anticipated in the proximity of Point Conception.

(5) Sublittoral Zone (to approximately 200 m)

A major feature of the sublittoral zone is the kelp beds of the portions shallower than about 35 m and having rocky bottoms. Kelp grows in water beyond the breaker zone from approximately 20 to 100 feet (6.1 - 30.5 m) and attaches itself to the bottom by means of rootlike structure called a "holdfast". Stems (or stipes) extend upward toward the surface from which the fronds (leaves) grow outward. Kelp maintains buoyancy by means of bubble-like structures located on the proximal end of each frond, and because it is a green plant requiring sunlight, it grows to the surface where it bends over to form a kind of canopy. Kelp beds commonly are very dense, providing an excellent habitat for many species of pelagic organisms. Kelp also is an important commercial resource itself, the top four feet (1.2 m) of which is harvested several times each year by cutting at certain California Department of Fish and Game lease areas.

Giant kelp is a perennial, living and sending up new stalks called stipes for a period of 5 to 10 years. These stipes reach the surface to form a canopy, and live for about 6 months. There is a constant succession of new stipes growing to the surface to replace dead and dying ones, and a single holdfast may have more than 100 stipes. A young plant takes about 1 year to become established. Under favorable conditions, a young plant will double in size every 3 weeks. Growth and reproduction are limited by the available light (water clarity and depth), temperature, amount of available rocky substrate, nutrients present, number of grazers in area (opaleye, sea urchins, abalone, and other gastropods), disease (black rot), storms, and by heated water discharges and sewage outflows in the area.

Growth is primarily from the terminal tips of the stipes. Nutrients are taken from the surrounding water in the presence of sunlight during the process of photosynthesis. Rapid growth may follow an increase in the amount of plant food present in the water. During periods of optimum

TABLE II-20

REPRESENTATIVE PLANTS AND ANIMALS TYPICAL OF
SOUTHERN CALIFORNIA ROCKY SHORES

Compiled from Emery (1960, pp. 145-148)

TOP ZONE

plants	
brown alga	*Ralfsia*
blue-green algae	various species
animals	
periwinkle	*Littorina planaxis*
limpet	*Acmaea digitalis*

HIGH TIDE

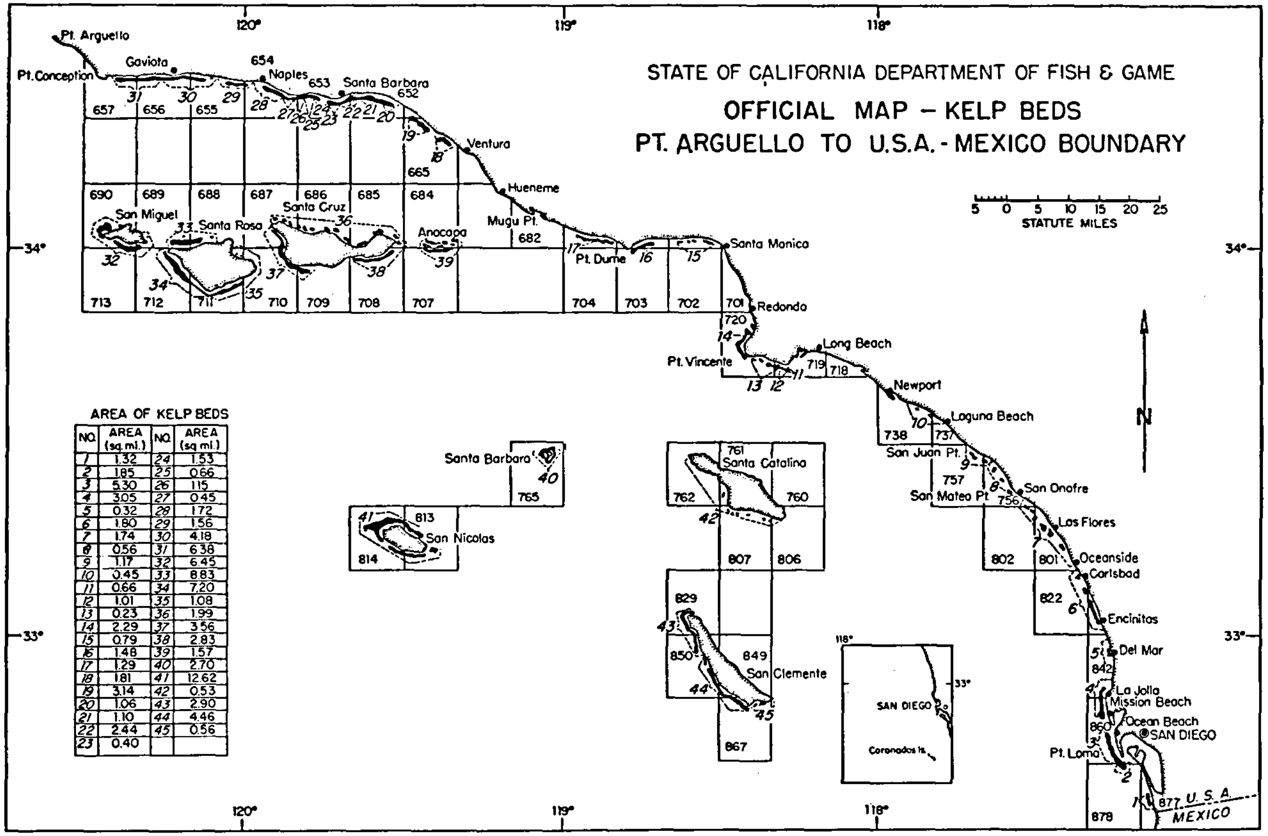
plants	
brown algae	several species including *Pelvetia fastigiata*
red alga	*Endocladia muricata*
animals	
snail	*Littorina scutula*
snail	*Tegula funebralis*
acorn barnacle	*Balanus glandula*
limpets	several species
crabs	several species including *Pachygrapsus*
hermit crabs	mostly species of *Pagurus*

MIDTIDE ZONE

plants	
red algae	several species of which the calcareous *Corallina vancouverensis* is one of the more common
green algae	larger species of *Ulva*
red algae	several species including *Gigartina canaliculata* and *G. leptorhynchos*
red algae (crutose)	*Lithothamnium*
animals	
sea anemone	*Bunodactis elegantissima*
black mussel	*Mytilus californianus*
barnacle (large)	*Balanus tintinabulum*
gooseneck barnacle	*Mitella polymerus*
chitons	many including *Nuttallina californica*

LOW-TIDE ZONE

plants	
brown alga (large)	*Egregia laevigata*
red alga	*Gigartina spinosa*
red alga	*Gelidium cartiligineum*, and a wide variety of smaller forms
red alga (calcareous)	*Melobesia mediocris* (commonly present as an encrustation on blades of *Phyllospadix*)
grass-like seed plant (angiosperm)	*Phyllospadix torryi* (closely related to *Zostera* which lives in certain minus-tide regions)
animals	
green sea anemone	*Anthopleura xanthogramica*
starfish	several species including the large *Pisaster orchracus*
spiny sea urchin	*Strongylocentrotus franciscanus*
purple sea urchin	*S. purpuratus*
rock borers	several species of *Pholadidea*
wood borers	
isopod	*Limnoria* spp.
amphipod	*Chelura terebrans*
mollusk	*Teredo diegensis*
other animals:	various species of hydroids, corals, sponges, abalones, tunicates, worms, crabs, and "others too numerous to mention"



NO.	AREA (sq. mi.)	NO.	AREA (sq. mi.)
1	1.32	24	1.53
2	1.85	25	0.66
3	5.30	26	1.15
4	3.05	27	0.45
5	0.32	28	1.72
6	1.80	29	1.56
7	1.74	30	4.18
8	0.56	31	6.38
9	1.17	32	6.45
10	0.45	33	8.83
11	0.66	34	7.20
12	1.01	35	1.08
13	0.23	36	1.99
14	2.29	37	3.56
15	0.79	38	2.83
16	1.48	39	1.57
17	1.29	40	2.70
18	1.81	41	12.62
19	3.14	42	0.53
20	1.06	43	2.90
21	1.10	44	4.46
22	2.44	45	0.56
23	0.40		

FIGURE II-35 OFFICIAL MAP OF THE NUMBERED KELP BEDS IN SOUTHERN CALIFORNIA, AND SELECTED STATISTICAL AREAS, 10' LAT. X 10' LONG. USED FOR REPORTING FISH CATCHES (From: North and Hubbs, 1968, p. 152) conditions, which consist of clear, cool waters, below 66°F, enriched with nutrients upwelled to the surface, giant kelp stipes have been observed to grow from 12 to 24 inches in a single day. When water temperatures reach 66°F, growth is arrested and sloughing occurs. (See Frey, 1971)

The most common specie of kelp in southern California waters is the giant kelp, *Macrocystis pyrifera*, however *M. augustifolia* is the most common in certain areas. Kelp beds occur off the Channel Islands and along the coast from Point Conception to about three miles north of Ventura. Based on data published in 1968, there are approximately 28 square miles of kelp beds between Point Dume and Point Conception and 34 square miles of kelp beds around the offshore islands for a total of 62 square miles (figure II-35). See section II.F.8., "Mariculture", for location of the most important commercial kelp beds and annual kelp harvests from several of these beds.

The benthic fauna of the sublittoral zone is represented by many of the forms of the littoral and bathyal zones, most of which provide food for the abundant pelagic fauna. In general, the species of major direct importance to man are the Pismo clam, which occurs to depths of 25 m off sandy beaches, the spiny lobster, rock crabs, and red and pink abalones, which occur mostly on rocky bottoms to depths of about 80 m.

Community Assemblages

Often certain species occur together in a characteristic assemblage which can be recognized as a "community". Allan Hancock Foundation (1965) lists such communites:

- "*Listriolobus*.[1] A distinct and remarkable assemblage is that of *Listriolobus pelodes* on the Santa Barbara shelf (Barnard & Hartman, 1959). *Listriolobus* accounts for 80% of the biomass of this community. Nowhere else is there a known comparable concentration of this or any other echiuroid. Elsewhere on the southern California shelf the species occurs sporadically, but only as sparsely distributed or small individuals. The total biomass of *Listriolobus* in its main area is about 100,000 tons.

- "*Amphiodia*. As already noted, *Amphiodia urtica* is found in 85% of the samples, under a wide range of conditions. It becomes dominant on soft bottoms, generally at depths between 120 and 300 feet, especially south of Ventura. Its limitations appear to be imposed by physical factors including small size of sedimentable food particles and such biological factors as lack of successful competition by other animals.

- "*Amphiodia-Cardita*. The community dominated by *Amphiodia urtica* and *Cardita ventricosa* is distinguishable on the Santa Barbara shelf, in depths below the *Listriolobus* community, roughly from 180 feet to 300 feet. This codominated community is not found in the southern part of the study area, since *Cardita* is infrequent south of Ventura.

[1] Emphasis supplied by underlining throughout this list, although scientific terms in italics are not conventionally underlined.

- "Chaetopterus. A distinctive community of *Chaetopterus variopedatus* is observed off the San Pedro Hills. This worm requires black mixed muddy bottoms, close to shore, in depths of 36 to 120 feet where food content is high and where relatively strong currents prevail. It flourishes under these conditions, with thickly massed tubes overlying the substrate. It is always associated with a highly diversified fauna of predictable kinds. Similar large concentrations of *Chaetopterus* occur at a few other places, including Bechers Cove on Santa Rosa Island, Howlands Landing on the leeward side of Santa Catalina Island, and off East End at the tip of this island. The associated organisms differ according to locality. At White Point it is a clam, *Lima dehiscens*. At Bechers Cove it is a polychaete, *Myxicola infundibulum,* and at Howlands Landing it is *Owenia* and other kinds of chaetopterids. In Newport Bay *Chaetopterus* fouls the bottoms of floats and boats which have been undisturbed for a year or more (MacGinitie, 1938, p. 209).

- "Pista-Nothria. A community of *Pista disjuncta* and *Nothria pallida* with or without brissopsid urchins, *Briasaster* and/or *Brissopsis,* is present in many green muds in moderate depths, near the edge of the shelf or on the deeper slopes. It occurs especially in the vicinities of submarine canyons. The distribution and abundance may fluctuate according to the refinements of the sediments, the remoteness from adequate food supplies, and possibly latitude.

- "Onuphis sp. Wherever the grain size of the sediment increases near the *Amphiodia urtica* community, the sandy tube-building worm *Onuphis* increases in density. Correspondingly, *Amphiodia* decreases in frequency until, where coarse sand is most common, the worm dominates the bottom.

- "Blephariopoda-Branchiostoma. A community dominated by *Blepharipoda occidentalis* and *Branchiostoma californiensis* is limited more or less sharply to the few areas where red or brown sands are known to occur. The associated organisms are more sharply limited than in any of the other communities, since they are often kinds of animals not found elsewhere. They include: *Ampelisca cristata,* an amphipod; *Sipunculus nudus,* a sipunculid; *Dendraster excentricus,* the common sand dollar; and seven species of polychaetes not present in other areas . . . .

- "Diopatra. *Diopatra ornata* has been found in greatest concentrations in shallow seas along the entire coast and is best established as a dominant where kelps and rocky bottoms occur. At maximum development the tubes measure more than 12 inches long, being matted or massed over the surface. Where algae abound it is commonly found with a nest-building nereid, *Platynereis bicanaliculata*.

- "Slope Communities (200 to 600 ft.). Three assemblages of broad distribution have been delineated in this environment. One is dominated by the large ophiuroid *Amphiacantha amphacantha;* the second by another large ophiuroid, *Amphiodia digitata,* and the third by two polychaetes, the stinging worm *Chloeia,* and the cone worm *Pectinaria*.

"These are areas where the large sea urchins *Briaster* and *Brissopsis* comprise a considerable proportion of standing crop so that slope communities maintain as high a standing crop as communities in shelf waters (30 - 200 ft.). Nevertheless, the small amount of existing organic matter in sea urchins and the probability that they grow slowly and have a low turnover are factors of importance in comparing raw data of standing crop between shelf and slope.

- "Rocky Bottoms. Several rocky bottom communities might be identified, but rocky outcrops are relatively sparse and difficult to sample with the gear used. Most animals are epifaunal, either attached to the rocks, or existing in crevices. Representative species are a seastar, *Asterina*, a large snail, *Astraea undosa*, a surface brittle-star, *Ophiothrix spiculata*, a stalked barnacle, *Scalpellum*, and other animals.. . . .

- "Some Small Communities. Possibly the following communities are recognizable, but they are of small extent in southern California. Most of them have been recovered in less than five samples, but they appear to be distinct types of assemblages.

- "*Dendraster sp*. The sand dollar community in sands in shallow water. May be mixed with *Chaetopterus*.

- "*Ophiura lutkeni*. A deep-water ophiuroid assemblage.

- "*Ampelisca*. A deep-water gravel community dominated by this tube-building amphipod.

- "*Pherusa-Onuphis*. A dominant complex recovered in three samples around the Whites Point outfall off San Pedro to a near exclusion of other animal species. Both animals are polychaetes.

- "*Capitella*. This polychaete, reported as an indicator of diluted sea-water and also of polluted areas in enclosed bays and harbors, dominated several samples. Two or three of the samples were probably indicative of natural pollution as a result of the metabolic activities of other epifaunal animals, whose fecal matter falls to the bottom and provides a rich organic mud. This is especially the condition in beds of *Diopatra* in kelp and algal fields.

- "*Tharyx*. The tube-building worm *Tharyx tesselata* dominates a number of samples on the San Pedro Shelf just off the breakwater. It might be considered an indicator of low levels of pollution, either man-made or natural, because the animal also dominates other samples where naturally produced dark gray or black sediments occur. Reish (1959) considers *Tharyx parvus* an indicator of 'healthy bottom' in Los Angeles Harbor. Notwithstanding some of the muds it occupies are black and, for open sea areas, this is most certainly indicative of an oversupply of organic matter. Species of *Tharyx* are widespread and numerous through about 15% of the total samples taken, and their presence alone is not an indicator of pollution.

Perhaps the numerical frequency in relation to surrounding samples may be of some use in pinpointing degrees of pollution."

On the basis of the samples spaced statistically according to area, an estimate has been made of the relative importance of these communities in southern California waters as illustrated in table II-21.

(6) Bathyal Zone (approximately 200 to 1,200 m)

The Allan Hancock Foundation (1965) has characterized bottom dwelling biota of the Santa Barbara Channel as follows:

"Area I. Point Conception to Santa Barbara Point. A narrow steeply-sloping shelf, characterized by high biomass values and supporting many species of animals of a northern fauna.

"Area II. Santa Barbara Point to Las Pitas Point. A broad gently-sloping shelf with inshore sediments of high silt content (at 20 fathoms depth), with high biomasses, and with many animals of a northern fauna.

"Area III. Las Pitas Point to the northern wall of Hueneme Canyon. A broad gently-sloping shelf having coarser sediments inshore than those on the Santa Barbara shelf, and with considerable terrestrial debris originating from the Santa Clara River. Biomasses are rather low."

The principal factor determining the species composition and abundance of benthic populations is the nature of the substrate, particularly the grain size of the sediment. In general, the grain size of the sediments tend to decrease with depth, i.e., distance from shore (which is the source of the inorganic portion of sediments), but there is much variability.

No living benthic plants occur in the bathyal zone due to lack of sufficient light energy. The diverse fauna existing in the depths gains nourishment from the organic detritus that falls from the waters above. Most organisms are detritus feeders, obtaining nourishment by ingesting sediment and removing the particulate organic matter. Some benthic

TABLE II-21

DOMINANCE OF BENTHIC COMMUNITIES ON THE SOUTHERN CALIFORNIA MAINLAND SHELF. SPACED STATISTICALLY ACCORDING TO AREA, BASED ON 150 STATIONS

	Percent of total shelf area
Amphiodia	23
Listriolobus	7
Onuphis	6
Amphiodia/Pectinaria	5
Nothria spp.	5
Amphiodia/Cardita	4
Diopatra	4
Cardita	3
Astropecten	1
Chloeia	1
Chaetopterus/Lima	1
Sternaspis	1
Amphiodia/Onuphis	1
Lytechinus	1
Tharyx	1
	67
Diversified and unclassified	33
TOTALS	100

(Source: Allan Hancock Foundation, 1965, p. 197. It is noted that the total percentage of classified communities is incorrectly added in the original publication).

organisms prey upon others and in turn are prey of large crustacea and fish.

Santa Barbara Basin, below sill depth, is one of the three basins in southern California having notably low concentrations of dissolved oxygen in both bottom sediments and overlying waters. Hydrogen sulfide production by anaerobic bacteria in the top sediment layers further inhibits biota requiring free dissolved oxygen (Emery, 1960).

(7) Pelagic Environment

The biota of this environment is made up of organisms which are either passively drifting (plankton) or swimming (nekton) in the water column.

(a) Plankton

Many of the neritic (nearshore) nekton are part of the food chain dependent on the large attached plants, but phytoplankton (plant plankton) consisting of single-celled or colonial algae are the primary producers and the ultimate source of food for the animals in the oceanic region. A seasonal variation in productivity and standing crop normally occurs in this coastal area with productivity values for spring and summer averaging about twice the value of fall and winter. Also, the southern part of the basin is notably more productive than the water in the northern end. Upwelling and eddying effects are believed to contribute to the establishment of a productive area in the northeastern portion of the basin (Oguri and Kanter in Straughan, 1971).

The smallest phytoplankton, nannoplankton (having a diameter less than 12 μm) have not been studied in detail in this area but are known elsewhere to be equally as important in primary production as the larger and better known phytoplankters such as the diatoms (unicellular or colonial algae with a silicious cell wall) and dinoflagellates (unicellular or colonial algae with a whip-like flagellum or "intracellular tail" for limited mobility).

Table II-22 gives a list of species of diatoms quoted in a study of the southern California mainland shelf by the Allan Hancock Foundation, and notes whether neritic or oceanic.

The standing crop of a plankton community is an estimate of the total mass of that community while the primary productivity of the community is the rate at which the phytoplankton photosynthesize carbon dioxide and water to oxygen and hydrocarbons. Fertilization of coastal waters by upwelling or inputs from rivers or other sources increases their primary productivity but would not necessarily increase the standing crop due to predation or other processes.

Data on primary productivity in the Santa Barbara Channel is presented in Oguri and Kanter (in Straughan, 1971, p. 17-48). These and other data pertaining to standing crop (measured by chlorophyll a concentration) and ratios of productivity to standing crop are further analyzed, and tabulated in Dames and Moore, 1974, manuscript in preparation. The latter draft manuscript summarizes from the literature: "A general pattern of higher productivity values for inshore stations was found (Straughan, 1971). Although this was not always accompanied by an increase in standing crop, photosynthetic efficiency was found to exhibit a more consistent pattern of higher values inshore (Straughan, 1971). Studies by the Allan Hancock Foundation revealed that values of productivity for spring and summer were about twice as high as the values for fall and winter along the coasts of

TABLE II-22

CHARACTERISTIC ENVIRONMENTS OF DIATOMS FOUND IN THIS STUDY, ACCORDING TO CUPP (1943) [1]

Species	*Environment*	*Climate*
Asterionella japonica	Neritic	So. Temperate
Asteromphalus heptactis	Oceanic	Temperate
Bacteriastrum delicatulum	Oceanic	Temperate
B. hyalinum	Neritic	Widespread
Biddulphia longicruris	Neritic	Temperate-Subtropical
B. mobiliensis	Neritic	Temperate-So. Temperate
Ceratulina bergonii	Neritic	So. Temperate
Chaetoceros affinis	Neritic	So. Temperate
C. compressus	Neritic	Boreal-So. Temperate
C. concavicornis	Oceanic	Boreal-Arctic
C. convolutus	Oceanic	Arctic-Boreal
C. costatus	Neritic	Tropical
C. curvisetus	Neritic	So. Temperate
C. debilis	Neritic	No. Temperate
C. decipiens	Oceanic	Arctic-Boreal
C. didymus	Neritic	So. Temperate
C. gracilis	Neritic	Widespread
C. laciniosus	Neritic	So. Temperate
C. pendulus	Oceanic	?
C. peruvianus	Oceanic	So. Temperate-Tropical
C. socialis	Neritic	No. Temperate
C. vanheurcki	Neritic	?
Coscinodiscus centralis pacifica	Oceanic	Temperate-No. Temperate
C. oculus iridis	Oceanic	Widespread
Coscinosira polychorda	Neritic	No. Temperate
Dactyliosolen mediterraneus	Neritic	Widespread
Ditylum brightwellii	Neritic	So. Temperate
Eucampia zoodiacus	Neritic	So. Temperate
Fragilaria crotonensis	Neritic	No. Temporate-Boreal
Guinardia flaccida	Neritic	So. Temperate
Hemiaulus hauckii	Neritic and Oceanic	Temperate, Tropical
H. sinensis	Neritic	So. Temperate-Subtropical
Leptocylindrus danicus	Neritic	No. Temperate
Licmophora abbreviata	Littoral	Widespread
Lithodesmium undulatum	Neritic	So. Temperate
Navicula distans	Littoral	?
Nitzschia closterium	Littoral	Widespread
N. pungens var. *atlantica*	Neritic	Temperate
Pseudoeunotia doliolus	Neritic and Littoral	Warm Seas
Rhizosolenia alata	Oceanic	Temperate
R. castracanei	Oceanic	Tropical
R. delicatula	Neritic	Temperate
R. robusta	Oceanic	Warm Seas
R. stolterfothii	Neritic	Widespread
Rhizosolenia styliformis	Oceanic	No. Temperate
Schroderella delicatula	Neritic	?
Skeletonema costatum	Neritic	Widespread
Stephanophyxis turris	Neritic	Temperate and Subtropical
Thalassionema nitzschioides	Neritic	No. Temperate
Thalassiosira aestivalis	Neritic	?
T. decipiens	Neritic	No. Temperate
T. rotula	Neritic	Temperate and So. Temperate
Thalassiothrix mediterranea	Neritic	Temperate-So. Temperate
Tropidoneis antarctica polyplasta	Littoral and Neritic	?

[1](From: Allan Hancock Foundation, 1965)

Orange and San Diego counties."

Zooplankton are larger animal plankton which feed on phytoplankton (and smaller zooplankton) and thus form a link between the primary production and consumption by higher organisms of direct value to man such as fishes. Included in the zooplankton are protozoans, larvae and eggs of various groups of organisms including fish, crustaceans, wormlike forms, jellyfish, pelagic mollusks and tunicates. Table II-23 lists some of the more common planktonic invertebrate species in order of abundance in the Santa Barbara Channel area.

Figure II-37 also lists planktonic larval fishes of the Santa Barbara Channel. Dames and Moore, 1974, manuscript in preparation, contains additional data on depth of fishes found as adults and graphical presentations on estimated relative abundance of Pacific sardine larvae, northern anchovy larvae, and sampling locations. The following narrative is quoted from the Dames and Moore, 1974, draft manuscript.

"The most abundant species of planktonic fishes were the California smooth tongue and Northern lampfish. These species 'usually, outnumbered all others in trawls within the channel' (EPA, 1971). Most of the larvae of the meso- or bathypelagic (depths greater than 200 meters) fishes are at depths of 0 to 300 meters (EPA, 1971). Larval Northern anchovies, Jack mackerel, and Pacific sardines, which are near-surface fishes as adults, are found at depths less than 100 meters (EPA, 1971; Miller and Lea, 1972).

"Pacific hake and the California smooth tongue (that live on the bottom as adults) typically range throughout mid-depths (200 to 550 meters) as larvae. Species including the Longspine and Shortspine thornyheads, Speckled and Pacific sanddabs, combfishes, and Dover sole inhabit the upper

TABLE II-23

FISH AND INVERTEBRATE PLANKTON
(From: Environmental Protection Agency, 1971, p. 66)

Captures of deep and shallow macroplankton, listed by species in order of abundance: fishes, then invertebrates. All captures (numbers of individuals), made by midwater trawl from the General Motors Research Vessel SWAN in 10 February-March hauls during the 1969 oil spill, are pooled for both the Santa Barbara Channel and the Santa Cruz Basin. Fishes are designated by scientific name, followed by general common name and family; invertebrates by scientific name and group only.

FISHES

Species	Common Name	Family	Captures
Stenobrachius leucopsarus	Lanternfish	Myctophidae	508
Cyclothone acclinidens	Bristlemouth	Conostomatidae	168
C. signata	Bristlemouth	Conostomatidae	132
Leuroglossus stilbius	Deep-sea smelt	Bathylagidae	116
Triphoturus mexicanus	Lanternfish	Myctophidae	58
Sebastodes sp. (larvae only)	Rockfish	Scorpaenidae	41
Merluccius productus (larvae only)	Pacific hake	Gadidae	31
Engraulis mordax (larvae only)	Northern anchovy	Engraulidae	16
Diaphus theta	Lanternfish	Myctophidae	11
Lampanyctus ritteri	Lanternfish	Myctophidae	9
Melanostigma pammelas (young)	Eelpout	Zoarcidae	7
Argyropelecus lychnus	Hatchetfish	Sternoptychidae	6
Parmaturus xaniurus	Filetail catshark	Scyliorhinidae	6
Citharichthys stigmaeus (larvae only)	Speckled sanddab	Bothidae	5
Danaphos oculatus	Bigeye lightfish	Gonostomatidae	4
Bathylagus wesethi	Deep-sea smelt	Bathylagidae	3
Scorpaenichthys marmoratus? (larvae only)	Cabezon	Cottidae	2
Sagamichthys abei	Shining tubeshoulder	Searsiidae	1
Bathylagus milleri	Deep-sea smelt	Bathylagidae	1
Argyropelecus pacificus	Hatchetfish	Sternoptychidae	1
Idiacanthus antrostomus	Blackdragon	Idiacanthidae	1
Stomias atriventer	Dragonfish	Stomiatidae	1
Chauliodus macouni	Viperfish	Chauliodontidae	1
Protomyctophum crockeri	Lanternfish	Myctophidae	1
Sebastolobus altivelis (young only)	Longspine channel rockfish	Scorpaenidae	1
Microstomus pacificus (larvae only)	Dover sole	Pleuronectidae	1
Citharichthys sordidus (larvae only)	Pacific sanddab	Bothidae	1
Zaniolepis frenata (larvae only)	Shortspine combfish	Zaniolepidae	1

INVERTEBRATES

Species	Group	Captures
Euphausia pacifica	Euphausiid (krill) shrimp	2607
"Pointed siphonophores"	Siphonophore	1299
Pasiphaea emarginata	Decapod shrimp	930
Euplokamis californiensis	Ctenophore	270
Emerita analoga (larvae only)	Sand crab	233
Sergestes similis	Decapod shrimp	233
Nematoscelis difficilis	Euphausiid (krill) shrimp	205
Thysanoessa spinifera	Euphausiid (krill) shrimp	192
Sagitta sp.	Chaetognaths (arrow-worm)	190
Hymenodora frontalis	Decapod shrimp	160
Salpa fusiformis	Salp	58
Blepharipoda occidentalis? (larvae only)	Sand crab	39
Aegina sp.	Medusa (jellyfish)	34
Paracallisoma coesus	Amphipod crustacean	34
Hyperia galba	Amphipod crustacean	28
Pasiphaea pacifica	Decapod shrimp	25
Vibilia sp.	Amphipod crustacean	23
"Megalops larvae"	Crab larvae	23
Paraphronima crassipes	Amphipod crustacean	20
"Zoea larvae"	crab larvae	18
Euphausia hemigibba	Euphausiid (krill) shrimp	17
Atolla wyvillei	Medusa (jellyfish)	13
Colobonema sp.	Medusa (jellyfish)	13
Pasiphaea chacei	Decapod shrimp	4
Pleuroncodes sp (larvae only)	Galatheid shrimp (decapod)	4
Praya dubia	Siphonophore	4
"Zoea larvae"	Crab larvae	3
Phronima sedentaria	Amphipod crustacean	3
Conchoecia sp.	Ostracod crustacean	3
Gennadas propinquus	Decapod shrimp	2
Lepidopa myops (larvae only)	Sand crab	2
Crossota rufobrunnea	Medusa (jellyfish)	2
Sergestes phorcus	Decapod shrimp	2
Doliolum gegenbauri	"Doliolid salp"	1

mid-depth (200 to 300 meters) as larvae. As adults, these species are considered benthic (bottom living) fishes inhabiting depths of 10 to 5,000 feet (EPA, 1971; Miller and Lea, 1972).

"Except for Cabezon, Pacific hake, Dover sole, Northern anchovies, Pacific sardines, Jack mackerel, and the rockfishes, none of the species listed in . . . (table II-23) . . . are caught commercially. Most of these species obtain a maximum length of less than one foot (Miller and Lea, 1972). The greatest period of abundance of fish larvae in the plankton occurs in the early spring, with young rockfishes and anchovy larvae appearing from later winter to early spring (EPA, 1971) . . ." (Dames and Moore, 1974)

The specific composition and the biomass (usually expressed as wet volume of zooplankton per 1,000 cubic meters) is extremely variable from year to year, seasonally, and even from station to station (due to patchy distribution), within a local area. In the Santa Barbara Channel area the average volumes found range from about 75 to 1,200 cc/1000 m^3 with the higher volumes tending to be found in summer and lower volumes in winter (Smith, 1971). Volumes by species type for many of the microplanktonic as well as macroplanktonic forms are also included in Smith, 1971.

(b) Nekton

The nekton are the free swimming pelagic animals. These are mostly the adult fishes and squids. Pelagic mammals (cetaceans) will be discussed under "Marine Mammals" (section II.E.2.a.(8)).

The Santa Barbara Channel area does not support an extensive estuarine-related fisheries resource as do the Atlantic and Gulf coasts. Coastal wetlands (marsh, mudflat and tidal channels) between Point Conception and Point Dume include: Devereaux Ranch Lagoon (45 acres); Goleta Slough (260 acres); Carpinteria marsh (200 acres); and Mugu Lagoon (2,170 acres). Wildlife of these coastal wetlands are adapted to a different environment than the afore discussed rocky or sandy shoreline habitats or to offshore open water habitats.

The productivity and variety of marine resources are large and important to local commercial and sport fishermen. Some species of fish, including albacore, bluefin tuna, striped marlin, bonito, yellowtail, white seabass, barracuda, salmon and others, are seasonally present, highly valued, migratory species. Many other valued fish are the surfperches, rockfishes and flatfishes which are present year-round.

Best and Oliphant (1965) list 297-some marine fish species which inhabit the coastal waters of the Point Arguello area. A more recent list of the expected and observed marine fishes in the Santa Barbara Channel Region is presented in Dames and Moore, 1974. All of these species are important in the ecology of the area but only those of direct major importance to man are listed and discussed below.

(i) Neritic Nekton

The neritic nekton is represented only by fish. The neritic fishes as defined here are fishes which commonly occur near the shoreline although many species are found somewhat offshore as well. These fishes, while taken also in commercial catches, are of prime importance to sport fishermen because of accessibility.

Neritic fishes may conveniently be divided on the basis of the characteristic habitat of the species of which there are only two major ones in the area considered: those off sandy and rocky shores.

Sandy Shore Fishes

Common Name	Scientific Name
jacksmelt	*Atherinopsis californiensis*
barred surfperch	*Amphistichus argeuteus*
silver surfperch	*Hyperprosopon ellipticum*
California corbina	*Menticirrhus undulatus*
spotfin croaker	*Roncador stearnsi*
yellowfin croaker	*Umbrina roncador*
white croaker	*Genyonemus lineatus*
queenfish	*Seriphus politus*
sanddabs	*Citharichthys spp.*

Rocky Shore Fishes

giant sea bass	*Stereolepis gigas*
kelp bass	*Paralabrax clathratus*
sand bass	*P. nebulifer*
opaleye	*Girella nigricans*
halfmoon	*Medialuna californiensis*
California sheephead	*Pimelometapon pulchrum*
white seaperch	*Phanerodon furcatus*
black perch	*Embiotoca jacksoni*
pile perch	*Rhacochilus vacca*
shiner perch	*Cymatogaster aggregata*
blue rockfish	*Sebastes mystinus*
cabezon	*Scorpaenichthys marmoratus*
ling cod	*Ophiodon elongatus*

More recent studies have been made to determine the shallow bottom fishes and more common shallow bottom invertebrates of the Santa Barbara Channel area. Table II-24 , from the Environmental Protection Agency, 1971, gives some indication of the relative abundance of those organisms.

(ii) Oceanic Nekton

Oceanic nekton is composed of fishes and the squids (mollusks). The only squid species of importance in the Santa Barbara Channel is *Loligo opalescens*. The oceanic fishes form the major

TABLE II-24

SHALLOW BOTTOM FISHES AND SELECTED INVERTEBRATES
(From: Environmental Protection Agency, 1971, p. 67)

Captures of shallow bottom fishes and selected invertebrates, listed by species (or invertebrate group) in order of abundance: fishes, then invertebrates. All captures (numbers of individuals), made by semi-balloon trawl from the Boston Whaler skiff in 56 February-August hauls during the 1969 oil spill, are pooled for all three localities (I-III, deep, intermediate, and shallow) around kelp beds in the "oiled" nearshore area off Santa Barbara and the "not oiled" area off Zuma Beach and Paradise Cove to the south. Fishes are designated by scientific name, followed by common name and family; invertebrates by kind only.

FISHES

Species	Common Name	Family	Captures
Citharichthys stigmaeus	Speckled sanddab	Bothidae	1421
Sebastodes semicinctus	Halfbanded rockfish	Scorpaenidae	615
Zalembius rosaceus	Pink seaperch	Embiotocidae	478
Citharichthys sordidus	Pacific sanddab	Bothidae	442
Porichthys notatus	Northern midshipman	Batrachoididae	410
Microstomus pacificus	Dover sole	Pleuronectidae	295
Genyonemus lineatus	White croaker	Sciaenidae	232
Seriphus politus	Queenfish	Sciaenidae	201
Zaniolepis latipinnis	Longspine combfish	Zaniolepidae	190
Icelinus quadriseriatus	Yellowchin sculpin	Cottidae	177
Phanerodon furcatus	White seaperch	Embiotocidae	163
Citharichthys xanthostigma	Longfin sanddab	Bothidae	147
Symphurus atricauda	California tonguefish	Cynoglossidae	139
Embiotoca jacksoni	Black perch	Embiotocidae	117
Hypsurus caryi	Rainbow seaperch	Embiotocidae	112
Micrometrus minimus	Dwarf seaperch	Embiotocidae	58
Syngnathus sp.	Pipefish	Syngnathidae	53
Hyperprosopon argenteum	Walleye surfperch	Embiotocidae	45
Pleuronichthys coenosus	C-O sole	Pleuronectidae	39
P. decurrens	Curlfin sole	Pleuronectidae	36
Cymatogaster aggregata	Shiner perch	Embiotocidae	34
Hippoglossina stomata	Bigmouth sole	Bothidae	34
Porichthys myriaster	Slim midshipman	Bathrachoididae	25
Heterostichus rostratus	Giant kelpfish	Clinidae	21
Parophrys vetulus	English sole	Pleuronectidae	21
Sebastodes vexillaris	Whitebelly rockfish	Scorpaenidae	20
Pleuronichthys verticalis	Hornyhead turbot	Pleuronectidae	18
Xystreurys liolepis	Fantail sole	Bothidae	17
Odontopyxis trispinosa	Pygmy poacher	Agonidae	15
Hypsopsetta guttulata	Diamond turbot	Pleuronectidae	11
Rhinobatos productus	Shovelnose guitarfish	Rhinobatidae	10
Otophidium scrippsae	Basketweave cusk-eel	Ophidiidae	10
Lepidogobius lepidus	Bay goby	Gobiidae	9
Zaniolepis frenata	Shortspine combfish	Zaniolepidae	9
Paralichthys californicus	California halibut	Bothidae	8
Squatina californica	Pacific angel shark	Squatinidae	8
Lyopsetta exilis	Slender sole	Pleuronectidae	8
Gibbonsia metzi	Striped kelpfish	Clinidae	8
Sebastodes levis	Cow rockfish	Scorpaenidae	7
Hyperprosopon anale	Spotfin surfperch	Embiotocidae	7
Leptocottus armatus	Pacific staghorn sculpin	Cottidae	7
Cephaloscyllium uter	Swell shark	Scyliorhinidae	6
Xeneretmus triacanthus	Bluespotted poacher	Agonidae	6
Scorpaenichthys marmoratus	Cabezon	Cottidae	6
Platyrhinoides triseriata	Thornback	Rhinobatidae	5
Synodus lucioceps	California lizardfish	Synodontidae	5
Sebastodes rastrelliger	Grass rockfish	Scorpaenidae	5
Sebastodes miniatus	Vermilion rockfish	Scorpaenidae	5
Xeneretmus ritteri	Spiny poacher	Agonidae	5
Pleuronichthys ritteri	Spotted turbot	Pleuronectidae	5
Amphistichus argenteus	Barred surfperch	Embiotocidae	4
Sebastodes rubrivinctus	Flag rockfish	Scorpaenidae	4
Paralabrax clathratus	Kelp bass	Serranidae	3
Sebastodes dalli	Calico rockfish	Scorpaenidae	3
Psettichthys melanostictus	Sand sole	Pleuronectidae	3
Stellerina xyosterna	Pricklebreast poacher	Agonidae	3
Aulorhynchus flavidus	Tube-snout	Aulorhynchidae	3
Neoclinus blanchardi	Sarcastic fringehead	Clinidae	3
Triakis semifasciata	Leopard shark	Carcharhinidae	2

TABLE II-24 (Continued)

Species	Common Name	Family	Captures
Agonopsis sterletus	Southern spearnose poacher	Agonidae	2
Otophidium taylori	Spotted cusk-eel	Ophidiidae	2
Paralabrax nebulifer	Sand bass	Serranidae	1
Menticirrhus undulatus	California corbina	Sciaenidae	1
Artedius harringtoni	Scalyhead sculpin	Cottidae	1
Ulvicola sanctaerosae	Kelp gunnel	Pholidae	1
Sebastodes chlorostictus	Greenspotted rockfish	Scorpaenidae	1
Phanerodon atripes	Sharpnose seaperch	Embiotocidae	1
Torpedo californica	Pacific electric ray	Torpedinidae	1
Hyperprosopon ellipticum	Silver surfperch	Embiotocidae	1
Gibbonsia elegans	Spotted kelpfish	Clinidae	1
Apodichthys flavidus	Penpoint gunnel	Pholidae	1
Hippoglossus stenolepis	Pacific halibut	Pleuronectidae	1

INVERTEBRATES

Kind	Captures	Kind	Captures
Stichopus (sea cucumber)	1930	Loxorhynchus (spider crab)	(Not compiled)
Eusicyonia ingentis (deep seasquirt)	831	Pugettia (kelp crab)	" "
Astropecten (starfish)	305	Styatula (sea pen)	" "
Sea urchins	(Numerous)	Octopus	" "
Brittle stars	(Numerous)	Pleurobranchia (tectibranch)	" "
Crango	242	Clams	" "
Cancer crabs	106	Hermit crabs	" "
Other crabs	91	Dendraster (sand dollar)	" "
Kelletia (kelp whelk)	7	Nudibranchs	" "
Pateria (starfish)	2	(Several other shrimps, etc., including the mysid shrimps of the kelp canopy	" "
Gorgonians	not compiled)		
Luidia (starfish)	" "		

part of the commercial fish harvest in the area. They are also important to sport fishermen and include some species of prestige in this sport such as striped marlin and swordfish. The northern Anchovy is important commercially as a baitfish.

The oceanic nekton can be classified in three groups on the basis of position occupied in the water column, from top to bottom: epipelagic, mesopelagic, and demersal. The mesopelagic fishes are chiefly smaller species which are little used by commercial or sport fisheries but which are very important in the food chain. The composition of this group is reported in a survey by Berry and Perkins (1966). The major species of the other two groups are listed below.

Epipelagic Nekton

Common Name	Scientific Name
basking shark	*Cetorhinus maximus*
soupfin shark	*Galeorhinus zyopterus*
thresher shark	*Alopias vulpinus*
bonito shark	*Isurus oxyrinchus*
northern anchovy	*Engraulis mordax*
Pacific sardine	*Sardinops sagax*
coho salmon	*Oncorphynchus kisutch*
chinook salmon	*O. tshawytscha*
Pacific saury	*Cololabis saira*
jack mackerel	*Trachurus symmetricus*
yellowtail	*Seriola dorsalis*
white seabass	*Cynoscion nobilis*
California barracuda	*Sphyraena argentea*
Pacific mackerel	*Scomber japonicus*
Pacific bonito	*Sarda chiliensis*
albacore	*Thunnus alalunga*
yellowfin tuna	*T. albacares*
bluefin tuna	*T. Thynnus*
striped marlin	*Tetrapturus audax*
broadbill swordfish	*Xiphias gladius*

Estimates of tonnages of surface schooling pelagic fishes have been made by aerial fish spotter pilots (Squire, 1972). This work does not provide an estimate of the total absolute abundance of the many species reported (but does serve to indicate abundance among the species for the years from 1962 to 1969).

Demersal Fishes

Common Name	Scientific Name
Pacific hake	*Merluccius productus*
chilipepper	*Sebastes goodei*
boccaccio	*S. paucispinus*
stripetail rockfish	*S. saxicola*
blue rockfish	*S. mystinus*
yellowtail rockfish	*S. flavidus*
olive rockfish	*S. serranoides*
gopher rockfish	*S. carinafus*
sablefish	*Anoplopoma fimbria*
ling cod	*Ophiodon elongatus*
California halibut	*Paralichthys californicus*
petrale sole	*Eopsetta jordani*
English sole	*Parophrys vetulus*
rex sole	*Gluptocephalus zachirus*
starry flounder	*Platichthys stellatus*

(8) Marine Mammals

Numerous species of cetaceans (whales, dolphins, porpoises) occur along the coast of southern California including the Santa Barbara Channel. There are seasonal fluctuations in both number of species and species population counts as most marine mammals are migratory. During October to April, the most numerous species listed in order of decreasing abundance are the common dolphin, Pacific white-sided dolphin, and the northern right whale dolphin. The Pacific pilot whale, Pacific bottle-nose dolphin, and the Dall porpoise are less abundant and occur in about equal numbers (Leatherwood, 1972). The gray whale, blue whale, and the thin-back whale are present and listed as endangered species.

The gray whales, probably the most popular of the whales occurring along the coast of southern California, are found in these waters between

November and April during their annual migration to and from their Mexican calving and breeding grounds. Their numbers are greatest off the San Diego area during the south migration in January and the north migration in March (Leatherwood, 1972). Whaling operations from 1850 through 1890 reduced the California gray whale herd, estimated to once number between 25,000 and 50,000 individuals, to perhaps a few thousand. Since then, except for the period 1924 through 1937, the gray whale has had complete protection (U.S. Department of the Interior, 1960). The result has been a gradual increase in population size. It has been estimated that the herd numbers now between 8,000 and 9,000 individuals (Straughan, 1971, p. 262).

Blue whales migrate south in the early winter (primarily in November) and north in July and August. Their migration path takes them outside the Channel Islands. Hump-backed whales (classified as endangered) are abundant in the winter at Richardson Rock off San Miguel Island and similar rocks off San Nicolas and San Clemente Islands. Breeding activity probably occurs at these locations. Little piked whales and fin-backed whales are found year-round with numbers peaking in winter. The little piked whale is probably the most abundant species found in the area on a year-round basis (Leatherwood, 1972).

> "Accurate assessment of cetacean numbers off California, as in other ocean areas, is extremely difficult to make. Most smaller cetaceans travel in herds whose numbers may vary greatly from season to season and which exhibit far-ranging movement patterns governed mainly by the availability of food species. It has recently been demonstrated--by Leatherwood, Lingle, Hall and Evans (manuscript in preparation)--that the peak period of abundance for all cetaceans in the inshore waters off California occurs during winter and early spring. This period of abundance coincides with the winter upwelling of rich nutrient water off southern California and related increases in biomass as potential food sources for the cetaceans. The upwelling is highlighted by tremendous concentrations of spawning squid and anchovies, which serve as a magnet for large schools of the cetaceans."

Table II-25 presents the number of herds off southern California during peak periods.

The California Department of Fish and Game (1969) surveys of transects established following the 1969 oil spill revealed the following cetacean numbers present in the 1,075 square miles sampled:

Survey period	Average number/day	
	Whales	Porpoises
January 28 - March 31, 1969	34	55
April 1 - May 31, 1969	4	65

Several species of pinnipeds including the California sea lion, Steller sea lion, harbor seal, northern elephant seal, and northern fur seal occur in the Santa Barbara Channel including the four offshore islands. In 1949, one individual Guadalupe fur seal was recorded on San Nicolas Island which is located south of the Santa Barbara Channel off Los Angeles. This species, which is generally restricted to Guadalupe Island, Mexico, has been classified as an endangered species by the Department of the Interior (Bureau of Sport Fisheries and Wildlife).

The following table gives the approximate assessment of pinniped populations off the California coast:

APPROXIMATE
CALIFORNIA PINNIPED POPULATIONS

California Sea Lion	40,000	(Dept. of Commerce, 1973)
Northern Elephant Seal	10,000	(Dept. of Commerce, 1973)
Northern Sea Lion	5,200	(Carlisle and Aplin, 1971)
Harbor Seal	1,675	(Carlisle and Aplin, 1971)
Northern Fur Seal	800	(Personal Communication)
Guadalupe Fur Seal	10	(Various Sightings)

TABLE II-25

NUMBER OF HERDS OFF SOUTHERN CALIFORNIA DURING PEAK PERIODS*

(From Leatherwood, et al., Manuscript in preparation)

SPECIES	NUMBER OF HERDS
Common Dolphin *(Delphinus delphis)*	7-27
Pacific White-sided Dolphin *(Lagenorhynchus obliquidens)*	2-8
Northern Right Whale Dolphin *(Lissodelphis borealis)*	1-4
Pacific Pilot Whale *(Globicephala macrorhynca)*	1-3
Pacific Bottlenose Dolphin *(Tursiops gilli)*	.5
Dall Porpoise *(Phocoenoides dalli)*	.5
California Gray Whale *(Eschrichtius robustus)*	**
Killer Whale *(Orcinus orca)* Risso's Dolphin *(Grampus griseus)* Striped Dolphin *(Stenella coeruleoalba)* False Killer Whale *(Psuedorca crassidens)* Blue Whale *(Balaenoptera musculus)* Humpback Whale *(Megaptera novaeangliae)* Minke Whale *(Balaenoptera acutorostrata)* Pacific Right Whale *(Balaena glacialis)*	Occasional or limited seasonal visitors to the California inshore waters.

*During peak periods within the inshore waters (November - March) the bulk of cetacean herds are found south of Point Conception where food species concentrations are optimum.

**The authors believe the California gray whale population is from 9,000 to 12,000 individuals, many of which annually migrate through the entire California inshore area from November to March.

TABLE II-25 (continued)

NUMBER OF HERDS OFF SOUTHERN CALIFORNIA DURING PEAK PERIODS

(From Leatherwood, et al., Manuscript in preparation)

SPECIES	NUMBER OF HERDS
Sei Whale *(Balaenoptera borealis)* Finback Whale *(B. physalus)* Sperm Whale *(Physeter catadon)* Pygmy Sperm Whale *(Kogia breviceps)* Harbor Porpoise *(Phocaena phocaena)* Miscellaneous Beaked Whales (Family *Ziphiidae*), including: Baird's Beaked Whale *(Berardius bairidi)* Hubb's Beaked Whale *(Mesoplodon carlhubbsi)* Cuvier's Beaked Whale *(Ziphius cavirostris)*	Occasional or limited seasonal visitors to the California inshore waters.

Tables II-26 through II-28 give a geographical breakdown of pinniped populations for the coast of California as derived by censuses conducted by the California Department of Fish and Game (Carlisle and Aplin, 1971, p. 124 - 126) for the years indicated. (The Santa Barbara Channel Islands are underlined)

Most of the sea lions south of Point Conception are California sea lions but a few Steller sea lions range into the Channel. Odell (1970, p. 187-190) reported San Miguel Island as being the southern limit of the breeding range of the Steller sea lion. His analysis of the 1964 aerial census revealed a total of 68 animals: 19 adult males, 42 females or immature males, and seven pups.

Odell (Ibid.) and Peterson, LeBoeuf, and DeLong (1968, p. 899-901) reported the existence in 1968 of a small breeding northern fur seal colony on San Miguel Island. The colony was estimated to consist of one adult male, 60 females, and 40 young in natal pelage (fur). Odell reviewed 1964 aerial census photos of the same area where they were observed in 1968 and indicated that the colony was probably present in 1964.

The population levels of these species within the Santa Barbara Channel area fluctuate widely during the year due to their migratory nature.
Their numbers peak in summer (June) when they return to the islands to give birth and breed. After the breeding season, they migrate along the Pacific Coast of the U.S. and out to sea. For example, the California sea lion is found as far north as Vancouver Island in the winter.

Population Estimates for Marine Animals Known to Occur in the Santa Barbara Region

The data presented unless otherwise noted are taken from the Bureau of Land Management (1975). Additional biological and population data on both a regional and world basis are available in the National Marine Fisheries Service/National Oceanic and Atmospheric Administration, 1975, Administration of the Marine Mammal Protection Act of 1972.

Cetaceans

Pacific Right Whale - *Balaena glacialis*

The Right Whale was originally very abundant, but heavy exploitation, mostly during the 19th century, reduced all populations to near extinction by the turn of the century. The North Pacific Ocean population is estimated at about 250 animals.

Minke Whale - *Balaenoptera acutorostrata*

Population is unknown for North Pacific but listed as about 200,000 in the southern hemisphere.

Sei Whale - *Balaenoptera borealis*

The Report of the Secretary of Commerce (Administration of the Marine Mammal Protection Act of 1972, December 21, 1972 to June 21, 1973) lists stock sizes available for commercial harvest are estimated to be about 80,000 in the southern oceans and 33,000 to 37,000 in the North Pacific Ocean. This estimate does not consider unharvestable young whales. In this report, the Sei Whale is listed as the second most valuable baleen whale, and that its populations appear to be near the level of maximum sustainable yield.

Finback or Fin Whale - *Balaenoptera physalus*

The report from the Secretary of Commerce gives an estimated 120,000 Fin Whales (of harvestable size) world-wide. Of this number, 10,000 to 13,000 are estimated from the North Pacific area. The report states that the Fin Whale is commercially the most valuable baleen whale and that stocks in the North Pacific and southern oceans are below maximum sustainable yield levels.

California Gray Whale - *Eschrichtius gibbosus*

Since the latter half of the 19th century, it has been no longer profitable to hunt them. In 1938 they were given complete protection by international treaty. Adjusted counts taken from 1969 to 1970 totaled 10,906 animals. It is estimated that the population has a consistent increase of about 11 percent a year. Leatherwood, et al. (unpublished) lists this whale as the most abundant Mysticeti from Point Conception to Ensenada.

False Killer Whale - *Pseudorca crassidens*

There are no data on the current population of this species, but judging by the size of the stranded schools, it exists in considerable abundance.

Killer Whale - *Orcinis orca*

No data on population figures have been reported. However, since they have no known natural predators and are not hunted commercially locally, it can be assumed with some certainty that a large stable population exists.

Pacific Pilot Whale - *Globicephala macrorhyncha*

No population figures are available but numerous sitings would indicate a large, stable population in the southern California area. Pilot Whales are still taken commercially in Japan. Leatherwood, et al. (unpublished) lists this whale as the fourth most abundant Odontoceti from Point Conception to Ensenada.

Hubb's Beaked Whale - *Mesoplodon carlhubbsi*

Considered rare throughout its range of the North Pacific Ocean. No population estimates available.

Cuvier's Beaked Whale - *Ziphius cavirostris*

No published numbers on population but appear regularly in Japanese waters.

Pygmy Sperm Whale - *Kogia breviceps*

The industrial yield of the Pygmy Sperm Whale is very small. This, in conjunction with rare sitings, make it impossible to estimate its population.

Sperm Whale - *Physeter catadon*

There is no estimate of the population size of the world. The North Pacific population is estimated at 70,000 to 100,000 animals. Over eleven years of whaling (1919 to 1929) off the western coast of North America, 1,217 Sperm Whales were taken out of the total 15,985 whales of various species. Of these only 22 were from lower California. Their numbers can be considered negligible in southern California waters.

Pacific (Gill's) Bottlenose Dolphin - *Tursiops gilli*

Herds of several hundreds are reported so this species is presumed to exist in fairly high numbers, although no census data is available. Leatherwood, et al. (unpublished) lists this dolphin as the fifth most abundant Odontoceti along with *P. dalli* from Point Conception to Ensenada.

Common Dolphin - *Delphinus delphis*

Population is estimated at more than 30,000 but this is probably a conservative estimate. Leatherwood, et al. (unpublished) lists this dolphin as the most abundant cetacean from Point Conception to Ensenada.

Pacific Striped or White-sided Dolphin - *Lagenorhynchus obliquidens*

Schools up to 1,000 animals have been reported. Populations near Japan alone are estimated to number between 30,000 to 50,000. Leatherwood, et al. (unpublished) lists this dolphin as the second most abundant Odontoceti from Point Conception to Ensenada.

Northern Right Whale Dolphin - *Lissodelphis borealis*

The population is estimated at more than 10,000 animals. Leatherwood, et al. (unpublished) lists this species as the third most abundant Odontoceti from Point Conception to Ensenada.

Harbor Porpoise - *Phocoena phocoena*

This species is abundant in the North Atlantic and Eastern North Pacific.

Dall Porpoise - *Phocoenoides dalli*

The population of the northwestern North Pacific may be as many as 50,000 animals. There are no published figures for the large stable population as schools of 100 or more have been reported by Daugherty (loc. cit.). Leatherwood, et al. (unpublished) lists this porpoise as the fifth most abundant Odontoceti along with *T. gilli* from Point Conception to Ensenada.

Long-beaked Dolphin or Blue-white Dolphin - *Stenella caeruleoalba*

Even though this species is uncommon in southern California waters, the Pacific population is estimated at 15,000 to 200,000 animals. The Blue-white Dolphin is taken commercially in limited numbers by the Japanese.

Pacific Spotted Dolphin* - *Stenella graffmani*

This species is seen in very large schools and run with the tuna. For this reason they have been harvested in large numbers with tuna catches. There is concern about their numbers if this practice continues. Special escape nets are now being developed by the National Marine Fisheries Service hopefully to remedy this situation.

Pinnipeds

Northern or Alaska Fur Seal - *Callorhinus ursinus*

Threatened by extinction due to heavy killing, they were given protection

*This species listed as *Stenella dubia* by Rice and Scheffer, 1968.

by international treaty in 1911. Since that time the total fur seal population, which was estimated at fewer than 125,000 animals, has risen to 1,500,000 to 1,800,000 on the Pribilof Islands, and 60,000 and 40,000 on the Commander and Robben Islands, respectively.

Guadalupe Fur Seal - *Arctocephalus philippii*

This species was once thought to be extinct but now thought to be about 500 animals.

California Sea Lion - *Zalophys californianus*

The estimated world population of the California Sea Lion is 60,000 animals (National Marine Fisheries Service, NOAA, Fed. Reg. 39(122):23903-23905).

Stellar or Northern Sea Lion - *Eumetopias jubatus*

The estimated world population of the Northern or Stellar Sea Lion is 240,000 to 300,000 animals (National Marine Fisheries Service, NOAA, Fed. Reg. 39(122):23903-23905)

Northern Elephant Seal - *Mirounga angustirostris*

In 1972, California Fish and Game counted 3,470 animals with an estimated pup production of 2,500 to 3,000 over the last three years (Robert DeLong, personal communication) bringing the current total to above 6,000 animals.

Harbor Seal - *Phoca vitulina*

The world population of Harbor Seals is estimated at 150,000 to 450,000 animals. Of this total, the southern California species numbers 20,000 to 50,000. Only about 500 individuals are in California. The numbers hauling out on beaches, in bays, etc., have not been reported. Robert DeLong (personal communication) reports that about 300 *Phoca* were observed on San Miguel Island during 1973.

Carnivores

Sea Otter - *Enhydra lutris*

This mammal no longer exists along the southern California coast but is included here because of past representation. The Sea Otter was the most sought after of marine fur bearers during the 18th and 19th centuries; and like the pinnipeds, it was virtually exterminated by commercial hunters early in the 19th century. Prior to that time, it apparently abounded along the southern California coast as far south as Baja California. The remnant California population is now found only from the Monterey Bay area south to Morro Bay.

b. Channel Areas of Special Concern

The following chart provides some indication of the approximate area and comparative percentages of the various wetland habitats of fish and wildlife value found on the mainland coast of the Santa Barbara Channel.

Area	Acres of brackish or saltwater wetland	Percent of Santa Barbara Channel total
Goleta Slough	260	8.6
Carpinteria Marsh	200	6.6
Santa Ynez River	160	5.3
Goleta Point Marsh	60	2.0
Santa Maria River	65	2.1
Devereaux Ranch Lagoon	45	1.5
Mugu Lagoon	2,170	71.6
Santa Clara River	60	2.0
Ventura River	10	.3

(from California Department of Fish and Game, 1973)

TABLE II-26

COMPARISON OF SEA LION DISTRIBUTION ON ROOKERIES AND HAULING GROUNDS, 1958, 1961, 1965, 1969 AND 1970

	1958	1961	1965	1969	1970
St. George Reef to Cape Mendocino	1,321	907	625	1,069	1,026
To Pt. Arena	1,050	781	278	552	402
To Pt. Reyes	936	795	259	420	197
To Pigeon Point	90	23	--	263	68
Farallon Islands	941	703	311	855	585
Pt. Ano Nuevo	1,170	2,342	2,574	1,985	1,542
To Pt. Lobos	517	230	317	488	265
To Pt. Conception	1,028	894	634	1,524	1,104
Northern California	7,053	6,675	4,998	7,156	5,189
To Pt. Loma (mainland)	164	33	67	37	39
San Miguel Island	5,192	9,512	11,641	7,734	9,835
Santa Rosa Island	295	--	125	--	220
Santa Cruz Island	262	15	401	317	201
Anacapa Island	45	15	--	--	40
Santa Barbara Island	1,847	1,760	1,100	654	484
San Clemente Island	1,507	2,361	1,900	667	949
Santa Catalina Island	233	30	35	107	39
San Micolas Island	3,074	4,637	1,900	7,935	6,240
Southern California	12,672	18,363	17,169	17,451	18,047
Total California	19,725	25,038	22,167	24,607	23,236

TABLE II-27

DISTRIBUTION OF HARBOR SEALS DURING 1965, 1969 AND 1970

	1965	1969	1970
St. George Reef to Cape Mendocino	56	167	421
To Point Arena	304	409	227
To Point Reyes	78	454	591
To Pigeon Point	250	204	114
Pt. Ano Nuevo	--	172	88
To Point Lobos	94	41	75
To Point Conception	70	151	148
To Point Loma	--	7	--
San Miguel Island	140	64	--
Santa Rosa Island	--	209	3
Santa Cruz Island	70	168	8
Anacapa Island	--	93	--
Total	1,062	2,139	1,675

TABLE II-28

DISTRIBUTION OF NORTHERN ELEPHANT SEALS DURING 1965, 1969 AND 1970 CENSUSES

	1965	1969	1970
Point Ano Nuevo	363	172	85
San Miguel Island	3,000	1,451	2,917
San Clemente Island	100	--	--
San Nicolas Island	100	191	--
Total	3,563	1,642	3,005

The wetland areas consist of three basic habitat types: marsh, mudflat, and surface water. Of this total wetland area approximately two-thirds is marshland, while the other third is about equally divided between mudflat and open water area.

The wetland areas of the mainland channel region support significant wildlife populations and provide invaluable habitat for more than 150 species of water-associated birds. The submerged mudflat and open water areas provide habitat and nutrients for numerous fishes on a resident or seasonal basis. Fish populations found in these areas could be expected to include sharks, rays, flatfish, perch, croakers, smelt, herring, bass, anchovy, mackerel, bonita, gobies, cottids, mullet and many others. In the southern California area as a whole, over 60 species of fishes are known to frequent wetland and bay areas (Fay, 1972).

The offshore Channel Islands are of considerable concern also. The table below lists the islands and indicates some of their characteristic values.

Approximate Times of Pinniped Activity on the Santa Barbara Channel Islands

Species	On Land	Pupping	Breeding	Nursing
Northern fur seals	May to about 15 November[1]	Late May to mid-August	Late May to late August	Late May to about 15 November
Northern sea lion	May through November[1]	June	June	June to November. A few may nurse all year.
California sea lion	All year	June	June to July	June to November. A few all year
Northern elephant seal	All year	Late December to late February	January to mid-March	Late December to mid-March
Harbor seals	All year	March to April	April	March to May
Guadalupe	A few all year	--- ---	--- ---	--- ---

1. A few may be on land at any time.

SANTA BARBARA CHANNEL ISLANDS

(Quoted from California Department of Fish and Game, 1973, p. 180, 193)

San Miguel Island

San Miguel Island, located 25 miles south of Point Conception Light House, is owned by the U.S. Navy and administered by the National Park Service. Landing is allowed only by special permit. The island has 24 miles of sandy beaches, scenic cliffs and sea caves. The shores are predominantly broken and rocky, but there are a few short stretches of sandy beach located between rocky outcroppings.

Skindivers take charter boats to this island to spearfish and dive. In 1970 divers harvested abalone, rock scallops, rockfish, kelp bass, and California sheephead from the waters surrounding the island. The catch was 0.88 fish and shellfish per diver-hour.

Santa Rosa Island

Santa Rosa Island is located about 27 miles southwest of Santa Barbara Harbor. The island is privately owned. The shoreline is predominantly high rock cliffs, but there is approximately 12 miles of sandy shoreline at the western end of the island.

Skindivers taking charter boats to this island harvested spiny lobster, abalone, rock scallop, rockfish, kelp bass, and California sheephead from its surrounding waters. The catch per diver-hour was 0.64 fish and shellfish in 1970.

Santa Cruz Island

Santa Cruz Island is about 22 miles south-southeast of Santa Barbara. It is the largest of the Channel Islands having approximately 60 miles of shoreline. The shores are high, steep, and rugged and are famous for the many sea caves found here. The island has numerous anchorages and landings. Sandy shoreline is found in pocket beaches along the eastern end of the island and in harbors along the northeastern side. The entire island is owned by two families, with permission from the owners being required for public landing.

Skindivers taking charter boats to this island harvest abalone, rock scallop, California sheephead, spiny lobster, kelp bass, and other species from the surrounding waters. The catch per diver-hour was 0.62 fish and shellfish in 1970.

Anacapa Island

Anacapa Island, actually a string of several small islands, is located approximately 15 miles southwest of Port Hueneme. The island is typified by seacliffs up to 500 feet high, with a few small rocky bays and insignificant sandy pocket beaches. Anacapa Island and Santa Barbara Island comprise the Channel Islands National Monument and are administered by the National Park Service. A ferry runs tourists to the islands periodically from Channel Islands Marina.

Skindivers taking charter boats to Anacapa Island harvest abalone, spiny lobster, rock scallop, California sheephead, and other species. In 1970 the catch per diver-hour was 0.66 fish and shellfish at Anacapa Island.

Further area specific resource descriptions are found in U.S. Coast Guard Eleventh Coast Guard District Coastal Survey, 1972, Coastline characteristics of southern California national oil and hazardous substances pollution contingency plan - Region 9, Annex II: Sub-regional contingency plans, Appendix I: California Sub-Region, Tab A: Critical water use areas,

Table 4: Shoreline detail, Santa Barbara County, 61 p. See also "Areas of Special (Biological) Significance", section II.G.2.b.

c. Biotic Communities of the South Coast Subprovince

For continuity with section II.E.1 Terrestrial Communities, table II-29 continues the marine biotic communities cited by the California Resources Agency. Again, examples represent high quality occurrence over which the California Resources Agency has expressed concern for existing landscape protection.

TABLE II-29

BIOTIC COMMUNITIES OF THE SOUTH COAST SUBPROVINCE (MARINE)

(Compiled from California Department of Parks and Recreation, 1971 (Reprinted November 1972), p. 39-41 and 51).

Examples represent high quality occurrence over which the California Resources Agency has expressed concern for existing landscape protection.

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9. Sandy Intertidal Zone

Location and Examples

Public Ownership: Leo Carrillo SB, Gaviota SB, Refugio SB, El Capitan SB, Carpinteria SB.

Private Ownership: Gaviota Area, Carpinteria Marsh, Santa Rosa Island, Santa Cruz Island, Santa Catalina Island.

Splash Zone

The upper limits of the beach, reached only by very high tides.

High Tide Zone

This zone is generally exposed to the air but frequent high tides cover it.

Middle Tide Zone

This zone is generally covered by water but is exposed by most low tides.

Low Tide Zone

The lowest intertidal zone, usually covered by water and reached only at very low tides.

Characteristic Animals

Beach louse, beach hopper *(Orchestoidea californica)*, sand flea *(Orchestia traskiana)*, bay shore crab *(Hemigrapsus oregonensis)*, grunion *(Leurestes tenuis)*.

Bent nosed clam *(Macoma nasuta)*.

Spiny sand crab *(Belpharipoda occidentalis)*, red beachworm *(Thoracophelia mucronata)*, basket cockle *(Clinocardium nuttalli)*, ghost shrimp *(Callianassa californiensis)*, moon snail *(Polinices lewisi)*.

Pismo clam (*Tivela stultorum*), sand dollar (*Drendraster excentricus*), shrimp (*Crago*), nudibranch.

Shore Birds Characteristic of the Sandy & Muddy Shore of California:

Long-billed curlew (*Humenius americanus*), hudsonian curlew (*Phaeopus hudsonicus)*, marbled godwit (*Umosa fedoa*), western willet (*Cataptiophorus semipalmatus*), avocet (*Recurvirostra americana*), black bellied plover (*Squatarola squatarola*).

10. Rocky Intertidal Zone

Location and Examples

Public Ownership: Emma Wood SB, Leo Carrillo SB, Gaviota SB, Refugio SB, El Capitan SB, Carpinteria SB, Parks No. 3 & 4 (Ventura Co.), San Miguel Island (Fed-Navy), Anacapa Island (Fed.-NPS), Santa Barbara Island (Fed.-NPS), Ship Rock (Fed.-Catalina Ch.), Farnsworth Bank (Fed.-Catalina Ch.)

Private Ownership: Gaviota Area, Santa Rosa Island, Santa Cruz Island, Santa Catalina Island.

Splash Zone

This community is the rocky shoreline above high tide where there is only the splash of the waves. The plant life in this zone is not conspicuous. Those growing here are green felt-like plants in the deep crevices.

Characteristic Plants

Characteristic plants: Sea felt (*Enteromorpha*), sea lettuce (*Ulva*).

Characteristic Animals

Characteristic animals: Rock louse (*Ligia occidentalis*), gray littorine (*L. planaxis*), checkered littorine (*L. scutulata*). Found only in southern California are the acorn barnacle (*Balanus glandula*), small acorn barnacle (*Chtalamus fissus*), rough limpet (*Acmaea scabra*), finger limpet (*A. digitalis*), file limpet (*A. limatula*).

High Tide Zone

This zone lies between the mid-tide level and the area usually covered by every high tide. This second zone is most often referred to as the rock-weed zone.

Characteristic Plants

Characteristic plants: Common rockweek (*Pelvetia fastigiata*), spongeweed (*Codium fragile*).

Characteristic Animals

Molluscs and crustaceans: Black turban (*Tegula funebralis*), checkered littorine (*Littorina scutulata*), speckled limpet (*Acmaea persona*), owl limpet (*Lottia gigaetea*), shore crab (*Pachygrapsus crassipes*), blue-clawed hermit crab (*Pagurus samuelis*).

Fish: Tidepool sculpins (*Clicottus analis*), young opaleyes (*Girella nigricans*).

Middle Tide Zone

The middle tide zone occurs between mean sea level and mean lower low water. This zone is covered by water 75% of the time. Within this zone exists a wealth of plant and animal life.

Characteristic Plants

Characteristic plants: California lithothamnium (*Lithothamnium californicum*), circular pink algae (*Melobesia spp.*), agar weed (*Gelidium cartilagineum*), feather boa kelp (*Egregia menziesi*), southern sea palm (*Eisenia arborea*).

Characteristic Animals

Characteristic animals: Aggregate sea anemone (*Anthopleura elegantissima*), giant green anemone (*A. xanthogrammica*), pink barnacle (*Balanus tintinnabulum*), thatched barnacle (*Tetraclita squamosa*), porcelain crab (*Petrolisthes cintipes*), ringed serpent star (*Ophiohereis annulata*), fuzzy brittle star (*Ophiothrix apiculata*), southern pistol shrimp (*Cragon dentipes*), angular unicorn (*Acanthina spirata*), sea hare (*Tethys californica*), green abalone (*Haliotis fungens*), black abalone (*H. refescens),* California spiny lobster (*Panilurus interruptus*), two spotted octopus (*Octopus bimaculoides*).

Low Tide Zone

This zone is reached only at the lowest tides of the year, and is characterized by the growth of green surf grass.

Characteristic Plants

Characteristic plants: Green surf grass (*Phyllospadix torreyi*), sea palm (*Postelsia palmaeformis*), laminarians (*Laminaris spp.*).

Characteristic Animals

Characteristic animals: Red velvety encrusting sponges (*Ophlitaspongia spp.*), California moray (*Gymnothorax mordax*), giant keyhole limpet (*Megathura cremulata*), smooth turban (*Norrisia norrisi*), Red Sea urchin (*Strongylocentrotus franciscanus*); purple urchin (*S. purpuratus*).

11. Nearshore Zone

Description

This area extends from the seaward limit of the intertidal zone to ½ mile at sea.

Location and Examples

Public Ownership: Leo Carrillo SB, Gaviota SB, Refugio SB, El Capitan SB, Carpinteria SB, San Miguel Island (Fed.-Navy), Anacapa Island (Fed.-NPS), Santa Barbara Island (Fed.-NPS), Ship Rock (Fed.-Catalina Ch.), Farnsworth Bank (Fed.-Catalina Ch.).

Private Ownership: Gaviota Area, Carpinteria Marsh, Santa Rosa Island, Santa Cruz Island, Santa Catalina Island.

Characteristic Plants

Characteristic plants: Giant bladder kelp (*Macrocystis pyrifera and m. augustifolia*), bull kelp (*Nereocystis leuticeana*), elk kelp (*Pelagophycus porra*).

Fish

Shovelnose guitarfish (*Rhinobatos productus*), round stingray (*Urolophus halleri*), bat ray (*Myliobatis californicus*), whitebait (*Hypomesus pretiosus*), diamond turbot (*Hypsopsetta guttulata*), starry flounder (*Platichthys stellatus*), striped bass (*Roccus saxatilis*), California grunion (*Leuresthes tenuis*), jacksmelt (*Atherinopsis californiensis*), California sargo (*Anisotremus davidsoni*), California corbina (*Menticirrhus undulatus*), white croaker (*Genyonemus lineatus*), spotfin croaker (*Ronacor stearnsi*), barred surfperch (*Amphistichus argenteus*), walleye surfperch (*Hyperprosopon argenteum*), black perch (*Embiotoca jacksoni*), shiner perch (*Cymatogaster aggregata*), opaleye (*Girella nigricans*), halfmoon (*Medialuna californiensis*), kelp rockfish (*Sebastodes atroviерns*), grass rockfish (*S. rastelliger*), greenling seatrout (*Hexagrammos decagrammus*), cabezon (*Scorpaenicthys marmoratus*), monkeyface eel (*Cebidicthys violaceus*), common thresher (*Alopias vulpinus*), blue shark (*Prionace glauca*), king salmon (*Oncorhynchus tshawytscha*), silver salmon (*O. kisutch*), Pacific sanddab (*Citharichthys sordidus*), longfin sanddab (*C. xanthostigma*), California halibut (*Paralichthys californicus*), giant sea bass (*Stereolepis gigas*), kelp bass (*Paralabrax clathratus*), California barracuda (*Sphraena argentea*), California yellowtail (*Seriola dorsalis*), Pacific jack mackerel (*Trachurus symmetricus*), Pacific mackerel (*Scomber japonicus*), California bonito (*Sarda chiliensis*), bluefin tuna (*Thunnus thynnus*), albacore (*T. alalunga*), striped marlin (*Makaira audax*), white seabass (*Cynoscion nobilis*), white croaker (*Genyonemus lineatus*), ocean whitefish (*Caulolatilus princeps*), sheep-head (*Pimelometopon pulchrum*), bocaccio (*Sebastodes paucispinis*), olive rockfish (*Sebastodes serranoides*), blue rockfish (*S. mystinus*), vermilion rockfish (*S. miniatus*), sculpin (*Scorpaena* *guttata*), sablefish (*Anoplopoma finbria*), lingcod (*Ophiodon elogatus*).

Birds

Fork-tailed petrel (*Oceanodroma furcata*), beal's petrel (*O. Leucorhoa*), brandt's cormorant (*Phalacrocorax pencillatus*), double-crested cormorant (*P. auritus*), baird's cormorant (*P. pleagicus*), black oystercatcher (*Haematopus bachmani*), western gull (*Larus occidentalis*), California murre (*Uria aalge*), pigeon guillemot (*Cepphus columba*), tufted puffin (*Lunda cirrhata*), cassin's auklet (*Ptychoramphus aleuticus*), rhinoceros auklet (*Cerorhinca monocerata*).

Characteristic Animals

Mammals: Pacific right whale (*Balaena glacialis japonica*), little piked whale (*Balaenoptera acutorostrata*), sei whale (*B. borealis*), blue whale (*B. musculus*), finback whale (*B. physalus*), humpback whale (*Megaptera novaeangliae*), California gray whale (*Eschrichtius gibbosus*), common dolphin (*Delphinus delphis bairdi*), Pacific pilot whale (*Globicephala scammoni*), risso's dolphin (*Grampus griseus*), Pacific striped dolphin (*Lagenorhynshus obliquidens*), northern right whale dolphin (*Lissodelphis borealis*), killer whale (*Orcinus orca*), harbor porpoise (*Phocoena phocoena*), dall porpoise (*Phocoenoides dalli*), false killer whale (*Pseudorca crassidens*), long-beaked dolphin (*Stenella euphrosyne*), Pacific spotted dolphin (*S. graffmani*), rough-toothed dolphin (*Steno bredanensis*), Pacific bottlenose dolphin (*Tursiops truncatus gilli*), sperm whale (*Physeter catodon*), pygmy sperm whale (*Kogia breviceps*), baird's beaked whale (*Berardius bairdi*), hubbs's beaked whale (*Mesoplodon carlhubbsi*), cuvier's beaked whale (*Ziphius cavirostris*), Guadalupe fur seal (*Arctocephalus philippii townsendi*), northern fur seal (*Callorhinus ursinus*), steller sea lion (*Eumetopias jubata*), California sea lion (*Zalophus californianus*), ribbon seal (*Historiophoca fasciata*), northern elephant seal (*Mirounga augustirostris*), harbor seal (*Phoca vitulina*), sea otter (*Enhydra lutris*).

F. Resources

1. Population - Historical and Projected Growth

As of July 1, 1974, California had an estimated population of 20,933,000 reflecting a one percent increase as compared to a year earlier. The two fastest growing metropolitan areas in total actual gain were Orange and San Diego counties, with respective increases in population of 50,600 and 40,800. In 1974 Los Angeles County was the only Standard Metropolitan Statistical Area in California to show a decrease with approximately 8,900 fewer people than in the same period in 1973 (table II-30).

Southern California's coastal counties from Santa Barbara to San Diego, had an estimated population of 10,833,200 by July 1, 1974. This represents slightly more than one-half the population of the entire state on less than nine percent of the land area. Southern California experienced approximately a one percent increase in population in 1974. This is the same rate of growth as experienced by California and the United States as a whole (tables II-30 and II-31).

During the century following 1860, California's population doubled five times, or once each twenty years. In the period 1960 to 1970, California's population increased 27 percent, which was more than double the average growth rate for the United States (table II-32).

The unusual rate of growth which California experienced through 1965 is no longer possible not only because of the very size of the base, but also because in absolute terms net migration and the number of births has declined substantially. In the past five years the level of migration has averaged about 207 per day more arrivals than departures. This is substantially below the "thousand per day" which was commonplace a decade ago.

Table II-30

TOTAL POPULATION OF SOUTHERN CALIFORNIA COASTAL COUNTIES

JULY 1, 1971, JULY 1, 1972, JULY 1, 1973 and JULY 1, 1974
WITH ANNUAL PERCENT CHANGE

County	July 1, 1971 (Revised)	July 1, 1972 (Revised)	July 1, 1973 (Revised)	July 1, 1974 (Provisional)	Annual Percent Change 71-72	72-73	73-74
Los Angeles-----------	7,058,700	7,015,100	6,970,100	6,961,200	-0.6	-0.6	-0.1
San Diego-------------	1,390,600	1,432,100	1,469,100	1,509,900	3.0	2.6	2.8
Orange----------------	1,481,600	1,532,000	1,605,700	1,656,300	3.4	4.8	3.2
Ventura---------------	391,700	405,900	417,900	426,000	3.6	3.0	1.9
Santa Barbara---------	269,700	271,500	276,100	279,800	0.7	1.7	1.3
Total Southern California---	10,592,300	10,656,600	10,738,900	10,833,200	0.6	0.8	0.9
State Total-----------	20,311,000	20,518,000	20,730,000	20,933,000	1.0	1.0	1.0

Source: State of California, Department of Finance, Population Research Unit.

Table II-31

ESTIMATED POPULATION OF CALIFORNIA AND THE UNITED STATES, 1960-73

Year (July 1)	United States[a]	Annual change Number	Annual change Percent	California	Annual change Number	Annual change Percent
Total[b]						
1960............	179,979,000	---	---	15,863,000	---	---
1961............	182,992,000	3,013,000	1.7	16,366,000	503,000	3.2
1962............	185,771,000	2,779,000	1.5	16,905,000	539,000	3.3
1963............	188,483,000	2,712,000	1.5	17,518,000	613,000	3.6
1964............	191,141,000	2,658,000	1.4	18,021,000	503,000	2.9
1965............	193,526,000	2,385,000	1.2	18,491,000	470,000	2.6
1966............	195,576,000	2,050,000	1.1	18,851,000	360,000	1.9
1967............	197,457,000	1,881,000	1.0	19,234,000	383,000	2.0
1968............	199,399,000	1,942,000	1.0	19,513,000	279,000	1.5
1969............	201,385,000	1,986,000	1.0	19,819,000	306,000	1.6
1970............	203,810,000	2,425,000	1.2	20,027,000	208,000	1.0
1971............	206,212,000	2,402,000	1.2	20,296,000	269,000	1.3
1972............	208,230,000	2,018,000	1.0	20,518,000	222,000	1.1
1973............	209,851,000	1,621,000	0.8	20,741,000	223,000	1.1
Civilian						
1960............	178,140,000	---	---	15,567,000	---	---
1961............	181,143,000	3,003,000	1.7	16,076,000	509,000	3.3
1962............	183,677,000	2,534,000	1.4	16,598,000	522,000	3.2
1963............	186,493,000	2,816,000	1.5	17,198,000	600,000	3.6
1964............	189,141,000	2,648,000	1.4	17,714,000	516,000	3.0

Table II-31 (Continued)

Year (July 1)	United States[a]	Annual change		California	Annual change	
		Number	Percent		Number	Percent
1965............	191,605,000	2,464,000	1.3	18,182,000	468,000	2.6
1966............	193,420,000	1,815,000	0.9	18,499,000	317,000	1.7
1967............	195,264,000	1,814,000	1.0	18,871,000	372,000	2.0
1968............	197,113,000	1,849,000	0.9	19,147,000	276,000	1.5
1969............	199,145,000	2,032,000	1.0	19,458,000	311,000	1.6
1970............	201,722,000	2,577,000	1.3	19,690,000	232,000	1.2
1971............	204,250,000	2,528,000	1.1	19,972,000	282,000	1.4
1972............	206,457,000	2,207,000	1.1	20,218,000	246,000	1.2
1973............	208,094,000	1,637,000	0.8	20,441,000	223,000	1.1
1974............				*20,656,000	215,000	1.1

[a] Includes Alaska and Hawaii.
[b] Includes members of the Armed Forces stationed in the area.

Source: U. S. Bureau of the Census, Current Population Reports, Series P-25, No. 504 (August 1973), and Department of Finance estimates. (*Series P-25, No. 523, June 1974)

Department of Finance
Budget Division
Population Research Unit

Table II-32

POPULATION[a] AND PERCENT INCREASE IN POPULATION BY DECADE, CALIFORNIA, PACIFIC DIVISION, AND THE UNITED STATES, 1970

	1970
Population[a]	
California	19,953,134
Pacific division[b]	26,525,774
United States	203,184,772
Percent change	
California	27.0
Pacific division	25.1
United States	13.3

[a] Includes Armed Forces stationed in the state or states.

[b] Includes the states of California, Oregon, Washington, Alaska, and Hawaii.

Source: U. S. Bureau of the Census, U. S. Census of Population, 1960. Final Report PC(1)-1A; 1970 Census of Population, Advance Report PC(V1)-6 and news releases.

Department of Finance
Budget Division
Population Research Unit

The greatest stimulus to California's economic and population growth came between the years 1950-1960 as a result of new highs in defense spending. The impact of defense spending effected major changes in California's growth patterns. Some urban centers have grown more rapidly than otherwise would have been the case. This was most obvious in the areas around Los Angeles, San Diego, San Jose and Orange Counties. Defense spending stimulated the expansion of the manufacturing sector of the economy during the 50's which created new employment opportunities and the resultant population expansion. Simply stated "people tend to migrate to areas which offer employment opportunities."

The pressures that have been put on California's coastal zone as an attractive location for industrial and military developments has also brought heavy urban development; consequently the heavy population centers are to be found here. The heavy influx of people combined with a search for "cheap land" had helped lead to the urban sprawl we experience today.

Coastal areas are expected to experience continued growth by recent projections, with the exception of the Los Angeles County area. Projections for the Los Angeles area vary from an increase in population to a shallow decline. Some of the basic reasons given for a decline are pollution, crowded conditions, drop in birth expectations and decrease in net in-migration (table II-33).

In southern California the reasons for the changing rate of migration have been frequently debated. Cited among them are problems of congestion, pollution and earthquakes. The sheer size of the area creates problems of urban sprawl and related considerations which may weigh heavily on personal decisions to move to southern California, and on the decisions of some

Table II-33

COMPONENTS OF POPULATION CHANGE
5 SOUTHERN CALIFORNIA COASTAL COUNTIES
SELECTED YEARS 1961 - 1974

(AS OF JULY 1)

		Los Angeles County	San Diego County	Orange County	Ventura County	Santa Barbara County	Total
1961	Total Change	148,000	31,200	69,700	14,900	16,400	280,200
	Natural Increase	85,900	19,400	15,300	4,100	3,200	127,900
	Net in-Migration	54,400	15,800	51,800	11,300	12,900	146,200
	Net Military	7,700	-4,000	2,600	-500	300	6,100
1965	Total Change	106,100	19,800	79,400	24,600	7,900	237,800
	Natural Increase	76,200	14,900	17,700	4,900	3,300	117,000
	Net in-Migration	26,300	2,100	62,300	20,800	4,400	115,900
	Net Military	3,600	2,800	-600	-1,100	200	4,900
1970	Total Change	15,400	10,300	48,200	9,400	1,300	84,600
	Natural Increase	69,400	14,500	17,400	5,100	2,500	108,900
	Net in-Migration	-69,000	28,500	28,700	8,200	-800	-4,400
	Net Military	15,000	-32,700	2,100	-3,900	-400	-19,900
1971	Total Change	13,500	32,100	48,700	10,500	5,000	109,800
	Natural Increase	63,764	13,572	17,202	5,008	2,293	101,839
	Net in-Migration	-59,397	18,831	31,677	6,229	2,786	126
	Net Military	9,133	-303	-179	-737	-79	7,835
1972	Total Change	-43,600	41,500	50,400	14,200	1,800	64,300
	Natural Increase	46,670	11,465	13,989	4,338	1,849	78,311
	Net in-Migration	-100,616	36,483	35,340	8,293	-40	-20,540
	Net Military	10,346	-6,448	1,071	1,569	-9	6,529

Table II-33 (Continued)

		Los Angeles County	San Diego County	Orange County	Ventura County	Santa Barbara County	Total
1973	Total Change	-45,000	37,000	73,700	12,000	4,600	82,300
	Natural Increase	43,779	10,686	13,852	4,066	1,517	73,900
	Net in-Migration	-92,662	34,817	58,764	7,131	3,473	11,523
	Net Military	3,883	-8,503	1,084	803	-390	-3,123
1974	Total Change	-8,900	40,800	50,600	8,100	3,700	94,300
	Natural Increase	39,557	10,096	13,273	3,997	1,229	68,152
	Net in-Migration	-37,868	27,862	37,796	5,852	2,540	36,182
	Net Military	-10,589	2,842	-469	-1,749	-69	-10,034

Source: State of California, Department of Finance, Population Research Unit

Californians to move elsewhere. It may be true that southern California has a moderate year-round temperature, which makes it an attractive place to live, but few people select their place of residence on the basis of climate alone.

One prerequisite for a high rate of immigration is a vibrant and healthy economy. Thus, the immigration trends of the latter 1950's and early 1960's were sustained by the aerospace boom. Conversely, the major cutbacks in NASA, Department of Defense, and other high-technology industries, undertaken in the last few years have deterred new migrants from moving into the area and induced some southern Californians to leave. This latter trend, moreover, coincided in part with a period of economic recession, which always has a negative impact on immigration rates, as in 1953-54, 1957-58 and 1970.

Within the five county area, three of the counties, Los Angeles, Orange and San Diego, are the most populous in the state in that order. Between 1960 - 1970 the population density per square mile or total population in Orange County almost doubled (table II-34). Almost 77 percent of this growth was due to immigration which compares with 50 percent for the state as a whole (table II-35). Much of this growth can be attributed to a significant increase in new business in the county which included an influx of some Los Angeles firms moving across the county line. In total almost 90 percent of the county's population lives in the lowlands in the western half of Orange County. The heavy population centers are located adjacent to the Los Angeles County line and the area is becoming a suburb or bedroom community to Los Angeles proper. Pointing up this fact is that while Los Angeles is losing population, civilian employment is on the upswing. Ventura County's population increase during this same ten year period was almost as dramatic, reflecting approximately a 90 percent increase of which 74 percent was

TABLE II-34

POPULATION PER SQUARE MILE OF
SOUTHERN CALIFORNIA COASTAL COUNTIES
SELECTED YEARS

County	Land Area in Square Miles	Population Density Per Square Mile 1960	1970	1973	1974	Percent Change 1970/1960	1974/1960
Los Angeles	4,069	1492	1731	1713	1710	16	15
Orange	782	920	1832	2053	2118	99	130
San Diego	4,261	246	319	345	354	30	44
Ventura	1,863	109	205	224	229	88	110
Santa Barbara	2,737	63	97	102	103	54	63
Southern California[1]	13,712	599	764	783	790	28	32
California	156,361	101	128	133	134	27	33

From: Statistical Abstract of California (1974).

[1]Total of the five coastal counties.

Table II-35

SOUTHERN CALIFORNIA COASTAL COUNTIES

ESTIMATES OF THE COMPONENTS OF TOTAL POPULATION CHANGE--JULY 1, 1960 TO JULY 1, 1970

County	Population: July 1, 1960	Population: July 1, 1970	Change, 1960-1970: Number	Change, 1960-1970: Percent	Components of change: Natural increase	Components of change: Net migration 1/
Los Angeles---------------	6,071,900	7,044,500	972,600	16.0	730,700	241,900
San Diego----------------	1,049,000	1,358,500	309,500	29.5	152,300	157,200
Orange-------------------	719,500	1,432,900	713,400	99.2	164,600	548,800
Ventura------------------	203,100	381,200	178,100	87.7	46,100	132,000
Santa Barbara------------	173,600	264,700	91,100	52.5	30,400	60,700
Total, Southern California-----	8,217,100	10,481,800	2,264,700	27.6	1,124,100	1,140,600
State Total------------	15,863,000	20,027,000	4,164,000	26.2	2,082,000	2,082,000

1/ Includes changes in the military population stationed in the county and the State.

Source: State of California, Department of Finance, Population Research Unit.

attributed to an influx of new people. Much of the growth took place in the eastern portion of the county where approximately one-half of the work force commutes to Los Angeles daily. This is an extension of the trend towards urban sprawl and away from the inner core city.

During this past decade, Santa Barbara County reflected a better than 50 percent growth of which two-thirds was due to new people moving into the area. The county is presently striving to control its growth and it appears to have achieved some success in this area, although 70 percent of new growth can still be attributed to immigration from other areas.

factors responsible for this slow rate of growth compared to earlier periods. Among them were cutbacks in the aerospace industry, slow economic growth, and finally, the recession and earthquake in 1970. This trend continued until 1972 when Los Angeles County turned in a negative growth rate with the loss of approximately 43,600 people. During this period (July 1971-72) more than 100,000 people moved out of the county than in. 1973 was almost a repeat of 1972 with the total population showing a decline which was coupled with a heavy out migration. Between July 1973-74 a distinct slowing in this trend was noted. The county still turned in a negative growth but it was much smaller than the previous two years. The population loss between 1973 and 1974 can be mainly attributed to a loss in military personnel such as at Fort MacArthur.

In summary, southern California coastal counties experienced exceptional population growth during the past several decades. A distinct slowing was apparent in the latter part of the 1960's. As the decade progressed, it became evident that a decline in the rate of population growth was taking place and this trend has continued to the present time. The increases in three of the counties (Orange, San Diego and Ventura) when examined separately is two to three times greater than the national percentage increase, but when these areas are lumped with Los Angeles County the negative growth factor and the sheer size of the base pulls the area increase (including Santa Barbara County) down to the level of the national population increase (tables II-30, II-31).

Southern California's image is changing. Potential newcomers are reading about congestion, pollution, earthquakes and unemployment and some are changing their thinking. There are, of course, positive aspects of a slower growth rate. Ironically, one of the impediments to future growth of this area has been the rapid rate of economic expansion that occurred over the past two or three decades. It was very difficult for planning authorities actually to plan ahead. Nearly all they could do was attempt to keep up with the rapid population and economic growth of the area. With a more orderly rate of expansion, it would appear that this area might now be in a better position to plan for the future.

In forecasting projections of population for an area, there are two important components which must be analyzed: 1) natural increase; and 2) migration. Population at any given time is necessarily a function of the births and deaths in the study area (natural increase), plus the difference between incoming and outgoing persons (i.e., migration). Natural increase is a much easier component to evaluate than migration. This encompasses such things as marriages, birth, mortality and fertility rates. The characteristics of a community by age group is critical when making an analysis. A concentration of young people, such as in Ventura County, will probably have the effect of raising the fertility and birth rates and lowering the mortality rate (barring major disasters and catastrophes). The opposite would be true for Santa Barbara County where the median age is somewhat higher. The age and sex distribution of populations in the United States, California and southern California are shown in table II-36.

Migration rates are much more difficult to project. The most promising possibility for an accurate forecast in this area would be to consider

Table II-36

GENERAL POPULATION CHARACTERISTICS

AGE and SEX - 1970

	Age								Sex		
	Under 5		5 - 17		18 - 65		65 and over				Median Age
	%	Number	%	Number	%	Number	%	Number	% Male	% Female	
Los Angeles County	8.3	584,025	14.7	1,034,363	67.7	4,763,685	9.3	654,390	48.4	51.6	29.6
Orange County	8.9	126,414	21.1	299,700	63.1	896,267	6.9	98,005	49.1	50.9	26.2
San Diego County	7.9	107,265	15.3	207,740	68.0	923,292	8.8	119,485	51.8	48.2	25.6
Santa Barbara County	7.9	20,880	15.9	42,025	67.1	177,359	9.1	24,060	49.3	50.7	26.2
Ventura County	9.6	36,135	23.2	87,330	60.6	228,120	6.6	24,845	49.7	50.3	25.1
Southern California	8.4	874,719	16.0	1,671,158	66.8	6,988,723	8.8	920,785	48.9	51.1	28.4
California	8.2	1,636,533	16.1	3,213,192	66.6	13,291,838	9.1	1,816,152	49.2	50.8	28.4
United States	8.4	17,069,881	16.1	32,717,272	65.6	133,307,649	9.9	20,118,075	48.7	51.3	28.3

Source: U. S. Department of Commerce, Bureau of The Census, County and City Data Book - 1972.

variables such as trends in employment, labor force participation, wages and salaries, and factors related to intracounty and intrastate migration. In simple terms economic and climatic conditions are the major variables. Since a great deal of uncertainty is encountered in this area, differences will be noted from one projection to the next depending upon interpretation of available statistics and who is conducting the forecast. Additionally, these differences will be carried over to forecasting of business and agriculture as well. Differences may also be noted on current and historic population figures between different sources. Some of this can be accounted for by time frame (some are mid-year, others end-of-year figures). Another dependent factor is whether or not the data is preliminary or revised figures. This in itself can often be responsible for marked changes in estimates even from the same source.

It should be pointed out that population projections are not normally predictions of things to come, but are a set of population figures that may reasonably be expected if a certain set of conditions are met. These conditions which include migration and fertility levels are based on current as well as historic performance. In table II-37 there are four projections, one a baseline and three alternate projections based on various fertility levels of 2.1 to 2.8 and inmigration annually of between zero and 150,000. These levels are thought to be reasonable but do not represent possible extremes. In California between 1971-73 natural civilian increase has varied between 132,000 - 184,000 while net civilian inmigration has fluctuated between 46,000 - 79,000. Other factors were considered such as changes due to military, etc. It should be noted that this projection is based on a demographic model and does not include assumptions for either social, economic or political changes.

Table II-37

BASELINE AND ALTERNATIVE PROJECTIONS
TOTAL POPULATION OF SOUTHERN CALIFORNIA COASTAL COUNTIES,
PROJECTED 1975-2020 WITH ASSUMED MILITARY POPULATIONS

July 1, 1975

County	BASELINE Series D-100[1]	ALTERNATE PROJECTIONS Series E-0	Series D-150	Series C-150	Assumed Military
Los Angeles...........	6,924,500	6,868,900	6,924,500	6,936,600	24,200
Orange................	1,712,000	1,698,900	1,712,000	1,714,900	11,100
San Diego.............	1,573,100	1,560,700	1,573,100	1,575,800	97,400
Ventura...............	446,200	444,000	446,200	447,000	6,000
Santa Barbara.........	283,300	282,100	283,300	283,700	5,500
Southern California[2]..	10,939,100	10,854,600	10,939,100	10,958,000	144,200
The State.............	21,206,000	21,075,000	21,206,000	21,242,000	275,000

July 1, 1980

County	BASELINE Series D-100	ALTERNATE PROJECTIONS Series E-0	Series D-150	Series C-150	Assumed Military
Los Angeles............	6,963,200	6,674,500	6,977,900	7,043,300	24,200
Orange.................	1,970,500	1,900,500	1,980,600	1,997,100	11,100
San Diego..............	1,801,300	1,750,600	1,821,700	1,837,000	97,400
Ventura................	523,300	497,700	527,400	532,000	6,000
Santa Barbara..........	305,800	298,900	307,400	309,800	5,500
Southern California....	11,564,100	11,122,200	11,615,000	11,719,200	144,200
The State..............	22,659,000	21,933,000	22,760,000	22,955,000	275,000

Table II-37 (Continued)

July 1, 1985

County	BASELINE Series D-100	ALTERNATE PROJECTIONS Series E-0	Series D-150	Series C-150	Assumed Military
Los Angeles............	7,122,900	6,574,700	7,155,600	7,294,200	24,200
Orange.................	2,233,900	2,063,600	2,280,600	2,318,900	11,100
San Diego..............	2,022,400	1,905,800	2,105,800	2,141,700	97,400
Ventura................	612,100	550,200	626,800	638,000	6,000
Santa Barbara..........	333,700	313,600	336,900	342,300	5,500
Southern California....	12,325,000	11,407,900	12,505,700	12,735,100	144,200
The State..............	24,363,000	22,757,000	24,727,000	25,159,000	275,000

July 1, 1990

County	BASELINE Series D-100	ALTERNATE PROJECTIONS Series E-0	Series D-150	Series C-150	Assumed Military
Los Angeles............	7,346,800	6,571,100	7,396,900	7,609,000	24,200
Orange.................	2,465,300	2,194,900	2,560,900	2,625,100	11,100
San Diego..............	2,242,300	2,044,400	2,397,900	2,458,700	97,400
Ventura................	704,400	601,600	730,500	749,700	6,000
Santa Barbara..........	361,900	326,500	367,800	376,600	5,500
Southern California....	13,120,700	11,738,500	13,454,000	13,819,100	144,200
The State..............	26,098,000	23,573,000	26,738,000	27,445,000	275,000

Table II-37 (Continued)

July 1, 2000

County	BASELINE Series D-100	ALTERNATE PROJECTIONS Series E-0	Series D-150	Series C-150	Assumed Military
Los Angeles...........	7,850,400	6,530,800	7,935,800	8,356,200	24,200
Orange................	2,810,600	2,377,700	2,945,600	3,071,500	11,100
San Diego.............	2,654,100	2,260,100	2,919,800	3,046,500	97,400
Ventura...............	870,900	676,000	946,400	985,200	6,000
Santa Barbara.........	413,600	345,800	425.100	442,400	5,500
Southern California...	14,599,600	12,190,400	15,172,700	15,901,800	144,200
The State.............	29,277,000	24,746,000	30,489,000	31,870,000	275,000

July 1, 2010

County	BASELINE Series D-100	ALTERNATE PROJECTIONS Series E-0	Series D-150	Series C-150	Assumed Military
Los Angeles...........	8,492,700	6,448,500	8,650,600	9,399,300	24,200
Orange................	3,153,900	2,509,700	3,308,800	3,542,800	11,100
San Diego.............	3,130,900	2,474,200	3,501,200	3,751,700	97,400
Ventura...............	1,034,400	731,900	1,167,200	1,242,400	6,000
Santa Barbara.........	470,400	361,800	487,800	520,700	5,500
Southern California...	16,282,300	12,526,100	17,115,600	18,456,900	144,200
The State.............	32,787,000	25,683,000	34,626,000	37,178,000	275,000

Table II-37 (Continued)

July 1, 2020

County	BASELINE Series D-100	ALTERNATE PROJECTIONS Series E-0	Series D-150	Series C-150	Assumed Military
Los Angeles...........	9,255,800	6,371,800	9,496,300	10,681,600	24,200
Orange................	3,493,500	2,610,000	3,668,600	4,046,000	11,100
San Diego.............	3,655,600	2,689,900	4,143,000	4,565,400	97,400
Ventura...............	1,195,900	775,800	1,388,600	1,515,200	6,000
Santa Barbara.........	531,500	376,600	555,300	609,500	5,500
Southern California...	18,132,300	12,824,100	19,251,800	21,417,700	144,200
The State.............	36,605,000	26,535,000	39,124,000	43,268,000	275,000

[1] D-100 etc. Letter designates key to assumed future fertility levels (D,E,C), while numerical designates key to assumed future annual net migration rate.
Letter - assuming a future fertility level of: c = 2.8, D = 2.5, E = 2.1
Number - assuming a future net migration rate from 0 to 150,000 people

[2] Totals of the 5 coastal counties

Source: State of California Department of Finance, Population Research Unit.

a. Rural - Urban Population Distribution

The rural - urban population distribution in the United States was 73.5 percent urban and 26.5 percent rural in 1970. Southern California was more urbanized than the United States as a whole with a 97.6 percent urban and 2.4 percent rural population. Table II-38 gives a county by county breakdown of the rural - urban population distribution in the five southern California counties. The counties of Santa Barbara, 11.5 percent rural, and Ventura, 7.6 percent rural, have the highest percentage of rural population in the five county area. This points out the importance of agriculture in these two counties which will be discussed in more detail in the agricultural section.

b. Population and Business Projections

For a comparison of population and business projections, the OBERS projections for the Santa Barbara - Santa Maria - Lompoc, California, SMSA and the Oxnard - Simi Valley - Ventura, California, SMSA are presented in tables II-39 and II-40. As mentioned before population projections are not normally predictions of things to come, but are a set of population figures that may reasonably be expected if a certain set of conditions are met which existed at the time of projection.

A population study of Santa Barbara and Ventura Counties describing community characteristics follows:

TABLE II-38

Rural - Urban Population Distribution

	Urban 1970		Rural 1970	
	Total	%	Total	%
Los Angeles County	6,944,990	98.7	91,473	1.3
Orange County	1,403,340	98.8	17,046	1.2
San Diego County	1,269,525	93.5	88,257	6.5
Santa Barbara County	233,925	88.5	30,399	11.5
Ventura County	347,820	92.4	28,610	7.6
Southern California	10,199,520	97.6	255,785	2.4
California	18,136,000	90.9	1,817,000	9.1
United States	149,332,000	73.5	53,878,000	26.5

Source: U.S. Department of Commerce, Bureau of the Census, County and City Data Book - 1972.

Table II-39. Indexes of Production for Selected Industries, Projected, 1980 - 2020

(1970 EQUALS 100)

	1970	1975	1980	1985	1990	2000	2020
MINING	100	104	103	113	124	149	207
METAL	100	(S)	(S)	(S)	(S)	(S)	(S)
CRUDE PETROLEUM & NATURAL GAS	100	103	101	110	119	142	191
NONMETALLIC, EXCEPT FUELS	100	125	150	166	185	238	401
MANUFACTURING	100	126	151	182	219	325	618
FOOD & KINDRED PRODUCTS	100	107	119	125	131	148	191
TEXTILE MILL PRODUCTS	100	(S)	(S)	(S)	(S)	(S)	(S)
APPAREL & OTHER FABRIC PRODUCTS	100	(S)	(S)	(S)	(S)	(S)	(S)
LUMBER PRODUCTS & FURNITURE	100	(S)	(S)	(S)	(S)	(S)	(S)
PAPER & ALLIED PRODUCTS	100	(S)	(S)	(S)	(S)	(S)	(S)
PRINTING & PUBLISHING	100	112	132	156	184	263	519
CHEMICALS & ALLIED PRODUCTS	100	(S)	(S)	(S)	(S)	(S)	(S)
PETROLEUM REFINING	100	105	111	120	130	155	223
PRIMARY METALS	100	109	89	96	104	126	182
FABRICATED METALS & ORDNANCE	100	149	188	235	293	462	816
MACHINERY, EXCLUDING ELECTRICAL	100	118	133	153	176	240	443
ELECTRICAL MACHINERY & SUPPLIES	100	105	123	147	175	250	476
TRANS. EQUIP., EXCL. MTR. VEHS.	100	219	207	261	328	516	1153
OTHER MANUFACTURING	100	131	167	205	251	386	871

(S) too small to project.

SMSA - Santa Barbara - Santa Maria - Lompoc, California
(BEA Code Number - 481)

Table II-39 (continued) Indexes of Production for Selected Industries Projected, 1980-2020

(1970 EQUALS 100)

	1970	1975	1980	1985	1990	2000	2020
MINING	100	109	122	134	147	177	246
CRUDE PETROLEUM & NATURAL GAS	100	108	121	131	143	171	229
NONMETALLIC, EXCEPT FUELS	100	133	155	182	214	302	585
MANUFACTURING	100	153	213	272	348	565	1332
FOOD & KINDRED PRODUCTS	100	137	190	234	288	429	853
APPAREL & OTHER FABRIC PRODUCTS	100	169	266	352	465	777	1832
LUMBER PRODUCTS & FURNITURE	100	180	248	316	401	622	1303
PAPER & ALLIED PRODUCTS	100	48	59	80	107	185	480
PRINTING & PUBLISHING	100	137	185	238	306	504	1228
CHEMICALS & ALLIED PRODUCTS	100	155	234	317	430	775	2190
PETROLEUM REFINING	100	132	154	185	223	322	617
PRIMARY METALS	100	147	170	203	243	343	627
FABRICATED METALS & ORDNANCE	100	161	209	267	342	562	1047
MACHINERY, EXCLUDING ELECTRICAL	100	149	229	314	430	766	2027
ELECTRICAL MACHINERY & SUPPLIES	100	173	246	322	422	713	1793
MOTOR VEHICLES & EQUIPMENT	100	(S)	(S)	(S)	(S)	(S)	(S)
TRANS. EQUIP., EXCL. MTR. VEHS.	100	217	305	372	454	683	1445
OTHER MANUFACTURING	100	113	156	205	268	455	1170

(S) too small to project.

SMSA - Oxnard - Simi Valley - Ventura, California
(BEA Code Number - 445)

SMSA - SANTA BARBARA-SANTA MARIA-LOMPOC, CALIF.
(BEA CODE NUMBER - 481)

Table II-40

POPULATION, EMPLOYMENT, PERSONAL INCOME, AND EARNINGS BY INDUSTRY, HISTORICAL AND PROJECTED,
SELECTED YEARS, 1950 - 2020

	1950	1959	1968	1970	1975	1980	1985	1990	2000	2020
POPULATION, MIDYEAR	99,062	166,272	257,049	264,514	293,300	322,200	350,700	381,700	437,200	575,300
PER CAPITA INCOME (1967$)	2,769	2,939	3,031	3,119	3,695	4,284	4,939	5,694	7,944	14,286
PER CAPITA INCOME RELATIVE (US=1.00)	1.34	1.20	.92	.90	.90	.90	.91	.92	.96	1.00
TOTAL EMPLOYMENT	39,130	67,021				116,000	127,600	140,400	171,600	239,800
EMPLOYMENT/POPULATION RATIO	.40	.40				.36	.36	.37	.39	.42
IN THOUSANDS OF 1967 $										
TOTAL PERSONAL INCOME *	274,296	489,615	779,161	825,092	1,083,800	1,380,600	1,732,100	2,173,400	3,473,900	8,219,800
TOTAL EARNINGS	223,601	389,198	630,431	648,185	890,900	1,156,600	1,457,100	1,835,600	2,954,300	7,045,400
AGRICULTURE, FORESTRY & FISHERIES	48,432	28,171	31,501	26,974	26,000	23,400	21,700	20,200	23,800	41,600
AGRICULTURE	47,762	27,964	31,361	26,827	25,900	23,300	21,600	20,100	23,700	41,300
FORESTRY & FISHERIES	669	207	140	147	(S)	(S)	(S)	(S)	(S)	(S)
MINING	1,978	8,270	8,496	10,256	10,500	10,400	11,200	12,000	14,200	19,400
METAL			154	173	200	300	400	500	800	1,600
COAL			11	9						
CRUDE PETROLEUM & NATURAL GAS	(D)	(D)	7,280	9,144	9,000	8,600	9,100	9,700	11,000	13,800
NONMETALLIC, EXCEPT FUELS	(D)	(D)	1,051	930	1,200	1,400	1,600	1,700	2,200	3,800
CONTRACT CONSTRUCTION	13,794	36,669	41,083	39,007	61,500	79,000	100,100	127,000	206,500	502,300
MANUFACTURING	30,543	54,178	89,824	90,802	115,000	135,000	161,000	192,100	281,700	592,300
FOOD & KINDRED PRODUCTS	7,764	15,877	9,628	10,061	10,400	11,500	11,900	12,400	13,800	17,700
TEXTILE MILL PRODUCTS	(D)	(D)		11	(S)	(S)	(S)	(S)	(S)	(S)
APPAREL & OTHER FABRIC PRODUCTS	61	95	162	140	(S)	(S)	(S)	(S)	(S)	(S)
LUMBER PRODUCTS & FURNITURE	1,225	1,396	686	826	(S)	(S)	(S)	(S)	(S)	(S)
PAPER & ALLIED PRODUCTS	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
PRINTING & PUBLISHING	2,680	4,190	5,141	6,160	6,700	7,800	9,300	10,900	15,700	31,000
CHEMICALS & ALLIED PRODUCTS	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
PETROLEUM REFINING	3,831	2,580	1,389	1,310	1,400	1,500	1,600	1,700	1,900	2,700
PRIMARY METALS	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
FABRICATED METALS & ORDNANCE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
MACHINERY, EXCLUDING ELECTRICAL		2,157	3,269	3,676	4,200	4,800	5,500	6,300	8,600	16,000
ELECTRICAL MACHINERY & SUPPLIES		15,667	16,287	20,393	20,500	22,800	26,300	30,200	40,900	73,100
TOTAL MACHINERY (1950 ONLY)	414									
MOTOR VEHICLES & EQUIPMENT		182	254	305						
TRANS. EQUIP., EXCL. MTR. VEHS.	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
OTHER MANUFACTURING	13,913	9,463	14,180	14,670	19,800	25,300	31,000	38,000	58,400	131,800
TRANS., COMM. & PUBLIC UTILITIES	9,719	14,943	26,950	27,937	36,800	46,600	57,300	70,600	109,500	249,100
WHOLESALE & RETAIL TRADE	44,439	65,758	102,800	107,653	144,100	188,000	232,500	287,700	448,800	1,019,300
FINANCE, INSURANCE & REAL ESTATE	7,778	16,498	25,736	26,238	36,700	48,500	60,800	76,200	121,700	293,400
SERVICES	38,936	85,549	158,481	173,095	241,200	327,000	423,200	547,700	917,500	2,306,000
GOVERNMENT	27,982	78,161	145,561	146,223	214,400	298,500	387,000	501,800	830,100	2,021,600
CIVILIAN GOVERNMENT	21,042	47,708	94,940	105,085	151,500	215,600	285,600	378,400	652,400	1,680,200
ARMED FORCES	6,940	30,453	50,621	41,138	62,700	82,900	101,100	123,400	177,600	341,300

(D) deleted to avoid disclosure of data pertaining to an individual establishment.

(S) too small to project.

SMSA - OXNARD-SIMI VALLEY-VENTURA, CALIF.
(BEA CODE NUMBER - 445)

Table II-40 continued

POPULATION, EMPLOYMENT, PERSONAL INCOME, AND EARNINGS BY INDUSTRY, HISTORICAL AND PROJECTED,
SELECTED YEARS, 1950 - 2020

	1950	1959	1968	1970	1975	1980	1985	1990	2000	2020
POPULATION, MIDYEAR	115,630	195,968	352,573	378,835	418,800	464,500	510,500	561,000	654,000	883,900
PER CAPITA INCOME (1967$)*	2,205	2,630	2,662	2,672	3,274	3,899	4,491	5,173	7,187	12,815
PER CAPITA INCOME RELATIVE (US=1.00)	1.07	1.08	.81	.77	.80	.82	.83	.84	.87	.90
TOTAL EMPLOYMENT	43,274	74,756				139,200	155,200	173,000	216,200	311,200
EMPLOYMENT/POPULATION RATIO	.37	.38				.30	.30	.31	.33	.35
					IN THOUSANDS OF 1967 $					
TOTAL PERSONAL INCOME *	254,984	515,357	938,706	1,012,290	1,371,200	1,811,100	2,292,700	2,902,400	4,700,400	11,328,500
TOTAL EARNINGS	192,268	404,421	740,362	771,368	1,058,000	1,378,500	1,743,400	2,205,000	3,566,500	8,555,600
AGRICULTURE, FORESTRY & FISHERIES	51,034	66,073	88,033	74,760	93,600	101,500	106,500	111,700	131,600	229,500
AGRICULTURE	50,740	65,907	87,835	74,620	93,300	101,100	106,000	111,200	130,900	228,500
FORESTRY & FISHERIES	294	166	198	141	(S)	(S)	(S)	(S)	(S)	(S)
MINING	4,907	19,387	18,111	18,957	20,300	22,500	24,300	26,200	31,300	44,000
CRUDE PETROLEUM & NATURAL GAS	4,892	19,098	15,928	16,697	17,200	18,800	20,000	21,200	24,200	30,300
NONMETALLIC, EXCEPT FUELS	15	289	2,183	2,261	3,100	3,600	4,200	5,000	7,000	13,700
CONTRACT CONSTRUCTION	14,342	38,537	33,973	48,753	59,300	69,200	89,600	116,000	194,400	488,500
MANUFACTURING	9,137	54,219	126,063	116,649	176,300	239,100	300,700	378,100	599,200	1,378,500
FOOD & KINDRED PRODUCTS	2,761	3,870	10,166	10,288	13,600	18,700	22,800	27,900	41,200	81,000
APPAREL & OTHER FABRIC PRODUCTS	7	329	2,073	2,171	3,400	5,200	6,800	8,900	14,600	33,800
LUMBER PRODUCTS & FURNITURE	65	321	901	1,078	1,400	1,900	2,300	2,800	4,200	8,500
PAPER & ALLIED PRODUCTS	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
PRINTING & PUBLISHING	1,112	1,822	5,223	5,960	7,900	10,700	13,700	17,700	29,200	71,100
CHEMICALS & ALLIED PRODUCTS	4	1,895	3,332	3,580	5,100	7,400	9,800	12,900	22,100	57,400
PETROLEUM REFINING	(D)	(D)	1,836	1,790	2,500	2,900	3,400	4,000	5,600	10,500
PRIMARY METALS	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
FABRICATED METALS & ORDNANCE	1,973	1,909	7,119	6,091	9,600	12,400	15,600	19,700	31,800	76,200
MACHINERY, EXCLUDING ELECTRICAL		775	4,190	5,677	8,300	12,700	17,500	24,000	42,700	113,100
ELECTRICAL MACHINERY & SUPPLIES		12	27,895	22,727	37,700	50,900	64,300	81,100	129,900	306,800
TOTAL MACHINERY (1950 ONLY)	226									
MOTOR VEHICLES & EQUIPMENT			4,117	2,916	(S)	(S)	(S)	(S)	(S)	(S)
TRANS. EQUIP., EXCL. MTR. VEHS.	1,877	40,630	45,422	31,807	61,000	85,600	104,500	127,500	192,000	406,000
OTHER MANUFACTURING	323	1,958	10,158	14,313	16,600	23,000	30,200	39,500	67,200	172,900
TRANS., COMM. & PUBLIC UTILITIES	6,700	11,748	30,812	33,501	45,500	59,400	75,200	95,300	154,900	378,500
WHOLESALE & RETAIL TRADE	32,852	58,548	102,869	121,959	153,300	198,800	251,500	318,200	515,600	1,236,800
FINANCE, INSURANCE & REAL ESTATE	4,475	10,547	23,104	25,042	35,300	49,300	64,200	83,600	140,500	354,300
SERVICES	18,190	39,283	83,190	93,999	135,000	191,700	256,000	341,800	601,200	1,613,700
GOVERNMENT	50,631	106,078	234,208	237,747	335,400	446,600	572,400	733,700	1,197,500	2,831,500
CIVILIAN GOVERNMENT	40,250	88,111	183,797	206,899	280,400	385,500	502,800	655,900	1,098,100	2,668,600
ARMED FORCES	10,382	17,967	50,411	30,848	53,900	61,100	68,900	77,700	99,300	162,900

(D) deleted to avoid disclosure of data pertaining to an individual establishment.

(S) too small to project.

SANTA BARBARA COUNTY

Population Characteristics, April 1970

Racial or ethnic group	Total	Percent	Male	Female
Total................	264,324	100.0	130,311	134,013
White.....................	249,558	94.4	122,467	127,091
Black.....................	6,426	2.4	3,444	2,982
Japanese..................	2,055	.8	927	1,128
Chinese...................	800	.3	442	358
Filipino..................	1,660	.6	1,025	635
American Indian...........	1,008	.4	529	479
Other races...............	2,817	1.1	1,477	1,340
Spanish American (a)......	45,856	17.3	22,805	23,051

Source: U. S. Census of Population, 1970.
(a) In the racial distribution most Spanish Americans are counted as White; the rest are distributed among the other racial categories.

Estimated population, July 1974: 279,800

c. Community Characteristics - Santa Barbara County

Santa Barbara County is bordered on the east by Ventura County, on the north by San Luis Obispo and Kern counties, and on the south and west by 107 miles of coastline of the Pacific Ocean. The county is over twice the size of the state of Rhode Island and with a total area including the Channel Islands of 2737 square miles. Much of Santa Barbara County is mountainous and nearly 40 percent of the total land area is either farmed or cultivated. The Sierra Madre, Santa Ynez, San Rafael mountains rim numerous fertile areas including the Santa Maria, Cuyama, Lompoc, and Santa Ynez Valleys, and the southwest coastal plain. These areas, which include most of the developed land, also accommodate the majority of the population.

The climate is equable throughout the year. Dry, rainless summers are followed by a season in which the average rainfall varies from 14 inches in the valleys to 18 inches on the coast. The average daily temperature is a maximum of 70.5 and a minimum of 49.2.

The population of Santa Barbara County increased by 52.5 percent between 1960 and 1970, far surpassing the growth rates of California and the United States. The rapid population expansion in the county was mainly due to the development of the Vandenberg Air Force Base during the late 1950's and early 1960's, a continuous inflow of retired persons, a substantial buildup of industrial and commercial activities in the Goleta Valley area, and steady growth at the University of California at Isla Vista.

The growth rate of the older members of the population has been very pronounced and is expected to hold at a substantial pace. Approximately 9.1 percent of the total county population was 65 years old or more, equal to the statewide elderly-to-total ratio. The proportion of Spanish-surname individuals to the county total exceeded the comparable statewide ratio (15.5 percent), but the proportion of Blacks was much smaller than in the state as a whole.

VENTURA COUNTY

Population Characteristics, April 1970

Racial or ethnic group	Total	Percent	Male	Female
Total..............	376,430	100.0	186,972	189,458
White..................	361,361	96.0	179,706	181,655
Black..................	6,354	1.7	3,114	3,240
Japanese................	2,484	.7	1,056	1,428
Chinese.................	714	.2	360	354
Filipino................	1,550	.4	824	726
American Indian.........	1,150	.3	558	592
Other races.............	2,817	.7	1,354	1,463
Spanish American (a)....	73,684	19.6	37,349	36,335

Source: U. S. Census of Population, 1970.
(a) In the racial distribution most Spanish Americans are counted as White; the rest are distributed among the other racial categories.

Estimated population, July 1974: 426,000

d. Community Characterists - Ventura County

Ventura County, with an area of 1863 square miles, ranks 26th in size among California's 58 counties. The county is bordered on the north by Kern County, and on the southeast by the metropolitan area of Los Angeles. The Pacific Ocean provides the county's southwestern border stretching along 42 miles of coastline. Most of the northern half of the county is part of the Los Padres National Forest. The mountain ranges extend in an east-west direction creating fertile valleys and broad alluvial basins, primarily in the southern half of the county which includes the major cities of Oxnard and Ventura. The area's highest point is the 8,831 foot Mt. Pinos, located in the Los Padres National Forest.

The county boasts the Channel Islands Marina, the rehabilitated Ventura Marina, miles of clean beaches, and lakes. In addition, the offshore island of

Anacapa is ripe with recreation development opportunities. The Port of Hueneme, located just south of Oxnard, is the only deepwater general cargo port between Los Angeles and San Francisco.

Total population in Ventura County increased by nearly 90 percent between 1960 and 1970 for the second fastest growth rate among California counties during the decade. The area's rapid population expansion was due in part to the proximity of the county to the Los Angeles metropolitan area. More than 50 percent of the people who live in the eastern part of the county, notably in the Simi and Conejo Valleys, commute to jobs in Los Angeles County. Consequently, these areas showed the largest gains in population between 1960 and 1970.

Ventura County can be characterized as having a very young population. More than one-third of the area's residents are 15 years of age and under, compared to the national average of approximately 28 percent. In addition, the 5-9 year old population showed growth in the county during the 1960's while that of the nation declined.

2. Employment - Historical and Projected Growth

Even with the State's economic problems of 1970 and 1971, California's economy has done a good job of providing employment opportunities for its residents. From 1970 to 1973, 534,000 new jobs were created, almost 50,000 more than the increase in the civilian labor force during the 3 year period (table II-41).

During the 1970 to 1971 recession, fluctuations in the economy impacted heavily on the labor force. Business conditions slowed during the recession, the labor force which had shown substantial increases during the sixties advanced slowly and virtually stabilized between 1970 and 1971. Unemployment was up sharply during this period and the unemployment rate averaged 7 percent during 1971. Had the labor force not stabilized during the recession, unemployment would have been considerably more severe.

Manufacturing, the largest employment category, was most affected, suffering the greatest loss in numbers of jobs during the downturn, but enjoying the greatest rebound in the recovery and expansion that followed. Historically, demand for manufactured goods follows (the rise and fall of) the overall business cycle. This recession which became evident in early 1970 was felt not only in California but nationally. However, the economy of the local region (southern California) was further affected by cutbacks in the aerospace industry. As recently as 1968 employment in aerospace accounted for 12 percent of total employment. The turnaround occurred in late 1971. The economic expansion which followed was mainly stimulated by the consumption of durable goods.

With the advent of the Arab oil embargo on October 17, 1973, recession and inflation resulted until July, 1975, when the economy started to expand again after approximately 18 months of decline. The

TABLE II-41

Total Civilian Employment For
Southern California Coastal Counties
1970 Thru 1973, Forecast 1974
(Annual Averages)

County	Annual Averages (000) Estimated Forecast					Annual Change Number (000)			Annual Change Percent		
	1970	1971	1972	1973	1974	1972	1973	1974	1972	1973	1974
Los Angeles	3179	3117	3225	3321	3378	108	96	57	3.5	3.0	1.7
Orange	476	485	520	551	574	34	31	23	7.2	6.0	4.2
San Diego	444	457	479	493	502	22	14	9	4.8	2.9	1.8
Ventura	116	119	125	130	134	6	5	4	5.0	4.0	3.1
Santa Barbara	99	100	103	106	108	3	3	2	3.0	2.9	1.9
Southern California	4314	4278	4452	4601	4696	174	149	95	4.1	3.4	2.1
State Total	8036	8007	8314	8570	8725	307	256	155	3.8	3.1	1.8

Source: United California Bank

unemployment rate in Santa Barbara County reached a high of 8.2 percent in February of 1975 before declining to 7.0 percent in March, 1975. (Area Manpower Review, California Health and Welfare Agency, March, 1975)

Ventura and Santa Barbara Counties together account for less than 5 percent of the South Coast total work force. Although small in labor force, Ventura County continues to be one of the fastest growing regions in California. Of significance is that this area's employment growth is broadly based, as opposed to one industry inspired gains. Santa Barbara County has achieved some success in striving for controlled growth, but still is experiencing some economic expansion. Much of the recent growth has been in the trade and service sectors. An employment study, by county, describing labor market trends and employment by industry follows in table II-42.

TABLE II-42

Southern California Coastal Counties
Labor Market Trends
September 1972
(Thousands)

	Los Angeles	Orange	San Diego	Ventura	Santa Barbara	Total
Total Civilian Labor Force	3359.5	531.9	495.9	132.3	107.3	4626.9
Unemployment	171.5	26.1	26.1	6.6	5.3	235.6
Unemployment Rate (Seas. Adj.)	5.4	5.3	5.5	5.9	5.3	
Total Civilian Employment	3188.0	505.8	469.8	125.7	102.0	4391.3
Non-Agriculture Wage/Salary	2870.2	445.2+	411.6	100.1	83.4	3910.5
Manufacturing	789.6	121.4	57.9	14.1	9.6	992.8
Durable Goods	536.8	91.7	44.9	8.1	6.9	688.4
Non-Durable Goods	252.8	29.7	13.0	6.0	2.9	304.4
Non-Manufacturing	2080.6	323.8	353.7	86.0	73.6	2917.7
Mining	10.6	2.0	.5	1.7	.9	15.7
Construction	94.9	26.5	24.1	4.9	3.7	154.1
Transportation/Utilities	174.1	15.2	22.2	4.6	3.5	219.6
Trade	645.6	107.5	95.2	24.1	19.6	892.0
Finance/Ins./Real Estate	179.3	24.5	21.1	3.7	3.2	231.8
Services	544.5	77.7	84.0	16.2	21.2	743.6
Government[a]	431.6	70.4	106.6	30.8	21.5	660.9
Other Non-Agriculture Employment[b]	307.9	52.5	47.2	11.9	12.5	432.0
Agriculture Employment	9.9	8.1	11.0	13.7	6.1	48.8

[a]Includes civilian employees of Federal, State and Local governments.
[b]Includes domestics, self-employed and unpaid family workers.

Source: State of California, Employment Development Department

a. Labor Market Trends - Ventura County

Ventura County is in transition from almost total dependency upon agriculture to a metropolitan complex of light manufacturing, retail shopping centers and residential communities. Between 1967 and 1972, agricultural employment in the county remained about even; however, the farm-to-total worker ratio has dropped from 20 percent in 1957 to 11 percent currently. The major gains in employment during this period have occurred in the government, trade, services, and manufacturing industries.

Total civilian employment in the county exhibited strong growth patterns in 1972 and 1973 following the 1970 to 1971 economic slowdown. During 1972, employment rose at an annual 5.0 percent rate or nearly two times the increase shown during the previous year. A further expansion occurred in 1973 as the year was characterized by record levels of employment. (See table II-43.)

Approximately 30 percent of the county's wage and salary jobs during the first six months of 1974 were in government and another 23.5 percent were employed in trade. Services followed with 18.3 percent while manufacturing was closely behind accounting for 14.3 percent of the total.

The number of wage and salary jobs in 1971 rose only fractionally as the recession limited growth in most industries. Manufacturing employment was hit hardest during the year with layoffs in aerospace firms primarily responsible. The economy recovered in 1972 as some aerospace workers were recalled and large gains were posted in service-producing industries. The recovery gained momentum in 1973 with wage and salary employment advancing by 5.2 percent as

Table II-43

EMPLOYMENT BY INDUSTRY
VENTURA COUNTY
(Thousands)

Industry	July 1971	July 1972	July 1973
Total civilian employment	119.3	125.6	129.7
Nonagricultural wage & salary workers	94.7	101.0	103.7
Mining	1.7	1.6	1.6
Contract construction	5.0	5.2	5.4
Manufacturing	12.7	13.7	14.0
Food products	1.3	1.4	1.4
Paper, printing, & publishing	1.7	1.8	1.8
Petroleum & chemicals	.4	.3	.3
Primary & fabricated metals	1.0	1.0	1.0
Nonelectrical & electrical machinery	2.6	2.8	2.9
Transportation equipment	2.9	3.0	3.1
Other manufacturing	2.8	3.4	3.5
Trans., communication & utilities	4.3	4.5	4.6
Wholesale & retail trade	23.2	24.4	25.5
Finance, insurance & real estate	3.4	3.6	3.6
Service	15.2	17.2	18.2
Government (a)	29.2	30.8	30.8
Other nonagricultural employment (b)	11.7	11.9	11.9
Agriculture	12.9	12.7	14.1

(a) Includes all civilian employees of Federal, State, and local governments, regardless of the activity in which the employees are engaged.
(b) Includes employers, own-account workers, unpaid family workers, and domestic servants.

Source: State of California, Employment Development Department

all major industries showed year-to-year employment increases except for mining and construction. The largest absolute gains occurred in services, manufacturing, retail trade, and government, in that order, and every major industry except mining was at an all-time high.

During the first half of 1974, employment expanded at a 5.6 percent annual rate. Manufacturing and services employment slowed down somewhat during the period but the net gain in the six-month span was bolstered by exceptional gains in public education. Retail trade employment continued to expand while construction activity was at its highest level in three years during June. (See table II-44)

The government sector is the largest single employing division in the county, accounting for approximately 30 percent of all wage and salary workers. Public education is the leading employer in government while the number of State workers remains high due mainly to jobs at Camarillo State Hospital. Most of the federal civilian employees work at the Pacific Missile Range in Point Mugu and the Naval Construction Battallion Center in Port Hueneme.

Between 1970 and 1973, the main impetus in employment occurred at the state and local levels, notably education, while federal defense-related establishments lost workers primarily due to a hiring freeze imposed at Point Mugu during most of this time.

Government employment moved ahead to a first half average of 33,600 in 1974, an increase of almost 6 percent from the year before and was primarily due to staff increases in the county's two junior colleges.

Retail trade, like services, grew over the years primarily to meet the rising demands of an expanding population. Between 1970 and 1973, the industry

TABLE II-44

Labor Force, Employment and Unemployment

Ventura County

Source: State of California, Employment Development Department, Southern California Employment and Research, December 1974.

	1974			1973
	December	November	October	December
Civilian Labor Force a/.....	175,100	176,400	177,200	166,100
Employment...............	162,700	163,700	166,800	156,900
Unemployment..............	12,400	12,700	10,400	9,200
Seasonally adjusted rate	7.5	7.1	7.2	5.8
Unadjusted rate.........	7.1	7.2	5.9	5.5
Labor Market Classification b/	D	D	D	D

a/ Total labor force (and components) by place of residence and including workers involved in trade disputes. Employment includes self-employed, unpaid family, and domestic workers.

b/ U.S. Department of Labor Classification according to adequacy of labor supply. Group "D" - Area of Substantial Unemployment.

Nonagricultural Wage and Salary Employment
Total Agricultural Employment for Ventura County

	Dec 1974c/	Nov 1974	Oct 1974	Dec 1973
Total nonag wage and salary employ.a/	112,700	112,800	113,200	108,900
Mining	1,500	1,500	1,500	1,600
Construction	4,500	4,700	4,800	4,900
Manufacturing	16,000	16,500	16,900	15,700
Durable goods	9,600	9,600	9,600	9,800
Stone, clay, and glass	200	200	200	200
Machinery	3,900	3,900	3,900	3,600
Ordnance and trans. equip.	3,500	3,500	3,500	3,800
Other durable goods	2,000	2,000	2,000	2,200
Nondurable goods	6,400	6,900	7,300	5,900
Food and kindred	2,300	2,800	3,100	1,900
Printing and publishing	900	900	900	900
Other nondurable goods	3,200	3,200	3,300	3,100
Trans., comm., and utilities	4,600	4,600	4,600	4,600
Trade	27,000	26,500	26,700	25,900
Wholesale	4,200	4,600	4,900	4,000
Retail	22,800	21,900	21,800	21,900
Fin., ins., real estate	3,600	3,600	3,600	3,600
Services	20,800	20,800	20,800	19,700
Government	34,700	34,600	34,300	32,900
Federal	10,500	10,500	10,500	10,500
State and local	24,200	24,100	23,800	22,400
Total agricultural employment b/	11,500	12,400	14,800	9,700

a/ Employment reported by place of work excluding workers involved in labor disputes.

b/ Includes farmers, employees, and unpaid family workers.

c/ Current month preliminary; past months revised.

increased its payrolls by 2,600 jobs, a gain of almost 15 percent during the period. Yearly, the industry employment rose by 5.3 percent in 1972, and 5.1 percent in 1973, following a recession-dampened gain of 3.3 percent in 1971.

The fastest growing industry in terms of employment between 1970 and 1973 was the services industry because of the expanding demand for all types of services of an increasing population. On a year-to-year basis, services employment grew 3.3 percent in 1971; 13.0 percent in 1972; and 11.5 percent in 1973. The overall gain in 1973 was spread generally among most component groups with the largest increases occurring in medical and other health facilities and in research and development firms.

Manufacturing also was affected by the 1971 recession with the number of factory workers in the county declining by nearly 4 percent during the year. However, an upturn in capital spending and a rebuilding of inventories supported a renewed employment growth of 7.6 percent in 1972 and 7.7 percent in 1973. The growth rate, however, has slowed in the first six months of 1974 as a result of a trade dispute and a layoff in durable goods manufacturing and material shortages. Manufacturing employment averaged 15,700 in this period, an increase of 5.4 percent from the first half in 1973.

In the manufacturing durable goods sector nearly two out of every three workers are employed by aerospace firms and as a result, trends in durable goods employment are dominated mainly by the pattern set by the aerospace industry. The Aerospace employment buildup began in the early 1960's when several new firms engaged in aircraft production moved to the area mainly from older plants in Los Angeles County and to be near the Pacific Missile Range in Point Mugu. Aerospace employment expanded through the mid-sixties and reached a peak in 1968 when the industry averaged 8,500 workers. During the next three years, layoffs occurred as aircraft production dwindled and by 1971 only 5,400 workers were employed in the industry. A slight recovery trend took place over the next two years and in 1973 the industry averaged 6,100 workers. Aerospace employment expanded moderately in the first half of 1974 from 6,300 in January to 6,600 in June with all gains occurring in the aircraft and parts and electrical machinery groups.

The increases posted by aerospace during the opening half of 1974 were moderated by losses which occurred in the other durable goods category. The most significant declines took place in June when the cancellation of a contract involving fiberglass barges forced the first stage of a large layoff in transportation equipment and a trade dispute idled many workers at a firm engaged in manufacturing non-electrical machinery.

Employment in the nondurable goods producing sector dropped fractionally in 1973 as gains in food processing plants and apparel manufacturers were negated by employment losses caused by a large paper company closing. Non-durables employment rose in 1974 paced by seasonal and expansion hiring in food processing firms. Overall growth, however, was limited by a moderate layoff in the plastics industry in January as material shortages curtailed production of some items.

Manufacturing employment was expected to show a further slackening in the current expansion trend during the remaining months of 1974. The heaviest impact was expected in transportation equipment production as the final stage of a previously announced layoff occurs. Aerospace employment was expected to gain fractionally during the final months of the year due mainly to further expansion in the electrical equipment and supplies group.

Over the three year period of 1971 through 1973 construction employment remained relatively unchanged. During the first six months of 1974 employment in this field was up 8.7 percent compared to the same period of 1973.

All of the expansion took place among special trade contractors which includes contractors who undertake specialized activities such as plumbing, painting, plastering, carpentering, etc.

The seasonally adjusted unemployment rate was only 5.6 percent at the beginning of 1970 but ten months later it had risen to a peak in the seventies of 8.8 percent. The jobless rate remained high during the height of the recession in 1971 and ended the year with a twelve month average of 7.8 percent, 0.8 above the year before. As manufacturing recovered and job expansion occurred in the nonmanufacturing sector, the rate dropped to 5.5 percent in May 1973, but in the following months of 1973 the rate was at or around the 6.0 percent mark. The high level of unemployment persisted into 1974 and in May it was 0.8 above the same month in 1973. During the first half of 1974, joblessness averaged 6.2 percent of the civilian labor force, compared with 6.0 percent during the first six months of 1973.

The unemployment picture in Ventura County during June 1974 compared favorably with the State but not with the nation. Locally, the jobless rate was 6.4 percent which was below the State rate of 7.5 percent, but above the 5.2 percent level nationwide.

The civilian labor force in Ventura County rose 12.4 percent over a four-year period (1970 thru 1973). During this span the expansion in labor force kept reasonable pace with the growth in civilian population, which rose by approximately 13 percent.

The local labor market outlook for the remainder of 1974 was somewhat pessimistic. Growth in employment was expected to slow further as business expansion was dulled by high interest rates and inflationary pressures on the local economy increase. In addition, a further slowdown in population growth will limit expansion in many industries. Employment was expected to show an expansion of about 4 percent in 1974, substantially less than the growth rate of 5.3 percent experienced between 1972 and 1973.

(1) Ventura County Labor Force Trends and Outlook

Economic activity in Ventura County during the latter part of 1974 and the first half of 1975 was hampered by the effects of the nationwide recession. The growth in the number of working Ventura County residents slackened in the latter part of 1974 and continued to decline through the first six months of 1975. Employment in January was 5.4 percent above the year-earlier level while the next four months showed a further slowdown to .3 percent in May. At mid-June, employment fell below the year-earlier level for the first time in nearly two years. Nevertheless, employment averaged 158,000 during the first half of 1975, a gain of 3,500, or 2.3 percent, from the same period the year before. (See table II-44a)

Unemployment was also severely affected by the economic downturn as each month in the first half of 1975 was well above the comparable month in 1974. On a year-to-year basis, unemployment was up 3.3 percent over the year in January; 28.0 percent in February; 40.5 percent in March; 23.0 percent in April; 40.7 percent in May; and 20.5 percent higher this June. For the first six months of 1975, unemployment averaged 14,800, up 3,000, or 25.4 percent from the comparable period one year-earlier. Joblessness rose to a record level for the current series of 16,300 in March. A seasonal decrease occurred in April but then a sharp contraseasonal rise took place in May

TABLE II-44a

NONAGRICULTURAL WAGE AND SALARY EMPLOYMENT
VENTURA COUNTY
JANUARY - JUNE 1975

	1975 January	1975 February	1975 March	1975 April	1975 May	1975 June	1975 6-Month Average	1974 6-Month Average	Absolute Change Previous Year	Percent Change Previous Year
Nonag. Wage & Salary Emp. - total	110.9	111.1	111.8	112.1	112.3	113.2	112.1	109.8	+ 2.3	+ 2.1
Mining	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.8	- .1	- 5.6
Construction	4.2	4.0	4.0	4.1	4.2	4.2	4.1	4.9	- .8	-16.3
Manufacturing - total	16.6	16.0	16.0	15.9	15.4	15.7	16.0	16.5	- .5	- 3.0
Durables - total	10.3	10.2	10.1	10.0	9.9	9.9	10.1	10.3	- .2	- 1.9
Stone, clay, glass	.2	.2	.2	.2	.2	.2	.2	.2	---	---
Machinery	4.3	4.2	4.1	4.1	4.0	4.0	4.1	4.1	---	---
Ord/Trans. equipment	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.5	- .2	- 5.7
Other durables	2.5	2.5	2.5	2.4	2.4	2.4	2.5	2.5	---	---
Nondurables - total	6.3	5.8	5.9	5.9	5.5	5.8	5.9	6.2	- .3	- 4.8
Food products	2.0	1.7	2.0	2.0	1.6	1.8	1.9	2.0	- .1	- 5.0
Prtg./publishing	.9	.9	.9	.9	.9	.9	.9	.9	---	---
Other nondurables	3.4	3.2	3.0	3.0	3.0	3.1	3.1	3.3	- .2	- 6.1
Trans., comm., utilities	4.3	4.3	4.4	4.4	4.4	4.4	4.4	4.4	---	---
Trade	24.3	24.3	24.6	25.1	25.6	26.1	25.1	24.6	+ .5	+ 2.0
Wholesale	4.1	4.3	4.6	5.0	5.4	5.7	4.9	4.7	+ .2	+ 4.3
Retail	20.2	20.0	20.0	20.1	20.2	20.4	20.2	19.9	+ .3	+ 1.5
Fin., Ins., Real Estate	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.0	+ .2	+ 5.0
Services	20.4	20.4	20.5	20.6	20.7	20.7	20.6	19.5	+ 1.1	+ 5.6
Government	35.2	36.2	36.4	36.1	36.1	36.2	36.0	34.1	+ 1.9	+ 5.6
Federal	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.7	+ .1	+ .9
State and Local	24.4	25.4	25.6	25.3	25.3	25.4	25.2	23.4	+ 1.8	+ 7.7

Source: State of California, Employment Development Department, September, 1975.

while the new and reentrants into the labor force in June helped swell the jobless total to 15,900.

During the latter part of 1974, the seasonally adjusted unemployment rate started to rise sharply and by year's end it was up to 8.5 percent. The unemployment rate remained at a high level in 1975, reaching a new high of 9.3 percent by mid-May. The monthly average in this period was 8.3 percent, compared with 6.8 percent in the same period the year before. (See table II-45)

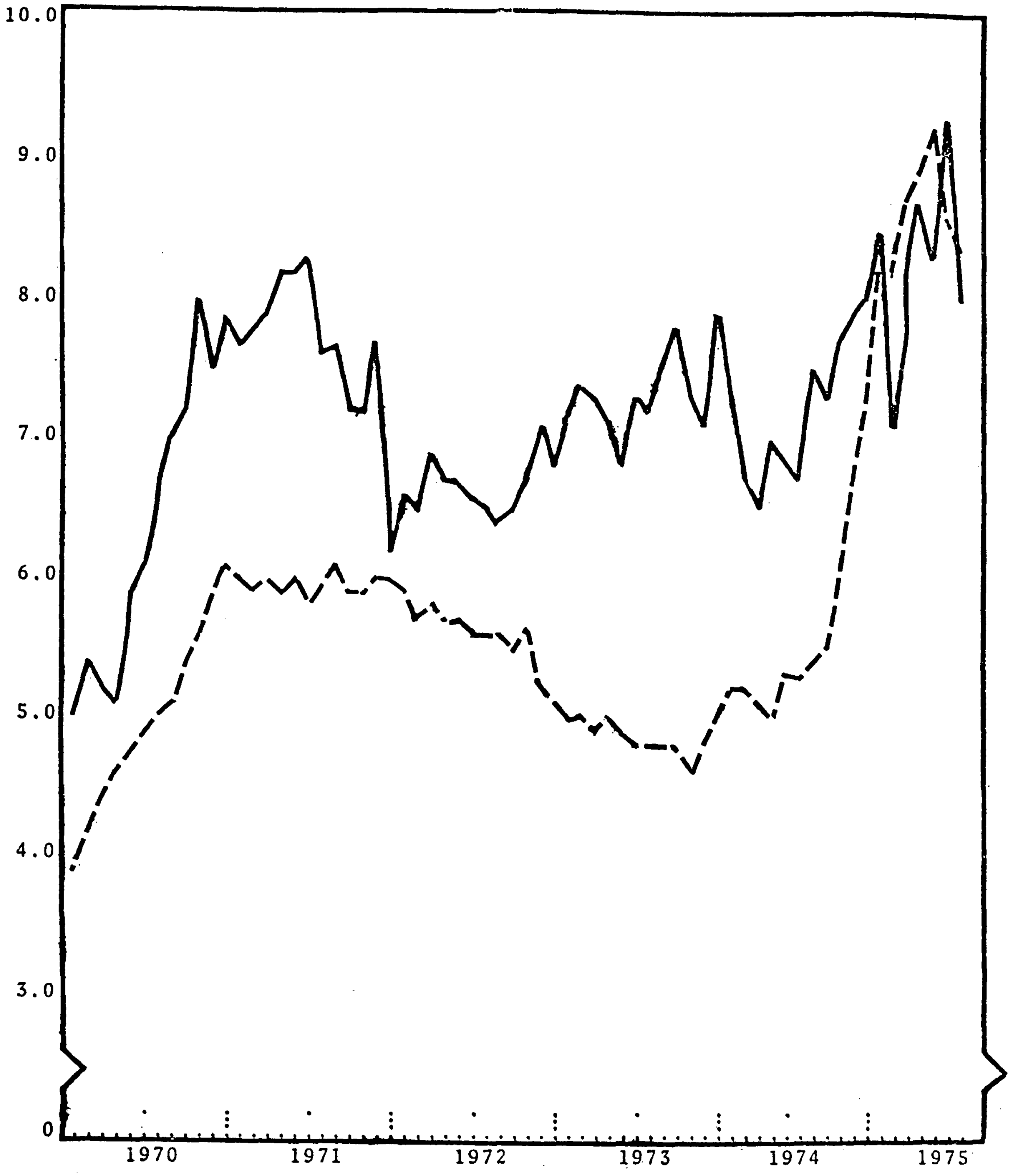
<u>OUTLOOK</u>: It is expected that economic activity in Ventura County will gather force through 1976. The economic well-being of neighboring Los Angeles County, however, will strongly effect job opportunities for Ventura County residents since a large portion of the labor force commutes to that area for employment. The rate of inflation will also play a vital role in the expected recovery. Employment in Ventura County was forecast to grow by about 2.0 percent in 1975.

Unemployment will remain substantially above the year-earlier levels but some narrowing in the over-the-year rise is expected for the rest of the year.

Source: Area Manpower Review, State of California Health and Welfare Agency, June, 1975.

TABLE II-45

Comparison of Seasonally Adjusted Unemployment Rates in Ventura County and United States 1970 - 1st Half of 1975



Source: State of California, Employment Development Department, September, 1975.

b. <u>Labor Market Trends - Santa Barbara County</u>

Much of Santa Barbara County is mountainous terrain. Approximately 40 percent of the total land area is either farmed or cultivated and another 44 percent is taken up by the Los Padres National Forest in the eastern part of the county.

Over 50 percent of the county labor force is located adjacent to the major centers of Santa Barbara City and the Goleta Valley in the southern part of the county. The industrial mix in that area is concentrated in services, government, trade, manufacturing and agriculture, in that order.

The number of nonagricultural wage and salary jobs in Santa Barbara County rose by 6.1 percent in 1973 with most major industries contributing to the gain. The largest absolute gain occurred in the services industry as tourism continued to be a viable factor in the sector. Employment in the retail trade division also rose significantly in 1973 and the increase was mainly due to the expansion of existing facilities and an increase in the level of consumer expenditures. (Table II-46)

Services, the largest employing division in Santa Barbara County, employed an average of 23,000 workers in 1973 reflecting an 8 percent increase over 1972. Tourism in the area spurred employment in hotels and lodging places during the summer months. Medical and health services employment, which comprises more than one-fifth of the total payrolls in the services division, showed consistent growth throughout all of 1973. The largest component in services continues to be the business services group which is comprised mainly of scientific and technical research and development firms.

The government division, the second largest employing category in Santa Barbara County, had an average work force of 22,200 in 1973. This count is

Table II-46

EMPLOYMENT BY INDUSTRY
SANTA BARBARA COUNTY
(Thousands)

Industry	July 1971	July 1972	July 1973
Total civlian employment	100.9	103.2	105.8
Nonagricultural wage & salary workers .	81.8	84.0	86.6
Mining	1.0	.9	.9
Construction	3.7	3.7	3.6
Manufacturing	9.8	10.0	10.5
Food products	1.6	1.5	1.7
Paper, printing & publishing	.8	.9	.9
Petroleum & chemicals	.3	.4	.4
Primary & fabricated metals	.3	.5	.5
Nonelectrical & electrical machinery	2.7	2.8	3.0
Transportation equipment	.2	.2	.2
Other manufacturing	3.9	3.7	3.8
Trans., communication & utilties . . .	3.5	3.4	3.3
Wholesale & retail trade	19.0	19.7	30.3
Finance, insurance & real estate . . .	3.3	3.6	3.7
Service	20.7	21.8	23.0
Government (a)	20.8	20.9	21.3
Other nonagricultural employment (b) . .	12.3	12.5	12.5
Agriculture	6.8	6.7	6.7

(a) Includes all civilian employees of Federal, State, and local governments, regardless of the activity in which the employees are engaged.
(b) Includes employers, own-account workers, unpaid family workers, and domestic servants.

Source: State of California, Employment Development Department

only 300 or 1.4 percent higher than the comparable figure reported in 1972 with local government payrolls accounting for the entire net gain.

Trade employment, averaging 21,300 in 1973, was 1,600 or 8.1 percent higher than the 19,700 recorded in the previous year. Annual average gains occurred in both the wholesale and retail divisions. Most retail jobs are found in eating and drinking establishments, automotive dealers and service stations, and general merchandise stores.

The number of workers reported on manufacturing payrolls in Santa Barbara County firms rose by 1,100 or 10.4 percent between 1972 and 1973 with net gains occurring entirely in the durable goods group. In the nondurables classification, modest annual growth in food processing was equally offset by scattered losses in most other groups. In durables, more than half the annual advance occurred in the manufacture of electrical and scientific equipment while partial losses were evident in ordnance.

The annual average unemployment rate in 1973 at 4.8 percent was well below the previous year's level of 5.6 percent. The area's seasonally adjusted and unadjusted unemployment in 1973 ran well below the California rate but somewhat paralleled comparable rates for the United States. By December, 1974 the unemployment rate had climbed to 6.6 percent. (Seasonal adjusted rate) (Table II-47) (See table II-48 for a more detailed breakdown of unemployment by sectors)

The southern portion of Santa Barbara County continues to be a nationwide tourist attraction. Consequently, motels, hotels, restaurants, and related service industries are major sources of employment opportunities. The education component is the major factor in employment in the government sector, with the Santa Barbara Campus of the University of California being

TABLE II-47

Labor Force, Employment and Unemployment

Santa Barbara County

Source: State of California, Employment Development Department, Southern California Employment Data and Research, December 1974.

	1974			1973
	December	November	October	December
Civilian labor force a/	117,100	117,500	116,300	113,700
Total employment	110,100	110,400	110,600	108,800
Total unemployment	7,000	7,100	5,700	4,900
Seasonally adjusted rate	6.6	6.3	5.4	4.7
Unadjusted rate	6.0	6.0	4.9	4.3
Labor Market Classification b/	C	C	C	C

a/ Total labor force (and components) by place of residence and including workers involved in trade disputes. Employment includes self-employed, unpaid family, and domestic workers.

b/ U.S. Department of Labor Classification according to adequacy of labor supply. Group "C" - Area of Moderate Unemployment.

Nonagricultural Wage and Salary Employment
Total Agricultural Employment for Santa Barbara County

	Dec 1974c/	Nov 1974	Oct 1974	Dec 1973
Total nonag wage & salary employ.a/	93,000	93,400	93,000	92,200
Mining	700	700	700	700
Construction	3,300	3,400	3,500	3,300
Manufacturing	11,700	12,500	12,300	12,200
Durable goods	8,400	8,900	8,900	8,900
Stone, clay, glass	300	800	800	800
Machinery	4,400	4,400	4,500	4,400
Ordnance and trans, equip.	1,600	1,600	1,600	1,600
Other durable goods	2,100	2,100	2,000	2,100
Nondurable goods	3,300	3,600	3,400	3,300
Food and kindred	2,000	2,300	2,100	2,000
Printing and publishing	1,000	1,000	1,000	1,000
Other nondurable goods	300	300	300	300
Trans., comm., & utilities	3,300	3,300	3,300	3,300
Trade	22,700	22,100	22,100	22,400
Wholesale	4,300	4,400	4,400	4,000
Retail	18,400	17,700	17,700	18,400
Fin., ins., real estate	4,300	4,300	4,300	4,300
Services	23,900	23,800	23,700	23,300
Government	23,100	23,300	23,100	22,700
Federal	4,000	4,000	4,000	3,900
State and local	19,100	19,300	19,100	18,800
Total agricultural employment b/	4,800	5,200	5,800	4,700

a/ Employment reported by place of work excluding workers involved in labor disputes.

b/ Includes farmers, employees, and unpaid family workers.

c/ Current month preliminary; past months revised.

TABLE II-48

TOTAL CIVILIAN LABOR FORCE, UNEMPLOYMENT, AND RATE BY PLACE OF RESIDENCY
SANTA BARBARA COUNTY
1973 - FIRST QUARTER 1975

ITEM	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	AVG.
1975													
Civilian Labor Force	110,750	113,450	114,000										
Unemployment	8,150	9,350	8,000										
Unemp. Rate Seas. Adj.	6.7	7.2	6.7										
Unemp. Rate	7.4	8.2	7.0										
Total Civilian Employment	102,600	104,100	106,000										
1974													
Civilian Labor Force	108,000	109,700	111,750	112,500	113,500	115,150	113,400	112,500	113,000	113,400	114,850	114,600	112,700
Unemployment	7,600	7,200	6,450	6,400	5,400	6,450	6,700	5,900	6,700	6,300	7,850	8,000	6,700
Unemp. Rate Seas. Adj.	6.4	5.7	5.5	5.9	5.3	5.3	5.8	5.4	6.4	6.2	7.0	7.0	5.9
Unemp. Rate	7.0	6.6	5.8	5.7	4.8	5.6	5.9	5.2	5.9	5.6	6.8	7.0	5.9
Total Civilian Employment	100,400	102,500	105,300	106,100	108,100	108,700	106,700	106,600	106,300	107,100	107,000	106,600	106,000
1973													
Civilian Labor Force	104,400	104,800	106,700	106,050	107,000	108,900	108,350	107,850	106,750	107,700	109,250	109,050	107,200
Unemployment	7,100	7,900	6,800	5,750	5,600	6,500	6,350	6,150	5,450	5,600	6,050	6,450	6,300
Unemp. Rate Seas. Adj.	6.2	6.6	6.1	5.6	5.8	5.6	5.8	5.9	5.5	5.7	5.7	5.9	5.9
Unemp. Rate	6.8	7.5	6.4	5.4	5.2	6.0	5.9	5.7	5.1	5.2	5.5	5.9	5.9
Total Civilian Employment	97,300	96,900	99,900	100,300	101,400	102,400	102,000	101,700	101,300	102,100	103,200	102,600	100,900

Source: State of California, Employment Development Department

the largest employer in the county. Manufacturing is primarily considered to be of light variety, in direct response to the communities' concern that the southern portion of the county not be despoiled by heavy industry. Therefore, volume jobs usually connected with manufacturing are not found in this area, but are restricted to assembly of electronic/electrical components and related operations.

The northern part of Santa Barbara County has been in a state of transition between rural and urban. A large percentage of the employment in the area, especially in the city of Santa Maria, is dependent upon agriculture, although manufacturing and service industries have played an increasing role in the total structure of employment over the past ten years. Vandenburg Air Force Base played a large part in the expansion of the area.

(1) Santa Barbara County Labor Force Trends and Outlook

The civilian labor force in Santa Barbara County, the sum of employed and unemployed persons residing in the county, averaged 112,700 per month in 1974, a gain of 5.1 percent from 1973. This percentage increase was above the population growth rate for the same period reflecting the increased labor force participation of women and youth.

Total civilian employment rose by 5.1 percent in 1974 to a record monthly average of 106,000. June was the peak month with 108,700 at work while the usual post-holiday lull in the local economy reduced employment to 100,400 in January. The year-to-year growth in jobs eased during the latter part of the year as the nationwide recession deepened and inflationary pressures were felt by the local economy. The annual employment growth rates reached 6.6 percent in May but by November the rate was down to 3.7 percent. The employment slowdown which became evident during the latter half of 1974 continued through the first quarter of 1975. By the beginning of 1975, year-to-year growth declined to 2.2 percent and February and March showed a further slackening in the annual growth rate to 1.6 percent and 0.7 percent. (See tables II-49 and II-50)

The number of unemployed persons residing in the county averaged 6,700 per month in 1974, up 400 from 1973. Unemployment totalled 7,600 at the start of the year, but then dropped in each of the next four months to a low for the year of 5,400 in May. An upswing in joblessness occurred in the summer months as new school graduates entered the labor force and many non-certificated school personnel were released for the summer recess. In contrast to previous years, unemployment continued to rise during the fall months as several layoffs occurred and the growth in jobs was not keeping pace with the expansion in labor force. By the end of 1974, unemployment had risen to 8,000, the highest in the current series which dates back to 1970. In the first quarter of 1975, the number of persons looking for work averaged 8,500 per month, about 20 percent above the year-earlier level. Unemployment in the county set a new all-time high of 9,350 in February.

OUTLOOK: The employment outlook in Santa Barbara County is highly uncertain. Much will depend on consumer spending in the county and fiscal and monetary policies at the federal government level. Consumer spending, however, is very difficult to project because of the current pessimism about the economic outlook and the rising level of unemployment.

TABLE II-49

NONAGRICULTURAL WAGE AND SALARY EMPLOYMENT
AREA SANTA BARBARA COUNTY
(IN THOUSANDS)

	1961	1970	1971	1972	1973	1974	1975	PERCENT CHANGE 1961-1970	PERCENT CHANGE 1973-1974	PERCENT CHANGE 1974-1975
TOTAL	52.4	81.3	81.6	84.6	90.1	91.9	94.1	+ 55.2	+2.0	+2.4
MINING	.9	1.0	1.0	.8	.7	.7	.7	+ 11.1	0.0	0.0
CONSTRUCTION	5.1	3.6	3.4	3.3	3.6	3.4	3.3	- 29.4	-5.6	-2.9
MANUFACTURING	9.7	10.4	9.6	10.6	12.2	13.3	13.8	+ 7.2	+9.0	+3.8
DURABLE GOODS	7.3	7.8	7.0	7.5	9.1	9.9	10.3	+ 6.8	+8.8	+4.0
NONDURABLE GOODS	2.4	2.6	2.6	3.1	3.1	3.4	3.5	+ 8.3	+9.7	+2.9
TRANS., COMM., UTILITIES	2.4	3.4	3.4	3.3	3.2	3.1	3.1	+ 41.7	-3.1	0.0
TRADE	11.6	18.3	18.8	19.7	21.1	20.9	21.7	+ 57.8	- .9	+3.8
WHOLESALE	2.2	3.0	3.4	3.8	3.7	3.9	4.0	+ 36.4	+5.4	+2.6
RETAIL	9.4	15.3	15.4	15.9	17.4	17.0	17.7	+ 62.8	-2.3	+4.1
FIN., INS., REAL ESTATE	1.8	3.2	3.3	3.7	4.1	4.2	4.3	+ 77.8	+2.4	+2.4
SERVICES	11.1	20.0	20.5	21.3	23.0	23.7	24.2	+ 80.2	+3.0	+2.1
GOVERNMENT	9.8	21.4	21.6	21.9	22.2	22.6	23.0	+118.4	+1.8	+1.8

Source: State of California, Employment Development Department

TABLE II-50

MONTHLY NONAGRICULTURAL WAGE AND SALARY EMPLOYMENT AND AGRICULTURAL EMPLOYMENT BY MONTH

AREA SANTA BARBARA COUNTY, 1974

(IN THOUSAND)

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	AVG.
NONAG WAGE & SALARY	89.9	90.5	92.5	92.4	93.0	92.7	90.2	91.3	92.0	92.8	93.2	92.8	91.9
MINING	.7	.7	.7	.7	.7	.7	.7	.7	.7	.7	.7	.7	.7
CONSTRUCTION	3.3	3.5	3.4	3.4	3.5	3.7	2.6	3.7	3.7	3.6	3.4	3.3	3.4
MANUFACTURING - TOTAL	12.5	12.6	13.8	13.4	13.8	13.3	13.3	13.3	13.2	13.5	13.7	12.9	13.3
DURABLES - TOTAL	9.6	9.7	10.0	10.0	10.1	9.9	10.0	10.0	10.0	9.9	9.9	9.3	9.9
STONE/CLAY/GLASS	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	.3	.8
MACHINERY	5.0	5.1	5.4	5.4	5.4	5.3	5.4	5.4	5.4	5.3	5.2	5.2	5.3
ORD/TRANS. EQUIP.	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.5
OTHER DURABLES	2.2	2.3	2.3	2.3	2.4	2.3	2.3	2.3	2.3	2.3	2.4	2.4	2.3
NONDURABLES - TOTAL	2.9	2.9	3.8	3.4	3.7	3.4	3.3	3.3	3.2	3.6	3.8	3.6	3.4
FOOD PRODUCTS	1.4	1.4	2.3	1.9	2.2	1.9	1.8	1.8	1.7	2.1	2.3	2.1	1.9
PRTG./PUBLISHING	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
OTHER NONDURABLES	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4
TRANS., COMM., UTILITIES	3.0	3.0	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
TRADE	20.6	20.6	20.9	21.0	21.0	21.0	20.9	20.9	21.0	20.9	21.0	21.5	20.9
WHOLESALE	3.7	3.7	4.1	4.0	3.9	4.0	3.9	3.8	3.9	4.1	4.1	4.0	3.9
RETAIL	16.9	16.9	16.8	17.0	17.1	17.0	17.0	17.1	17.1	16.8	16.9	17.5	17.0
FIN., INS., R.E.	4.0	4.1	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
SERVICES	23.0	23.2	23.6	23.6	23.7	23.6	24.0	24.1	24.1	23.9	24.0	24.1	23.7
GOVERNMENT	22.8	22.8	22.8	23.0	23.0	23.1	21.4	21.3	22.0	22.9	23.1	23.0	22.6
FEDERAL	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.8	3.7
STATE AND LOCAL	19.1	19.1	19.1	19.3	19.3	19.4	17.7	17.6	18.3	19.2	19.4	19.2	18.9
AGRICULTURAL	4.0	5.0	5.5	5.8	6.1	6.6	6.8	6.5	6.3	5.8	5.2	4.8	5.7

Source: State of California, Employment Development Department

Unemployment was forecast to be about 25 percent higher in 1975 as additional layoffs occur but may subside somewhat by the end of the year. The jobless total in 1975 was also adversely affected by the continuous problems of absorbing recent school graduates and an increasing number of women who are looking for full or part-time work to augment their family income. The unemployment rate was predicted to average about 7.0 percent during the forecast year, up from 5.9 percent in 1974.

Source: Area Manpower Review, State of California, Employment Development Department, March, 1975.

c. The Economic Importance of the Oil Industry in California-1974

The economic importance of the oil industry in California is underscored by the massive investment in physical assets of over $12.9 billion as of January 1, 1975. Of that total $6.8 billion was invested in the exploration and production phase, $3.8 billion in manufacturing, $1.8 billion in marketing and $530 million in various other physical assets. (See table II-51d)

These assets are made up of about 40,000 oil wells and 1,000 gas wells (of these wells almost 1,600 are located offshore) and petroleum refineries of all types with a capacity of over 1.8 million barrels. The total also included pipelines, office buildings, terminals, tank trucks, tank cars, tankships, and thousands of retail and wholesale marketing outlets.

For each of the 63,000 persons employed directly by the oil companies in California $207,000 has been invested in physical assets. (See table II-51e)

Oil industry expenditures for purchased services and materials which includes tankerships, trucks, and other items, in California was $1.6 billion. (See table II-51a)

As of January 1, 1975 the total number of employees and dealers was 237,000 in California. These employee figures include persons on the payrolls of oil companies, retail service station dealers and bulk plant dealers. Employees of supply companies and oil field contractors serving the oil industry together with oil company employees engaged in foreign operations are not included.

Taking into consideration the families of the oil industry employees, it is estimated that 675,000 persons in California are dependent upon the oil industry for their livelihood, that is 3.2 percent of California's population.

The wages and salaries earned by personnel employed by the oil industry in California totalled $870,750,000. The average earnings of these oil company employees for the year 1974 amounted to $13,800. (See table II-51e)

The oil-producing companies in California made payments of $190,000,000 to state, Federal and local government agencies and to private interests in the form of bonuses, rents, and royalties on oil and gas leases during 1974. (See table II-51b)

Direct taxes paid to California state and local governments in 1974 were $300 million in property taxes, $64 million in excise taxes, $110 million in income (franchise) taxes for a total of $474 million. (See table II-51c)

TABLE II-51a - MATERIALS AND SERVICES PURCHASED[1/]

California
$1,600,000,000

TABLE II-51b - BONUSES, RENTS AND ROYALTIES TO FEDERAL & STATE AND LOCAL AND PRIVATE COMPANIES OR INDIVIDUALS

California
$190,000,000

TABLE II-51c - DIRECT TAXES PAID TO STATE AND LOCAL GOVERNMENTS

Type of Tax	California
Property	$300,000,000
Excise	64,000,000
Income (Franchise)	110,000,000
TOTAL	$474,000,000

TABLE II-51d - ORIGINAL INVESTMENT IN PHYSICAL ASSETS*

(Investment in Thousands of Dollars)

Phase of Operations	California
Exploration & Production	$ 6,763,000
Manufacturing	3,800,000
Marketing	1,830,000
All Other Assets	530,000
TOTAL INVESTMENTS	$12,923,000

TABLE II-51e - EMPLOYEE AND SALARY STATISTICS - 1974

Category	California
Company Employees**	63,000
Employees' Salaries	$870,750,000
Average Salary Per Employee	$ 13,800
Investment Per Employee	$ 207,000
Employees and Related Personnel***	193,000

1/ Expenditures are for purchased materials and services for 1974. Includes allocations for tankerships, trucks and other such movable items. Excludes crude oil and other petroleum product purchases and exchanges.

* Excludes investments in physical assets and employee data of oil field service contractors, supply companies and foreign operations.

** Direct oil company employees only. Figures are in total dollars.

*** Also includes lessee operations, consignees, commission agents, dealers and their employees. EXCLUDES oil field service contractors and other service and supply companies and their employees as well as foreign operations employees. Figures are in total dollars.

Source for above tables: The Week in Review, Vol. 43, No. 41, Western Oil and Gas Association, Tax and Statistics Department, September, 1975.

3. Agriculture - California's Leading Industry

California has a land area of 100.2 million acres and is the third largest state in the United States ranking just behind Alaska and Texas. Approximately 36.2 million acres was utilized for farmland in 1973, which is better than 1/3 of the area of the state. On this farmland California farmers produced 9 percent of the national gross cash receipts from farming in 1973. This production was realized from 63,000 farms or 2 percent of the Nation's total. The average California farm was estimated at 575 acres in 1973 and valued at $277,000 including buildings. Nationally, the average farm size in 1973 was 383 acres and valued at $90,960 also including buildings.

California is often the number one agriculatural state in the United States. In 1972 it led the nation in cash farm receipts for the 26th consecutive year, reaching a new landmark in California history of 5.6 billion dollars. This is 400 million or 8 percent above the 5.2 billion high established a year earlier (table II-52). The 1973 gain in cash receipts was largely attributable to sharply higher prices, although there was increased production for several major crops.

One often overlooked fact about the California economy is that agriculture is the state's leading industry. Despite urban pressures that threaten farming in many parts of the state, acreage devoted to crops increased to 8.5 million acres from 8.1 in 1972. The state lead the nation in the production of 46 individual farm products in 1973, ranging from alfalfa seed and almonds to tomatoes and walnuts, and including such diverse items as eggs, carrots, melons, olives and lettuce (table II-52a). The state accounts for more than 90 percent of the nation's production of almonds, apricots, artichokes, broccoli, dates, figs, garlic, grapes, nectarines, olives,

Table II-52

Southern California Coastal Counties
Agricultural Receipts
and Major Crops
1971, 1972, 1973

County	Cash Farm Receipts 1973	1972	1971	Annual Percent Change 72-73	72-71	Most Important Crops and Values 1973 (Millions)			
Ventura	277,793,100	220,328,400	200,401,100	26.1	9.9	Fruits & Nuts	144.8	Vegetables	75.9
San Diego	219,342,100	167,510,700	153,092,630	30.9	9.4	Eggs	49.7	Tomatoes	29.5
Los Angeles	136,802,100	120,667,630	123,205,040	13.4	-2.1	Nursery Stock	50.7	Livestock & Poultry	48.8
Santa Barbara	152,215,806	115,140,543	108,725,570	32.2	5.9	Cattle & Calves	29.1	Lettuce	19.8
Orange	131,104,900	97,563,200	96,977,900	34.4	0.6	Nurs. Stock & cut flowers	45.6	Eggs	18.0
Totals $	917,258,006	721,286,343	672,402,240	27.5 1/	5.9 1/				
Total Calif. 2/	7.5 billion	5.5 billion	5.0 billion	36.4	10.0	Cattle & Calves	1,315.5	Milk & Cream	693.8
So. Calif. Cash Farm Receipts as a Percent of the State	12.2	13.1	13.6						

1/ Weighed by county receipts
2/ Rounded totals for state

Source: U. S. Dept. of Agriculture, Departments of Agriculture of the Respective Counties.

Table II-52a

Crop and livestock commodities in which California leads the Nation

Alfalfa seed	Carrots	Ladino clover seed	Peaches	Strawberries
Almonds	Cauliflower	Lemons	Pears	Spinach
Apricots	Celery	Lettuce	Peppers, bell	Safflower
Artichokes	Cut flowers	Lima beans	Peppers, chili	Sugarbeets
Asparagus	Dates	Misc. melons	Persimmons	Tomatoes
Avocados	Eggs	Nectarines	Plums	Walnuts
Blackeye beans	Figs	Nursery stock	Pomegranates	
Broccoli	Flower seeds	Olives	Potted plants	
Brussels sprouts	Garlic	Onions	Prunes	
Cantaloupes	Grapes	Oriental vegetables	Rabbits	

Source: U. S. D. A., California Crop and Livestock Reporting Service, California Agriculture 1973 persimmons, pomegranates, prunes, safflower, clover seed and walnuts.

The state's harvested farm production in 1973 was the largest on record at 44.3 million tons, up 1 percent from the previous 1972 high of 43.9 million tons. Increased aggregate production for vegetables and fruits and nuts more than offset a lower output from field crops. Increased production of significant magnitudes includes processing tomatoes (7 percent), peaches (9 percent), grapes (72 percent), walnuts (45 percent) and prunes (164 percent) while lower outputs were recorded for sugarbeets (29 percent) and all hay (4 percent).

California's "Top Twenty" crop and livestock commodities accounted for over 80 percent of the state's gross farm income in 1973. Cattle and calves and dairy products continue to dominate the livestock industry, while grapes, cotton, hay and tomatoes are the most important crops. In dollar value of marketings cattle sales brought in over $1,316 million followed by milk and cream ($694 million), grapes ($609 million) and cotton lint ($395 million). (See table II-52b.)

California's agriculture is considered one of the most diversified in the world, with no single crop dominating the state's farm economy. This is illustrated by the fact that most crops individually account for less than 3 percent of the state's total gross farm income. California also leads the nation by a wide margin in the production of fruits and vegetables.

Agriculture in California is important not only in supplying food to the Nation, but also for many other reasons. It has created many jobs in commerce and industry, and contributes directly or indirectly almost $19 billion a year to the state's economy. The state's farm production accounts for 1/2 of the total tonnage shipped by trucks and approximately

Table II- 52b

California
Ranking and Value
20 leading farm products,
1972-73

Farm product	Commodity ranking		Value 1/		Percentage of state total	
	1972	1973	1972	1973	1972	1973
	Number		1,000 dollars		Percent	
Cattle & calves	1	1	1,049,169	1,315,549	19.1	17.6
Milk & cream	2	2	608,082	693,802	11.1	9.3
Grapes	3	3	364,958	609,422	6.6	8.1
Cotton, lint & seed	4	4	306,841	483,029	5.6	6.5
Hay	5	5	281,486	385,385	5.1	5.1
Eggs, chicken	7	6	202,461	323,629	3.7	4.3
Tomatoes	6	7	258,741	308,721	4.7	4.1
Rice	11	8	128,868	258,659	2.3	3.5
Lettuce	8	9	183,287	257,655	3.3	3.4
Nursery products	9	10	170,021	242,900	3.1	3.2
Almonds	14	11	98,125	192,960	1.8	2.6
Oranges	12	12	123,158	133,262	2.2	1.8
Turkeys	16	13	73,048	123,987	1.3	1.7
Potatoes	19	14	67,698	116,312	1.2	1.6
Sugarbeets	10	15	133,659	115,920	2.4	1.5
Barley	15	16	74,867	110,262	1.4	1.5
Cut flowers	13	17	105,641	106,000	1.9	1.4
Wheat	27	18	42,012	100,360	0.8	1.3
Walnuts	22	19	65,424	97,440	1.2	1.3
Prunes	28	20	41,195	95,613	0.8	1.3

1/ Based on value of quantity harvested for crops and on value of quantity marketed for livestock and poultry products.
Source: U. S. D. A. California Crop and Livestock Reporting Service, California Agriculture, 1973.

1/2 of the value of water borne exports from California ports. Also, there are nearly 3,000 manufacturing plants for processing food and kindred products in the state.

In 1972 the average value of farm land per acre in southern California was the highest in the state in 4 out of 8 categories including non-irrigated cropland, pastureland, rangeland and irrigated orchards. Since then non-irrigated farmland in the central coast area has appreciated at a rapid pace relegating southern California's non-irrigated farmland to second place in all categories in terms of value (table II-52c). A possible exception would be irrigated orchards for which current average values were not available.

In 1973 approximately 12.2 percent of total cash receipts for all farm products sold were produced in southern California coastal counties. This compares with 13.1 percent in 1972. Total cash receipts were up sharply for the area in 1973 reflecting a 27.5 percent rise. Although this appears to be a very large increase it is still 9 percentage points below the state increase of approximately 36 percent (table II-52). These increases primarily reflect sharply higher prices for a wide variety of products rather than increased production.

The south coast counties rank in 1973 according to their total cash farm receipts were Ventura, San Diego, Santa Barbara, Los Angeles and Orange.

a. The Agriculture Industry - Projections

A new landmark in cash farm receipts is the optimistic outlook for California's farmers in 1975. Cash receipts are expected to reach $10 billion, or 17.7 percent over the previous record of $8.5 billion in 1974. It is probable that California will regain the distinction as the

Table II-52c

California
Average value of farmland per acre
by district and land use
March 1973

District	Irrigated 1/				Nonirrigated		
	Truck and Vegetables	Intensive field crops 2/	Intensive field crops 3/	Pasture	Crop-	Pasture	Range-
	Dollars						
Northern California 4/	805	520	440	575	330	315	200
Central Coast	2,250	1,590	1,095	1,025	930	760	400
Sacramento Valley	1,035	910	770	600	435	340	225
San Joaquin Valley	1,215	1,005	880	695	430	330	205
Southern California	1,480	1,170	920	960	685	525	320
State	1,550	1,035	865	695	580	440	250

1/ Orchard and grove values not available for 1973.
2/ Includes land used for cotton, sugarbeets, rice, etc.
3/ Includes land used for barley, beans, corn and sorghum.
4/ Excluding Sacramento Valley.

Source: U. S. D. A. California Crop & Livestock Reporting Service, California Agriculture 1973.

nation's number one agricultural state in 1975, after having relinquished that honor to Iowa in 1973 and 1974. Prior to that setback, California had successfully defended the title for 26 consecutive years.

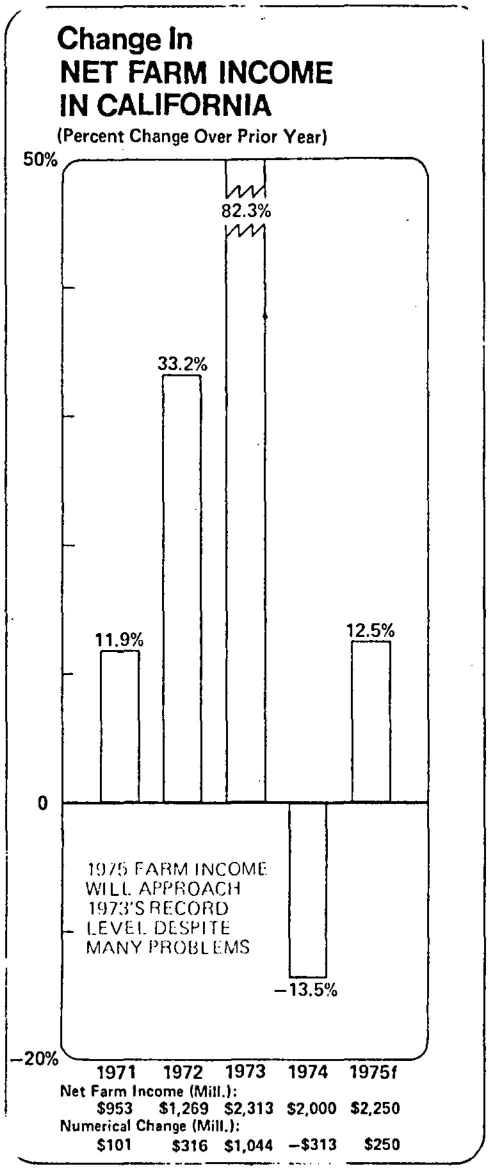
CALIFORNIA CASH FARM RECEIPTS

	Total Cash Receipts	Change From Prior Year	
		Numerical	Percent
	...... (000)		
1966	$4,188	$385	10.1%
1967	4,096	- 92	- 2.2
1968	4,452	356	8.7
1969	4,656	204	4.6
1970	4,714	58	1.3
1971	5,202	488	10.4
1972	5,683	481	9.3
1973	7,405	1,722	30.3
1974 (estimate)	8,500	1,095	14.8

Net farm income is expected to reach $2.25 billion, representing a 12.5% gain over 1974's farm income of $2.0 billion. The base for this very high level of net farm income was set in 1973 when heavy demand for farm commodities pushed income to $2.3 billion, an incredible jump of 82.3% over the prior year. Inflation impacted sharply on the farmers' operating costs in 1974, so that net income declined to $2.0 billion, a loss of 13.5%.

CALIFORNIA NET FARM INCOME

	Total Net Income	Change From Prior Year	
		Numerical	Percent
	...... (000)		
1966	$ 963	88	10.1%
1967	804	-159	-16.5
1968	975	171	21.3
1969	978	3	0.3
1970	852	-126	-12.9
1971	953	101	11.9
1972	1,269	316	33.2
1973	2,313	1,044	82.3
1974 (estimate)	2,000	-313	-13.5
1975 (forecast)	2,250	250	12.5



Source: United California Bank
1975 Forecast of the
Research and Planning Division

Livestock Prices Continue to Increase

California's farmers and ultimately the state's consumers will eventually experience the costly effects of the damaging weather conditions which dealt a triple blow to the Midwestern states throughout 1974 -- wet spring, summer drought, and early frosts. Since California must import about one-half of its cattle feeds and about one-half of its fresh beef supplies, there will be no escape from high prices for these commodities in the foreseeable future. Cattle feeds, especially corn, will be in such short supply that prices will skyrocket. This could lead to higher consumer prices for California's livestock and products because of the higher cost of feeding animals and poultry. Many feedlot operators have been forced out of business as a result of their losses, and still others refuse to take the risk of fattening cattle.

Although California's farm production differs significantly from that of other agricultural regions in the nation, the state's farmers are vulnerable to the same kinds of problems that stem from inflation and shortages. Examples of the price acceleration of farm supplies in just a one-year period, 1973-1974, are as follows:

Farm machinery	up 140%
Fertilizers	up 150%
Cattle feeds	up 175%
Propane gas	up 200%
Hay	up 310%
Baling wire	up 400%

Foreign demand for American food is expected to show some moderation in 1975 because of improved crop prospects abroad and also because of a slowing in the economies of U. S. major overseas trading partners.

However, California should not fare too badly in comparison with the U.S. as a whole in agricultural exports in 1975. Along with rice and cotton, the state's specialty crops will always have strong demand in foreign markets. Source: United California Bank, 1975 Forecast

b. Agriculture in Southern California Counties

Two groups, nursery stock and livestock/poultry, account for over 70 percent of Los Angeles County's agricultural income.

The 13.2 percent increase in agricultural sales in Los Angeles County was significant in light of the fact that in 1972 sales were off 2.1 percent compared to a year earlier. At the same time the increase was so small in comparison to the other 4 counties in the area that Los Angeles County dropped from third to fourth place in value of production of sales and was passed by Santa Barbara County in 1973.

Although agriculture sales in Orange County were the smallest of the south coast counties, the percent increase (32.2) was the largest compared to a year earlier. Favorable weather combined with much better prices received in 1973 helped make it the best year on record. Approximately 500 acres of truck crops acreage was lost to other uses (3.6 percent) but production in this area was still up 8 percent. The two major commodities in 1973 were nursery stock/cut flowers and eggs. Combined income from these commodities was up over 50 percent compared to a year earlier.

In San Diego County, the major commodities were eggs and tomatoes followed by avocados and milk. Income from these four commodities represented almost 60 percent of the agricultural income to the county. Egg production values almost doubled but this was offset by soaring feed costs. It was noted that farmland acreage in the county was up almost 5,000 acres or 9 percent compared to the 1972 level.

(1) Agriculture was the leading industry in Santa Barbara County in 1973 as cash receipts rose 32 percent from approximately 115 million dollars in 1972 to 152 million in 1973 (table II-52). Increased

receipts from cattle and calves and the lettuce crop were mainly responsible for the added income. Receipts from cattle and calves were up almost 50 percent to $29,129,819 while the lettuce crop receipts increased from approximately 8 1/2 million dollars to almost 20 million. Increased lettuce acreage as well as unit price were significant factors.

Agriculture continues to be the leading industry in Santa Barbara County with a 1974 gross value production of $151,426,247. This is a decrease of over one million dollars from the record set in 1973. While 1974 did not see a record high in gross values received by producers it did see a record high in costs for producing agricultural commodities.

It must be emphasized that the figures below are gross values returned to the economy of Santa Barbara County and in no way reflect net returns to the grower. Costs of production, transportation and marketing have to be subtracted in order to determine net income.

SUMMARY

	Year	Acreage	F.O.B. Value
Fruit and Nut Crops	+1974	17,372	$ 24,806,207
	1973	15,334	26,493,583
Vegetable	1974	38,059	52,428,994
	1973	35,801	53,667,816
Field Crops	+1974	850,335	18,725,560
	*1973	844,020	15,758,378
Nursery Products	1974	290	8,285,300
	1973	218	5,541,400
Cut Flowers	1974	658	8,607,700
	1973	688	7,802,900
Seed Crops	1974	7,708	8,464,931
	1973	7,453	4,047,037
Livestock and Poultry	1974		21,487,995
	1973		30,479,116
Livestock, Poultry, and Apiary Products	+1974		8,619,560
	*1973		8,701,846
Total	+1974	914,422	$151,426,247
	*1973	903,514	152,492,076

+ Preliminary
* Revised

Source: Graydon B. Hall,
Agricultural Commissioner, Santa Barbara County

- Vegetable Crops in 1973 were artichokes, lima beans (frozen), broccoli (market and frozen), cabbage, carrots, cauliflower (market and frozen), celery, sweet corn, endive, lettuce, dry peppers, potatoes, pumpkins, squash, spinach, tomatoes (fresh and canning), and miscellaneous.

- Field Crops in 1973 were barley, beans (small whites, limas, garbanzos, and miscellaneous), alfalfa hay, grain hay, oats, irrigated pasture, other pasture, corn silage, sugar beets, wheat, and miscellaneous.

- Fruit and Nut Crops in 1973 were avocados, lemons (market and processing), oranges, strawberries (market and processing), walnuts, wine grapes, and miscellaneous.

- Nursery Products in 1973 were fruit trees and grapevines, potted chrysanthemums, ornamental trees and shrubs, indoor decorative potted plants, and ground cover, bedding and vegetable plants.

- Cut Flowers in 1973 were carnations, chrysanthemums, orchids, gypsophila, greenhouse grown flowers and foliage, and field grown flowers and foliage.

- Livestock and Poultry in 1973 were cattle and calves, sheep and lambs, hogs and pigs, chickens, turkeys, and miscellaneous.

- Livestock, Poultry and Apiary Products in 1973 were milk (market and manufacturing), wool, chicken eggs, and apiary products.

- Seed Crops in 1973 were bean seed, flower seed, vegetable seed, and miscellaneous.

A list of million dollar agricultural products is depicted in table II-52d below. The list is lead by the production of cattle and calves with a total of $20,597,044 followed by brocolli with $13,631,200. A total of 27 different million dollar crops was produced in Santa Barbara County in 1974.

TABLE II-52d

1974 MILLION DOLLAR PRODUCTS - SANTA BARBARA COUNTY

1.	Cattle & Calves	$20,597,044	15.	Eggs	$ 3,730,324
2.	Broccoli	13,631,200	16.	Potatoes	3,334,080
3.	Lettuce, Head	13,580,688	17.	Chrysanthemums, cut	3,057,300
4.	Avocados	9,282,000	18.	Pasture, Nonirrigated	3,044,110
5.	Cauliflower	8,116,080	19.	Sugar Beets	2,425,269
6.	Lemons	7,025,000	20.	Orchids	2,422,300
7.	Strawberries	6,541,800	21.	Ornamental Trees & Shrubs	1,950,000
8.	Dry Beans	5,040,838	22.	Tomatoes	1,593,864
9.	Celery	4,973,520	23.	Cabbage	1,450,725
10.	Milk	4,609,540	24.	Ground Covers, Bedding & Vegetable Plants	1,427,100
11.	Alfalfa Hay	4,564,560	25.	Carrots	1,407,203
12.	Bean Seed	3,957,959	26.	Grapes, Wine	1,385,160
13.	Indoor Decorative Potted Plans	3,818,700	27.	Grain Hay	1,184,040
14.	Flower Seed	3,734,232			

In table II-52e following, the historic production of agricultural products in Santa Barbara County is shown in total dollars per year beginning with 1964. Agricultural production has increased at an average annual rate of 7.81 percent since 1964 and reached a record high 32 percent yearly increase for the 1972-1973 period. After an all-time high of $152,492,076 in 1973 agricultural production decreased by one percent in 1974 to $151,426,247. Production is expected to increase again in 1975 after the temporary decline in 1974.

TABLE II-52e

SANTA BARBARA COUNTY COMPARATIVE AGRICULTURAL VALUES

		Percent Increase from Previous Year
+1974	$151,426,247	-1%
*1973	152,492,076	32%
1972	115,140,543	6%
1971	108,725,570	11%
1970	97,533,460	5%
1969	92,773,860	3%
1968	90,363,720	3%
1967	88,016,920	3%
1966	85,737,590	9%
1965	78,753,540	10%
1964	71,390,560	

+ Preliminary
* Revised

Source: Graydon B. Hall, Agricultural Commissioner, Santa Barbara County

A detailed summary of agricultural production for the years 1950, 1960, and 1970, is shown in table II-52f.

TABLE II-52f

SUMMARY OF AGRICULTURAL PRODUCTION IN SANTA BARBARA COUNTY, 1950, 1960 and 1970

Source: Department of Agriculture, Santa Barbara County, California

Crop	Year	Acreage	F.O.B. Value
Fruit and Nut Crops	1950	12,244	$ 7,867,399
	1960	13,090	11,809,900
	1970	10,038	18,669,000
Vegetable Crops	1950	27,328	14,245,582
	1960	27,611	16,995,500
	1970	26,640	25,930,000
Field Crops	1950	91,296	10,731,974
	1960	561,969	8,589,000
	1970	643,970	10,910,800
Nursery Products	1950	---	---
	1960	115	1,711,100
	1970	145	3,040,600
Cut Flowers	1950	---	---
	1960	359	1,144,200
	1970	564	5,197,000
Seed Crops	1950	---	---
	1960	8,338	3,003,800
	1970	10,490	4,286,300
Livestock and Poultry	1950	610,000	18,813,066
	1960	---	17,838,900
	1970	---	22,748,100
Livestock and Poultry Products	1950	---	---
	1960	---	5,964,700
	1970	---	6,751,660
Totals	1950	740,868	51,658,021
	1960	611,482	67,057,100
* Bearing (15,344 planted)	1970	691,847	97,533,460

(2) Ventura County not only ranked first in value of production but also claimed agriculture as the number one industry in the county. The major crops are fuits and nuts (lemons, oranges, walnuts) which accounted for about 1/2 of the gross income attributable to agriculture. Income received for the livestock, poultry and dairy group was up 58 percent in 1974 and was mainly responsible for the county's large increase in agricultural receipts. Vegetables were also a primary source of income but total receipts were up only slightly compared to a year earlier. Production in the fruit and nut, field crops and aviary products groups was down in 1974. Approximately 3 out of 10 dollars in total agricultural income in the southern California coastal counties was produced in Ventura County in 1974.

Table II-52g gives a historical picture of agricultural production since 1950 in Ventura County.

During 1974 agricultural production reached a record high of $306,039,100 surpassing the previous high of $277,829,100 set in 1973 by $28,210,000 or 10 percent above the 1973 level. (Table II-52h.) The five largest dollar crops in 1974 were:

Lemons	$82,456,000
Chicken Eggs	25,976,900
Strawberries	25,763,300
Celery	22,927,600
Tomatoes	21,697,300
Total	$178,821,100

These five individual crops represent 58 percent of the total agricultural production in Ventura County for 1974.

In terms of revenue to growers, the area's farmers received about $306 million in 1974, about $29 million above the record level in 1973. Lemons were the county's most lucrative crop, however, citrus production was down

TABLE II-52g

SUMMARY OF AGRICULTURAL PRODUCTION IN VENTURA COUNTY, 1950, 1960, 1970

Source: Department of Agriculture, Ventura County, California

Crop	Year	Acreage (Bearing or Harvested)	F.O.B. Value
Fruit and Nut Crops	1950	57,080	$ 37,149,088
	1960	53,482	54,900,066
	1970	51,966	90,281,000
Vegetable Crops	1950	46,859	11,829,870
	1960	42,140	23,736,253
	1970	37,000	50,939,000
Livestock, Poultry and Dairy	1950	---	8,945,755
	1960	---	15,280,867
	1970	---	29,708,000
Field Crops	1950	17,771	930,320
	1960	33,066	6,412,589
	1970	17,120	4,649,000
Nursery Stock	1950	---	906,744
	1960	---	1,274,904
	1970	---	5,482,500
Cut Flowers	1950	---	---
	1960	---	1,161,750
	1970	---	8,491,500
Apiary Products	1950	---	---
	1960	---	163,800
	1970	---	85,000
Totals	1950	121,710	60,993,541*
	1960	128,688	102,930,230
	1970	106,086	184,153,500

* Includes Government Payments for Sugar Beets

TABLE II-52h

VENTURA COUNTY AGRICULTURAL CROP REPORT

RECAPITULATION

1973-1974

	YEAR	$ VALUE
FRUIT & NUT CROPS	1974	$142,244,200
	1973	144,838,100
VEGETABLE CROPS	1974	83,302,600
	1973	75,919,600
LIVESTOCK, POULTRY	1974	55,252,000
& DAIRY	*1973	34,942,300
NURSERY STOCK	1974	12,657,800
	1973	9,275,100
CUT FLOWERS	1974	3,208,800
	1973	3,167,800
FIELD CROPS	1974	9,018,400
	1973	9,139,200
APIARY PRODUCTS	1974	355,300
	1973	547,000
GRAND TOTAL	1974	$306,039,100
	*1973	277,829,100

*Revised

Source: Leslie D. Haworth, Agricultural Commissioner, Ventura County Agricultural Crop Report 1974 considerably because of a bad blossom in the fall of 1973. Eggs moved into second place bringing in $26 million in 1974. This represents an increase of $10 million from 1973 as the price per ton rose from $111 to $146. The biggest drop of all crops was Valencia oranges which grossed about $9 million less than in 1973, despite a price increase of $38 per ton.

4. Income Characteristics

The California coastal zone is the most highly developed portion of the state. Within this area is found the bulk of the state's population and the major portion of its income. The intensive urbanization in and around the Los Angeles, San Diego and San Francisco areas is an expression of some of the advantages which the coastal zone enjoys over other areas of the state.

In an important respect, the comparative advantages of the urban complexes around the coast is strongly associated with their position as transportation modes and dependence on harbors and shipping. A number of economic activities are drawn to the ports, including warehouses, insurance companies and industry.

While it is true that many of the industries that form the basis of the California economy do not use the ports extensively to ship their products (e.g., aircraft, electronics industries), the income generated nevertheless creates an enormous demand for goods which must be met.

Other industries which are drawn to the coast are canneries, petroleum refineries, defense installations, etc. As a result of this concentration, service industries and others which are market oriented will also tend to locate near the coast.

a. Personal Income

Personal income, of which the main component is wages and salaries, accounts for approximately 80 percent of gross state product. Employment trends is one of the significant factors affecting the growth of personal income. The large movement of wage earners into southern California in the 1950's and early 1960's had direct impact on total personal income in southern California. Since then migration from other regions of the country has slowed dramatically. This resulted in southern California's income growth becoming more closely aligned with the growth rate of the Nation.

Total personal income for the five southern California coastal counties is estimated at $59.3 million for 1973. This is 9.8 percent above 1972 and approximates the personal income growth rate of California as a whole (table II-52i).

Within southern California, a major factor affecting personal income gains has been county-to-county population and labor shifts. It is important to note in this respect that county personal income data measures income earned by residents of that county regardless of which county the income was generated in. Thus county business trends may not parallel personal income trends exactly.

Ventura County has absorbed part of the population outflow of Los Angeles County and, with an estimated 11.1 percent growth in personal income in 1973, is exhibiting rapid growth. Santa Barbara County registered almost a ten percent increase in personal income in 1973 compared to a nine percent increase a year earlier. Construction was much weaker during 1973, but retail sales were up sharply.

b. Gross National Product

The most comprehensive measure of activity within any economy is gross national product (GNP) defined as the final market value, in current prices, of all goods produced and services performed. In terms of GNP, the United States ranks ahead of all countries in the world. If the State of California's total production in 1972 was ranked with the ten largest countries in the world, it alone would have ranked seventh on the list (table II-52j).

The coastal zone counties from Santa Barbara south to the Mexican Border produce more than one-half of the state's total goods and services, which points up the significance of this area in broad terms.

After the economic doldrums of the 1970-71 recession, business activity in California picked up sharply. The 1971-73 growth pattern in California closely paralleled that for the United States. During the 1971-73 three

Table II-52i

TOTAL PERSONAL INCOME, SOUTHERN CALIFORNIA, CALIFORNIA AND THE NATION
($000,000)

	1960	1965	1970	1971	1972	1973	Percent Change 71-72	Percent Change 72-73
Los Angeles	18,071.5	24,288.0	34,282.9	35,300.6	37,786.0	41,278.0	7.0	9.2
Orange	1,702.0	3,373.1	5,968.3	6,291.2	6,971.0	7,766.0	0.8	11.4
San Diego	2,590.2	3,273.8	5,662.4	5,925.0	6,535.0	7,267.0	10.3	11.2
Ventura	473.5	758.0	1,220.8	1,314.8	1,437.0	1,596.0	9.3	11.1
Santa Barbara	445.1	746.3	1,098.6	1,160.4	1,264.0	1,389.0	9.0	9.9
Southern California Total	23,282.3	32,439.2	48,233.0	49,992.0	53,993.0	59,296.0	8.0	9.8
California Total	42,980.0	60,234.0	89,312.0	94,412.0	102,100.0	112,100.0	8.1	9.8
United States Total	400,953.0	538,893.0	808,290.0	863,515.0	939,161.0	1,033,200.0	8.8	10.0

Source: Security Pacific Bank, California Department of Finance, Williams Research Associates, U.S. Department of Commerce.

TABLE II-52j

GROSS NATIONAL PRODUCT OF THE WORLD'S TEN LARGEST COUNTRIES, PLUS CALIFORNIA

1982 Rank	Countries	Current U.S. Dollars 1962	1972	1982	10-year % Increase '72/'82
		........(billions).......			
1.	U.S.	$ 560	$1,155	$ 2,600	125%
2.	U.S.S.R	247	560	1,400	150
3.	Japan	59	294	1,100	274
4.	West Germany ..	90	260	850	227
5.	France	75	202	700	247
6.	United Kingdom	80	154	400	160
7.	Italy	44	117	375	221
8.	Canada	40	103	325	215
	California	62	126	300	138
9.	China	67	120	275	129
10.	India	36	60	125	108
	Top ten countries'	$1,298	$3,025	$ 8,150	169%
	GNP % of total	74%	74%	74%	
	Rest of world's	452	1,075	2,850	165%
	GNP % of total	26%	26%	26%	
	Total world GNP.	$1,750	$4,100	$11,000	168%

Source: United California Bank, Research and Planning Division, 1974 forecast.

year period, the gross national product advanced nearly 22 percent while California's gross state product climbed by nearly 21 percent.

c. <u>Income by Source</u>

Wages and salaries for California make up approximately two thirds of total personal income (figure II-52k). The group which receives the largest share of this are government workers followed by manufacturing, wholesale and retail trade workers, and those in the service industries.

d. <u>Per Capita Income</u>

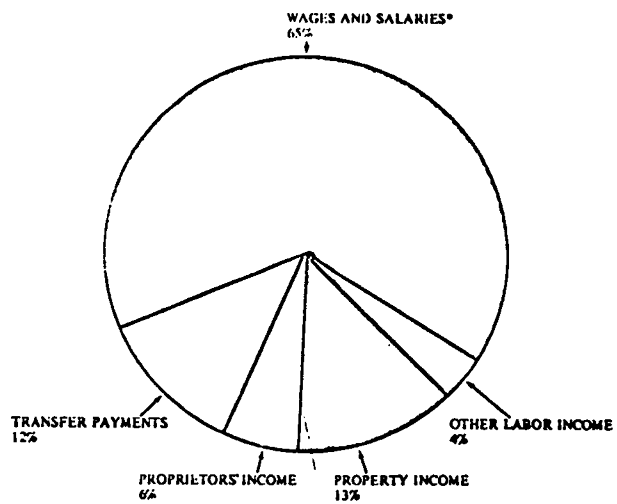
Per capita income in the five southern California coastal counties is estimated at $5,513 for 1973, 2 percent above the California and 12 percent above the U. S. per capita incomes. This area (southern California) with its concentration of highly paid manufacturing wage earners has historically registered per capita income levels slightly higher than the rest of the state and considerably higher than the national average (table II-52ℓ). More important is that southern Californians are experiencing a rising standard of living by virtue of earnings growth after adjusting for inflation. Since the beginning of the last decade, per capita income has risen by an average of 5.2 percent annually while consumer prices have risen by 2.9 percent.

e. <u>Median Family Income</u>

Median income could be defined as the middle income in an array from the lowest to the highest. The median family income in southern California coastal counties ranges from a low of $12,533 in San Diego County to a high of $14,471 in Orange County (table II-52m). Compared to the median family of the United States, all counties in the South Coast area are above this average from as little as 3 percent to a maximum of 19 percent. In comparison to the median family income for the state as a whole, the

Table II-52k

TOTAL PERSONAL INCOME,
SOUTHERN CALIFORNIA
BY SOURCE, 1973



*Excludes employee contributions for social insurance, paid by wage and salary workers.
Souce: Security Pacific Bank

TABLE II-52ℓ

PER CAPITA INCOME AND CONSUMER PRICE INDEX, SOUTHERN CALIFORNIA
CALIFORNIA AND THE NATION

	Per Capita Income			Consumer* Price Index		C.P.I. Percent Change Year Ago	
	So. Calif. /1	Calif.	U.S.	Los Angeles	U.S.	So. Calif.	Los Angeles
1960	$2,833	$2,709	$2,129	88.5	88.7	-	-
1965	3,367	3,258	2,773	95.7	94.5	3.5	2.1
1970	4,602	4,436	3,945	114.3	116.3	5.9	5.1
1971	4,713	4,652	4,171	118.5	121.3	3.6	3.7
1972	5,058	4,976	4,497	122.3	125.3	7.3	3.2
1973	5,513	5,405	4,911	129.4	132.7	8.9	5.8

*1967 = 100

Source: Security Pacific Bank, California Department of Finance, U.S. Department of Commerce
Bureau of Labor Statistics

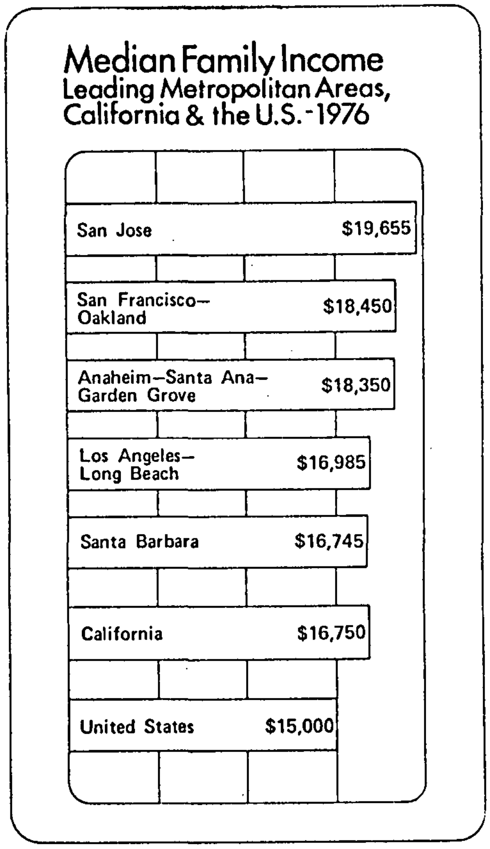
/1 Includes Los Angeles, San Diego, Ventura, Orange, Santa Barbara Counties only.

TABLE II-52m

MEDIAN FAMILY INCOME, SOUTHERN CALIFORNIA, CALIFORNIA AND THE NATION

	Actual			Estimated	Forecast	Numerical Change		Percent Change	
Counties	1970	1971	1972	1973	1974	'72/'73	'73/'74	'72/'73	'73/'74
Los Angeles	11,390	11,718	12,654	14,095	15,290	1,441	1,195	11.4	8.5
San Diego	10,507	10,807	11,506	12,533	13,260	1,027	727	8.9	5.8
Ventura	11,423	11,563	12,233	13,466	14,395	1,233	929	10.1	6.9
Santa Barbara . . .	10,931	11,152	11,880	13,098	13,895	1,218	797	10.3	6.1
Orange	$12,620	$12,642	$13,271	$14,471	$15,310	$1,200	$ 839	9.0%	5.8%
California	$11,156	$11,472	$12,289	$13,527	$14,485	$1,238	$ 958	10.1%	7.1%
United States . . .	$ 9,867	$10,285	$11,116	$12,150	$13,000	$1,034	$ 850	9.3%	7.0%

Source: United California Bank, Research and Planning Division 1974 forecast southern coastal counties do not come out as well. Los Angeles and Orange Counties exceed the state average while Santa Barbara, San Diego and Ventura fall below. Indications point to a continuation of this trend, as shown by the following graph:



Source: Research and Planning Division,
United California Bank, Forecast 1976.

5. Recreation

Recreation is an important component of southern California's environment and economy. An abundance of opportunity combined with a large, highly mobile population, creates a situation unparalleled elsewhere in the country. This section discusses the existing population, usage and resources of southern California.

a. Population

Population has a large effect on recreation demand and ability to meet such demands with density and distribution patterns as important factors. Southern California has undergone an explosive rate of population growth over the greatest part of the past two decades but evidence that the rate has declined in the seventies is strong. Los Angeles County, for example, has had a net outmigration evidenced as long ago as 1968 and continuing to the present, with actual population losses in the past two or three years. Orange County, in contrast has shown continued strong increases through the present time.

Southern California gained 3.4 million people in the decade 1950 to 1960 declining to a gain of 2.7 million between 1960 to 70. Growth rates will likely remain much reduced until the onset of another boom industry such as the defense and aerospace expansions of the late 50's and early 60's.

Lowered growth rates have been attributed to growing congestion, pollution, earthquakes and urban sprawl. Cutbacks in NASA, Department of Defense and other high technology industrial contracts combined with economic recession has made the southern California economic climate less attractive than it had been in the past. The regional economy remains strong but does not enjoy the rampant expansion of the earlier period.

Environmental considerations may restrict a recurrence of the past's rapid expansion through such means as stricter zoning, restricted availability of public services and limitations on atmospheric pollutants.

Rural populations exert a much lower demand for recreation resources than do urban areas. Rural people have open space and outdoor recreation opportunities near at hand. They are also not subjected to the pressures of urban existence and are not as compelled to seek relief and self-renewal in the natural environment. Population in the five southern California counties ranges from 88.5 percent urban in Santa Barbara County to 98.8 percent urban in Orange County. Southern California averages 97.6 percent urban while the State population, as a whole, is 90.9 percent urban.

Population characteristics of southern California match very closely those of the Nation. Children under five and five to seventeen years of age compose 8.4 percent and 16.0 percent of the population, respectively, for southern California and 84 percent and 16.1 percent for the Nation. Age group 18 to 65 years and over 65 years are 66.8 percent and 8.5 percent of southern California, respectively, and 65.6 percent and 9.9 percent for the Nation.

Growth will continue but not at the explosive rate of the past for the region. Population expansion will occur mainly in Orange County followed by San Diego and Ventura counties.

	County Population 1970[1]	Forecast 1974[2]
Santa Barbara	264,324	280,000
Ventura	376,430	440,000
Los Angeles	7,036,463	6,948,000
Orange	1,420,386	1,699,000
San Diego	1,357,782	1,538,000

[1]Source - U.S. Dept. of Commerce, Bur. of Census, *County and City Data Book 1972.*

[2]Source - United Calif. Bank, Res. and Planning Div., *1974 Forecast,* 1973.

Decreased rates occurred due to a decline in net migration, lowered birth rate and rise in the number of resident deaths. According to U.S. Census Bureau estimates, the birth rate for women in the 18 to 24 year old bracket declined from 2.9 per woman in 1955, to 2.6 in 1967, and reaching 2.1 by 1972. High birth rates are not likely to be reached again which indicates a lower rate of population growth.

Geographically, most of California's population occurs within the coastal strip and predominantly along the southern portion of it. This results in great pressure upon large portions of the coast for both recreation and other land uses. This pattern of population distribution will continue for the foreseeable future.

b. Tourism

Tourism is the third largest industry in southern California and supports approximately a million jobs according to the Southern California Visitors Council. In 1973 as estimated 8.5 million out-of-state U.S. visitors (not including those attending conventions or traveling on business) spent almost $2 billion in southern California. In addition to out-of-state tourists, an estimated 2.1 million people visited southern California from other parts of the State plus a growing number of foreign travelers. The overall economic benefit gained from tourist expenditures in southern California is important in that it adds to the economic well-being of the area by contributing directly and indirectly to almost every sector of regional economic activity. The direct impact of visitor spending is discernible through expenditures and from the number of employees and their dependents directly supported by tourism in service related activities.

Also of economic significance is that dollars spent by tourists represents "new money"--money earned elsewhere and spent here in a service industry typified by rapid dollar turn over and a high multiplier effect within the local economy. It has been estimated that the overall effect of tourist expenditures on the regional economy is close to two times the dollar amount of these expenditures as a result of the multiplier effect or dollar turn over. Thus the total impact of tourist spending would not be the direct expenditure of almost $2 billion but closer to $4 billion.

Another important benefit derived from tourism is in the form of taxes paid by the visitor. In 1973 tourists paid an estimated $119 million in taxes while making relatively small demands on such services as police, fire protection, etc. These taxes represent a significant contribution to the southern California economy. The principal taxes paid by tourists are the retail sales tax and the gasoline tax. A portion of the retail sales tax is rebated to the local communities. The gasoline tax collected in southern California also benefits the region through a better system of freeways and through rebates to the counties and cities for local road improvement.

In 1973 the major recipients of the $1,966 million tourist expenditures in southern California were establishments engaged in the sale of food and beverages (23.2 percent) and hotels and motels (22.3 percent). In addition, visitors allocated 17.0 percent of their expenditures to sports, theatres, and other recreational activities; and purchases of gasoline and other automobile products or services accounted for 14.0 percent. Clothing establishments were another prime beneficiary of 1973 tourist expenditures in southern California, receiving 11.2 percent.

In spite of an economic slowdown and growing inflation since mid-1973, and energy shortages during the last quarter of 1973 and first quarter of 1974, a record 8,446,000 out-of-state visitors came to southern California in 1973. Hence, the impact of energy shortages on tourist arrivals in southern California was slight, and the crisis (which lasted from late December 1973 through March 1974) appears to have resulted primarily in a shift in the mode of transportation employed. During this period, an increased percentage of the visitors to southern California arrived by airline or railroad. On the other hand, there was a corresponding decline in the proportion of visitors arriving by automobile.

It must be remembered that travel and most recreation are based on the mobility of people coming into the State and/or moving around in it by means of fuel-dependent vehicles--automobiles, aircraft, trains and buses. In its simplest terms tourism, like "travel," is the movement of people through various modes of transportation upon which they are dependent. In the event of another fuel shortage, the major impact would probably be a continued shift to the common carrier and away from the private automobile. There would, of course, be some loss in trade which would be expected to increase indirectly in relation to the increased severity of the fuel shortage.

In connection with this, the Southern California Visitors Council conducted a survey by sending questionnaires to people who had written for information. Of those who requested information but did not visit southern California, 11 percent listed the reason as the energy shortage. This was fourth on a list headed by illness in the family, not enough money, or not enough time to make the trip.

The 1960's, a decade of economic expansion, saw steady increases in the number of visitors in southern California. An economic slowdown caused tourist arrivals to level off in 1970 and decline somewhat in 1971. Since 1971, the number of visitors to southern California has continued to expand but at a very modest rate.

Historically, the trend in tourist expenditures has paralleled that of tourist arrivals. However, a significant increase in the rate of inflation in 1973 (led by sharp increases in the cost of food and fuels) resulted in tourist expenditures during that year expanding at a significantly faster rate than the number of visitors. This is reflected in the following table, II-53.

The seasonal characteristics of tourism in southern California have changed considerably since the early 1900's. During earlier periods, the tourist season was almost exclusively the winter months, as the wealthy and more affluent people vacationed in southern California to escape the harsh eastern winters.

TABLE II-53

SOUTHERN CALIFORNIA TOURIST ARRIVALS AND EXPENDITURES, 1968-1974

	1968	1969	1970	1971	1972	1973	First Five Months 1973	First Five Months 1974
Number of Tourists Arriving in Southern California (in thousands)....	7,882	8,185	8,248	7,599	8,125	8,446	3,042	3,118
Percent change compared to 1968 (Base year).........................	--	3.8	4.6	- 3.6	3.1	7.2	--	--
Tourist Expenditures in Southern California (in millions of $)..................	$1,242	$1,271	$1,461	$1,320	$1,402	$1,966	808	n.a.
Percent change compared to 1968 (Base Year).........................	--	2.3	17.6	6.3	12.9	58.3	--	--

Source: Southern California Visitors Council

At present, tourism is a year-round business with the greatest number of visitors arriving during the summer months when families can take advantage of school vacations. In spite of this shift, southern California has not lost its appeal to winter vacationers. It is interesting to note that per capita tourist expenditures are highest during the winter months. (See table II-53a)

In the survey conducted by the southern California Visitors Council, it was indicated that 60 percent of the out-of-state visitors to southern California in 1973 lived east of the Mississippi River. The greatest concentration of visitors came from the east-north-central and mid-Atlantic areas of the United States, each of which accounted for 22 percent of the visitors to southern California. The east-north-central area includes the States of Illinois, Indiana, Michigan, Ohio and Wisconsin. New York, New Jersey and Pennsylvania comprise the mid-Atlantic states. Significant proportions of visitors to southern California also came from the mountain states (11 percent), the west-north-central region (9.5 percent) and the south Atlantic states (9.6 percent). The attractions which southern California has to offer the tourist are many and varied. Those who like outdoor recreation have the mountains, desert and excellent beaches to choose from while others may be attracted to the cultural activities found in the larger cities. Just as important, however, are the number of commercial attractions, most famous of which is Disneyland. Others include Knotts Berry Farm, Marineland, Lion Country and Magic Mountain, all located in the Los Angeles-Orange County areas, and Sea World located in San Diego. Southern California also has outstanding zoos located in Los Angeles and San Diego. The area also offers a temperate climate which can be enjoyed the year round.

TABLE II-53a

SOUTHERN CALIFORNIA TOURIST ARRIVALS
AND EXPENDITURES BY MONTH, 1973

	Tourist Arrivals	Tourist Expenditures	Expenditures Per Tourist
January	562,000	$ 173,000,000	$308
February	533,000	168,000,000	315
March	606,000	193,000,000	318
April	686,000	134,000,000	195
May	655,000	140,000,000	213
June	848,000	183,000,000	216
July	943,000	153,000,000	162
August	959,000	160,000,000	167
September	814,000	140,000,000	172
October	655,000	177,000,000	270
November	602,000	168,000,000	279
December	583,000	177,000,000	304
Total	8,446,000	$1,966,000,000	$233 1/

1/ Weighted average

Source: Southern California Visitors Council

The current outlook for tourist activity in southern California is that only a modest increase in activity is expected. The number of visitors during the first five months of 1974 is only slightly greater than for the same period a year earlier. Recent economic uncertainty and increases in the rate of inflation appear to have some effect.

As these problems diminish and with rapid gains in personal income levels, the long-term outlook is for a healthy growth of this industry in southern California.

c. Physical Resources and Usage

Regional recreation facilities include a diverse array of opportunities ranging from ocean oriented activities such as surfing and fishing, to mountain activities such as hiking and skiing. This variety lends much to the attractiveness of the region.

Recreation options exist although most opportunities are fully exploited, thus there is no surplus of any particular facility. Dislocation in one recreation type cannot be readily absorbed elsewhere as a result. Regional recreation supplies will then materially affect coastal recreation pressures.

Table II-53b, adapted from the California Department of Parks and Recreation, Parks and Recreation Information System (Paris), summarizes physical facilities of record that are available. For purposes of this analysis, those recreation sites within the immediate coastal area and seaward are to be directly considered.

d. Santa Barbara County

Santa Barbara County has 110 miles of coastline of which

TABLE II-53b

INVENTORY OF OUTDOOR RECREATION AREAS
AND SELECTED FACILITIES - SUMMARY

SANTA BARBARA COUNTY

Categories	Area	Existing sites	Units
Playfield	224	58	
Swimming beach	101*	9	
Picnic	197	167	1,802 tables
Boat access parking	0	1	150 spaces
Tent camp	287	192	1,073 "
Trailer camp	69	59	262 "

*includes inland and ocean

Total Acreages

	Land Acres	Wetlands	Water	Total
Land Types	831,891	2	29	831,922

BOR Land Classes	Class I AC	Class II AC	Class III AC	Class IV	Class V	Class VI
	529	549	756,032	5	74,468	101

Annual Attendance	Day-1959	Nite-1959	Total-1959	Day-1969	Nite-1969	Total-1969
	2,082,220	116,600	2,198,820	5,544,213	470,125	6,014,338

Source: California Department of Parks and Recreation, Summary Printouts 1969 (Feb. 1971).

this document will consider the 61 miles extending easterly from Point Conception.

Of this 61 miles, 15 miles are publicly owned and 46 are private. Public recreational use occurs on 13 miles with private recreational use on 10 miles. Non-recreational development occurs on 6 miles and 32 miles remain undeveloped. Fifty-six miles, or 92 percent is classified as sandy beach.

Physically, this shoreline is quite uniform from Point Conception to Santa Barbara Harbor. The beach is narrow and sandy, backed by low cliffs and bluffs. Occasional rocks punctuate some stretches of this beach.

Between Point Conception and Gaviota, the coast is privately owned and largely inaccessible except by boat. Uplands are generally not developed. Gaviota State Park is the only developed recreation site in this reach. This park is located where the westerly progress of U.S. Highway 101 terminates as it turns inland and north.

From Gaviota State Park to Coal Oil Point, the shoreline is mostly privately owned and largely undeveloped. Oil derricks and tank farms occupy the eastern portion of the area. Between Coal Oil Point and Santa Barbara Harbor, approximately half of the shoreline is privately owned and the remainder is mostly State land. Much of the upland is developed to some degree.

State Park System

Gaviota State Park

Gaviota State Park has scenic, historic, scientific and recreational values. This park includes 5.4 miles of coastline and extends inland for about 3 miles in a 1½-mile wide strip which encloses a total of approximately

2,800 acres. Upland portions of the park contain many typical ecological communities consisting of coastal sage, chaparral, oaks and sycamores. These communities are to be preserved and upland development will be restricted as a result. Limited beach area will restrict the availability of recreation opportunity to about 500 people at one time. Behind the beach there are 59 camp units, 29 picnic tables, and 75 beach parking sites. This provides a potential beach visitation of 834 (California, 1972).

59 x 8	=	472	
29* x 3.5	=	101	((101.5) should be rounded to 102)
75* x 3.5	=	261	((262.5) was "261" in original report)
*Total		834	(836 if added literally)

Figures updated from FY 1972 to 1973 Stat. Report.

In 1972, the potential beach visitation was 820 people and this figure was being reached on busy weekends. Overflow was being accommodated at the fishing pier and at isolated portions of the beach downcoast (Calif. 1972).

The visitation in 1969 to 1970 FY totalled 112,512 (Calif., 1969 to 70) rising to 128,291 in 1972 to 1973 FY (Calif. 1972 to 73).

Scenic values are rated as high for the most part. Ocean vistas, including the offshore islands are important features. Identified unesthetic elements include the railroad right-of-way with its trestles, wires and poles, along with tanks, buildings, and other facilities constructed by oil companies along this coast (Calif. 1972).

Abundant evidence of Indian villages exists primarily along the mouths of larger streams. Cabrillo is known to have anchored here in 1542. Portola camped near or at this beach in 1769. Gaviota Pass was a principal pass dating from Spanish times and, as such, functioned prominently in the early history of the region.

Recreation activities in the park include surf fishing. Sportsmen all fish from the pier at the mouth of Gaviota Creek and embark from there on deep sea party-boat fishing trips. Swimming, sunbathing, surfing, picnicking, beachcombing, and sightseeing constitute the beach activities. Inland activities are primarily hiking and horseback riding. Sightseeing and natural history study are the corollaries to hiking experiences in this park.

Expansion of Gaviota State Park in all four directions with beach acquisition sufficient to connect this park with Refugio State Beach to the east would be desirable, according to the State of California.

Refugio and El Capitan State Beaches

Eastward six to ten miles of Gaviota are Refugio and El Capitan State Beaches. These parks lie between the ocean and the Southern Pacific railroad track. The beach is relatively narrow and small portions of it are totally inundated at high tide. While lacking individually spectacular features, these parks have a peaceful charm and serve to maintain public access to this beautiful section of coast.

Historically, these parks are important. The whole coastal plain and adjacent canyons from Santa Barbara to Point Conception have played an important part in the early Spanish exploration and settlement of California.

Juan Rodriguez Cabrillo anchored near this coast in the fall of 1542. While in the vicinity, he replenished wood and water supplies.

Sebastian Vizcaino entered the Santa Barbara Channel on December 4, 1602, naming the passage after the saint whose feast fell upon that day.

Two Spanish landgrants comprised the original European ownership of this area. Some of the earlier adobes built on these grants still remain.

Many expeditions passed through the area including those of Gaspar de Portola, Pedro Fages, Junipero Serra, and Juan Bautista de Anza. Many padres used this trail communicating between Mission Santa Barbara and Mission Santa Ines.

Archeological values exist both within and near the park lands. Little work has been done in studying these sites.

El Capitan State Beach covers 133 acres containing 85 camping units and 30 picnic units (Calif. 1972 to 1973). Refugio State Beach has 90 acres with 85 camping units and 60 picnic units.

Visitor attendance at El Capitan rose from 209,378 in FY 1969 to 70 to 278,283 in FY 1972 to 73 (Calif. 1969 to 70, 1972 to 73). Attendance at Refugio was 131,033 in FY 1969 to 70, rising to 137,270 in FY 1971 to 72 and falling to 104,160 for FY 1972 to 73. During this time, park acreage was increased but the number of camping units was reduced from a high of 111 in 1969 to 85 in 1972 (Calif. 1969 to 70, 1971 to 72, 1972 to 73). Part of the decline may have been due to the reduction in available facilities and part due to the weather being cooler than normal during the summer of 1973. This reduced pressures on beaches all along the coast.

The remaining State installation is Carpinteria State Beach at Carpinteria, having a total of 50 acres with a shore of 4,100 ft. Picnic facilities number 103, and 125 camping units are provided. Visitor attendance for the 1972 to 1973 FY was 337,372 (California 1972 to 73).

State-owned sites are made available for operation by Federal or local agencies in some cases. Goleta State Beach is operated by the Santa Barbara County Park Department.

Total pertinent figures for State-owned and-operated units within the studied portion of the Santa Barbara County coastal area are:

Park Acreage	Oceanfront	Family Units Camping	Family Units Picnicking	1972-73 FY Visitation
3046	55,135 ft.	354	222	811,124

County Parks

Santa Barbara County Park Department operates several facilities along the south coast. These are Goleta State Beach, Arroyo Burro Beach, Lookout, Carpinteria Beach West, and Rincon Beach.

Goleta State Beach

Located just east of Goleta Point, this beach is state owned and county operated. Total acreage is 24 with 14 acres of beach. There are 20 picnic and no overnight units. Visitation in 1969 was 183,480.

Arroyo Burro Beach

This beach is located on the west side of Santa Barbara and is five acres in size. Day-use facilities include five picnic units. Visitation in 1969 was 292,508.

Other Beaches

Other beaches are located at Montecito, Carpinteria West, and Rincon Point.

Local, Private and Miscellaneous Sites

A varied assortment of recreational facilities such as fishing piers, boat facilities, wildlife refuges and locally operated beaches exists primarily in the City of Santa Barbara area.

Beginning just west of Coal Oil Point, at Ellwood, there are Ellwood Pier and Devereux Slough. The University of California at Santa Barbara occupies Goleta Point and provides a beach which is not open for general public use. Continuing easterly, there are the airport wildlife preserve located near the Santa Barbara Airport and Hope Ranch private beach park. In the Santa Barbara municipal area beachfront, there are the following sites: Shoreline, Leadbetter, Pershing, La Mesa and Palm Parks; Cabrillo and Miramar Beaches; Andre Clark Bird Refuge and Child's Estate. Private parks are the Santa Barbara Shores Beach Club and El Descandero Park. Farther east, at Carpinteria, is the Sandyland Wildlife Preserve.

Federal Parks

Channel Islands National Monument includes three islands collectively called Anacapa Island which is in Ventura County and Santa Barbara Island which is in Santa Barbara County. This national monument was established in 1938 primarily for its unusual geological features and unique plant and animal life. Recreational use has grown in recent years to the point where management to protect the ecological values has become imperative.

Recreational facilities exist at both Anacapa and Santa Barbara Islands. At Anacapa there are anchorages at Cat Rock, Frenchy's Cove, East Fish Camp, and the landing cove at East Island. No piers or mooring facilities are maintained, so anchorage may be unsafe under adverse sea conditions and skiffs are needed to make landings. Day-use facilities consisting of pit toilets and picnic tables exist at Frenchy's Cove and at East Island. Camping is primitive and restricted to East Island. All supplies including water and fuel must be brought in by the camper.

Santa Barbara Island is 42 miles (68 km) from the mainland coast and is roughly one square mile (2.6 km^2) in area. There is an anchorage at the landing cove on the northeast side of the island. This anchorage, like those at Anacapa, is uncertain and it is recommended that boats not be left unattended. Camping is primitive, as on Anacapa, and is restricted to the area of the quonset hut.

Recreational attractions include the isolated island environment, hiking, unique ecosystems, spectacular scenery, diving and fishing in the magnificently lucid surrounding waters and boating near the islands. Archeological values exist on these islands but neither salvage nor interpretation has been undertaken.

In the past, patrols were made irregularly and park personnel were resident occasionally in the monument. Under these circumstances, accurate visitor data was difficult to obtain. Presently, patrols are made much more frequently and NPS personnel are resident on the islands. The use estimates were made by using the following parameters. Total visits are the sum of the following items:

- Total number of persons debarking from boats onto Anacapa Island, estimated by actual physical counts at Frenchy's Cove by National Park Service personnel seasonally resident on the island or by reports from Island Packer Cruises;
- Number of persons aboard boats within a nautical mile of Anacapa and Santa Barbara Islands, except boats known to be bound for

Frenchy's Cove;

- Effective January 1, 1968, the number of persons debarking from boats onto San Miguel Island, as estimated from actual physical counts by Service personnel, is to be added to the total.

Approximately two-thirds of the total visits are day use only. It has been estimated that this segment of the total visitation spends an average of six hours in the monument, though they may not set foot on the islands.

A distinction has been made between overnight stays on the shore as opposed to privately owned boats. A rough estimate suggests that boat "camper" numbers are normally at least double their shoreline counterparts.

Monthly totals for three years were as follows:

	1967	1968	1969	1970
January		1,246	1,516	596
February		1,159	320	470
March		1,012	111	845
April		1,476	1,942	760
May		1,848	1,952	
June		3,367	4,040	
July	4,750	3,443	6,159	
August	4,293	6,124	6,790	
September	2,168	4,834	5,648	
October	1,626	2,752	1,900	
November	1,386	2,174	1,000	
December	1,510	1,575	700	
	15,733	31,010	33,078	2,671

NPS, 1970, Basic Data: Channel Islands, unpublished.

The preceding monthly breakdown indicates the timing of use throughout the year. Subsequent annual visitor totals follow:

1971	1972	1973	1974
30,886	41,610	54,034	34,526*

*Through September.

Visitation figures probably underestimate the number of people using the surrounding waters without going ashore. The monument includes those waters within one nautical mile of shore.

Use of the islands has reached the limit of their carrying capacity and visitor restrictions will probably be necessary. Increased use will necessarily have to take place in the surrounding waters.

Proposed Addition

Several proposals have been made to include all of the northern Channel Islands into a sea-dominated national park. None of these proposals has come to fruition, as yet. If this national park is established, it will immensely expand the recreational opportunities available to the people of the area and the Nation. The resource presented by this proposed park is, perhaps, unparalleled anywhere in the world with so wide a variety of marine mammals available close to as large a concentration of people. However, it must be remembered that recreation impacts on marine mammals and other wildlife is extremely severe and may be in direct conflict with conservation efforts.

San Miguel Island

The westernmost island, San Miguel, is under Navy administration with joint management of surface resources by the Department of the Interior. The island comprises 14,000 acres, most of it 122 to 152 meters (440 to 500 ft.) in elevation, reaching a peak of 253 meters (831 ft.). It has

38.6 km (24 miles) of coastline, most of which is bold rocky bluffs. Short stretches of sandy beaches and pocket beaches total about 10 km (6 miles). Several landings and anchorages are available although the Navy ordinarily prohibits landings. There are abundant archeological and paleontological values present. Rookeries of sea birds and pinnipeds are present. The sea elephant colony is one of the largest known. Wildflower displays are prominent in spite of grazing and erosion. Archeological values are present and present an interpretive as well as a valuable cultural resource. San Miguel is most valuable for its natural history resources rather than for its recreational activity values such as hiking or camping.

Santa Rosa

Santa Rosa is privately owned, about 16 km (10 miles) wide by 24 km (15 miles) long and comprises 55,000 acres. The shoreline extends 70 km (44 miles) and varies in character from high rocky bluffs to low sand spits. Sand dunes occur near the western end of the island. Sandy shores occur over about 19 km (12 miles) of the coast. The interior is mountainous extending to elevations of 484 meters (1,589 ft.). Most of the vegetation is grassland accented occasionally by shrubs and a few trees. The island is used for grazing with a small area in cultivation. Abundant archeological resources are present.

Potential recreational uses are numerous. A few are boating, fishing, diving, picnicking, hiking, camping and exploring. Unique ecological assemblages exist which lend themselves to interpretive opportunities for both the casual and serious ecologist. As the island has State and Federal status as an Area of Special Biological Significance, unique assemblages, rare and endangered species could be severely impacted or decimated by recreational use.

Santa Cruz

Santa Cruz is the largest of the islands and it, like Santa Rosa, is privately owned and used for ranching. Ninety-seven km (60 miles) of shoreline enclose the 62,000 acres of this island which is roughly 8 km (5 miles) wide and 34 km (21 miles) long. The shore is bold, steep and rugged, gashed with numerous points and indentations and punctuated by sea coves. There are plentiful anchorages, harbors and landings, and approximately 10 km (6 miles) of sandy shorelines exist in pocket beaches and harbors. Numerous peaks occur on the island, with the highest reaching 732 meters (2,400 ft.) and several extending above 518 meters (1,700 ft.). Topography is varied and interesting as is the vegetation. This island is the most densely wooded of the northern islands, presenting a park-like atmosphere of wooded groves interspersed with open grass and brushlands. Unique plant and animal communities exist. Marine life abounds with good representation of invertebrates, fishes, marine grasses, kelp and other algae. This island, like the others, possesses bounteous archeological values.

Recreation attractions include the spectacular scenery, sea coves, fishing, diving, swimming, hiking, camping, and natural history study. Current land use is ranching with some cultivation. Public landings are prohibited without the owner's permission. Santa Cruz Island is also an Area of Special Biological Significance.

Incorporation of the preceding three islands with the existing two islands of the national monument into a new national park would radically alter recreation opportunities available in the Bight region. Use is now restricted to the small islands of the national monument and to the waters surrounding the larger islands. With the establishment of a five-island national park, 1980 use is expected to reach 400,000 to 600,000 recreation days (BOR, Memo 1973). This recreational impact on wildlife conservation efforts would be significantly adverse.

All of the northern islands are within Santa Barbara County jurisdiction with the exception of Anacapa Island, which is in Ventura County.

Boating Facilities and Use

Boating comprises a major portion of the Santa Barbara area's recreation mix. Both sail and powered craft are used as well as small skiff types. Sports fishing utilizing both private craft and party boats is common. Sports fishing is covered in greater detail elsewhere in this section.

Launching facilities are available at Gaviota and both rental and launching are available at Goleta. The major facilities are in Santa Barbara Harbor where a large marina and slips are available. Launching and rentals are also available in the harbor. Party boats and private craft land their sport fish catches in this harbor. There are presently 782 slips available in the harbor of which approximately 175 are utilized by commercial fishing vessels. Waiting lists for slips currently entail a three to four year wait. Construction is proposed to commence in November which will provide an additional 350 slips.

Twelve visitor slips are maintained with stays limited to 14 days.

The destination of the majority of the permanent boaters is the waters surrounding Santa Cruz Island.

Recreational use comprises an important part of the Santa Barbara environment. While much of the recreational use comes from the local population, Santa Barbara's south coastal recreational sites are within one to four hours of Los Angeles' metropolitan population center. Consequently, weekend pressure comes from the Los Angeles area. The BOR (1973) estimates a total visitation of over two million people for state, county and city ocean-front parks in Santa Barbara County.

An analysis of the Santa Barbara tourist industry, prepared by the Santa Barbara Chamber of Commerce is summarized in table II-53c.

Also, the Chamber estimated that expenditures of overnight visitors staying in hotels or motels in the Santa Barbara area in 1973 were as shown in table II-53d.

TABLE II-53d

EXPENDITURES OF OVERNIGHT VISITORS STAYING IN HOTELS OR MOTELS IN THE SANTA BARBARA AREA IN 1973

	Percent of Total	Value
Food and beverages	25	$10,846,380
Accommodations	23	9,978,609
Retail purchases	18	7,809,393
Automotive supplies and services	12	5,206,262
Personal and professional services	9	3,904,696
Recreation	9	3,904,696
Local public services	4	1,735,420
	100	$43,385,520

e. Ventura County

Ventura County, as befits its location, is transitional between Santa Barbara County and populous Los Angeles County. Santa Barbara is cooler, more pastoral and is growing more slowly. Ventura County is growing rapidly and sustains far greater impact from the Los Angeles area on its resources than does Santa Barbara County. Although still largely rural, urbanization is spreading from the San Fernando Valley to Ventura County. Much of the County's coastline is readily accessible

TABLE II-53c

ANALYSIS OF THE SANTA BARBARA TOURIST INDUSTRY

		1973
Estimated rooms available for transient guests per night		3,902
Total room nights available per year (365 x number of units)		1,424,230
Room tax collections (Santa Barbara, Goleta, Montecito, Carpinteria) @ 6%		$564,827
Total room sales subject to tax		$9,413,783
Extimated total room sales (including first 30 days not subject to tax)		$9,978,609
Estimated total average expenditure per visitor, per day (overnight motel and hotel)		$32
Estimated total average expenditure per visitor, per day (overnight private homes)		$11
Estimated total average expenditure per visitor, (2-8 hour and en route visitors)		$5
Estimated average number of visitors per day:		
Overnight motel and hotel		3,714 @ $32
Overnight private home		1,000 @ $11
2-8 hour and stopping en route		7,200 @ $5
	Total	$11,914
Estimated total visitors per year, all categories. (Does not mean different people, i.e. 2 persons staying 10 days would be 20 in the total figure)		4,348,610
Total tourist expenditure:		
3,714 persons @ $32 x 365		$43,379,520
1,000 persons @ $11 x 365		4,015,000
7,200 persons @ $ 5 x 365		13,140,000
	Total	$60,534,520
Average daily tourist expenditure:		
Hotel and motel visitors		$ 118,848
Visitors in private homes		11,000
2-8 hour visitors, en route stops		36,000
	Total	$ 165,848

both to local residents as well as to the Los Angeles metropolitan area. The total length of the shoreline is 66 km (41 miles) most of which is sandy beach. Steep bluffy terrain is found on the County's northern coast and some cliffy terrain is found on the southern coast. Much of the backshore has some development.

Beginning at Rincon Point and going 25 km (16 miles) to the City of San Buenaventura (Ventura), there are 15 km (9.4 miles) of publicly owned and 10 km (6.4 miles) of privately owned shoreline. Public recreational use occurs on 11 km (7 miles) while private recreational use occupies less than 1 km (0.5 mile). Non-recreational development utilizes 12 km (7 miles), while 1.7 km (1 mile) remains undeveloped. The beaches are narrow and sandy or cobbly. A total of 24 km (15 miles) is classified as sandy. At high tide some of these beaches are covered. U.S. Highway 101 closely parallels the ocean in most of this reach. The northern portion of this shoreline has several offshore and onshore petroleum installations. All of the publicly owned land is either owned by recreational agencies or by the State Department of Transportation.

Living and non-living resources of this coastal reach are: tide pools, kelp beds, shoreline biotic communities, scenic vistas and archeological sites. Recreational activities include surfing, fishing, camping, beach strolling, picnicking and scenic driving.

The Ventura County Coastal Study (Ventura County, 1974) policies for this region include that of preserving the character of the north coast through the protection of designated environmental and cultural resources.

The next regional breakdown extends from Ventura to Point Mugu and covers

29 km (18 miles) all of which is classified as sandy beach. Public ownership involves 26 km (16 miles) of shoreline including 11 km (7 miles) which is within the Point Mugu and Port Hueneme Naval Reservations. There are 3 km (2 miles) of private land which are used for private recreation. Public recreational use occurs on 13 km (8 miles). Non-recreational development has taken place on 2 km (1 mile) while 11 km (7 miles) remain undeveloped.

Backshores consist of the Oxnard Plain which is a lowland of sand dunes, wetlands and some development. Urban development exists at the northern end of this reach within the City of San Buenavantura and at the south at the City of Oxnard and the unincorporated communities of Hollywood by the Sea and Silver Strand. Lagoons exist at the mouth of the Santa Clara river and Mugu Lagoon at Point Mugu. Planning efforts for this reach are mostly within city jurisdictions.

The final segment of Ventura County coast extends from Point Mugu to the Los Angeles County line at Leo Carrillo State Park. Total length of this segment is 12 km (7.5 miles) of which 5 km (3 miles) are publicly owned and 7 km (4.4 miles) are privately owned. Public recreational use occurs on 5 km (3 miles) with private recreational use occurring on 0.5 km (0.3 miles). Non-recreational development exists on 0.6 km (0.4 mile) with 6 km (3.7 miles) remaining undeveloped. Almost all of this beach is sandy, ranging in width from 30 m (110 ft.) to 90 m (300 ft.) and backed by low bluffs and containing occasional small rocky protrusions. Backshores contain the Coast Highway, scattered groups of residential development and grades into the western end of the Santa Monica Mountains.

Recreation's dominant use of the Ventura County shoreline is demonstrated in the following table II-53E.

Summary of Ventura County Shoreline Use

Category	Km	(Miles)
Public Recreational	18	29
Private Recreational	4	3
Non-recreational Development	14	9
Undeveloped	18	12
Ownership		
Public	46	28.5
Private	20	12.7
Total Shoreline	66 Km	41 Miles

State Parks

There are four State Park Units within the Ventura County coastal area. Funding has been assured by voter approval of the 1974 Park Bond Act, for a proposed addition to the Leo Carrillo State Beach within Ventura County.

Emma Wood State Beach

Emma Wood State Beach lies just west of the City of Ventura between the Southern Pacific tracks and the ocean. This narrow beach has 101 acres of land with 440 m (14,440 ft.) of ocean frontage. Camping for 200 families is available next to an abandoned section of highway. At high tide, the beach is inundated but several small tide pools are available at low tide.

Major recreational activities available are camping, picnicking, swimming, surfing and fishing. Bird life is abundant and there is a small fresh-water marsh at the southwest end of the beach which attracts small rodents, raccoons, song birds and red-tailed hawks. Gray whales can be seen from

TABLE II-53e

INVENTORY OF OUTDOOR RECREATION AREAS
AND SELECTED FACILITIES - SUMMARY

VENTURA COUNTY

Categories	Area	Existing sites	Units
Playfield	428 acres	84	
Swimming beach*	231 "	10	
Picnic	432 "	175	2292 tables
Boat access parking	91 "	4	400 spaces
Tent camp	347 "	134	1302 "
Trailer camp	49 "	7	557 "
Marina	302 "	2	180 slips

*All ocean

Total Acreages

	Land Acres	Wetlands	Water	Total
Land Types	535,705	0	18,453	554,158

BOR Land Classes	Class I AC	Class II AC	Class III AC	Class IV	Class V	Class VI
	248	2,110	450,444	2,000	500	8

Annual Attendance	Day-1959	Nite-1959	Total-1959	Day-1969	Nite-1969	Total-1969
	1,817,102	8,260	1,825,362	7,030,803	1,006,100	8,036,903

Source: California Department of Parks and Recreation, Summary Printouts 1969 (Feb. 1971).

the beach when they are migrating. Visitor attendance was 84,761 for the 1972 to 73 FY, coming down from a high of 101,747 in 1971 to 72 FY.

San Buenaventura State Beach

Providing ocean-oriented recreation opportunity within the City of Ventura, this beach offers picnicking, swimming, surfing, fishing and birdwatching. A total space of 116 acres is available which includes an ocean frontage of 355 m (11,630 ft.). A 518 m (1,700 ft.) fishing pier offers opportunity to take bonita, surf perch, shark, bass and corbina. Partakers of the southern California sport of grunion hunting may indulge themselves at this beach when the runs occur in March, June, July and August. One hundred sixty-five picnic tables are available but no overnight camping. Future expansion may include 115 campsites by 1980. Many upland and shore birds add to the enjoyment of visitors.

Visitation was 727,743 in 1972 to 1973 FY, down from a high of 909,761 reached in 1969 to 1970 FY.

McGrath State Beach

Located at the western city limits of Oxnard, this 295 acre park provides 318 m (10,445 ft.) of ocean frontage. Facilities include 174 campsites. Expansion at McGrath is expected to result in 575 campsites by 1980.

Sunbathing and fishing for bass, corbina and perch are some of the activities available at the park. Although lifeguards are on duty during the summer, swimming is not recommended because of strong currents and riptides.

The park includes the wetlands of the Santa Clara River's mouth in its northern boundary and a small body of water, McGrath Lake, in its southern end. Numerous small mammals (including weasels, muskrats, skunks, jack rabbits, opossum and squirrels) and reptiles (such as tortoises and gopher snakes) are found in the river wetlands and surrounding uplands area. McGrath Lake attracts in excess of two hundred bird species, including white-tailed kites, marsh and red-tailed hawks, owls and herons. Rare birds, including ospreys, white wagtails and black skimmers, have been reported there also.

Visitation was 106,493 in the 1972 to 1973 FY, down from a high of 114,287 reached in the 1969 to 1970 FY.

Point Mugu State Park

A large park containing over 9,000 acres of beach and upland Santa Monica Mountain area, Point Mugu State Park offers a wide variety of vegetation and environmental variety.

Camping is available at 100 units and picnicking may take place at 50 developed units. Expansion will provide a total of 710 campsites by 1980.

Swimming, sunbathing, fishing and surfing take place from the 60 acres of beach which is washed by 586 m (19,224 ft.) of the Pacific. Point Mugu State Park is included in landscape preservation projects along with McGrath Lake. Included with the Point Mugu State Park proposal are a total of 11 km (7 miles) of beach, several geologic features and numerous biotic communities.

Visitation was 210,713 in the 1972 to 1973 FY down from a high of 264,554 reached in the 1971 to 1972 FY.

Beach attendance for the four State Beaches in Ventura County has averaged

1,184,679 over the years 1970 through 1973. High attendance of 1,321,149 occurred in the 1969 to 1970 FY and the low was reached in the 1971 to 1972 FY at 1,106,300. The low attendance last year was probably related to weather as the 1973 summer was unusually cool and more frequently overcast.

County Parks

There are no state owned, county operated parks in the County. Hobson (1.8 ac) and Faria (1.5 ac) Parks are two small sites located on the coast north of the City of Ventura. Neither park contains beach oriented recreation. Visitation for Faria Park was 90,775 and for Hobson Park 135,940 in 1971 (BOR Memo, 1973).

Within the City of Ventura, the County Fairgrounds and associated beach park offer ocean recreation opportunities.

Hollywood and Silver Strand Beaches lie in the Oxnard area and receive heavy use from that metropolitan area. Hollywood Beach has a total of 53 acres of beach while Silver Strand has a total of 41 acres. Visitation in 1969 was 685,850 for both beaches, falling to 663,700 in 1971 for both parks. Parking problems exist at both beaches, hindering their effective use.

Local, Private and Miscellaneous Sites

Ventura marine beaches are operated by the City of Ventura. Oxnard owns the, as yet, undeveloped Oxnard Shores Park and operates the beach within county-owned Channel Islands Marina.

The city also has plans to develop Ormond Beach in the future.

The City of Port Hueneme operates the Port Hueneme City Beach Park, a

50-acre site containing a public fishing pier and other major recreation facilities. This is the largest park in the city and attracts people from the regional area as well as from the City of Port Hueneme. There are 30 acres of beach for swimming and sunbathing. Picnic facilities and children's play equipment are available.

Visitation was 500,000 in 1969 and 350,000 in 1971.

In addition to the developed sites within the County, there are many miles of public and private beach areas which are used by the public. Loss of these unofficial resources through such actions as closure of private lands used for beach access would have damaging effects on regional recreation opportunities. For example, since 1941, undeveloped County shoreline has decreased from over 48 km (30 miles) to less than 12.9 km (8 miles). To be sure, as the available undeveloped shoreline continues to decrease, competition between public and private interests will further intensify, adding to the pressures and conflicts already existing (Ventura County, 1974).

The Ventura County Coastal Study 1974 notes a statement by the County Parks Commission:

> *"The singularly most unique recreational feature of Ventura County is its long Pacific shoreline. Few coastal counties in California have more miles of beaches suitable for boating facilities, day and overnight camping, fishing, clamming, surfing, and general play use. Without doubt, the Ventura coastline is the county's outstanding recreational resource."*

In recognizing the value of its coastal resource, Ventura County sees ever-increasing demands on that resource:

"During 1972-73, the number of visitors to the County Beach Parks was about 929,000. With the demand for outdoor recreation opportunities in the County increasing, as a result of a general increase in population, mobility, affluence, leisure time and environment appreciation, the amount of area open for public recreation to satisfy the demand also needs to increase, especially near the shoreline. For Ventura County, the increasing demand for coastal public recreation opportunities will be especially great because of its close proximity to the Los Angeles Metropolitan Area (Ventura County, 1974."

Boating Facilities and Use

Ventura Marina, located in the City of Ventura, is owned by the Ventura Port District. Within the marina, the Ventura Yacht Club has 57 slips and the Ventura Isle Marina has 507. The predominant destination for most of the users is the Channel Islands area.

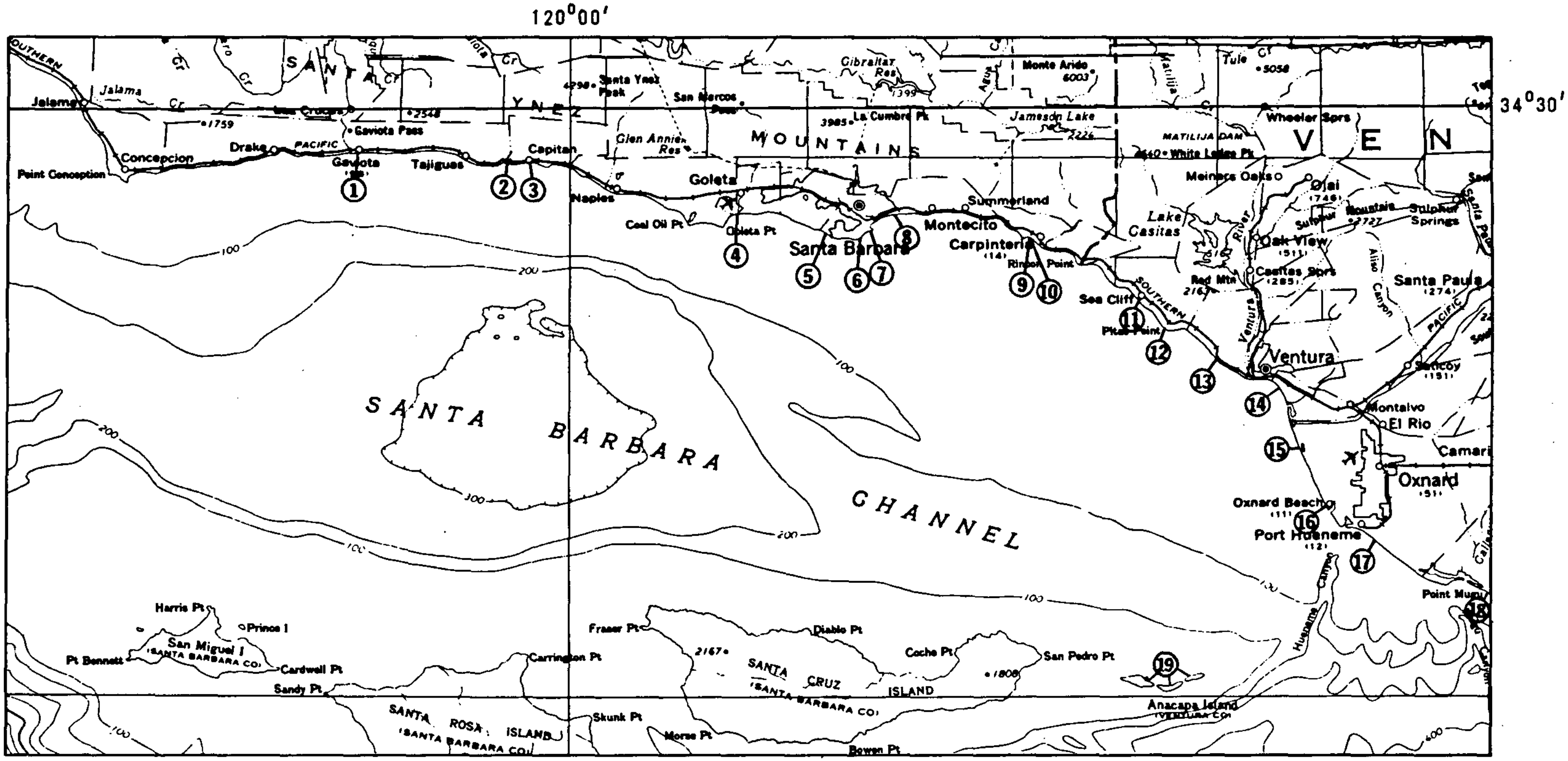
Channel Islands Harbor is located in Oxnard and is owned by the Ventura County Department of Airports and Harbors. It occupies an area of 313 acres, of which 83 acres are land and 230 acres are water. Facilities include public beaches, public launching, boat repair, restaurants and parking. Approximately 600 slips are presently available with potential for an additional 1,200 to 1,800. Charter trips to Channel Islands National Monument are available from the Harbor. The destination of most private boaters is the Channel Islands.

There is a small craft harbor within the commercial harbor of Port Hueneme. Table II-53f summarizes the above information and figure II-36 shows the geographical location of the most important recreational resources along the coast from Point Conception to Point Mugu.

TABLE II-53f

BEACHES AND PARKS OPERATED BY THE CALIFORNIA DEPARTMENT OF PARKS AND RECREATION
(POINT CONCEPTION TO POINT MUGU)

State Beach or Park	Acreage	Family Units		Ocean Frontage (miles)	Attendance		
		Camp	Picnic		1970-71	1971-72	1972-73
El Capitan SB	111	85	30	1.8	234,215	228,443	278,283
Gaviota SB	2,795	59	29	5.2	104,644	107,770	128,291
Refugio SB	39	85	60	2.7	134,700	137,270	104,160
Carpinteria SB	48	125	103	0.8	313,351	337,641	337,372
Emma Wood SB	101	200	-	2.7	91,775	101,747	84,761
McGrath SB	295	174	-	2.0	109,880	110,022	106,493
San Buenaventura SB	116	-	165	2.2	809,574	629,977	727,743
Point Mugu SP	9,063	100	50	3.6	170,349	264,554	210,713



Base from U.S. Geological Survey map
State of California, South Half, 1970

0 5 10 15 20 MILES

1. Gaviota State Beach
2. Refugio State Beach
3. El Capitan State Beach
4. Goleta Beach Co. Park
5. Arroyo Burro Beach Co. Park
6. Leadbetter Beach
7. West Beach
8. East Beach
9. Carpenteria State Beach
10. Carpenteria City Beach
11, Hobson Co. Park
12. Faria Co. Park
13. Emma K. Wood State Beach
14. San Buenaventura St. Beach
15. McGrath State Beach
16. Oxnard Beach
17. Ormand Beach
18. Point Mugu State Park
19. Channel Islands Nat. Mon.

FIGURE II-36 Beaches and Parks in the Point Conception–Point Mugu Coastal area.

6. Education

Santa Barbara County alone has more than 60 public elementary, junior high, and senior high schools. Additionally, there are a number of private and denominational schools, 3 Catholic seminaries, 6 institutions for exceptional children, and 20 public and private nursery schools. Institutions in Santa Barbara and Ventura counties that provide higher education and training include the University of California at Santa Barbara, Westmont College, Santa Barbara City College, Ventura College, Moorpark College, and California Lutheran College. (See figure II-37.)

- University of California at Santa Barbara (UCSB)

  UCSB is one of nine general campuses of the University of California. It is located 12 miles west of the City of Santa Barbara near Goleta on a 600-acre seaside site. Present enrollment is approximately 14,000 with a planned maximum of 25,000.

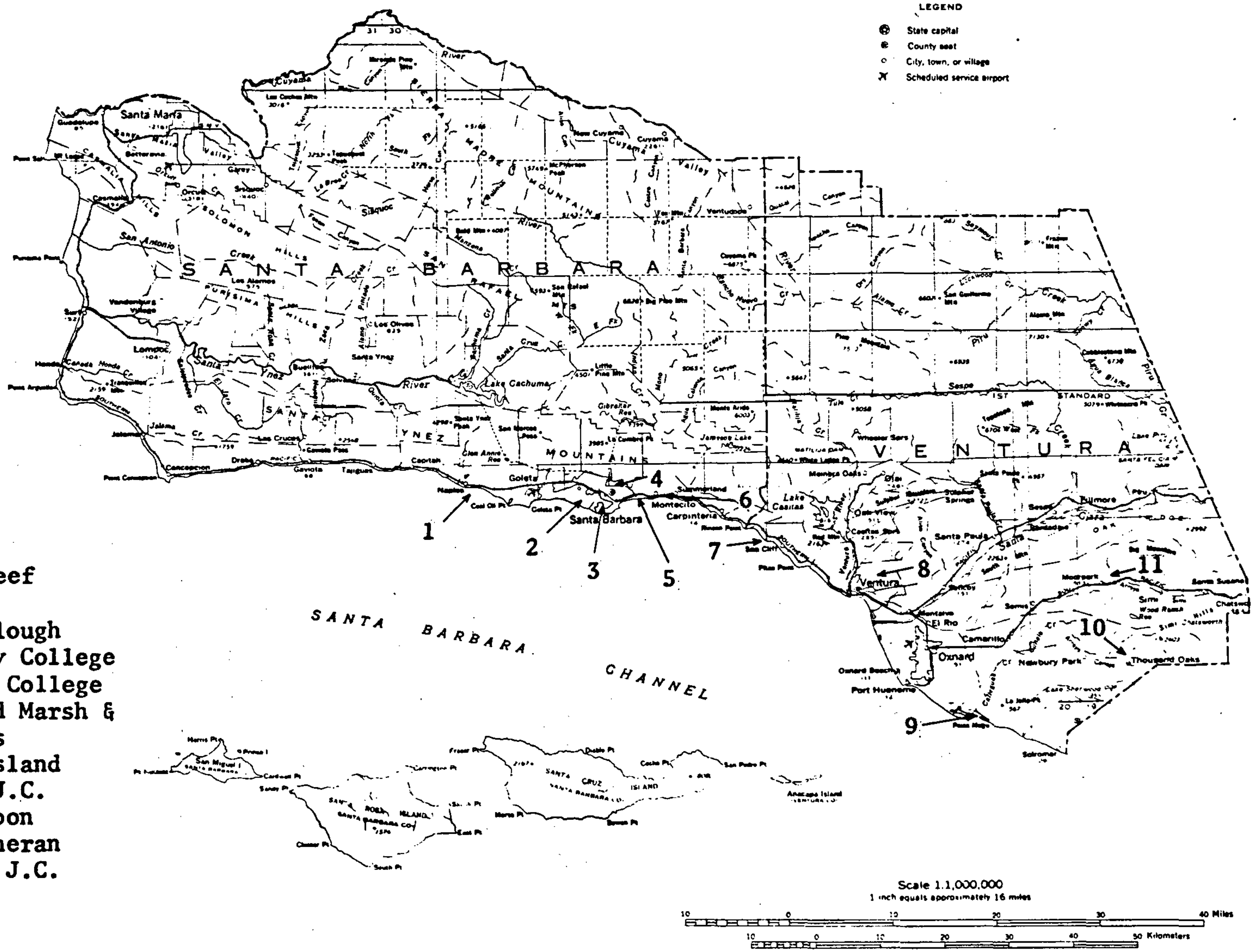
  Research and professional programs are offered in 40 academic fields through the Colleges of Creative Studies, Engineering, Letters and Science, and the Graduate School of Education. The Graduate Division offers masters and doctoral programs in many fields.

- Westmont College

  Westmont College is a 4-year coeducational and inter-denominational Christial liberal arts college with approximately 800 students, located in suburban Montecito, about 3 miles from Santa Barbara. Bachelor's degree.

- Santa Barbara City College

  Santa Barbara City College is a fully accredited 2-year public junior college with approximately 4,000 daytime students. It provides lower division work for students planning transfers to 4-year schools; pre-employment occupational training, or occupational advancement training; health occupation training; and preparatory and remedial education to make up scholastic deficiencies. Associate of arts degree.



1. Naples Reef
2. U.C.S.B.
3. Goleta Slough
4. S.B. City College
5. Westmont College
6. Sandyland Marsh & Tidelands
7. Rincon Island
8. Ventura J.C.
9. Mugu Lagoon
10. Cal. Lutheran
11. Moorpark J.C.

Figure II-37. Location of Colleges, Universities, and Marine Research Sites, Ventura and Santa Barbara Counties

- Ventura College

  Ventura College is a fully accredited 2-year public junior college. It provides lower division work for students planning transfers to 4-year schools, as well as occupational training and specialized programs. Associate of arts degree.

- Moorpark College

  Moorpark College, located in Moorpark, California, is a 2-year public junior college. It provides coeducational education for students planning transfers to 4-year schools as well as occupational training leading to the associate of arts degree.

- California Lutheran College

  California Lutheran College is located in Thousand Oaks, Ventura County, California. It is a fully accredited, coeducational private school with educational programs leading toward the bachelor's degree.

Educational Instruction and Research

Specific areas within Ventura and Santa Barbara counties that are used for research include Goleta Slough, Carpinteria Marsh, Mugu Lagoon, Rincon Island, and San Miguel Island. (See figure II-37 .)

- Goleta Slough

  Schools within reasonable travel distance use Goleta Slough as an outdoor classroom. It is estimated that 1,100 elementary and high school students annually study the slough. Also, about 1,000 students from the U.C. Santa Barbara utilize the slough for various studies in the life science field.

- Carpinteria Marsh

  Carpinteria Marsh also receives heavy use from students at UCSB. An agreement between the University and the property owners allows a portion of the marsh to be used for study that is otherwise closed to the public.

- Point Mugu

  The Mugu area is available for use by education institutions. USC and Moorpark College have, for several years, been utilizing the area for scientific study.

- <u>Rincon Island</u>

  Rincon Island has been used for years by Moorpark College as the site of a marine biology laboratory.

- <u>San Miguel Island</u>

  San Miguel and, to a lesser degree, the other Santa Barbara Channel Islands are used for advanced university research as well as for research by the academic community at large.

Tables II-53g and II-53h show public school enrollments in Santa Barbara and Ventura Counties.

TABLE II-53g

PUBLIC SCHOOLS - COUNTY OF SANTA BARBARA

Enrollment and Grade Progression Ratios by Grade Level Eighth Grade through Graduates

YEAR	EIGHTH	NINTH	TENTH	ELEVENTH	TWELFTH		DAY GRADS		EVENING GRADS		TOTAL GRADS	TOTAL K-8	TOTAL 9-12
1961	3103	3008	2732	2199	1928	.8667	1671	.0456	88	.9123	1759	32280	9867
	1.1134	1.0465	1.0421	.9445									
1962	3417	3455	3148	2847	2077	.9109	1892	.1035	215	1.0144	2107	36603	11527
	1.0603	.9974	.9740	.9153									
1963	3598	3623	3446	3066	2606	.9206	2399	.0886	231	1.0092	2630	38846	12741
	1.0356	.9898	.9864	.9419									
1964	3724	3726	3586	3399	2888	.9093	2626	.0609	176	.9702	2802	40348	13599
	1.0373	1.0062	.9760	.9594									
1965	3916	3863	3749	3500	3261	.8997	2934	.1024	334	1.0021	3268	41681	14373
	1.0197	1.0047	.9720	.9246									
1966	4330	3993	3881	3644	3236	.9252	2994	.1122	363	1.0374	3357	42456	14754
	1.0326	1.0135	.9771	.9490									
1967	4388	4471	4047	3792	3458	.9271	3206	.1197	414	1.0468	3620	42972	15768
	1.0096	.9754	.9568	.9235									
1968	4457	4430	4361	3872	3502	.9386	3287	.0985	345	1.0371	3632	43063	16165
	1.0337	.9975	.9658	.9233									
1969	4547	4607	4419	4212	3575	.9580	3425	.1001	358	1.0582	3783	43086	16813
	1.0275	.9909	.9749	.9335									
1970	4803	4672	4565	4308	3932	.9545	3753	.1101	433	1.0646	4186	42973	17477
	.9377	.9895	.9586	.9234									
1971	4675	4744	4623	4376	3978	.9367	3726	.1264	503	1.0631	4229	41532	17721
	1.0272	1.0040	.9435	.8958									
1972	4617	4802	4763	4362	3920	.9352	3666	.0911	357	1.0263	4023	40479	17847
	1.0245	.9815	.9442	.9094									
1973	4726	4730	4713	4497	3967	0.0000	-0	0.0000	-0	0.0000	-0	39256	17907

TABLE II-53h

PUBLIC SCHOOLS - COUNTY OF VENTURA

Enrollment and Grade Progression Ratios by Grade Level Eighth Grade through Graduates

YEAR	EIGHTH		NINTH		TENTH		ELEVENTH		TWELFTH		DAY GRADS		EVENING GRADS		TOTAL GRADS	TOTAL K-8	TOTAL 9-12
1961	3900	1.0862	3736	1.0209	3393	.9859	2487	.9341	2232	.9229	2060	.0829	165	1.0058	2245	[illegible]	11848
1962	4310	1.0858	4236	1.0484	3814	1.0113	3345	.9578	2323	.9118	2118	.1033	240	1.0151	2358	43423	13718
1963	4447	1.1271	4680	1.0622	4441	.9993	3857	.9725	3204	.9482	3038	.0793	254	1.0275	3292	[illegible]	16182
1964	5267	1.0649	5012	1.0128	4971	.9950	4438	.9995	3751	.9326	3498	.0754	283	1.0080	3781	56680	18172
1965	5702	1.0547	5609	1.0253	5076	.9915	4946	.9266	4436	.8711	3864	.0958	425	.9669	4289	61633	20067
1966	6249	1.0415	6014	1.0106	5751	.9741	5033	.9106	4583	.9121	4180	.1093	501	1.0214	4681	[illegible]	21381
1967	6636	1.0482	6510	1.0218	6078	.9717	5602	.9018	4563	.9121	4180	.1119	513	1.0240	4693	69418	22773
1968	7023	1.0652	6956	1.0165	6652	.9603	5906	.9147	5052	.9293	4695	.1273	643	1.0566	5338	73237	24566
1969	7697	1.0130	7481	.9842	7071	.9480	6388	.8951	5402	.9404	5080	.1224	661	1.0628	5741	75916	26342
1970	8061	1.0239	7797	.9949	7363	.9413	6703	.9003	5718	.9509	5437	.1074	614	1.0532	6051	76776	27581
1971	8455	1.0031	8254	.9872	7757	.9509	6931	.8839	6035	.9327	5629	.0951	574	1.0278	6203	77153	28977
1972	8615	1.0144	8481	.9838	8148	.9368	7376	.8730	6126	.9416	5768	.0904	554	1.0320	6322	76802	30131
1973	8779		8739		8344		7633		6439	0.0000	-0	0.0000	-0	0.0000	-0	76309	31155

II-454

7 . Research

In addition to academic institutions, a number of individuals and organizations are engaged in a wide variety of advanced research and development. These include interdisciplinary research-management corporations, engineering, electronic and oceanographic firms, and the military. Portions of these efforts are directed toward specific environmental concerns at local and subregional levels.

Current and future research programs of broad scope are discussed in some detail in section IV.B.12. These include: a monitoring program of oil pollution in the Santa Barbara Channel (Federal interagency); threatened species research (Federal and State); California Cooperative Fisheries Investigations (Federal, State, including the University of California); comprehensive studies by the Southern California Coastal Water Research Project (independent, sponsored by five city or county agencies); and a study of oil, tar, and gas seeps (University of Southern California scientists, contract by the California State Lands Commission).

8. Military

In the coastal area between Point Conception and Point Mugu, there are two military installations both in Ventura County. Total payroll from these facilities in fiscal year 1973 was $192,044,782. The military continues to be Ventura County's second-ranking source of income, substantially increased from the previous year's figure of $168,011,650. (Agriculture is the leading source of income in Ventura County.)

- Pacific Missile Range, Point Mugu - The base was established in Point Mugu as a Naval Air Station in 1946, and the Pacific Missile Range established in 1957. It has become one of the world's most advanced missile testing centers and one of the most important military facilities in the western United States.

- Naval Construction Battalion Center, Port Hueneme - Port Hueneme is the home of the Seabees. The Naval Construction Battalion Center has operated continuously since 1942. It covers 1,640 acres and has seven deep-water berths.

Pacific Missile Range Complex Point Mugu		1972-73 Payroll
Military Personnel	2,106	$ 21,000,000
Civilian Personnel	6,802	95,200,000
Total	8,908	$116,200,000
Port Hueneme Naval Base Tenant and Component Activities		
Military Personnel	3,872	$ 17,205,000
Civilian Personnel	5,075	58,639,782
Total	8,947	$ 75,844,782
Total Military Facilities		
Military Personnel	5,978	$ 38,205,000
Civilian Personnel	11,877	153,839,782
Total	17,855	$192,044,782

The extreme western part of the Santa Barbara Channel is subject to missile overflights from Vandenburg Air Force Base (see section I.F.1.b. and section IV.A.7.)

Several submerged submarine transit lanes cross the southern California OCS areas as shown on U.S. Coast and Geodetic Survey Chart 5202 but none traverse the Santa Barbara Channel. The primary lane leaves San Diego heading west and,directly south of San Clemente Islands, a secondary lane takes off to the south. Midway between San Clemente and the Cortes Bank the primary lane splits into two lanes, one northwest and the other southwest. The southwest lane leaves the lease area at the extension of the Mexican border. The northwest lane turns west midway between San Nicolas, San Clemente and the Cortes Bank with another branch heading northwest about 35 miles west of San Nicolas.

The overflight path of the Pacific Missile Range is outside of the Santa Barbara Channel. An underwater acoustic range facility is located just outside the Channel off the seaward side of Santa Cruz Island. U. S. Coast and Geodetic Survey Chart 5202 outlines a chemical dumping ground within the Santa Cruz basin. The general area, particularly in the vicinity of San Clemente Island, has been used as a gunnery and bombing exercise area by the U. S. Navy for many years so there is a strong probability that unexploded projectiles are in the area. There are no submarine lanes or chemical and ammunition dumps in the Santa Barbara Channel.

San Miguel, San Nicolas, and San Clemente Islands are under U. S. Navy control and are restricted to access, including a 3-mile danger area around the islands, although, under certain conditions, vessels may be permitted to anchor in specified areas. These islands are used for military operations.

San Clemente, in particular, has gunfire, bombing and rocket ranges and the waters around the island are used for various naval operations. The operations on and around San Miguel are the only ones with the potential of conflicting with oil and gas operations in the Santa Barbara Channel.

See section I.F.1.b. for a discussion on the relationship of oil and gas activities and military activities in the Santa Barbara Channel.

9. Fishing

a. Commercial Fishing

Much of the following section was taken directly from the Bureau of Land Management (1975) after Horn (1974).

(1) Introduction and Overview

The Southern California Bight has a history as an important center in the United States for both commercial and sportfishing interests, reflecting the environmental heterogeneity and high diversity of fishes in the region. California has claimed a significant share of the value of the United States fish landings (25% in 1950, 17% in 1968, Frey, 1971). Both the commercial and sport fisheries have a history of fluctuation regarding certain individual species. During the last twenty years, although there has been a general stabilization, commercial landings in southern California have declined (figure II-38)

Almost all sport and commercial fish landed in southern California waters are either pelagic fishes, taken by a variety of methods, or inshore predatory fishes, such as halibut and rockfishes, caught by selective hook-and-line fishing.

North of Point Mugu, to Point Arguello, is a region which the California Department of Fish and Game refers to as the California halibut trawling grounds, and commercial trawling is permitted within one mile from shore to a depth of 25 fathoms (about 50 metres). Santa Monica Bay is closed to commercial fishing of all kinds except those using extremely small nets for sportfish bait. Unlike southern California, trawling and long line fishing in the central and northern portions of the State account for a large portion of the fish landed (SCCWRP, 1973).

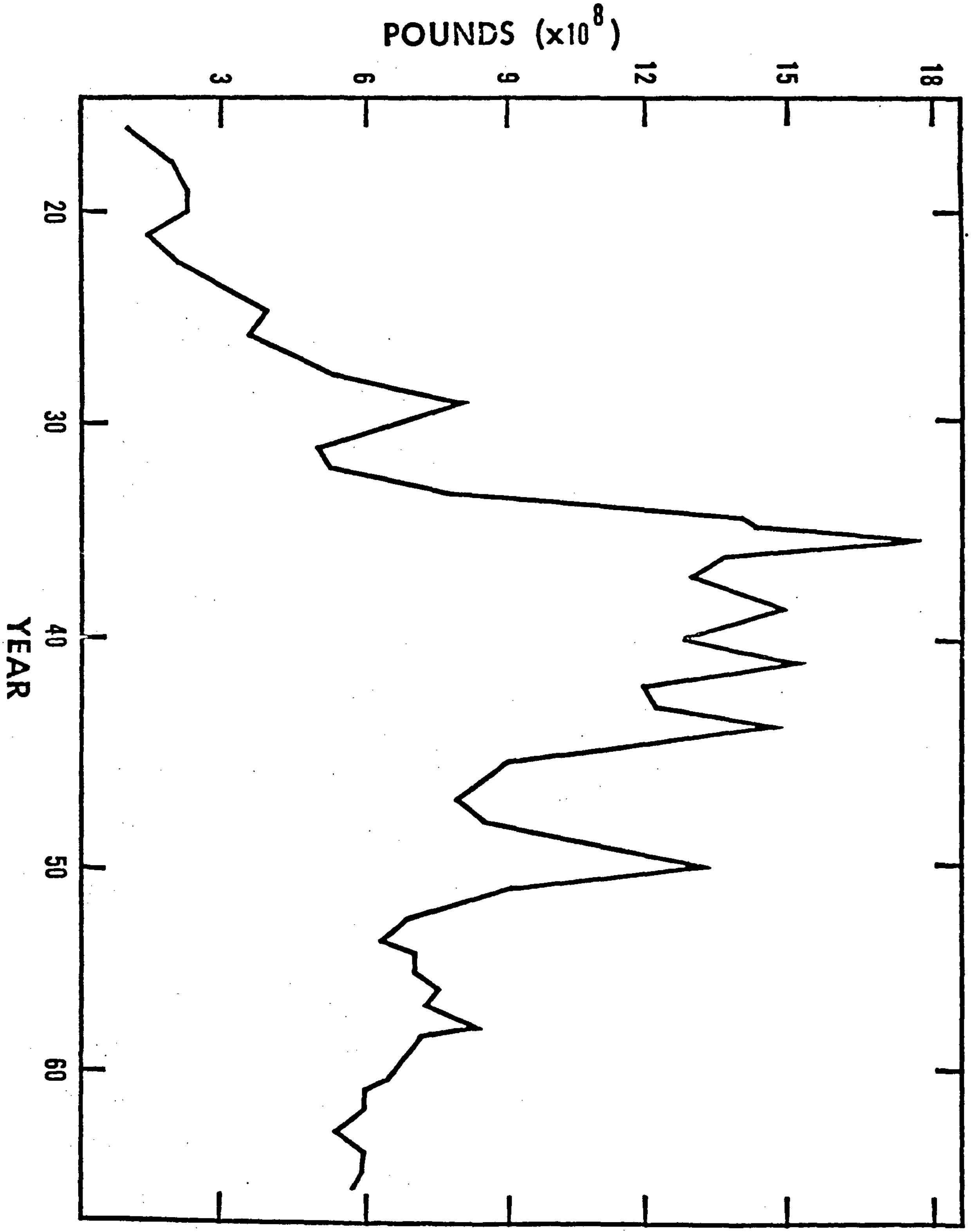


Figure II-38 Total annual commercial landings and shipments of fish and shellfish into California, 1916-1968. (from Heimann and Carlisle, 1970).

Commercial fishing in southern California has largely consisted of pelagic wetfish (sardine, anchovy, Pacific mackerel, and jack mackerel) and tunas. When canned, pelagic wetfish are first put in the can and then cooked. This is unlike tunas, which are cooked before canning. Pelagic wetfish include anchovies, sardines, mackerels and squid. The wetfish industry has both declined and changed in species composition. Following the decline of the sardine during the period 1945 to 1952, the anchovy became and is now the most important species in the wetfish industry. The anchovy, however, is not processed as wetfish but reduced to fish meal and oil, and is low, although increasing, in price.

United States landings of edible fishery products have remained close to 1.1 million tons a year for many years, but imports of these products have nearly doubled since 1959 from less than one million tons to 1.6 million (figure II-38a). The per capita consumption of edible fishery products for the United States and California has remained relatively stable over the past 20 years (figure II-38b) and there has been no significant change in the consumption pattern, although there was a seven percent increase in 1972 over 1971 (Anonymous, 1973). The fresh and frozen market accounts for 55 percent of total consumption, while canned fish accounts for 40 percent and cured fish five percent (Frey, 1971). California's comsumption of edible fish averages 12.0 pounds per person and is ten percent higher than the United States average, which seems to be consistent with the proximity-availability concept (Frey, 1971). In recent years, between 60 and 65 percent of the U. S. fish catch has been going for human comsumption.

Per capita utilization, which includes inedible industrial fishery

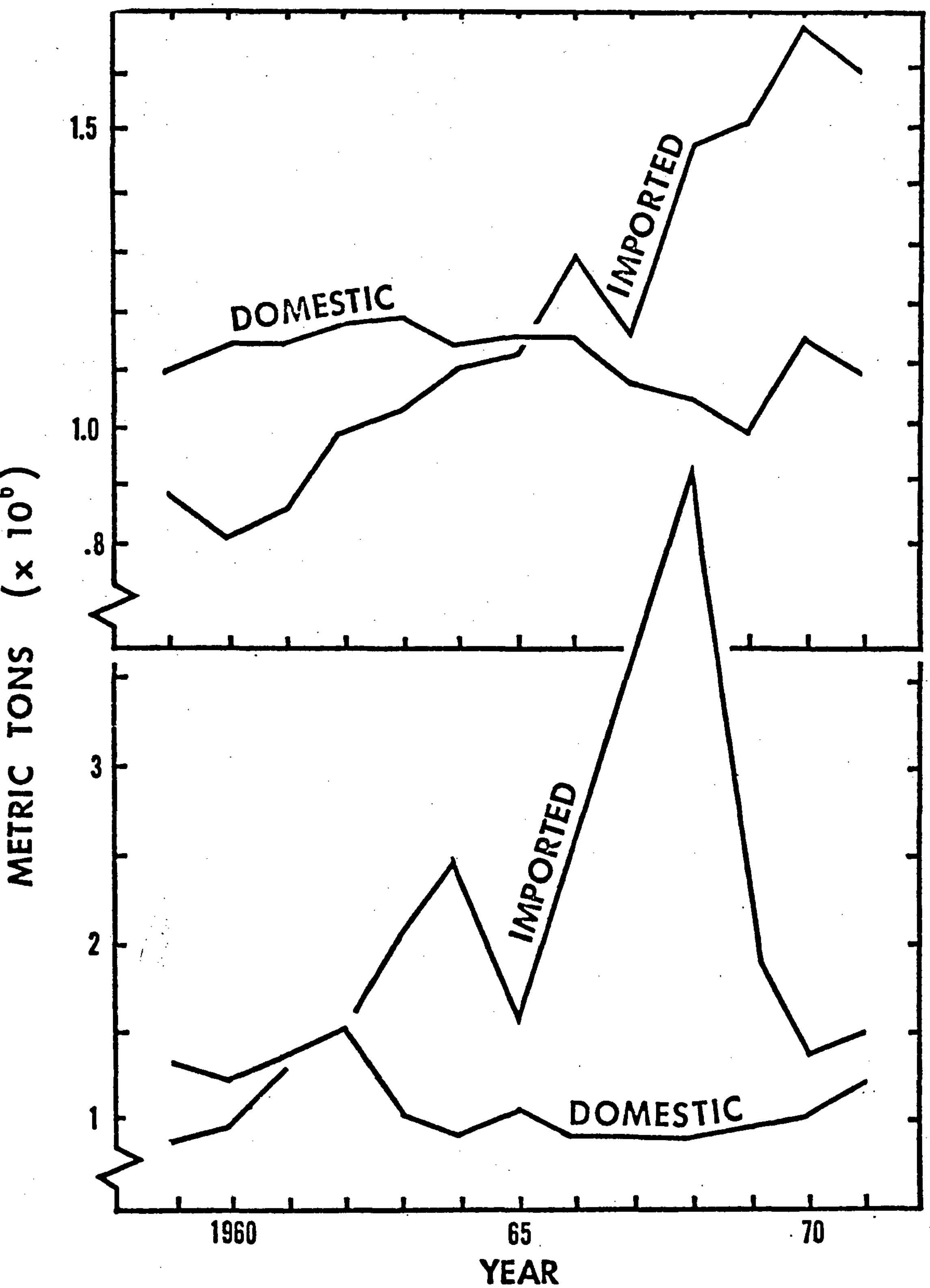


Figure II-38a U.S. supply of edible and industrial fishery products, 1959-1971. (from Wise, 1972).

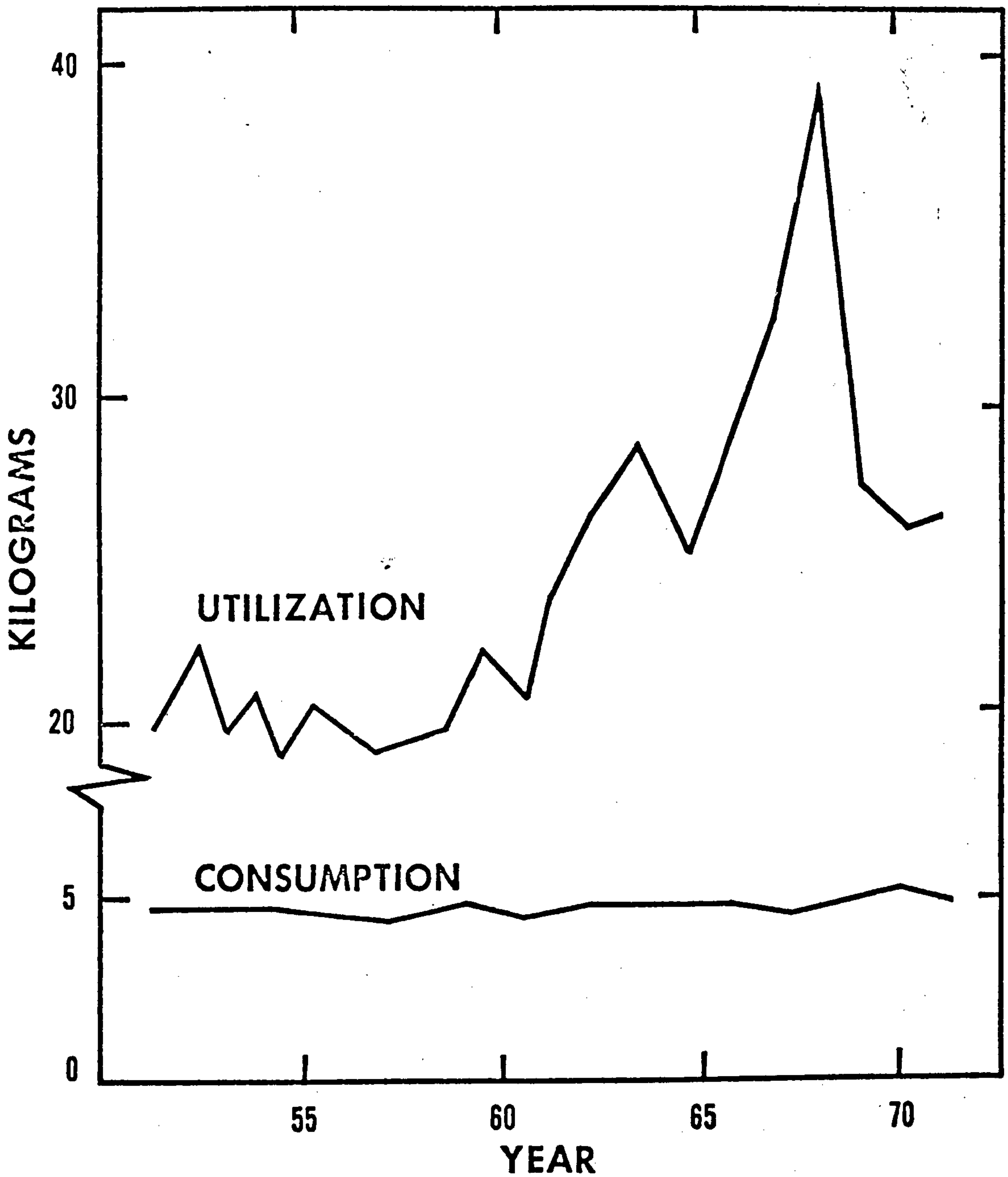


Figure II-38b Per capita consumption and utilization of fishery products in the U.S., 1951-1971. (from Wise, 1972).

products, increased from about 20 kg in the 1950's to a peak in 1968, and has remained around 25 to 26 kg through 1971 (figure II-38b). The marked fluctuations in importation and utilization of industrial fishery products (figure II-38a) are closely related to demand for fish meal used principally as a supplement in poultry feeds (Wise, 1972).

(2) Historical Aspects

Heimann and Carlisle (1970) reviewed the catch record for the years 1916 through 1968, giving the entire statistical summary of the fisheries of California since the beginning of its recorded history. Landings during the 53-year period showed an almost steady rise from 1916 to 1936 when a peak of 1.76 billion pounds of fish were landed, followed by a fluctuating decline into the early 1950's and finally followed by a slow but steady decline since 1958 (figure II-38). Sardines dominated the landings during the 1930's and 1940's (83 percent of the 1936 record catch).

Most California fishery landings since the late 1940's have been made into the southern part of the State, especially into the Los Angeles area (figure II-38c). Figure II-38d illustrates the relative importance of sardines to the total catch before 1952, and the lesser but sizeable contribution of anchovies to the total landings from 1953 to 1960 and since 1965. Figure II-38e indicates the important anchovy fishing sites in the southern California area.

(3) The Santa Barbara Channel Area

Figure II-39 shows party boat landing locations and sport and commercial fish catch summaries for Santa Barbara and Ventura Counties.

The commercial fish catch for the entire Santa Barbara Channel area totaled

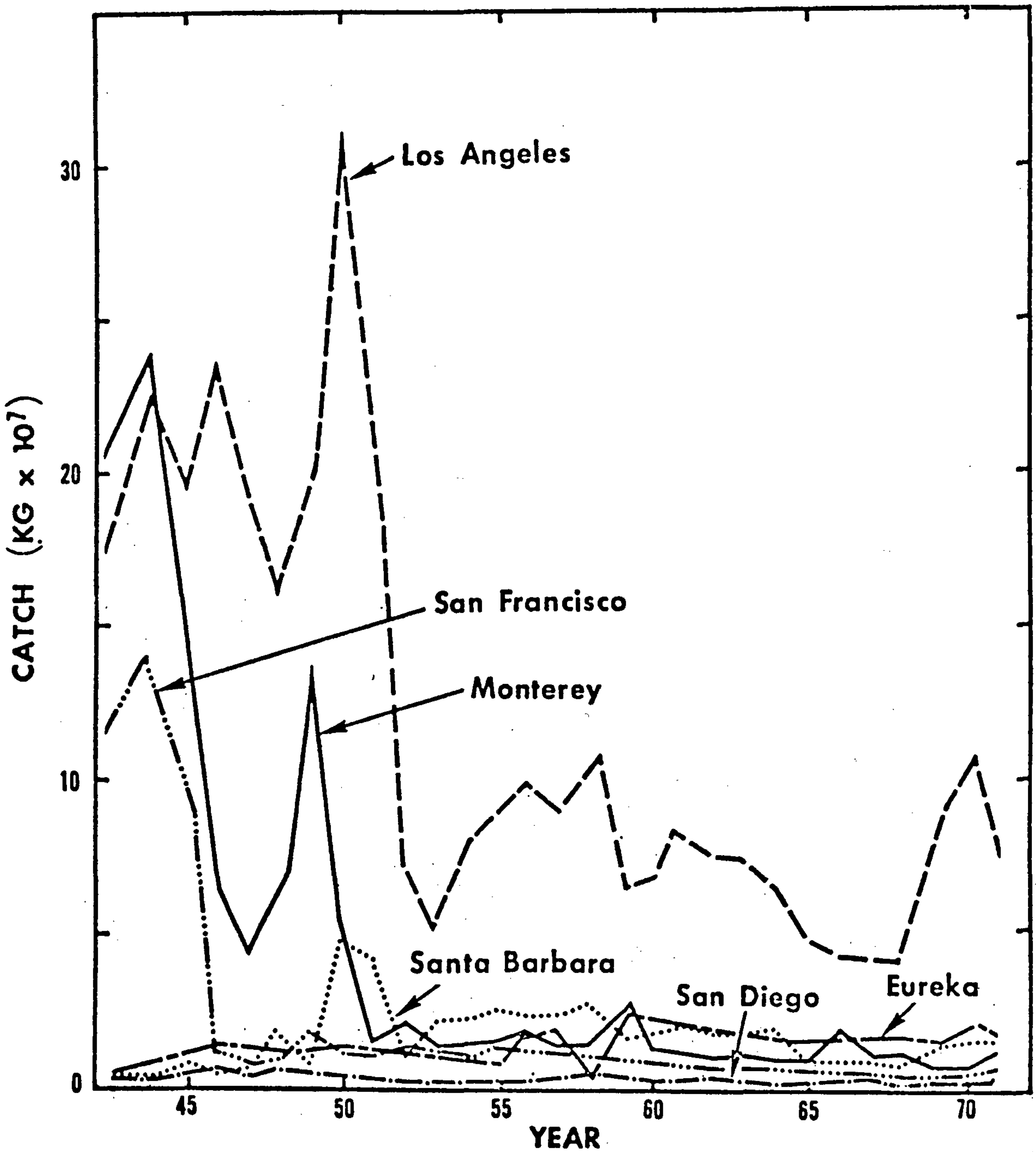


Figure II-38c California commercial fish and shellfish landings by region, 1943-1971. (from SCCWRP, 1973).

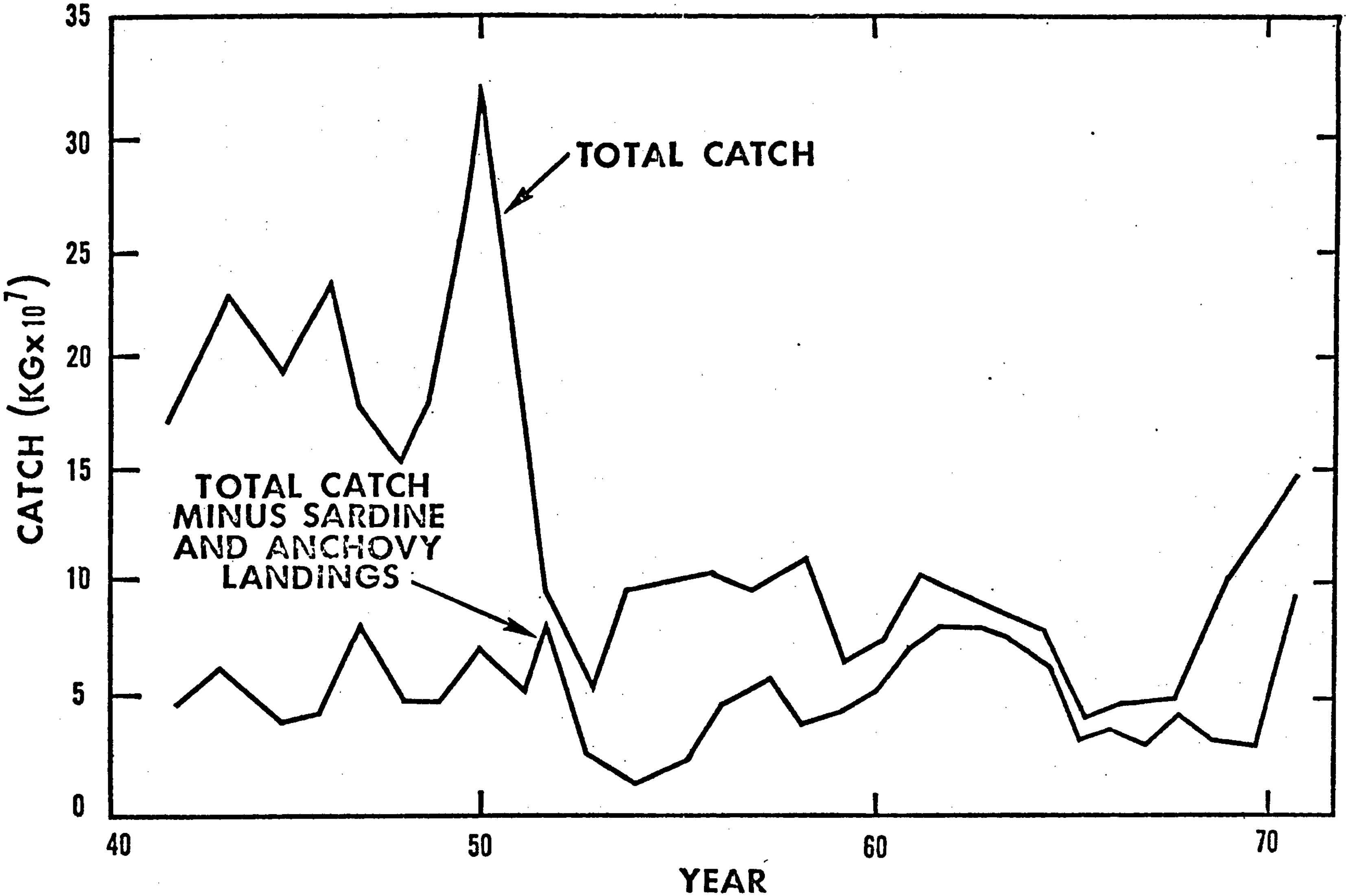


Figure II-38d Commercial fish and shellfish landings into the Los Angeles and San Diego regions from California waters, 1943-1971. (from SCCWRP, 1973).

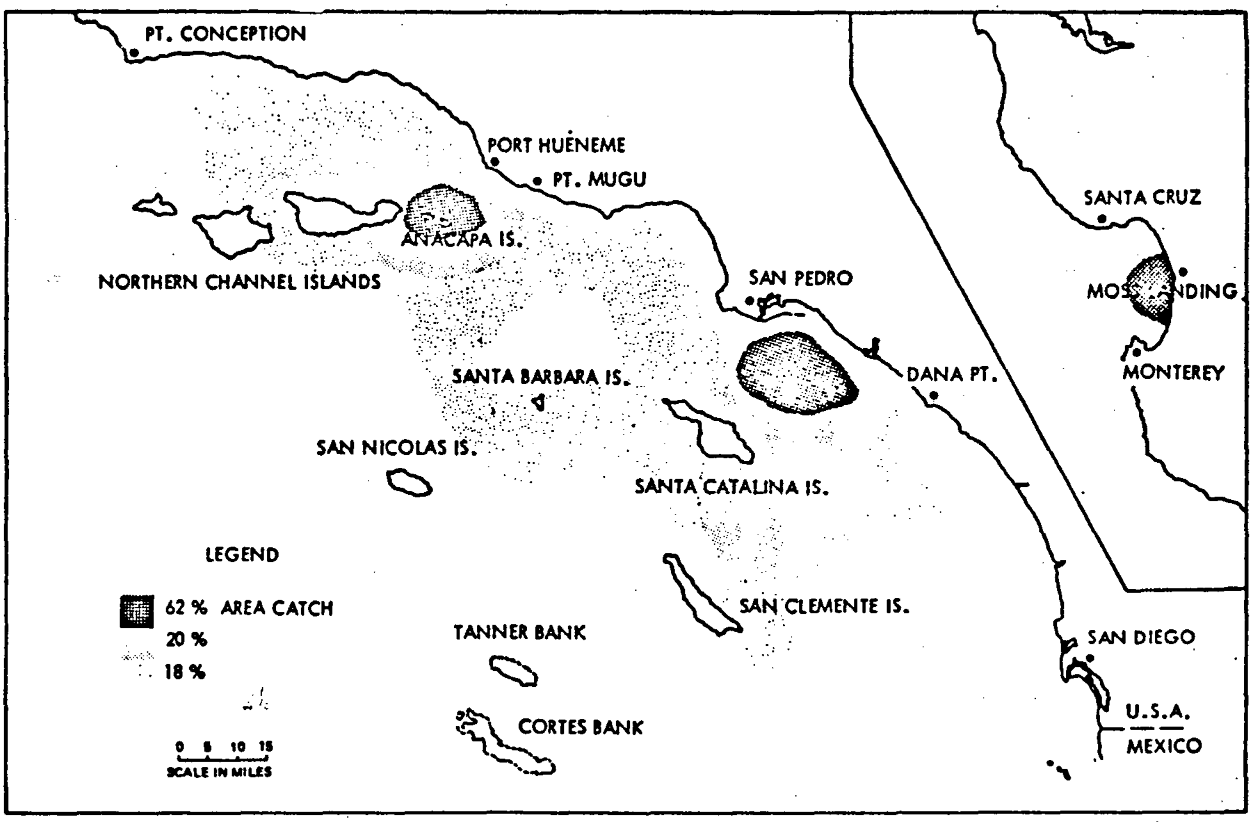


Figure II-38e Anchovy reduction fishing catch areas, 1 October 1966 through 30 April 1967.

From: Messersmith (1969)

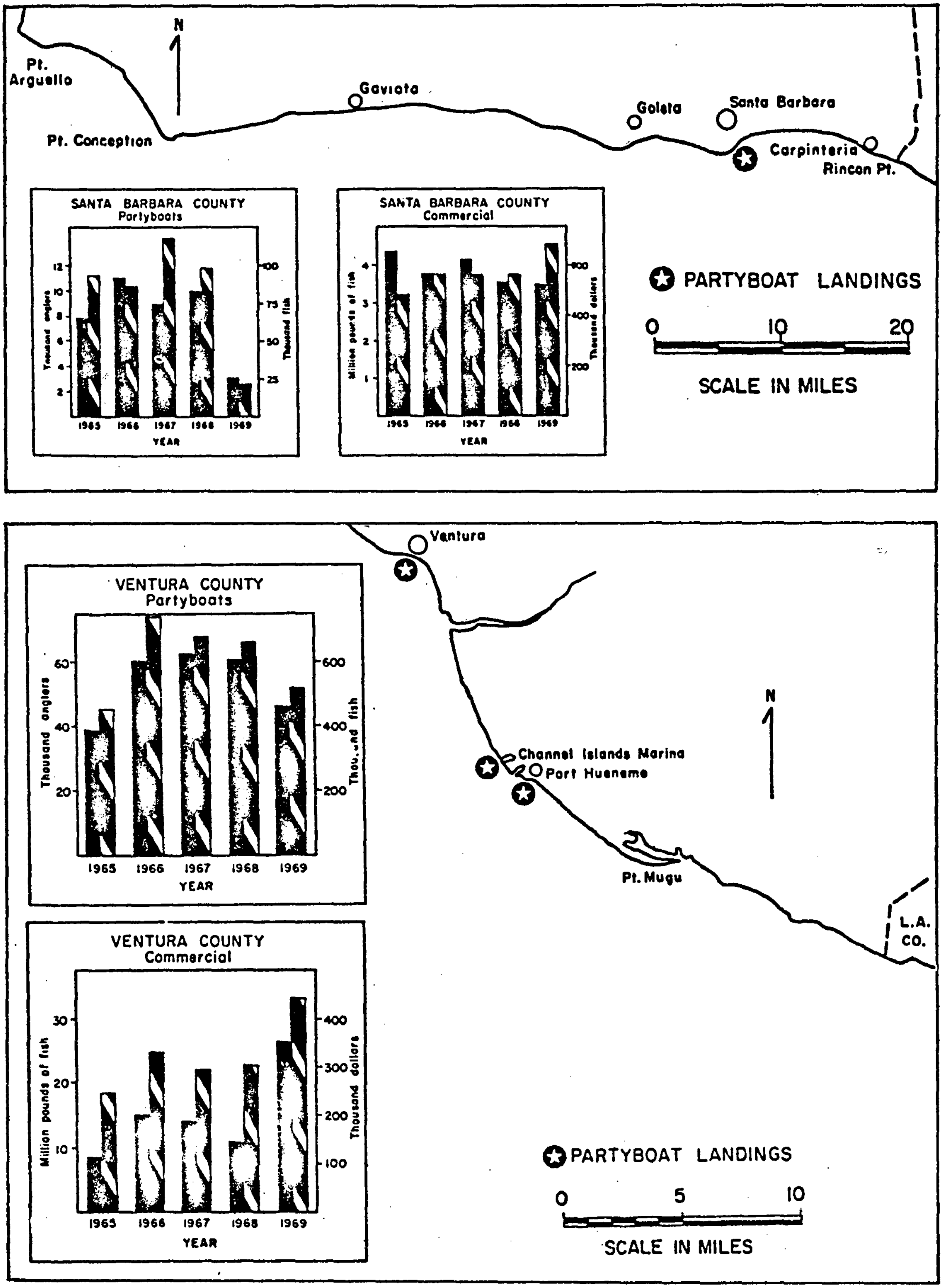


FIGURE II-39

SANTA BARBARA AND VENTURA COUNTIES--SPORT AND COMMERCIAL FISHING SYNOPSIS (Modified from California Department of Fish and Game, 1973, p. 174, 187)

26,281,791 pounds in 1971. The breakdown by California Department of Fish and Game Statistical Block data (table II-53i)shows the annual block-by-block totals for 1969 through 1971 in the Channel area. Figure II-39a indicates the specific area represented. The following are the predominant fishing methods (by approximate percentages of total catch) utilized and the most commonly caught fish for each method (from California Department of Fish and Game, commercial catch data sheets for years 1966 to 1970).

- Trolling 46 percent
  - Pacific bonito
- Purse seining 11 percent
  - jack mackerel
  - anchovy
- Long lining 2 percent
  - petrale sole
  - sablefish
- Traps 2 percent
  - rock crab
  - spiny lobster
- Bottom trawling 17 percent
  - English sole
  - rex sole
  - dover sole
  - California halibut
  - rockfish
  - giant sea bass
- Divers (block #657 only) 20 percent
  - red abalone
  - pink abalone

The areas of Santa Barbara and Ventura Counties also support significant commercial fish landing and limited processing operations. The extent of the commercial fish landings from 1966 to 1970 for the individual counties is outlined in tables II-53j and II-53k Table II-53ℓ presents more recent data for the entire Santa Barbara region for the years 1971 and 1972.

FIGURE II-39 a

COMMERCIAL FISH BLOCKS, SANTA BARBARA CHANNEL AREA (as designated by the California Department of Fish and Game)

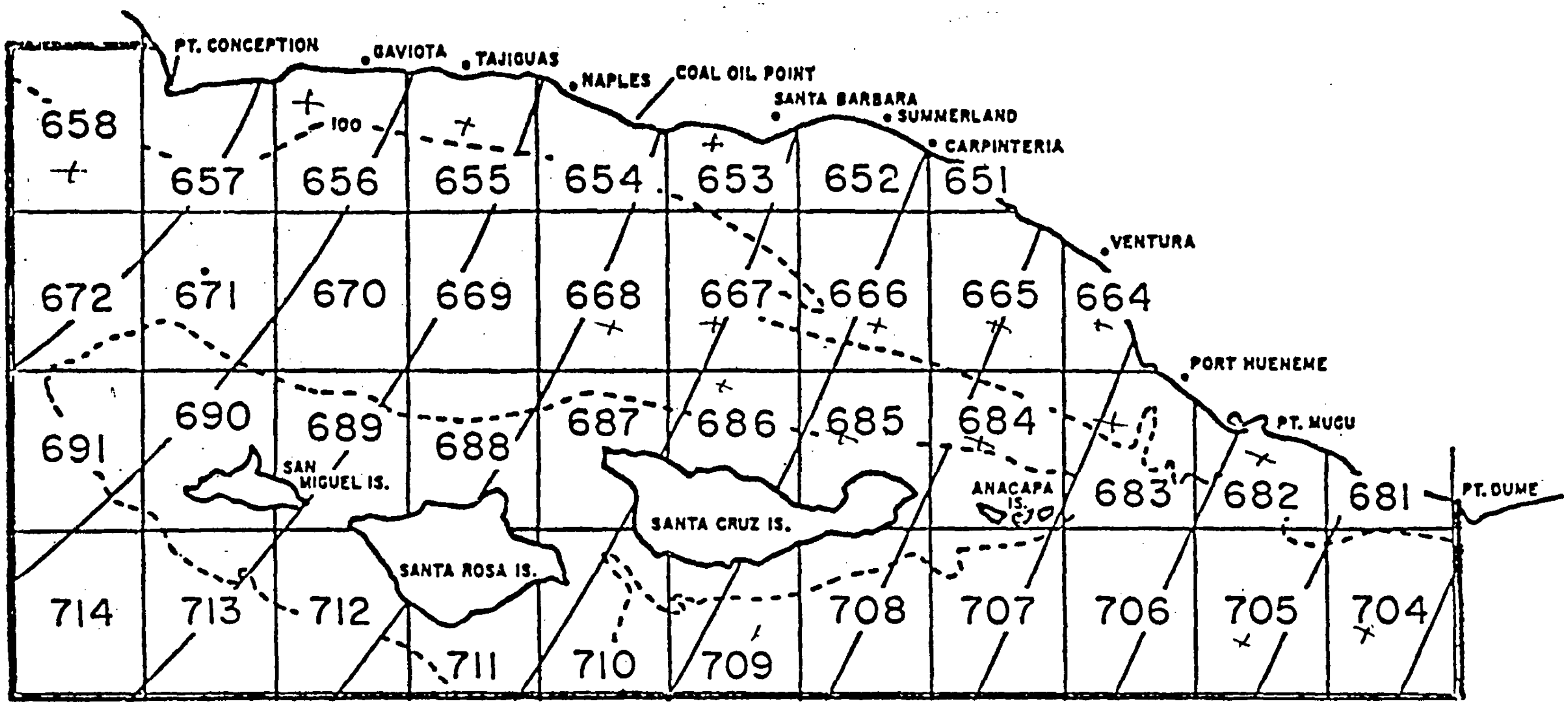


TABLE II-53i

ANNUAL COMMERCIAL CATCH IN POUNDS IN SANTA BARBARA CHANNEL
(California Department of Fish & Game Fish Block Statistics)

BLOCK #	1969	1970	1971
651	9,973	19,225	63,728
652	203,007	199,259	220,139
653	695,148	238,795	766,381
654	232,514	198,642	256,295
655	203,007	350,227	599,398
656	404,339	1,175,843	671,174
657	677,374	177,110	352,254
658	17,014	1,027	600,800
664	740,700	372,942	1,551,442
665	1,254,723	2,180,895	5,257,182
666	1,901,101	607,099	4,432,356
667	409,144	172,074	1,119,455
668	389,095	743,922	740,644
669	196,300	148,064	10,190
670	240,634	55,200	187,257
671	587,200	120,799	
672	810		18,600
681	16,896	3,911	33,397
682	467,292	1,943,400	2,032,253
683	2,193,368	347,137	2,978,527
684	2,699,046	858,472	714,124
685	1,086,674	513,911	386,890
686	441,338	852,311	289,402
687	257,110	325,564	110,965
688	35,702	165,628	1,924
689	31,360	36,400	4,700
690	220,504	248,514	286,629
691	4,325	35,315	19,603
704	10,750,926	1,791,012	1,176,681
705	5,397,457	722,210	79,761
706	2,535,536	159,226	278,732
707	1,005,893	46,006	9,637
708	774,270	858,090	64,434
709	1,227,271	1,234,773	309,981
710	266,597	493,026	52,028
711	541,050	205,897	318,135
712	93,992	230,550	17,448
713	56,423	43,556	254,119
714	16,924	22,210	2,126

TABLE II-53j

SANTA BARBARA COUNTY COMMERCIAL FISH LANDINGS
POUNDS AND VALUE* FOR YEARS 1966 TO 1970

SPECIES	1966	1967	1968	1969	1970
Abalone (lbs.)	1,442,336	1,330,278	1,109,032	1,166,239	1,043,683
Value	$279,013	$263,268	$292,211	$376,183	$356,084
Barracuda, Calif.(lbs.)	5,569	4	9,382	---	---
Value	$1,071	$1	$1,857	---	---
Bonita, Pacific (lbs.)	12,891	76,439	25,357	14,228	216,504
Value	$504	$2,336	$997	$608	$14,171
Crab, rock (lbs.)	102,102	77,798	102,623	126,435	135,228
Value	$6,398	$4,982	$6,588	$11,189	$11,078
Halibut, Calif. (lbs.)	89,497	160,416	111,378	24,320	24,734
Value	$24,115	$45,363	$33,153	$8,472	$9,887
Lobster, spiny (lbs.)	95,524	84,916	93,114	75,488	47,599
Value	$77,460	$69,636	$79,722	$77,880	$58,127
Rockfish (lbs.)	603,219	1,060,279	1,179,559	1,067,389	545,349
Value	$35,475	$59,520	$68,981	$66,822	$37,478
Sablefish (lbs.)	---	---	---	1,385	---
Value	---	---	---	$62	---
Sea Bass, giant (lbs.)	---	---	---	662	678
Value	---	---	---	$111	$102
Sea bass, white (lbs.)	62,098	46,419	31,334	24,734	32,258
Value	$18,616	$14,045	$11,962	$9,016	$12,473
Shark (lbs.)	68,271	149,521	80,657	78,536	92,049
Value	$7,212	$15,421	$8,324	$8,084	$10,952
Sole, dover (lbs.)	2,275	8,026	19,590	7,570	4,207
Value	$137	$482	$1,175	$461	$252
Sole, English (lbs.)	393,333	227,918	200,143	322,077	269,118
Value	$29,316	$17,103	$15,652	$23,767	$22,465
Sole, petrale (lbs.)	104,133	90,745	67,513	53,610	44,096
Value	$13,493	$11,818	$8,783	$7,525	$6,734
Sole, rex (lbs.)	50,017	52,078	35,934	46,744	26,715
Value	$4,242	$4,304	$2,939	$4,333	$2,814
Swordfish (lbs.)	112,921	81,691	34,590	175,254	91,673
Value	$47,680	$42,018	$22,773	$83,620	$48,082
Misc. animal food(lbs.)+	583,743	692,539	450,236	359,491	351,022
Value	$11,629	$13,851	$9,005	$7,190	$7,017
All other (lbs.)	61,919	11,397	6,777	8,507	32,038
Value	$11,091	$2,695	$2,356	$2,688	$12,661
TOTAL POUNDS	3,789,848	4,150,464	3,557,219	3,552,669	2,956,951
TOTAL VALUE	$567,452	$566,843	$566,478	$688,011	$610,377

*Value based on price paid fishermen.

+Due to different reporting methods, miscellaneous animal food appears as a sizable item beginning 1961.

(California Department of Fish and Game, 1973)

TABLE II-53k

VENTURA COUNTY COMMERCIAL FISH LANDINGS
POUNDS AND VALUE* FOR YEARS 1966 - 1970

SPECIES	1966	1967	1968	1969	1970
Abalone (lbs.)	109,466	50,279	112,368	58,060	46,663
Value	$21,656	$10,162	$28,704	$18,250	$15,658
Anchovy (lbs.)	9,039,290	8,289,185	4,007,925	19,861,453	19,614,260
Value	$88,881	$79,648	$30,494	$202,322	$224,597
Barracuda (lbs.)	28	11	4	10	572
Value	$6	$3	$1	$3	$166
Bonito, Pacific (lbs.)	432,858	143,556	222,233	900,574	384,668
Value	$16,908	$4,386	$8,736	$38,470	$25,178
Halibut, Calif.(lbs.)	78,607	61,314	80,254	9,808	24,121
Value	$21,180	$17,339	$23,888	$3,416	$9,642
Lobster, spiny (lbs.)	27,995	26,746	18,525	20,539	32,946
Value	$22,701	$21,933	$15,861	$21,190	$40,234
Mackerel, jack(lbs.)	3,403,878	2,943,445	3,971,495	2,803,806	3,383,123
Value	$111,078	$109,761	$148,932	$105,159	$128,888
Mackerel,Pacific (lbs.)	518,480	6,700	---	---	---
Value	$18,481	$394	---	---	---
Rockfish (lbs.)	9,672	31,131	11,546	11,741	8,413
Value	$667	$1,726	$1,113	$1,235	$1,569
Sardine (lbs.)	29,644	7,000	---	---	---
Value	$4,806	$1,400	---	---	---
Sea bass,white (lbs.)	10,718	7,612	1,851	1,135	54
Value	$3,214	$2,302	$707	$414	$20
Shark (lbs.)	11,336	10,276	11,526	2,683	2,051
Value	$1,194	$1,149	$1,208	$296	$238
Sole, English (lbs.)	18,290	10,202	2,031	639	1,830
Value	$1,363	$766	$158	$47	$94
Squid (lbs.)	1,305,038	2,592,543	2,660,395	3,036,160	4,878,300
Value	$17,160	$38,696	$37,318	$43,109	$70,561
Swordfish (lbs.)	20,317	8,722	2,088	27,056	28,536
Value	$8,579	$4,487	$1,375	$12,910	$14,967
All other (lbs.)	73,050	10,751	28,266	22,353	32,487
Value	$993	$864	$2,546	$2,515	$3,272
TOTAL POUNDS	15,088,667	14,199,773	11,242,875	26,756,017	28,438,024
TOTAL VALUE	$338,867	$295,016	$301,041	$449,336	$535,084

(California Department of Fish and Game, 1973)

*Value based on price paid fishermen.

TABLE II-53ℓ

WEIGHT (POUNDS), VALUE (DOLLARS), AND PRINCIPAL MONTHS OF COMMERCIAL LANDINGS OF FISH AND SHELLFISH INTO THE SANTA BARBARA REGION 1971 THROUGH 1972*

Santa Barbara 1971[1/]

Species	Pounds	Dollars	Months
Anchovy	19,721,639	268,214	12,10,1,11
Squid	6,683,735	96,914	1,4,2
Albacore	3,402,926	1,004,544	9,8,10
Jack mackerel	2,295,898	91,836	11,4,6
Rockfish	1,915,762	155,026	6,10,11,9
Abalone	1,401,326	509,728	1,7,6,12
Pacific bonito	619,795	48,902	11,9
Misc. animal food	573,827	11,476	6,5
Petrale sole	411,791	67,739	12,11,5
English sole	409,196	39,364	2,1,3
Lingcod	225,857	22,451	11,10,9,12
White sea bass	166,885	62,598	10
Rock crab	159,853	14,468	1,2,3
California halibut	134,198	54,859	8,7,6,1
Salmon	100,100	73,623	6,7,5,9
Spiny lobster	78,363	106,990	11,10,1,12
Giant Pacific oyster	74,074	64,444	2,1,3
Rex sole	49,762	5,693	2,1,10,11
Shark	44,335	5,629	5,12,11,6
Sand sole	29,866	4,178	1,3
Swordfish	28,349	15,272	10,9
Dover sole	22,111	1,793	5,6,9
Turbot	18,587	1,472	5,3,4
Pacific hake	18,310	366	6
Flounder	15,013	1,492	3,2,4
Perch	11,417	3,059	1,2,3
Miscellaneous sole	8,466	1,041	12,11
Market crab	4,261	2,029	4,5,3
Ocean shrimp	2,110	253	6
Cabezon	1,730	152	2,1,3
Pacific pompano	1,478	361	5
Sanddab	1,286	64	6
Giant sea bass	876	202	8
Sablefish	830	33	1
California sheephead	410	48	12,2
California barracuda	372	129	9,11
White croaker	248	25	5,4,1
Sea urchin	200	36	6
Skate	181	15	3,5,6
Smelt	74	7	4
Pacific mackerel	71	4	1
California yellowtail	30	4	9,8

TABLE II-53ℓ (continued)

WEIGHT (POUNDS), VALUE (DOLLARS), AND PRINCIPAL MONTHS OF COMMERCIAL LANDINGS OF FISH AND SHELLFISH INTO THE SANTA BARBARA REGION 1971 THROUGH 1972*

Santa Barbara 1971[1/] (continued)

Species	Pounds	Dollars	Months
Miscellaneous fish	30	--	11
Spot prawn	26	32	6
Ocean whitefish	23	2	8
TOTALS	38,635,677 lbs.	$2,736,567	

Santa Barbara 1972[2/]

Anchovy	27,476,975
Albacore	3,928,400
Squid	3,644,435
Rockfish	3,291,223
Pacific bonito	2,637,149
Abalone	1,939,905
Jack mackerel	771,916
Petrale sole	531,181
Lingcod	515,599
Miscellaneous animal food	370,053
English sole	307,007
Rock crab	191,094
Salmon	129,553
Dover sole	92,793
California halibut	89,054
Spiny lobster	87,308
White sea bass	74,723
Shark	74,673
Rex sole	73,120
Sea urchin	72,351
Smelt	41,750
Swordfish	34,320
Sand sole	28,737
Giant Pacific oyster	28,586
Market crab	20,815
Perch	14,599
Miscellaneous sole	14,224
Sablefish	10,947
Flounder	8,442
Turbot	2,543
White croaker	2,445
Pacific pompano	2,345
Cabezon	2,089
California barracuda	880

TABLE II-53ℓ (continued)

WEIGHT (POUNDS), VALUE (DOLLARS), AND PRINCIPAL MONTHS OF COMMERCIAL LANDINGS OF FISH AND SHELLFISH INTO THE SANTA BARBARA REGION 1971 THROUGH 1972*

Santa Barbara 1972[2/] (continued)

Species	Pounds
Pacific hake	875
Giant sea bass	808
Octopus	518
Sanddab	517
Skate	452
Dolphinfish	339
California yellowtail	267
Miscellaneous fish	187
California sheephead	164
TOTAL	46,515,361 lbs.

*Weight only for 1972

1/Oliphant, M. S., and staff, 1973. California marine fish landings for 1971. California Department of Fish and Game, Fish Bull. 159: 1-49.

2/Bell, R. R., 1974. Statistical report of fresh, canned, cured, and manufactured fishery products for 1972. California Department of Fish and Game Circular No. 47: 1-19.

(Taken from Southern California Ocean Studies Consortium 1974)

Based on data presented by Oliphant, personal files (1974), the statewide party boat catch has fluctuated in the period from 1962 to 1972 from a low of 3.6 million fish to a high of 5.7 million in 1968 and 1969. The mean number for the 1962-1971 period was 4.8 million fish and the fish/angler ratio ranged from 5.7 in 1967 to 7.1 in 1969. These data show that the 1972 catch of the California barracuda was only 10% of the 1970 total. Information is not yet available to predict whether this decrease represents long-term trends or short-term fluctuations. Table II-53m shows the latest party boat landings for southern California (California Department of Fish and Game data). The rockfish remains the principal fish.

The Marine Fisheries Statistics Staff of the California Department of Fish and Game has for the past several years compiled a record of the annual sport catch by party boats from each of a series of 10 x 8 nautical mile blocks in California waters. These unpublished data include the number of each species landed for each month from each block and the amount of fishing effort expended. Figure II-40 is a summary of the 1972 data for southern California and shows the areas where the largest catches occurred, and the principal species landed in each area.

The figure indicates that most sport fishes are caught relatively close to the mainland or to the offshore islands. Figure II-40a indicates the approximate location of many of the inshore areas of sport fishing significance and the more notable species to be found on either a resident (AY) or migratory (M) basis for both anglers and divers (U.S. Coast Guard, 1972).

Table II-53n lists the annual totalled figures for the party boat fleet for the Santa Barbara--Port Hueneme area as well as all of southern California from Santa Barbara south to the Mission Bay--San Diego complex for the years

TABLE II-53m

REPORT OF THE CALIFORNIA PARTYBOAT FLEET

SPECIES	1972 Santa Barbara	1972 Southern California	1973 Santa Barbara	1973 Southern California	1974 Santa Barbara	1974 Southern California
Rockfish	568,951	1,934,483	712,680	2,174,515	801,656	2,583,000
Kelp & sand bass	123,140	842,681	92,216	656,195	91,371	618,034
Bonito, Pacific	6,525	418,606	7,092	472,369	762	141,580
Yellowtail	724	59,031	76	221,287	15	121,149
Salmon	57	102	8	110	23	89
Pacific mackerel	614	245,841	1,571	198,997	167	102,161
Sculpin	1,921	65,877	1,902	83,475	713	85,955
Lingcod	7,809	12,575	7,554	13,769	10,120	18,686
Barracuda	549	38,243	397	92,483	223	55,256
Halfmoon	33,732	159,637	36,871	168,438	5,632	46,736
Sablefish	497	11,507	1,010	4,323	3,037	36,759
Misc. flatfish	3,656	9,675	5,535	13,881	6,442	12,932
Sheephead	10,482	33,539	15,507	46,234	8,235	30,379
White croaker	250	37,022	334	26,406	4,492	25,209
Ocean whitefish	7,993	24,615	8,238	42,347	5,556	23,291
Albacore	125	76,350	240	448	33	4,080
Jack mackerel	88	3,833	111	7,604	40	2,631
California halibut	1,360	7,852	1,365	9,316	588	9,801
White seabass	205	3,836	282	7,067	710	4,002
Giant sea bass			18	816	14	419
All others	1,107	33,878	149	24,628	1,972	39,809

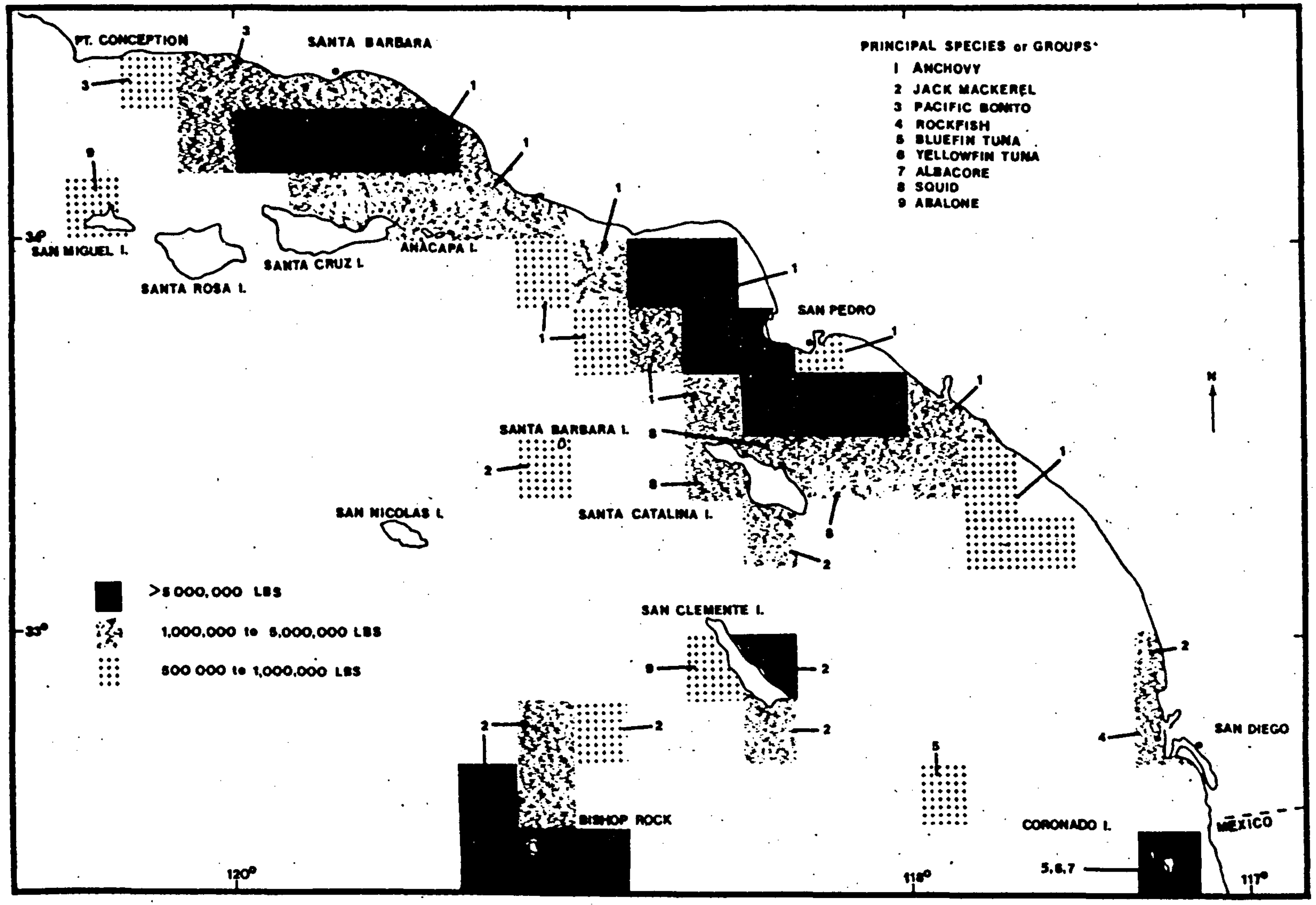


Figure II-40 Areas of concentration of commercial fish landings in Southern California waters for 1972. Principal species are referred to by number. (from Report I-AA (unpublished) catch by origin and species, compiled by the Marine Fisheries Statistics Staff, Calif. Fish and Game.)

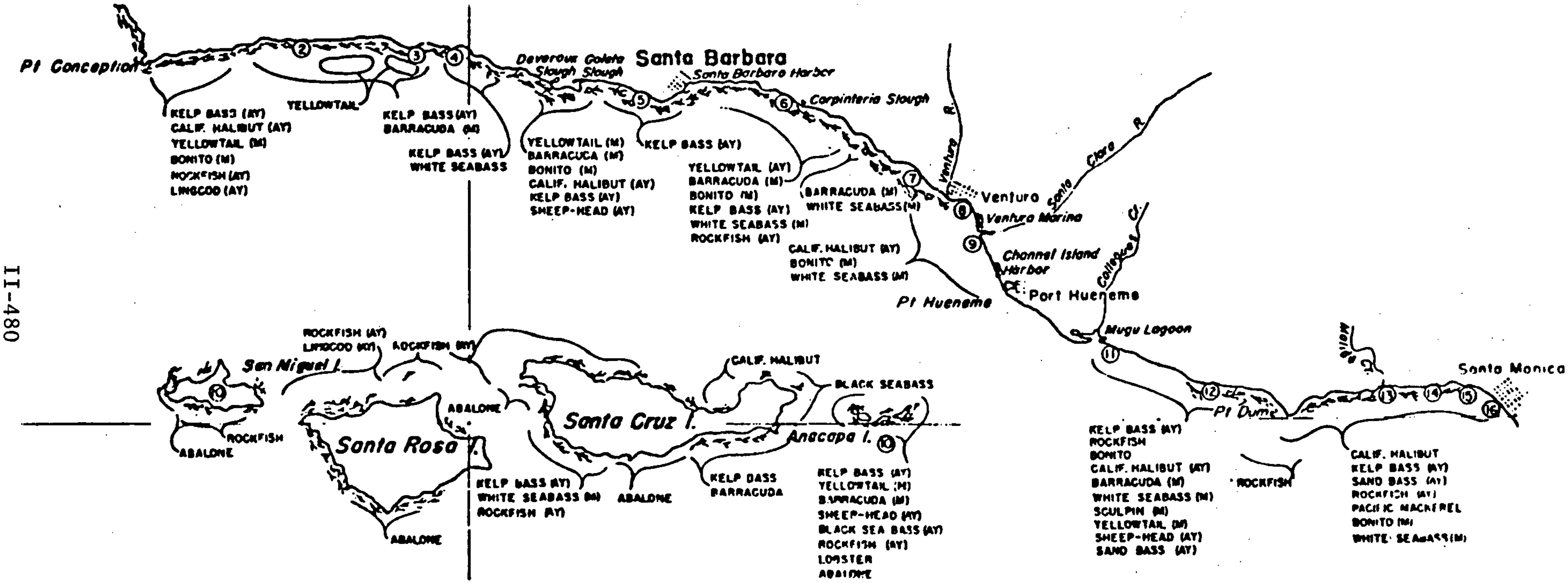


FIGURE II-40a

APPROXIMATE LOCATION OF IMPORTANT COASTAL FISHES
(Modified from U. S. Coast Guard, 1972)

TABLE II-53n

Santa Barbara and Southern California
Party Boat Fleet

Note: Compiled from annual party boat sport fish summaries published by the California Department of Fish and Game

	Santa Barbara-Port Hueneme			Total Southern California		
Year	Total Fish	Total Anglers	Total Boats	Total Fish	Total Anglers	Total Boats
1965	547,644	47,315	27	3,782,628	555,384	194
1966	832,629	72,057	38	4,438,124	677,417	252
1967	801,489	72,100	35	3,504,134	604,641	239
1968	762,563	71,339	26	4,691,723	660,663	238
1969	543,052	49,773	29	4,684,650	616,951	244
1970	678,662	65,149	32	4,322,364	666,785	237
1971	654,084	59,561	32	3,572,695	527,568	257
1972	771,529	68,052	35	4,028,166	552,673	247
1973	894,511	83,384	28	4,272,554	623,072	245
1974	941,801	85,405	26	3,961,958	547,892	208

1965-74. The data for the former area give an estimate of the magnitude of the fishery in the whole Santa Barbara Channel area. It is felt that there may be a much greater potential for this fishery in the Santa Barbara region at present but the fishery is possibly limited artificially by bait quantity. (Jack Schott, 1973, California Department of Fish and Game, Marine Resources Division, personal communication).

(The following discussions on sport fishing other than party boats and the socioeconomic comparison of sport versus commercial fishing are taken from BLM, 1975, after Horn 1974).

Information on the three other main types of sport fishing are less up to date and comprehensive and more difficult to obtain than that for party boat fishing. For the period 1963 to 1966, Pinkas, et al. (1968) provided a numerical ranking of the 15 most important sport-caught fish in southern California waters for each type of fishing (table II-53o) The ranking readily identifies the relative importance of species of different habitats to the sportfishery. For both party boats and private boats, kelp and sand bass, Pacific bonito, and rockfish were important species. For both pier and jetty fishing and fishing in inland bays, white croaker and queenfish were principal species. For open coast shoreline angling, the surfperches were the most important group. Pacific bonito and bass (kelp and sand) were the most frequently caught species for all types of sportfishing in southern California during the period 1963 to 1966.

Pinkas, et al. (1968) compared the four main types of sportfishing in southern California (table II-53p) and found that party boats accounted for nearly 55% of all sport-caught fish. Party boats also had the highest catch-per-man hour of fishing (1.429) while shoreline fishing has the lowest (0.305).

TABLE II-53o

NUMERICAL RANKING OF THE 15 MOST IMPORTANT SPORT-CAUGHT FISH IN SOUTHERN CALIFORNIA MARINE WATERS, 1963-66

(From: Pinkas, et al, 1968, p. 36)

Rank Species	Numbers	Percent comp.
Party Boats (Annual Average, 1963-66)		
1. Kelp and sand bass	1,207,996	30.2
2. Pacific bonito	879,335	22.0
3. Rockfish species	604,601	15.1
4. California barracuda	530,658	13.3
5. Sculpin	192,369	4.8
6. Pacific mackerel	150,739	3.8
7. California halibut	116,489	2.9
8. Albacore	103,748	2.6
9. California yellowtail	45,834	1.2
10. Halfmoon	35,202	0.9
11. California sheephead	34,970	0.9
12. White croaker	23,359	0.6
13. White seabass	12,109	0.3
14. Ocean whitefish	10,608	0.3
15. Jack mackerel	10,161	0.3
Subtotals	3,958,208	99.0
Other fish	39.631	1.0
Grand totals	3,997,839	100.0
Piers and Jetties (1963)		
1. Queenfish	362,892	19.7
2. White croaker	342,002	18.5
3. Pacific bonito	283,068	15.3
4. Walleye surfperch	141,151	7.7
5. Shiner perch	132,968	7.2
6. Smelt, jack and top	72,187	3.9
7. Black perch	64,764	3.5
8. California halibut	56,933	3.1
9. Pacific mackerel	56,669	3.1
10. Kelp and sand bass	46,821	2.5
11. Opaleye	31,448	1.7
12. Northern anchovy	29,686	1.6
13. Barred surfperch	23,990	1.3
14. White seaperch	17,769	1.0
15. California barracuda	17,351	0.9
Subtotals	1,678,699	91.0
Other fish	166,271	9.0
Grand totals	1,844,970	100.0
Private Boats (1964)		
1. Pacific bonito	401,575	42.0
2. Kelp and sand bass	132,150	13.8
3. California halibut	98,692	10.3
4. White croaker	84,641	8.8
5. Rockfish species	51,516	5.4
6. Pacific mackerel	24,173	2.5
7. Sculpin	21,025	2.2
8. Halfmoon	19,879	2.1
9. Black perch	19,558	2.0
10. California barracuda	16,235	1.7
11. Queenfish	15,939	1.7
12. Smelt, jack and top	5,936	0.6
13. Albacore	5,902	0.6
14. White seaperch	5,713	0.6
15. California yellowtail	4,926	0.5
Subtotals	907,860	92.5
Other fish	73,600	7.5
Grand totals	981,460	100.0
Open Coast (1965-66)		
1. Barred surfperch	85,743	36.4
2. Opaleye	33,494	14.2
3. California corbina	29,644	12.6
4. Black perch	25,413	10.8
5. Walleye surfperch	12,405	5.3
6. Halfmoon	8,563	3.6
7. Yellowfin croaker	4,190	1.8
8. White seaperch	3,212	1.4
9. Cabezon	2,743	1.2
10. Sargo	2,659	1.1
11. Pacific staghorn sculpin	2,412	1.0
12. Pile perch	2,389	1.0
13. Wrasses, unspecified	2,380	1.0
14. Sharks, unspecified	2,310	1.0
15. Kelp and sand bass	2,231	1.0
Subtotals	219,788	93.3
Other fish	15,905	6.7
Grand totals	235,693	100.0

TABLE II-53p

SUMMARY OF SPORTFISHING EFFORT, CATCH, CATCH-PER-UNIT-OF-EFFORT IN SOUTHERN CALIFORNIA MARINE WATERS (from PINKAS, et al. 1968)

Fishery	Man or angler days	Man hours	Numbers of fish	Catch-per-man hour of fishing[1]
Party boats (avg. 1963-66)	570,477	2,797,250	3,997,839	1.429
Piers and Jetties (1963)	1,404,079	5,090,523	1,844,970	0.362
Private boats (1964)	443,258	2,773,405	981,460	0.354
Shore line (1965-66)	551,151	1,646,289	501,734	0.305
TOTALS	4,379,203	12,307,467	7,326,003	0.595

[1] Calculated from adjusted estimates.

Skin diving and scuba diving form a fifth and expanding type of sportfishing. There has been a steady increase from 1958 (the first year records were kept) to the present in the number of divers on charter boats. In 1960, 1,239 divers used charter boat facilities and by 1970 the number had grown to 23,656 (Duffy, 1973). Diving logs obtained from California party boats over the period 1965 to 1970 show that 83,996 divers landed 199,466 fish, mollusks, and crustaceans, averaging 2.4 animals per diver (Young, 1973a). The six-year catch was dominated by abalones (54 to 59% of the total catch), spiny lobster (12 to 17%), rock scallop (10 to 15%), sheephead (8 to 9%), and kelp bass (4 to 6% of the total). These data indicate the much greater interest of divers in shellfish than in finfish. Southern California offshore islands were most favored by divers, with Santa Catalina and Santa Cruz islands supporting the bulk of the diving effort. According to Young (1973a), three species, rock scallop, sheephead, and giant sea bass, are relatively vulnerable to divers and could be overexploited.

No information is available on the effort expended by sports divers operating from the shoreline or private boats. It is known, however, that divers take spiny lobster and other species and that the number of divers annually certified is increasing. By 1970, the Los Angeles County Department of Parks and Recreation was certifying about 10,000 divers per year (Duffy, 1973). In addition, many other organizations and institutions train divers in all southern California coastal counties.

Major sportfishing areas have been briefly described and principal sport species listed for each of the five coastal counties (Santa Barbara, Ventura, Los Angeles, Orange, and San Diego) of southern California in a recent publication by California Department of Fish and Game (1973). Annual angler days and estimated expenditures by sport fishermen in the five counties are also provided in the report and are listed in table II-53q. An increase of about 25% in angler days from 1970 to 1980 is projected and indicates that careful management of sportfishing areas and stocks will be required. This paper is further summarized below.

Principal Commercial and Sport Groups of Fish and Shellfish

This section provides in tabular form (table II-53r) a summary of the rank in the 1972 commercial landings, the type of fishery, the state of utilization, and the party boat rating of 15 groups of fish and shellfish presently comprising most of the fisheries resources in the waters off southern California. The basis for the table is data from Frey (1971). Papers by Ahlstrom (1968) on the state of utilization of fishery resources, by Young (1969) on the party boat fishery, and by a series of authors who summarized the status of eleven groups or species as part of the proceedings of a recent (12-15 March 1973) marine fisheries workshop (Squire, 1973) were also of importance in formulating table II-53r.

Socioeconomic Comparison of Commercial Fishing and Sport Fishing

Commercial fishing and sport fishing are important industries providing employment for a considerable number of people and bringing large revenues into the state. The two industries are utilizing the same marine waters off southern California (except that most tunas are caught ouside of California waters), and frequently fishing for the same species of fish or shellfish. Young (1969) pointed out that of the 20 most important gamefish as rated by southern California party boat operators in 1968, all except one entered into the commercial fishery. The data of table II-53r indicates that most of the fishery species listed are sought by both sport and commercial fishermen. Several species such as white seabass, yellowtail, and spiny lobster have

TABLE II-53q

ANNUAL NUMBER OF ANGLER DAYS AND ESTIMATED EXPENDITURES OF SPORT FISHERMEN IN THE FIVE COASTAL COUNTIES OF SOUTHERN CALIFORNIA (from California Department of Fish and Game Planning Team, 1973)

COUNTY	ANGLER DAYS (Annual average) 1970	1980 (Projection)	ESTIMATED EXPENDITURES, 1970
Santa Barbara	187,500	236,300	$ 2,294,000
Ventura	662,500	834,800	8,104,000
Los Angeles	2,875,000	3,622,500	35,166,000
Orange	2,700,000	3,400,000	32,800,000
San Diego	1,200,000	1,500,000	14,700,000
TOTALS	7,625,000	9,593,600	$93,064,000

TABLE II-53r

UTILIZATION AND STATUS OF THE PRINCIPAL GROUPS OF COMMERCIAL AND SPORT FISH AND SHELLFISH IN SOUTHERN CALIFORNIA (from Horn, 1974b)

Group and Species	Type of Fishery[1]	Rank in 1972 Commercial landings[2]			Party boat Rating[3]	State of Utilization[4]	References on Status
		L.A.	S.D.	S.B.			
Echinoderms							
Sea Urchins	C						Kato (1972)
Crustaceans							
Spiny Lobster	C,S	16	9	16		Overutilized	Frey (1971) Duffy (1973)
Rock Crabs	C,S	11	15	12		Moderately underutilized	Frey (1971)
Pelagic Red Crab	C					Much under-utilized	Frey (1971)
Mollusks							
Abalones	C,S	12	7	6		Overutilized	Frey (1971)
Squid	C	8		3		Moderately underutilized	Frey (1971)
Sharks, Rays, and Skates	C,S	27	12	18		Much under-utilized	Frey (1971)
Pelagic Wetfish							
Northern Anchovy	C	2	28	1		Moderately under-utilized	Frey (1971) Ganssle (1973)
Pacific Sardine	C	14	15			Commercial Moratorium	Frey (1971) Haugen (1973)
Jack Mackerel	C,S	3		7		Much Under-utilized	Frey (1971) Knaggs (1973)
Pacific Mackerel	C,S	24	24			Commercial Moratorium	Frey (1971) MacCall (1973)
Pacific Saury	C,S					Much Under-utilized	Frey (1971)
Flatfish							
California Halibut	C,S	28	18	15	5	Fully utilized	Frey (1971)

TABLE II-53r (Continued)

Group and Species	Type of Fishery[1]	Rank in 1972 Commercial landings[2] L.A.	S.D.	S.B.	Party-boat Rating[3]	State Utilization[4]	References on status
Dover Sole	C			14		Moderately underutilized	Frey (1971)
English Sole	C			11		Moderately underutilized	Frey (1971)
Petrale Sole	C			18		" "	Frey (1971)
Rex Sole	C			19		" "	Frey (1971)
Sanddabs	C					" "	Frey (1971)
Rockfish	C,S	10	6	4	6	" "	Frey (1971) Miller and Hardwick (1973)
Pacific Hake	C					Much under-utilized	Frey (1971) Jow (1973)
Sablefish	C,S				19	Much under-utilized	Frey (1971)
Tunas							
Yellowfin	C,S	1	1			Fully utilized	Frey (1971)
Skipjack	C,S	4	2			Moderately underutilized	Frey (1971)
Albacore	C,S	7	4	2	7	Fully utilized	Frey (1971)
Pacific Bonito	C,S	5	5	5	4	Moderately underutilized	Frey (1971) Thayer (1973)
Bluefin	C,S	6	3		9	Fully utilized	Frey (1971)
Black Skipjack	C,S	9	11				
Billfish							
Swordfish	C,S	22	13	22			Frey (1971)

TABLE II-53r (Continued)

Groups and Species	Type of Fishery[1]	Rank in 1972 Commercial landings[2]			Party-boat Rating[3]	State of Utilization[4]	References on status
		L.A.	S.D.	S.B.			
Striped Marlin	S						Frey (1971)
Nearshore Game Fish							
Kelp and Sand Bass	S				2		Frey (1971)
Giant Sea Bass	C,S	25	20		12		Frey (1971)
California Barracuda	C,S		23		1		Frey (1971) Schultze (1973)
California Yellowtail	C,S	18	14		3		Frey (1971) Collins (1973)
Sculpine and Greenlings							
Cabezon	C,S				17		Frey (1971)
Lingcod	C,S			9	14		Frey (1971)
Croakers							
White Sea Bass	C,S	13	8	17	8		Frey (1971) Young (1973b)
White Croaker	C,S	15	27		20		Frey (1971)
Surfperch	C,S	21	17	26			Frey (1971)

1 C= Commercial, S = Sport

2 From Bell 1974; L.A. = Los Angeles, S.D. = San Diego, S.B. = Santa Barbara

3 From 1968 ratings of the 20 most important game fish species by eleven southern California partyboat landing operators (Young, 1969).

4 Based on qualitative ratings by Ahlstrom (1968) and updated from personal communication with California Fish and Game workers.

dual regulations and other species, such as kelp and sand bass may not be fished commercially in California waters. This kind of dual utilization of resources by commercial and sport interests can lead to conflicts of interest and requires interaction and close cooperation between the two industries.

A second type of conflict between the two industries may occur when a commercial species is forage for sportfishes. An example is the northern anchovy which is the most important species in the commercial fishery, but which is also important food for several species of game fish upon which the sportfishing boats depend. Thus, sportfishermen protested when the California Game and Fish Commission recently granted the commercial fishing industry permission to take an additional 20,000 tons of anchovies from southern California waters over the normal seasonal quota of 100,000 tons which had already been reached (Los Angeles Herald-Examiner article, 12 March 1974). Conflicts such as this and others make the comparative economic value of commercial and sportfishing important information for decision-makers to have regarding regulation of fisheries and the management of resources.

Gruen, Gruen and Associates (1972) in a socioeconomic analysis of California's sport and commercial fisheries concluded that in terms of net economic value, total sport fishing (including inland fishing) contributes more to California than total commercial fishing (including inland fishing)--$100 to $200 million for sport fishing as compared to about $43 million for commercial fishing (table II-53s. If, however, inland fishing is excluded from both types, and strictly marine sport and commercial fishing are compared, the net economic values are similar -- $23 to 47 million for sport fishing and $43 million for commercial fishing. On the other hand, if tunas caught in out-of-state waters are excluded, the marine commercial value becomes substantially lower than the

TABLE II-53s

NET ECONOMIC VALUE OF COMMERCIAL FISHING AND SPORT FISHING IN CALIFORNIA, 1970 (from GRUEN, GRUEN, AND ASSOCIATES, 1972)

Commercial Fishing

	Gross Landed Value	Assumed Proportion	Net Economic Value
Tuna caught in out-of-State waters	$56,710,695	0.5	$28,355,347
Other Marine Species	29,689,634	0.5	14,844,817
Inland	312,738	0.5	156,369
Total Marine and Inland	$86,713,067	0.5	$43,356,533

Sport Fishing

	Angler Days	Assumed Value Per Day	Net Economic Value
Marine	11,910,000	$2	$ 23,820,000
	11,910,000	$3	35,730,000
	11,910,000	$4	47,640,000
Inland	38,370,000	$2	76,740,000
	38,370,000	$3	115,110,000
	38,370,000	$4	153,480,000
Total, Marine and Inland	50,280,000	$2	100,560,000
	50,280,000	$3	150,840,000
	50,280,000	$4	201,120,000

marine sport value even at only $2 per angler day -- about $24 million for sport fishing versus about $15 million for commercial fishing.

Gruen, et al. (1972) made clear that their valuation of California's two uses of fish cannot be precise owing to the weaknesses in existing data and to problems of measurement method peculiar to fish resources. They further pointed out that their comparison does not legitimately make it possible to conclude that any particular species is worth more to sport fishing than to commercial fishing.

An estimate by Gruen, et al. (1972) of marine sportfishing activity in California for 1970 is given in table II-53t. They expressed lack of confidence in their breakdown in the relative magnitude of the types of sport fishing, but indicated that the data did show the greater importance of southern California as compared with the rest of the state, and of pier, jetty, and shoreline fishing as compared with other types of sport fishing. Their data reveal a considerable increase in the importance of pier, jetty, and shoreline fishing in terms of angler days over that presented by Pinkas et al. (1968) for 1963-1966 (table II-53p.

TABLE II-53t

ESTIMATE FOR 1970 OF MARINE SPORT FISHING ACTIVITY BY GEOGRAPHICAL AREA AND TYPE OF FISHING IN ANGLER DAYS
(from GRUEN, GRUEN, AND ASSOCIATES, 1972)

	Central and Northern California	Southern California	Total
Piers and jetties	1,832,088	3,730,395	5,562,483
Shoreline	2,074,895	1,467,877	3,542,772
Partyboats	182,235	691,092	873,327
Private Boats	419,394	1,180,924	1,600,318
Other	132,440	198,660	331,100
TOTAL	4,641,052	7,268,948	11,910,000

b. Sport Fishing

Much of the following section was taken from Bureau of Land Management (1975) after Horn 1974.

A sizable marine sport fishery exists in the Santa Barbara area. This can be divided into three general types of activities: angling for fin fishes, gathering of invertebrates for food, and collection of bait animals. The first two are the major activities of economic and aesthetic importance.

Angling

Angling is done either from boats--party boats or private boats--or from the shore. Good data are available from the party boat fishery as the State law requires logs from each boat to be submitted to California Department of Fish and Game (Young, 1969). The log program was interrupted during World War II but was fully reinstituted by 1947. During the 21 year period, 1947-1967, 400 to 600 boats participated in the fishery and a total catch in excess of 71 million fish was reported. Consecutive catch records were maintained of 28 species and species groups. Annual catch totals ranged from 2.0 to 5.4 million fish. In 1947, an estimated 435,000 anglers fished from party boats, and in 1966, an estimated 857,000. Following a brief downward trend from 1947 to 1952, the sport fish catch from party boats has risen rather sharply through the period 1953 to 1970 (figure II-40b), even though catches of individual species fluctuated greatly. Based on Young's (1964) data, the top four species or species groups in terms of numbers caught in the period 1947-1967 were: 1) rockfish, 22,000,000+; 2) kelp and sand bass, 16,000,000+; 3) barracuda, 9,000,000+; and 4) bonito, 8,000,000+.

The party boat fleet has experienced a downward trend in the number of registered vessels during the period 1953-1967, but the average carrying

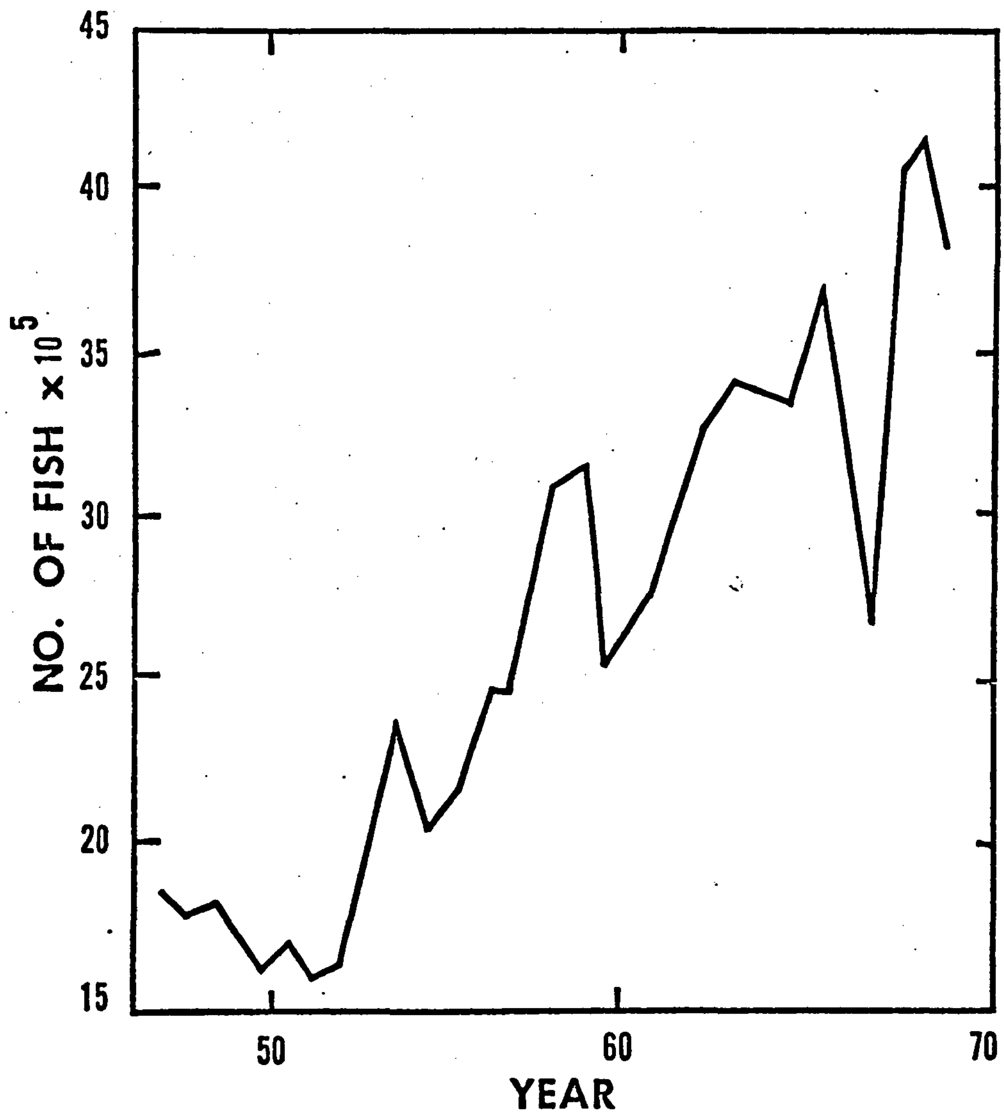


Figure II-40b Total number of fish caught by party boats in southern California waters, 1947-1970. (from SCCWRP, 1973; after Young, 1969).

capacity of the boats has become greater and a larger number of anglers fish from party boats (figure II-40c). According to Frey (1971) the California party boat fleet is considered to be in a "healthy condition".

The southern California party boat fishery is distinct. About 75% of the statewide party boat effort is expended in southern California, and the number of boats operating in the region is slightly higher than in the rest of the state (Miller and Hardwick, 1973). Southern California boats are larger and there are more operations of half-day boats compared with northern areas. The fishery extends from shallow areas to depths in excess of 600 feet and includes a wide variety of species, whereas in the northern and central areas party boat fishermen rarely fish below 300 feet (Miller and Hardwick, 1973).

In the party boat catch of central and northern California, rockfish contributed from 71.7% to 90.0% of the total catch by numbers of fish from 1955 through 1971 (figure II-40d) with salmon, lingcod, and striped bass the only other species consistently contributing significantly to the catch. In southern California, rockfish have contributed from 9.0% to 57.2% of the total catch in the same time period (figure II-40e) with kelp and sand bass, Pacific bonito, and barracuda as the other species making up significant portions of the total catch. However, southern California rockfish landings have exceeded those for the rest of the state since 1964 (Miller and Hardwick, 1973). Rockfish have gradually become the predominant forms in the statewide party boat catch in the period from 1962 to 1971 (Oliphant, personal files, 1974). In 1962, rockfish constituted only 26% of the total sportfish catch, whereas in 1972 this group made up 56% of the catch.

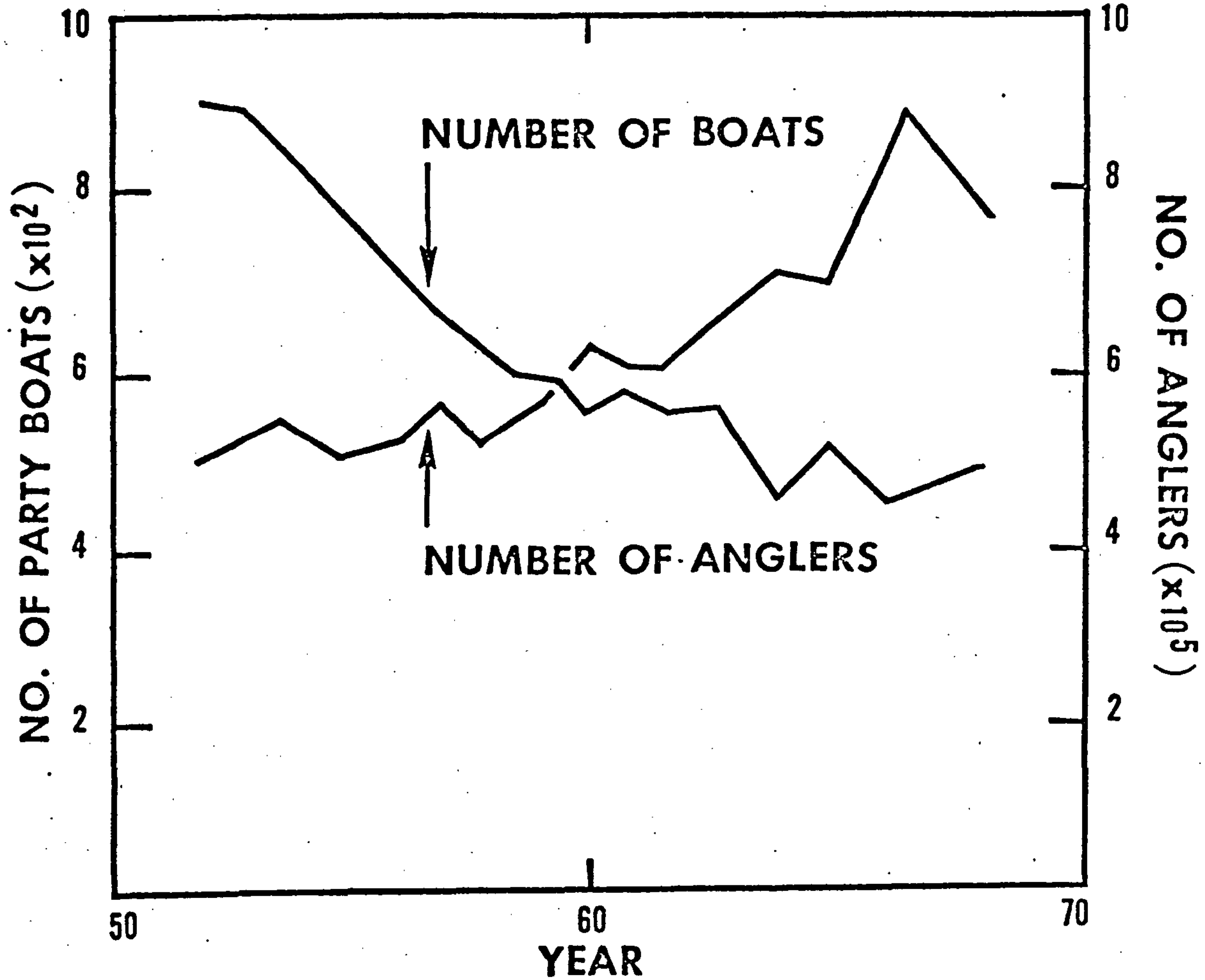


Figure II-40b Annual number of California partyboats and anglers, 1953-1967. (from Frey, 1971).

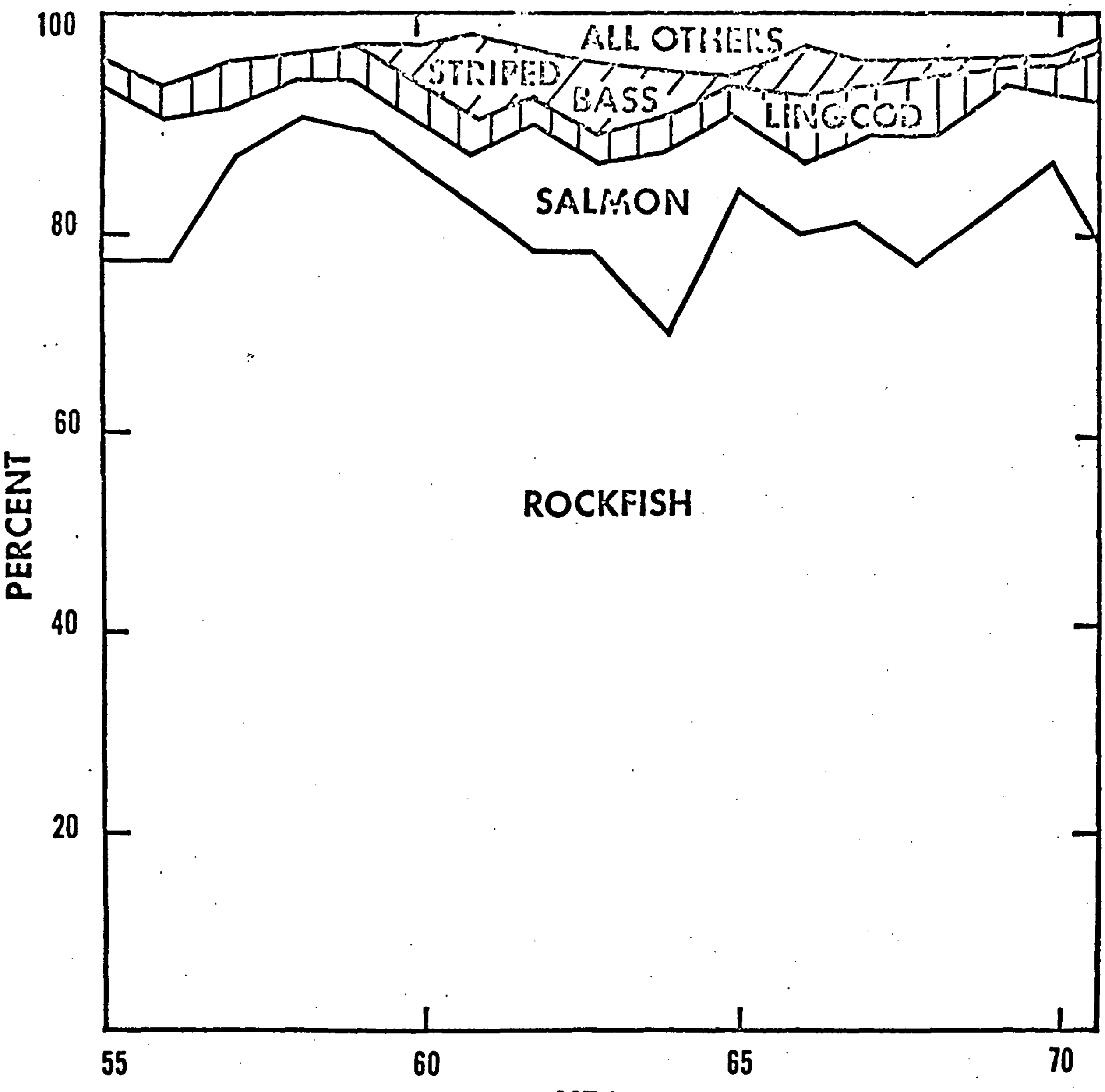


Figure II-40d Annual percent composition by numbers of the central and northern California (Avila to Crescent City) partyboat catch, 1955-1971. (from Miller and Hardwick, 1973).

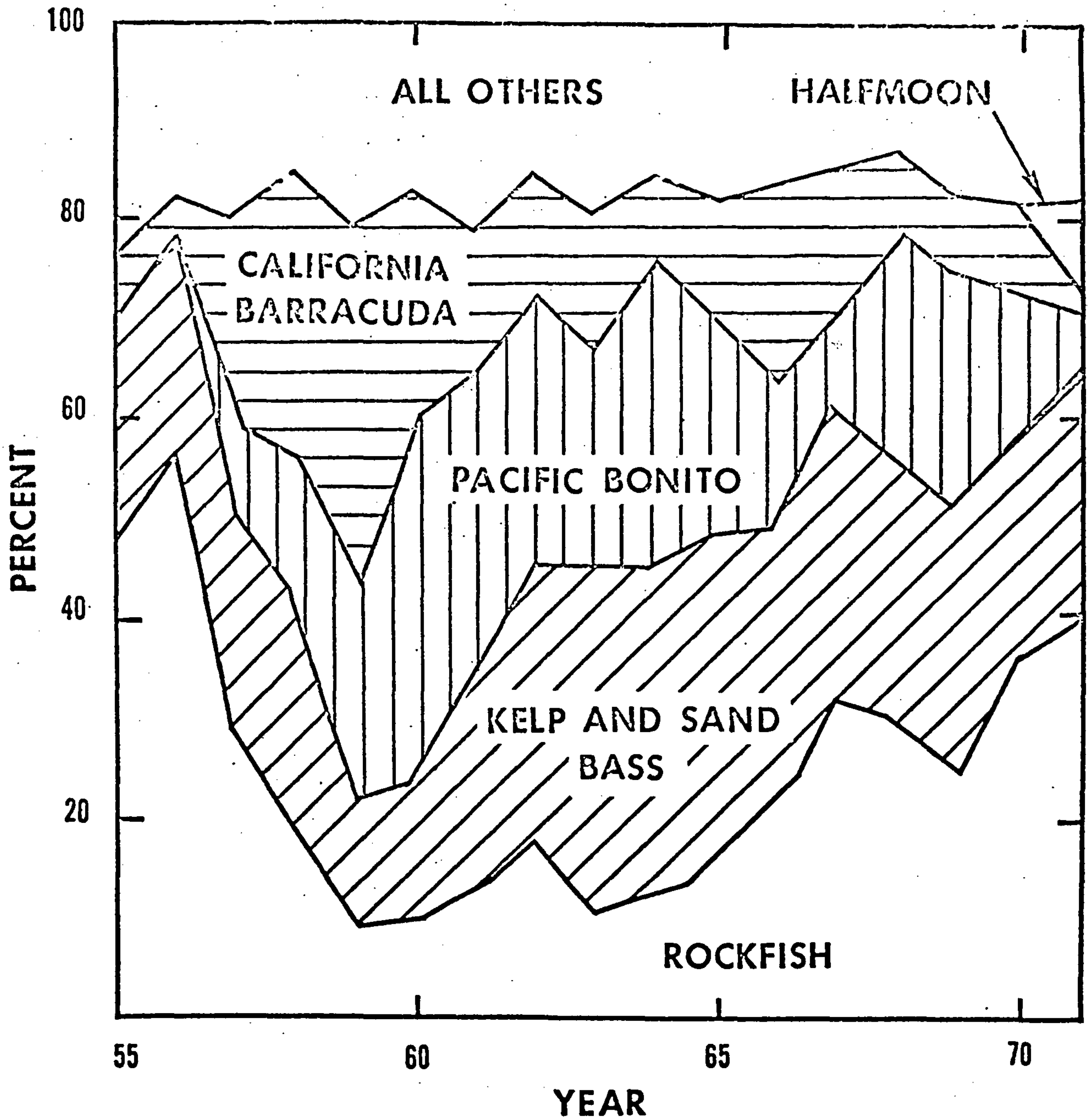


Figure II-40e Annual percent composition by numbers of the southern California partyboat catch, 1955-1971. (from Miller and Hardwick, 1973).

10. Mariculture

a. Kelp

The following is a brief discussion of kelp and the kelp industry and the relative importance of each to the economy and ecology of southern California. (Source: California's Living Marine Resources and their Utilization, California Department of Fish and Game, Herbert W. Frey, Editor, 1971, pages 5-7)

The giant kelp, *Macrocystis*, has been harvested commercially and processed in California since 1910. Kelp contains carbohydrates, minerals, vitamins, and algin or alginic acid. Kelp meal, used as an animal food supplement, and algin, used in many modern products, are the most important items of commercial significance today. At present, there are more than 200 uses for algin.

The annual California kelp harvest has varied from a high of 395,000 wet tons in 1918 to a low of 260 tons in 1931, but averaged 129,000 wet tons during the ten-year period (1960 to 1969). (See table II-53u) No adverse influence on the rich fauna associated with kelp beds can be attributed to harvesting as currently practiced.

Kelp beds are numbered and designated beds may be leased for a 20-year period. Commercial kelp harvesters may lease two-thirds of the kelp beds in California; however, the remaining one-third is not leased and may be harvested by any company. These are called open beds. Commercial harvesters bid for the privilege of exclusive use of leased beds. A single entrepreneur may not lease more than a total of 25 square miles or 50 percent of the total kelp areas, whichever is greater. Every harvester must purchase an annual license and pay a royalty per ton of wet kelp harvested. Over or under harvesting a leased bed constitutes a violation of the lease agreement,

TABLE II-53u

KELP HARVEST BY SELECTED BEDS IN WET TONS

Bed Number	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
17	6,411	10,993	6,403	9,168	5,111	2,321	1,260	5,640	7,076	6,983	6,888	4,728	4,244	3,641	2,090	4,059
18	246	37	...	...	...	...	...	...	...	...	...	...	97	...	144	199
19	1,843	1,736	905	1,497	1,235	734	167	...	454	1,363	1,802	2,069	247	...	455	1,179
20	2,497	3,430	1,684	3,290	1,501	900	...	...	230	...	...	...	...	...	...	...
21	11,215	5,016	2,387	4,270	6,082	9,606	1,891	1,593	3,311	1,465	4,788	5,250	3,068	...	4,694	...
22	2,774	2,812	1,421	3,310	2,333	2,408	999	2,101	1,293	981	1,845	1,318	50	...	...	1,307
23	...	93	717	1,537	737	1,273	103	...	562	...	...	...	188	...	...	718
24	1,763	1,247	1,419	784	452	1,454	834	1,149	2,599	...	...	...	378	...	712	139
25	4,109	4,554	3,190	5,528	4,251	6,227	3,233	331	2,985	1,416	...	...	1,668	1,179	2,350	2,323
26	2,080	2,255	1,313	1,858	2,329	2,812	1,037	1,479	1,992	1,195	846	1,290	1,880	1,301	3,160	4,377
27	...	1,137	1,190	2,334	1,209	874	885	2,119	3,863	5,540	5,276	5,915	3,346	6,486	4,105	1,068
28	...	6,932	6,051	17,221	9,361	10,125	6,183	8,663	7,540	1,778	4,470	5,007	5,800	...	6,598	2,196
29	992	3,812	3,353	1,972	2,709	3,328	4,366	7,899	2,621	942	2,616	604	493	3,887	4,308	1,772
30	2,436	17,291	16,527	17,714	22,375	21,753	31,824	15,655	19,002	14,269	7,438	3,859	15,341	11,316	15,192	4,336
31	4,498	11,346	11,780	10,544	767	273	19,948	...	17,929	12,397	20,587	9,753	8,388	2,329	18,007	9,036
32	809	20	563	...	268	...	1,160	3,118	10,340	3,125	12,777	4,382	1,577	5,400	7,356	13,905
33	...	4,586	2,282	1,928	338	...	2,223	...	...	...	...	...	...	...	...	606

(From California Department of Fish and Game) and a fine and loss of the exclusive lease can occur.

Giant kelp is harvested by specially built barges. These vary in size and some are capable of carrying up to 300 tons of wet kelp. Kelp is cut to a maximum depth of four feet (by regulation) below the water's surface and is transferred by a conveyor belt into the open hold of the barge. It then is transported to a processing plant where it is transformed to a salable product.

Giant kelp ranges from Sitka, Alaska, southward to Point Abreojos, Baja California; nevertheless, kelp harvesting has been centered in southern California. Kelp grows in water from just outside the surf to depths of 100 feet.

California kelp beds have decreased in size since the early 1900's when they covered approximately 100 square miles. Today they cover less than 75 square miles. There are 74 designated kelp beds along the California coastline. These cover 53.86 square miles south of Point Conception, including the offshore islands, and 15.5 square miles between Point Conception and Point Montara. In the last ten years, some of the major kelp beds of southern California have all but disappeared due to temperature changes, sewage discharges, and kelp grazers. Kelp habitat improvement projects, initiated in 1963 by industry and the academic society, have restored the Point Loma kelp bed near San Diego to a point where it again can sustain a commercial harvest.

Presently, some work is being done under Sea Grant at the University of California at Santa Barbara under Dr. Neushal on some methods of kelp culture.

b. Commercial Value of the Kelp Industry

About 52,000 tons of kelp are harvested in the Santa Barbara Channel region annually. At a price of $90 to $125 a ton, this represents an annual sum of $4.7 million to $6.5 million for the Channel kelp industry.

The locations of the most important commercial kelp beds in the Channel area are included in figure II-40f. The annual kelp harvests from several of those beds are presented in table II-53u (personal communication, California Department of Fish and Game, 1974). A general discussion of kelp appeared in section II.E.2 a.(5) "Marine Biology, Sublittoral Zone".

c. Other

There are no other licensed mariculture operations in the Santa Barbara Channel area.

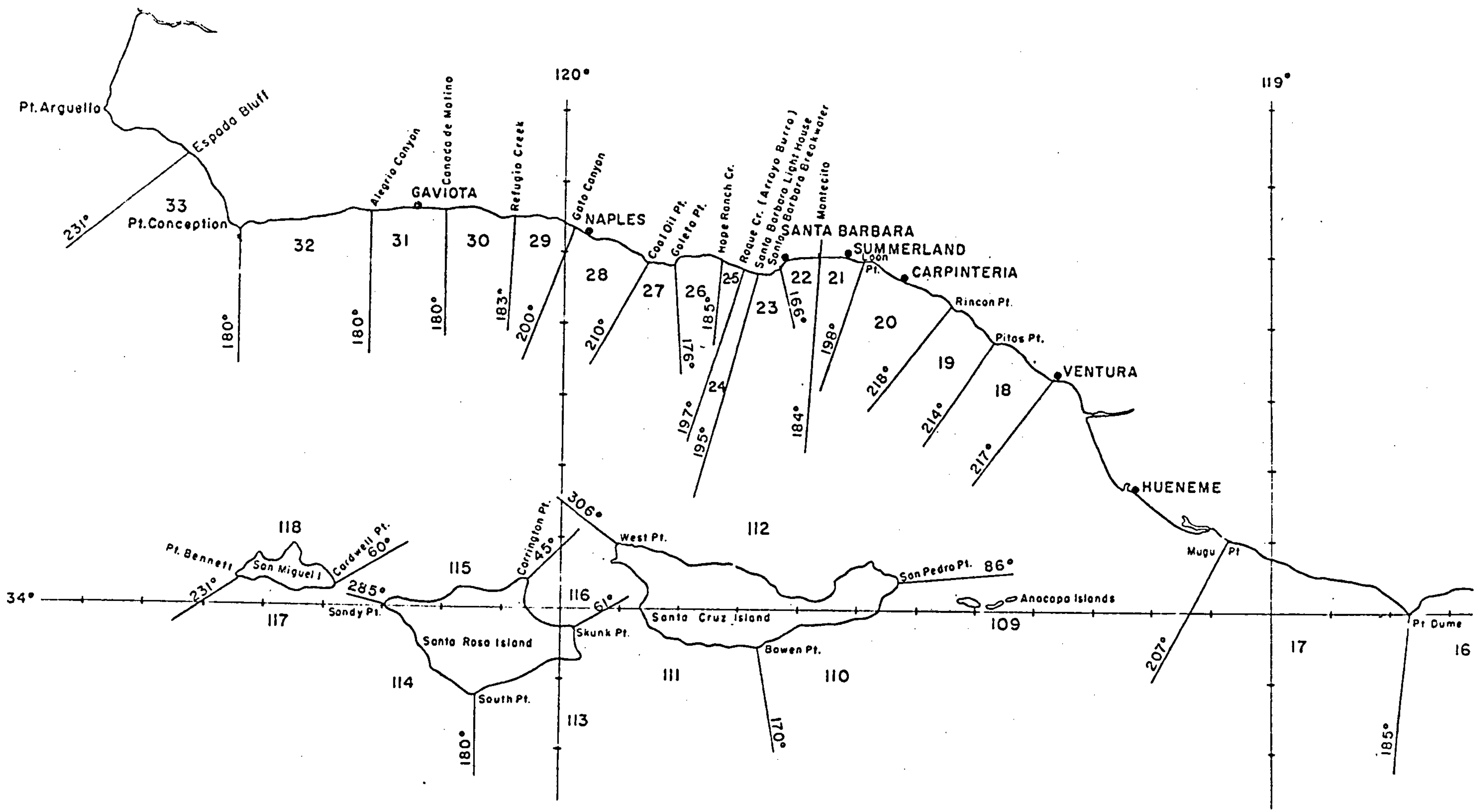


FIGURE II-40f

LOCATION CHART, KELP BEDS OF THE SANTA BARBARA CHANNEL
(From California Department of Fish and Game)

11. Archeological and Historical

a. Archeological Resources

When Cabrillo sailed through the Santa Barbara Channel in 1542 he was met by Chumash Indians living in seacoast villages. The Chumash living between Point Conception and the Rincon made up the most dense coastal California Indian population south of the San Francisco Bay. They declined or quickly dispersed through ensuing Spanish missionization, disease and the impacts of cultural change in the post-mission period. Studies of the historic records, notably Landberg's summary (1965), provide a description of the culture and settlement patterns of the Chumash which can be used to structure testable hypotheses concerning the prehistoric period. However, the limited archeological record that remains constitutes the data base needed to test the hypotheses generated by the known historic record. For this reason, the coastal archeological record for the Santa Barbara mainland is vital to any understanding of human occupation of this area.

Coastal Chumash culture, and probably its prehistoric precedents, probably existed in a network of trade, seasonal movement and economic relationships between interior mountains and the Channel Islands. (Spaulding and Glassow 1972; King 1971; Spanne 1970). Landberg has separated the Chumash region into four areas in which the economy, population distribution, social life and village organization relate distinctively to natural resources; these areas are Channel Islands, Northern Coast, Interior and Channel Mainland. The latter is the most obvious area of direct impact, however, the sea floor in the Channel itself must be considered. During the Pleistocene, continental ice sheets covered much of Northern America. At this time the worlds sea level was lower, and much of the outer continental shelf was exposed as coastal areas. There is mounting evidence that much of the archeological record for early coastal occupations along the Santa Barbara Channel is now resting on the sea floor. This record extends from 3,000 years ago to as early as 10,000 years ago, or perhaps even earlier.

The Channel Mainland Chumash area was the most populous, totalling possibly 5000. These coastal groups resided in villages from approximately 15 to 800, situated either around lagoons or headlands next to the mouths of ponded streams and rivers. West of Rincon Point, where the Santa Barbara coast turns into bluffs broken only occasionally by lagoons, villages frequently were on top of headlands with a clear ocean view. The largest villages were observed between Rincon and Goleta (see figure II-41). Smaller campsite remains are found in the mouths of smaller canyons emptying into the sea and on stream banks farther inland. These village locations offer optimum access to the wild foods in the Chumash diet: channel fisheries, waterfowl catching in ponded streams and lagoons, shellfish gathering in lagoons and sloughs, hunting land game, and gathering a variety of plant foods inland. Prime in their food resources was deep-sea fishing from plank canoes. The dense population of the Channel Chumash was apparently based on yearly harvest of schools of tuna that congregated at the kelp beds offshore.

Archeological sites have been recorded for approximately 100 years on the Santa Barbara coast. Present data is based primarily on sporadic surveys between highway 101 and the seacoast. Recent re-surveys indicate that present knowledge is most reliable and intensive from Mugu to Gaviota; inland areas to the Santa Inez range are very superficially recorded. Prehistoric sites show distributions paralleling that of Chumash localities, with heaviest concentrations between Refugio Beach and Carpinteria. The most dense site

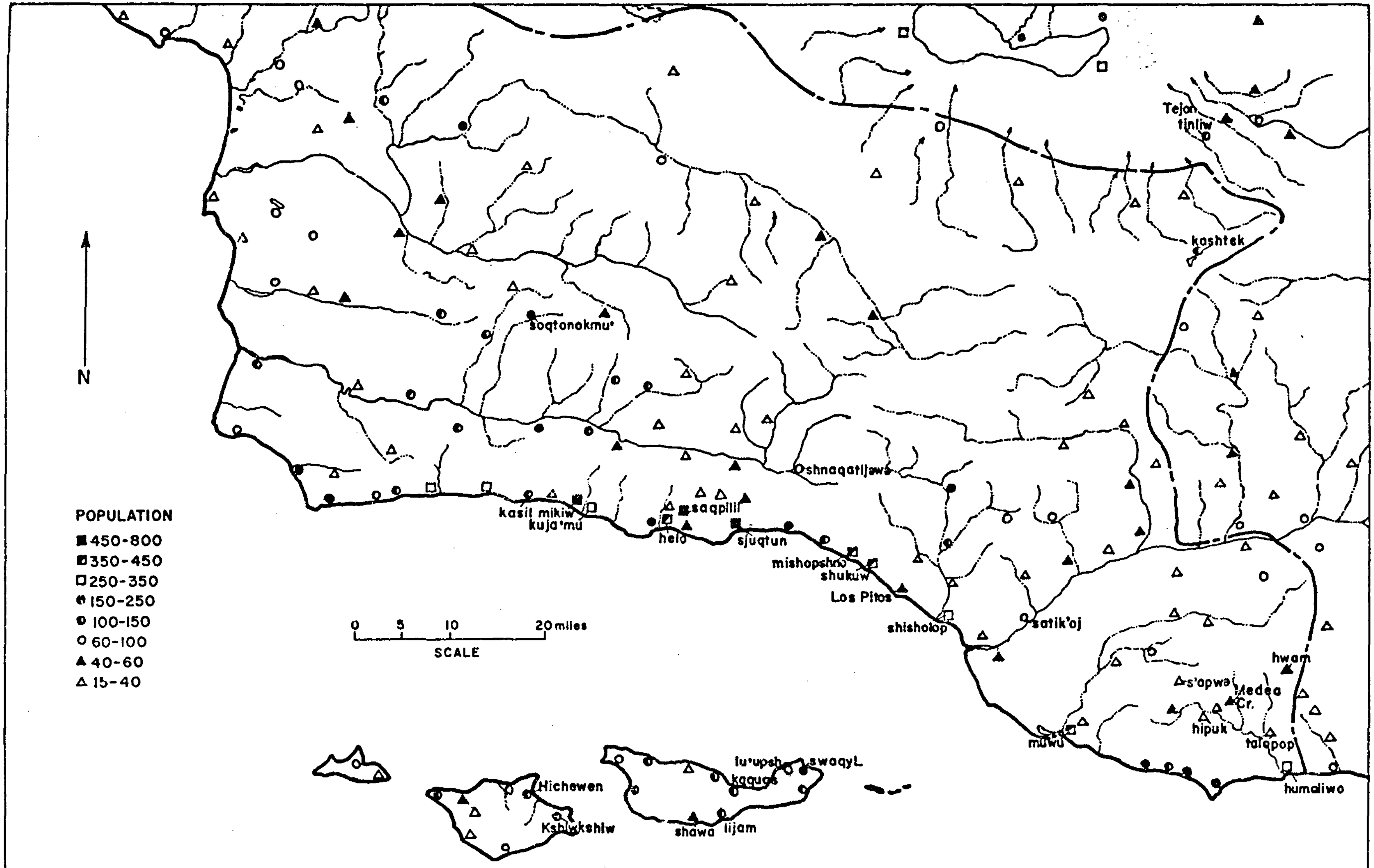


FIGURE II-41 Approximate 1760 Chumash Village Locations and Populations

(From King, Carpenter and Leonard, p.3)

distributions were in and around Santa Barbara. Thus the aboriginal populations show much the same distribution as modern ones. Destruction of these sites is reflected in the loss of archeological sites throughout Santa Barbara and Ventura Counties. Professional estimates are that in Santa Barbara County overall, 81% of archeological sites have been destroyed in recent times, primarily due to residential development, vandalism, roads, and highways, and industrial development. This figure of 81% site destruction in Santa Barbara County has recently been attacked as being too high, however, for the heavily populated (both prehistorically and historically) coastal areas this is still considered to be an adequate estimate (Dr. D. T. Hudson, personal communication). Because the impact of the undertaking will be focused in the coastal areas this estimate is appropriate. In Ventura County, it is estimated that 50% of all sites have been destroyed by these causes, (See Moratto, 1973, Appendix I).

A large number of sites have been excavated, with emphasis on cemeteries and recovering tools and food remains. However, there is considerable potential for controlled excavation to obtain information on subsistence, settlement patterns, and social structure. The history of man in the Santa Barbara Channel may begin as early as 30,000 years ago if split and burned dwarf mammoth bones on Santa Rosa Island are demonstrated to be the result of human activity. However, the validity of this find is open to question. The earliest human occupation that is generally accepted begins approximately 8000 B.C. on Santa Rosa Island. Traditionally, prehistoric cultures on the mainland coast have been assigned to one of three periods: Oak Grove (5000 - 1000 B.C.), Hunting People (3000 - ? B.C.), and Canalino (Beginning c. 2000 B.C.). Remains of the Oak Grove culture, the oldest period, are found on crests of high rounded hills adjacent to mountains--usually some distance from the sea. Reliance on plants and seeds for food is indicated by milling stones and manos, and some sites contain remains of shellfish.

The Hunting People's sites are found on coastal headlands and hillocks bordering sloughs. In contrast to Oak Grove sites they contain numerous projectile points and large amounts of bones of large sea and land mammals, together with some shellfish. Acorns were apparently exploited for the first time in this period. Large sites are few, by contrast with earlier and later sites.

The Canalino culture, oriented toward sea-fishing and acorn gathering, is essentially the prehistoric counterpart of the Chumash.

The interpretation of this traditional sequence is under question by several archeologists because the full settlement pattern and land-use relationships of these cultures are not clearly defined. (Spaulding and Glassow, 1972, Landberg, 1965). It has been further suggested that the prehistoric settlement on the coast may involve early sites on the Continental Shelf that have been submerged by the rising sea-level in post-Pleistocene times. Taking recent reconstruction of sea-level change in conjunction with significant differences between northern and southern California coastal archeology, this proposal is that sites pre-dating 7000 B.C. may well lie submerged on the Continental Shelf. It has also been proposed that the Hunting People, rather than being a distinctive group of Northwest Coast Immigrants, are only a continuation of a kind of coastal site which is now submerged, and may have been a part of the Oak Grove seasonal round (Bickel et al., 1973).

Evidence for prehistoric occupation of the Continental Shelf is presently limited to isolated finds of stone bowls or mortars recovered by divers offshore from Point Conception to Rincon Point. These have been found at depths of 15 feet to 60 feet and at distances of 30 yards to one mile from the shore. D. T. Hudson of the Santa Barbara Museum of Natural History has so far recorded 33 such finds reported by local divers, and has noted that they frequently occur on reefs at the edge of deep channels which may correspond to submerged arroyos. Perhaps three times this number have been informally reported. Presently the cause of their deposition is not known; further study of their context and their relationship to the shelf is necessary to interpret these underwater finds. Because of the uneven and rocky sea bottom, these sites can apparently be located only by diving.

Prehistoric occupation on the Channel Islands appears to relate closely to that of the mainland, with the exception of the still questionable early occupation suggested by burned pygmy mammoth bone. On the basis of incomplete survey, the three largest islands--San Miguel, Santa Rosa and Santa Cruz--all have a large number of archeological sites, with earliest occupation beginning approximately 8000 B.C. The cultural development appears to resemble that of the mainland, beginning with dependence on plant foods - indicated by manos and metates, and developing into a sea-oriented subsistence continuing into the historic period.

In summary, the Santa Barbara Channel represents one of the areas of heaviest native occupation in California. Because of its rich marine resources, the later periods of occupation represent a subsistence pattern and dense population duplicated few places in the world. Although the area has been frequently studied for the last 100 years, social organization, village patterns, economy and inter-regional relationships are subjects that offer potential for considerably more study. The evidence for early man in the area requires more substantiation. Large portions of the Islands, the Continental Shelf, and the area north of highway 101 are not well investigated.

b. Historical Resources

The first recorded exploration of the Santa Barbara coastal area was by Cabrillo and Ferrelo in October 1542. Because of stormy weather, they spent several days at or near Refugio Beach, where they were offered fresh sardines and other food by the Canalinos. Cabrillo reported the natives to be friendly, happy, and numerous. Later Cabrillo crossed to San Miguel where he died and was buried. A second Spanish explorer, Sebastian Vizcaino, entered the Channel on the feast day of Santa Barbara in 1602, and named the Channel and shoreline accordingly.

The earliest land exploration was led by Gaspar de Portola, accompanied by Padre Junipero Serra and his Franciscan monks in 1767, who took possession of Alta California in the name of the King of Spain. The party traveled up the coast through what is now Santa Barbara County, where they were offered seeds, acorns, and fresh fish by the native Indians. The same route was followed by Juan Bautista de Anza in 1774 and 1775 (Dibblee, 1950).

In 1782, Father Junipero Serra dedicated the site for a presidio. Mission Santa Barbara, 10th in a series of 21 Franciscan missions built in early California, was founded on December 4, 1786, 184 years to the day after Vizcaino's arrival. Santa Barbara Mission, known as the "Queen of the Missions," is the only one that has remained continuously in the hands of the Franciscans since its founding, and despite damage from storms and earthquakes, its altar light has never been extinguished. Other historic landmarks include two additional missions--La Purisma Concepcion and Santa Ynez, the Casa de la Guerra, completed about 1826 and described in Dana's "Two Years Before the Mast," and a stretch of coast used by smugglers and pirates around 1818.

As Spanish "conquistadores" entered during the 18th century, the culture of the native Indians gave way during an era when life centered in large ranches and Franciscan missions. When American explorers and troops invaded California during the 1840's, the rancheros prospered from business with Yankee traders. In 1846, General John C. Fremont and his troops came south by Foxen Canyon and over San Marcos Pass, and took Santa Barbara without resistance. After California was annexed to the United States in 1850, easterners settled in Santa Barbara County in ever increasing numbers (Dibblee, 1950). Santa Barbara County is one of the 27 original counties established in 1850.

Historic sites presently preserved on federal, state or county registers are almost entirely restricted to the impressive central structures of the Mission Presidio and Ranchos, and victorian structures of the merchants and farmers of the post-Statehood period. Little if anything has been done to identify, record and preserve structures representing less central elements of society: ranch and farm out-buildings, the adobes of laborers.

Primarily because of the hazards of navigating the channel, which is often rough, a number of shipwrecks are recorded in the channel, only one of which dates to the Spanish period. However, in view of the extensive sea routes along the California coast during the period of 1565 to the mid 1800's, discovery of Spanish period shipwrecks is probable and must be considered. The following list, taken from Gibbs (1962) and Askenazy (1973), gives those older than 50 years. A larger number have been sunk in the last 5 decades. This list can be taken only as an indication of known wrecks, with the recognition that there may be a number of others:

Santa Barbara:

San Sebastian	1754
Elizabeth	1847
Laura Bevin	1857
Chetco	1918
Jane L. Standard	1929

Gaviota:

Rosecrans (salvaged)	1912

Point Honda:

Edith	1848
Yankee Blade	1854
Seven U.S. Destroyers	1923

Point Conception:

Shasta	1906
Berkeley	1907
Lotus	1921
Thomas Crowley	1921

San Miguel Island:

Kate & Annie	1902
J. M. Colman	1905
Anubis (salvaged)	1908
Comet	1911
Watson A. West	1923
Cuba	1923

Santa Rosa Island:

Crown of England	1894
Golden Horn	c.1900
Dora Bluhm	1910
Aggi	1915

Santa Cruz Island:

Thornton	1910
International	1918
Babina	1923

Pitas Point:

McCullough	1918

Carpinteria:

Coos Bay	1914

Because of the rough water of the channel, wrecks of this age can be expected to have been broken up, and will probably not be discernible except through actual diving. These wrecks extend from the tidelands out to the deepest parts of the channel. Localities of many recorded wrecks are known to divers in the Santa Barbara area.

National Register of Historic Places

National Register entries for Santa Barbara and Ventura Counties are listed as follows. An asterisk indicates those designated National Historic Landmarks by the Secretary of the Interior.

Santa Barbara County

Lompos vicinity, *La Purisima Mission, 4 miles east of Lompoc.

Los Alamos vicinity, *Los Alamos Ranch House, 3 miles west of Los Alamos on old U. S. 101.

Santa Barbara, *Gonzales House, 835 Laguna Street.

Santa Barbara, Santa Barbara Presidio, bounded roughly by Carrillo, Garden de la Guerra, and Anacapa Streets.

Santa Barbara, *Santa Barbara Mission, 2201 Laguna Street.

Santa Barbara vicinity, Painted Cave, 11 miles north of Santa Barbara off Calif. 150.

Ventura County

Oxnard, Oxnard Public Library (Oxnard Chamber of Commerce--Art Club of Oxnard), 424 South C Street.

Ventura, Ventura County Courthouse, 501 Poli Street.

State Historical Landmarks

The following information was obtained from the California Department of Parks and Recreation (personal communication, 1974):

The staff for the State Historic Preservation Officer, has identified the following State Historical Landmarks:

#248	Gaviota Pass, 4 miles northeast of Gaviota, Santa Barbara County.
#306	Burton Mound, between Natoma Avenue and West Mason Street, Santa Barbara County.
#307	Casa de la Guerra, De La Guerra Plaza, Santa Barbara County.
#308	Covarrubias Adobe, 715 Santa Barbara Street, Santa Barbara County.
#361	Old Lobero Theater, 33 East Canon Perdido Street, Santa Barbara County.
#559	Hastings Adobe, 412 West Montecito Street, Santa Barbara County.
#636	Royal Spanish Presidio, East Canon Perdido Street, Santa Barbara County.
#721	Carillo Adobe, 11 East Carillo Street, Santa Barbara County.
#535	Carpinteria and Indian Village of Mishopshnow, City of Carpinteria, Santa Barbara County.
#784	El Camino Real, coast highway through Santa Barbara and Ventura Counties.
#113	Serra's Cross, City of Ventura, Ventura County.
#114	Reservoir of San Beunaventura Mission, City of Ventura, Ventura County.
#115	Olivas Adobe, 4 miles south of Ventura, Ventura County.
#310	San Buenaventura Mission, City of Ventura, Ventura County.
#309	Mission Santa Barbara, 2201 Laguna Street, Santa Barbara County.

In addition the following county and local landmarks are in the area:

1. Santa Barbara County (Point Conception to Ventura County Line).
2. Point Conception, Point Conception Lighthouse, 13 miles west of Gaviota.
3. Gaviota, Gaviota Landing, 1/2 mile southwest of Gaviota.
4. Tajiguas, Vincent Ortega Adobe Ranch, 3 miles east of Gaviota.
5. Tajiguas, Tajiguas Ranch, 4 miles northeast of Gaviota.
6. Naples, Dos Pueblos Prehistoric Sites, 9 miles west of Goleta.
7. Goleta, Sherman Stow House, 3 miles northwest of Goleta.
8. Goleta, Daniel Hill Adobe, 1½ miles west of Goleta.
9. Goleta, Sexton House, ½ mile east of Goleta.
10. Goleta, Mescalitan Island Area (prehistoric), 3/4 mile south of Goleta.
11. Goleta, Whaling Camp, 1 mile south of Goleta.
12. Goleta, Fremont Oak Tree, 2 miles north of Goleta.
13. Goleta, Old Stage Road (slippery rock), 3 miles north of Goleta.
14. Goleta, Cathedral Oaks, 2 miles northeast of Goleta.
15. Goleta, largest bay tree in the world, 2 miles northeast of Goleta.
16. Santa Barbara, Hope Home, 4 miles west of Santa Barbara.
17. Santa Barbara, Cienequitas Indian Village and Chapel site, 4 miles northwest of Santa Barbara.
18. Santa Barbara, Glendessary Home, 2 miles north of Santa Barbara.
19. Santa Barbara, Henry Perry House, ½ mile west of Santa Barbara.
20. Santa Barbara, Botiller Monterey Two Story Adobe, Downtown Santa Barbara.

21. Santa Barbara, Bruno Orella Adobe, Downtown Santa Barbara.

22. Santa Barbara, Deshine House and Chapel, 3/4 mile south of Santa Barbara.

23. Santa Barbara, Hunt/Stambach House, 3/4 mile southeast of Santa Barbara.

24. Santa Barbara, Fernald House, 1 mile southeast of Santa Barbara.

25. Santa Barbara Moreton Bay Fig Tree, 1 mile south of Santa Barbara.

26. Santa Barbara, Mispu Prehistoric Site, 1 mile south of Santa Barbara.

27. Montecito, Hosmer Adobe, 4 miles northeast of Santa Barbara.

28. Montecito, Casa San Ysidro Adobe, 4½ miles northeast of Santa Barbara.

29. Montecito, Massini Adobe, 4 miles east of Santa Barbara.

30. Summerland, first oil well in Summerland, 5 miles east of Santa Barbara.

31. Summerland, Fleischmann House, 7 miles northeast of Santa Barbara.

32. Carpinteria, Heath Adobe, 1½ miles northwest of Carpinteria.

33. Carpinteria, Carpinteria Tar Pit, just southwest of Carpinteria.

34. Ventura, first oil production site in Ventura County, between Ventura and Ojai.

35. Ventura, Ortega Adobe, West Main Street (Ventura).

36. Camarillo, Adolfo Camarillo Victorian House, Camarillo.

The Wardholme Torry Pine has been determined as a State Point of Historical Interest in the City of Carpinteria, Santa Barbara County.

Sanctuaries

In 1963, the Department of the Navy and the National Park Service completed a cooperative agreement by terms of which the National Park Service assumes responsibility for the natural, historical, and archeological resources of San Miguel Island (which is known to contain at least 50 ancient village sites of various Indian cultures).

Anacapa and Santa Barbara Islands constitute the Channel Island Monument. Several legislative proposals have been put forth to establish or to study the establishment of a Channel Islands National Park, comprising Santa Cruz, Santa Rosa, San Miguel, Santa Barbara and Anacapa Islands.

12. Aesthetics and Land Use

a. General Description

The approximately 100 miles of coastline between Point Conception and Point Dume illustrate a variety of coastal zone amenities, geologic formations, landform features, biotic communities, population densities, and land/ocean uses. Integral with amenities are the numerous combinations of water, climate, physical form, geology, vegetation, open space and wildlife.

The northwestern portion of the Santa Barbara Channel region is one of the more attractive areas of southern California. Like much of coastal California, both mountainous terrain and the sea contribute to its appeal. The lofty tree- and brush-covered Santa Ynez range rises from grassy hills near Point Conception and extends eastward across the northern part of the region. Slab-like outcrops of rocks form distinctive patterns on the higher southern slopes of the mountains. Numerous valleys (cañadas), through which small intermittent streams flow, cut the rolling southern foothills of the range. Grass and brush are common at lower elevations and trees line some of the stream beds. During the "wet" season the grass is green and wild flowers abound. During the dry season the grass is golden. Citrus groves are cultivated on many of the valley floors. Precipitous cliffs, occasionally interrupted by stream valleys, overlook the shoreline. Long straight sandy and rocky beaches alternate with rocky headlands along the shoreline. The majestic hills and mountains on the Channel Islands, 30 to 35 miles south of the shoreline, may be seen rising from the sea on the relatively rare days when fog and haze are absent.

Part of the charm of the northwestern portion of the Santa Barbara Channel is its rural, undeveloped setting. The area's remote location from major southern California population centers so far has preserved this pastoral setting. Evidence of human activities include widely scattered citrus and cattle ranches, stores and service stations, park and other recreational facilities, and oil and gas field facilities.

Several oil fields are present onshore and many of the structures are screened from casual view by topography and vegetation. Production of oil and gas from oil and gas fields on State tidelands is transported to storage and treatment facilities onshore. Several of these facilities are present near the coastline in the northwest portion of the Santa Barbara Channel region.

U. S. Highway 101 and the Southern Pacific Railroad extend westward along the shoreline to the settlement of Gaviota where the highway turns northward, and the railroad continues along the coast to Point Conception and beyond. A road extends northward over the Santa Ynez mountains from Refugio Beach State Park. All other roads in the northwest portion of the Santa Barbara Channel are unimproved.

Many people pass through the Santa Barbara Channel region. U. S. Highway 101 and the Southern Pacific Railroad are major arteries connecting southern and northern California population centers. In addition, many people choose to drive along the coast when visiting the tourist attractions of Ventura and Santa Barbara Counties, including inland Buellton and Solvang. However, because of its remoteness from major population centers, relatively few people stop to use particular parts of the area. Beaches and surfing areas are frequently uncrowded, pleasure boats are rare, but campgrounds are often full. To the casual observer passing through the area by automobile or railroad train, the northwest portion of the Santa Barbara Channel region appears rural and pastoral. Many of the onshore structures are obscured from view by topography and natural vegetation. The impact of offshore structures is diminished by distance from shore and the common occurrence of fog and haze.

Aesthetic values, unique to the individual, are not necessarily diminished. The California Comprehensive Ocean Area Plan (no date, P. II-9) enumerates some coastal zone amenities. Included among others are: visual,feelings, sound, surf, steep cliffs of rocky headlands, long beaches, marsh grasslands, shorebirds, fishing boats, port activities, tidepool exploration, salt-laden air, and wildlife.

> "The amenities of the coastal zone, though, are more than these various combinations of natural features. Man has imprinted his character on the land and waterscape by his very presence and by his artifacts, his roads, buildings, piers; intensive agricultural development characterizes much of the coastal zone. In many portions of the coastal zone, particularly in the southern part of the State, the landscape is definitely man-dominated. Houses and commercial structures are strung along the often narrow beaches and terraces, and placed on man-shaped hills or cling precipitously to the cliffs to satisfy the longing for an ocean view. The broad plains are occupied by large cities, and the protected waters used for ports and recreational boating. These man-made additions often lend variety and interest. The ports each have their own character, with their variety of rather unique activities. In other instances, though, this variety and interest is not present, and homes situated side by side obscure ocean views; vast parking lots dominate the setting; and countless other additions, such as the seemingly ever-present forest of signs, depreciate the environment."

(See California Comprehensive Ocean Area Plan, no date, p. II-10)

Oil Structures

There is no disputing of aesthetic tastes. For example, one artist found a "source of inspiration" in oil derricks in the ocean near Ventura (Saturday Review, 1972, p. 48). To others, oil structures are a "blight", of "moderate interest", or "passively ignored".

> "The important thing to stress is that in dealing with an oil rig you are dealing with a practical functional structure. Attempts to disguise this fact rather than to face it squarely and develop a satisfactory solution to the problem are inevitably doomed to aesthetic failure. We must also recognize that aesthetics are an important consideration in the design of any large structure exposing itself to the public view. The challenge is clearly here today but so are many of the answers if we will simply apply ourselves to the task of seeking them out. Each structure that we build, for whatever purpose it may serve, has the potential of becoming another monument to aesthetic apathy or a visual asset to the community." (County of Santa Barbara, 1967, p. 6-10)

The publication cited details (p. 6-1 through 6-20) functional design and harmony with the environment. To some, however, any visible component of oil and gas production will be aesthetically objectionable.

Public Opinion and Offshore Oil Drilling

Hetrick (1973) utilized a procedure known as a "stratified multi-stage area sample, with individual selection at the final stage" in order to sample public opinion on the coastal zone environment. Details of this survey, conducted in 1972, are presented in the Introduction to the publication.

"It is interesting to compare the survey question which elicits the respondents' views toward environmental problems in general with the question dealing with attitudes toward offshore oil drilling in Santa Barbara. While 73 percent of the respondents thought general environmental concerns constituted "serious problems," only 53 percent gave this response when asked about the offshore oil drilling. It appears that, in spite of the disastrous oil spill in Santa Barbara in 1969, many local residents are less concerned about drilling in the Channel than with other environmental issues. The wide publicity given general environmental problems such as air pollution and the population explosion was probably a factor in this. In addition, the length of time since the oil spill could have had some effect on decreasing the saliency of this issue. Another possibility is that many of the respondents were satisfied with governmental restrictions placed on offshore drilling since the spill. However, 82 percent of the sample favored either a halt in offshore drilling or tightening the regulation of the drilling." (See Hetrick et al., 1974.)

The following tabulations summarize responses regarding offshore oil drilling, as related to attitudes (Hetrick, 1973, p. 72-73).

QUESTION NUMBER 30

Question: Would you say that present offshore oil drilling in the Santa Barbara Channel is a serious problem; a problem, but not so serious; or not a problem at all?

Response Categories	County Total	North County	South Coast	Goleta (excluding Isla Vista)	Santa Barbara City
	RESPONSES (IN PERCENT)				
1. A serious problem	53	41	58	52	61
2. A problem, but not so serious	35	40	32	37	29
3. Not a problem at all	4	5	4	5	4
4. It depends, can't say	8	13	5	6	6
5. No response	0	1	0	0	0
TOTAL (%)	100	100	99	100	100
N =	523	172	351	123	181

QUESTION NUMBER 31

Question: What is the main reason that you think offshore drilling is a problem: Is it because of the tar on the beaches, because of another possible big oil spill, because the platforms are ugly, because offshore drilling will attract too many new people and industry to the Santa Barbara area, or is it for some other reason?

Response Categories	County Total	North County	South Coast	Goleta (excluding Isla Vista)	Santa Barbara City
	RESPONSES (IN PERCENT)				
1. Tar on beaches	6	6	6	6	6
2. Oil Spill	44	49	41	41	44
3. Platforms ugly	5	4	6	6	6
4. New people and industry	1	1	1	2	1
5. All of above or some combination of these	28	19	32	30	29
6. Other ____________ (please specify)	12	16	10	12	11
7. It depends	1	3	1	1	1
8. No response	4	2	4	3	3
TOTAL (%)	101	100	101	101	101
N =	462	141	321	112	162

NOTE: Question asked only of those who answered "A serious problem" or "A problem, but not so serious" in Q. 30.

b. Detailed Description of Santa Barbara and Ventura County Viewshed

The following is a detailed description of the Santa Barbara and Ventura County shoreline as presented in the national Shoreline Study California Regional Inventory, U. S. Army Corps of Engineers, San Francisco, California, August 1974, pages 63-73.

(1) Santa Barbara County

The northern portion of this county is characterized by prominent rocky headlands which separate stretches of sandy beach backed by cliffs. This region of rocky headlands marks a change from the dominant north-south trend of the California Coast to an east-west trend beginning at Point Conception (mile 49). The southern portion of the Santa Barbara County shoreline is along this east-west trend and consists of narrow sandy beaches predominantly backed by cliffs or low bluffs.

A majority of the coastline is privately owned; however, there is the Federally owned Vandenberg Air Force Base which is not available for public recreation.

Shoreline protection north of Point Conception consists of seawalls to protect threatened portions of highway and railroad line. The primary erosion problem is the critically eroding beaches south of Santa Barbara Harbor (mile 96).

Mile 0.0 to 5.4

From the Santa Barbara County line, southward to Point Sal, is a sandy beach backed by sand dunes and cliffs. This stretch of coastline is privatley owned and is suitable for recreation, but there are no provisions for public recreation. The shoreline is non-eroding for 0.4 mile, while the remaining

5.0 miles is eroding non-critically.

Mile 5.4 to 18.2

This is a hook-shaped bay segment of coastline which, in the northerly portion, is rocky and backed by cliffs. The shore in the southern part of the segment becomes sandy with a long, wide beach suitable for recreation. The backshore consists of sand dunes.

The northernmost part of this hook-shaped bay is privately owned, while the remainder consists of Point Sal State Beach and Vandenberg Air Force Base, both of which are available for recreation to military personnel only. This shoreline is non-eroding for 3.0 miles and is eroding non-critically for 9.8 miles.

Mile 18.2 to 49.6

This stretch of the California coastline, ending at Point Conception, is rocky cliffs. Point Conception marks a change in the predominantly north-south trend of the California coastline to an east-west trend which extends into Ventura County. Both the rocky shoreline and sandy beaches along this coastline region are backed by cliffs.

The northern 11.8 miles of this shoreline consist of Vandenberg Air Force Base. The remainder is privately owned with two exceptions - the Coast Guard Reservation at Point Conception and Jalama Beach Park (mile 43), which is administered by the county.

There is approximately one-half mile of seawall protection between Jalama Beach Park and Point Conception for the Southern Pacific Railroad line. There is a short breakwater forming an abandoned Coast Guard lifeboat station approximately three miles east of Point Arguello (mile 32). This reach of coastline is experiencing non-critical erosion between the non-eroding headlands.

Mile 49.6 to 84.0

This stretch of shoreline is quite uniform, being a narrow, sandy beach backed by bluffs and low cliffs. The coast is privately owned, with the exception of approximately five miles set aside for public recreation. Beach access for public recreation is available at Gaviota State Park (mile 63), Refugio State Beach (mile 72), and El Capitan State Beach (mile 75). The shoreline is essentially undeveloped; however, non-recreational developments consisting of piers with oil derricks and oil tank farms are in the eastern portion.

A 0.2 mile segment of the highway and railroad near Refugio State Beach and a 1.0 mile segment of El Capitan Beach are threatened by critical erosion. The remaining 33.2 miles of shoreline is eroding non-critically.

Mile 84.0 to 95.9

A sandy beach backed by cliffs extends to Santa Barbara Harbor with the beach becoming very narrow in some portions. Goleta Slough empties into the sea over a small sandbar one mile east of Goleta Point (mile 86).

Approximately half of this shoreline is privately owned, while the remainder is owned mainly by the State, including the University of California at Santa Barbara located on Goleta Point. The seacliffs in this area are receding at a rate of about 0.5 foot per year. Beaches for public recreation include Goleta State Beach and Arroyo Burro State Beach. There is a Federal Reservation for the lighthouse at Santa Barbara Point (mile 95). The one and one-half miles of beach along the University of California site are not available for public recreation. The coastline is experiencing non-critical erosion.

Mile 95.9 to 110.0

The southern portion of Santa Barbara County's shoreline from Santa Barbara Harbor to the county line consists predominantly of sandy beach, with localized rocky portions. It is backed by residential and commercial developments along more than half its length.

The shoreline is primarily privately owned. The main exceptions are Santa Barbara Harbor, Carpinteria State Beach and Carpinteria Beach Park, which is administered by Santa Barbara County. Carpinteria Marsh is privately owned.

The beaches downcoast from Santa Barbara Harbor are narrow and are mainly backed by developments. Santa Barbara Harbor is protected by a breakwater which entraps littoral sand drift that is continuously dredged and bypassed to the downcoast beaches. There are a few groins and revetments protecting isolated portions of the coastline. In addition to the beach fill, groin fields from Goleta to Carpinteria (mile 96.5 to 110.0) may be suitable protection to assist in stabilizing the beaches due to the critical erosion along this shoreline.

San Miguel Island

San Miguel is the westernmost of the Channel Islands. Its western point is a little over 25 miles south of Point Conception Lighthouse and its eastern point is about 2.7 miles west of Santa Rosa Island. It has 24 miles of sandy beaches, scenic cliffs, and sea caves. There are several places where anchorages and landings are possible, Cuyler Harbor being the largest. However, the island is owned by the U. S. Navy and landing is ordinarily not permitted. No facilities are maintained on the island. The shores are bold, broken, and rocky; however, there are a few short stretches of sand beach and pocket beaches with a total length of about 6 miles. The coastline is experiencing non-critical erosion.

Santa Rosa Island

Santa Rosa Island lies about 27 miles southwest of Santa Barbara Harbor. The island is entirely private property belonging to the Vail Estate, and is operated as a cattle ranch with a small portion under cultivation. A small military installation is on the island's south side.

The shoreline is approximately 44 miles long, and is predominantly bold, high, rocky cliffs. There are approximately 12 miles of sandy shoreline including long, low sand spits with beaches backed by sand dunes found at the western end of the island. The shoreline is eroding non-critically.

Santa Cruz Island

The west end of Santa Cruz Island is about 22 miles south-southwest of Santa Barbara and the east end about 24 miles south-southeast of Santa Barbara. It is the largest of the Channel Islands having approximately 60 miles of shoreline. The shores are high, steep, and rugged with numerous points and indentations, and is famous for its sea caves. The island has numerous anchorages and landings, and sandy shoreline is found in pocket beaches along the eastern end of the island and in harbors along the north-eastern side. The shoreline is eroding non-critically. The entire island is owned by two families, with permission from the owners required for public landing.

(2) Ventura County

Ventura County has approximately 41 miles of coastline which is predominantly sandy beach with some rocky coastline at the southern end. The backshore is developed over much of its length, especially in the vicinities of Ventura (mile 14) and Port Hueneme (mile 24). Bluffs are found in the backshore along the northern portion of the county, and cliffs are found along the southern portion. In addition, there are significant lengths of lowlands in the backshore.

A majority of the county's central coastline is publicly owned and available for recreation with the primary exception being the Point Mugu Naval Reservation (mile 31). Harbors along this coastline include Ventura Marina (mile 16), Channel Islands Harbor (mile 22), and Port Hueneme Harbor (mile 24). Critical erosion is occurring along 10.3 miles of the county's shoreline.

Mile 0.0 to 15.8

This section of coastline begins at Rincon Point and extends to the city of Ventura. It consists of a very narrow cobble beach which provides little protection to the backshore from wave erosion. The beaches in some locations are so narrow that there is no exposed beach at high tide while the backshore consists of low bluffs approximately 20 to 30 feet in elevation. The northern shoreline is developed as petroleum installations, while the southern portion is the city of Ventura.

This coastline is privatley owned except for portions of state and county parks. These are: Hoffman, Hobson, and Faria County Parks, and Emma Wood Beach State Park and San Buenaventura State Beach. The state, under the jurisdiction of the Division of Highways, also owns portions of shoreline between the highway and the mean tide line.

Approximately nine miles of bulkhead or revetment presently exist along this stretch of coastline due to the narrow beach backed by steep mountains. There are approximately two miles of San Buenaventura State Beach protected by groins. The remainder of this coastline is considered to be under critical erosion. Suitable protection would be revetments, similar to those constructed, or groins and beach fill. An example of a typical groin field is given in Figure 41a.

Mile 15.8 to 33.8

A sandy beach extends from the northern jetty of the Ventura Marina to Point Mugu. Much of the backshore consists of lowlands and includes the coastal plain and lagoons of the Santa Clara River and Mugu Lagoon. The remainder of the backshore consists of sand dunes and developments.

More than seven miles of this coastline are owned by the Federal government, consisting of Point Mugu Naval Reservation and the Naval reservation at Port Hueneme. The remainder of the shoreline consists of McGrath State Beach and county, city and private ownership. The shoreline owned by local governments is used primarily for recreation. Ventura Marina, Channel Islands Harbor, and Port Hueneme Harbor are along this stretch of coast. Port Hueneme Harbor is part of the naval reservation and is also used by commercial interests.

Existing protection along this segment of coastline consists of breakwaters at harbor entrances and groins protecting developed portions of Point Mugu Naval Reservation. Critical erosion periodically occurs north of the entrance to Mugu Lagoon, at Ventura, Oxnard Shores (mile 20), Port Hueneme, and Laguna Point (mile 31). Additional groins with beach fill in these areas would be suitable to stabilize the beach. (Figure 41a)

Mile 33.8 to 41.2

The coastline from Point Mugu to the Ventura-Los Angeles county line consists entirely of a sandy beach backed by cliffs. The beach is generally narrow,

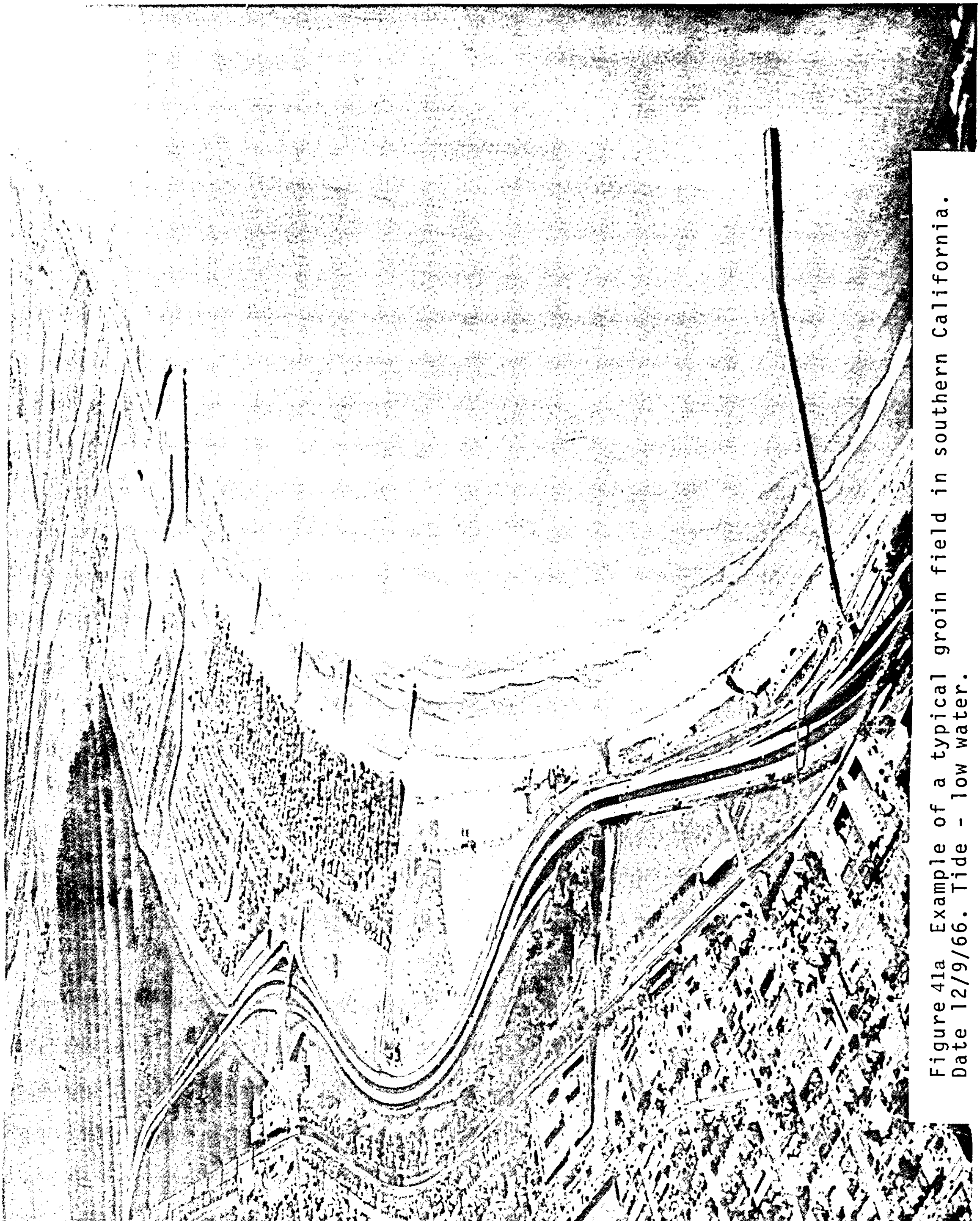


Figure 41a Example of a typical groin field in southern California.
Date 12/9/66. Tide - low water.

100 to 300 feet wide, and interrupted by small rocky protrusions. The highway is immediately behind the beach due to the Santa Monica Mountains along this portion of coastline.

Three miles of this coastline fall within the Point Mugu State Recreation area, with the remainder privately owned and undeveloped.

Revetments exist along segments of the shoreline where the highway is threatened by wave erosion. Approximately 6,000 feet of additional revetment would be suitable protection for areas of critical erosion.

Anacapa and Santa Barbara Islands

These two islands' approximate 20 miles of coastline are considered together due to similar physical characteristics, and both are administered by the National Park Service. These islands represent the Channel Islands National Monument. They are both characterized by seacliffs up to 500 feet height with a few small rocky bays and insignificant sandy pocket beaches. Erosion is noncritical. (Santa Barbara Island is part of Santa Barbara County.)

c. Land Use

(1) Santa Barbara County Coast

The Santa Barbara County Coast is 101.2 miles of beach (46 percent) and 118.6 miles of non-beach (54 percent). Private parties own 168.1 miles of the coastline (76 percent), while the Federal government owns 36.7 miles (17 percent), the remaining 15 miles is owned by other public agencies (7 percent).

Recreation is the main use of the coast with 13.3 miles of public recreation (6 percent) and 9.3 miles of coastline used for private recreation (4 percent). Non-recreation development accounts for 6.4 miles of coastline (3 percent) but the vast majority of the Santa Barbara County Coast, 190.6 miles (87 percent), is undeveloped. (Table II-54)

(2) Ventura County Coast

The entire 41.4 miles of Ventura County Coastline (excluding Anacapa Island) is beach front. The Federal government owns 27.2 miles or 44 percent of the total while 21.3 miles (34 percent) is owned by other public agencies with the remaining 12.7 miles (21 percent) being privately owned.

Public recreation uses 38.2 miles of the coast (62 percent) and private recreation 2.7 miles (4 percent). Non-recreational development accounts for 8.8 miles of coastline (14 percent) with the remaining 11.5 miles (19 percent) being undeveloped. (See table II-54 , figure 41b and 41c).

(3) Land Use Characteristics

Figure 41b depicts a land use map for the southern California coast. Land use is described as urban, agricultural, and undeveloped or vacant. As can be seen from figure II-41d much of the Santa Barbara and Ventura County Channel coastline is developed for urban or agricultural use while the northern Santa Barbara County coastline is still undeveloped. Downcoast from the northwestern portion of the Santa Barbara Channel region, population and land-use characteristics vary considerably as indicated by the following data.

LAND AREA AND POPULATION OF
SOUTHERN CALIFORNIA COUNTIES, 1960-1970

	LAND AREA (sq km)		POPULATION (thousands)			
			Total		In Coastal Basin	
	Total	In Coastal Basin	1960	1970	1960	1970
Santa Barbara	7,090	750	169	264	91	150
Ventura	4,830	4,150	199	376	198	374
Los Angeles	10,540	7,410	6,039	7,032	5,979	6,949

LAND USE CHARACTERISTICS
(BY HYDROLOGIC UNIT, 1971, IN SQ KM)

Hydrologic Unit	Residential	Commercial	Industrial	Public	Agricultural	Total Developed	Wilderness	Total Land Area
Santa Barbara/ Rincon	27	7	13	140	27	214	620	834
Ventura	28	6	37	63	188	322	269	591
Santa Clara/ Calleguas	114	55	24	1,498	426	2,117	2,882	4,999
Malibu	12	2	2	100	1	117	510	627
Los Angeles/ San Gabriel	1,498	194	320	1,501	291	3,804	1,262	5,066

(See Southern California Coastal Water Resources Project, 1973, p. 40-45)

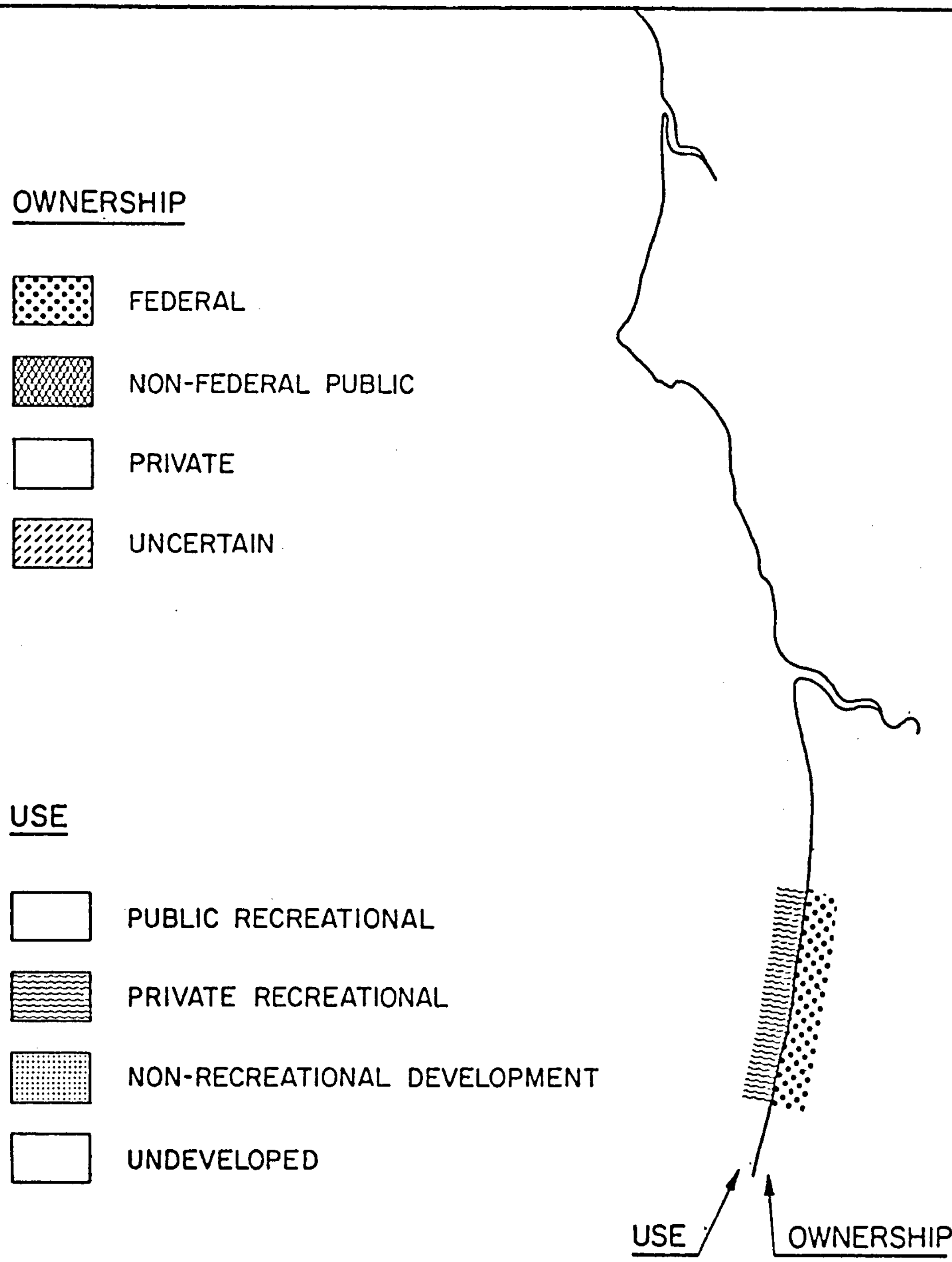
TABLE II-54

COASTLINE CLASSIFICATION
by County 1971
(Includes Channel Islands)

Physical Characteristics	Santa Barbara	Ventura	Los Angeles	Orange	San Diego	Total
Beach	101.2	41.4*	86.8	34.2	71.7	335.3
Non Beach	118.6	0	88.1	7.8	103.3	317.8
Coast Ownership						
Federal	36.7	27.2	28.6	0.8	93.8	187.1
Other Public	15.0	21.3	56.3	25.0	45.3	162.9
Private	168.1	12.7	90.0	16.2	35.9	322.9
Coast Use						
Recreation, Public	13.3	38.2	36.5	25.5	52.6	166.1
Recreation, Private	9.5	2.7	22.5	13.6	12.2	60.5
Non Recreation Development	6.4	8.8	31.0	1.8	21.8	69.8
Undeveloped	190.6	11.5	84.9	1.1	88.4	376.5

*Excludes Anacapa Island

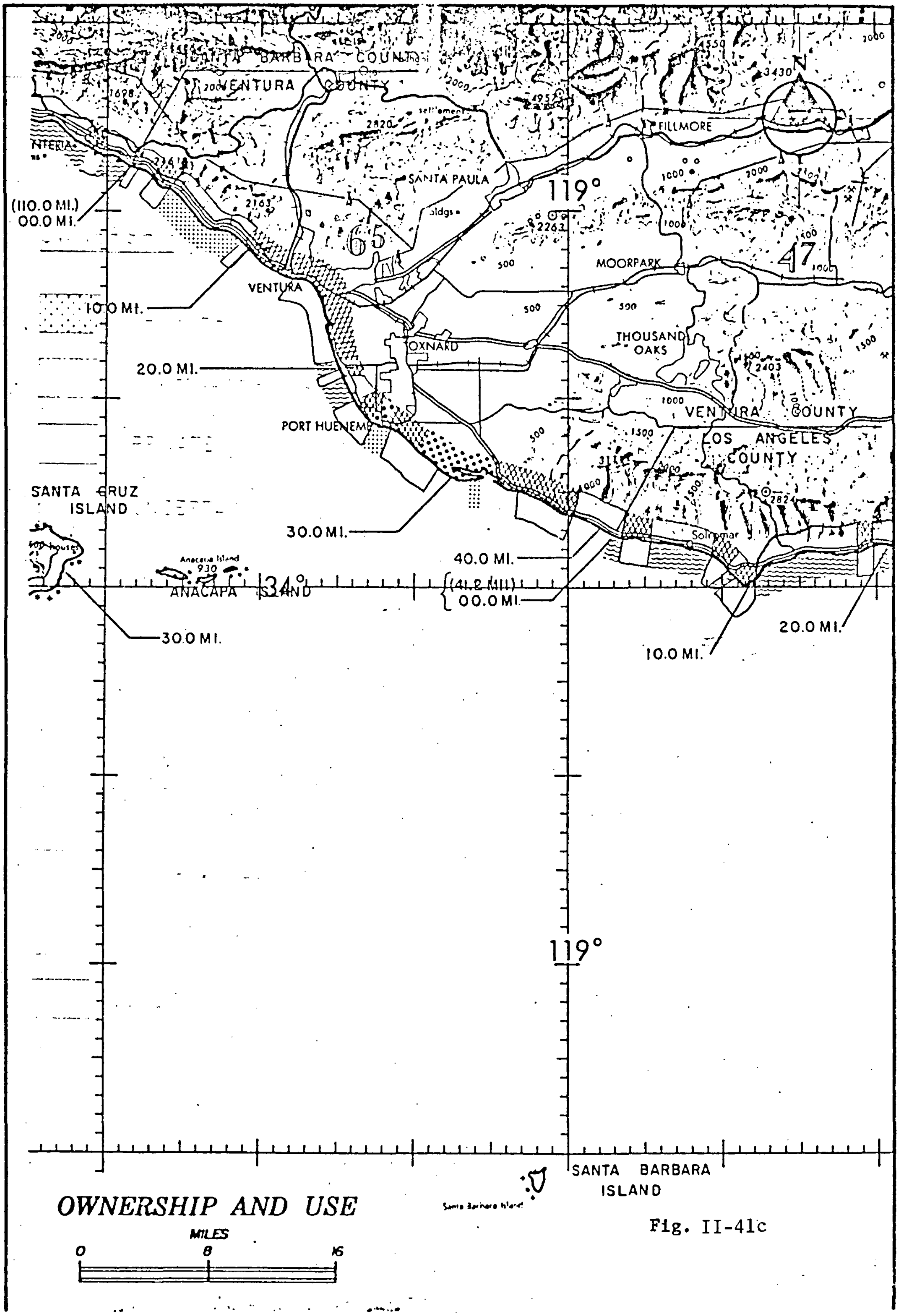
Source: U. S. Corps of Engineers 1971



LEGEND

OWNERSHIP AND USE

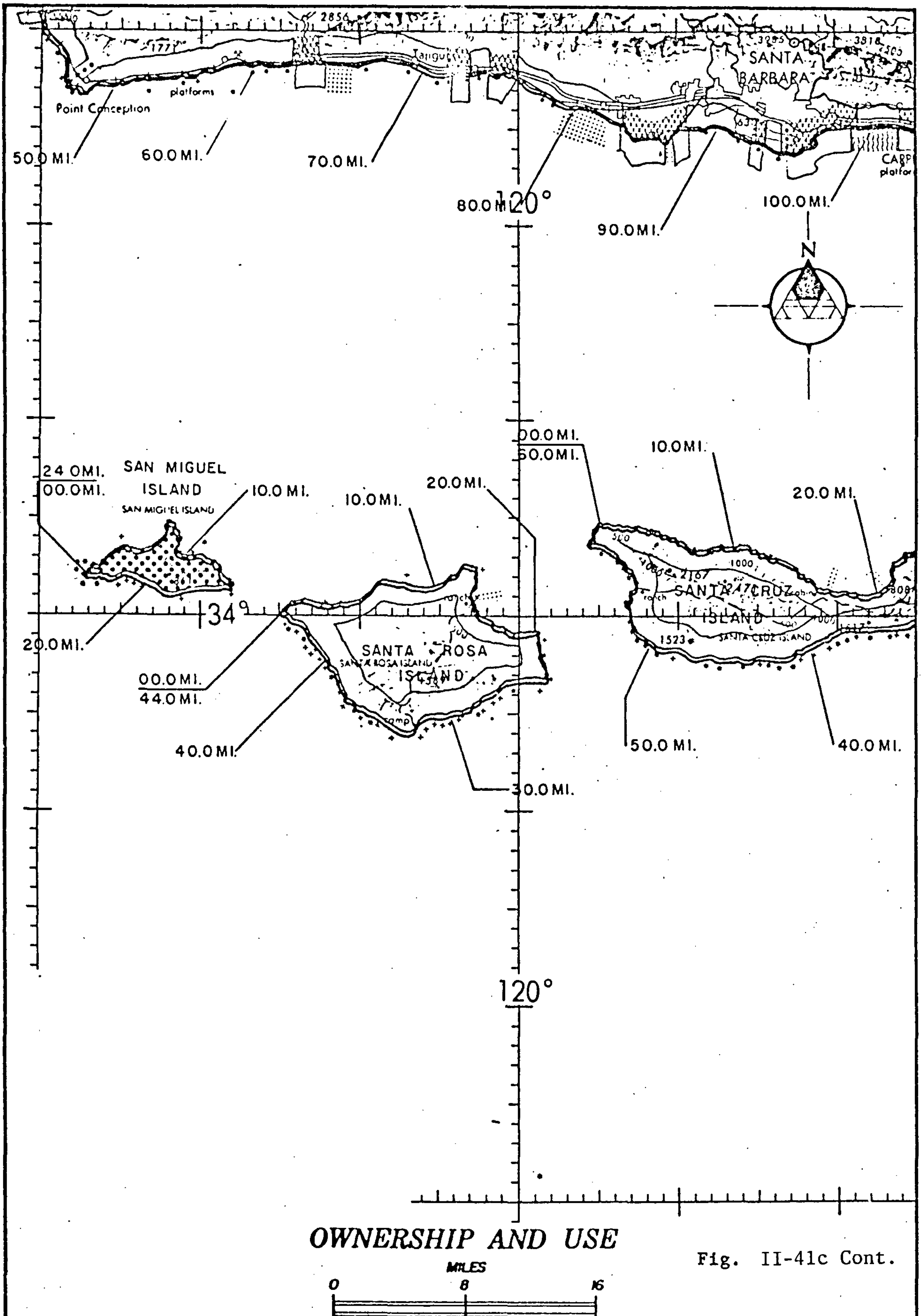
Fig. II-41b



OWNERSHIP AND USE

MILES
0 8 16

Fig. II-41c



OWNERSHIP AND USE

Fig. II-41c Cont.

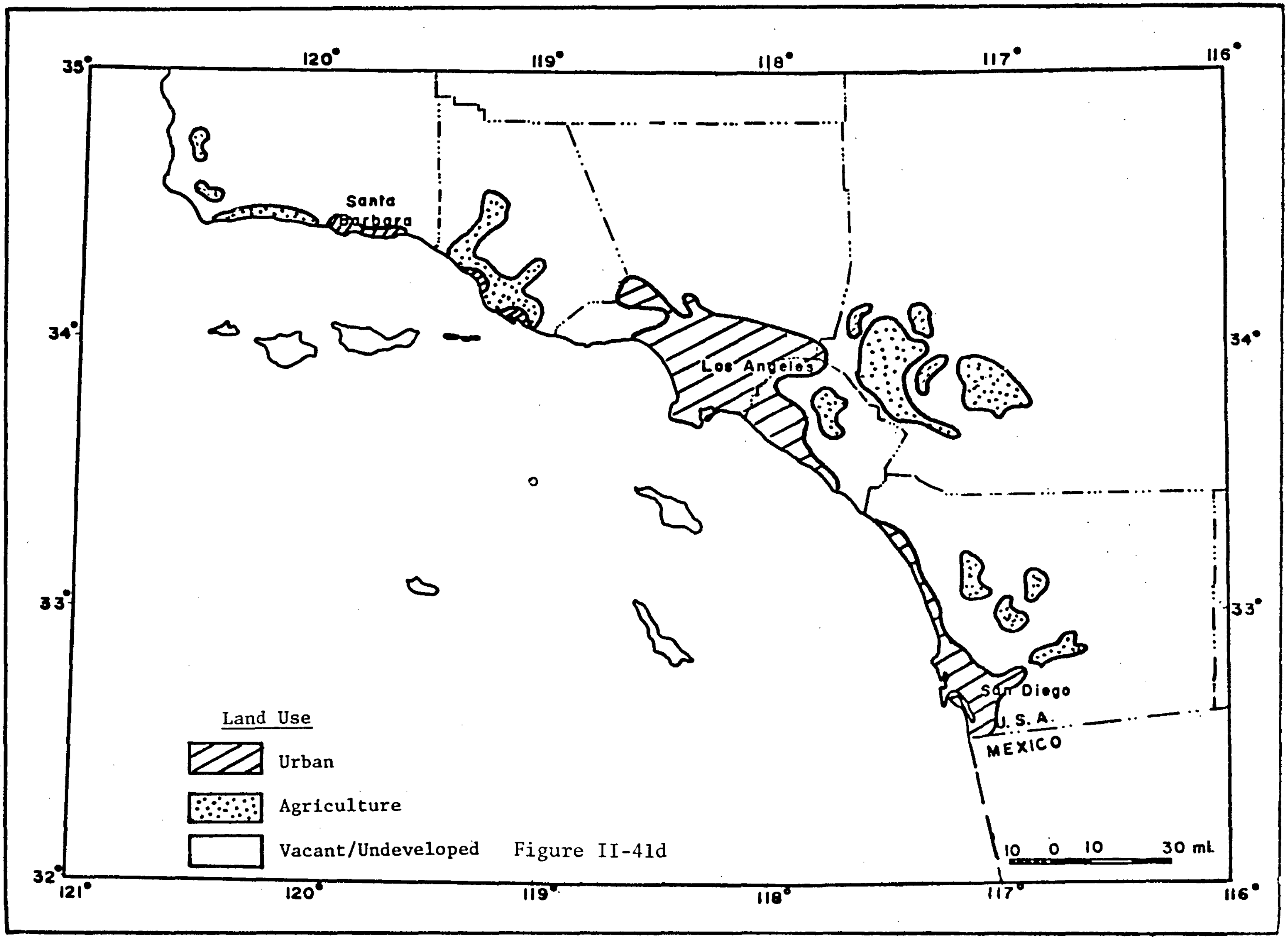


Figure II-41d

13. Mineral Resources

The total value of mineral production from Ventura and Santa Barbara Counties is shown in table II- 54a. Total value of Santa Barbara County's mineral industry was down nearly $2 million from the 1970 total value of $104.9 million. The value of Ventura County's mineral industry was up nearly $8 million. The increase is attributed to new interest in the clay and decorative stone markets.

In past years, mineral deposits in Santa Barbara County have yielded gold, platinum, bituminous rock, clay for brick, and potash. Other mineral deposits that have not been developed include barite, chromite, copper, gilsonite, gypsum, and manganese. Lime was produced by Union Sugar Division, Union Sugar Company for use in its sugar refinery in Santa Barbara County in 1970 and 1971. A small quantity of phosphatic shale, averaging about 4 percent P_2O_5, was developed by Cuyama Phosphate Corporation in 1970 from an open pit near New Cuyama, Santa Barbara County for use as a soil conditioner.

Muscovite (mica), borates, and minor amounts of phosphate, amber, and uranium have been reported in Ventura County. Gypsum deposits from Cuyama Wash, Ventura County, have been developed by the Monolith - Portland Cement Company.

The principal mineral commodities in Ventura and Santa Barbara Counties, other than fossil fuels, includes mercury, diatomite, and sand and gravel deposits. The location of these deposits is shown on figure II-42.

a. Mercury

Mercury was discovered in the Santa Ynez Mountains in Santa

TABLE II-54a

VALUE OF MINERAL PRODUCTION IN
SANTA BARBARA AND VENTURA COUNTIES, 1971

Commodity	Quantity	Value
Santa Barbara County		
Petroleum	19,221,000 42-gallon bbls.	$ 52,281,000
Natural Gas	50,699,000 mcf.	16,528,000
Sand and Gravel	1,190,000 short tons	1,569,000
Unapportioned (diatomite, lime, mercury, natural gas liquids, and stone)		32,906,000
	TOTAL VALUE	$103,284,000
Ventura County		
Petroleum	23,579,000 42-gallon bbls.	$ 64,135,000
Natural Gas	33,030,000 mcf.	10,768,000
Sand and Gravel	4,872,000 short tons	4,842,000
Unapportioned (clay, natural gas liquids, and stone)		9,573,000
	TOTAL VALUE	$ 89,318,000

Source: California Division of Mines and Geology, "Mineral Production - Santa Barbara and Ventura Counties, 1971.

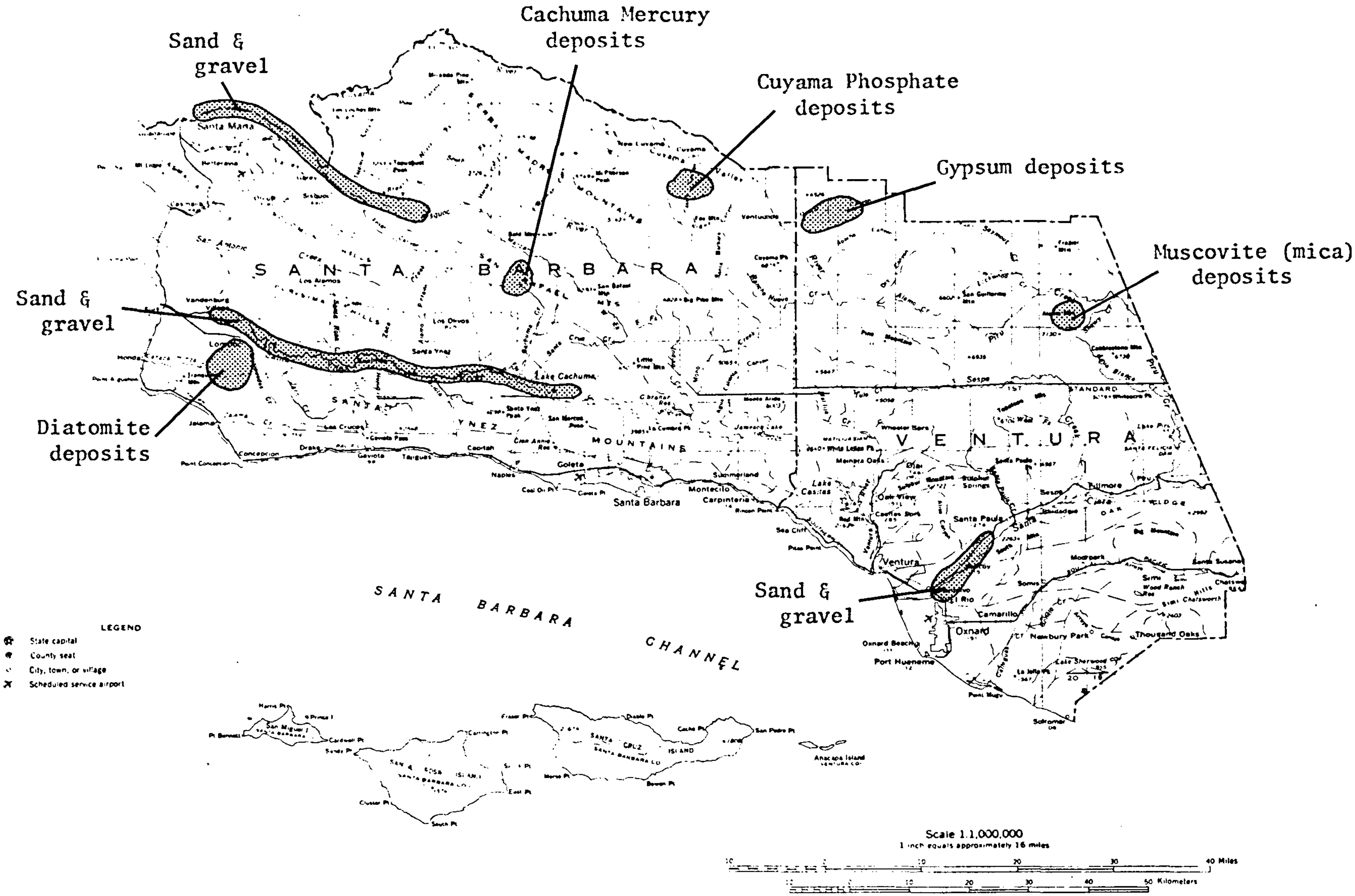


Figure II-42 Mineral Resources of Santa Barbara and Ventura Counties

Barbara County in 1860 and in Cachuma (referred to in early literature as Acachuma) Canyon in the San Rafael Mountains several years later. Mercury has been mined from these localities intermittently ever since, and the Cachuma district (figure II-42) has been a major California mercury source. The Gibralter Mine, operated by Sunbird Mines, Ltd., in the Cachuma district, was one of the State's principal producers, and the only Santa Barbara County producer in 1970 and 1971.

b. Diatomite

Diatomite (diatomaceous earth, or kieselguhr) is formed from the "skeletal" (cell wall or valve) remains of diatoms, a class of unicellular or colonial algae that live in water. Significant deposits occur only in ocean or lake basins where ecological conditions will support large numbers of these minute plants and where there is a sufficient supply of chemical nutrients to replenish those taken out of solution during the growth of the diatom community. The principal deposits of diatomite in California occur near Lompoc, in Santa Barbara County. These deposits are believed to be the largest source of diatomite currently being exploited in the world. The diatomite occurs as gently folded strata in isolated patches in the northern hills of the western Santa Ynez Mountains south of Lompoc, and in the Purisima, Casmalia, and Solomon Hills north of Lompoc. Only certain selected strata a few feet or tens of feet thick that meet commercial specifications are quarried, but the aggregate thickness of the commercial diatomite may be several hundred feet thick.

In the late 1880's, a small quantity of diatomite was mined from the Lompoc deposits for use as building stone, and during the early 1900's a few hundred tons per year were being mined. At this time, testing began for several uses, including heat insulation and as a filtration agent in sugar refining. The industry developed rapidly after World War I and the Johns-Manville Products Corporation gained control of a large part of the Lompoc deposits in 1928. Since then, the industry has grown rapidly and in 1958, Great Lakes Carbon Corporation (now Grefco, Inc.) centered all of its production in the Lompoc area. Today, the Lompoc area has strengthened its position as the main world source of diatomite.

The two suppliers of diatomite in the Lompoc area continue to be Johns-Manville Products Corporation and Grefco, Inc. The general location of the deposits is shown in figure II-42

c. Sand and Gravel

Sand and gravel is produced in Santa Barbara County from stream-laid deposits along the Sisquoc and Santa Ynez Rivers, for use primarily in the construction industry (figure II-42). Guadalupe Sand Company produced a specialty sand product for use as sandblast sand near Guadalupe. The market for sand and gravel will continue to expand at about the same rate as population growth. However, there are no undiscovered deposits near the large metropolitan areas that can be developed to meet the demand. Therefore, most populated areas face depletion of their major sand and gravel resources within the next three decades unless sand and gravel deposits can be set aside as natural resource zones for future use.

Stream-laid deposits along the lower reaches of the Santa Clara River provide sand and gravel for use in Ventura, Oxnard, and Santa Paula, Ventura County. The largest developers of this resource include Montalvo Rock Company, Saticoy Rock Company, and Southern Pacific Milling Company.

d. Oil and Natural Gas

Oil and gas fields in Santa Barbara and Ventura Counties are shown on figure II-43 and plate 1. Natural gas liquids production in California comes entirely from eight contiguous counties situated in the southern part of San Joaquin Valley, the southern coastal area, and the Los Angeles basin. The five largest counties of natural gas liquids production are, by rank, Kern, Los Angeles, Ventura, Santa Barbara, and Orange.

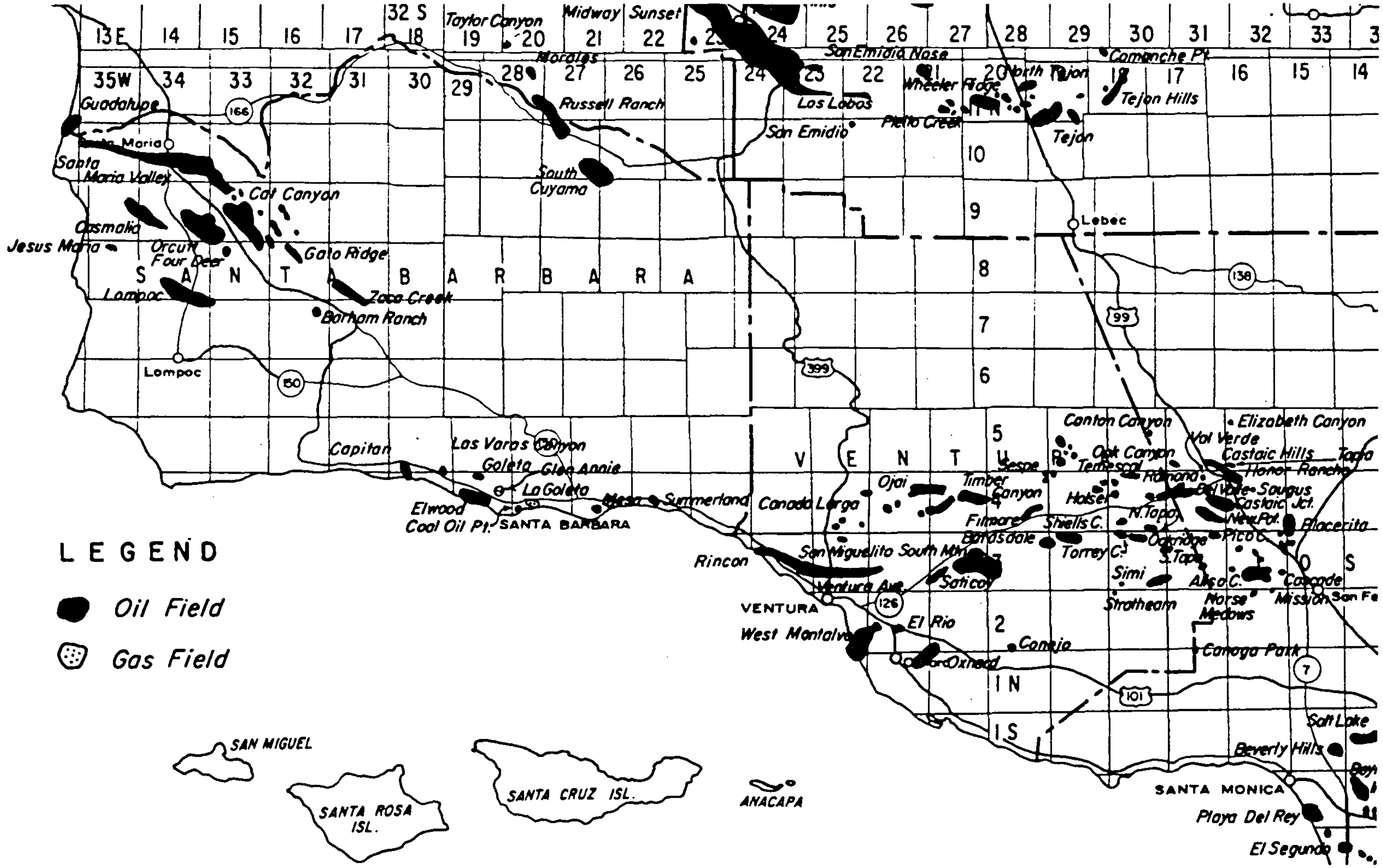
Cumulative production of natural gas and petroleum in Santa Barbara and Ventura Counties to 1972 is given in table II-54b. Table II-54c gives the capacity of California petroleum refineries.

e. Offshore Minerals Other Than Oil and Gas

Presently no minerals other than oil and gas are extracted from the Santa Barbara Channel, however, in the future it is possible sand, gravel, phosphorite, manganese and other minerals will be recovered in paying quantities from the Santa Barbara Channel ocean floor.

At present, offshore mining technology for the retrieval of authigenic and terrigenous mineral resources is in its infancy. Minor amounts of work are ongoing in the development of mining hardware and retrieval systems. With a change in the mineral economic conditions, mineral retrieval may be justified. In the future, the offshore may become a major source for such resources as mentioned above.

FIGURE II-43 Oil and Gas Fields of Santa Barbara and Ventura Counties



(From: Munger Oilogram, 1958)

TABLE II-54b

CUMULATIVE PETROLEUM AND NATURAL GAS PRODUCTION IN VENTURA AND SANTA BARBARA COUNTIES TO 1972

Ventura County	
Petroleum	1,313,086,126 42-gallon bbls.
Natural Gas	2,886,057,032 mcf.
Santa Barbara County	
Petroleum	265,403,345 42-gallon bbls.
Natural Gas	260,625 mcf.

Source: California Division Oil and Gas, Summary of Operations, 1972.

San Joaquin Valley Region	
Petroleum	6,893,871,771 42-gallon bbls. (cum. to 1/73)
Natural Gas	8,213,594 mcf.
Coastal Region[1]	
Petroleum	2,737,740,257
Natural Gas	4,156,383
Los Angeles Region	
Petroleum	6,463,261,209
Natural Gas	6,688,642

Source: California Oil Producers Conservation Committee, 1972 Annual Review

[1] Includes Santa Barbara, Santa Clara Valley, Santa Maria, San Fernando Valley, Ventura, Contra Costa County, Salinas Valley, San Luis Obispo County, San Mateo County, Santa Cruz and Sonoma County Districts.

TABLE II-54c

CAPACITY OF CALIFORNIA PETROLEUM REFINERIES

(From: The Oil and Gas Journal, April 7, 1975. Refinery capacities as of January 1, 1975)

Company	Location	Capacity[1]
Atlantic Richfield Co.	Carson	185,000
Beacon Oil Co.	Hanford	12,000
Champlin Petroleum Co.	Wilmington	30,600
Douglas Oil Co. of California	Paramount	35,000
Douglas Oil Co. of California	Santa Maria	9,500
Edington Oil Refineries, Inc.	Long Beach	29,500
Edington Oxnard Refinery	Oxnard	2,500
Fletcher Oil & Refining Co.	Carson	19,200
Golden Bear Div., Witco Chemical Corp.	Oildale	11,000
Golden Eagle Refining Co.	Carson	13,000*
Gulf Oil Corp.	Hercules	27,000
Gulf Oil Corp.	Santa Fe Springs	51,500
Exxon Oil & Refining Company, USA	Benicia	88,000
Kern County Refinery, Inc.	Bakersfield	15,900
Lunday-Thagard Oil Co.	South Gate	5,400
Macmillan Ring-Free Oil Co.	Signal Hill	12,200*
Mobil Oil Corp.	Torrance	123,500
Mohawk Petroleum Co.	Bakersfield	22,100
Newhall Refining Co., Inc.	Newhall	11,500
Phillips Petroleum Co.	Avon	110,000
Powerine Oil Co.	Santa Fe Springs	46,000
Road Oil Sales, Inc.	Bakersfield	1,500
Sabre Refining Inc.	Bakersfield	3,500
San Joaquin Refining Co.	Oildale	29,300
Shell Oil Co.	Martinez	100,000
Shell Oil Co.	Wilmington	96,000
Standard Oil Co. of California, Western Operations, Inc.	Bakersfield	26,000
	El Segundo	230,000
	Richmond	190,000
Sunland Refining Corp.	Bakersfield	15,000
Tenneco Oil Co.	Bakersfield	1,200
Texaco Inc.	Wilmington	75,000
Toscopetro Corp.	Bakersfield	40,000
Union Oil Co. of California	San Francisco	111,000
	Wilmington	108,000
West Coast Oil Co.	Oildale	15,000

[1] Barrels per calendar day
*Barrels per stream day

14. Transportation

a. Highways

U.S. Highway 101, a multilane divided highway, portions of which have controlled access, traverses Santa Barbara and Ventura Counties in a southeasterly direction from Santa Maria in the north to Thousand Oaks in the south (figure II- 44).

Primary State Highway 1 runs from Guadalupe at the northern Santa Barbara County boundary through Orcutt and Lompoc to Las Cruces where it joins U.S. Highway 101 to Oxnard. At Oxnard, Highway 1 turns south to Point Mugu and continues into Los Angeles County. Other State Primary Highways that transverse Santa Barbara County include Numbers 33, 135, 144, 154, 166, and 246. In Ventura County, State Highway 126 connects Ventura with U.S. Interstate 5. State Highway 365 travels northward from Ventura to Ojai and continues on into Santa Barbara and San Luis Obispo Counties. Other State Primary Highways in Ventura County include Numbers 23, 34, 118, and 150.

An extensive network of Ventura and Santa Barbara county roads provide a means of vehicular transportation to outlying and more sparsely settled localities.

b. Railroads

Southern Pacific Railroad connects the cities of Santa Barbara, Ventura, and Oxnard with San Francisco and Los Angeles. Smaller trunk lines connect Port Hueneme in Ventura County and Lompoc in Santa Barbara County to the main Southern Pacific tracks.

c. Airports

The Santa Barbara Municipal Airport at Goleta is the largest

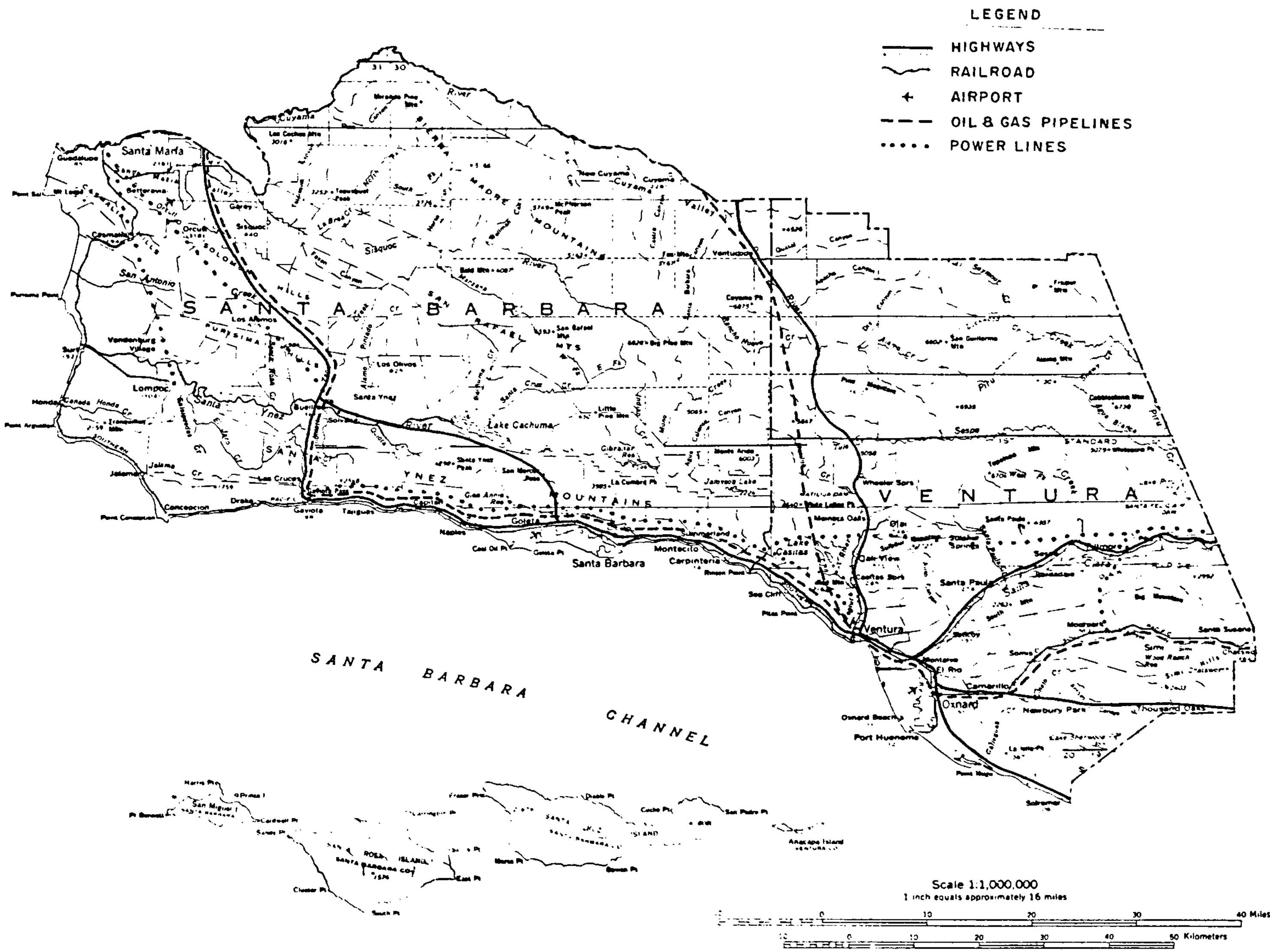


Figure II-44 Major land-based transportation rights-of-way, Santa Barbara and Ventura Counties terminal for scheduled passenger flights, air cargo services, air charter flights, and helicopter flights. Air West, United Airlines and American Airlines link Santa Barbara to the major airports of Los Angeles and San Francisco. Golden West Airlines, a regional company, provides daily flights from Santa Barbara to Los Angeles; Valley Airlines provides daily flights to San Jose and San Francisco. Other commercial airports in Santa Barbara County include the Santa Maria Public Airport and the Lompoc Airport.

Ventura County's largest municipal airport is located in Oxnard. Air West provides daily connections to the cities of Santa Barbara, San Francisco, and Los Angeles.

Military airbases are located at Vandenberg Air Force Base in Santa Barbara County and Point Mugu Naval Air Base in Ventura County. Oxnard Air Force Base, located south of Oxnard along U.S. Highway 101, has been recently abandoned.

d. Marine Transportation

Santa Barbara yacht harbor, created by construction of a breakwater in 1930, is a protected water area of 84 acres. The harbor provides year-round accommodations for about 800 commercial and pleasure boats.

The port is California's fourth most productive fishing port. Commercial fleets harvest about 35 million pounds of fish off the coast and in waters surrounding the Channel Islands. Mackerel, anchovies, rockfish, and albacore comprise 75 percent of the catch. Other important products are bonito, cabezon, halibut, shark, lobster, and rock crab.

Small boat harbors in Ventura County include Ventura Marina and Channel

Island Harbor in Oxnard.

The location of shipping lanes is shown in plate 1. These lanes connect with large deepwater harbors in San Francisco, Los Angeles-Long Beach, and San Diego. The only deepwater port in either Ventura or Santa Barbara Counties is located at Port Hueneme.

Several small offshore petroleum loading terminals are located in Santa Barbara County offshore from Corral (Las Flores) Canyon, Gaviota (Getty Oil Company), Molino Field (Shell Oil Company), Conception (Phillips Petroleum), and Coal Oil Point (Signal Oil). A small offshore terminal is located offshore from Ventura in Ventura County (see table II-54d and II-54e for location and complete list of offshore oil production and oil tanker mooring facilities in southern California).

e. Oil and Gas Pipelines

(1) Oil Pipelines

Several four- to eight-inch Shell Oil Company pipelines connect petroleum production in the West Montalvo Field, near Oxnard, to treating and storage facilities in the Los Angeles-Long Beach area. Several smaller trunk lines, for example Mobil Oil Company's 2½-Inch pipeline to Coyote Creek field, connect to Shell's pipeline.

General Petroleum owns and operates an oil pipeline between Rincon oil field and Pierpont Landing in Ventura, Ventura County. The crude oil is transported by pipeline to an offshore loading terminal where it is taken aboard tankers and shipped to treating and storage facilities in Los Angeles.

Table II-54d lists the location, size, and length of crude oil pipelines to the various offshore oil fields and drilling platforms in the Santa Barbara Channel.

TABLE II-54d

OFFSHORE OIL PIPELINES - VENTURA AND SANTA BARBARA COUNTIES

Operator	Location	Facility	Function	Size Lines (inches)	Length (feet)	Volume (bbls.)
Atlantic Richfield	Rincon	Rincon Island	Crude oil	6	3,000	110
		1 ocean floor well	Flow line	2	3,100	10
Standard	Carpinteria	Platforms Heidi and Hope	Crude oil	10	21,500	2,090
Phillips	Carpinteria	Platforms Houchin and Hogan	Crude oil	10	32,500	3,150
Union	Carpinteria	Platforms A and B	Crude oil	12	62,000	8,700
Standard	Summerland	Platforms Hilda and Hazel	Crude oil	6	26,400	960
		2 ocean floor wells	Flow lines	4	9,200	130
Atlantic Richfield	Elwood	Platform Holly	Crude oil	6	14,500	530
Texaco	Cuarta	Platform Helen	Crude oil	6	11,500	420
Texaco	Pt. Conception	Platform Herman	Crude oil	6	12,000	440
		20 ocean floor wells	Flow lines	2½	39,000	200

TABLE II-54e

OFFSHORE GAS PIPELINES IN SANTA BARBARA COUNTY

Operator	Location	Facility	Function	Size Lines (inches)	Length (feet)
Phillips-Pauley	Gaviota	4 ocean floor wells	Flow lines	4	57,600
Shell-Standard	Gaviota	5 ocean floor wells	Flow lines	4	13,000
Standard-Shell	Gaviota	1 ocean floor well	Flow lines	4	13,000
Standard-Shell	Gaviota	2 ocean floor wells	Flow lines	3 4	24,000 5,000
Atlantic Richfield	Gaviota	1 ocean floor well	Flow lines	3	22,500

(2) Gas Pipelines

Southern California Gas Company and Southern Counties Gas Company of California operate a series of natural gas transmission and distribution trunk lines in Santa Barbara and Ventura Counties. The transmission lines vary in size from 8 to 22 inches in diameter and generally parallel U.S. Highway 101 from Guadalupe in northern Santa Barbara County to the Ventura and San Miguelito fields in Ventura County. Here, the lines divide either southward toward Port Hueneme and Point Mugu or east and southeastward along State Highway 126 and U.S. Highway 101 respectively. Major pumping or storage stations are located either in the Ventura or San Miguelito fields in Ventura County or the Goleta field in Santa Barbara County. Offshore natural gas pipelines in Santa Barbara County are listed in table II-54e.

Atlantic Richfield Company owns and operates a 20-inch natural gas transmission line between fields in the southern San Joaquin Valley area and Ventura.

f. Electrical Power Lines

Southern California Edison Company operates and maintains electrical power transmission lines rated at 220 kilovolts between Goleta in Santa Barbara County and Santa Clara, Moorpark, and Mandalay steam power plants in Ventura County. These power lines are connected to the rest of Edison's network at Saugus in Los Angeles County.

Pacific Gas and Electric Company operates electrical transmission lines rated at 230 kilovolts, and smaller distribution lines throughout the northern half of Santa Barbara County.

15. Government Finances, Medical Facilities, Police and Fire Protection Capabilities

This section discusses the finances of county and local governments in Ventura and Santa Barbara Counties, their tax rates and assessed valuation of property. The Counties' licensed health-care-related facilities are also detailed as are the police and fire protection capabilities.

a. Santa Barbara County

(1) Finances

The financial transactions concerning Santa Barbara County entailed total receipts of $73,839,000 and payments of $65,851,000 in 1973. Financial transactions concerning cities in the County were total receipts of $32,238,000 and $30,350,000 of payments with a bonded indebtedness of $14,215,000 in 1973. Financial transactions concerning school districts in Santa Barbara County showed total receipt of $86,175,000 and payments of $85,863,000 and a bonded indebtedness of $49,465,000 in 1973.

The assessed valuation of State assessed, County assessed, and total tangible property subject to local taxation in the County for calendar year 1973 was as follows:

State assessed	$ 58 million
County assessed	739 million
Total	$797 million

The assessed value of tangible property subject to local taxation, taxes, average tax rate, and the assessment ratio in 1973 to 1974 for the County is shown below.

Net taxable assessed value		$708,687,000	
Taxes levied:	Cities	4,290,000	5%
	County	19,169,000	24%
	School	48,459,000	61%
	Other	7,693,000	10%
	Total	$ 79,611,000	100%

The average tax rate per $100 of assessed value in 1973 to 1974 was $11.23 compared to a State rate of $11.15 per $100. The assessment ratio was 21.7% compared to a State ratio of 23.8% taxes to assessed valuation. (Source: California Statistical Abstract, 1974)

(2) Health Care Facilities

The number of licensed health-care-related facilities and bed capacity in Santa Barbara County on December 31, 1973 is depicted below.

Type of Facility	Number	Bed Capacity
Medical clinic	1	0
Outpatient clinic	0	0
Psychiatric clinic	0	0
Day treatment clinic	0	0
General hospital	10	1,528
Psychiatric hospital	1	31
Skilled nursing facility	14	978
Long-term mental facility	0	0
Alcoholism hospital	0	0
Intermediate care facility	0	0
Nursery - Mentally retarded	2	10
Child day center	0	0
Home health agency	1	0
Community care facilities	13	1,527
Residential care (24 hour facility)	6	15
Day care facility	34	1,579
Totals	82	5,668

Source: California Statistical Abstract, 1974

The ratio of general hospital beds to population in the County in 1973 was one hospital bed per 180 people.

(3) Police Capabilities

The Santa Barbara County Sheriff's Department is staffed with a total of 242 deputies, 62 corrections officers, and 121 administrative and support associated civilian employees. The authorized strength of the department is 242 deputies of which nine are not salaried. The Sheriff's department is currently maintaining a ratio of approximately one deputy per 1,200 citizens in the areas patrolled. This compares to a ratio of approximately one police officer per 600 citizens in the City of Santa Barbara.

The Sheriff's department maintains only a holding facility in Santa Maria and has its main correctional facility (the Santa Barbara County Jail) in the City of Santa Barbara. A total of 350 people could be accommodated at this facility.

A total of 36 black-and-white patrol cars and a few detective cars are in the department's equipment inventory. (The above information, as per personal telephone conversation with Inspector Zanella, Patrol Division Commander, Santa Barbara County Sheriff's Department, November 25, 1975)

In addition to the Sheriff's department, the City of Santa Barbara maintains a police force of 125 officers and 32 civilians; the City of Carpinteria has 12 officers and three civilians. Additional police forces are maintained by the Cities of Santa Maria, 45 officers and 12 civilians; Lompoc, 31 officers and seven civilians; and Guadalupe, 7 law enforcement officers and 4 civilian employees. The total number of police officers and sheriff's deputies for the entire County is 462, that is, a ratio of approximately one police officer per 600 of population. (Source of the above information: Crime in the U. S. 1973, Federal Bureau of Investigation, October 31, 1973)

(4) Fire Protection

The fire and rescue division operational area inventory for Santa Barbara County as of September 8, 1975 shows a total of 330 fire fighters of which 211 are paid, 95 are partially paid, and 24 are volunteers. In addition, there are 11 fire chiefs, 36 chief fire officers, 109 fire officers (captains and lieutenants), 148 fire apparatus engineers, and 54 administrative personnel for a total of 688 of which 538 are full-time paid.

The equipment inventory for the entire County shows 43 type-one engines, 19 type-two conventional engines and eight type-two off-road vehicles, two type-three engines, and one type-four engine. There are also ten conventional patrol vehicles and ten off-road patrols. Six light and three heavy rescue vehicles, in addition to one ambulance, are also in the inventory. Two trucks, one dozen tenders, two heavy transport vehicles, five bulldozers, nine water tenders, and thirty staff vehicles are also maintained.

Of the above totals, the City of Santa Barbara has 99 fire department personnel and 15 fire engines, the City of Carpinteria has 32 fire personnel and four fire engines, the City of Montecito has 26 fire personnel and four fire engines.

It is felt that land based, oil related fires could be handled adequately, but offshore fires would be more difficult to control.

b. Ventura County

(1) Finances

The financial transactions concerning Ventura County in 1972 to 1973 show receipts of $90,901,000 and payments of $82,304,000. Financial transactions concerning cities in the County show receipts of $62,415,000, payments of $57,159,000, and a bonded indebtedness of $35,234,000 in 1972 to 1973.

Financial transactions concerning school districts in the County for 1972 to 1973 totalled $131,399,000 in receipts, $129,542,000 in payments, and a bonded indebtedness of $58,259,000.

The assessed valuation of State assessed, County assessed and total tangible property subject to local taxation in Ventura County in 1973 is shown below.

State assessed	$ 117 million
County assessed	1,237 million
Total	$ 1,354 million

The assessed value of tangible property subject to local taxation, taxes, average tax rate, and the assessed ratio for Ventura County in 1973 to 1974 was as follows:

Net taxable assessed value		$1,210,181,000	
Taxes levied:	Cities	$ 7,422,000	6%
	County	30,523,000	24%
	School	71,838,000	55%
	Other	19,765,000	15%
	Total	$ 129,548,000	100%

The average tax rate per $100 of assessed value in 1973 to 1974 was $10.70 compared to a State rate of $11.15 per $100. The assessment ratio was 23.1% compared to the State ratio of 23.8% taxes to assessed valuation. (Source: California Statistical Abstract, 1974)

(2) Health Care Facilities

The number of licensed health-care-related facilities and bed capacity in Ventura County on December 31, 1973 are depicted as follows:

Type of Facility	Number	Bed Capacity
Medical clinic	0	0
Outpatient clinic	0	0
Psychiatric clinic	0	0
Day treatment clinic	0	0
General hospital	10	1,456
Psychiatric hospital	0	0
Skilled nursing facility	17	1,378
Long-term mental facility	0	0
Alcoholism hospital	2	52
Intermediate care facility	1	18
Nursery - Mentally retarded	1	6
Child day center	1	105
Home health agency	1	0
Community care facility	27	1,944
Residential care (24-hour facility)	8	31
Day care facility	62	2,766
Totals	130	7,756

Source: California Statistical Abstract, 1974.

The ratio of general hospital beds to population in the County in 1973 was one hospital bed per 287 people.

(3) Police Capabilities

The Ventura County Sheriff's Department is staffed with 519 deputies, of which 416 are male. In addition to that total, the City of San Buenaventura has 108 police, the City of Oxnard has 130 police, and the Port of Hueneme has 23 officers. Simi Valley police total 75, Santa Paula 34, Fillmore 17, and Ojai 17, for a total of 923 for the entire County. The ratio of police to population in the County is one officer per 461 people. This compares to a ratio of one to 593 in the City of San Buenaventura, one to 618 in the City of Oxnard, and one to 765 in Port Hueneme. (Source: Virginia Riddle, Statistician, Ventura County Sheriff's Department)

(4) Fire Protection

The Ventura County Fire Department, which provides fire protection to the Cities of Camarillo, Ojai, Thousand Oaks, Port Hueneme, Simi Valley, and unincorporated areas of Ventura County, maintains 295 fire fighters with a minimum of 79 on duty per day. The department has standard mutual-aid agreements with all fire protection agencies around and within Ventura County, including the California Division of Forestry and the United States Forest Service. However, no agreement is in effect with the United States Coast Guard.

According to Battalion Chief, Donald L. Henney, of the Ventura County Fire Department, the equipment and manpower of the department,

> *"...provides an adequate force to handle landbased and pier fires involving petroleum, which have occurred in this jurisdiction and which could occur in the future.*
>
> *The control and extinguishment of fires involving offshore facilities would necessitate the movement of equipment and manpower by tugs and barges to the scene. This would be a very time-consuming process unless reliable on-site equipment and systems were provided for fire protection. This agency does not have offshore facilities within its jurisdiction at the present time. Therefore, on-site fire protection requirements, training and specialized equipment needs to meet this type of fire problem have not been developed."*

An inventory of Ventura County Fire Department equipment is presented in table II-55.

In addition to the Ventura County Fire Department, Oxnard has 45 fire fighters and 8 fire engines, Santa Paula has 12 fire fighters and 5 fire engines, the Point Mugu Naval Air Station has 45 fire fighters and 5 fire engines, Camarillo State Hospital has 16 fire fighters and two fire engines, the Naval Base of Port Hueneme has 20 fire fighters and 4 fire engines, the City of Buenaventura has 36 fire fighters and seven fire engines, and the Ventura School Fire Department has seven fire fighters and one fire engine. The total number of fire fighters in the County, including part paid, is 506, and a total of 79 fire engines are maintained.

TABLE II-55

Ventura County Fire Department
Mobile Fire Apparatus List

Number of vehicles	
13	Staff cars
4	Bureau of Training vehicles
10	Bureau of Fire Prevention vehicles
24	Brush patrols
15	Construction vehicles
4	Repair shop vehicles
8	Utility vehicles
8	Trailers
1	Display vehicle
45	Engines
2	Water tenders
6	Rescue trucks
1	Fire/rescue boat
1	Ladder truck

c. Coast Guard Capabilities

The following is a listing of U. S. Coast Guard Resources located between Point Mugu and Point Conception in the Santa Barbara Channel provided by Lieutenant R. W. Brandes of the U. S. Coast Guard, Marine Environmental Protection and Port Safety Branch:

"There is a Coast Guard Station located at Channel Islands Harbor, with approximately 35 personnel assigned. Channel Islands Station is equipped with three utility boats of 40, 41, and 17 feet in length. The primary missions of this station are search and rescue, service of short range aids to navigation, enforcement of laws and treaties and marine environmental protection.

"Coast Guard Group Santa Barbara is located on the wharf in Santa Barbara and has five personnel assigned. In addition, an 82-foot Coast Guard Cutter, with a crew of approximately nine members, is stationed in Santa Barbara. The primary missions of both units are search and rescue, enforcement of laws and treaties and marine environmental protection.

"In addition to the above Coast Guard facilities, there are unmanned Coast Guard light stations located at Point Conception, Santa Barbara, Port Hueneme and on Anacapa Island."

16. Taxable Sales

a. Santa Barbara County Retail Sales

Taxable transactions in Santa Barbara County totaled $210,239,000 in the fourth quarter of 1974 registering a gain of $16,572,000 or 8.5 percent from the fourth quarter of 1973. Performance was rather dismal considering that prices had increased over 12 percent since the 1973 period. Retail sales totaled $157,161,000 in the fourth quarter of 1974. That is a gain of $7,160,000 or 4.7 percent over the same period in 1973. (See table II-55a) Taxable sales in 1973 totaled $701,301,000.

b. Ventura County Retail Sales

Ventura County taxable transactions totaled $278,705,000 in the fourth quarter of 1974, registering a gain of $26,668,000 or 10.5 percent above the fourth quarter of 1973. Performance was above the State average of 7.8 percent but still not equal to the rate of inflation of 12 percent. Retail sales totaled $212,470,000 in the fourth quarter of 1974. That is an increase of $20,668,000 or 10.7 percent over the fourth quarter of 1973. (See table II-55a) Taxable sales in 1973 totaled $903,106,000.

Taxable sales in selected Santa Barbara and Ventura County cities is shown in table II-55b.

TABLE II-55a

TAXABLE SALES IN SANTA BARBARA AND VENTURA COUNTIES, BY TYPES OF BUSINESS, FOURTH QUARTER 1974

Type of business	SANTA BARBARA		VENTURA	
	Permits	Taxable transactions	Permits	Taxable transactions
Retail Stores				
Women's apparel	100	4,493	101	3,261
Men's apparel	41	1,865	39	2,072
Family apparel	47	2,551	31	2,806
Shoes	44	1,799	54	2,228
Apparel stores group	232	10,708	225	10,367
Limited-price variety	20	2,091	31	3,776
Department and dry goods	43	22,840	81	40,399
Drug stores	63	6,596	82	7,938
Other general merchandise	9	1,400	22	1,618
General merchandise stores	135	32,927	216	53,731
Gifts, art goods, and novelties	134	1,913	80	940
Sporting goods	68	1,895	67	1,529
Florists	35	504	45	470
Photographic equipment and supplies	21	861	9	506
Musical instruments	43	1,622	44	1,541
Stationery and books	52	1,459	46	1,384
Jewelry	43	1,783	41	2,045
Office, store, and school supplies	32	3,200	31	746
Other specialties	249	3,844	176	2,566
Specialty stores group	677	17,084	539	11,727
Food stores selling all types of liquors	41	8,331	54	13,808
All other food stores	189	4,124	225	7,413
Packaged liquor stores	88	5,299	95	6,222
Eating places, no alcoholic beverages	241	6,240	314	9,805
Eating places, beer and wine	205	4,235	219	3,454
Eating and drinking: all types of liquor	119	7,602	143	7,957
Eating and drinking group	565	18,077	676	21,216
Household and home furnishings	182	6,292	169	6,789
Household appliance dealers	54	1,791	64	2,385
Second-hand merchandise	39	244	65	351
Farm implement dealers	15	1,588	17	2,095
Farm and garden supply stores	53	1,449	68	2,463
Fuel and ice dealers	11	369	9	322
Lumber and building materials	45	5,243	49	5,333
Hardware stores	32	2,370	30	3,108
Plumbing and electrical supplies	13	259	9	371
Paint, glass, and wallpaper	27	1,183	31	1,305
Building material group	117	9,055	119	10,117
New motor vehicle dealers	48	15,825	70	29,925
Used motor vehicle dealers	23	969	31	1,044
Automotive supplies and parts	70	2,825	106	3,842
Service stations	294	17,349	338	23,648
Mobile homes, trailers, and campers	22	1,745	32	3,373
Boat, motorcycle, and plane dealers	38	1,110	53	1,632
Automotive group	495	39,823	630	63,464
Retail Stores Totals	2,893	157,161	3,171	212,470
Business and Personal Services	961	10,542	1,077	8,468
All Other Outlets	4,876	42,531	4,306	57,767
Totals All Outlets	8,730	210,234	8,554	278,705
HISTORICAL DATA				
Comparable data for retail stores:				
1969	2,519	102,029	2,808	123,708
1970	2,595	98,391	2,942	128,870
1971	2,676	111,583	3,035	146,722
1972	2,744	138,885	3,023	179,457
1973	2,766	150,001	3,061	191,802
Comparable data for all outlets:				
1969	6,313	133,346	6,455	172,295
1970	6,774	129,413	7,017	170,913
1971	7,427	144,903	7,320	190,175
1972	7,771	175,989	7,582	226,660
1973	8,090	193,662	7,863	252,037

TABLE II-55b

TAXABLE SALES IN SELECTED SANTA BARBARA AND VENTURA COUNTY CITIES, BY TYPES OF BUSINESS, FOURTH-QUARTER 1974

(Taxable transactions in thousands of dollars)

Type of Business	Thousand Oaks	Oxnard	Ventura	Santa Barbara	Santa Maria
Retail Stores					
Apparel stores	1,966	3,514	2,562	6,185	2,189
General merchandise stores	6,423	16,270	15,769	10,575	5,387
Drug stores	1,858	1,848	1,696	1,676	2,463
Food stores	2,870	3,933	3,628	4,597	2,012
Packaged liquor stores	698	1,462	1,093	2,108	843
Eating and drinking places	3,443	6,626	4,598	7,638	2,477
Home furnishings & appliances	989	3,358	2,322	3,393	1,854
Bldg. mat. & farm implements	1,923	4,149	1,477	3,111	2,855
Auto dealers & auto supplies	6,200	11,328	11,531	8,708	6,906
Service stations	3,942	3,994	4,621	5,461	3,442
Other retail stores	2,687	5,583	5,600	11,918	3,436
RETAIL STORES TOTALS	32,999	62,065	54,897	65,370	33,864
All Other Outlets	3,606	10,658	10,529	16,846	13,809
TOTALS ALL OUTLETS	36,605	72,723	65,426	82,216	47,673

17. Housing

a. Santa Barbara County

The 1970 census housing inventory for Santa Barbara County totalled 88,806 housing units with 4,877 vacancies for a 5.5 percent vacancy rate and 3 persons per housing unit. The County Planning Commission estimates that in April 1975, housing units totalled 103,051. (See table II-55c)

The electric meter count by the Southern California Edison Company in Santa Barbara County showed 59,039 total meters with 1,122 idle for a 1.8 percent idle rate in September 1975. Edison covers only approximately half the county housing units. The idle rate of 1.8 percent applied to the 103,051 total housing units in the county would result in 1,854 idle dwelling places. Multiple units totalling 20,188 dwellings had 633 idles for a rate of 3.1 percent in September 1975. (See table II-55d) Single family units totalled 36,746 of which 311 were idle for a .8 percent rate. The combined idle rate for all units was 1.8 percent in September 1975. (See table II-55e)

b. Ventura County

The 1970 census housing inventory for Ventura County totalled 112,133 units with 5,664 vacancies for a 5.1 percent vacancy rate and 3.4 persons per dwelling place. The County Planning Commission estimates that in July, 1975 a total of 145,612 units existed. (See table II-55c)

The electric meter count by the Southern California Edison Company in Ventura County showed 133,241 meters with 3,284 idle for a 2.5 percent idle rate. The 2.5 percent idle rate applied to the total housing units would result in 3,640 vacancies for July, 1975. (In gathering its statistics the Edison Company classifies most apartments with a "common" meter as "commercial" and

TABLE II-55c

HOUSING INVENTORY BY COUNTIES

	Total Two-County Area	Ventura	Santa Barbara
U. S. Census Reports			
1940 Census Apr. 1			
Total Dwelling Units	43,436	20,772	22,664
Vacant Dwelling Units	3,146	1,721	1,425
% Vacant	7.2	8.3	6.7
Population Per Unit		3.4	3.3
1950 Census Apr. 1			
Total Dwelling Units	67,717	34,551	33,166
Vacant Dwelling Units	5,171	2,591	2,580
% Vacant	7.6	7.5	7.8
Population Per Unit		3.3	3.0
1960 Census Apr. 1			
Total Housing Units	117,988	60,698	57,290
Vacant Housing Units	11,220	5,951	5,269
% Vacant	9.5	9.8	9.2
Population Per Unit		3.3	2.9
1970 Census Apr. 1			
Total Housing Units	200,939	112,133	88,806
Vacant Housing Units	10,541	5,664	4,877
% Vacant	5.2	5.1	5.5
Population Per Unit		3.4	3.0
County Planning Commission Estimates - to Extent Available			
Total Dwelling Units	App. Total		
1972 Jan		125,559	
Apr			
July		128,261	
1973 Jan		132,203	
Apr			
July		135,076	
1974 Jan		137,728	
Apr			
July		140,026	
1975 Jan		144,468	
Apr			103,051
July	248,663	145,612	

Source: Residential Research Report, Third Quarter 1975
Residential Research Committee of Southern California.

TABLE II-55d

ELECTRIC METER INFORMATION FOR SINGLE AND MULTIPLE UNITS SHOWN SEPARATELY

COVERS ALL SINGLE UNITS IN EDISON TERRITORY

IN SINGLE FAMILY UNITS

Edison Districts	LATEST INFORMATION — SEPTEMBER 1975							PAST COMPARISONS OF TOTAL PERCENT IDLE								
	NUMBER OF METERS				PERCENT IDLE											
	TOTAL METERS	NORMAL IDLE	SET IDLE	TOTAL IDLE	NOR-MAL IDLE %	SET IDLE %	TOTAL IDLE %	JUNE 1975 %	MAR 1975 %	DEC 1974 %	SEPT 1974 %	JUNE 1974 %	MAR 1974 %	DEC 1973 %	SEPT 1973 %	JUNE 1973 %
Thousand Oaks	51,043	435	613	1,048	0.9	1.2	2.1	1.9	2.1	1.8	2.2	2.5	2.9	2.6	2.2	2.6
Ventura	64,754	650	142	792	1.0	0.2	1.2	1.2	1.6	1.9	1.7	2.3	2.6	2.9	2.6	2.4
Total Ventura Co.	115,797	1,085	755	1,840	0.9	0.7	1.6	1.5	1.8	1.9	1.9	2.4	2.8	2.8	2.4	2.5
Santa Barbara	36,746	237	74	311	0.6	0.2	0.8	1.0	0.9	0.9	1.1	1.2	0.9	0.8	0.9	1.1

IN MULTIPLE* UNITS *INCLUDES DUPLEXES

COVERS ALL MULTIPLE UNITS IN EDISON TERRITORY

Edison Districts	LATEST INFORMATION — SEPTEMBER 1975							PAST COMPARISONS OF TOTAL PERCENT IDLE								
	NUMBER OF METERS				PERCENT IDLE											
	TOTAL METERS	NORMAL IDLE	SET IDLE	TOTAL IDLE	NOR-MAL IDLE %	SET IDLE %	TOTAL IDLE %	JUNE 1975 %	MAR 1975 %	DEC 1974 %	SEPT 1974 %	JUNE 1974 %	MAR 1974 %	DEC 1973 %	SEPT 1973 %	JUNE 1973 %
Thousand Oaks	6,425	171	1	172	2.7	—	2.7	3.8	4.7	5.8	7.6	7.2	7.2	8.1	6.8	9.4
Ventura	20,748	662	497	1,159	3.2	2.4	5.6	5.7	7.4	8.1	7.4	6.7	6.6	8.2	6.8	7.8
Total Ventura Co.	27,173	833	498	1,331	3.1	1.8	4.9	5.2	6.7	7.5	7.4	6.8	6.7	8.2	6.8	8.2
Santa Barbara	20,188	555	78	633	2.7	0.4	3.1	5.0	3.1	3.3	3.4	6.4	4.4	3.3	2.8	5.7
Total 6-County Area (Edison Territory Only)	661,887	23,657	1,861	25,518	3.6	0.3	3.9	4.4	4.7	4.7	4.7	4.9	4.7	4.9	4.9	4.8

NOTES: *A "multiple" as used here includes units in all structures with 2 or more housing units. Most apartments with a "common" meter are classified as "commercial" and are not included with the residential meters tabulated above

Source: Southern California Edison Company

From: Residential Research Report, Third Quarter 1975, Residential Research Committee

TABLE II-55e

Meter Count by Counties for Reporting Utilities
(Includes all residential meters-multiples and singles)

VENTURA COUNTY (Edison Areas Cover Co.)			SANTA BARBARA COUNTY (Edison Areas Only)			
METERS TOTAL	METERS IDLE	IDLE %	METERS TOTAL	METERS IDLE	IDLE %	
68,730	3,614	5.3	36,020	1,376	3.9	1963
76,521	3,976	5.2	39,897	2,286	5.7	1964
85,598	5,560	6.5	42,334	2,119	5.0	1965
91,331	5,830	6.4	43,681	1,552	3.6	1966
93,494	4,572	4.9	44,930	1,383	3.1	1967
95,705	3,136	3.3	46,198	962	2.1	1968
99,425	2,402	2.4	47,806	932	1.9	1969
104,902	3,546	3.4	49,747	1,170	2.4	1970
110,323	3,933	3.6	51,571	1,486	2.9	1971
117,228	4,658	4.0	53,386	1,239	2.3	1972
123,118	5,019	4.1	55,556	1,221	2.2	1973
128,547	4,844	3.8	57,848	1,369	2.4	1974
						1974
126,411	5,497	4.3	56,791	1,152	2.0	January
126,646	5,414	4.3	57,226	1,236	2.2	February
127,071	5,195	4.1	57,446	1,394	2.4	March
127,311	4,975	3.9	57,555	1,486	2.6	April
128,230	5,331	4.1	57,649	1,543	2.7	May
128,597	5,193	4.0	57,908	1,641	2.8	June
128,976	4,884	3.8	58,025	1,578	2.7	July
129,194	4,674	3.6	58,161	1,436	2.5	August
129,468	4,350	3.4	58,217	1,700	2.9	September
129,737	4,321	3.3	58,313	1,198	2.1	October
130,256	4,144	3.2	58,631	977	1.7	November
130,666	4,152	3.2	58,526	1,087	1.9	December
						1975
131,017	4,134	3.2	58,633	1,175	2.0	January
131,434	4,078	3.1	58,700	1,037	1.8	February
131,633	3,723	2.8	58,756	1,030	1.8	March
131,921	3,765	2.8	58,817	1,120	1.9	April
132,195	3,718	2.8	58,844	1,188	2.0	May
132,243	3,453	2.6	58,876	1,321	2.2	June
132,581	3,356	2.5	59,002	1,298	2.2	July
132,898	3,398	2.6	59,013	1,180	2.0	August
133,241	3,284	2.5	59,039	1,122	1.8	September

Sources: Los Angeles Department of Water & Power, Southern California Edison Company.

From: Residential Research Report, Third Quarter 1975
Residential Research Committee

they are not included with the residential meters.)

The City of Ventura totalled 20,748 meters in multiple unit housing units with 1,159 idle for a 3.2 percent rate in September, 1975. (See table II-55d) Single family units in the City of Ventura totalled 64,754 with 792 idle for a 1.2 percent idle rate. The combined idle rate for all units in Ventura County was 2.5 percent in September, 1975. (See table II-55e)

G. Air and Water Quality

Quantitative environmental data (pollutant discharge, type, volume, and effects on water and air quality) are collected by a number of agencies and dischargers. In some cases data are not compiled, analyzed, and interpreted in a form suitable for use as baseline information. The voluminous nature of primary data and differences in sampling and analysis techniques account, in part, for this.

Two significant reference sources are:

- California Air Resources Board--continuing data collection and publications. E.g., Quarterly Data Reports, Air Resources Bulletins, and Ten Year Summary of California Air Quality Data, 1974.
- Southern California Coastal Water Research Project (SCCWRP)[1]--ongoing research and publications. E.g., The Ecology of the Southern California Bight: Implications for Water Quality Management, 1973.

1. Air Quality

Portions of this section were excerpted from the Final Environmental Statement Proposed 1975 OCS Oil and Gas General Lease Sale Offshore Southern California (OCS Sale No. 35) and from the Report-Review of Daniel, Mann, Johnson, Mendenhall EIR Meteorology/Air Quality, Exxon Treatment Facilities, Canada Del Corral prepared by Dames and Moore for Exxon Company, U.S.A.

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[1] A local government agency for marine ecological research sponsored, but neither administered nor directed, by the County Sanitation Districts of Los Angeles County, City of Los Angeles, County Sanitation Districts of Orange County, City of San Diego, and County of Ventura. Local, State, and Federal agencies aid in formulating research plans, providing data and assistance. Additionally, data contributions and suggestions were provided by individuals, universities and private agencies.

a. Jurisdiction of Air Quality

Regulation of air quality standards is under the jurisdiction of Santa Barbara and Ventura Counties, the California Air Resources Board, and the U. S. Environmental Protection Agency (EPA). EPA oversees regulations regarding the preparation, adoption, and submittal of implementation of plans, including intergovernmental cooperation required within each State. Local regulations and prohibitions are contained in county or district rules and regulations.

California ambient air quality standards applicable statewide are summarized in table II-56 and California and Federal ambient air quality standards are summarized in table II-57 (California Air Resources Board, 1973c).

b. Air Quality Data

The Channel coast area of Santa Barbara County and most of Ventura County lies within the South Coast Air Basin, Region 5 (the remainder of Santa Barbara County is within the South Central Coast Air Basin, Region 4). Table II-58 lists monitoring stations in Santa Barbara and Ventura Counties and the pollutants measured.

The following information contained in Figure II-45a indicates the percentage of emissions from major sources within the air basin.

Tables II-59 through II-61 present emission inventories by source for Santa Barbara and Ventura Counties, 1972, by air basin (California Air Resources Board, manuscript in preparation). Emission inventories are compiled at two-year intervals.

The California Air Resources Board narrative of emission inventories (tables II-59 through II-61) follows.

TABLE II-56

CALIFORNIA AMBIENT AIR QUALITY STANDARDS, APPLICABLE STATEWIDE

Substance	Concentration and Methods*	Duration of Averaging Periods	Most Relevant Effects	Comments
Oxidant, Including Ozone	0.10 ppm neutral buffered KI***	1 hour	Eye irritation	This level is below that associated with aggravation of respiratory diseases.
Carbon Monoxide	40 ppm NDIR 10 ppm NDIR	1 hour 12 hours	2-2½% COHb 2-2½% COHb	This level is below those associated with impairment in time discrimination visual function and psychomotor performance.
Sulfur Dioxide	0.5 ppm Conductimetric Method 0.04 ppm Conductimetric Method	1 hour 24 hours	a. Approximate odor threshold. b. Possible alteration in lung function. With particulate matter, 0.05 ppm long term average may be associated with respiratory irritation.	Alteration in lung function was found at this level in only one study. Other studies reported higher concentrations to cause this effect.
Visibility Reducing Particles	In sufficient amount to reduce the prevailing visibility** to less than 10 miles when relative humidity is less than 70%	1 observation	Visibility impairment on days when relative humidity is less than 70%.	
Suspended Particulate Matter	100 ug/m³ Hi-Vol Sampling 60 ug/m³ Hi-Vol Sampling	24 hour sample 24 hour samples, annual geometric mean	Exposure with SO_2 may produce acute illness. Long continued exposure may be associated with increase in chronic respiratory disease.	This standard applies to suspended particulate matter in general. It is not intended to be a standard for toxic particles such as asbestos, lead, or beryllium. Because size distribution influences the effect of particulate matter on health, the standard will be reevaluated as data on health effects related to size distribution become available.
Lead (particulate)	1.5 ug/m³ Hi-Vol Sampling, Dithizone Method	30 day average	Possible inhibition of d-ALA dehydrase which is used in heme synthesis.	With exposure to 2 ug/m³ or above as a 30 day average, increased storage of lead will produce detectable metabolic effects.
Hydrogen Sulfide	0.03 ppm, cadmium hydroxide Stractan Method	1 hour	Exceeds the odor threshold.	
Nitrogen Dioxide	0.25 ppm, Saltzman	1 hour	a. At slightly higher dosage, effects are observed in experimental animals, which imply a risk to the public health. b. Produces atmospheric discoloration.	
Ethylene	0.5 ppm 0.1 ppm	1 hour 8 hours	Damage to vegetation.	California Administrative Code, Title 17, 30501.

* Any equivalent procedure which can be shown to the satisfaction of the Air Resources Board to give equivalent results at or near the level of the air quality standard may be used.

** Prevailing visibility is defined as the greatest visibility which is attained or surpassed around at least half of the horizon circle, but not necessarily in continuous sectors.

*** Corrected for nitrogen dioxide.

TABLE II-57
AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	California Standards		National Standards[1]		
		Concentration[2]	Method[3]	Primary[2,4]	Secondary[2,5]	Method[6]
Photochemical Oxidants (Corrected for NO_2)	1 hour	0.10 ppm (200 ug/m^3)	Neutral Buffered Potassium Iodide	160 ug/m^3[7] (0.08 ppm)	Same as Primary Std.	Chemiluminescent Method
Carbon Monoxide	12 hour	10 ppm (11 mg/m^3)	Non-Dispersive Infrared Spectroscopy	—	Same as Primary Standards	Non-Dispersive Infrared Spectroscopy
	8 hour	—		10 mg/m^3 (9 ppm)		
	1 hour	40 ppm (46 mg/m^3)		40 mg/m^3 (35 ppm)		
Nitrogen Dioxide	Annual Average	—	Saltzman Method	100 ug/m^3 (0.05 ppm)	Same as Primary Standards	Proposed: Modified J-H Saltzman (O_3 corr.) Chemiluminescent
	1 hour	0.25 ppm (470 ug/m^3)		—		
Sulfur Dioxide	Annual Average	—	Conductimetric Method	80 ug/m^3 (0.03 ppm)	—	Pararosaniline Method
	24 hour	0.10 ppm (260 ug/m^3)		365 ug/m^3 (0.14 ppm)	—	
	3 hour	—		—	1300 ug/m^3 (0.5 ppm)	
	1 hour	0.5 ppm (1310 ug/m^3)		—	—	
Suspended Particulate Matter	Annual Geometric Mean	60 ug/m^3	High Volume Sampling	75 ug/m^3	60 ug/m^3	High Volume Sampling
	24 hour	100 ug/m^3		260 ug/m^3	150 ug/m^3	
Lead	30 Day Average	1.5 ug/m^3	High Volume Sampling, Dithizone Method	—	—	—
Hydrogen Sulfide	1 hour	0.03 ppm (42 ug/m^3)	Cadmium Hydroxide Stractan Method	—	—	—
Hydrocarbons (Corrected for Methane)	3 hour (6-9 a.m.)	—	—	160 ug/m^3 (0.24 ppm)	Same as Primary Standards	Flame Ionization Detection Using Gas Chromatography
Ethylene	8 hour	0.1 ppm	—	—	—	—
	1 hour	0.5 ppm				
Visibility Reducing Particles	1 observation	In sufficient amount to reduce the prevailing visibility to less than 10 miles when the relative humidity is less than 70% (8)		—	—	—

NOTES:

1. National standards, other than those based on annual averages or annual geometric means, are not to be exceeded more than once per year.
2. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm of mercury. All measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of Hg (1,013.2 millibar); ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.
3. Any equivalent procedure which can be shown to the satisfaction of the Air Resources Board to give equivalent results at or near the level of the air quality standard may be used.
4. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health. Each state must attain the primary standards no later than three years after that state's implementation plan is approved by the Environmental Protection Agency (EPA).
5. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Each state must attain the secondary standards within a "reasonable time" after implementation plan is approved by the EPA.
6. Reference method as described by the EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the EPA.
7. Corrected for SO_2 in addition to NO_2.
8. Prevailing visibility is defined as the greatest visibility which is attained or surpassed around at least half of the horizon circle, but not necessarily in continuous sectors.

SOURCE: California Air Resources Board, November 1974, Vol. 5, No. 10, p. 3; Sacramento, California.

TABLE II-58

DATA RECEIVED BY THE AIR RESOURCES BOARD FROM AIR MONITORING STATIONS IN CALIFORNIA 1963-1972

Santa Barbara and Ventura Counties

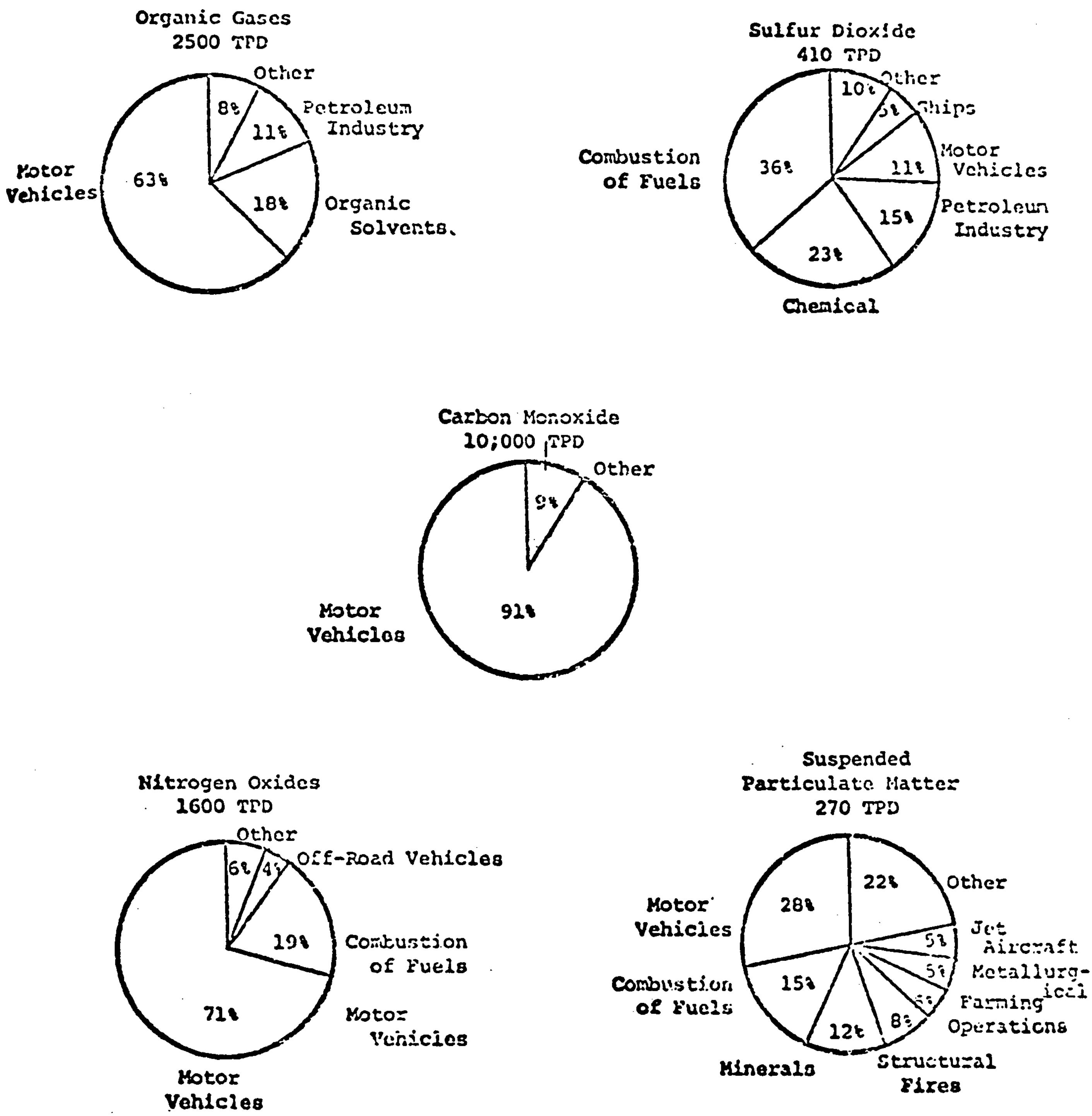
(Data by South Central and South Coast Air Basins from California Air Resources Board, 1973, p. 200-201.)

BASIN, COUNTY, AND CITY	POLLUTANTS MEASURED									ORIGINATING AGENCY
	OX	CO	NO	NO_2	NO_X	HC	SO_2	PARTICULATE MATTER		
								AISI	HI-VOL	
SOUTH CENTRAL COAST AIR BASIN										
Santa Barbara County										
Lompoc H.D.								H		Santa Barbara County Health Department
Santa Maria ARB	H							H	X	California Air Resources Board
Santa Maria - Library									X	California Air Resources Board
Santa Maria - Wtr.& Storage									X	California Air Resources Board
SOUTH COAST AIR BASIN										
Santa Barbara County										
Santa Barbara ARB	H	H	H	H	H	H		H	X	California Air Resources Board
Santa Barbara H.D.	H	H	H	H	H			H	X	State Department of Public Health
Santa Barbara - State St.	H	H	H	H	H	H		H	X	California Air Resources Board
Ventura County										
Camarillo - Magnolia	H	H	H	H	H					Ventura County Air Pollution Control District
Camarillo - Palm	H	H	H	H	H	H			X	Ventura County Air Pollution Control District
Moorpark College	H									Ventura County Air Pollution Control District
Ojai	H	H	H	H	H				X	Ventura County Air Pollution Control District
Oxnard									X	Ventura County Air Pollution Control District
Oxnard - A St.									X	Ventura County Air Pollution Control District
Point Mugu			H	H	H					Ventura County Air Pollution Control District
Port Hueneme									X	Ventura County Air Pollution Control District
Santa Paula									X	Ventura County Air Pollution Control District
Thousand Oaks									X	Ventura County Air Pollution Control District
Ventura	H	H	H	H	H	H		H	X	Ventura County Air Pollution Control District

H = hourly sampling
X = summary of particulate measurements collected over a 24-hour period
AISI = a photoelectric (optical density) method of measuring particulates known as soiling technique
(See narrative description following tables II-4 through II-6 for further explanation)

FIGURE II-45a

PERCENTAGE OF EMISSIONS
FROM MAJOR SOURCES IN SOUTH COAST AIR BASIN
1972



Source: Air Pollution in California Annual Report 1973, State of California Air Resource Board, p. 25

TABLE II-59 SANTA BARBARA COUNTY* SOUTH CENTRAL COAST AIR BASIN - AVERAGE EMISSIONS OF POLLUTANTS - 1972 (TONS PER DAY)

Emission Sources	Organic Gases		Particulate Matter	Oxides of Nitrogen	Sulfur Dioxide	Carbon Monoxide
	High Reactive	Total				
STATIONARY SOURCES						
PETROLEUM						
Production	0.4	3.5				
Refining	0.1	0.6	0.1	0.2		
Marketing	0.6	1.5				
SUBTOTAL	1.1	5.6	0.1	0.2		
ORGANIC SOLVENT USERS						
Surface Coating	0.2	1.2				
Dry Cleaning	0.1	0.4				
Degreasing	0.2	0.8				
Other						
SUBTOTAL	0.5	2.4				
CHEMICAL						
METALLURGICAL						
MINERAL			4.7			
FOOD AND AGRICULTURAL PROCESSING			0.1			
PESTICIDES	0.4	0.5				
WOOD PROCESSING						
COMBUSTION OF FUELS						
Power Plants						
Other Industrial	0.6	6.9	0.3	[illegible]	0.5	0.9
Domestic and Commercial	0.2	0.2	0.2	0.9		
Orchard Heaters						
SUBTOTAL	0.8	7.1	0.4	8.0	0.5	1.1
WASTE BURNING						
Agricultural Debris		0.1	0.1			0.2
Forest Management		0.1	0.1			0.3
Range Improvement	1.0	9.1	3.9	0.5		14.8
Dumps						
Conical Burners						
Incinerators						
Other		0.1	0.1			0.2
SUBTOTAL	1.0	9.4	4.2	0.5		15.5
MISCELLANEOUS AREA SOURCES						
Wild Fires	1.6	14.4	10.8	0.7		46.8
Structural Fires		0.3	0.2			1.0
Farming Operations			3.2			
Construction and Demolition			0.1			
Unpaved Roads			0.3			
Other						1.6
SUBTOTAL	1.6	14.7	14.6	0.7		49.4
TOTAL, STATIONARY SOURCES	5.4	39.7	24.1	9.4	0.5	66.0
MOBILE SOURCES						
MOTOR VEHICLES-ON ROAD						
Light-Duty Vehicle Exhaust	8.1	10.8	0.7	9.4	0.4	80.5
Heavy-Duty Gasoline Vehicle Exhaust	2.7	3.6	0.1	1.6	0.1	21.2
Heavy-Duty Diesel Exhaust	0.3	0.4	0.1	1.6	0.1	1.6
Motorcycle Exhaust	0.2	0.3				1.3
Evaporation	1.9	2.8				
Crankcase	0.1	0.1				
SUBTOTAL	13.3	18.0	0.9	12.6	0.6	105
JET AIRCRAFT	0.1	0.1				1.9
PISTON AIRCRAFT	0.1	0.1		0.1		0.2
RAILROADS	0.2	0.3	0.1	1.0	0.2	0.4
SHIPS						
OTHER OFF-ROAD VEHICLES	1.0	1.3	0.2	1.8	0.3	13.0
TOTAL, MOBILE SOURCES	14.7	19.8	1.2	15.5	1.1	120
TOTAL, ALL SOURCES	20.1	59.5	25.3	24.9	1.6	186

*Portion of This County in the South Central Coast Basin

PRELIMINARY DATA SUBJECT TO REVISION

TABLE II-60 SANTA BARBARA COUNTY* SOUTH COAST AIR BASIN - AVERAGE EMISSIONS OF POLLUTANTS - 1972 (TONS PER DAY)

Emission Sources	Organic Gases		Particulate Matter	Oxides of Nitrogen	Sulfur Dioxide	Carbon Monoxide
	High Reactive	Total				
STATIONARY SOURCES						
PETROLEUM						
Production	0.2	1.3				
Refining						
Marketing	1.3	2.9				
SUBTOTAL	1.5	4.2				
ORGANIC SOLVENT USERS						
Surface Coating	0.3	1.5				
Dry Cleaning	0.1	0.5				
Degreasing	0.2	1.1				
Other						
SUBTOTAL	0.6	3.1				
CHEMICAL						
METALLURGICAL						
MINERAL			1.0			
FOOD AND AGRICULTURAL PROCESSING						
PESTICIDES	0.2	0.2				
WOOD PROCESSING						
COMBUSTION OF FUELS						
Power Plants						
Other Industrial	0.1	[illegible]		[illegible]		0.2
Domestic and Commercial		[illegible]	0.1	[illegible]		0.1
Orchard Heaters	0.1	[illegible]		[illegible]		
SUBTOTAL			0.1	[illegible]		0.3
WASTE BURNING						
Agricultural Debris		[illegible]	0.2			0.7
Forest Management						
Range Improvement						
Dumps						
Conical Burners						
Incinerators						
Other						
SUBTOTAL		0.2	0.2			0.7
MISCELLANEOUS AREA SOURCES						
Wild Fires		0.1				0.2
Structural Fires		0.4	0.3			1.4
Farming Operations			1.1			
Construction and Demolition			0.4			
Unpaved Roads			0.4			
Other	0.2	0.3				2.1
SUBTOTAL	0.2	0.8	2.2			3.7
TOTAL, STATIONARY SOURCES	2.6	10.1	3.5	1.7		4.7
MOBILE SOURCES						
MOTOR VEHICLES-ON ROAD						
Light-Duty Vehicle Exhaust	11.2	14.9	0.9	13.3	0.5	113
Heavy-Duty Gasoline Vehicle Exhaust	3.7	4.9	0.2	2.3	0.1	29.9
Heavy-Duty Diesel Exhaust	0.4	0.5	0.2	2.3	0.2	2.2
Motorcycle Exhaust	0.3	0.4				1.8
Evaporation	2.6	3.9				
Crankcase	0.2	0.3				
SUBTOTAL	18.4	24.9	1.3	17.9	0.8	147
JET AIRCRAFT	0.2	0.5		0.1		0.1
PISTON AIRCRAFT	0.6	0.8	0.1	0.1		3.9
RAILROADS	0.4	0.5	0.1	1.2	0.3	0.6
SHIPS					0.1	
OTHER OFF-ROAD VEHICLES	1.0	1.3	0.3	2.3	0.4	10.0
TOTAL, MOBILE SOURCES	20.6	28.0	1.8	22.2	1.6	162
TOTAL, ALL SOURCES	23.2	38.1	5.3	23.9	1.6	166

* Portion of This County in the South Coast Air Basin

PRELIMINARY DATA SUBJECT TO REVISION

TABLE II-61 VENTURA COUNTY - SOUTH COAST AIR BASIN - AVERAGE EMISSIONS OF POLLUTANTS - 1972 (TONS PER DAY)

Emission Sources	Organic Gases		Particulate Matter	Oxides of Nitrogen	Sulfur Dioxide	Carbon Monoxide
	High Reactive	Total				
STATIONARY SOURCES						
PETROLEUM						
Production	4.5	29.9				
Refining		0.3				
Marketing	2.6	5.6				
SUBTOTAL	7.1	35.8				
ORGANIC SOLVENT USERS						
Surface Coating	0.9	3.9				
Dry Cleaning	0.3	2.3				
Degreasing	1.2	6.3				
Other						
SUBTOTAL	2.4	12.5				
CHEMICAL	1.1	3.3	0.3	0.1	.	1.3
METALLURGICAL		0.1	0.1			
MINERAL	0.1	0.3	19.3	0.1	5.0	
FOOD AND AGRICULTURAL PROCESSING		0.3	0.7			
PESTICIDES	2.9	3.6				
WOOD PROCESSING						
COMBUSTION OF FUELS						
Power Plants			0.2	[illegible]	[illegible]	
Other Industrial		[illegible]	0.3	[illegible]	0.1	
Domestic and Commercial		[illegible]	0.3	2.0		0.3
Orchard Heaters		[illegible]	2.0			
SUBTOTAL		5.3	2.8	27.2	15.2	0.3
WASTE BURNING						
Agricultural Debris	0.1	0.5	0.4	0.1		2.5
Forest Management						
Range Improvement						
Dumps						
Conical Burners						
Incinerators						
Other						
SUBTOTAL	0.1	0.5	0.4	0.1		2.5
MISCELLANEOUS AREA SOURCES						
Wild Fires	0.1	0.6	0.5			2.0
Structural Fires	0.1	1.1	0.8			3.6
Farming Operations			4.5			
Construction and Demolition			0.5			
Unpaved Roads			0.3			
Other	0.4	0.5				3.5
SUBTOTAL	0.6	2.2	6.6			9.1
TOTAL, STATIONARY SOURCES	14.3	63.9	30.2	27.5	20.2	13.2
MOBILE SOURCES						
MOTOR VEHICLES-ON ROAD						
Light-Duty Vehicle Exhaust	27.2	36.3	2.1	32.4	1.2	275
Heavy-Duty Gasoline Vehicle Exhaust	9.0	12.0	0.4	5.5	0.2	72.8
Heavy-Duty Diesel Exhaust	1.0	1.3	0.4	5.5	0.4	5.3
Motorcycle Exhaust	0.8	1.1				4.4
Evaporation	6.5	9.7				
Crankcase	0.4	0.6				
SUBTOTAL	44.9	61.0	2.9	43.4	1.8	358
JET AIRCRAFT	1.9	3.8	0.6	0.1		33.4
PISTON AIRCRAFT	2.0	4.0	1.9	0.9	0.3	3.6
RAILROADS	0.3	0.5	0.1	1.6	0.2	0.6
SHIPS			0.2	0.5	1.9	
OTHER OFF-ROAD VEHICLES	2.3	3.1	0.4	5.3	0.8	23.4
TOTAL, MOBILE SOURCES	51.4	72.4	6.1	51.8	5.0	419
TOTAL, ALL SOURCES	65.7	136	36.3	79.3	25.2	432

PRELIMINARY DATA SUBJECT TO REVISION

"The following tables provide detailed information on the quality of the ambient air over California cities. The data are provided by cooperating air pollution control districts and from air monitoring stations operated by the California Air Resources Board . . . ." (California Air Resources Board, 1973c, p. 7; Definition of terms, Sampling Methods and Reporting Units are defined on p. 8-9.)

"The data on emissions from motor vehicles are developed by the staff of the Board, as the control of these emissions is exclusively a state function. Data on emissions from nonvehicular sources are developed by local control agencies. Because local air pollution control differs greatly as to organization, rules and regulations and activities, the data available from control agencies vary in both completeness and format. Some agencies have highly developed programs for assessing pollution sources within their jurisdiction, others do not. Where established programs exist, the data already compiled are used to the fullest extent feasible; where no information is available, the Air Resources Board staff made the estimate jointly with local personnel to develop the data.

"The emission inventories of all coastal counties are shown in tables . . . . Emissions of pollutants are listed in terms of tons per day according to emission source. The pollutants are divided into five categories--organic gases, particulate matter, oxides of nitrogen (NO_x), sulfur dioxide (SO_2) and carbon monoxide (CO). Organic gases, including hydrocarbons, aldehydes, ketones and organic acids, are of interest because of their role in the formation of photochemical air pollution, and are therefore, separated into the categories of high and low photochemical air pollution reactivity. Particulate matter includes only those solid and liquid particles that are emitted directly; it does not include the amount formed in the air through photochemical reactions. Oxides of nitrogen, as tabulated in this report, include essentially nitric oxide and nitrogen." (California Air Resources Board, 1971, pp. 46-47)

Various air pollutants have been monitored at several locations within the urban area and suburban fringe of the City of Santa Barbara since 1959. These pollutants include oxidants, carbon monoxide, oxides of nitrogen, hydrocarbons, suspended particulates, and lead (Santa Barbara County APCD, 1973). State and/or federal ambient air quality standards have been adopted for most of these pollutants (Table II-57). The current status of each air contaminant, as measured at sampling locations within the urban area/surburban fringe, is summarized below.

Oxidants: Oxidant consists of a variety of intermediate and end-products formed in the presence of sunlight by reactions between (non-methane) hydrocarbons and oxides of nitrogen. Historically, daily maximum hourly average concentrations of oxidant have frequently exceeded the federal (8 pphm) and State (110 pphm) ambient air quality standards at the various sampling locations during the years monitored (Table II-61a). Typically, diurnal peak concentrations occur between 1200 and 1600 hours (Santa Barbara County APCD, 1973).

Carbon Monoxide: The primary source of carbon monoxide emissions in the region is motor vehicles (Figure II-45a). Sampling instrumentation situated adjacent to U. S. Highway 101 and in downtown Santa Barbara have been (and are) in excellent locations to provide cross-section evaluations of the transportation corridors (Santa Barbara County APCD, 1973). Historically, daily maximum hourly average concentrations of carbon monoxide have never exceeded the federal (35 ppm) or State (40 ppm) air quality standards (Table II-61a). Quarterly "max-hour" concentrations are higher during the late fall through early spring quarters than during the late spring through early fall seasons (Table II-61a; Santa Barbara County APCD, 1973).

Peak concentrations are geared to morning and evening commuter traffic. However, morning values decrease after the morning peak, but evening values remain relatively high into the early morning hours. The 8-hour federal ambient air quality standard (9.0 ppm) is sometimes exceeded during this period (10 days/68 hours during 1972 in downtown Santa Barbara). These occasions typically occur during the late fall through early spring seasons (Santa Barbara County APCD, 1973).

TABLE II-61a

AIR QUALITY DATA

South Coast Air Basin Portion - Santa Barbara County[1,2]

OXIDANT

SUMMARY OF DAILY MAXIMUM HOURLY AVERAGE CONCENTRATIONS (Parts per Hundred Million)

STATION / YEAR	ANNUAL: NO OF OBS	HIGH	ARITHMETIC MEAN	ARITHMETIC STD DEV	GEOMETRIC MEAN	GEOMETRIC STD DEV	CONCENTRATIONS EQUALLED OR EXCEEDED BY STATED PERCENT OF OBSERVATIONS: 1%	2%	3%	4%	5%	10%	25%	50%	75%	QUARTERLY: JAN - MAR ARITH MEAN	JAN - MAR HIGH	APR - JUN ARITH MEAN	APR - JUN HIGH	JUL - SEP ARITH MEAN	JUL - SEP HIGH	OCT - DEC ARITH MEAN	OCT - DEC HIGH
SANTA BARBARA ARB																							
1971*	214	11	4.7	1.8	4.4	1.5	10	9	9	9	8	7	6	4	3			4.7*	9	5.6	11	3.8	8
1972	359	13	4.6	2.0	4.2	1.5	12	10	9	9	9	7	6	4	3	4.4	12	5.5	13	4.8	10	3.5	9
SANTA BARBARA H.D.																							
1963	324	24	6.7	3.1	6.1	1.5	16	15	14	13	12	10	8	6	4	5.5	14	6.0	14	8.3	22	6.6	24
1964	358	16	5.1	2.1	4.7	1.5	13	10	9	9	9	8	6	5	4	4.8	11	4.6	10	5.5	13	5.4	16
1965	365	25	7.3	2.8	6.8	1.4	16	15	14	13	12	11	8	7	5	6.4	25	7.9	15	7.8	17	6.9	16
1966*	151	15	7.0	2.5	6.5	1.4	14	14	12	12	11	10	9	7	5	6.1	14	8.3	15				
SANTA BARBARA-STATE ST																							
1972*	327	11	3.5	1.7	3.2	1.6	9	8	7	7	7	6	4	3	2	3.5*	7	3.8	10	4.2	11	2.7	8

CARBON MONOXIDE

SUMMARY OF DAILY MAXIMUM HOURLY AVERAGE CONCENTRATIONS (Parts per Million)

STATION / YEAR	ANNUAL: NO OF OBS	HIGH	ARITHMETIC MEAN	ARITHMETIC STD DEV	GEOMETRIC MEAN	GEOMETRIC STD DEV	CONCENTRATIONS EQUALLED OR EXCEEDED BY STATED PERCENT OF OBSERVATIONS: 1%	2%	3%	4%	5%	10%	25%	50%	75%	QUARTERLY: JAN - MAR ARITH MEAN	JAN - MAR HIGH	APR - JUN ARITH MEAN	APR - JUN HIGH	JUL - SEP ARITH MEAN	JUL - SEP HIGH	OCT - DEC ARITH MEAN	OCT - DEC HIGH
SANTA BARBARA ARB																							
1971*	202	13	3.3	2.2	2.7	1.8	9	9	9	8	8	7	4	3	2			2.0*	3	2.3	7	4.6	13
1972	355	12	3.5	2.2	2.9	1.9	11	10	10	9	9	7	4	3	2	4.0	12	2.4	4	2.8	12	4.8	12
SANTA BARBARA H.D.																							
1964	353	26	6.5	4.8	5.2	1.9	22	21	18	17	17	14	8	4	3	9.2	26	3.7	10	4.0	17	8.8	25
1965	365	31	7.2	5.7	5.6	2.0	27	25	24	20	19	15	9	5	3	9.0	26	3.9	8	3.9	16	11.8	31
1966*	151	20	6.5	4.1	5.4	1.6	19	17	17	17	17	12	8	5	3	8.3	20	3.7	6				
SANTA BARBARA-STATE ST																							
1972*	324	21	4.7	3.2	3.9	1.8	15	14	13	12	11	9	6	4	3	5.2*	13	3.0	6	3.0	11	7.9	21

HYDROCARBONS

SUMMARY OF DAILY MAXIMUM HOURLY AVERAGE CONCENTRATIONS (Parts per Million)

STATION / YEAR	ANNUAL: NO OF OBS	HIGH	ARITHMETIC MEAN	ARITHMETIC STD DEV	GEOMETRIC MEAN	GEOMETRIC STD DEV	CONCENTRATIONS EQUALLED OR EXCEEDED BY STATED PERCENT OF OBSERVATIONS: 1%	2%	3%	4%	5%	10%	25%	50%	75%	QUARTERLY: JAN - MAR ARITH MEAN	JAN - MAR HIGH	APR - JUN ARITH MEAN	APR - JUN HIGH	JUL - SEP ARITH MEAN	JUL - SEP HIGH	OCT - DEC ARITH MEAN	OCT - DEC HIGH
SANTA BARBARA ARB																							
1971*	206	19	7.9	3.6	7.1	1.6	18	16	16	15	15	13	10	7	5			7.6*	13	7.4	16	8.7	19
SANTA BARBARA-STATE ST																							
1972*	324	50	6.9	3.5	6.4	1.4	15	14	13	12	12	10	8	6	5	7.4*	14	7.5	50	5.0	8	7.8	15

TABLE II-61a (continued)

NITROGEN DIOXIDE

SUMMARY OF DAILY MAXIMUM HOURLY AVERAGE CONCENTRATIONS
(Parts per Hundred Million)

STATION / YEAR	ANNUAL: NO OF OBS	HIGH	ARITHMETIC MEAN	ARITHMETIC STD DEV	GEOMETRIC MEAN	GEOMETRIC STD DEV	CONCENTRATIONS EQUALLED OR EXCEEDED BY STATED PERCENT OF OBSERVATIONS: 1%	2%	3%	4%	5%	10%	25%	50%	75%	QUARTERLY: JAN - MAR ARITH MEAN	JAN - MAR HIGH	APR - JUN ARITH MEAN	APR - JUN HIGH	JUL - SEP ARITH MEAN	JUL - SEP HIGH	OCT - DEC ARITH MEAN	OCT - DEC HIGH
SANTA BARBARA ARB																							
1971°	207	16	5.8	2.0	5.4	1.4	11	11	10	9	9	8	7	5	4			5.5°	9	5.5	11	6.1	16
1972	364	16	5.8	2.0	5.5	1.4	13	11	11	10	9	8	7	5	4	6.5	16	5.9	13	5.4	11	5.3	11
SANTA BARBARA H.D.																							
1964	353	18	3.8	2.3	3.4	1.6	15	10	9	8	8	6	4	3	3	4.0	10	3.2	18	3.3	18	4.9	15
1965	363	31	5.2	3.3	4.6	1.6	20	15	14	11	10	8	6	4	3	5.9	24	4.0	8	4.2	14	6.7	31
1966°	150	13	5.3	1.9	5.0	1.4	12	12	10	9	9	8	6	5	4	5.8	13	4.6	9				
SANTA BARBARA-STATE ST																							
1972°	324	21	4.8	1.9	4.5	1.4	12	10	9	9	8	7	5	4	4	5.8°	21	4.6	10	4.2	11	4.9	12

OXIDES OF NITROGEN

SUMMARY OF DAILY MAXIMUM HOURLY AVERAGE CONCENTRATIONS
(Parts per Hundred Million)

STATION / YEAR	ANNUAL: NO OF OBS	HIGH	ARITHMETIC MEAN	ARITHMETIC STD DEV	GEOMETRIC MEAN	GEOMETRIC STD DEV	CONCENTRATIONS EQUALLED OR EXCEEDED BY STATED PERCENT OF OBSERVATIONS: 1%	2%	3%	4%	5%	10%	25%	50%	75%	QUARTERLY: JAN - MAR ARITH MEAN	JAN - MAR HIGH	APR - JUN ARITH MEAN	APR - JUN HIGH	JUL - SEP ARITH MEAN	JUL - SEP HIGH	OCT - DEC ARITH MEAN	OCT - DEC HIGH
SANTA BARBARA ARB																							
1971°	207	70	18.7	13.9	15.0	1.9	64	58	56	54	50	40	24	14	9			10.1°	16	12.8	38	26.6	70
1972	363	88	21.2	14.4	17.6	1.8	78	62	60	55	52	40	26	16	12	23.2	62	14.0	36	14.7	60	32.7	88
SANTA BARBARA H.D.																							
1964°	204	47	8.8	8.2	6.1	2.3	39	28	28	28	25	21	13	5	3	14.5	47	5.5	25	3.4°	8		
1965	362	76	13.8	13.3	9.7	2.2	63	56	52	46	44	33	16	9	5	9.8	25	7.8	24	8.0	36	29.1	76
1966°	150	65	18.6	14.9	13.2	2.4	61	55	51	50	47	42	29	13	6	26.2	65	7.6	20				
SANTA BARBARA-STATE ST																							
1972°	323	66	15.5	14.0	11.0	2.3	61	55	51	50	47	38	21	10	5	14.9°	55	7.8	27	8.9	42	30.0	66

NITRIC OXIDE

SUMMARY OF DAILY MAXIMUM HOURLY AVERAGE CONCENTRATIONS
(Parts per Hundred Million)

STATION / YEAR	ANNUAL: NO OF OBS	HIGH	ARITHMETIC MEAN	ARITHMETIC STD DEV	GEOMETRIC MEAN	GEOMETRIC STD DEV	CONCENTRATIONS EQUALLED OR EXCEEDED BY STATED PERCENT OF OBSERVATIONS: 1%	2%	3%	4%	5%	10%	25%	50%	75%	QUARTERLY: JAN - MAR ARITH MEAN	JAN - MAR HIGH	APR - JUN ARITH MEAN	APR - JUN HIGH	JUL - SEP ARITH MEAN	JUL - SEP HIGH	OCT - DEC ARITH MEAN	OCT - DEC HIGH
SANTA BARBARA ARB																							
1971°	207	65	14.1	13.2	9.8	2.4	57	51	50	47	45	33	19	9	5			5.9°	12	8.7	31	21.7	65
1972	362	82	16.5	14.1	11.7	2.5	72	56	54	49	45	36	21	12	7	18.2	56	9.3	31	10.1	53	28.0	82
SANTA BARBARA H.D.																							
1964°	204	38	6.2	7.1	3.3	3.2	32	26	24	22	20	17	9	3	1	11.3	38	3.0	19	1.8°	5		
1965	332	72	10.0	13.2	4.3	4.2	58	51	48	43	41	29	13	5	2	4.7	21	4.3	21	4.5	29	24.5	72
1966°	150	57	14.4	14.3	7.0	4.1	56	51	46	44	43	35	24	9	2	21.7	57	3.8	16				
SANTA BARBARA-STATE ST																							
1972°	321	60	11.8	13.3	5.6	4.0	56	49	46	45	42	32	18	7	2	10.7°	47	4.2	22	5.7	34	25.8	60

TABLE II-61a (continued)

BUSPENDED PARTICULATE (BY AISI METHOD)

SUMMARY OF DAILY MAXIMUM 2-HOUR COH VALUES
(COH Value x 10)

STATION / YEAR	ANNUAL: NO OF OBS	HIGH	ARITHMETIC MEAN	ARITHMETIC STD DEV	GEOMETRIC MEAN	GEOMETRIC STD DEV	CONCENTRATIONS EQUALLED OR EXCEEDED BY STATED PERCENT OF OBSERVATIONS: 1%	2%	3%	4%	5%	10%	25%	50%	75%	QUARTERLY: JAN - MAR ARITH MEAN	JAN - MAR HIGH	APR - JUN ARITH MEAN	APR - JUN HIGH	JUL - SEP ARITH MEAN	JUL - SEP HIGH	OCT - DEC ARITH MEAN	OCT - DEC HIGH
SANTA BARBARA ARB																							
1971*	108	34	9.5	8.4	6.8	2.3	32	32	29	28	28	23	14	6	4	15.9	34					4.0	8
1972	351	14	4.4	2.6	3.7	1.8	12	12	11	10	10	8	6	4	2	3.9	9	2.6	8	4.6	14	6.3	14
SANTA BARBARA H.D.																							
1963	344	29	9.4	5.5	8.1	1.7	28	26	23	22	21	18	12	8	5	11.5	24	6.3	14	6.8	18	13.3	29
1964	366	31	7.6	5.4	6.1	1.9	25	24	21	19	18	16	10	6	4	11.9	31	5.2	18	5.1	18	8.5	22
1965	365	39	10.3	6.3	8.8	1.7	32	28	28	26	25	19	13	8	6	9.3	22	7.0	17	7.9	23	16.7	39
1966*	151	42	11.9	6.8	10.3	1.7	34	32	29	27	24	20	15	10	7	14.7	42	7.6	23				
1968*	75	18	7.7	3.5	7.0	1.6	18	16	15	15	15	12	10	7	5							7.7	18
1969*	162	20	4.1	4.2	2.9	2.2	18	18	18	16	14	11	4	2	2	3.1*	7	2.3	14			10.5*	20
1970*	261	28	7.4	5.7	5.7	2.0	25	23	22	21	20	18	10	5	3	6.1	20	3.6	8	4.0*	14	12.0	28
SANTA BARBARA-STATE ST																							
1972*	302	41	8.9	6.7	6.9	2.0	27	26	24	23	23	21	12	6	4	6.1*	13	5.0	10	6.3	23	16.6	41

TOTAL SUSPENDED PARTICULATE (BY HI-VOLUME METHOD)

SUMMARY OF 24-HOUR SAMPLES
(Micrograms per Cubic Meter)

STATION / YEAR	TOTAL NO. OF SAMPLES	MAX	CONCENTRATIONS EQUALLED OR EXCEEDED BY STATED PERCENT OF ALL SAMPLES: 10%	20%	30%	40%	50%	60%	70%	80%	90%	MIN	ARITHMETIC MEAN	ARITHMETIC STD DEV	GEOMETRIC MEAN	GEOMETRIC STD DEV	NUMBER OF SAMPLE ≥100	>150	>26
SANTA BARBARA ARB																			
1968*	10	96	92	77	68	59	57	56	54	52	46	45	63.2	15.4	61.6	1.3	0	0	
1969	23	88	86	77	73	62	59	57	51	48	39	18	60.0	18.0	56.9	1.4	0	0	
1970*	19	78	78	75	71	67	60	56	49	37	33	17	57.7	17.5	54.3	1.5	0	0	
1971	61	168	101	82	74	70	64	58	51	49	36	11	65.8	27.5	59.8	1.6	7	1	
1972	55	222	106	91	84	76	70	63	58	49	39	86	69.7	37.6	69.7	1.9	7	1	
SANTA BARBARA H D.																			
1965*	23	129	87	83	80	72	70	62	55	54	49	39	70.5	21.9	67.6	1.3	2	0	
1966*	19	165	139	121	112	94	87	77	73	63	54	30	91.2	32.9	85.2	1.5	7	1	
SANTA BARBARA-STATE ST																			
1972*	50	126	102	92	84	79	72	69	61	55	51	32	73.2	21.3	70.0	1.4	5	0	

*Statistic may be unrepresentative.

[1]After California Air Resources Board, 1974.

[2]See Legend in Table IIIa.

LEGEND FOR TABLE II-61a

DEFINITION OF STATISTICAL TERMS

BASIC DATA

Hourly Average is the average concentration for a 60-minute clock-hour. There are 24 such periods each day, beginning with midnight.

Daily Maximum Hourly Average, referred to as max-hour, is the highest of the hourly average concentrations reported each day.

TABULATED DATA

Annual High is the highest hourly average concentration for the year.

Quarterly High is the highest hourly average concentration for a given quarter of the calendar year.

UNITS OF MEASUREMENT

UNITS

1. ppm means parts of pollutant per million parts of air, by volume.
2. pphm means parts of pollutant per hundred million parts of air, by volume.
3. ppm C means parts per million hydrocarbons calculated as methane.
4. $\mu g/m^3$ means micrograms of pollutant per cubic meter of air.
5. COH/1000 feet means coefficient of haze per 1000 linear feet of air sampled.

Oxides of Nitrogen: Mobile sources account for approximately 75% of the oxides of nitrogen emitted into the atmosphere of the region (Figure II-45a). Diurnal trends in nitric oxide concentrations show peaks correlated with morning and evening commuter traffic. Nitrogen dioxide concentrations increase steadily after the morning nitric oxide peak, and remain relatively high until after midnight. This is attributed to the oxidation of nitric oxide to nitrogen dioxide as photochemical reactions form oxidant (Santa Barbara County APCD, 1973). However, "max-hour" concentrations are usually well below the State standard of 25 pphm. This standard was exceeded on only 3 occasions during one year at one sampling location (Santa Barbara Health Department during 1965) (Table II-61a; Santa Barbara County APCD, 1973). The federal standard of 5 pphm (annual average) has never been exceeded (California ARB, 1974).

Total Hydrocarbons: Hydrocarbons, including the photochemically reactive portions, are contributed primarily by moving sources, although stationary sources (petroleum marketing and organic solvent users) are also important in the region (See Organic Gases Figure II-45a). The diurnal and seasonal variation in hydrocarbon concentrations is somewhat similar to that for carbon monoxide (Santa Barbara County APCD, 1973). Measurements of total hydrocarbons cannot be compared to the 3-hour federal standard (.25 ppm non-methane hydrocarbon) because of the inclusion of methane. Estimates of 50% of the total hydrocarbon as the non-methane component appear reasonable for intermediate hydrocarbon levels, but produce over-estimates of the non-methane portion at lower concentrations (Santa Barbara County APCD, 1973). On this basis, background levels of hydrocarbons (California ARB, 1974) appear to exceed the 3-hour federal air quality standard throughout southern California.

Particulates and Lead: Man-made sources of particulate matter in the region include vehicular emissions, farming operations, and the mineral industry (Figure II-45a). Airborne particulate matter also originates from natural sources and atmospheric reactions involving gaseous pollutants (California ARB, 1971). Measurements of total suspended particulates (high volume method) frequently exceeded the State standard (60 $\mu g/m^3$) for the annual geometric mean at the locations and times sampled (Table II-61a). The State suspended particulate (100 mg/m^3) standard for the 24-hour averaging time was exceeded in about 12% of the samples taken at Santa Barbara Air Resources Board during recent years (1971 and 1972; data at other stations may not be reliable). The federal secondary standard (150 mg/m^3) was exceeded once each year during the same period (Table II-61a).

Suspended particulates by the AISI method reached moderate and high COH values during 25% and 5% of the samples, respectively, at the locations and times indicated (Table II-61a). Moderate and high COH values are indicative of moderate and heavy suspended particulate loads. Values are highest during the late fall through early spring quarters (Table II-61a; Santa Barbara County APCD, 1973).

Lead determinations made from high volume samples at two stations within the urban/suburban fringe during 1972 are shown in Table II-61b. The State standard for the 30-day average (1.5 $\mu g/m^3$) was exceeded at both stations on two of the ten months sampled, and at the downtown station during a third month (Table II-61b).

Sulfur Compounds: These have not been monitored within the region (Santa Barbara County APCD, 1973). About 1.6 tons per day of sulfur dioxide are produced within the region by mobile sources (Table II-59). The Santa

TABLE II-61b

ATMOSPHERIC LEAD FROM AMBIENT AIR SAMPLES[1]

1972

Average Pb/Mo. ($\mu g/m^3$)

Goleta	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Santa Barbara[4]	ND[2]	ND	0.64	1.16	0.91	0.68	0.72	0.95	1.10	[3]1.67	1.31	1.52
	ND	ND	0.56	1.00	0.61	0.49	0.55	0.70	1.14	1.76	1.65	2.70

[1]After Santa Barbara County APCD, 1973.

[2]ND Not Determined

[3]____ Exceeds State 30-day average standard of 1.5 μ/m^3

[4]Central Business District

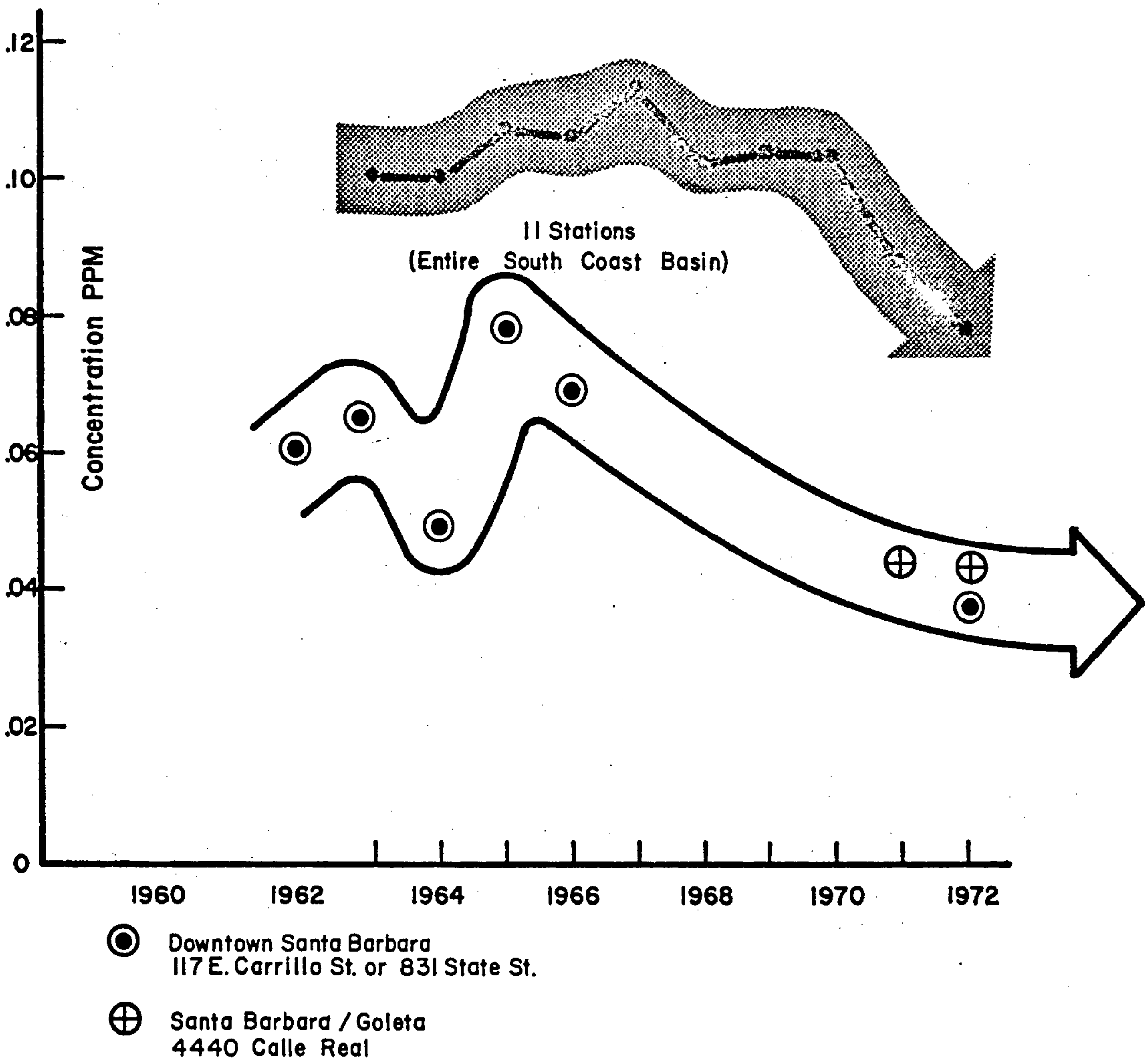
Barbara County APCD has a record of intermittent odor problems, relating to incomplete combustion of hydrogen sulfide-containing gas, at an oil treating facility near Ellwood. The situation is expected to be resolved in the near future by modifications of process equipment (English, 1974).

Air Basin Comparisons and Trends: Analysis (Santa Barbara County APCD, 1973) of pollutant trends over the last 4-6 years provides a perspective on the long term air quality experienced in the South Coast Air Basin portion of Santa Barbara County (Figures II-45b, c, d, and e). In all cases except hydrocarbons, values in Santa Barbara County are markedly lower than in the South Coast Air Basin as a whole. The local trends are similar in all cases to the trends for the entire basin. These trends show a reduction in oxidants and carbon monoxide (despite an increase in vehicles), but an increase in oxides of nitrogen. The decrease in the former gases is related to increased emission controls; the increase of the latter is related to increased vehicle use and a tendency for hydrocarbon control systems to increase exhaust emissions of oxides of nitrogen (California Air Resources Board, 1972). However, with increasing utilization of 1975 vehicles characterized by much reduced emissions through increased controls (Environmental Protection Agency, 1973), concentrations of nitrogen oxides are expected to decline along with those of carbon monoxide and hydrocarbons.

FIGURE II-45b

OXIDANT TRENDS

Yearly Average of Daily Maximum Hour Concentrations



All total oxidant measurements shown were made by continuous monitoring instrumentation. From 1967 thru 1969 measurements of total oxidant were made by a single sample of fifteen minutes at some time during the working day.

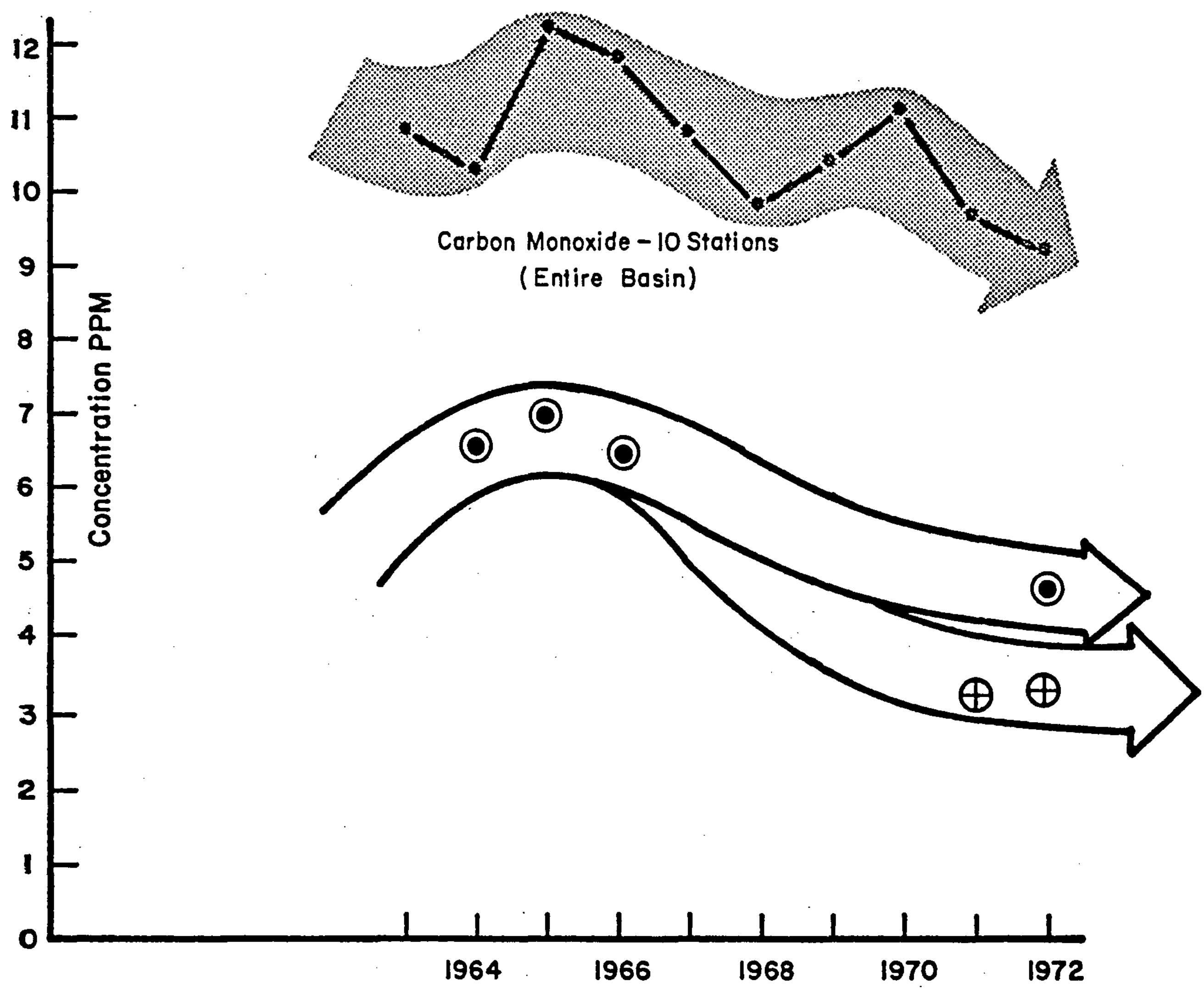
(after Santa Barbara County APCD, 1973)

DAMES & MOORE

FIGURE II-45c

CARBON MONOXIDE TRENDS SOUTH COAST AIR BASIN

Yearly Average of Daily Maximum Hour Concentrations



◉ Santa Barbara – Downtown
117 E. Carrillo St. and 831 State St.

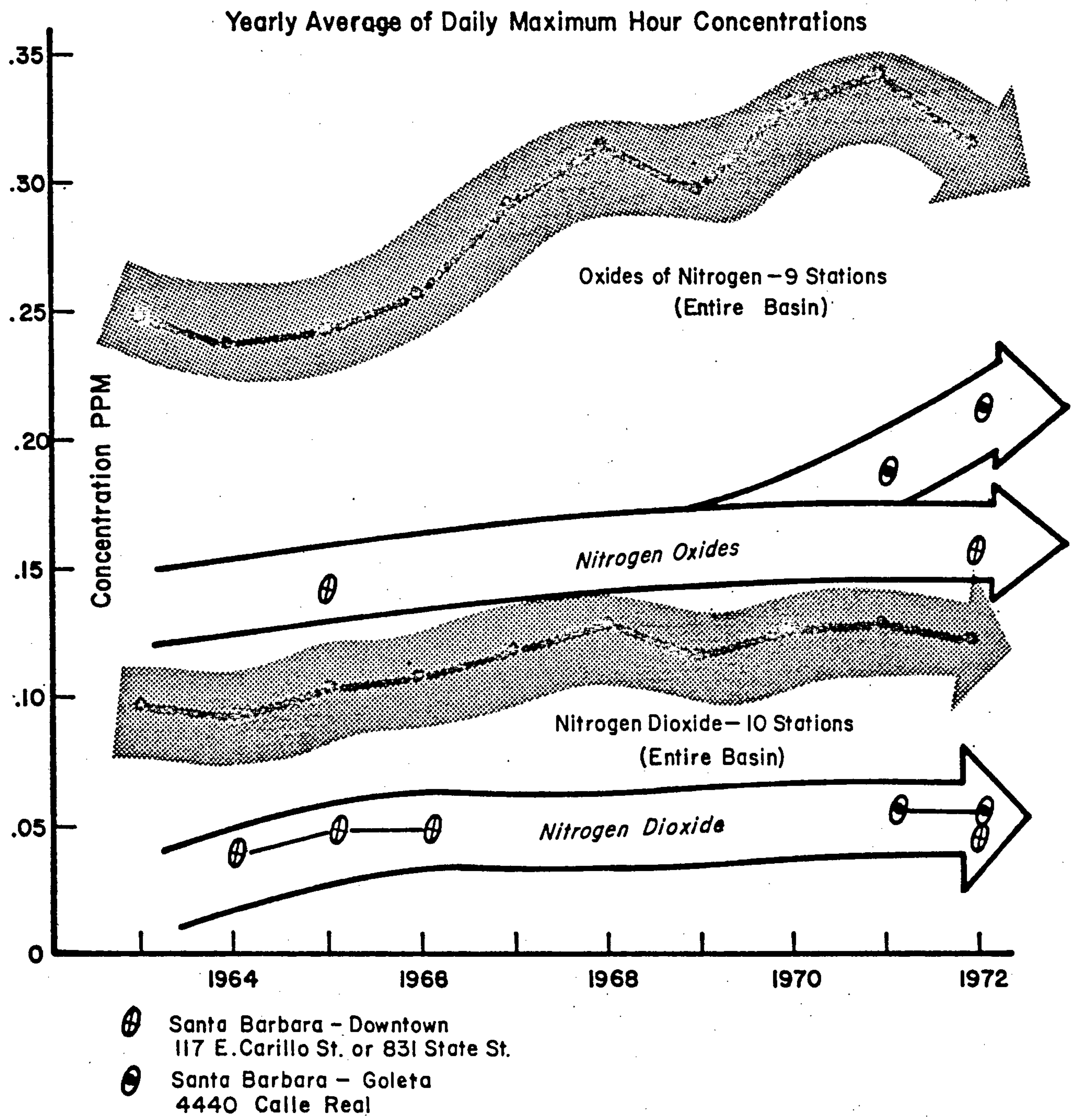
⊕ Goleta – Santa Barbara
4440 Calle Real

(after Santa Barbara County APCD, 1973)

DAMES & MOORE

FIGURE II-45d

OXIDES OF NITROGEN AND NITROGEN DIOXIDE TRENDS SOUTH COAST AIR BASIN



Santa Barbara Nitrogen Dioxide and Oxides of Nitrogen have been made by continuous colormeter instrumentation during all periods of record.

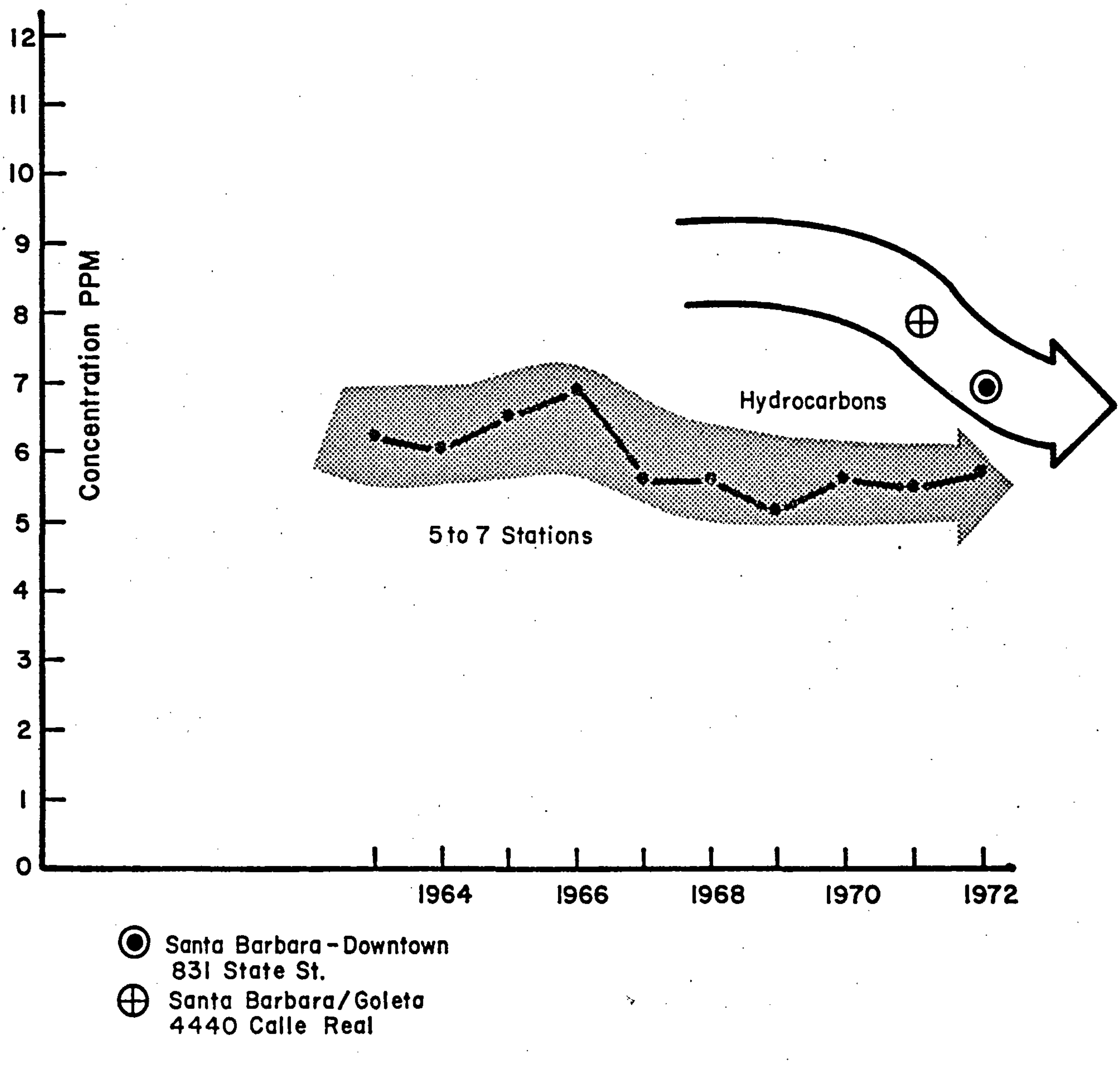
(after Santa Barbara County APCD, 1973)

DAMES & MOORE

FIGURE II-45e

HYDROCARBON TRENDS
SOUTH COAST AIR BASIN

Yearly Average of Daily Maximum Hour Concentrations



These are total hydrocarbon measurements and include methane. Background values for methane will be evaluated when the District receives the mobile air monitoring laboratory.

(after Santa Barbara County APCD, 1973

DAMES & MOORE

2. Water Quality

a. Jurisdiction of Water Quality of the Santa Barbara Channel

Water quality regulation of coastal waters in the Santa Barbara Channel is administered by two regional boards of the California Regional Water Quality Control Board and by the California State Water Resources Board. The Federal Water Pollution Control Act, 1972 Amendment, requires that the States adopt and enforce certain guidelines and standards. Along the coast and offshore, the Central Coastal Region Board is the responsible agency from Point Arguello to Rincon Point (designated as the Santa Barbara Coastal Sub-Basin). Continuing downcoast, the Los Angeles Region Board administers the remainder of the Channel coastal zone which is included in an area designated as the Santa Clara River Basin.[1]

[1] The authority and responsibility of these boards is far more comprehensive, geographically; only jurisdiction relative to the Santa Barbara Channel coastal zone (coastal and offshore) is listed.

Although the primary responsibility for water pollution in California is delegated to the regional boards, there are additional responsibilities of the State Water Resources Control Board, e.g., formulation of statewide policies and the direction of, or taking, action when a regional board fails to take or obtain appropriate corrective action. Recent State legislation and significant publications by the State Water Resources Control Board are listed with the references. These publications, for the most part, result from The Federal Water Pollution Control Act Amendment of 1972. It is the State's responsibility to adopt certain guidelines and standards and the Environmental Protection Agency is to see that the State meets this responsibility. The California State Water Resources Control Board may represent the State or local agencies in any matters involving the Federal Government which are within the scope of its powers and duties. The U. S. Geological Survey has been responsible for the regulation of waste discharges into OCS waters from OCS oil and gas lease operations; however, due to the Federal Water Pollution Control Act Amendments of 1972, the Environmental Protection Agency (EPA) now has jurisdiction over certain types of discharges from such operations. A memorandum of understanding between EPA and the Geological Survey may be forthcoming in order to minimize any redundance of efforts. (See section IV.A.1.c and d.)

b. Water Quality Objectives

(1) Status

In 1974, Interim Water Quality Control plans of both Region 3, Central Coastal Region (including Santa Barbara County), and Region 4, Los Angeles Region (including Ventura County) prepared Final Water Quality Control Plans. Public Hearings have been held on each and both have been submitted to the State Water Resources Control Board. Until formally adopted by the State Board, guidelines remain the following plans: the

Regional Interim Plans, the State Water Resources Control Board Plan for Ocean Waters of California, and the Thermal Plan. It is anticipated that Final Regional Plans will be finalized by late 1974 for both Regions, and publication and distribution will require additional time.

The adherence to objectives in effect is for the purpose of protection of the beneficial uses of water in the interstate waters of the coastal area, as well as inland. An example of the objectives is presented in table II-62.

Surveillance rationale, sampling locations, and analytical and observation procedures are also presented in Regional Water Quality Control Plans.

(2) Areas of Special Biological Significance (ASBS)

Areas of Special Biological Significance (ASBS) were identified and adopted in State Water Resources Control Board Resolutions 74-28 (March 21, 1974) and 74-32 (April 18, 1974). The designation of ASBS by the State Water Resources Control Board established a series of areas along the coast of California wherein the State and Regional Board maintain natural water quality conditions through applicable legislative authority and administrative measures. The concept of ASBS is now embodied in the State and Federal water quality standards for the ocean waters of California.

"Areas of special biological significance" (ASBS) are defined as those areas containing biological communities of such extraordinary, even though unquantifiable value, that no acceptable risk of change in their environments as a result of man's activities can be entertained.

ASBS in the Santa Barbara Channel area are:

- San Miguel, Santa Rosa and Santa Cruz Islands, Santa Barbara County.
- Anacapa Island, Ventura County (Description: waters surrounding

TABLE II-62

PRESENT AND ANTICIPATED FUTURE USES OF WATERS
IN THE INTERSTATE AREAS OF CENTRAL COAST BASIN

From: California Regional Water Quality Control Board, Central Region, 1971, Interim water quality control plan for the Central Coastal Basin

COASTAL WATERS	SCIENTIFIC STUDY RESEARCH AND TRAINING	CLAMMING AND SHELLFISH HARVESTING	INDUSTRIAL SUPPLY	WATER-CONTACT RECREATION	MARINE HABITAT	COMMERICAL FISHING	SWIMMING	NAVIGATION	NON-WATER-CONTACT RECREATION
Pt. Arguello to Rincon Pt.	X	X*	X	X	X	X		X	X
Coal Oil Pt. to Rincon Pt.	X		X	X	X	X	X	X	X
Santa Barbara Harbor			X	X	X			X	X
Beach Parks				X	X		X	X	X

* Areas not well defined.

these islands to a distance of one nautical mile offshore or to the 300-foot isobath, whichever is the greater distance).

- Mugu Lagoon to Latigo Point (Description: ocean waters within a line originating from Laguna Point at 34° 5' 40" north, 119° 6' 30" west, thence southeasterly following the mean high tide line to a point at Latigo Point defined by the intersection of the mean high tide line and a line extending due south of Bench Mark 24; thence due south to a distance of 1,000 feet offshore or to the 100-foot isobath, whichever distance is greater; thence northwesterly following the 100-foot isobath or maintaining a 1,000-foot distance from shore, whichever maintains the greater distance from shore to a point lying due south of Laguna Point, thence due north to Laguna Point.

c. Overview of Water Discharge to the Santa Barbara Channel[1]

"The chief water quality problem involves the discharge to the ocean of municipal and industrial waste waters. Most of the ocean discharges are through rather short outfalls and minimum dilution and dispersion is achieved.

"There are five municipal waste water treatment and disposal systems serving the southern Santa Barbara Coast, all discharging to the ocean. The Carpinteria, Montecito and Summerland Sanitary Districts all provide secondary treatment, while the City of Santa Barbara and the Goleta Sanitary District which also serves the Isla Vista Sanitary District, the University of California at Santa Barbara, and the Santa Barbara Airport provide primary treatment.[2] The two private domestic systems located in the basin are Cate School and Rancho la Scherpa. Both utilize land disposal facilities. All separate industrial discharges in this sub-basin are related to oil production. Standard Oil Company, Atlantic Richfield Company, Getty Oil Company, Phillips Petroleum Company and the Union Oil Company all maintain separate waste treatment and disposal facilities."

---

[1]Quoted from: California Regional Water Quality Control Board, Central Coastal Region, 1971, interim water quality control plan for the central coastal basin, pp. 26-27.

[2]Since the publication cited, secondary treatment provisions are under way.

Tables II-63 and II-64 list municipal and industrial dischargers in the Santa Barbara Channel region. Additionally, there are two thermal discharges located north of Point Mugu, the Ormond Beach and Mandalay Beach generating stations operated by Southern California Edison Company.

d. Waste Discharge Related to Oil Production

(1) Existing Facilities and Discharges - General

The offshore production facilities in the Santa Barbara Channel are listed in table II-65 and their locations are shown in figure II-46. The tanker mooring facilities are described in table II-66 and their locations are shown in figure II-46.

Discharges, listed in table II-67, are from petroleum facilities along the Santa Barbara Channel coastline related to onshore and offshore oil production, transport, and processing. Locations of these discharges are shown in figure II-48.

SCCWRP summarized the available constituent concentration data for individual dischargers, and calculated the average constituent concentrations for oil field brines, and oil tankers and line ballast as follows:

	Average concentration (mg/L)		
Type of Waste	Total suspended solids	Oil and grease	Chemical oxygen demand
Oil field brine (produced waste water)	60	12	3,000
Tanker and line ballast	50	14	1,100

According to SCCWRP, by assuming the above characteristics are representative of all similar industrial wastes, one can make the following comparison.

TABLE II-63

LIST OF MUNICIPAL DISCHARGERS (OCEAN) IN THE SANTA BARBARA COASTAL AND SANTA CLARA RIVER BASINS

From: California Regional Water Quality Control Board--Central Coastal Region, June 1971, p. 13, and Los Angeles Region, June 1971, p. 20.

NUMBER	CENTRAL COASTAL BASIN
065	Goleta Sanitary District
066	Santa Barbara
067	Montecito
068	Summerland Sanitary District
069	Carpinteria Sanitary District
	SANTA CLARA RIVER BASIN
	Rincon Area--unsewered area, sea cliff homes
4A-56-001	City of San Buenaventura, Seaside Plant
4A-56-006	City of San Buenaventura, Eastside Plant
4A-56-008	Naval Construction Battalion Center, Port Hueneme
4A-56-005	City of Port Hueneme
4A-56-004	City of Oxnard
4A-56-007	Pacific Missile Range, Point Mugu

TABLE II-64

LIST OF INDUSTRIAL DISCHARGERS (OCEAN) IN THE SANTA BARBARA CHANNEL REGION

From: California Regional Water Quality Control Board, Central Coastal Region June 1971, pp. 18 - 19.

NUMBER	DISCHARGER
140	Union Oil Co. - Pt. Conception
141	Phillips Oil Co. - Platform Harry
143	Standard Oil Co. - Gaviota
144	Getty Oil Company
145	Shell Oil Company
148	**Atlantic Richfield Company - Platform Holly**
149	Signal Oil Co. - Elwood Field
153	Santa Barbara Dredge
155	Standard Oil Co. - Carpinteria
157	Sun Oil Co. - Platform Hillhouse

From: Southern California Coastal Water Project, 1972, p. 81.

NUMBER	DISCHARGER
118	Continental Oil - Pitas Point
119	Continental Oil - Grub Lease
120	Getty Oil - Ventura
121	Standard Oil - McGrath Beach

TABLE II-65

OFFSHORE OIL PRODUCTION FACILITIES IN SOUTHERN CALIFORNIA*

(From SCCWRP, 1973, Table 3-9, p. 48)

Ref. No.**	Operator	Facility	Function††	Oil Pipelines† Diameter (in.)	Length (ft)	Volume (bbl)
E2	Texaco	Platform Herman;	Crude oil	6	12,000	440
		20 ocean floor wells	Flow lines	2-1/2	39,000	200
E3	Texaco	Platform Helen	Crude oil	6	11,500	420
E4	Atlantic-Richfield	1 ocean floor well	Flow lines	3	22,500	180
E5	Standard-Shell	2 ocean floor wells	Flow lines	3	24,000	Condensed Gas
E6	Standard-Shell	1 ocean floor well	Flow lines	4	13,000	Condensed Gas
E7	Standard-Shell	5 ocean floor wells	Flow lines	4	13,000	Condensed Gas
E8	Phillips-Pauley	4 ocean floor wells	Flow lines	4	57,600	Condensed Gas
E9	Atlantic-Richfield	Platform Holly	Crude oil	6	26,400	960
E10	Atlantic-Richfield	3 ocean floor wells	Flow lines	2	34,700	140
E11	Standard	Platform Hilda	Crude oil	6	26,400	960
		Platform Hazel	Crude oil	6	26,000	960
		2 ocean floor wells	Flow lines	4	9,200	130
E12[1]	Union	Platforms A & B	Crude oil	12	62,000	8,700
E13	Phillips	Platforms Houchin & Hogan	Crude oil	10	32,500	3,150
E14	Standard	Platforms Hope & Heidi	Crude oil	10	21,500	2,090
E15	Atlantic-Richfield	Rincon Island	Crude oil	6	3,000	110
E16	THUMS Long Beach Co.	Islands Grissom,		6	3,700	130
		White, Chaffee, &		8	21,300	1,320
		Freeman	Crude oil	12	20,400	2,860
				14	4,400	840
E17	Humble	Monterey Island	Crude oil	3	8,700	80
E18	Standard	Island Ester	Crude oil	12	8,000	1,120
E19	Union	Platform Eva	Crude oil	8	18,000	1,120
E20	Signal	Platform Emmy	Crude oil	14	7,000	1,190

**Key to location on Figure II-46

†There are other submarine pipelines connecting the offshore production facilities to shore and serving various functions. For example, each THUMS Island in San Pedro Bay has 5 additional pipeline connections to Pier J. The production lines are an emergency line, a clean oil line and a gas line; the supply lines from shore carry fresh water and water to be injected into water-flood wells.

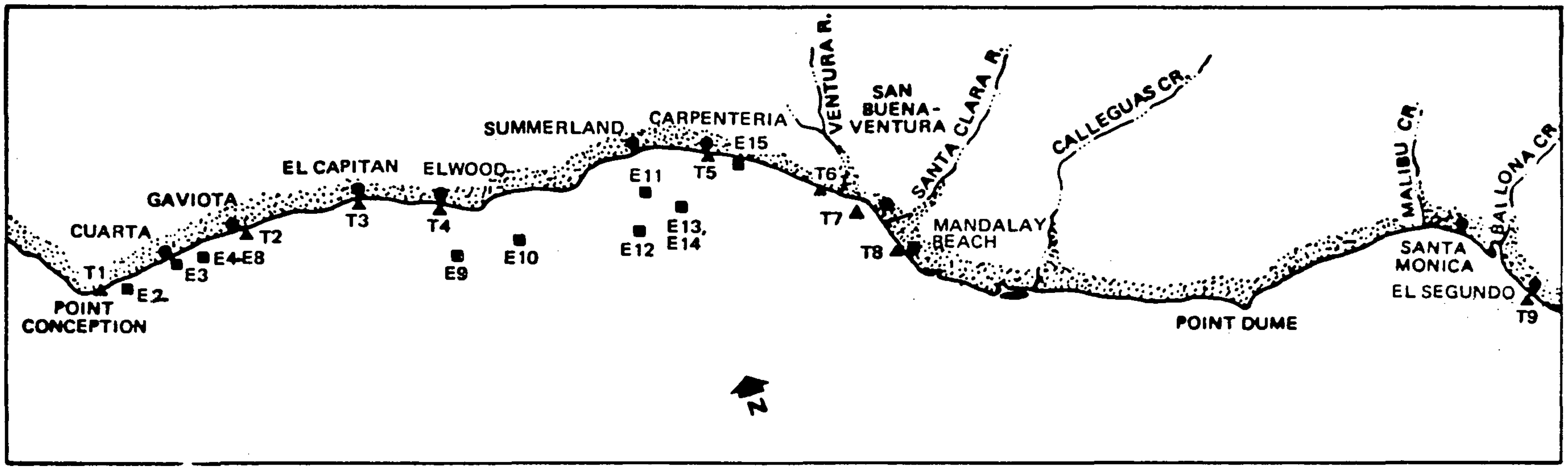
††Flow lines from E5, E6, E7, and E8 carry condensed gas; flow lines from other facilities carry a combination of gas and crude oil (the volumes given are for the crude oil portion only.)

[1] The U.S. Geological Survey notes that under Reference Number E-12, Operator should read "Union & Sun" and "Facility" should read "Platforms A, B, and Hillhouse".

FIGURE II-46

OFFSHORE OIL PRODUCTION FACILITIES
IN THE SANTA BARBARA CHANNEL AREA*

(Abridged from SCCWRP, 1973; Figure 3-20, p. 49)



*Based on California Department of Conservation 1971.

TABLE II-66

OIL TANKER MOORING FACILITIES IN
SOUTHERN CALIFORNIA COASTAL AREA*

(From SCCWRP, 1973, Table 3-10, p. 50)

			Oil Pipelines		
Ref. No.**	Operator	Function	Diameter (in.)	Length (ft)	Volume (bbl.)
T1	Phillips	Crude oil loading	10	2,000	200
T2	Getty	Crude oil loading	12	4,800	680
T3	Shell	Crude oil loading	16	2,890	700
T4	Signal	Crude oil loading	11	2,530	300
T5	Standard	Crude oil & refined products loading & unloading (3-ship facility)	20 10	2,550 2,500	970 240
T6	Union	Crude oil loading	10 & 20	9,120	2,050
T7	Getty	Crude oil loading	18	4,300	1,350
T8	So. Calif. Edison	Fuel oil unloading	24	4,480	2,520
T9	Standard	Crude oil & refined products loading & unloading (3-ship facility)	8 12 14 16 20 26	5,300 7,780 7,900 2,100 3,200 7,780	330 1,090 1,470 530 1,250 5,100
T10	Gulf	Crude oil unloading	24	5,950	3,320
T11	San Diego G & E	Fuel oil unloading	20	3,000	1,160

*Excluding Los Angeles and Long Beach Harbors; based on Calif. Dept. of Conservation 1971.
**Key to location on Figure II-46

TABLE II-67

DISCRETE INDUSTRIAL WASTE DISCHARGERS ON THE SOUTHERN CALIFORNIA COAST
(Abridged from SCCWRP, 1973, Table 4-14, p. 81.)

Area		Discharger	Type of Waste	Flow (mgd)	Pipe Length (m)	Pipe Depth (m)	Reference to Tab. 3-9 & 3-10
I	I1	Phillips Petroleum--Point Conception	Oil brine Tanker ballast	0.2			T1, E1
	I2	Texaco, Inc.--San Augustin	Oil brine	0.2			E2, E3
	I3	Getty Oil--Gaviota	Oil brine Tanker ballast	0.16			T2
	I4	Shell Oil--El Capitan	Oil brine Tanker ballast	0.2			T3
	I5	Signal Oil & Gas--Ellwood	Oil brine Tanker ballast	0.29			T4
	I6	Atlantic Richfield--Coal Oil Point	Oil brine	0.06			E9, E10
	I7	Standard Oil-Summerland	Oil brine	0.4		32	E11
	I8	Standard Oil--Carpinteria	Oil brine Tanker ballast	0.4	120	3	T5
	I9	Atlantic Richfield--Rincon	Oil brine	0.01	76	6	
	I10	Atlantic Richfield--Rincon Island	Oil brine	0.04	800	18	E15
	I11	Western Oil & Dev.--Rincon	Oil brine	0.36		3	
	I12	Petrol Industries--Rincon	Oil brine	0.01			
	I13	Continental Oil--Rincon	Oil brine	0.49	150	4	
	I14	Norris Oil Co.--Rincon	Oil brine	0.05	670	3	
	I15	Phillips Petroleum--La Conchita	Oil brine	0.36	270	6	
	I16	Phillips Petroleum--Punta Gorda	Oil brine	0.4	150	6	
	I17	Mobil Oil--Sea Cliff	Oil brine Tanker ballast	0.18	950	9	
II	I18	Continental Oil--Pitas Point	Oil brine	0.27	150	4	
	I19	Continental Oil--Grubb Lease	Oil brine	0.75	150	2	
	I20	Getty Oil--Ventura	Oil brine Tanker ballast	0.06		3	T7
	I21	Standard Oil--McGrath Beach	Oil brine	0.14		1	

*Key to location on Figure II-48

The total constituent mass emission rates contributed by discrete industrial waste discharges into the Pacific Ocean for total suspended solids and oil and grease are approximately two percent of that contributed by municipal dischargers, and chemical oxygen demand is about seven percent of that of municipal discharges. It is noted that industrial wastes are not always discharged directly from their originating sources, but are often directed into municipal waste systems.

(2) Regulation of Wastewater Discharged into the Santa Barbara Channel OCS Waters

Throughout this Statement when referring to wastewater discharge into the Outer Continental Shelf (OCS) waters, the phrase "would be cleaned to appropriate standards in effect at the time" is frequently used in lieu of quoting the present standards. The presently existing standards are cited in section IV under the OCS Order discussion (see the excerpts from OCS Orders 7 and 8); however, it should be pointed out thet these requirements and standards could be substantially changed in the future. The OCS Orders are continuously evolving and the sections governing wastewater disposal requirements are presently under consideration for revision. Also contributing to the likelihood that wastewater disposal requirements will be revised as deemed necessary in the future, are certain sections of the Federal Water Pollution Control Act Amendments of 1972 applicable to some aspects of OCS produced wastewater disposal. The regulation of wastewater disposal and the Federal Water Pollution Control Act Amendments of 1972 are further discussed in section IV.

(a) <u>Environmental Protection Agency Guidelines and Permitting Procedures for Future OCS Discharges</u>

The Environmental Protection Agency has prepared a "Draft Development Document for Effluent Limitations Guidelines and New Source Performance Standards for the Oil and Gas Extraction Point Source Category" (October 1974). This is a draft document and is subject to changes resulting from comments received. The development document presents the findings of an extensive study of the oil and gas extraction industry for the purposes of developing effluent limitation guidelines, standards of performance, and pretreatment standards for the industry to implement Sections 304, 306, and 307 of the Federal Water Pollution Control Act of 1972, (PL 92-500). Supporting data and rationale for the development of proposed effluent limitation guidelines and standards of performance are contained in this development document. It is pointed out the variation in treated produced wastewater is in part due to the variation in methods of analyzing wastewater samples for oil and grease content. The Geological Survey has also recognized this problem and the API Committee on offshore Safety and Anti-Pollution Research, Work Group for Recommendation No. 4 (see section IV.A.8.) is studying the various oil and grease analysis procedures to determine the best one for all OCS operators to adopt. It is agreed they should all use the same sample preparation method and analysis procedure.

In late 1974 the Environmental Protection Agency issued Santa Barbara Channel OCS platform operators draft permits to discharge wastewater into

Federal waters (more than three miles from shore). These are draft permits and the stipulations and conditions are subject to change.

(b) Environmental Protection Agency Interim Final Effluent Limitations and Guidelines

In the Federal Register, Vol. 40, No. 179 (September 15, 1975) the Environmental Protection Agency published interim final effluent limitations and guidelines for existing discharge sources by establishing 40 CFR Part 435. Portions of this interim final rule making (Subpart B) is applicable to the discharge of produced waste water (and other waste) into OCS waters. In Subpart B, the oil and grease maximum for any one day is 72 ppm and the average daily values for 30 consecutive days shall not exceed 48 ppm.

(3) Waste Disposal at Santa Barbara Channel OCS Platforms

The five existing OCS platforms have sewage treatment systems and the sewage is treated in accordance with the Pacific Area OCS Orders and EPA requirements (see excerpt from OCS Order No. 8 in section IV). Inasmuch as the drilling phase on the five OCS platforms is, for the most part, completed, only small volumes of drilled cuttings and cuttings-wash-water are being intermittently discharged. Also, on infrequent occasions, during normal drilling operations, minor amounts of nontoxic drilling mud are discharged into the ocean (see section I.D.3.d. for further discussion of drilling muds). However, inasmuch as the drilling phase is completed little to no drilling-mud discharge occurs. All solid trash is hauled to shore.

Presently (January 1976) part of the produced waste water from the five OCS platforms is discharged into the OCS waters at the platform, in accordance with Environmental Protection Agency Requirements, and part of it is disposed of by subsurface injection into platform wells in accordance with Geological Survey requirements.

- Platforms Hogan and Houchin, Lease OCS-P 0166:
  Presently the total produced waste water is disposed of by subsurface injection, therefore, none is discharged into the ocean.

- Platform Hillhouse, Lease OCS-P 0240:
  Presently approximately 1,000 barrels of produced waste water is disposed of by subsurface injection into platform wells per day and the remainder (approximately 5,000 barrels per day) is treated and discharged into OCS waters at the platform.

- Platforms A and B, Lease OCS-P 0241:
  Presently approximately 50 percent of the produced waste water is disposed of by subsurface injection into platform wells and the remainder (approximately 12,000 barrels per day) is treated and discharged into OCS waters at the platforms.

As indicated above, a total of approximately 17,000 barrels per day of produced waste water is treated and discharged into Santa Barbara Channel OCS waters at the platforms. Portions of the produced waste water is separated and treated at the platforms and part of it is treated at onshore facilities and then piped back to the platforms for disposal.

Two onshore treating and storage facilities handle the total OCS production, the Rincon onshore facility and the La Conchita onshore facility. Production from Platforms Hillhouse, A and B is processed at the Rincon facility; Platform Hogan and Houchin production is processed at the La Conchita facility. These two onshore facilities are designated as 116 and 117 on figure II-48. (See page II-622)

Figure II-47 is a graphical summary of the monitoring data of waste discharge from the Phillips La Conchita onshore facility, and Table II-68 is representative of the typical physical and chemical properties of treated OCS produced waste water discharge. Figure II-47 and table II-68 were submitted to the U. S. Geological Survey by Phillips, operator for the La Conchita onshore facility.

(4) Produced Waste Water from State Water Santa Barbara Channel Platforms

According to data received in January 1973, from the California Regional Water Quality Control Board and supplemented by information supplied verbally by the Division of Oil and Gas, Resources Agency of California, the approximate total produced waste water from State water Santa Barbara Channel platforms is 20,000 barrels per day. All produced waste water from these State platforms is discharged from onshore facilities.

(5) Produced Waste Water Disposal in the Future

The onshore facilities that were discharging State and Federal lease produced waste water into the Santa Barbara Channel State waters have for the most part discontinued discharging into State waters for they cannot meet, either physically or economically, the stringent ocean discharge requirements being established by the State Water Resources Control Board as a result of the Federal Water Pollution Control Act as amended in 1972. the State Water Resources Control Board is responsible for establishing

FIGURE II-47

MONITORING DATA
PHILLIPS PETROLEUM COMPANY LA CONCHITA ONSHORE
FACILITY, VENTURA COUNTY

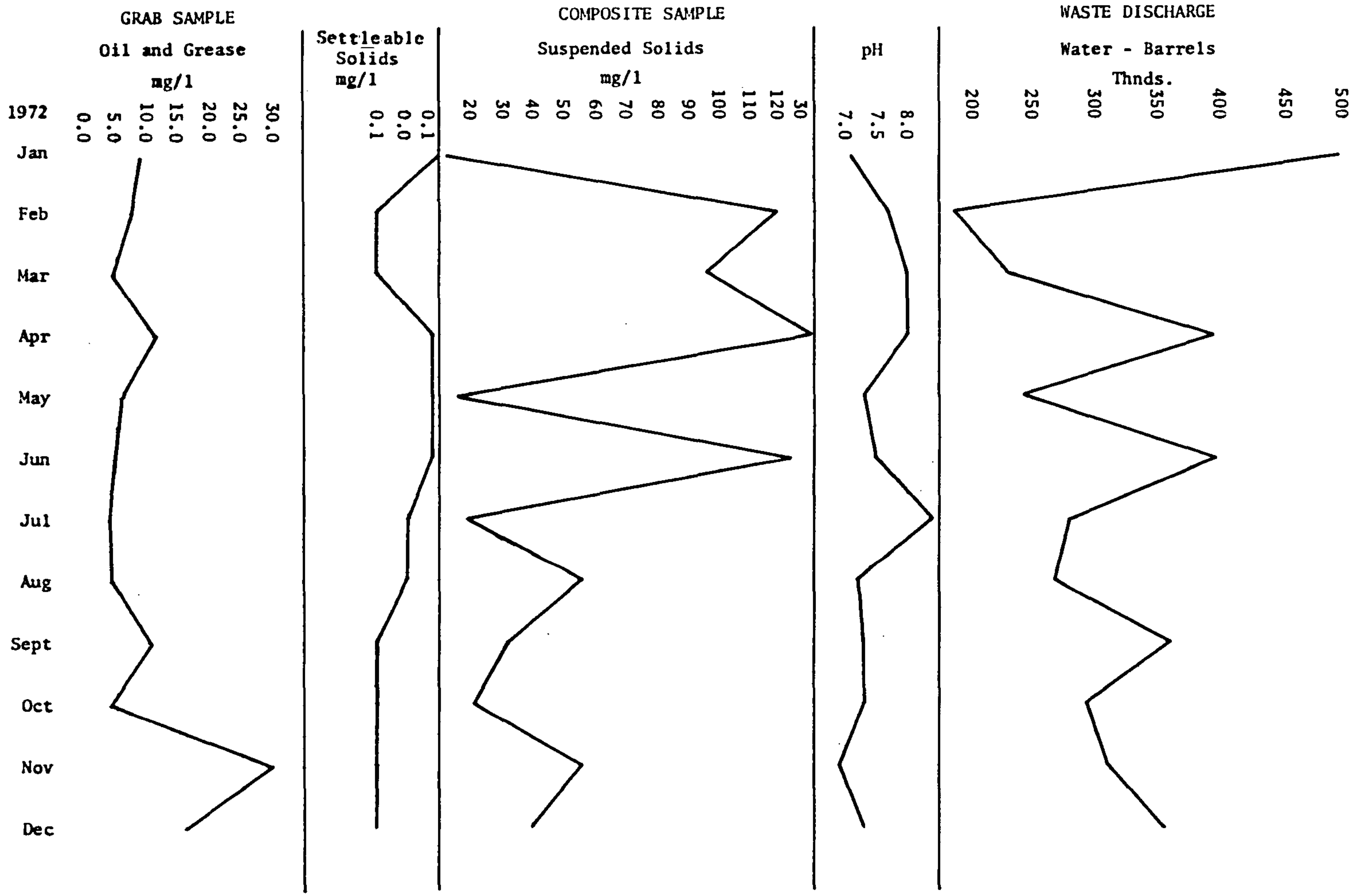


TABLE II-68

TYPICAL CHARACTERISTICS OF EFFLUENT FROM WATER TREATMENT FACILITIES

Phillips Petroleum Company

Lease OCS-P 0166 - La Conchita Plant

Physical Properties		Chemical Properties, mg/l	
pH	7.3	Aluminum	2.2
Specific Gravity	1.02	Ammonia, N	39.7
Turbidity	12 JTU	Arsenic	0.001
Total Dissolved Solids (Calc.)	40,400 mg/l	Barium	0.
Total Solids	20,990 mg/l	Bromide	183.8
Total Volatile Solids	1810 mg/l	Cadmium	0.030
Total Suspended Solids	56 mg/l	Chromium	0.020
Setteable Solids	0.1 mg/l	Copper	0.116
Floatable Solids	0.3 mg/l	Cyanide	0.004
Temperature	77°F	Fluoride	1.7
		Iron	1.35
		Lead	0.28
Specific Conductance	31,630 m-mhos/cm		
Max. $CaSO_4$ Possible (Calc.)	0. mg/l	Magnesium	50.0
Max. $BaSO_4$ Possible (Calc.)	0. mg/l	Manganese	0.062
Alkalinity as $CaCO_3$	3480 mg/l	Mercury	0.0005
		Nickel	0.29
Dissolved Solids		Nitrate, N	0.0
Cations		Nitrate, N	0.000
Total Hardness	10 me/l	Kjeldahl Nitrogene	54.6
Sodium, Na^{+} (Calc.)	15,000 mg/l	Phosphorus-Ortho, P	1.54
Calcium, Ca^{++}	80 mg/l	Phosphorus, P	1.89
Magnesium, Mg^{++}	72 mg/l	Silver	0.030
Iron (Total), Fe^{+++}	1.0 mg/l	Zinc	0.18
Anions		Phenolic Compounds C_6H_5OH	2.10
Chloride, Cl^{-}	21,000 mg/l	Identifiable Chlorinated Hydrocarbons	None
Sulfate, $SO_4^{=}$	0. mg/l		
Carbonate, $CO_3^{=}$	0. mg/l	Radioactivity	
Bicarbonate, HCO_3^{-}	4,270 mg/l	Gross Alpha Activity	None Detected
Hydroxyl, OH^{-}	0. mg/l	Gross Beta Activity	None Detected
Sulfide, $S^{=}$	1.1 mg/l	Oil and Grease	5.0
Dissolved Gases			
H_2S	0.4 mg/l		
CO_2	320 mg/l		
O_2	0.3 mg/l		

these requirements and the Environmental Protection Agency is responsible for overseeing that the State establishes requirements in accord with the intent of the Federal Water Pollution Control Act as amended in 1972. The two onshore facilities (La Conchita and Rincon) handling the Federal OCS production phased out produced waste water discharge into near shore State waters by either initiating subsurface injection into platform wells, or returning the treated waste water to the platforms for discharge into OCS water more than three-miles from shore. They totally eliminated waste water discharge into nearshore waters in mid 1975.

It appears the majority of the onshore facility operators in the Santa Barbara Channel Area will not be discharging produced waste water into ocean waters within 3-miles of the shoreline. The primary alternative presently is to reinject the waste water into subsurface formations; however, this type of disposal is also stringently regulated. Regulation of waste disposed by injection is the responsibility of the State Division of Oil and Gas, except on Federal OCS leases for which the U. S. Geological Survey is responsible. In the search for the method of produced waste water disposal that will least affect the environment, it is generally agreed that disposal into deeper waters, more than 3 miles from shore, is the most desirable alternative to discharging it into shallower, nearshore waters. However, in the event that the Environmental Protection Agency and Geological Survey regulations and requirements resulting from the Federal Water Pollution Control Act 1972 Amendments, rule out produced waste water being discharged into OCS waters at certain platform sites; subsurface disposal is the most likely alternative.

Presently all signs indicate little to no produced waste water will be discharged from onshore facilities into near shore waters of the Santa Barbara Channel.

e. Oil, Gas, and Tar Seeps

Onshore and offshore oil and gas seeps account for considerable quantities of oil pollution worldwide (section III.L.2.).

(1) Seep Locations and General Characteristics

All of the active seeps known to occur offshore California have been found between Point Conception and Huntington Beach (Orange County). The largest concentration of seeps appears to be in the Santa Barbara Channel area. Table II-69 is a Catalog of California Oil and Gas Seeps. Plate 2 includes location of seeps in the Santa Barbara Channel. The possibility of additional sites exists, but has not been established.

Some seeps apparently remain dormant for extended periods of time. Reactivation occurs by either a pressure build-up or perhaps earth movement. Causes of fluctuations in seep flow rate and volume are not completely explained. Tar mounds have been observed offshore the Point Conception area, Coal Oil Point (near Goleta), and Carpinteria. These are the result of tar accumulation around a seep or vent. While some tar rises to the surface, some becomes more dense than sea water and sinks, becoming part of the mound. Factors which contribute to a gradual density increase are: loss of gas and light petroleum fractions, contraction due to cooling, and the accumulation of sediments and organisms. Dispersion of tar, oil, and gas fractions depends on oceanographic and meteorological conditions. (Wilkinson, 1972)

(2) Seep Rate and Volume

Seep flow rate and volume have been studied at Platform A and Coal Oil Point. Studies conducted during the month of

TABLE II-69

CATALOG OF OIL AND GAS SEEPS

From: Wilkinson, E. R., 1972, California oil and gas seeps: California Division of Oil and Gas

	LOCATION	LAT. & LONG.	REFERENCES	REMARKS
1.	Coronado	32° 28'20"N 117° 21'30"W	Oil Age, 1923	Questionable - May be a spill
2.	Catalina, west end	33° 28'20"N 118° 36'50"W	Western Oil & Gas Assoc., 1931	½-acre oil slick sighted from steamer, 1923 Frequently sighted by fishermen; now inactive
3.	Catalina, west end	33° 29'10"N 118° 36'30"W	See 2	See 2
4.	San Pedro Channel	33° 35'40"N 118° 20'30"W	U. S. Bureau of Mines, 1923 Calif. Academy of Science, 1917	Oil droplets & slabs of tar as large as 8"x5"x1"
5.	Huntington Beach	33° 40'10"N 118° 01'50"W	Signal Oil and Gas Co.	Gas bubbles from outcrop, probably of marsh gas sands
6.	Palos Verdes	33° 48'10"N 118° 24'40"W		
7.	Redondo Beach	33° 49'00"N 118° 26'10"W	U. S. Bureau of Mines, 1923	Oil and gas, about 3.5% sulfur Intermittent flow in 1927; no estimate made Oil slick about 50 acres in 1928
8.	Redondo Beach	33° 50'10"N 118° 25'30"W	University of Southern California	Oil and gas On line of Palos Verdes fault
9.	Manhattan Beach	33° 52'10"N 118° 27'40"W	Seismological Soc. America, 1920 Standard Oil Co. of California and W. T. Knowlton, 1928	Oil and gas, about 4% sulfur 9 & 10 together estimated to be discharging about 10 barrels of oil per day in 1928 200-to-400-acre oil slick On line of Palos Verdes fault
10.	Manhattan Beach	33° 52'20"N 118° 29'20"W	See 9	See 9
11.	San Miguel Island	34° 04'30"N 120° 25'20"W	Western Oil & Gas Assoc., 1931 Oil and Gas Journal, 1937	First noted by U. S. Coast & Geodetic Survey in 1875 Oil and gas
12.	Santa Cruz Island	34° 03'20"N 119° 54'10"W	Papers written about the island in French in 1893 and translated by Dr. Redwine, Union Oil Co.	Mostly tar
13.	Santa Cruz Island	34° 00'40"N 119° 53'40"W	Emery, 1960	Mostly tar
14.	Santa Barbara Channel	34° 02'20"N 119° 16'10"W	Emery, 1960	Discovered by continuous presence of oil, gas bubbles and tar on the water
15.	Santa Barbara Channel	34° 08'00"N 119° 41'24"W	Standard Oil Co. of California	See 14
16.	Platform A	34° 20'20"N 119° 36'30"W	Lewis & Lewis (surveyors for Union Oil Co.), 1968	Discovered before platform was installed about 800 feet from platform Oil and gas from saturated shale outcrop
17.	Platform Houchin	34° 20'00"N 119° 33'40"W	U. S. Geological Survey	
18.	Platform Heidi	34° 21'00"N 119° 30'20"W	Mattei, 1929, in Santa Barbara newspaper	On crest of anticline
19.	Rincon Trend	34° 21'30"N 119° 29'40"W	L. S. Fox, 1930	Gas bubbles from crest of anticline
20.	Rincon Point	34° 22'50"N 119° 29'30"W	Whitney, 1865	From fractured Monterey Formation
21.	Carpinteria	34° 23'30"N 119° 31'20"W	Father Crespi, 1770	Gas bubbles
22.	Carpinteria	34° 23'40"N 119° 32'10"W	Father Crespi, 1770	Similar to seeps on shore
23.	Montecito	34° 25'00"N 119° 38'00"W	Calif. Div. Mines Bull. 118	Probably on a fault
24.	Montecito	34° 25'00"N 119° 38'30"W	Calif. Div. Mines Bull. 118	See 23
25.	La Mesa	34° 21'40"N 119° 44'30"W	Standard Oil Co. of Calif.	
26.	Hope Ranch	34° 22'00"N 119° 46'20"W	Standard Oil Co. of Calif.	
27.	Hope Ranch	34° 24'20"N 119° 45'50"W	Standard Oil Co. of Calif.	
28.	Coal Oil Point	34° 23'40"N 119° 51'40"W	Father Pedro Font, 1776 Sixth Annual Report, State of Calif. Mineralogist, 1886 Allen & Schleuter, 1969	Best known seep area Oil, gas and tar. Oil is 12.4 gravity Typically, oil is released as globules from sand patches, some of which are in line and some of which are independent Estimated discharge for area: Max. 160 bbls. oil per day Min. 11 bbls. oil per day Avg. 50-70 bbls. oil per day More than induced seeps at Platform A

TABLE II-69 (Continued)

CATALOG OF OIL AND GAS SEEPS

From: Wilkinson, E. R., 1972, California oil and gas seeps: California Division of Oil and Gas

LOCATION	LAT. & LONG.	REFERENCES	REMARKS
29. Coal Oil Point	34° 24'00"N 119° 52'40"W	See 28	See 28
30. Coal Oil Point	34° 24'30"N 119° 52'00"W	See 28 J. Eaton, geologist, 1931	See 28
31. Platform Holly	34° 24'30"N 119° 54'40"W	Sixth Annual Report, State of Calif. Mineralogist, 1886	Probably similar to Coal Oil Point
32. Naples	34° 25'30"N 119° 57'30"W	Holder, 1910	Tar in shale
33. Capitan Beach	34° 27'20"N 120° 00'30"W	Holder, 1910 Standard Oil Co. of Calif.	At intersection of faults
34. Refugio	34° 26'00"N 120° 03'30"W	Holder, 1910	Probably from Monterey Formation Oil slicks noted on water
35. Molino	34° 28'00"N 120° 09'20"W	Holder, 1910 Standard Oil Co. of Calif.	See 34
36. Gaviota	34° 27'30"N 120° 13'30"W	Holder, 1910 Standard Oil Co. of Calif.	See 34
37. Platform Helen	34° 26'50"N 120° 17'00"W	Standard Oil Co. of Calif.	Faulted area
38. Cuarta	34° 27'30"N 120° 17'30"W	Standard Oil Co. of Calif. Emery, 1960	Faulted area
39. San Augustine	34° 26'40"N 120° 20'30"W	Union Oil Co. of Calif. Emery, 1960	
40. Platform Herman	34° 26'00"N 120° 22'20"W	Union Oil Co. of Calif. Emery, 1960	
41. Cojo	34° 27'20"N 120° 24'30"W	Standard Oil Co. of Calif. Emery, 1960	Fractured shale on faulted anticline
42. Point Conception	34° 26'20"N 120° 26'50"W	Standard Oil Co. of Calif. Emery, 1960	Fractured shale on faulted anticline
43. Point Conception	34° 26'40"N 120° 28'30"W	Mattei, 1929 Standard Oil Co. of Calif.	Oil, gas and sulfur water seeps onshore Globs of tar more than 1 ft. in diameter Type of tar indicates seepage from Monterey Formation
44. Point Conception	34° 28'00"N 120° 29'00"W	See 43	See 43
45. Santa Barbara Channel	34° 06'40"N 120° 23'04"W	J. Stearns, 1969	Oil slick sighted from air Location approximate
46. Platform Holly	34° 23'30"N 119° 55'00"W	Atlantic Richfield Co.	
47. Platform Holly	34° 23'30"N 119° 56'10"	Atlantic Richeield Co.	First observed in 1969 Discharge has less than 1 bbl. oil per day at present
48. Platform A	34° 20'20"N 119° 36'30"W	U. S. Geol. Survey Prof. Paper 679	
49. Point Dume	33° 59'10"N 118° 46'20"W	Standard Oil Co. of Calif.	At 50 fm. contour on line between Pt. Dume & Pt. Vicente
50. White's Point	33° 42'50"N 118° 19'10"W	Emery, 1960 Standard Oil Co. of Calif.	Analyzed by Atlantic Richfield Co.
51. Hermosa Beach	33° 51'27"N 118° 28'10"W	Standard Oil Co. of Calif.	Oil seep
52. El Segundo	33° 53'35"N 118° 32'55"W	Standard Oil Co. of Calif.	Oil seep
53. Venice	33° 55'05"N 118° 35'05"W	Standard Oil Co. of Calif.	Oil seep
54. Platform Heidi	34° 20'30"N 119° 30'45"W	Calif. Div. of Oil and Gas	Gas bubbles

October 1969 (ten months after the Platform A blowout) indicated that the average flow of oil to the surface near Platform A is between five and thirty barrels per day and most likely on the order of ten barrels. The Coal Oil Point[1] seep was studied during the same period. Estimates of volume flow rate are on the order of 50 to 70 barrels of oil per day, although the possible range is 11 to 160 barrels per day. (Allen and Schleuter, 1969) (See section III.L.1.a. for additional estimates)

Fischer, 1975, estimates total natural seepage in the Santa Barbara Channel to be on the order of 200 to 250 barrels/day.

> "Natural seeps have been active within the Santa Barbara Basin for at least the last 10,000 years and perhaps during all of late Pleistocene time. Prior to the advent of drilling for oil and gas, these same seeps were reported to have covered the basin with a film of oil. During at least one major historic earthquake, fishermen found the entire "channel" covered with oil . . . . In a tectonically active basin, the possibility of major natural oil seeps or leaks is considered to be greater than another 1969 Platform A spill, provided that adequate drilling safeguards and frequent inspections during drilling and production operations are made and enforced." (See Fischer, 1975, p. 37)

f. Baseline Data

Collection of baseline data of pollution parameters has been initiated by the Southern California Coastal Regional Water Research Project (SCCWRP)[2]. Figure II-48 and table II-70 are from SCCWRP (1973),

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[1]The Coal Oil Point seep area may be subdivided into three separate areas of seep vents: Coal Oil Point (29), Isla Vista (30), and Goleta (28). Numbers in parenthesis correspond to those in table II-79.

[2]SCCWRP was founded in 1969 by Ventura County, the Cities of San Diego and Los Angeles, and the County Sanitation District of Orange and Los Angeles Counties.

FIGURE II-48 Municipal and Industrial Waste Discharges in the Santa Barbara Channel Area[1]

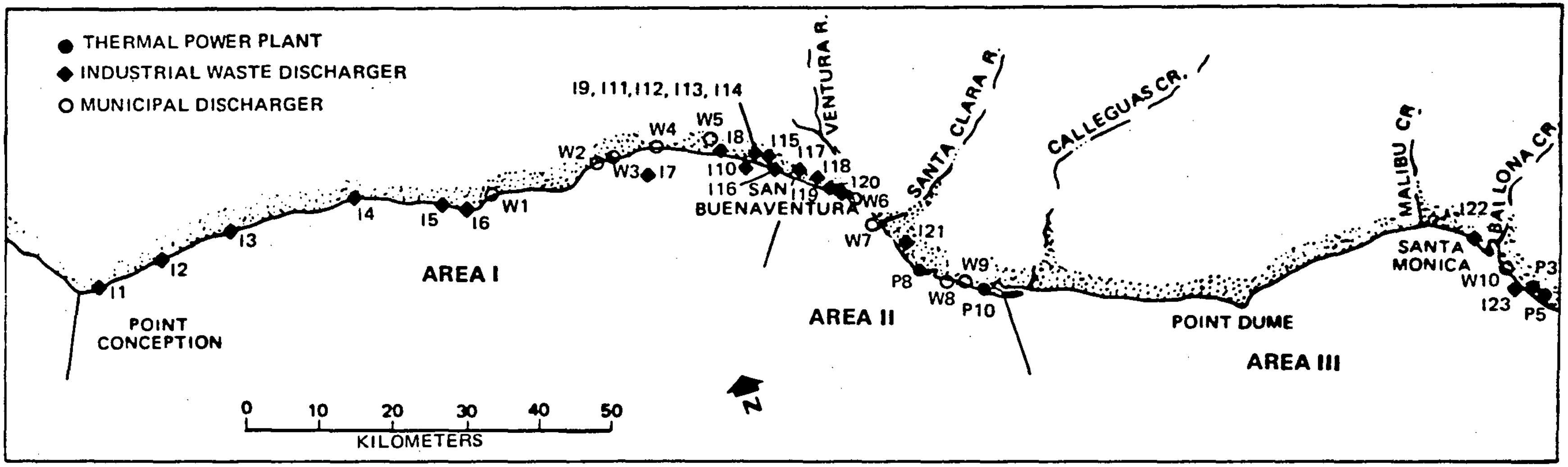

TABLE II-70 MUNICIPAL WASTE WATER DISCHARGES TO SOUTHERN CALIFORNIA COASTAL WATERS, 1971[2]

	Discharger				Ocean Outfall	
Area*	Ref No.*	Name	Flow (mgd)	Type of Treatment	Length (m)	Depth (m)
I	W1	Goleta San. Dist.	5.0	Primary	1,800	28
	W2	City of Santa Barbara	8.0	Primary	1,100	14
	W3	Montecito San. Dist.	0.8	Secondary	440	11
	W4	Summerland San. Dist.	0.1	Secondary	240	6
	W5	Carpinteria San. Dist.	1.3	Secondary	920	9
II		City of San Buenaventura				
	W6	Seaside Plant	2.7	Primary	800	11
	W7	Eastside Plant	4.0	Secondary		
	W8	Port Hueneme San. Dist.	3.5	Primary	1,900	18
	W9	City of Oxnard	12	Primary	1,750	16

*Areas and discharger locations are shown by number on Figure II-51

1 Abridged from SCCWRP, 1973, Figure 4-1, p. 58.

2 Abridged from SCCWRP, 1973, Table 4-2, p. 61.

"The Ecology of the Southern California Bight: Implications for Water Quality Management, Chapter 4, Sources and Magnitudes of Constituent Inputs." According to the designation, seven areas from Point Conception to the Mexican border have been delineated into seven subareas. Those subareas encompassing the Santa Barbara Channel are:

- Area I: Point Conception to Las Pitas Point
- Area II: Las Pitas Point to Point Mugu.

While a vast amount of data is presented for the entire southern California coast and coastal waters, in some cases data in the immediate Santa Barbara area are limited. SCCWRP (March 1973, p. 55-117) presents data on "Sources and Magnitudes of Constituent Inputs," including seven figures and 28 tables. Table II-71 is a summary of mass emission rates for southern California by areas. Other areas are:

- Area III: Point Mugu to Palos Verdes Point
- Area IV: Palos Verdes Point to Point Fermin
- Area V: Point Fermin to Newport Bay
- Area VI: Newport Bay to Del Mar
- Area VII: Del Mar to the Mexican border.

TABLE II-71

SUMMARY OF GENERAL CONSTITUENT MASS EMISSION RATES (M tons/yr) FROM DISCRETE SOURCES, 1971-72

(From SCCWRP, 1973; Table 4-28, p. 101)

Area	Flow* (10^6cu m/yr)	Silt	Total Suspended Solids	Volatile Suspended Solids	5-day Biol. Oxy. Demand	Chemical Oxygen Demand	Oil and Grease	Dissolved Silica (SiO_2)	Heat* (10^9 kwh/yr)
I. Muni. wastewaters	22		2,000	1,500	3,000	7,000	1,000	1,000	
Surface runoff	3.7	200				<1,000	<100	100	
Indust. waste	5.2		300			12,000	<100		
II. Muni. wastewaters	28		2,000	1,500	3,000	8,000	1,000	1,000	
Surface runoff	44	200,000				6,000	100	700	
Indust. waste	1.7		100			5,000	<100		17
III. Muni. wastewaters	470		61,000	37,000	59,000	154,000	14,000	12,000	
Surface runoff	50	12,000				8,000	1,400	800	
Indust. waste	100		2,800			18,000	1,300		23
IV. Muni. wastewaters	510		169,000	106,000	160,000	311,000	35,000	9,000	
V. Muni. wastewaters	196		28,000	21,000	36,000	113,000	7,400	5,500	
Surface runoff	131	45,000				14,000	2,400	900	
Indust. waste	144		12,800		6,000	43,000	800		38
VI. Muni. wastewaters	24		2,000	1,000	2,000	5,000	800	1,000	
Surface runoff	13	17,000				1,000	500	300	9
VII. Muni. wastewaters	132		14,000	11,000	28,000	77,000	5,800	3,500	7
All Area									
Muni. wastewaters	1,380		278,000	179,000	291,000	675,000	65,000	33,000	
Surface runoff	242	274,000				29,000	4,400	2,800	
Indust. waste	251		16,000		6,000	78,000	2,200		94

Area	Nitrate Nitrogen	Ammonia Nitrogen	Organic Nitrogen	Total Nitrogen	Phosphate Phosphorus	Detergent (MBAS)	Cyanide (CN)	Phenols
I. Muni. wastewaters	4	400	150	560	183	97	2	2
Surface runoff	24	34	15	73	14	0.5	<0.1	<0.1
Indust. waste								
II. Muni. wastewaters	38	550	190	780	350	69	2	2
Surface runoff	166	166	200	530	132	5	2	1
Indust. waste								
III. Muni. wastewaters	290	8,100	6,400	14,800	3,200	2,200	117	46
Surface runoff	210	102	260	570	64	17	5	3
Indust. waste								
IV. Muni. wastewaters	112	41,000	13,700	55,000	7,300	3,500	58	1,620
V. Muni. wastewaters	48	5,900	2,600	8,600	1,180	970	16	39
Surface runoff	400	100	560	1,070	165	40	4	265
Indust. waste	9,500	9,500		10,000				43
VI. Muni. wastewaters	4	350	123	590	240	95	2	3
Surface runoff	180	37	52	270	35	3	0.1	0.1
VII. Muni. wastewaters	33	3,100	1,700	5,100	810	690	13	16
All Area								
Muni. wastewaters	530	59,400	24,800	84,500	13,300	7,600	210	1,730
Surface runoff	980	440	1,090	2,510	410	66	11	769
Indust. waste		9,500		10,000				43

*Cooling water flow not included in industrial waste flow rate.

TABLE II-71 (Continued)
PART B

SUMMARY OF TRACE METAL AND CHLORINATED HYDROCARBON MASS EMISSION RATES (M tons/yr) FROM DISCRETE SOURCES, 1971-72

	Area	Flow (10^6 cu m/yr)	Trace Metals											Chlorinated Hydrocarbons			
			Silver	Cad-mium	Cobalt	Chro-mium	Copper	Mer-cury	Nickel	Lead	Zinc	Iron	Manga-nese	Total DDT	Total PCB	Dieldrin	Total CHC
I.	Muni. wastewaters	22															
	Surface runoff	3.7	0.02	0.04	0.3	0.9	0.6		0.8	0.6	2	970	9	0.001	0.001	0.0001	0.002
II.	Muni. wastewaters	28		0.3		1	1		1		4	8	2	0.002	0.003		0.005
	Surface runoff	44	0.2	0.5	3.4	11	8		10	7	22	11,600	105	0.007	0.010	0.0007	0.018
III.	Muni. wastewaters	470	1.1	25	3	148	190	2.1	147	31	330	660	16	0.088	0.57		0.86
	Surface runoff	50	0.4	0.2	0.4	5	3		1	22	21	1,190	15	0.021	0.018	0.0098	0.049
IV.	Muni. wastewaters	510	10.2	15.4		440	290	0.5	123	128	1,220	5,100	67	19	6		25
V.	Muni. wastewaters	196	3.6	10.9		41	66	0.2	34	40	101	230	17	0.075	3		3.1
	Surface runoff	131	0.5	0.4	0.9	7.3	6.0	0.05	4	57	52	11,900	39	0.088	0.214	0.02	0.322
VI.	Muni. wastewaters	24															
	Surface runoff	13	0.02	0.1	0.3	0.8	0.9	0.01	0.7	3	4	700	15	0.002	0.003	0.0007	0.006
VII.	Muni. waste waters	132		2.5		19	20	0.1	8	12	22			0.022	0.11		0.14
TOTAL																	
	Muni. wastewaters	1,380	15	54	3.0	649	567	2.9	313	211	1,680	6,000	102	19.2	9.7		29
	Surface runoff	242	1.1	1.2	5.3	25	18	0.06	17	90	101	26,000	183	0.119	0.246	0.031	0.396

H. Projection of Environmental Trends without Implementation of further Oil and Gas Production

Throughout this statement, especially in sections II and III, projections and statistics have been presented. The following is a narrative synopsis of apparent trends. Statistical data and detailed information, as available, are presented in sections cross-referenced. The time framework of the projection is approximately 25 years, to parallel that of the period of possible further production.

The California Coastal Zone Conservation Divisions will be important in the determination of land/ocean use within the area of 3 miles offshore to 5 miles inland (or the base of the nearest mountain range, whichever is closest). Numerous other governmental agencies also will be instrumental in policy decision; these have been identified throughout section II (e.g., II.G.1. and 2.).

The physical environment (covered under the section II headings of geography, geomorphology, geology, hydrology, meteorology, and oceanography) would be subject to the same changes and variations that have occurred throughout geologic time; this would include a mutual interaction. Erosion and littoral drift are two examples.

Wildlife and habitat concerns have been identified in section II.E. Extirpation of species has occurred throughout time, but has been accelerated within recent times by man's direct exploitation of certain species or habitat removal or disturbance. Land/ocean use impacts from all sources have been to remove available habitat and in recent times to introduce a variety of chemicals detrimental to certain species. Recent conservation efforts have reduced, and in some cases reversed, threats to wildlife. Additional legal protection may be anticipated, such as through the establishment of Areas of Special Biological Significance. Prediction of future individual species success would vary from "gloomy" to "complete recovery".

Historical records of the population of Ventura and Santa Barbara Counties have indicated a growth trend. This is despite the zero population growth objective advocated by some. Additional employment opportunities will be required even if no additional "immigration" were permitted in these counties, (section II.F.1. and III.N.2.). Plans for recreation and tourism (section II.F.5.) are for the acquisition of more lands and improvement/increase of existing facilities.

Agriculture (section II.F.3.) is important in both Santa Barbara and Ventura Counties (the number one industry in Ventura County). It is faced with both encroachment on agricultural lands and higher labor costs. The trend is to raise crops of higher value on less land and requiring fewer employees.

Education (section II.F.6.) demands are anticipated as increasing in the future, but at a lesser rate than in the past. Research (section II.F.7.) on aspects of the environment is planned by governmental agencies, academic and private industry groups, and individuals. This is in accordance with the increasing trend toward not only gathering baseline data, but for analytical utilization. Research organizations, other than environmental, are located in Santa Barbara and Ventura Counties.

Military employment (section II.F.8.) is the second largest source of income in Ventura County. San Miguel Island, Santa Barbara County is administered by the U.S. Navy. Prediction of future activity or employment is difficult. A reasonable assumption is that the Port Hueneme facilities and Vandenberg Air Force Base will continue at present levels.

Fishing (section II.F.9.) both commercial and sport may be evaluated by historical records. Annual catch varies from year to year due to fishing effort expended and natural fish population fluctuations. It would be reasonable to assume this trend will continue. Mariculture (section II.F.10.) is limited to kelp harvesting in the Channel. Kelp harvests, as fish catches, have varied annually. This is anticipated unless conditions change (e.g. sea urchin predation) or culturing techniques are applied.

Archeological and historical resources (section II.F.11.) have received more attention and protection in recent years than in the past. Many archeological midden sites have been destroyed as the result of land use; yet maps of cities tend to indicate that more sites are identified and disturbed in areas of higher population density and development. The present trends would appear to continue: concern and professional evaluation and disposition (including preservation) of historical, cultural, and archeological resources.

Aesthetics (section II.F.12.) is an individual judgment. The trend appears to be increased land/ocean development and use, with evolving control agencies and policies. A diversity of opinion and feelings is most predictable.

Air and water quality (section II.G.) have received considerable attention and concern within recent years. Studies, data compilation, analyses, improved technology, and controls are anticipated to accelerate. Cumulative pollution from man-made and natural sources is likely to continue, while control measures (including those for waste treatment and discharge) are likely to result in a decrease of the level of substances determined as hazardous being introduced into the environment, i.e., see section II.G.2. d.(5) "Produced Waste Water Disposal in the Future".

Without further development of the Santa Barbara Channel OCS, oil and gas operations will continue to some degree in the area for the next 25 or so years (existing State and Federal OCS Operations and possible leasing of areas seaward of the Santa Barbara Channel Islands).

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III. ENVIRONMENTAL IMPACT OF SANTA BARBARA CHANNEL OIL AND GAS DEVELOPMENT

A. Introduction

The purpose of this section is to define impacts that would result from the various possible levels of development of oil and gas production in Federally administered areas of the Santa Barbara Channel. (See preface and Section I.A. for the four general possible levels of development) Evaluation of these various means of development is motivated by the needs of our energy intensive society for further supplies of such products. Because the petroleum deposits of the Santa Barbara Channel are within the United States and are close to refineries and markets, their continuing development would alleviate to a marked degree the need for imports of foreign oil. Section I.E.6. has described the estimated amounts of recoverable oil and gas that could be obtained by implementation of the possible levels of Santa Barbara Channel OCS development.

This section discusses the impacts on the environment of the various possible components required for petroleum development and production. Since there are a variety of possible components and since each component may impact various aspects of the environment, the impacts can be summarized as a matrix of impacts of possible components on aspects of the environment. Such matrices of impacts are given in subsection P. The various impacts of the possible components on the whole environment are described in subsections A through J, while impacts of the whole program on various environmental aspects are described in subsection O. Impacts of oil spills are discussed in subsection L. and socioeconomic impacts are discussed in subsection N. Impacts on Air Quality are presented in subsection LL. As discussed earlier (see section I.E. for estimates of the number of required facilities) 10 to 21 additional platforms probably would be required over a period of 10 to 15 years to develop the assumed oil potential of the Santa Barbara Channel.

From zero to 21 additional subsea completions systems and one to five additional onshore treatment and storage facilities would be required. Either an additional pipe line from the Santa Barbara Channel Area to the refineries in the Los Angeles-Long Beach area or additional tanker or barge shipments would be required to transport the additional produced crude oil from the Santa Barbara Channel to the refineries at Long Beach or other locations.

Since several levels of possible development are being considered (not just one specific proposal) and due to the lack of specific knowledge as to the amount of and location of all additional oil that may be discovered and developed in the Channel, it is impossible to predict exactly where, or even how many, and what type of facilities may be required. This section, however, attempts to predict the possible beneficial and adverse impacts of activities and facilities that might be required for the possible levels of development. Some of the adverse impacts may never occur because of increasingly strict rules and regulations and restrictions on permitted equipment and techniques. Existing regulations are the strictest that have ever been imposed on such developments. Procedures, techniques, and equipment that would be used to mitigate the possible adverse environmental impacts are discussed in sections I and IV of this statement.

Basically there are three periods to be considered in relating the proposed increased production to the environment:

- Short-term--construction of the proposed facilities and well drilling.
- Intermediate term--operation of the facilities during their productive lives.
- Long-term--after all production ceases, wells are abandoned, and all offshore facilities are removed.

See table III-7 and III-8 in section III.N. for a hypothetical case over a 40-year period as to the wells, platforms, production, revenues, and employment that might result from the potential levels of Channel development.

1. Short-Term Construction Period

Construction would occupy a relatively short period during which platforms, pipe lines, and other facilities would be installed. This activity would overlap in time for many areas as near shore fields would be depleted first and development would move into deeper waters. Thus, drilling and some construction would continue after ongoing operations commence.

2. Intermediate-Term Operations Period

For a period of 20 to 40 years, oil and gas would be produced from wells in the Santa Barbara Channel. At the end of the operations period, production from the Santa Barbara Channel would phase out.

3. Long-Term Period

As production from Santa Barbara Channel fields begins to drop, the fields would be abandoned, wells would be plugged and cut off below the ocean floor, and platforms would be removed.

Onshore areas used for oil production could be returned to their natural or an improved state following oil production activities, if feasible. This may not be possible, however, because expansion of urban areas probably would have occured to such an extent that, by the time the areas were no longer needed for oil production facilities, they would be in great demand for other purposes.

Offshore oil wells would be abandoned and sealed in accordance with prescribed regulations; drilling platforms would be removed.

The possible impacts stemming from the proposed offshore platforms, pipelines, onshore facilities, treatment and storage terminals, submerged production systems, and the product transportation systems, are discussed separately. Oil spills could originate from any part of the system, and the overall effects would be similar regardless of which segment failed. Therefore, the probable impacts of major and minor oil spills from any source are treated together, rather than repetitiously under each subsystem. Impacts on air quality are likewise treated together rather than for each subsystem.

B. Impact of Exploratory Drilling Operations

Shallow core drilling that normally occurs on unleased areas prior to lease sales as well as exploratory drilling on already leased areas are included under this heading. Inasmuch as geophysical exploration precedes geological exploration (shallow core drilling) and exploratory well drilling, geophysical surveys will also be briefly considered. Geophysical, geological (shallow coring) and exploration well drilling operations are described in section I.D.1., 2., and 3. Also on July 30, 1971, the Department of the Interior issued an Environmental Impact Statement titled "Drilling of Exploratory Wells in the Santa Barbara Channel, Offshore California".

1. Geophysical Exploration

A considerable amount of geophysical exploration has been completed in the Channel area. However, more could be expected, particularly if new areas were offered for lease. Implementation of other various means of further developing the Santa Barbara Channel (see section I.E.) would lead to a limited amount of geophysical surveys. See section I.D.1. for a description of the various types of geophysical surveys that might be expected.

In the early years of offshore exploration, the energy source for the seismic wave was explosive charges detonated in the water layer. Because of the hazards associated with the use of dynamite to the seismic vessel, crew, and natural marine life, new equipment and methods have evolved within the last five years and now account for well over 95 percent of marine seismic activity.[1]

In particular, the use of a vibrator system, sparkers, air guns, and gas guns now provide excellent seismic data, with no harmful effect on the marine environment.

In January 1969 and October 1970, due to concern about the effect of acoustic energy sources on the ecology of the marine environment, a comprehensive investigation of the effects of compressed air charges on the water column, water bottom and marine life (oysters) was conducted by marine biologists of the Louisiana Wild Life and Fisheries Commission. The experiments were conducted in Sister Lake, Terrebonne Parish, Louisiana, in water depths from three to five feet at two separate locations: (1) hard shell bottom; (2) soft mud bottom. Normal seismic survey operating procedures were used in the tests. The evidence from the tests, as reported by the Commission, indicates no damage to the water, water bottom, or oysters from the air blasts. (The oysters were

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[1] Taken from Testimony of E. O. Bell, past President, Offshore Operators Committee, presented at OCS Public Hearing, Houston, Texas, February 22, 1973.

examined daily for approximately three months after the completion of the tests for evidence of mortality or abnormality.) General observations indicated that no fish or other marine animals were affected.[1]

Geophysical operations do slightly increase marine traffic, however, the geophysical operations as a result of further developing the Channel would probably create the need for no more than one or two additional vessels in the Channel at any one time.

Deep penetration common depth point (CDP) seismic reflection data and shallow penetration high resolution acoustic geophysical data help to detect hazards such as shallow geologic structures, unstable bottom sediments, faults and seeps thus minimizing potential hazards to drilling and production operations.

2. Geological Exploration

a. Dart Sampling

A weighted tube attached to a wire line is dropped over the side of a vessel, strikes the ocean floor and recovers from a few inches to a few feet of bottom sample depending on bottom conditions (see section I.D.2.b.). Dart sampling operations result in no adverse impacts on the marine environment. However, the presence of the surface

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[1] Field Notes, 1969, 1970. Louisiana Wild Life and Fisheries Commission; New Orleans, Louisiana.

vessel would result in a slight increase in boat traffic. A considerable amount of dart sampling has been done in the Channel. Further Channel development is not likely to result in a great amount of dart sampling programs. Never more than one or two dart sampling vessels would be operating in the Channel at any one time.

b. Shallow Coring

See section I.D.2.c. for a description of this operation. The purpose of this type drilling and coring is not to encounter oil or gas, but simply to recover suitable samples for geological study. This type operation is normally limited to a maximum depth of about 500 feet below the ocean floor. No riser pipe is used and, therefore, there is no return circulation of drilling fluid to the surface vessel. Drill cuttings and drilling fluid are circulated out of the hole and deposited on the ocean floor. Sea water or sea water and clay mud that is not toxic to marine life is used as the drilling fluid. No additional chemicals are added for this type drilling. See section III.C.2.b.(1)(a) and (b) for further discussion of drilling mud and drilled cuttings.

The sea water and cuttings circulated to the ocean floor would result in a temporary increase in water turbidity locally. The drill cuttings generated from a 50 to 500 foot hole would not likely create a noticeable drill-cuttings mound.

Regulations require that the holes be plugged with cement to insure against the possibility of any seeps developing at a later date. This requirement almost rules out the possibility of oil seeps occuring as a result of such a shallow coring program.

The presence of the surface vessel would result in a slight increase in marine traffic. The vessel would normally be on one location only a few hours.

It is unlikely that considerable shallow coring would be proposed as a result of further Santa Barbara Channel development. A number of core holes have been drilled and a number of exploratory wells have also been drilled throughout the area. Figure I-2 indicates the density of these operations. Such operations would be limited by Geological Survey permit stipulations requiring that these programs be made available to all parties wishing to participate and that duplicate locations are not permitted. Shallow coring drilling vessel availability would also serve to minimize such programs. The number of shallow core holes drilled as a result of further Channel development would probably be 0 to 50 holes ranging in depth from 50 to 500 feet. It is unlikely that more than one shallow coring program would occur at the same time.

3. Exploratory Drilling

Exploratory drilling in the Santa Barbara Channel is generally conducted from floating vessels and in a few instances from mobile "jack-up" platforms. (See section I.D.3. for a description of exploratory drilling operations.) Whether drilling is conducted on land, platform, or a floating vessel, most of the procedures and requirements are similar. Drilling from a floating vessel, however, requires certain modifications in procedures and, in some cases, equipment modifications. (Section I.D.3.a.)

In section I.E. the various possible levels of developing production from the Santa Barbara Channel are discussed and an estimate is given for the number of facilities that would be required to implement each of these levels (table I-1 summarizes these estimates). It is estimated that total Santa Barbara Channel development might result in the drilling of from 49 to 165 additional exploratory wells. For a breakdown of the estimated exploratory wells required for each level of development , see table I-1. The depth of the wells would range from 5,000 to 15,000 feet below the ocean floor; in water depths from 175 to 1,500 feet. A considerable number of exploratory wells (80), twin core holes[1](53), and shallow core holes have been drilled in the Channel. Figure I-2 indicates the density of these operations. Upon discovering a hydrocarbon bearing reservoir normally several (2 to 6) additional exploratory wells are required to delineate its boundaries and evaluate it prior to installing platforms.

The impacts on the marine environment that might result from exploration well drilling include the effects of deposition of drilled cuttings, effects of leakage or spillage of drilling muds, and effects of leakage of oil and/or gas from casing during normal drilling or as a result of loss of well control (blowout). These potential impacts are considered for platform development well drilling in section III.C.2.b. The amount of drilled cuttings generated from a typical platform well is given and the cuttings mound that might form under a platform is described. The composition of drilling fluid used is described and it is estimated that approximately 200 barrels of drilling mud might be lost to the ocean per platform well drilled. The discussion on impacts of drilling mud and drilled cuttings from platform wells is for the

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[1] Twin core holes are defined and discussed in the "Introduction" of this statement (page ii9).

most part applicable to exploratory well drilling. However, platform development drilling consists of the drilling of 20 to 60 wells from one location (platform) over a period of two to three years whereas exploration drilling consists of drilling wells several miles apart with each well requiring about one to three months to drill. It is apparent platform development well drilling results in a more concentrated, cumulative effect on a local area while exploration drilling results in a more dispersed effect. In the discussion on platform drilling (section III.C.) it was concluded that discharged drilled cuttings and limited amounts of spilled drilling mud would have a minimal adverse impact on the marine environment. Discharged drilled cutting and spilled drilling mud from exploration drilling would have even less impact on the environment.

The potential for a blowout from exploration drilling is considered greater than for development drilling,however, the mitigations discussed in section IV lower this risk considerably (also see section III.C.2.b.(2)(a)). It is possible but not likely that the loss of control of one platform well could result in loss of control of several wells, whereas the loss of control of an exploration well being drilled from a drilling vessel would involve only the one well.

Exploratory drilling operations as a result of further Channel development would result in a slight increase in local highway and sea surface traffic. This effect should be minimal for it is probable that no more than four exploratory drilling vessels would be operating simultaneously in the Santa Barbara Channel.

See section III.N. for a discussion on socioeconomic impacts that might result from the exploration, development and production phases of further Santa Barbara Channel development. It was determined that the socioeconomic impact of the exploration phase would not be significant. It would result in a maximum of 1,200 employees required for the exploration operations and a portion of those would be hired locally.

C. Impact of Drilling and Production Platforms

1. Construction Phase

Construction and installation of a drilling and production platform would require about two years. Construction of each platform would involve fabrication, possibly at Terminal Island in Los Angeles Harbor or elsewhere, and towing of the completed platform to the site in the Santa Barbara Channel, where it would be upended and set on the bottom by controlled flooding.

Towing of a platform would involve a minimal and temporary use of the shipping lanes.

Each platform would be uprighted, set on piles, and grouted from several hundred feet below the ocean floor. Sessile bottom-dwelling organisms would be destroyed in and around the area where the supports and well casings are placed on the ocean floor, but this would involve only a very minute portion of the sea bed.

2. Operational Phase

a. Impact of the Structure

(1) Relationship of Structure to the Environment

Each offshore structure would have a positive impact on the environment in that it would provide an artificial "reef" for colonization by sessile plants and animals in an area where reefs are lacking. The structure and attached organisms would combine to form a habitat which would attract higher forms of life, particularly fishes. This phenomenon is well documented from studies of offshore oil platforms (Carlisle, et al, 1964) and other artificial habitats (Turner, et al, 1969, Carlisle, et al, 1964), including Sealab II observations (Clark, et al, 1967).

The submerged surfaces of the structure would rapidly become colonized by a few plants and a wide variety of animals, especially to a depth of 100 feet or more. Plant species which may become attached in limited numbers include giant kelp (*Macrocystis* sp.) and strap kelp (*Egregia laevigata)*, at depths of 10 to 20 feet. Animals that would be attracted include: anemones, barnacles, crabs, hydrozoans, limpets, moss animals, mussels, nestling clams, sea slugs, sea squirts, sea stars, sponges, kelp scallops, and various worms (Carlisle, Turner, and Ebert, 1964). A variety of fish species probably would soon be found close to the platform. Some of the fish that could be attracted are reef fishes (including several species of surfperch, rockfish, silversides, sea basses, sculpins) and oceanic fish (including the Pacific sardine, jack mackerel, Pacific mackerel, yellowtail, and bonito). Sport fishing potential would be enhanced by the existence of the structures as they would be areas of concentrated fish populations.

Actual fishing might be limited, however, because of possible long distances to boat harbors and launching sites and the existence of other structures. nearer the boat harbors.

Disturbance to commercial fishing operations by the platforms could vary from minimal to significant depending upon factors such as species being sought, fishing method, season (related to fish migrations), weather, and currents. Purse-seining and bottom trawling would be the most affected fishing methods. The platforms would become charted obstructions to navigation and fishing activities.

(2) Visual Impact of Platforms

All platforms would be more than three miles from shore and the majority would probably be more than six miles from shore. Platform decks would stand up to 100 feet above sea level, and during the drilling phase these would support drilling rigs over 100 feet tall. These structures would be often visible to persons on shore and on nearby boats. Some might find such a view objectionable; others might find a platform a point of interest and not object to its presence. (See section II.F.12., Aesthetics)

One factor in assessing the potential visual impact of the platforms is the amount of time they might be visible from shore, unobscured by fog and haze. In section II, under Meteorology, the frequencies of visibilities of various distances are discussed for three portions of the Santa Barbara Channel (see table II-4). These data show that the periods of low visibility are most common during the summer and early fall (typically June to October). For example, the months when the frequency of visibility of less than 10 nautical miles is greater than 50 percent are as follows:

Eastern Portion	February to November
Central Portion	June and October
Western Portion	July to October.

The eastern portion of the Channel has the greatest frequencies of low visibilities while the central portion has the lowest frequencies of the three areas studied. Thus a platform that is 10 miles from the shore would be obscured from the nearest onshore point over 50 percent of the time during the above months for each of the three regions.

In addition to its visual impact, the platform would relate to human activities in a number of ways. Fish would be attracted to the platform and would provide improved fishing for local sportsmen. The platform support vessels would be capable of providing emergency assistance to commercial and pleasure boats. Several hundred assist and rescue incidents of this nature have been performed at oil company expense in the Santa Barbara Channel. Surface and airborne traffic to and from the platform would augment present activities and would produce higher noise levels along the transportation corridor leading from shore to the facility.

b. Impact of Platform Activities

Operational phases would include drilling of up to 60 wells per platform ranging from 4,000 to 15,000 feet. Many of these wells would slant horizontally with an average maximum deviation of about 40 degrees from vertical. Long-term activities would be production of gas and oil and routine maintenance of the wells. These operations could introduce minor amounts of pollutants into the marine realm. Such pollutants (in addition to oil and gas) might include drilling mud, drill cuttings, and produced waste water.

(1) Debris and Pollutants Other Than Oil

(a) Drilling Mud

Drilling muds are not normally dumped into the ocean. It is forbidden by OCS Order No. 7 to dump drilling mud containing oil into the ocean. This OCS order also forbids the discharging, into the ocean, of drilling mud that has been treated with chemicals of a type or quantity that would result in the drilling mud being toxic and thus detrimental to the marine environment. The muds normally used on OCS wells, down to the surface casing setting point, consist of sea water and gel (bentonite clay) as shown below. This is a light-weight mud with few chemicals.

Gelled Sea Water Mud Typical Composition

Mud component used	Weight (pounds)
Bentonite Clay	56,000
Caustic (Sodium Hydroxide)	5,500
Barium Sulfate (weighting agent)	12,200
Organic Polymer	3.700
Ferrochrome Lignosulfonate (Iron-2.6%, Chromium-3.0% Sulfur-5.5%	3,300
Pregelatinized Starch	500
Seawater	as required
Total Mud Components	81,200

Below the depth of the surface casing, the mud system is generally changed to a sea water lignosulfonate system. Materials widely used are aluminum stearate for foaming control, bentonite for gelling mud, barite for weighting material, carboxymethylcellulose for reduced fluid loss, lignosulfate for a thinner and for reduced fluid loss, bicarbonate of soda for cement contamination, and caustic soda for pH control. Caustic soda is considered toxic in concentrated form. The muds that are used offshore have pH's in the range of 7.5 to 10. The caustic soda (sodium hydroxide) used to keep the pH high (alkaline) will, in the presence of sea water and within certain pH ranges, react to form calcium hydroxide, magnesium hydroxide, and barium hydroxide. The latter is insoluble and will sink immediately to the bottom because of its specific gravity.

Of some concern is the presence of chromium in many marine drilling muds as the organic complex, (ferro)chrome lignosulfonate. Overboard loss or discharge of drilling fluids would introduce some of this chromium into the marine environment. Overboard discharge of large volumes of mud is not a common practice in the Santa Barbara Channel. Overall recent industry tendencies towards maximum recovery of chemical additives minimize any potential hazard to marine life.

Chromium is a constituent of natural seawater (Bowman, Olson, and Redwood, 1966, p. 456). Table II-71, Part B, indicates that chromium emission into the Santa Barbara Channel from municipal wastewaters is on the order of magnitude of 1.9 thousand tons per year, and chromium emission from surface runoff into the Channel is 11 thousand tons per year.

On a weight basis, chromium is present in unweighted commercial lignosulfonate drilling mud components at a concentration of about 12 ppt. Required sea water additions to the mud concentrate reduce this value to less than 4 ppt. -- the approximate concentration of chromium in drilling mud, if discharged. In addition, dilution/disperson effects associated with overboard discharge would be considerable.

Although data relating to toxicities of organic compounds containing chromium are scarce, recent work suggests that chrome lignosulfonate, in moderate to strong dilution, is relatively harmless. While readily soluble in sea water, the compound apparently dissociates very little. If inorganic chromate is also present in the drilling mud, however, oxidation of the chrome lignosulfonate occurs, evolving a new organic chromium complex (Skelly and Dieball, 1970). The nature of this new phase is not well understood.

Jessen and Johnson (1963) discuss physical adsorption and ion exchange relations between chrome lignosulfonate and clay components of drilling muds. Their work indicates a strong tendency towards adsorption of all chrome species present in the muds tested. Ion exchange occurred predominately in the high-sodium bentonite clay types. Both transfer mechanisms effect the removal of chrome components from the water column with subsequent deposition as clay sediment. Once on the sea floor, chrome lignosulfonate is fairly resistant to biodegradation, however, certain benthic invertebrates are known to concentrate trace amounts of various heavy metals over extended time. The possible role of drilling mud chromium additives in this phenomenon is the subject of ongoing research.

Normally the drilling mud is retained and used in drilling other wells on the platform. Moreover, if for any reason this is not the case, various companies will buy this liquid mud for re-sale when they have the opportunity and available mud boats to pick it up. Heavy, highly treated mud systems are expensive and economics alone normally rules out the dumping of this type of mud system. A typical ferrochrome lignosulfonate mud would consist of the following components:

Ferrochrome Lignosulfonate Mud - Typical Composition

Mud components used	Weight (pounds)
Barium Sulfate (weighting agent)	288,000
Caustic (Sodium hydroxide)	20,350
Ferrochrome Lignosulfonate (Iron-2.6%, Chromium-3.0%, Sulfur-5.5%)	26,740
Organic Polymer	3,700
Bentonite Clay	15,400
Proprietary defoamer	300
Water	as required
Total Mud Components	354,490
Total Components less Barium Sulfate	66,490

To drill a typical development well to approximately 8,000 feet from a platform which encounters no special drilling problems normally would require approximately 6,100 barrels of sea water drilling mud containing almost 355,000 pounds of mud components. About 1,300 barrels of commercial mud components and 4,800 barrels of sea water are used to make up and maintain the gelled sea water and ferrochrome lignosulfonate muds used for the well. Average drilling time is 10 to 14 days. As the drilling fluid-drill cuttings mixture is circulated to the surface, drill cuttings are separated from the drilling fluid by shale shakers, desilters, and desanders and discharged overboard. Conditioning of the mud system in order to maintain the desired mud characteristics requires some overboard discharge of clay solids and an addition of commercial mud and sea water to the system daily.

Occasionally, abnormal formation pressures, exceptionally tight formations, or other problems require the use of oil base mud or highly treated drilling muds. Drill cuttings are then separated and cleaned of entrained oil before being discharged overboard, and the drilling muds are retained and shipped to shore and stored in tanks for future use.

Some drilling mud would be lost to the ocean, (perhaps an average of about 200 barrels per well drilled) resulting in a temporary local increase in water turbidity.

(b) Drilled Cuttings

A typical 8,000-foot platform well would generate approximately 1,500 barrels of cuttings weighing about 1,223,000 pounds. The cuttings would normally be released from a vertical outfall pipe about 100 feet below the water surface. Immediately below a 30-well platform drill cuttings could produce a mound approximately 80 to 100 feet in diameter and 20 feet in height, in which grain size might differ from that of surrounding sediments. The finer-grained portions of the cuttings would be expected to be distributed by prevailing currents over a much larger area and would grade into the natural sediments, A reasonable estimate of the range of possible total affected area would be from about 1/5 acre to about 2 acres (Dames and Moore, 1974 manuscript in preparation).

The effects of cuttings deposition would be limited to the following:

- Smothering of the less motile representatives of the benthic epi- and infauna (occlusion of feeding mechanisms of filter and suspension feeders, and asphixiation attending burial). This would include burial of encrusting epifauna on portions of the platform near the ocean floor. The effect would be to reduce the food available to animals at higher trophic levels. As the affected area would be so limited, cuttings deposition is not likely to be of measurable significance to fish populations.

- Temporary increase in water turbidity, reducing the amount of light available for plant (mainly plankton) photosynthesis. The area, periods of turbidity, and portion of local plant populations involved would be very small, especially since the depth of outfall pipes would normally be well below the photosynthetic zone.

- Possible impedance of recolonization in the cuttings mound if sediment texture contrasts with local sediments. This effect, if it exists, might be temporary if deposition of a substantial layer of natural sediments occurs subsequent to drilling operations.

Studies by the California Department of Fish and Game indicated that deposition of washed drill cuttings on the bottom beneath Standard-Humble Oil Platform Hazel neither added anything favorable nor greatly detracted from the character of the environment (Fish Bulletin 124). Extent of recolonization of cuttings was investigated by Dr. R. P. Zingula and his findings indicate that the area returns to a normal sea bottom containing essentially the same fauna and in essentially the same abundance within eight months. (Testimony at E.P.A. Office of Toxic Substances, Conference on Environmental Aspects of Chemical Use in Well Drilling Operations, Houston, Texas, May 21-23, 1975).

(c) <u>Produced Waste Water</u>

See section II.G.2.d. for a description of the present status of produced waste water from the five existing OCS Santa Barbara Channel platforms. Also see section IV.A.1.c. and d. for a discussion on the jurisdiction and regulation of the disposal of produced waste water.

Produced waste water from future OCS Santa Barbara Channel oil and gas operations could be disposed of by:

- Discharging into OCS waters at platform sites more than three miles from shore.
- Subsurface injection into onshore wells near onshore treating and storage facilities or into OCS platform wells.

(i) <u>Discharging into OCS Waters</u>

It is possible the new regulations, evolving from the Federal Water Pollution Control Act Amendments of 1972, will not allow discharge of produced waste water into OCS waters in certain site-specific cases by either unconditional forbidding or by making the requirements so stringent that such discharge would not be economically feasible.

The existing Geological Survey regulations (OCS Order No. 8) stipulates a maximum oil content of 50 ppm in the processed waste water, however, the present OCS produced waste water treatment equipment is designed to reduce the oil content to less than 25 ppm. If discharge into OCS waters at a platform site were allowed under the present regulations, a discharge volume of 25,000 barrels with an oil content of 25 ppm would result in about one-half barrel of oil over a 24-hour period being released into open, deep waters more than three miles from shore. This type of discharge probably would not have an adverse impact on the marine environment except at the immediate area of discharge. The effluent would be moved from the outfall by water currents and diluted rapidly by large volumes of water. The discussion contained under the three following subheadings suggests that the toxicity of processed produced waste water is low.

- Toxicity Bioassay

This is a test procedure used to determine the toxicity of waste water pollutants to fish. The results of such testing do not reflect the effect waste water will have on the total environment of the receiving water.

However, it can be used to determine whether or not a waste or waste component is markedly toxic. The prescribed measure of acute toxicity is the median tolerance limit (TL_m) or the concentration of the tested material in a suitable diluent (sea water for example) at which just 50 percent of the test animals are able to survive for a specified period of exposure. This exposure period may be 24, 48, or 96 hours. Concentrations of dilutions of liquid industrial waste are expressed as percent by volume. For example, a 10 percent dilution, or a TL_m of 10 percent, equals 1 part of waste water and 9 parts of diluent water (sea water). The test fish should be a species adaptable to the laboratory conditions. The species belonging to the family Gasterosteidae (stickleback) is commonly used for testing discharges into the Santa Barbara Channel.

The toxicity bioassays observed by the U. S. Geological Survey on treated produced waste water discharged into the Santa Barbara Channel have ranged from a 96-hour TL_m of 25 percent to a 96-hour TL_m of 100 percent. The average 96-hour TL_m was 70 percent. The high readings of 100 percent indicate that in certain instances more than ½ the fish subjected to the test survived for 96 hours in undiluted treated produced waste water. The 70 percent average indicates that normally more than half the fish (sticklebacks) subjected to the test survived for 96 hours in a mixture of 70 percent produced waste water and 30 percent sea water.

Following is a chart reflecting the constituents and toxicity bioassy results of produced waste water from platform Harry in State waters off Point Conception. Refer to section II, figure II-46 (platform Harry shown as E1) and table II-65 for the platform Harry location.[1]

Date	10-5-70	5-17-71	10-6-71	2-29-72
Constituents (Mg/L)				
p^H	6.72	6.41	6.58	6.49
NO_3	0.27	0.0	.31	0.0
SO_4	53	57	60	60
PO_4	0.03	0.02	0	0.1
NH_4	26	28	16	26
Phenolic Compounds	2.4	2.9	3.5	2.6
Total Dissolved Solids	20,450	24,977	21,100	20,000
Oil and Grease ppm	8	7	4	8
96-hour TL_m	75%	100%	90%	86%

From the above toxicity bioassy results one cannot determine the impact of the produced waste water discharges on the Santa Barbara Channel marine environment; however, the results do reflect that the toxicity of tested produced waste water is low.

- Study of the Effect of Produced Waste Water Discharges on the Marine Environment

A study performed by J. G. Mackin, Texas A & M University, November 1971, on the effect of oil field brine effluents on biotic communities in shallow (8 feet) Texas estuaries indicated the following:

The discharges affected only the bottom organisms and this effect was

[1] This information was received from the California Water Quality Control Board, Central Coast Region (all platform Harry wells have now been abandoned and the platform has been removed. For more details on Santa Barbara Channel produced waste water characteristics refer to section II.G.2.d.(4).

localized. The rapidity of reduction of oil in the bottom muds around brine discharges has been determined by coring and chemical analysis of bottom muds. Values of hydrocarbons (nearly all petroleum) at the discharge site ranged from 0.11 percent to 20.3 percent. At a distance of only 75 feet the amount was reduced to 0.041 percent. This level is within the range of natural hydrocarbons in mud. It was estimated that the daily input of brine into the creeks above the bay carried about one barrel of crude petroleum. Evaporation, bacterial decomposition, and chemical recombination are sufficient to eliminate this amount in a fraction of a mile, based on the results of studies in the Cow Bayou and Clear Creek area. The failure to find any sign of oil in the Alazan arm of Baffin Bay is attributed to these eliminating factors.

The brine discharges, under conditions such as occur in deep water probably would be found to be ineffective, all other things being equal, in the reduction of bottom communities. For example, brine discharges in 30 to 150 feet of water rather than the 8 feet studied by Mackin, would be subject to enormously greater dilution, with probably greater bacterial action in destruction of the oil content of the brine.

Although a study performed on produced waste water discharges into shallow Texas estuaries is not directly applicable to discharges into the Santa Barbara Channel; it does indicate certain impact characteristics of produced waste water discharges that serve to limit possible detrimental effects of such discharges on the marine environment.

- Santa Barbara Channel Produced Waste Water Discharge Monitoring Program

Continental Oil Company from 1967 to 1971 discharged up to 10,000 barrels a day of produced waste water 600 feet from shore into the Santa Barbara Channel. (Since 1972 this water has been disposed of by subsurface injection into the San Miguelito field for secondary recovery.) The California Water Quality Control Board required a monitoring program. Divers sampled the ocean water near the end of the discharge line to determine the produced water effects in the ocean. Monitoring was at ten points. Oceanographic Services, Inc., analyzed the temperature, dissolved oxygen, pH, turbidity, suspended solids, aluminum and biology. A summary report of the three quarterly survey reports for 1971 indicated that the abundance and diversity of organisms communities expected at the sites of produced waste water discharge would show little correlation with on-site physical or chemical parameters other than bottom type (lithology).

Toxicity bioassays (96-hour TL_m) on this discharge water ranged from 40 percent to 100 percent.

(ii) Subsurface Injection

Disposal by subsurface injection into onshore wells would be in accordance with section 502 (6) (B) of the amended 1972 Federal Water Pollution Control Act and subject to approval and regulation by the California State Division of Oil and Gas. Disposal by subsurface injection into OCS platform wells would be in accordance with the Environmental Protection Agency recommended guidelines and subject to approval and regulation by the U. S. Geological Survey.

Disposal of produced waste water by subsurface injection would normally involve injection into strata partially depleted of fluids by oil production.

Such programs would have to meet stringent regulations aimed at preventing pollution of fresh water sources and damage to potential oil and gas resources. Regulations and seismic detection monitoring programs would also serve to minimize the possibility of earthquakes caused by the injection (see sections II.B.6.h. and IV.B.8.)

No significant detrimental impacts should result from the disposal of produced waste water into strata partially depleted of fluids. Subsurface injection, secondary recovery programs serve to increase the amount of oil that can be recovered from a field without increasing the number of platforms. Subsurface injection is also a means of preventing subsidence due to oil and gas production. Subsidence due to OCS operations has not been documented, although the Pacific Area initiated a program in mid-1970 on three platforms in the Dos Cuadros field to monitor subsidance that *may* occur, so that if it does, early detection will permit a course of remedial action to minimize it. "Whether or not subsidence will occur in a particular oil field cannot be predicted. If it does occur, it will be the result of fluid withdrawal from the reservoirs. Additionally, the major problems created will be operational with little likelihood of causing any damage to the environment. At the present time the best known method to minimize subsidence is to replace the withdrawn fluid with an equivalent volume of another fluid; in this instance, water" (Adams, 1973, p. 11-14).

(d) Sewage

Sewage (biological waste) would be treated in accordance with OCS Orders EPA regulations (see section IV.A.1.) and be disposed of below the sea surface. OCS Order No. 8 requires that the treated effluent contain less than 50 ppm of biochemical oxygen demands, less than 150 ppm suspended solids, and a chlorine residual of at least 1.0 milligrams per liter. This small volume (several acre feet per year per platform) of treated effluent discharged into OCS waters would have an insignificant effect on the marine environment.[1]

(e) Trash and Garbage

Garbage and other debris generated on platforms would be shipped to shore for disposal. Although stringent rules prohibiting dumping of garbage would be in effect, minor amounts of trash or garbage might fall overboard. The impact of these dumpages on the environment would probably be small due to the very small volumes involved. Material such as pieces of machinery, drums, cans, wood, and tools might be lost into the ocean by accident or during storms. Large pieces of debris could become entangled in the trawl nets of commercial fishermen. Small, reflective pieces of metal such as pull-tabs on beverage cans are sometimes ingested by fish as they settle through the water, resulting in injury to the fish. Floating material such as drums, cans, and wood constitutes a hazard to small boats. The screws of boats can be fouled on floating plastic sheeting and plastic or nylon ropes. Floating debris on the water and washed upon the beach would constitute an adverse aesthetic impact.

(f) Diffusible or Degradable Toxic Liquids

Paint, fuel, solvents, motor oil, etc., could be lost into the sea. This would occur infrequently and the amounts involved would ordinarily be so small that the impact would be very minor. If all the stored toxic liquids on a platform were released to the environment, then the impact might be similar to that described for oil pollution later in this section. The total volume of toxic liquids maintained on a platform would be on the order of 100 to 200 barrels.

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1 See section II.G.2. for jurisdiction of the Channel water quality. Specific "requirements" for each discharge of municipal or industrial waste are frequently revised based on the objective of the quality to be maintained in the receiving waters, these may be determined by the amount or concentration of pollutant in the effluent as well as the quality of the receiving waters.

(2) <u>Causes of Possible Major Oil Spills from Platforms</u>

The largest oil spill that might be expected to occur in association with operations in and around a platform is, most likely, the kind of uncontrolled flow that could result from a blowout. Historically, blowouts normally occur during the drilling of a well (rather than during production and maintenance operations) and are usually the result of failure of the drilling mud system to keep formation gas and fluid from invading the borehole, in combination with one or more of the following:

- Failure of the blowout preventer system (a series of powerful valves each backing up the other, all of which must fail).
- Failure of well casing to contain pressures that may be large enough to cause rupture of caprock, permitting oil and gas to seep through the strata around the casing.

Since the 1969 blowout on Platform A in the Dos Cuadras Offshore field, with the resulting oil spill that remains an unpleasant memory to many, offshore regulations have been made more stringent and anti-pollution procedures and equipment have been improved. The likelihood of a recurrence of a major spill from similar causes during future drilling operations at existing or future platforms is, therefore, very low. Conceivably, a major blowout could also occur at platforms operating only completed wells, if the wells were flowing and if the platform or conductor casings were severely damaged from events such as:

- Seismic shaking, with concomitant breaking of pipes or valves
- Deformation of the ground, either by slumping, faulting tilting or liquefaction, causing breaks in pipeline, or well casing.

- Collision
- Human error
- Vandalism, sabotage, or act of war.
- Fire
- Storm waves and winds.

The expectable frequencies and magnitudes of such damaging events as seismic shaking and storms are discussed in section II, to which the reader is referred for a more complete derivation of the rationale covering the following conclusions regarding environmental impact. Certain of these geologic hazards would represent a similar threat to pipelines from the platforms to shore.

(a) Blowout and Caprock Rupture

As described by McCulloh (1969), and discussed earlier in this report (see section II.B.7.), the fluid properties and reservoir characteristics that might contribute to a blowout occur in many of the fields of the Santa Barbara Channel region and may be expected in undiscovered fields in the region. Clearly, planning for every deep bore-hole should include the most accurate possible predictions of reservoir pressures, gas-oil ratios, and fracture gradients. Care should be taken that casing is run to sufficient depth to prevent formation damage by exposure to pressures from deeper zones.

Although such events have not been recorded, it is conceivable that producing wells could blow out under some conditions. Severe damage to a platform with flowing wells in production could occur from storm, earthquake shaking, collision, or other cause, and leaks from the casing, both above and below the mudline, could result. Such leaks could probably be controlled by subsurface safety valves as described in section I.D.5.d. Severe damage, including shearing of casing, can also be caused by earth movements such as landslides or active fault displacement. Conceivably, if casing in a flowing well or cluster of wells was broken, communication could be established between the pressure of a deep reservoir and shallower strata at depths where that pressure exceeds that necessary to cause fracture, and flow of reservoir fluids into and through the fractured shallow strata could result. From the historic record, such an accident seems extremely unlikely. There is no known instance of such an occurrence from natural ground movements. Although many cases of casing rupture from fault displacement and landslide displacement have been reported in several California oil fields, none has resulted in a blowout. Generally, reservoir pressures are depleted by the earliest stages of development of a field, and the wells would be vulnerable to such "blowout conditions" only for a relatively short period of time early in the development of the field, rather than for the entire producing life of the wells from a particular platform. Subsurface valves ("storm chokes"), would normally serve to prevent a major spill from even this type of accident.

(b) Seismic Shaking

The Santa Barbara Channel region is seismically active, as has been summarized in section II. It is reasonable to conclude that facilities in the region will be subjected to seismic shaking during their operational lifetimes. Proper design of platforms to insure their structural integrity during strong earthquakes considers several geologic factors, including: 1) degree of seismic wave amplification to be anticipated in the relatively soft and unconsolidated sediments that underly most potential platform sites; and 2) the possible presence of unconsolidated, water-saturated sands that could undergo liquefaction under the influence of seismic shaking, causing failures of the foundations of platforms. Detailed examinations at the sites of proposed platforms (or other structures to be founded on the sea floor) should determine the degree to which each might be vulnerable to such potential hazards, and should be considered in the engineering designs. The seismic history (section II.B. 6.g.) suggests ground motion parameters for bedrock sites near the epicenter of a magnitude 7.5 earthquake should be: 1) a peak horizontal acceleration greater than 1.0 g (980 cm/sec2); 2) a peak horizontal velocity greater than 125 cm/sec; and 3) a duration of strong shaking in excess of 40 sec. Corresponding near-fault horizontal ground motions for a magnitude 6.5 earthquake, based on instrumental data, are: 1) peak absolute acceleration 0.9 g; 2) peak absolute velocity 100 cm/sec; and 3) duration of 17 sec. Because the determination of these ground motion parameters is a rapidly advancing field of technology, the Geological Survey is in an advanced stage of arrangements for establishing a system of third-party certification of platform design and for the development of various design criteria for OCS platforms and other facilities (see section IV.B.10).

(c) Ground Movement

Ground movements that could damage wells, pipelines, and drilling platforms could be produced in several ways, including: 1) slumping or creep of unconsolidated sediment, with or without the triggering action of seismic shaking; and 2) tectonic rupture, with fault displacements sufficiently large to break or shear-off well casings or pipelines.

Submarine landslides have been recognized in the region, as discussed in section II.B.7.g. A large submarine landslide in the Santa Barbara Basin could cause a seismic sea wave and its attendant potential for hazard to oilfield operations. In addition, if a large landslide occurred where its movement caused the shearing-off of a flowing well or group of wells, it could result in the transmission of pressures to the shallow strata in excess of those required for hydraulic fracturing, thus creating the potential for uncontrolled flow of petroleum to the sea floor. Detailed examinations of sites where structures are proposed to be founded on the sea floor, and of routes where pipelines are proposed, should include an evaluation of the potential for damage by landsliding.

The evidence for Holocene fault rupture in the Santa Barbara Channel region (discussed in section II.B.6.f. and section II.B.7.c.), together with the seismicity (which is inferred to be caused by fault movement at depth), and geodetic measurements, indicate that fault displacements could cause rupture of well casings at depth and pipelines on the sea floor. The chief hazard of breaks in well casing has been discussed previously (section III.C.2.b.(2)(a)). Because the general trend of the faults is east-west, most pipelines from well areas to onshore facilities would have to cross one or more faults having a potential for surface displacement. Detailed examinations of the routes of proposed pipelines should locate and identify all faults and attempt to ascertain the age of the most recent movement along each fault. An appropriate siting of valves would likely reduce any spill to a very minor amount, in the event that a break should occur from such fault displacement.

Subsidence, and faulting associated with subsidence, are kinds of ground displacements that have accompanied the production of oil and gas in a number of California oil fields (see section II.B.6.f.). Such fault displacements may take place along older fault surfaces or along new breaks formed in response to the subsidence-related stress field. Maintenance of "optimum" pressures by means of water injection may be effective in limiting and controlling the amount of subsidence in some fields; however, water injection can upset pressure balances in some reservoirs and must be done with great care and forethought (McCulloh, 1969). There are some onshore data that indicate, under certain circumstances, there is a risk of triggering shallow earthquakes by the injection of fluid under pressure, as described in section II.B.6.h. The effects of these man-induced earthquakes and ground movements would create the same general kind of potential hazard to the environment as earthquakes and fault displacements from natural causes.

(d) Collision

Boats colliding with a platform could be severely damaged or destroyed, and people on them injured or killed. Collision of small boats with a platform would have no adverse effect on the platform. Collision by a vessel of 500 tons or larger, or by a large airplane, or missile could substantially damage the structure. Collision by a vessel is unlikely due to requirements for navigational equipment on the passing ships as well as on the platform.

Many of the potential offshore platforms in OCS waters of the Santa Barbara Channel would be along the northern shore of the Channel and at least several miles from the shipping lanes. Exceptions are the Pescado Offshore field in the Santa Ynez Unit which lies within a mile of the northbound shipping lane and two smaller unnamed fields in the Santa Clara Unit which partially underlie the northbound shipping lane. If platforms are erected on these fields, the potential for ship collisions will increase significantly. To mitigate the hazard the USGS and U.S. Coast Guard will not allow a platform to be built within ½ mile of any shipping lane. Collision of an airplane or missile with an offshore platform seems very remote although such a collision might occur due to vandalism, war or civilian insurrection.

(e) Human Error

Human error can never be completely ruled out, however, the Operator would be required to minimize it by close supervision, operating personnel training schools, and on-the-job safety drills.

(f) Vandalism

There has been no record of platform damage by vandals, but the possibility, though remote, cannot be ruled out. All preventive measures believed to be warranted would be required.

(g) Fire

A platform fire may result from a blowout or may result from some other source (for example, vapors coming in contact with arcing electric devices and overheated mechanical devices) and cause a blowout. If a well blowing out of control is ignited, the oil spilled is usually allowed to burn while operations are underway to control the wild well from a remote location. In this way, a high percentage of the hydrocarbons expelled by the well is burned and little ocean pollution results. However, the safety of personnel and the security of the platform would be imperiled should a fire occur. The impact of a well blowing out of control, either ignited or unignited, on water and air quality will be discussed in this section under subheading L. "Impact of Major and Minor Oil Spills on Marine and Littoral Environments".

(h) Storm Damage

Any proposed platform would be designed to withstand the most severe storm conditions likely to be encountered. Wind and wave conditions should not result in damage to a properly designed platform to the extent that oil and gas would be released to the environment. Tsunamis would have little or no effect on deepwater platforms more than three miles from shore. As they occur in deep water, they are no more than several feet high but have a wave length of a mile or more. The ocean surface is elevated two or three feet over a very large area and, as the waves reach shallow water, they have tremendous energy and begin to "stack up", causing the great waves that are destructive as they run up on the shore. Tsunamis would therefore be a threat to near-shore facilities and the near-shore portion of ocean floor pipelines. Burial of this portion of the pipeline should serve to protect it from tsunamis forces.

3. Platforms That Have Been Proposed

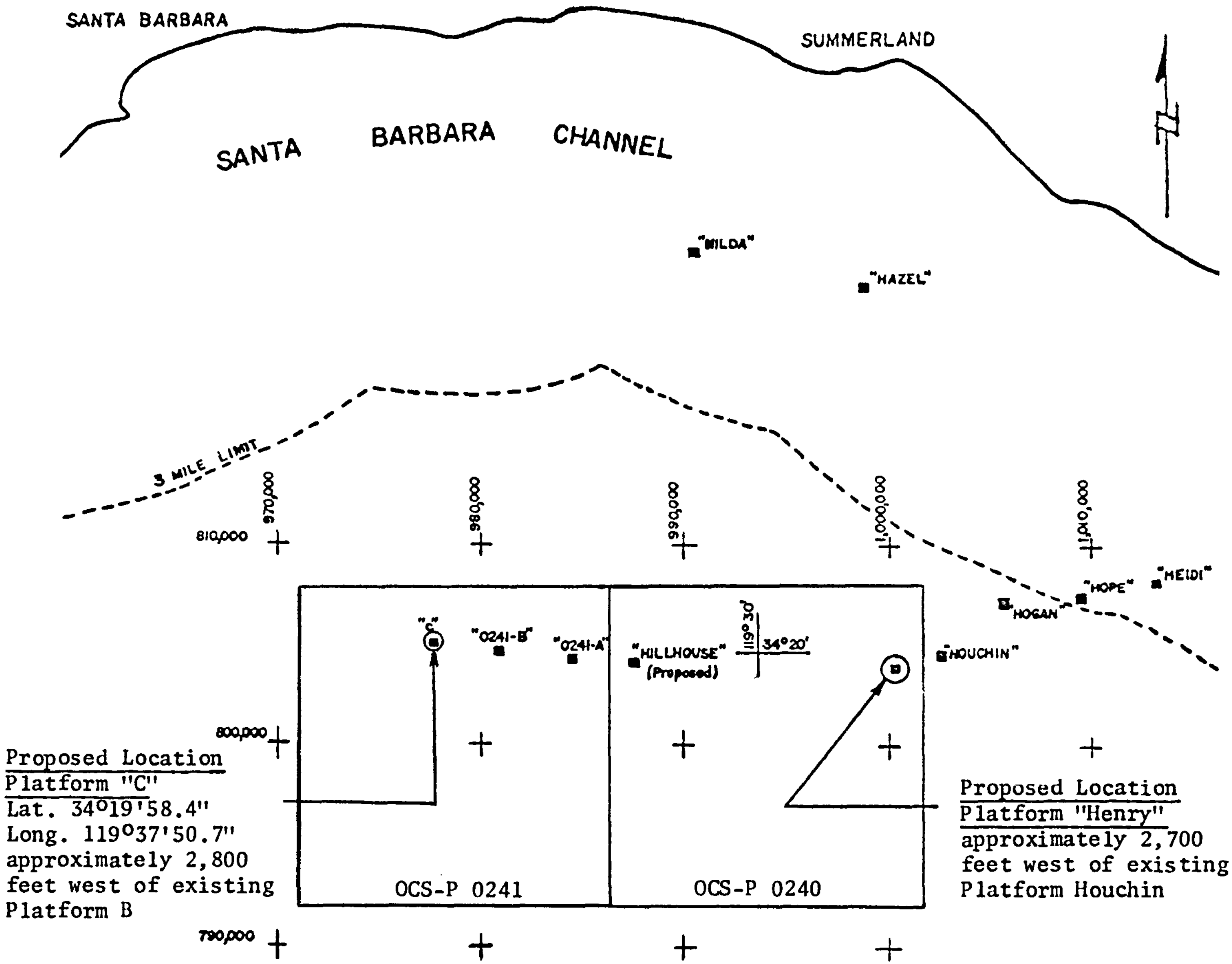
Under this heading, potential impacts are considered that might result from the installation and operation of three platforms that have been specifically proposed. These are C, Henry, and (unnamed) Hueneme Offshore.

Two platforms, C and Henry, were proposed and a Final environmental impact statement covering these two platforms was issued in 1971. Subsequently, the Department of the Interior denied the Applications. On September 29, 1975 a new application was filed on Platform Henry. See figure III-1 and plate 1 for the locations that were previously proposed for Platforms C and Henry.

It is possible that a similar application could be filed for Platform C in the future. For these reasons it is considered appropriate to include an evaluation of the impacts that might result from installation and operation of both platforms.

A third potential platform that will be considered here is for the potential field (referred to as Hueneme Offshore) on leases OCS-P 0202 and OCS-P 0203. A preliminary notice has been submitted to the Geological Survey by Mobil Oil Corporation of their intention to install a platform on lease OCS-P 0202. No action is being taken on this notice pending the submission of additional detailed information and completion of this Environmental Impact Statement. The Operator has informed the Geological Survey that the location of the anticipated platform, as shown on figure III-6 and plate 1, is tentative pending additional exploratory drilling to further evaluate and define the boundaries of the potential field. This tentative proposal is indefinite and lacking in detail, and therefore is not recognized by the Geological Survey as a formal application.

FIGURE III-1 Location of Proposed but Denied Platforms "C" and "Henry" (locations indicated by + are on the Lambert Grid Zone VI)



The initial platform proposed for the Santa Ynez Unit was covered in the Santa Ynez Unit Proposed Plan of Development Environmental Impact Statement and is not included in this subsection. The initial part of this development plan was approved August 16, 1974 (see appendix I-1 at the end of section I). See section I.E.2.a. for a brief description of this proposed platform and related facilities. For further detail refer to Environmental Impact Statement FES 74-20.

The discussion on impacts of platforms in III.C.1 and 2 is directly applicable here. The discussions under section III.L. "Impact of Major and Minor Oil Spills on Marine and Littoral Environments" and section III.N. "Socioeconomic Impacts" are for the most part also applicable to this specific platform proposal impact discussion.

a. Platforms on the Western Portions of the Dos Cuadros and Carpinteria Offshore Fields

Further development of the Dos Cuadros and Carpinteria offshore fields would most likely require installation of drilling and production platforms on the western portions of these fields. A final environmental statement (FES-71-9), issued by the Department of the Interior in 1971, described and discussed the environmental impacts that may result from the installation of proposed platforms C and Henry on the western portion of the Dos Cuadros and Carpinteria offshore fields respectively.

- Location

These platforms would most likely be located on the western portion of the Dos Cuadros and Carpinteria offshore fields - Federal leases OCS-P 0241 and 0240 respectively (see figure III-1 and plate 1). Both platforms would be four to five miles from the nearest shoreline point and ten to eleven miles north of the northbound shipping lanes. The water depth at these locations is approximately 50 to 55 m. (160 to 175 feet).

- Geology

The Dos Cuadros and Carpinteria fields are located on the offshore continuation of the Rincon trend. Section II.B.3.d.(3) describes the geologic structure of this trend. Section II.B.5. discusses the potential for increased oil and gas production of the Rincon trend. The hydrocarbon reservoirs in the Dos Cuadros and Carpinteria offshore fields occur in the upper part of the Repetto formation of Pliocene age. For convenience, the producing sands are divided into zones and given letter designations. At Platform A in the east-central part of the Dos Cuadros offshore field (see plate 1), Repetto zone B crops out on the ocean floor and zone H is approximately 3,000 feet below the ocean floor. The producing sands on the western portion of the Dos Cuadros offshore field are about 200 feet structurally lower than they are around Platform A. Thus there are at least 200 feet of additional sediment between the sea floor and the potential hydrocarbon reservoir. On the western end of the Carpinteria offshore field the potential Repetto reservoir sands are overlain by 900 feet of Pliocene lower Pico sediments. This additional rock section overlying the potential Repetto reservoirs at the locations that were originally proposed for Platforms C and Henry is an additional safety factor making the escape of hydrocarbons to the sea floor more unlikely.

Both normal and reverse faults are common along the Rincon trend. It is probable that there has been post-Pliocene movement, resulting in earthquakes, along some of these faults. Seismic forces acting on platforms in this area can produce stresses which are much greater than the stresses caused by wind and waves. For this reason, these seismic forces govern the design of the platforms. See section II.B.6. for a discussion of the seismic history and activity of the Santa Barbara Channel region. Also, see section II.B.6.g. for expectable earthquakes and design considerations of drilling and production platforms in the Channel area.

- Design Characteristics

The design characteristics of any platforms in the western portion of the Dos Cuadros and Carpinteria offshore fields probably will be similar to or very nearly the same as those proposed originally for Platforms C and Henry described in FES 71-9. (The recent proposal involving platform Henry is very similar to the 1970 platform Henry proposal)

Platform C

Platform C was designed as a 56-well, fixed drilling and production platform. The structure would be supported by twelve 44-inch platform legs and anchored to the ocean floor with twelve 40-inch steel pilings driven through platform legs to an approximate depth of 85 feet below the mud line. Available data indicate that these pilings would not penetrate any oil-bearing beds which could cause hydrocarbon seepage. The pilings are grouted to the platform jacket legs from the ocean floor back to sea level and then welded together, thereby tying the jacket securely to its support piles. The production deck is 43 feet above mean lower low water and the drilling deck 70 feet above the same reference. The drilling deck is 112 feet by 134 feet. The top of the drilling derrick is approximately 215 feet above water level. (See figures III-2 and III-3)

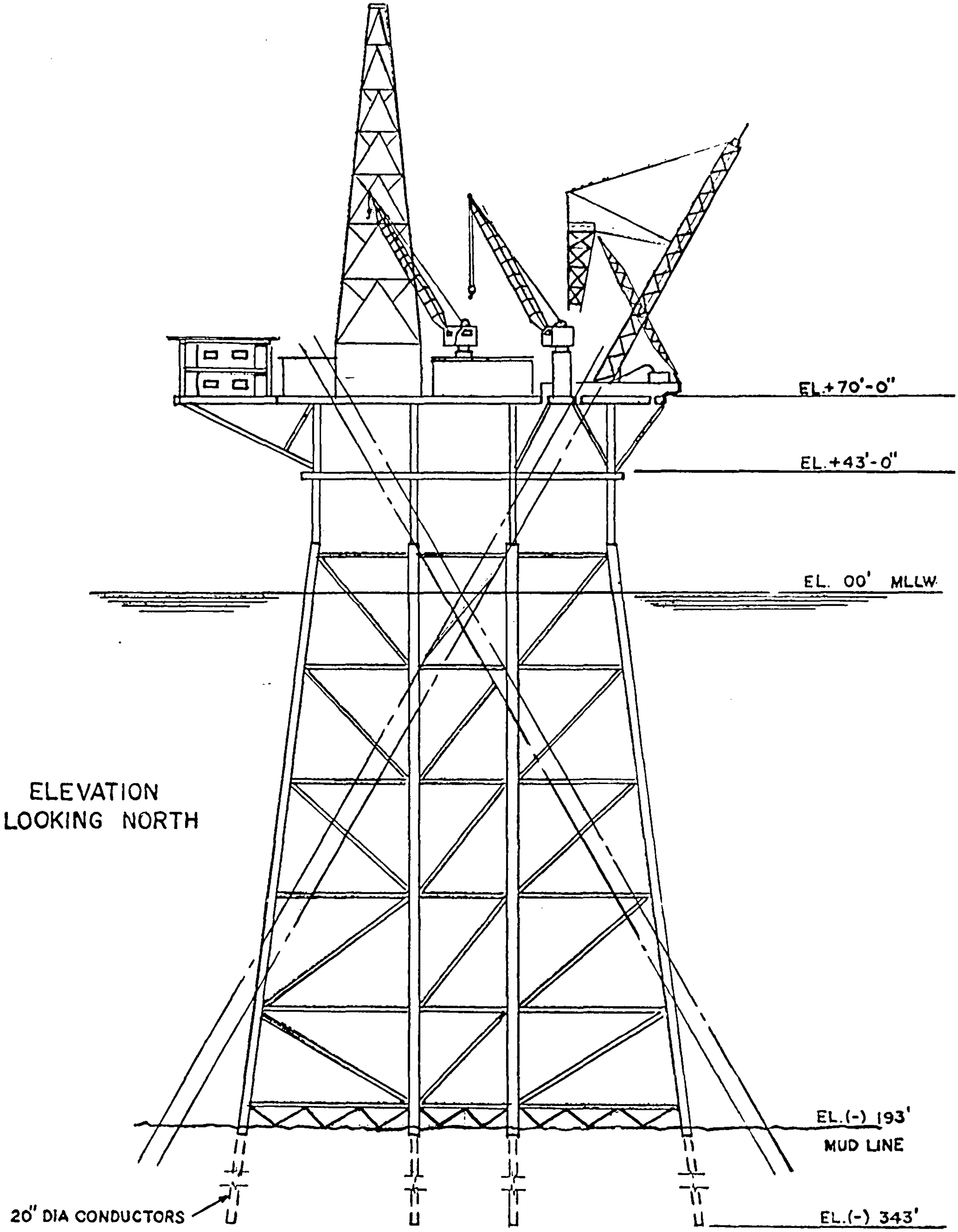


FIGURE III-2 Proposed but Denied Drilling and Production Platform "C" Santa Barbara Channel, California By Union Oil Company of California

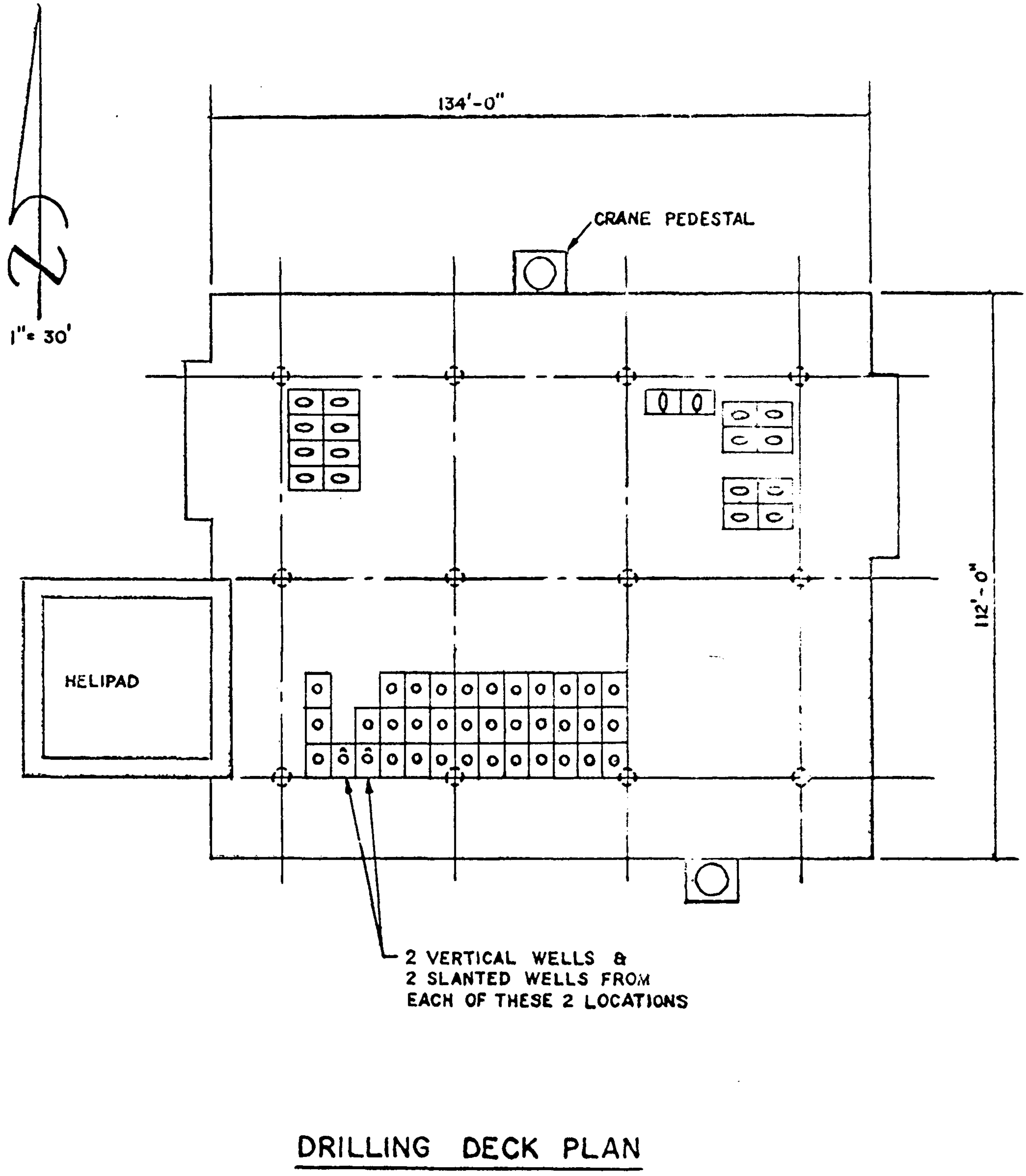


FIGURE III-3 Proposed but Denied Drilling and Production Platform "C" Santa Barbara Channel, California by Union Oil Company of California

Platform Henry

The original application to install Platform Henry, submitted to the Geological Survey, January 1970, stated that Platform Henry would be a 30-well platform. This has been reduced to 21 wells in the new application because water injection wells originally proposed are not included in this revision. Produced waste water would be injected into nearby Platform Hillhouse wells. Other than this modification this new (resubmitted) Henry application is for the most part identical to the original application; the location (see figure III-1 and plate 1), detailed structural plans and design criteria are the same.

Platform Henry would be installed in a water depth of 175 feet referenced to mean lower low water at Lambert Coordinates, Zone VI, of X = 1,000,580, and Y = 803,740. This is 4100' south and 1500' west of the northeast corner of OCS-P 0240 (see figure III-1 and plate 1). This location was chosen to facilitate field development as the expected center of the volumetric accumulation of the oil and gas reserves. Two soil borings drilled to depths of 76' and 176' below the mud line at the proposed site indicate that the soils were very similar to those encountered at the site of existing Platform Hillhouse. Dames and Moore, consulting engineers in the applied earth sciences, supervised the borings, analyzed the results, and concluded that the site was suitable for a platform installation.

The general design of Platform Henry would be an 8-pile template-type self-contained structure installed at a location where the bottom is sloping in the order of 1 foot in 100 feet southerly. The platform would be capable of withstanding the 100-year storm design wave of 35 feet high with a 12-second period while simultaneously withstanding a current velocity of 0.5 knots between the water surface and -40 feet and a wind velocity of 125 mph. There would be two main decks, a drilling deck and a production deck both approximately 80' x 125'. (See figures III-4 and 5) The production deck would be capable of supporting a uniformly distributed live load over the entire deck area of 500,000 pounds with a center of gravity assumed to be 3 feet above the deck.

The Platform would be supported by eight legs through which large diameter pilings would be driven to refusal, expected to be about 45 feet below the mud line. These large piles extend above the ocean surface and are grouted and welded to the jacket leg. Inside these large piles a somewhat smaller hole is drilled to a depth of about 200 feet below the mud line. A second pile would be installed in this drilled hole and the annular space between the two concentric piles grouted. The production deck would be located 37 feet above mean low low water; the drilling deck would be located 61 feet above the same reference. The top of the drilling derrick would be at an elevation of 223 feet above the water level (see figure III-4).

A 12,940' pipeline bundle consisting of two 6.625" O. D., .250" wall, 17.02 lbs./ft., API 5LX42 pipes would transport Platform Henry production to existing Platform Hillhouse. These lines would lie upon the ocean floor submerged in 175 feet of water at Platform Henry and a maximum depth of 190 feet at Platform Hillhouse. One line would carry Platform Henry fluid production (oil and water) and the other line would carry Platform Henry gas production.

- Potential Impacts of Platforms C and Henry

The impacts would be limited to those resulting from the two platforms (C and Henry) for no additional support facilities would be required.

No additional pipelines to shore would be required for two such platforms. Two segments of sea-floor pipeline, approximately 1.5 miles in length, would be required for connection to already existing platforms A and Houchin. No additional onshore treating and storage facilities would be

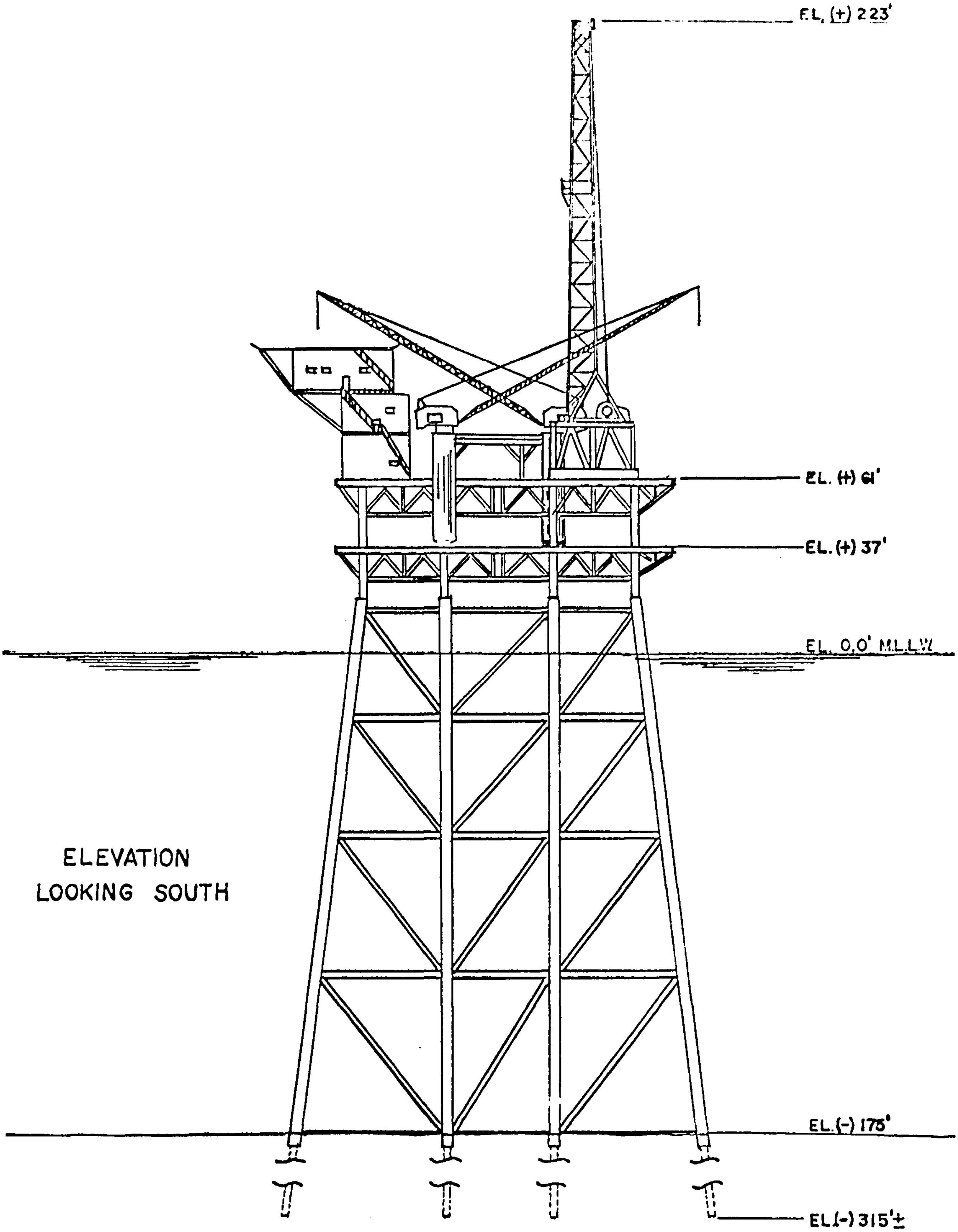
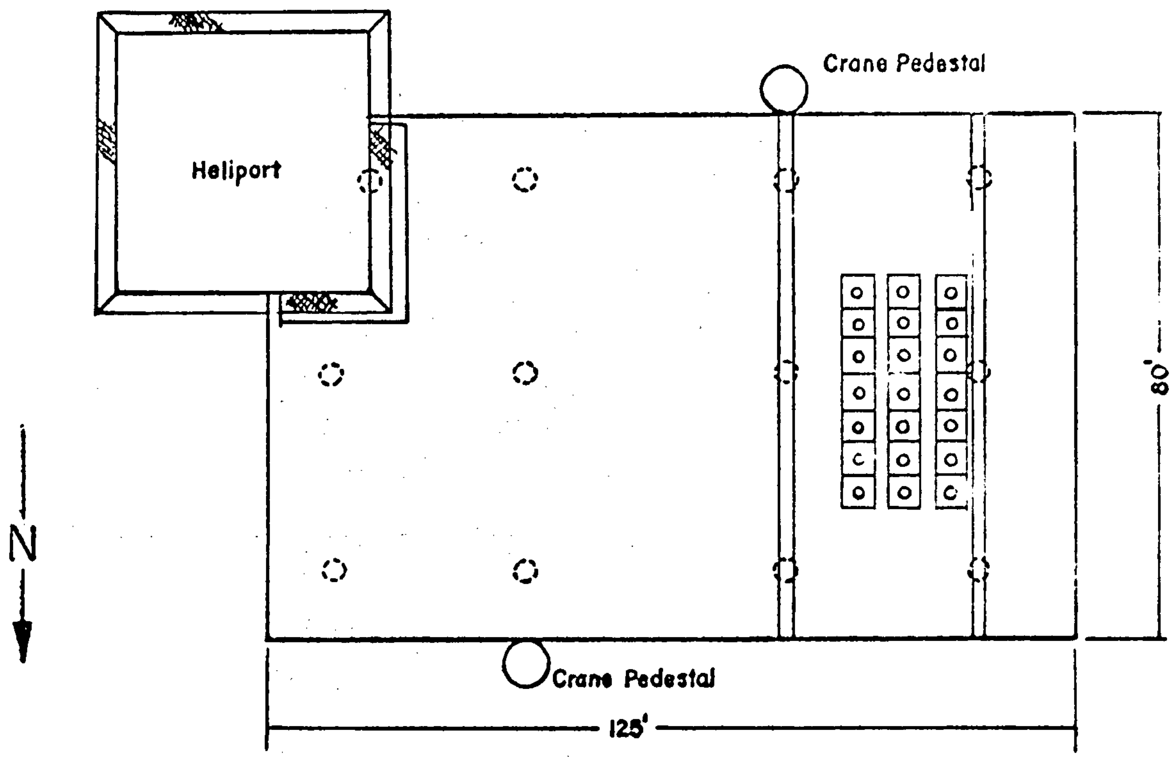


FIGURE III-4 Proposed Drilling and Production Platform "Henry"



DRILLING DECK PLAN

FIGURE III-5 Proposed Drilling and Production Platform "Henry" required as the production would be received at the existing onshore facilities.

Platforms for the western portions of the Dos Cuadros and Carpinteria offshore fields (such as Platforms C and Henry) would offer no unique potential impacts other than the ones considered in section III.C.1. and 2. where general platform operation potential impacts are discussed.

The two platforms would not represent a significant increase in the hazard to navigation for they are in the near vicinity of existing platforms and would be more than ten miles from the shipping lanes.

Installation of two such platforms, four to five miles offshore, would increase the number of platforms on Federal leases from five to seven and the total number of platforms in the Channel from twelve to fourteen. They would thus further modify the scenic character of the Channel area. These platforms would be easily visible from the shore as are the existing platforms in that area.

The most serious impacts of these platforms, if installed, would be those resulting from accidents causing a spill of crude oil. See section III.L. for a discussion on oil spill impacts.

b. <u>Hueneme Offshore Potential Field - Tentative Platform Proposal</u>

- <u>Further Evaluation</u>

The Hueneme offshore potential oil field was discovered by Mobil on leases OCS-P 0202 and OCS-P 0203, located in the Santa Barbara Channel approximately four miles southwesterly of Port Hueneme and 11 miles south of the City of Ventura. The discovery well was drilled and suspended in July 1969. The Operator now proposes (August 1974) to drill at least two confirmation wells to define the productive area of the field and to obtain the information necessary to determine the feasibility of further development of this oil field. A platform contingent upon the outcome of further evaluation has been tentatively proposed. The confirmation evaluation wells would be directionally drilled from a floating rig with the ocean floor locations situated near the discovery well wellhead. The wells would be drilled to vertical depths of approximately 5,000 feet to 6,000 feet and would be directed to bottom hole locations approximately 2,240 feet westerly and 2,000 feet northeasterly of the discovery well.

The confirmation wells would be drilled and completed in such a manner that they can be re-entered and used as producing wells, in the event that further development of the field were justified from the information obtained in logging and testing of the confirmation wells. The U. S. Geological Survey has requested more geophysical data prior to acting on the applications to drill these two exploratory evaluation wells.

- Tentative Platform Proposal

Mobil's tentative proposal is for installation of a 15-well drilling and production platform designated as Platform OCS-P 0202 "A", in 95 feet of water, with a tentative location as shown on figure III-6 and plate 1. The Operator has stated that the economic feasibility of development of this potential field is dependent on the information to be gained from drilling of additional evaluation wells. See figures III-7 and 8 for schematics of the tentative platform. This platform would be about four miles from the nearest point onshore and approximately two miles from the shipping lanes.

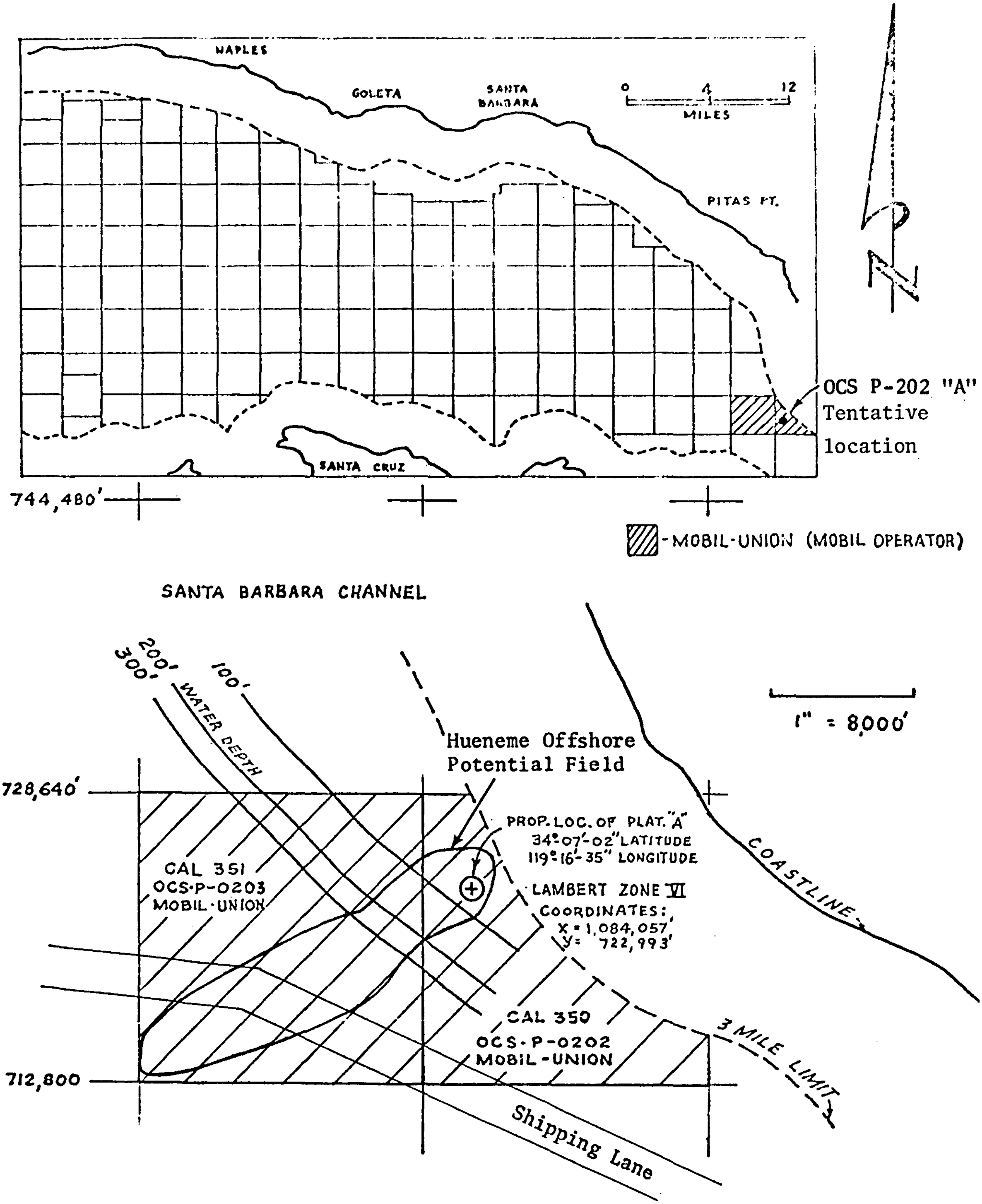


FIGURE III-6 Proposed Tentative Drilling and Production Platform
Hueneme Area, Santa Barbara Channel - California

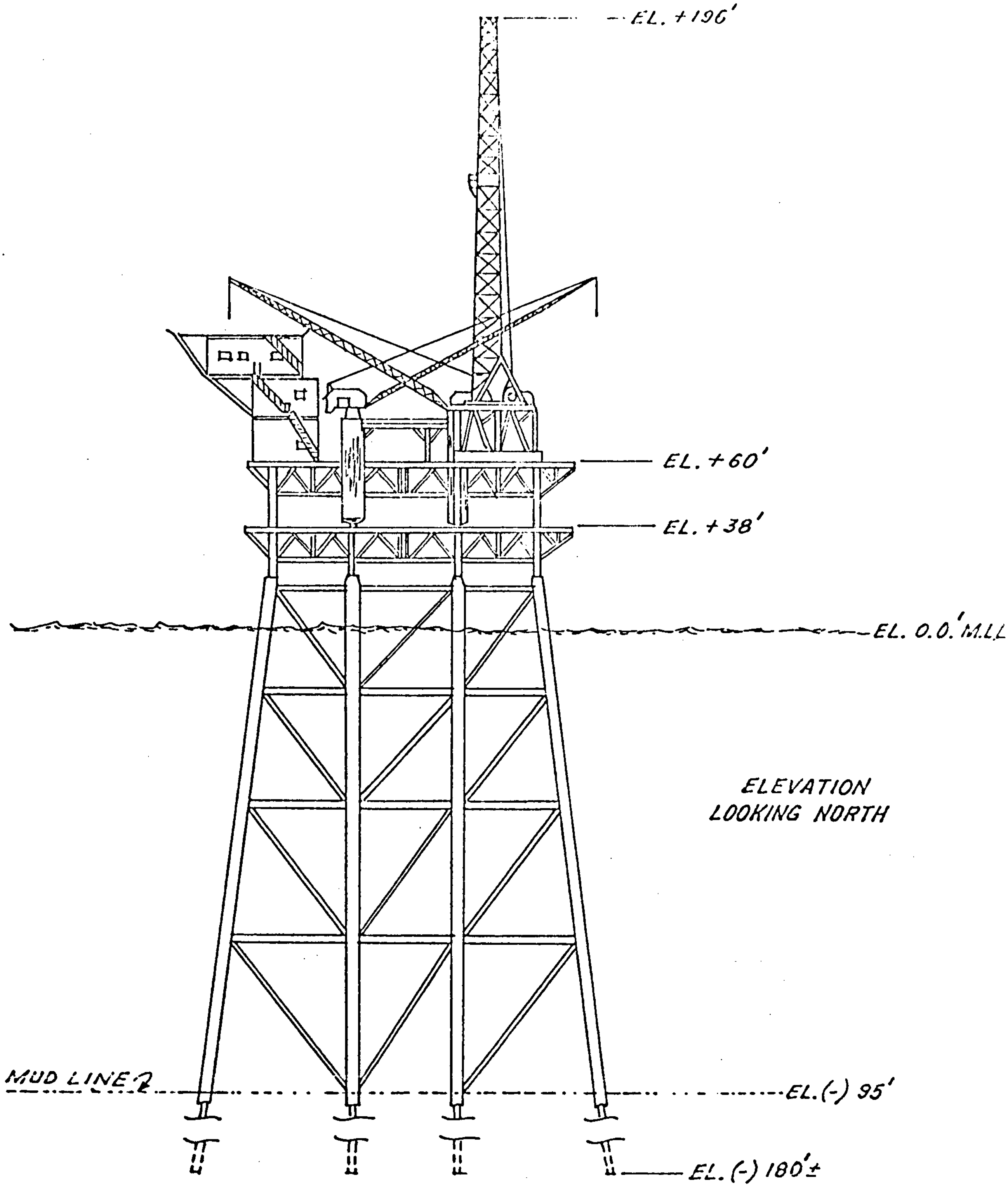
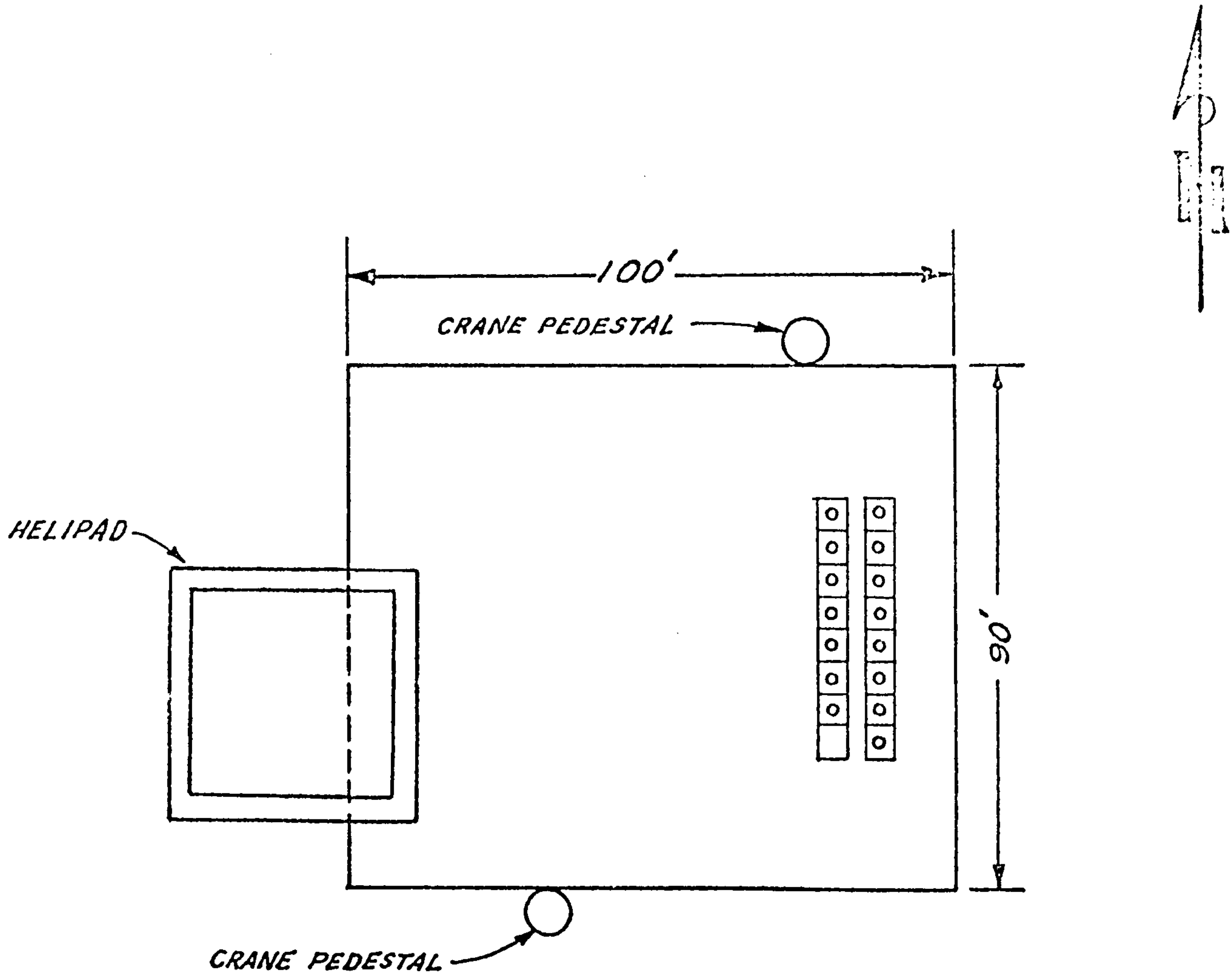


FIGURE III-7 Tentative Drilling and Production Platform
Hueneme Area, Santa Barbara Channel - California



DRILLING DECK PLAN

FIGURE III-8 Tentative Drilling and Production Platform
Hueneme Area, Santa Barbara Channel - California

Detailed geology of the Hueneme field is proprietary to the leaseholders and not available for publication. *Published* information is insufficient to provide a detailed description of its geologic setting. (See section II.B.5. for general geology) However, proprietary information is available to the U. S. Geological Survey for regulatory purposes.

- Potential impacts

It presently appears that this tentative platform would offer no unique potential impacts other than the ones considered in sections III.C.1. and 2., where general platform operation potential impacts are discussed. However, such a platform would be within approximately two miles of the shipping lanes thus meriting special consideration as to navigational safety requirements. The platform would be visible from shore and would alter the scenic character of the area.

The production would be pipelined to shore to an existing treating and storage facility or to a new treating and storage facility that would be located in Ventura County. If a new onshore facility were required, the general onshore facility impact discussion (section III.E.) as well as the pipeline impact discussion (section III.D.) would be applicable here.

The most serious impacts, of this platform, if installed, would be those resulting from accidents that would cause a spill of crude oil. See section III.L. for a discussion on oil spill impacts.

D. Impact of Pipelines

Construction of various pipelines would be required to transport crude oil, produced waste water and gas from offshore platforms to onshore treatment and storage facilities and to transport treated oil to the marine loading terminals for tanker shipment to refineries. The onshore and shallow marine portions of these pipelines would be buried or protectively covered with rock or concrete blocks (rip-rap). Because the various possible pipelines present substantially similar environmental impacts, they will be discussed herein as a unit. The impacts of a possible onshore pipeline from the Santa Barbara Channel area to the Los Angeles-Long Beach refineries is also discussed in section III.J.2.a.

1. Construction Phase

a. Offshore

Pipeline construction offshore would cause disruption along narrow zones on the ocean floor. Disruption on the ocean floor due to trenching would result in turbidity that might kill or stress sessile organisms and temporarily drive away fish and other mobile creatures. Turbidity resulting from resuspended sediment is capable of causing an adverse impact on filter-feeding organisms by blocking respiratory surfaces. These effects would be short-lived, as repopulation by benthic animals would be rapid. Sessile plants, such as giant kelp *(Macrocystis spp)* might suffer longer lasting (1- to 2-year) damage due to disturbance of holdfasts within the corridors. Kelp losses would be a negligible fraction of total kelp forests along the coast.

Another possible source of impact is the resuspension (if present) of toxic heavy metals and persistent pesticides that may have been deposited in the area. However, no detailed information has been found which would lead to a conclusion that the benthos would (or would not) be affected as a result of resuspension.

b. Nearshore[1]

(1) Impacts Associated with Jetting

If buried, a pipeline would be trenched to a minimum of three feet below the seasonal low level of sediment where feasible, inshore of the 200 foot depth contour. Normally this would be accomplished by jetting a trench of several feet in width; back-fill would take place by natural sediment movement. Even assuming that all of the organisms mechanically displaced by jetting are killed, the impact would be short-lived as repopulation would be expected within a year. A considerably larger area than the trench, itself, would be subjected to the settling of jetting spoils.

Large mobile organisms such as fish will simply move out of the way, but many sedentary or sluggish organisms making up the benthic community will be affected by the spoils settling to the sea floor either immediately adjacent to the trench, or down current. This will be analogous to the effects of a severe storm, with a short-term redistribution of unconsolidated bottom materials. Much of the benthic community is adapted to such shifts of sea floor materials but survival is a function of both mobility of the

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[1] Quoted with minor changes from Dames and Moore (to adapt site-specific to general-information), 1973, pp. 115-121, 138-142.

organism and rate and volume of cut and fill. In the immediate vicinity of the trench, mortality of the sessile or sluggish part of the benthic community will be greater, while the effects will diminish away from the trench. Distribution of the spoil will depend upon the exact path of trenching and on the wave and current conditions at the time, and cannot now be predicted. It is anticipated, however, that farther away, probably no more than a few tens of feet at the most, the rates will approximate the seasonal shifting of sediments to which many of the organisms are adapted, and with increasing distance from the trench, increasing numbers of the organisms will survive until there is no appreciable effect. Thus, the immediate impact will be significant along the pipeline route and the adjacent areas where the spoil is deposited. It is anticipated that recovery will be rapid, and by the time the displaced sediments reach equilibrium, the benthic fauna will be much as it had been.

The effects of redistributing material by trenching from the reducing zone at depths below the sea floor into an oxidizing environment on the sea floor is probably negligible. (General Oceanographics, 1971b.)

Access channels may have to be cut through kelp beds, if present. The amount of kelp destroyed by this process probably would be insignificant. Even if there is no permanent, exposed substrate on the bottom in the kelp area, young plants could repopulate the cropped area by attaching to ephemeral substrates, such as worm tubes, until the holdfasts grow enough to gain a secure purchase (Dawson et al., 1960). During one field survey, small *Macrocystis* plants were, in fact, observed attached to *Diopatra* tubes. This finding contradicts the suggestion, in General Oceanographics, 1971, regarding kelp growing on a sandy as compared to a rocky substrate that the "destruction of the holdfasts would likely preclude the development of new kelp for a long period of time, because these particular beds are growing on sand rather than on hard bottom, and there is little or nothing on which new plants may become established."

In summary, the effects of jetting would be of limited extent, perhaps a few tens of feet wide, and recovery of most organisms would be rapid, within months to a year. Recruitment of young kelp plants would soon occur, and these plants would require a year or two to reach maturity. No significant long term adverse effects are anticipated.

(2) Impacts Associated with Blasting

In some areas, bedrock and cobbles are exposed or present within the top three feet of sediment between the inner edge of the kelp bed and the beach. Blasting would be required to bury the pipe through such a zone. Two main effects of blasting are anticipated. The first is related to the pressure (shock) wave created by the explosion. Fish and mammals with internal air spaces (e.g., air bladders and lungs) can be killed or injured by the shock wave. The range of this effect is dependent on the weight, type, and placement of the charge (Hubbs and Rechnitzer, 1952). Bottom living fish seem to have a better chance of survival than pelagic forms. The second effect is associated with the movement of substrate out of the blast site by the force of the explosion. Animals and plants in the immediate vicinity of the blast would, presumably, be killed outright. Biota further away from the explosion would be covered with debris; survival in this region would depend upon the ability of the organisms to dig their way out (in the case of motile species) or clear themselves of sediment. The blasts would also raise a cloud of sediment. The impact of this cloud would be qualitatively comparable to that of the jetting spoils.

The adverse impact of the shock wave could be mitigated to some extent by a propitious choice of explosives. Fish are evidently more affected by an instantaneous shock wave of the type produced by dynamite than by a fluctuating wave produced by slow burning explosives such as black powder (Cole, 1948). Therefore, in order to minimize the loss of fish and, if present, mammals in the area to be blasted, the slowest burning type of explosive available should be employed.

Because blasting involves effects of both shock waves and debris redistribution, its short-term adverse effects influence a wider diversity of organisms and are generally more detrimental than those of jetting. Although the population sizes of many species would be reduced near the pipelines, recovery would be rapid (within a year or two). No significant long-term adverse effects are anticipated.

(3) Impacts Associated with Rip-Rap Installation

The alternative to burying a pipeline in the inshore regions is to lay the pipe on the surface and securely anchor it in place with a cover of rip-rap (rock, concrete blocks or concrete bags). Where the pipeline and rip-rap are placed on the bottom, epifauna, such as sea stars, brittle stars, and sea urchins, may be crushed, but infauna (animals living in sediments) would be relatively little affected. If the pipe and rip-rap were laid on the surface in the kelp bed, existing kelp plants and other organisms in a very narrow zone (e.g., possibly 10-12 feet) along the route would be killed. However, rip-rap, independent of the material utilized, would soon (probably within a year) be colonized by the characteristic fauna and flora naturally inhabiting permanent substrate in the area. Studies indicate that fish usually concentrate around artificial underwater structures (e.g., Turner, et al., 1969) and rip-rap reef should be no exception. Besides providing additional habitat for certain game fish, the rip-rap should be especially attractive to abalone and lobsters because of the abundance of cavities.

Lines of rip-rap, oriented perpendicularly to a beach through the inshore zone, would alter the pattern of long-shore sediment transport as well as seasonal on and off shore sand movement in the vicinity of the pipelines. Because of the small mass of the rip-rap, these effects would be of limited extent. The abundances and distributions of organisms in this small area would undergo changes, but there would be no significant long term effects. Small and medium boats would be unaffected. If in a bathing area, recreationalists including swimmers might find the rip-rap either interesting or aesthetically objectionable. Quantities of rip-rap for pipeline burial are far smaller than those for coastal engineering projects which do significantly affect longshore movement of sand (littoral drift).

Other Near Shore Impacts

The use of heavy equipment on the beach during construction of a pipeline would crush large numbers of upper beach epifaunal species such as sand hoppers (*Orchestoidea*). Infauna would be less affected. If fuel were spilled on the beach, it could be toxic to intertidal animals and algae. Repopulation by sand beach animals would be rapid; probably on the order of a few weeks.

The temperature of the produced oil will normally be over 105°F at a platform; it will have cooled to around 100°F or less by the time it reaches the shoreline. Assuming an ambient water temperature of 50°F, the skin temperature of a pipeline will be near 55°F. In nearshore waters, it is unlikely that a skin temperature even as high as 10°F above ambient would prevent the growth of fouling organisms (e.g. barnacles, tubeworms and bivalves).

(4) Summary of Alternative Methods

Blasting, jetting, and installation of rip-rap should be put in perspective both spatially and in relation to short- and long-term impact. Between the intertidal and inner edge of a kelp bed, if sediments are thin, rip-rap installation or blasting would be required. Blasting is clearly more detrimental than jetting in terms of short-term adverse effects, but neither has significant long-term impacts. The biological environment would, in the long run, return to a condition similar to that before construction. Although causing a redistribution of sediment (and hence redistribution of organisms) over a limited area, the installation of rip-rap would certainly provide additional habitat for many organisms including kelp, lobster, abalone, and game fish. The area would appear less "natural" than it had been previously, but biological conditions favoring commercially and recreationally important species would be enhanced.

(5) Impact of Construction on Kelp Beds

As summarized, three methods are likely for installing the marine pipelines in the Santa Barbara Channel.

Production of a trench for the pipelines by blasting in regions of shallow sediments.

Jetting to create trenches for pipes where depth of sedimentary overburden is adequate.

Stabilizing pipes by means of rip-rap in areas where sediment layer is thin.

(a) Short-Term Effects

Blasting could rupture immediately nearby kelp pneumatocysts, causing buoyancy loss in the fronds. If substantial proportions of the foliage sank, a severe reduction in photosynthetic capacity would result. Young fronds that normally replace senile tissues would suffer decreases in growth rates because of cutbacks in translocated nutrients they receive from actively photosynthesizing large fronds. The result might range from death of severely injured plants to an extended recovery period of many months before surface canopies reappeared. The affected area would probably display reduced productivity for a year or two.

Jetting would create a temporary turbidity locally for a period of a few days during operations. The effect would probably be comparable to turbidities from storm swells and would not be serious. Material displaced by jetting might bury lower portions of nearby plants. Except for very young plants, the effect would probably be negligible where the added burden was less than a foot. Most of the holdfasts are taller than this. The hapteral (attaching) tissues of *M. angustifolia* do not appear to suffer damage from burial. The displaced sediments would probably be redistributed very rapidly during periods of swells. Where sediments buried lower portions of plants above the level of the primary stipe at the holdfast apex, stipe deterioration might occur if the condition persisted for periods of the order of a week. Such deterioration has been observed in primary stipes when *M. pyrifera* plants suffered burial by sedimentary shifts. Consequently, there might be some loss of kelp plants in the immediate vicinity of a jetted trench, particularly if calm conditions prevailed for a week or two following the operation. Recruitment of juvenile plants to replace lost individuals would probably occur during the following spring and summer. A year or two would be needed before they would be mature adults with significant canopies.

Rip-rap material placed on top of a kelp plant would probably cause destruction. Although the fronds might protrude from underneath the rip-rap and still extend up into the water column, wave surge would rub the stipes back and forth against edges of the rip-rap and quickly abrade and sever the relatively soft tissue. Thus, any plants lying within the zone lying under any rip-rap would soon disappear. Restoration of this portion of the kelp bed would depend on the growth of juvenile plants that might colonize the solid rip-rap surfaces. Such a development would probably begin during the first spring following construction. The plants would achieve maturity in a year or two. Adverse effects are not anticipated to kelp beyond the immediate vicinity of the rip-rap.

(b) Long-Term Effects

Blasting and Jetting: It is anticipated that long-term effects resulting from use of these methods would be similar. In the immediate vicinity of construction activity, there might be temporary losses of kelp plants and of organisms using the plants as substrate. Such losses would probably be confined to within 100 feet on either side of a near-shore trench and possibly within lesser distances.

Fishes and other mobile organisms would probably migrate to intact portions of the bed. Such a migration would probably not cause undue ecological stress because the proportion of unaffected to impacted area would probably be large. Initial conditions would be restored through natural processes within two to three years.

Rip-rap: The area impacted by rip-rap would be smaller than the maximum predicted area for blasting or jetting. Effects would vary directly in proportion to the areas impacted by the various methods. Recovery times would be similar for all methods. Kelp plants would be attached to rocky substrate, however, if rip-rap were used. Plant density might be higher and plants might be more secure from being torn away by storm swell. Therefore, the long term effects of rip-rap might yield more permanent and denser stands of kelp than occur naturally. The rip-rap would also be colonized by a variety of sessile organisms that would enrich the fauna and flora. The enhancement would be similar to effects reported for artificial reefs (Carlisle et al., 1964; Turner et al., 1969).

(6) Other Impacts

Any pipelines would be hydrostatically tested with sea water prior to being placed in operation. After testing, the water would be cleaned of any pipeline contaminants and pumped back in the ocean. Small volume leaks along the pipelines during testing would have negligible impact. The accidental discharge of the test sea water would have appreciable effect only if it occurred on land. Vegetation in the immediate vicinity would be adversely affected, perhaps lost. There would be no significant long-term adverse effects.

Construction of pipelines on land areas will require trenching, burial of the pipeline, backfilling of the trench, and restoration of the surface. The area physically disturbed by such construction will not normally be over

50 feet in width although a wider zone might be affected visually and by construction noise.

Although the routes of any necessary pipelines would be chosen for minimal adverse environmental impacts, some impacts would be unavoidable. These impacts will depend on the topography of the land and on its use--whether urban or rural. In urban areas it might be necessary to tear up streets or other rights-of-way. Construction from the shoreline to onshore treating facilities could be completed within a month or less and the right-of-way returned to its former use. Adverse impacts might include interruption of traffic, congestion, or noise. In rural areas adverse impacts might be some crop damage or compaction of agricultural soils by heavy equipment. Possible adverse impacts due to soil erosion and greater visibility of the construction activity could result if pipelines were constructed in steeply sloping areas.

Detailed estimates of environmental impacts of onshore pipelines are not possible until specific pipeline proposals are made. At that time site-specific information can be obtained and impacts evaluated.

2. Operational Phase

No significant adverse impacts are anticipated during normal operation of pipelines after conditions become stable following re-establishment of viable plant communities. Rupture of the pipelines, however, could have an adverse impact on the environment as a result of oil spills. Maintenance and replacement of pipelines would cause adverse impacts similar to those described under construction of pipelines. In the event of a rupture in an onshore oil line, a moderate spill could adversely affect vegetation in the immediate vicinity and down slope from the break.

a. Oil Spill Predictions and Estimates

The following discussion and estimates as to potential pipeline oil spill volumes are based on hypothetical breaks and leaks in the proposed 16-inch oil pipeline (approximately four miles in length) from the proposed initial Santa Ynez Unit Platform to the onshore treating and storage facility. This proposed pipeline is used for these calculations as it represents a typical pipeline (flowline) required to bring Santa Barbara Channel OCS Platform oil to shore. See figure I-25 for diagram of these proposed Santa Ynez Unit facilities.

Spill volumes for leaks that are assumed to occur at different points along the proposed Santa Ynez Unit pipeline are estimated below. The full line would contain 7,500 barrels of oil between fail close valves on the platform and at the shore line. High-low pressure protection devices would close the valves and shut down the transfer pump if a rapid change in pipeline pressure should occur.

(1) Line Break

The oil spill resulting from a major break depends on the inclination of the line. Since the sea floor slope is not constant, the location of the break along the pipeline route enters into the calculation of the spill volume. the sea floor slope is relatively flat from the shoreline to the 300 foot water depth contour; at this point there is a major increase of slope into deeper water.

- If a break occurs between shore and 300-foot contour, the probable oil spill volume may be 70 to 170 barrels. This is because the almost flat bottom has minor undulating features which would effectively trap the sea water and form barriers after minor displacement of oil from the line.
- If a break occurs between 300-foot and 600-foot contour, the maximum oil spill volume may be 2,700 barrels; the minimum oil spill volume may be 1,400 barrels.

The volume of the spill depends on the viscosity of the oil-water emulsion being transported through the line. Sea water will actually trap the oil in the line above the break, and it will slowly displace the oil in the line below the break as a result of gravity forces. It may take up to 48 hours for the 1,400 to 2,700 barrels of oil to be displaced out of the line allowing most of it to be contained and picked up.

- If a break occurs between 600 foot contour and the platform, the maximum oil spill volume may be 1,300 barrels; the minimum oil spill volume may be 50 barrels.

The same discussion as above applies to this spill. The 50 barrel calculation occurs at the base of the platform and represents the oil bleeding out of the line as a result of expansion of the oil as the line pressure drops from its operating pressure to the sea pressure at the break.

(2) Small Leak

Based on experience with a volumetric comparison leak detector system in service between the Dos Cuadras field and the Mobil shore site, a leak as small as 1.4 percent of the flow rate can be reliably detected. For a production rate of 40,000 BOPD, a leak of less than 24 barrels per hour may not be detected by the system. A larger leak rate, however, will be detected immediately. The ultimate size of a leak that is undetected by the volume comparison depends on the time it takes to see the oil on the surface of the ocean. Since the line would be inspected at least daily the spill volume could be between 600 barrels and 300 barrels before detection.

After the pipeline was shut in upon detecting a small leak and its expansion volume bleeds off, due to the oil viscosity, there would be little if any additional oil leakage.

The above calculations were made to determine how much oil would leak from the proposed Santa Ynez Unit pipeline if it should break, as an example of the order of magnitude of a potential pipeline spill. It must be recognized that proper pipeline design and location, proper operating practices and procedures, and the USGS OCS order requirements render the odds of such a break occurring extremely small.

Records indicate that no major pipeline oil spills have occurred offshore California in State or Federal OCS waters, except for one 900-barrell OCS spill in 1969. As a result of a relatively poor nation-wide pipeline spill record, starting about 1969 several agencies took actions to decrease the volume of spillage per accident and to keep the frequency of recurrence low. (Preventive measures are discussed in section IV.) Spillage predictions for proposed pipelines, based on statistical data for the past 10 or 20 years, are somewhat meaningless. (See section III.K.1.b.)

b. Potential Causes for Loss of Pipeline Integrity

Structural integrity of the pipelines could be lost in several ways: by corrosion; mechanical breaking such as might be caused by a dragging anchor, fault displacement, landslide displacement, seismic shaking, or (particularly in the relatively shallow surf zone) the action of violent storm waves or seismic sea waves; or by loss of support due to slumping of unconsolidated sediments in which the pipe is buried. Full development of all the known and inferred oil fields of the region could result in a much greater number of submarine pipelines. This would increase the total length of, and the total number of, lines exposed to processes having the potential for causing breaks, and the likelihood that a single event (such as fault displacement) could break more than one line.

Careful study of proposed pipeline routes, proper design, and choice of suitable materials should minimize the likelihood that breaks will occur. In addition, the detailed studies of pipeline routes should include identification and location of anchorages and faults, and evaluate the potential for hazard from seismic shaking, submarine landslides, and violent, large waves. Such studies should make it possible to design the placement of safety valves in locations calculated to minimize the size of any spill that might result if a break should occur.

A tsunami in the Santa Barbara Channel originating from either a distant or local earthquake, could present a hazard to pipelines, particularly where they cross the beach. If such a tsunami originated from a distant earthquake, such as in the Aleutian or Chilean trench, its impact might be lower in the Santa Barbara Channel region than that from a tsunami originating in nearby areas because of the protection afforded by Point Conception and the Channel Islands. The effects of a tsunami from a local earthquake are difficult to predict, and would depend on the exact location, nature and intensity of the earthquake, and on local topography. Due to proper pipeline design and if buried out to a water depth of 200 feet, it is unlikely that a tsunami would cause a pipeline rupture. Tsunamis are of little to no consequence in deep waters as their energy does not become concentrated until they reach the near shore shallow waters. The part of the platform discussion about the possibility of seismic shaking and ground displacement caused by surface faulting and landslides and their effect on platforms is also, for the most part, applicable here in this pipeline section. The pipelines would be designed to withstand the maximum anticipated stresses imposed by shakes and ocean storms and currents. Therefore, pipelines would not be likely to sustain damage to the point of rupture as a result of earthquakes or ocean storms.

Pipeline systems would be designed and operated for maximum protection against internal and external corrosion. Therefore, corrosion should not result in pipeline leaks.

3. Compatibility of Fish Trawling and Pipelines[1]

a. Design Specifications and Environmental Conditions

Undersea oil and gas pipelines probably would be placed directly on the bottom at depths greater than 200 feet. Typical pipelines are smooth, welded lines except for one or more connector boxes. Pipelines laid directly on the ocean floor in depths greater than 200 feet would probably experience slow scour and would gradually become partially buried.

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1 From Dames and Moore, 1973, p. 152-157, and 164; with minor changes (to adapt site-specific to general information).

Individuals Contacted

Richard Barrow, Captain of Trawler "Blue Horizon", Avila Beach
Robert Breen, Captain of Trawler "Blue Jay", Avila Beach
Harold Durrah, Captain of Trawler "Elsie B.", Santa Barbara
Dana Enlow, Captain of Trawler "El Capitan", Santa Barbara
Ralph Hazard, Captain of Trawler "Kildee", Santa Barbara
Don Knapp, Captain of Trawler "El Capitan", Santa Barbara
Richard J. Nitsos, Assistant Marine Biologist, California Department of Fish and Game, San Francisco, California
M. C. Oliphant, Associate Marine Biologist, California Department of Fish and Game, Long Beach, California
Larry Pender, Member, Santa Barbara Harbor Commission, Santa Barbara California
John Todd, Captain of Trawler "Corsair", Santa Barbara
Allen D. Willard, Senior Mineral Resources Engineer, California State Lands Commission, Los Angeles, California
Henry W. Wright, Manager, Lands and Water, Western Oil and Gas Association, Los Angeles, California
Dale L. Zeiders, Principal Engineer, Leeds, Hill and Jewett, Inc., Consulting Engineers, San Francisco, California
Office of the Commander, U. S. Coast Guard (Santa Barbara Group) Santa Barbara, California

b. Survey of Impact

(1) Damage to Trawling Gear

A survey was made of seven fishermen and various officials as to the possible interference of proposed subsea pipelines in the Santa Ynez Unit with fish trawling activities. (See footnote on preceding page.) It was the general consensus of the fishermen interviewed that a bottom-lying pipeline, whether partially buried or on the surface of the ocean floor, would not damage their equipment under normal operations. Most cases of lost or damaged nets in the Santa Barbara Channel are the results of entanglement with natural objects or fouling on underwater oil wells. Of the seven fishermen contacted, only one reported the loss of an "otter" trawl due to contact with an ocean-bottom pipeline. (R. Hazard, pipeline from Union Oil Platform A, personal communication.)

Possible damage, in the form of fraying, may result when nets are dragged over barnacle-covered pipelines, although this problem is expected to be no more serious than present net contacts with barnacles on rocks.

Although recorded instances of pipeline-caused net damage appear to be infrequent, all seven fishermen interviewed agreed that the pipelines could (given the right set of circumstances) inflict damage on trawling gear. The possibility mentioned most was that a gap or scour area opened under a pipeline could function as a trap for trawling equipment. In such a situation, the "otter" board could ride under a pipe and wedge firmly, instead of sliding smoothly over it. If this occurred, an expensive net might be lost or severely damaged, especially if the towlines between the trawler and the net failed, due to pressure exerted by the vessel pulling against an immovable object (the pipeline). Most fishermen indicated that such a loss could normally be avoided by reversing power and "backing the net off the pipeline". However, adverse weather conditions, or other unforeseen factors, could make this course of action difficult.

(2) Damage to Undersea Pipelines

None of the trawlermen or State officials interviewed felt that otter boards (weighing 500-800 pounds each) represented a serious threat to a structurally sound pipeline. The slow trawling speeds (2-4 miles per hour) and the small size (under 40 tons) of most of the boats preclude high speed, high force impacts. Even the larger trawlers, weighing up to 140 tons, would represent only a minor potential problem, since they also operate at slow speeds. These thoughts are supported by recent literature (Brown, 1973). Brown found that random fish board impacts with pipelines had little, if any, effect on the pipes. With the pipes involved, concrete coatings were cracked when the same *exact* area was struck 40 times or more with 300 kilogram fish boards.

Although engineering calculations of the approximate impacts and stresses involved were beyond the scope of this work, such calculations would show that properly designed pipelines could withstand impacts and stresses much greater than those imposed by trawler activity as described in the Santa Barbara Channel.

c. Pipe Burial and Buoys

In view of the fact that subsea pipelines would be partially buried by water action, and that "otter" trawls are designed to and usually do move over such pipelines, burial appears unnecessary at this time.

United States Coast Guard Policy regarding underwater completions requires marker buoys above any projection within 200 feet of the surface that represents a potential hazard to fishing (Commander's Office, United States Coast Guard, Santa Barbara Group; personal communication). Pipeline connections (at depths approximating 300 feet) would be well beyond the area affected by the Coast Guard policy. Marker devices may be voluntarily installed above the underwater pipeline connection box, but a Class II permit (U. S. Coast Guard) must be obtained.

Coast Guard representatives expressed concern that a buoy anchored in an open water location would represent more of a general hazard to navigation than a useful marker for trawlermen. All seven of the trawler captains interviewed felt that a marker buoy would be of little practical value. They indicated that if the location of the pipeline connection box was identified on navigation charts, they could trawl around it. Also, several supported the statement that a buoy could, in fact, act as a hazard to navigation. After reviewing appropriate Federal policy guidelines and interviewing local government officials and trawlermen, it appears that buoys to mark pipeline routes and exact location of underwater connection boxes are unnecessary and undesirable.

E. Impact of Onshore Treating and Storage Facilities

Possible onshore treating and storage facilities include both oil and gas treatment plants, various tank farms and other necessary facilities. At such facilities, produced oil/water mixture is treated to separate emulsified crude oil from salt water. The mixture is heated to separate the oil and water. The oil is then cooled and stored in tanks. The produced waste water is piped to dirty-brine storage tanks where free oil is skimmed off and coalesced oil drawn off. Produced waste water is generally injected into non-potable subsurface zones or discharged into OCS waters. Details of this discharge were given earlier in section III.C.2.b.(1)(c).

The gas-treatment plant removes liquid hydrocarbons, CO_2, and H_2S (if present) from natural gas delivered from the offshore platform. Removed gaseous impurities are incinerated; H_2S may be reduced to elemental sulfur, temporarily stored and trucked to market. Hydrocarbon liquids are stored under pressure for trucking to market.

As outlined in section I.E. the estimated number of additional onshore oil treatment and storage facilities required for Channel development is from one to five. Since the precise number and location of the onshore facilities is not currently known, specific impacts on the environment cannot be evaluated at this time. If constructed, however, they will be subject to State or local zoning regulations and appropriate Federal, State, and local pollution standards.

1. Construction Phase

a. Physical Environment

New onshore treatment and storage facilities quite likely would be constructed in areas that are either well-hidden from public view or in areas already dedicated to industrial development. The treatment facility proposed for the Santa Ynez Unit will be hidden from public view in Corral Canyon and would also use facilities of the abandoned Capitan oil field, although a zoning variance was required for Las Flores Canyon.

Construction for such a treatment facility would involve a labor force of up to 150 workers to build the necessary roads, lay pipelines, grade sites, and construct the facilities. Trucks, bulldozers, graders, trenchers, welding machines, tractors, cranes, and equipment would be utilized. Dust and noise would be created, combustion products would enter the atmosphere. See section III.LL.1.b. for air quality impacts from construction. Depending on the topography of the region, slopes would be modified, some vegetation would be destroyed and runoff and erosion from storms would increase. In steep areas such as in Corral Canyon earth and rock material would be moved in grading and preparing the site for the facilities. Some wildlife habitat would be destroyed or be displaced permanently or temporarily. Each facility might cover ten to twenty acres which would be extensively modified. Up to five acres might be covered by impermeable surfaces, including roads, truck-loading aprons, storage tanks, buildings, and other facilities.

b. Biological Environment

Construction of onshore treatment and storage facilities would have various impacts on the biological environments. For example, any grading, cutting or filling of slopes would be stabilized and reseeded. Additionally, plantings of native shrubs and trees could be planned. The number of native trees introduced could exceed those removed, although the species composition and distribution of vegetation might be different than previously. Construction of onshore facilities would result in reduced population sizes of small mammals, reptiles, amphibians, and some birds within and adjacent to the area of terrain modification. Noise and other human activity during actual construction would temporarily discourage other wildlife, especially some birds and larger mammals, from occupying the site. After construction was completed, animals would reinhabit seeded and landscaped portions of the site.

Until slopes stabilize after construction, erosion of cut and filled areas would occur during rainy periods, with resultant siltation in stream beds and disruption of riparian vegetation, if present. However, many streams occasionally experience heavy sedimentation and debris for other reasons and riparian vegetation is more or less adapted to these conditions. With adequate planning and lacking unusual events, no significant long-range effects would be expected.

In addition to required conformance to applicable grading codes, all construction of new facilities and expansion of older facilities should be planned and designed only after comprehensive detailed evaluations of the potential damage for natural events such as landsliding, earthquake shaking, liquefaction, fault displacement, seismic sea waves, flooding, erosion, expansive soils, and subsidence. Although the potential for damage from a particular kind of event varies from area to area, all potential sites should be examined in detail (see section II.B.7.).

2. Operational Phase

Operation of additional onshore facilities would impact to some degree on the environment. Introduction of some pollutants would be an unavoidable consequence. Normal operations would result in some minor spills of liquids or solids and unintentional voiding of gases to the atmosphere. See section III.LL.1.(b) for operational air impacts. Over the operating life of the facility, minor but continuing quantities of certain pollutants could accumulate in near-site soils, vegetation, and water. Of more concern than the day-to-day escape of minor amounts of contaminants is the possibility of catastrophic failure of part or all of the system, with resultant massive spillage of oil. Depending on the specific location of the facility, such catastrophic failures could be caused by the following factors:

- Seismic shaking - leading to possible toppling or rupturing of storage tanks, surge tanks or pipe connectors.
- Surface faulting - either by tectonic creep or by sudden displacement of ground surface with rupture of facilities.
- Landsliding - sudden ground failure on unstable or over-steepened slopes could damage storage tanks or pipelines.
- Flooding - torrential rainfall in the drainage area could lead to flash flooding and possibly disruption of buried pipelines.
- Equipment failure or damage - all equipment would have to be in compliance with applicable codes, specifications and regulations. In order for major pollution to occur as a result of equipment failure, more than one malfunction must take place, for the primary control, in safety systems, is backed by secondary and in some cases tertiary systems.
- Vandalism or sabotage - the spillage in late January 1973 of over 4,000 barrels of waste lube oil in the Oakland Estuary was caused by vandalism and points up the possibility of this factor. However, such occurrences have been few in number.

a. <u>Assessment of Seismic Shaking, Ground Displacement, Landsliding, and Flooding</u>

(1) <u>Seismic Shaking</u>

The Santa Barbara Channel region is seismically active. Its seismic history is summarized and the expectable ground motions based on that history are listed in section II.B.6. The potential for hazard is summarized in section II.B.7.b. In addition to the direct effects of shaking, indirect effects such as liquefaction, landslide, and oscillatory waves that may form in tanks, add to the stresses. Careful site selection and foundation engineering can minimize the effect of most of the potential hazards. In addition, storage facilities are generally surrounded by earthen dikes designed to contain any spill. Advanced seismic design techniques of such facilities would be utilized. The probability is minimal that an earthquake would occur that could damage a properly designed onshore facility to the extent that a major oil spill would result. If, however, an oil spill were to occur, earthen dikes surrounding the facilities would contain a major spill.

(2) Ground Displacement Due to Surface Faulting

Well-designed and built structures may fail totally if horizontal or vertical ground displacement occurs along a fault that underlies the structure. The Santa Barbara Channel region is an area in which contemporary fault displacement can reasonably be expected (sec. II.B.6.f. and sec. II.B.7.c.). Unlike failures from other causes, wherein spills can reasonably be expected to be contained by surrounding earthen dikes, displacement of the ground under a tank may well be accompanied by displacement of the dikes along the same or en-echelon traces, and the dikes may fail at the same time, and from the same cause, as the storage tank. Detailed site examinations should locate and identify all faults, and, if possible, determine the age of the most recent movement on each. Surface traces of active faults should be avoided in siting storage facilities.

(3) Landslides

Nearly all kinds of landslides, from rockfalls to mudflows, are found in the onshore parts of the Santa Barbara Channel region (sec. II.B.6.f.), and the proposed development of any site for storage facilities should include detailed engineering geology studies to identify and locate landslides and landslide-prone areas. Planning and design of grading should include provisions for avoiding or correcting all slope stability problems. Reports and plans should be reviewed for adequacy, and various stages of the development should be inspected by local government grading inspectors to insure that all work necessary to prevent future landslide problems is being done. Any proposed facilities necessarily should be so located that mud slides or slope failure would be unlikely to cause damage to the extent that pollution to the environment would result.

(4) Flooding

Using precipitation records, stream runoff data, and drainage basin and bed-load characteristics, major facilities should be designed to accommodate a 100-year flood. All drainage facilities would be inspected and approved by county flood control engineers. Therefore, it is unlikely that flooding would occur to the extent that it would cause an onshore facility oil spill.

(a) Surface Water

Construction of an onshore treatment facility could affect the surface-water environment in two ways. First, if embankments were to constrict the flow in nearby channels the resulting backwater effect during flood periods could cause sediment deposition and back up debris. Second, if the capacity of available collecting basins were too small to handle local drainage from the tank farm, water could overflow and pollute nearby streams. Therefore, the drainage facilities should be designed to carry the maximum anticipated drainage.

Drainage systems of onshore treatment and storage facilities would be designed to handle the maximum rainfall and runoff expected in the area. Storm drains would be designed with catch basins so that they could not become clogged with debris. Tank farms should have water collector systems and oil separation equipment to collect and clean the maximum expected rainfall. These systems would insure that overflow from rainfall or flooding would not pollute downstream areas.

(b) Sedimentation and Wildfire

The possibility of erosion, mud flows, and debris flows occurring during heavy rainfall is increased by watershed burns. Watershed burns have a significant effect on sedimentation. Drainage near onshore facilities should be designed to accommodate peak discharge of water and sediment, thereby reducing the probability of severe site flooding even under watershed burn conditions.

b. Oil Spills

Oil would be stored in tanks prior to shipment. A considerable volume of oil might at times be on hand, but it is highly unlikely that the total maximum volume of stored oil would be spilled.

If a major oil spill occurred during dry weather, it could readily be handled with only modest, local adverse environmental effects. A spill resulting from landslides and flooding (the possibility of this occurring would be remote) during wet weather might not be so easily contained and could cause local massive pollution. The major effect could be contamination of nearby creeks, and possible pollution of the near shore marine environment. The short-term and long-term effects of marine oil pollution are discussed later in this section. The possibility of an onshore facility oil spill resulting in major oil pollution of the marine environment is remote.

c. Brine Spills and Sewage and Brine Disposal

Because onshore oil-treating and oil-storage facilities would necessarily include storage tanks for dirty-brine, backwash, brine, and brine-injection, limited brine spills could occur from time to time from the treatment facilities. A major spill, up to 10,000 barrels of saline water, is not likely from such a source, but the possibility cannot be ruled out. The very short-term effects of brine spills on the land environment would be salination of the soil zone in the vicinity of the spill. The long-term effects of brine spills would be limited because normal leaching by rainfall would remove the salt from the soil and shallow aquifers.

Biological wastes would be disposed through septic tanks and subsurface leaching in compliance with County Health Department standards and would have little to no detrimental effect on the environment. If a new facility required septic tanks, a few acre-feet per year of sewage would pass through the septic tank system and be leached to the soil. The water would be of usable chemical quality and would either be repumped for local irrigation or discharged to streams or the ocean as ground-water effluent.

Disposal of brine from the onshore facility by subsurface injection is feasible but would have to meet State and local regulations to prevent pollution of fresh water sources and damage to potential oil and gas resources. No significant impacts should result from the disposal of brine into subsurface strata that have been depleted of fluids by production, or existing saline aquifers, or other available reservoir rocks below and separated from the potable water-bearing aquifers.

d. Water Source

Fresh water supplies for onshore treatment and storage facilities would be from municipal supplies or alternately from wells. If water were obtained from wells, such wells would have necessary surface casing to prevent pollution of the well by surface water. For a detailed discussion on ground water, sources, discharge, recharge and quality, refer to section II.B.4. - "Hydrology".

The fresh water requirements for operation of an onshore facility are estimated to be about 20 acre-feet per year. Such a volume is not unreasonably large for mainland wells in the Santa Barbara Channel region although additional ground-water extraction in the Goleta ground-water basin would contribute to the existing overdraft of the ground-water supply in that area.

The pumping of ground water from wells along some parts of the coast may cause sea water to move inland into fresh water aquifers.

e. Impacts on Biota

Operation of an onshore treatment and storage facility would have impacts on the biota by reduction of native habitat areas and by emission of pollutants. Increased rate of runoff through drainage systems has the potential to increase the erosive capacity of nearby streams which could adversely affect riparian vegetation. If the drainage system became clogged for any reason (vegetation, debris), water could be impounded and debris and vegetation accumulated, adversely affecting biota. Pollution could also occur if local runoff from within the project area overflowed the drainage facilities for any reason.

Introduction of some pollutants would be an unavoidable consequence of operations. For example, normal operations would result in the atmospheric emission of small amounts of incinerated waste products and the voiding of other gases into the atmosphere. (See section III.LL.1.b. for air impacts). Such activities could adversely affect vegetation at onshore facility sites; however, historically this has not been the case and with the new and more stringent EPA, California Air Resources Board, and County Air Pollution Control District regulations, the likelihood of detrimental effects is further reduced. Minor spills of liquids or solids could also occur. Over the operating life of the facility, minor but continuing quantities of certain pollutants could accumulate in near-site soils, vegetation, and water.

Because of the limited use of reciprocating equipment and present silencing capabilities of this equipment, noise levels from equipment are not anticipated to present significant environmental problems. Increased activity, including vehicular, would likely drive certain wildlife from adjacent areas.

Artificial lighting (street lights, etc.) has long been known to produce local-scale adverse effects upon some species of plants (Kramer, 1936); and wildlife, including birds, may also be affected. Therefore, lighting at onshore facilities can produce microscale adverse effects. Along these is the possible reduced effectiveness of native landscaping to provide wildlife habitat. Facility lighting might also pose a potential nuisance to nearby residents.

The operation of a facility adjacent to chaparral or grass slopes would increase the fire hazard slightly. Unauthorized activity of personnel off the site, particularly in chaparral areas, might increase fire hazard and disrupt wildlife. However, fires originating in chaparral-covered public lands, if nearby, are probably a more likely occurrence and the paved roads to a facility could provide access to the fire for firemen and heavy equipment. Fire breaks could be made, depending on site characteristics.

Although unlikely, large spills of oil or brine, massive atmospheric emissions of toxic gas, explosion, and fire associated with catastrophe (earthquake, flood), or serious equipment malfunction cannot be ruled out. Toxic gas, explosion, or fire could damage or kill vegetation and animals nearby. A major spill, up to 10,000 barrels of saline water, is not likely, but the possibility cannot be ruled out. The extent to which soils would be salinized and plants affected by the brine is dependent on numerous factors including the degree of impoundment, dilution with runoff in streams, individual species characteristics, and other factors. As a minimum, individual plants would be killed, and several years might be necessary before the salts would be flushed from the root zone.

f. Recreation

If a proposed onshore construction site is near recreation sites or facilities, recreationists may experience an increase in background noise during the construction phase. Muddy water along a beach area also may result from increased siltation during and shortly after construction. The fumes and exhaust vapors dispersed by the wind might reach recreation areas causing an increase in the level of pollutants in the area. This would most likely occur at night when the winds generally blow from the mainland to the offshore areas.

During normal operations little noise or odor resulting from the onshore facility should be perceptible in nearby areas. In general, new onshore facilities should be screened by vegetation areas so as not to be visible from nearby beach areas. If an onshore facility oil spill were to result in oil reaching the beach and water, it would have at least a short-term detrimental impact on recreation. However, the possibility of this happening is remote. Therefore, an onshore facility construction phase may have a minor short-term adverse impact on recreation, whereas the operational phase should result in no significant adverse impact on recreation.

F. Impact of Near-Shore Loading Terminal

Near-shore (marine) loading facilities and loading operations are described in section I of this statement. Both long- and short-term impacts of the system would be minor, unless frequent minor spills or a major oil spill should occur. To reduce the possible impacts, the continued use and/or upgrading of existing loading terminals would appear to be generally preferable to construction of new terminals.

1. Construction Phase

Construction or modification of existing marine terminals may have some local adverse impacts. Although larger organisms, for the most part, would be unaffected, limited mortalities of immobile flora and fauna would occur over an area of several acres in the immediate vicinity of mooring facilities. Bottom sediments would be stirred up by construction, noise levels would be increased, and some additional combustion products would be released to the atmosphere. If near recreational areas, these effects would probably be disturbing to recreationists, but they would be of short duration (perhaps for one or two months).

2. Operational Phase

Operation of additional or modified marine terminals would have some adverse impacts. Major impacts could result from oil spills (discussed later in this section) and resulting water pollution. Recurrent minor spills can result from ships' deballasting water and from minor operational accidents, including overfilling of cargo tanks, leaks at ships' flanges where loading and discharge connections are made, and from pipe or hose leaks. Vessels engaged in marine terminal loading operations would most likely be equipped with clean segregated ballast tanks; therefore, the likelihood of oil spill from deballasting is quite small. Although minor spills would be kept at a minimum by preventive measures, the potential for spills during loading and unloading operations remains. A major oil spill could result from malfunction of equipment during loading operations, such as:

- Rupture of the pipeline-riser connection, fluid-swivel assembly, or hose arm.
- Rupture of hoses between the barge and hose arm.

Such ruptures could be caused by equipment or materials failure or by storms, collision with marine vessels, or by vandalism. The chances of a major spill are remote due to the increasingly strict preventive measures.

Minor quantities of combustion products and vapors would be emitted to the offshore atmosphere by tugs and barges during loading operations. (See section III.L.L.1.c. for Marine Terminal Air Impacts.) There would presumably be an enhanced habitat for some marine animals and fish: algae and animals would attach to the terminal and some fish would seek food and shelter nearby.

The major impact of marine loading terminals and their operations would be visual in nature. Tug/barge units or tankers often would be visible from shore. Loading of typical tankers requires five to ten hours, and half the loadings might be at night.

Tug noises would be audible during regular berthing operations, but of short duration. However, engine and loading noises usually would not exceed ambient noise levels now encountered by onshore visitors.

G. Impact of Offshore Treatment and Storage Terminal

A possible alternative to onshore treatment and storage facilities and onshore marine loading terminals is to combine these functions with offshore facilities. Such offshore treatment and storage terminals are now widely used globally. The primary benefits of offshore location of these functions is elimination of some onshore impacts, i.e., elimination of the need for irrigation water, wildfire hazard, onshore land use, pipeline costs to shore, and potential pipeline spills.

Although not included in the discussion below, it is recognized that in production operations utilizing an offshore treating and storage terminal, a gas line to shore to facilitate gas sales would be desirable. Details of similar pipeline construction and operation are discussed in the transportation section.

1. Construction Phase

Construction of offshore treatment and storage terminals would have some local adverse impacts. Although larger organisms would be unaffected, mortalities of immobile flora and fauna would occur in the immediate area of the mooring, and extend out to affect an area of a few acres. Bottom sediments would be roiled by construction, noise levels would be increased due to heavy equipment, and some combustion products might increase local air pollution. These effects may be disturbing to some recreationists, but they would be minor and of short duration (two to three months or less) and would occur offshore.

2. Operational Phase

Operation of offshore treatment and storage terminals would have some adverse impacts. A major impact could result from oil spills and resulting water pollution. Recurrent minor spills could come from two sources: (1) equipment failure, and (2) minor operational accidents, including overfilling cargo tanks, leaks at ships' flanges where loading and discharge connections are made, and from pipe, valve, or hose leaks. Such spills would be kept at a minimum due to preventive measures described in section IV.

A major oil spill could result from malfunction of equipment or accidents during operations, such as:

- Rupture of the pipeline-riser connections, fluid-swivel assemblies, or hose arms.
- Rupture of hoses between barges and the terminal during oil loading for shipment.
- Rupture of pipelines, valves, tanks, and other terminal equipment.
- Rupture of oil or brine storage tanks or compartments.

Such ruptures could be caused by equipment or materials failure or by storms, collision with marine vessels, or by vandalism. Presumably, the maximum oil spill could be 200,000 barrels or more, depending on the capacity of the terminal. Due to compartmental design, however, probably only a portion of the oil would be spilled. Such a floating facility could be moved to safe parts when severe sea states are forecast. Earthquakes would have less effect on floating facilities than on fixed structures.

The possibility of a major spill is minimal due to the preventative measures that would be required.

a. Physical Environment

The impact on the physical environment during operation of offshore treatment and storage terminals would be minor, except for the possible effects of minor recurrent oil spills or major oil spills. Minor amounts of combustion products and vapors would be emitted to the offshore atmosphere by tugs and barges during loading operations, but these would seldom, if ever, be noticed onshore. See section III.LL.1.c. on Marine Terminal Air Impacts. There would be an enhanced habitat for some marine animals and fish; animals would attach to the terminal or modified tanker and some fish would seek food and shelter nearby. Trash and garbage spills might inadvertently occur. There might be minor amounts of biological wastes (sewage) released by accident but provision for modern sewage treatment and disposal should prevent serious environmental pollution. All accidental recurring releases of trash, garbage, or sewage to the marine environment would have minimal impact.

Produced waste water separated from the crude oil would be treated by a system designed to clean the waste water to 25 ppm oil or less and then discharged into the ocean (Pacific Area OCS Order No. 8, specifies that the ppm oil must not exceed 50 ppm oil). The discussion about possible impacts of platform produced waste-water discharge (see section III.C.2.b.(1)(c)) is also applicable here. Also, see the discussion on EPA and Geological Survey regulation of produced waste-water disposal in section IV.A.1.c. and d.

One impact of OCS offshore treatment and storage terminals and their operations would be visual. A tug/barge unit or the tanker terminal would often be visible from shore--but its three-miles or more distance from shore and low profile would lessen the visual impact.

Operational noises on OCS offshore treating and storage vessels would be inaudible from onshore. Tug engine and loading noises usually would be inaudible from onshore.

H. Impact of the Submerged Production Systems

Several types of subsea production systems (SPS), as described in section I.D.6., might be considered for use in the Santa Barbara Channel. Impacts would vary depending on the type of subsea production system installed.

1. Construction and Installation Phase

Various units of such systems would be constructed in an established industrial area outside Santa Barbara County and be transported to the area for installation. Installation would involve setting pilings and laying pipelines. The environmental impacts would be similar to those described previously in the sections on impacts of pipelines and the marine terminal. Installation of an SPS would require one to two months. Surveys of faults and slide areas on the ocean floor would be accomplished and considered prior to site approval.

2. Drilling Phase

The impacts of well drilling described in the section on platforms are, for the most part, applicable here. There would be a drilling vessel on location which would create a short-term visual impact and navigation hazard. There would also be the risk of small amounts of trash or other undesirable materials being lost overboard.

3. Operational Phase

An SPS (cluster type) would occupy about one-half acre of ocean floor, and other types would require less. Very limited habitat for deep water bottom-dwelling marine animals would be altered. On the other hand, the environment of some marine species would be enhanced by the sheltered habitat provided by the structure. Trawling gear could become entangled with such installations in the event that commercial fishermen would operate in the area. Utilization of SPS in the future would serve to minimize the number of platforms required, thus lessening the long-term aesthetic impact.[1] The SPS does not necessarily eliminate all platforms since it requires a surface support facility located nearby. Further, considerable additional floating equipment (drilling vessels, service boats and workover rigs) would be required to operate and service the subsea system. Increasing numbers of subsea installations would increasingly interfere with fishing by trawling methods. During bad weather and sea conditions, maintenance performed from a surface vessel would be hindered.

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[1]By notice in the Federal Register of January 27, 1975 (40FR 4028) the Department of the Interior requested comments as to the current status of technology in subsea production systems.

Comments were also requested as to the impacts that would result from requiring subsea completions as a condition to granting some Outer Continental Shelf leases. See section I.D.6. for discussion of comments received and present status of subsea production systems.

A major impact would result from oil spills and resulting water pollution. In general, the hazards are about similar to those discussed in this section under the description of the platforms. The possible oil spill impacts are covered later in this section.

The visual impact of the SPS operations would extend over very short periods during installation, well-drilling, and operational servicing. The distance from shore and fog and haze would be inversely proportional to visual impact of the floating drilling-rig. There would be no continuing visual impact after drilling, reduced long-term possibility of surface-vessel collisions, no conflict with recreational fishing, but increased possible conflict with commercial fishing (trawling). See section I.D.6. for discussions of SPS testing, SPS state-of-the-art, and diver depth capabilities.

I. Summary of Possible Hazards to Facilities from Geologic Conditions and Processes

Several geologic conditions and active processes indigenous to the Santa Barbara Channel region might directly or indirectly affect petroleum development or production facilities in such ways as to create adverse environmental impact (sec. II.B.6.). Wells offer a potential channel of communication between high pore-fluid pressures in deep reservoirs of petroleum and shallower strata under lower pressure; in some circumstances, exposure to the higher pressures may cause fracture of the shallower strata, in turn leading to release of oil and gas at the surface (caprock rupture and blowout). Initial reservoir conditions in the fields of the Santa Barbara Channel region generally include gas-oil ratios at or near equilibrium for the hydrostatic pressures at their respective depths. Any event, either during drilling or after completion, that could open such communication should be considered as having a potential for causing a major discharge of oil and its consequential environmental impact. For example, ruptures of well casing at relatively shallow depths could be caused directly by movement along a fault penetrated by the well bore, or landslide displacement of the casing. As an indirect consequence, rupture of casing might also accompany damage to platform and sea-floor completion structures by other phenomena such as earthquake shaking, seismic sea waves, or liquefaction of shallow foundation materials. Other facilities at which the same geologic conditions and active processes have a potential for creating a major oil spill are the onshore treating and storage plants and storage tanks. These could be directly affected by earthquake shaking, fault rupture of the ground surface, liquefaction, landslide (including mudflow), flooding and erosion, expansive soils, and along the lower parts of the coast, by seismic sea waves. They can also be affected by many of the indirect effects of some events, such as oscillatory waves generated internally by earthquake shaking. These same kinds of events and processes could also cause rupture of pipelines, but resulting spills are more likely to be in significantly smaller amounts. See section IV.B.11. for discussion on research programs aimed at reducing the potential for adverse impact from certain geologic events.

J. Impact of Product Transportation Systems

Crude oil is presently being transported from the Santa Barbara Channel to refineries by two primary methods: 1) by marine transport in tankers or barges, and 2) by pipeline. The tankers move the product from marine loading terminals (the principal one is offshore Ventura) to refineries in the Los Angeles and San Francisco Bay regions. A 10-inch pipeline owned by Shell Oil Company extends from Ventura to Los Angeles and is presently operated at capacity. Two eight-inch lines (operated by Texaco and Union) connect with other pipelines north of Los Angeles.

A detailed estimate of the amounts transported by these various systems is not available. Use of such systems varies with time depending on fluctuating market conditions of supply and demand.

This section will discuss the possible impacts of continued operation and expansion of the two transportation systems.

1. Marine Transport by Barge or Tanker

a. Physical Environment

Crude oil is now transported from marine loading facilities in the Santa Barbara Channel to refineries by barges or tankers. The major impact of these barges and tankers would be possible major or minor oil spills. Major spills could result from collision or other accidents during transit. Minor spills could occur during loading or unloading operations or through discharge of polluted ballast waters. Regulations governing these operations are becoming increasingly strict and the probability of their occurrence is decreasing.

In any new proposed development in the Santa Barbara Channel, the possibility of discharge of oily ballast waters by tankers should be eliminated by use of totally segregated ballast systems. Clean sea water would be picked up as ballast in the discharge port, loaded in special clean tanks entirely separate from the cargo tanks, and discharged at the loading terminal. There would be no internal cross connections between the cargo tanks and clean ballast water holding tanks. Occasionally crude oil might be shipped by tankers which do not have separated cargo and ballast tanks, but U.S. Coast Guard regulations and unit operator policies prohibit discharge of unclean ballast. During those times when a tanker was substituted for the primary vessel the need for discharging ballast water could be eliminated by operating at less than oil-carrying capacity.

Cargo tanks of the newer vessels usually are equipped with remote-reading tank gages and high-level alarms. Remote shutdown of cargo pumps would be provided to prevent spillage during loading operations. Because of these provisions, minor re-occurring discharges of oil would be minimal.

A primary concern regarding marine transport would be the danger of oil spills resulting from collision with other ships. The route between the Santa Barbara Channel and Los Angeles is a major shipping lane. Transportation of produced crude oil to market in tankers would result in an increase in shipping on this route. Expanded shipping of oil from the Santa Barbara Channel might increase traffic 5 to 10 percent in the Channel and 3 to 5 percent in the Los Angeles-Long Beach Harbor complex thus increasing the chances for collision. The Santa Barbara Channel is a recognized shipping lane of moderate traffic density. Approximately 19 merchant ships of U. S. and foreign registry traverse the Channel daily. Ship traffic at the Los Angeles-Long Beach Harbor complex averages 14.6 ships per day with 3.1 ships being tankers.

Following is a tabulation reflecting an estimate of the marine traffic impact that might result from further developing the Santa Barbara Channel.

POTENTIAL MARINE TRAFFIC IMPACT

	Current Ship Traffic	Potential Ship Traffic with Further Channel Development
Santa Barbara Channel	6,977	7,350*
Los Angeles-Long Beach Harbor Complex**	5,319	5,550*

* Assumes additional Santa Barbara Channel crude displace other raw materials delivered in 50 thousand ton ships.

** Harbor traffic data from Marine Exchange (1970 data)

The capacity of transport vessels would of course vary but might average about 175,000 barrels. Such sized vessels would then likely be made up of approximately 15,000 barrel capacity compartments. If a vessel did sink or otherwise lose its cargo, up to 15,000 barrels of crude oil could be lost from each compartment of the vessel. It is highly unlikely that all of the compartments would be destroyed, but, if this happened, then up to approximately 175,000 barrels of crude oil could be released.

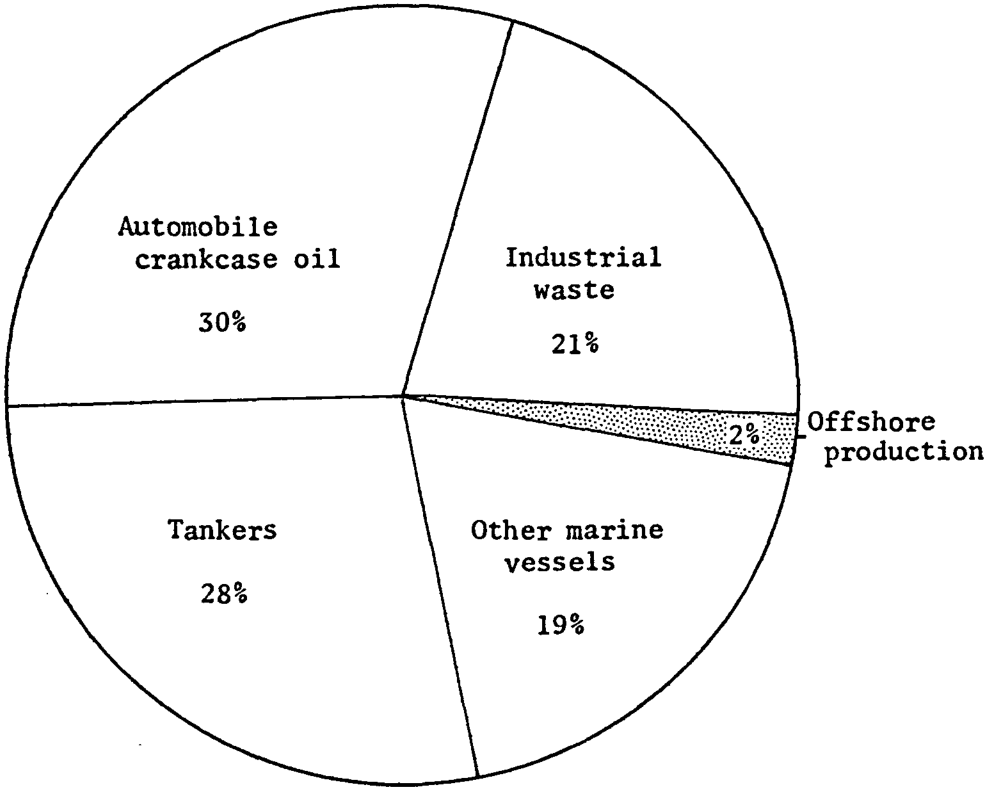
The danger of oil spills at sea would tend to be increased by increasing ocean transport but on the other hand is decreased by improved traffic controls and equipment such as traffic lanes, tighter regulations of many forms, improved navigation and proximity equipment, and improved crew training programs, etc. In terms of the total amount of oil being discharged at sea, oil pollution from tankers contribute almost one-fourth of the total (Figure III-9).

Because the south-bound shipping lanes are outboard of the north-bound lanes, tankers of barges leaving Santa Barbara Channel marine loading facilities bound for Los Angeles have to cross the north-bound shipping lanes as they head south. Consequently, review of present traffic patterns should be made and consideration given to establishing areas of further control to minimize the chance of collision. Generally, visibility will be adequate to permit safe navigation. During periods of low visibility the existence of modern radar and adequate bridge attention preclude the danger of collision.

It is difficult to assess the total amount of petroleum that will be introduced into the marine environment as a result of the daily operation of U. S. flag tankers and tank barges. The U. S. Coast Guard regulations and standards are among the most stringent and rigidly enforced in the world. This appears to result in a considerably lower discharge figure than is reported for the entire world fleet, vis-a-vis the very low .88 percent outflow of petroleum from U. S. flag vessels as a result of accidents. (Resource Agency of California, Department of Fish and Game, 1971)

FIGURE III-9

SOURCES OF OIL POLLUTION TO THE OCEANS
1969-1970



Accurate figures on the influx of oil into the world's waters are not available, but the various estimates that have been made agree that the contribution from offshore operations is relatively small. The major contributions are from marine vessels and automobile crankcase oil disposal. The estimates given in the diagram are from a paper by three U. S. Coast Guard authors, J. D. Porricelli, V. F. Keith, and R. L. Storch, entitled "Tankers and the Ecology," published by the Society of Naval Architects and Marine Engineers. The authors estimate nearly 5 million metric tons from all sources. Worldwide offshore operations contribute 100,000 tons (2%). Spillage from U. S. offshore operations in 1970 was 13,285 tons, less than 1/3 of 1% of the total from all sources.

Increased barge/tanker traffic may cause a small amount of interference with commercial and/or sport fishing and recreational boating.

2. Land Transport of Product by Pipeline

a. Crude Oil Pipeline to Refineries

An alternate method of transportation of produced crude oil to market would be a pipeline from the Santa Barbara Channel to the refineries at Los Angeles or Long Beach. The size of the pipeline that would be required is difficult to estimate as it would depend on the estimated total potential production of the Channel. Probably it would be in the range of 24 to 30 inches in diameter. A 30-inch, 120-mile pipeline from the Channel area to the Los Angeles-Long Beach refinery area would cost about 30 to 40 million dollars.

If a convenient sea route between the Santa Barbara Channel and Los Angeles were not available, a pipeline from oil field to refinery would be a normal proposal. In the specific Santa Barbara case, however, the marine transit route is available and offers the advantages of flexibility and low initial cost. The potential for adverse environmental impact is greater, however, for tanker transport than for a land based pipeline. Once constructed, a pipeline would have minimal adverse environmental impacts, whereas marine tankers would present the continual danger of oil spills during loading or unloading operations or due to collision during transit.

The Council of Environmental Quality (CEQ) has analyzed the relative probability of oil spills during oil transport by tanker and subsea pipelines. They found that although the statistics vary greatly with size of oil field and other factors, in general subsea pipelines have fewer spills and less total volume of oil spilled than do tankers. (CEQ 1974, Report to the President) Although pipelines on land might have comparable rates of oil spillage as subsea pipelines, pipeline inspection, repair of leaks, and containment of spilled oil would be much simpler from a pipeline break on land than at sea. This would be especially true during bad weather. According to a cost-risk analysis of transporting southern California OCS oil prepared for EPA by Booz, Allen and Hamilton, pipeline transportation is safer than tanker transportation by a factor ranging from 5 to 9; tanker transport shows a spill risk five to nine times higher than pipeline transport. (Booz, Allen and Hamilton, June 1975) Spill statistics from various sources clearly reflect that tanker spills occur more frequently and in larger volumes than do pipeline spills. For this reason, oil transport by onshore pipeline would appear to have less environmental risk than transport by tanker or barge.

(1) Construction Phase

Humble Pipe Line Company (now a division of Exxon Company, U.S.A.) made a study of a land based pipeline from the Santa Barbara Channel to Los Angeles in 1971 in connection with proposed drilling on the Santa Ynez Unit. Exxon concluded that such a pipeline is feasible but that it would cause significant short-term environmental impacts due to the necessary transportation of materials to the route, trenching, laying the pipe, and backfilling. The pipeline that Exxon studied would have been approximately 20-inches in diameter (for 80,000 to 90,000 barrels of oil per day) and about 140 miles long. Several intermediate pump stations would have been required. The tentative route selection from this study is shown in figure III-10. The route generally lies within the right-of-way of the Southern Pacific Railroad. This routing minimizes impacts upon surface improvements and private property but significant impacts would still occur. For example:

- In the cities of Goleta and Santa Barbara there would be approximately 36 road crossings.
- It is not feasible to skirt Santa Barbara, due to problems of topography, geology, hillside developments, and the position of the Los Padres National Forest.
- East of Summerland for a distance of about one mile the railroad is between the highway and ocean on a ledge cut into the ocean cliff. There is not room for a pipeline through this area which would have to be bypassed by crossing the highway and proceeding across private property.
- In the city of Ventura, the railroad is in a street for some distance and then crosses over the freeway.
- At least 6 miles of pipeline must be routed through city streets in Los Angeles. These areas are where the railroad skirts the downtown Los Angeles business district; the railroad passes over major streets and freeways, and there is no available space on the railroad right-of-way.

In addition to these localized effects, certain general impacts would occur at several points along the route. These include:

- Possible interference with railroad traffic due to work near the tracks. (The entire project would be required to meet railroad standards of safety).
- Placement of pipelines in cuts and fills by cutting back or stepping the cliff (this could be avoided in some areas by using sheet pile retaining walls).

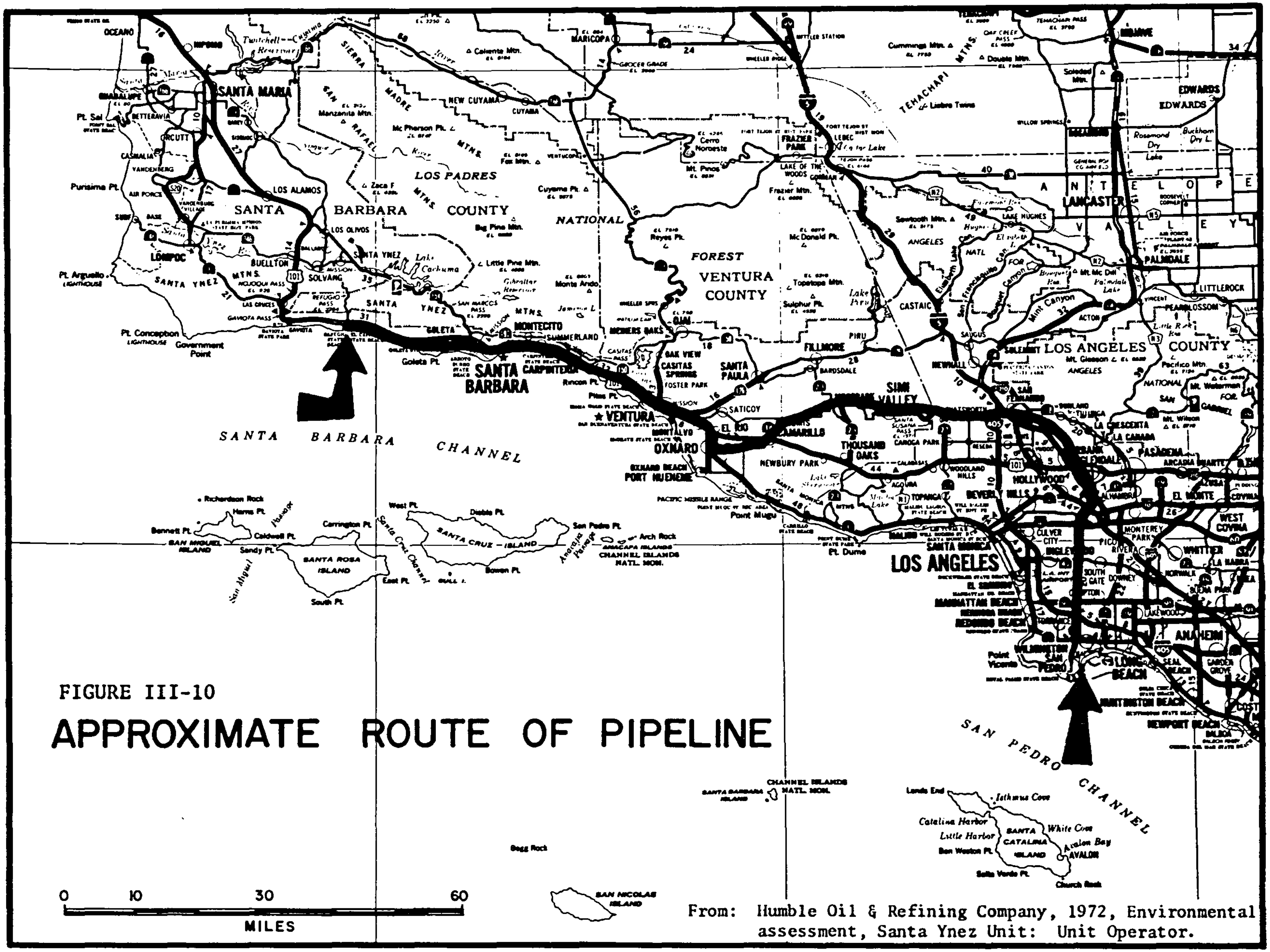


FIGURE III-10

APPROXIMATE ROUTE OF PIPELINE

From: Humble Oil & Refining Company, 1972, Environmental assessment, Santa Ynez Unit: Unit Operator.

- Temporary removal of railroad spur lines to gain additional working space. This problem would occur within the City of Santa Barbara.
- Possible service interruptions while relocating utility, electric, and communication lines.
- Disruption of private use of railroad right-of-way; for example, in Montecito where private owners use the right-of-way for access, parking, and personal use.

Pipeline construction activities could thus have significant (but temporary) impacts upon street traffic and other urban activities in several communities. Because the pipeline would pass through heavily populated areas, a large number of persons would be affected.

Once constructed the pipeline trench would be backfilled, regraded to contour, and reseeded with native plants where possible.

Another potential route for a new pipeline from the Santa Barbara Channel area to the Los Angeles area would be along the right-of-way of the existing Shell pipeline that is presently operating at capacity. Following this existing right-of-way would also minimize the impacts. (See figure II-44 for the route of the existing Shell pipeline.)

(2) <u>Operational Phase</u>

Only minor adverse environmental impacts would be present during pipeline operation. As has been mentioned the trench would be filled and reseeded with native plants so there would be virtually no visual impact. Leakage would be minimized and easily contained by various leakage detection and corrosion control systems.

One impact that would occur during the life of the pipeline is that the pipeline would, to some extent, interfere with future public and private improvements along its route. For a 6-foot pipeline right-of-way, this would amount to the commitment of 100 acres of land over a 140-mile route. In addition, installation or repair of underground utilities along the pipeline route would be made more difficult by the presence of the pipeline.

Although the potential for oil spillage is smaller on land than via marine transportation, excavation work near the pipeline could damage the line causing an oil spill. This type of damage has been one of the greatest contributors to oil spills from oil-transmission lines. The pipeline might also be subject to damage from possible land slides, fault displacements, corrosion, or floods. Inland obstructions and developments require that the pipeline closely parallel the sea bluff and beaches for 20 or more miles along the northern shore of the Santa Barbara Channel. An oil spill along this part of the route could possibly result in oil reaching the beaches or the ocean.

b. Natural Gas Pipeline

Expanded production of natural gas from the Santa Barbara Channel would be marketed through existing pipelines which are currently operated below design capacity. Natural gas liquids and sulfur would be transported by truck, probably to Los Angeles. This truck transportation would have a minor impact on existing highway traffic. Fuel combustion from additional trucks would slightly increase the level of exhaust emissions.

Pollution resulting from accidents would be localized because of the limited size of the cargo trucks. Although a hazard to human safety, most natural gas liquids spilled would evaporate quickly, without long-lasting effects. A spill of viscous or dry sulfur would not spread more than a few yards and could readily be recovered.

K. Accidents and Oil Pollution Records

1. Geological Survey Federal OCS Data

Data from the Geological Survey's records reflects a total of 159 accidents related to oil and gas operations on all Federal OCS lands within the period June 1956 through June 1973. Produced volumes of OCS crude oil and condensate for this period total approximately 3 billion barrels. Natural gas production from the OCS during this period amounted to approximately 18.7 trillion cubic feet. Producing leases during the period increased from 171 leases in 1956 to 694 leases at mid-year 1973. The number of active producing completions increased from 227 in 1956 to over 5,550 at mid-year 1973. The major portion of this OCS data is from the Gulf of Mexico because operations there are much more extensive and cover a longer period of time than in the Santa Barbara Channel.

a. Analysis of Data

A summary analysis of the 159 Federal OCS accidents occurring within the 17-year period includes the following:

- 105 of the 159 accidents resulted in, or were the result of, fires and/or explosions.
- 44 of the 159 accidents resulted in the spillage of 50 barrels or more of crude oil condensate or diesel fuel. (See table III-1 and table footnote)
- 43 of the 159 accidents were the result of, or resulted in, a blowout.
- 24 of the 159 accidents resulted in a total of 123 personal injuries and the loss of 59 lives.
- 13 of the 159 accidents involved a pipeline leak or break, three of which have definitely been attributed to anchor dragging.
- 9 of the 159 accidents were caused by storms or hurricanes.
- 3 of the 159 accidents were the result of a ship colliding with an offshore structure.

- 1 of the 159 accidents resulted in a documented loss of marine and bird life.

b. Applicability of Data

During the 17-year period in which such data were collected and evaluated, (1) technology advanced; (2) industry and Federal safety precautions were imposed; (3) more stringent Federal regulations were implemented; and (4) more comprehensive Federal inspection procedures were implemented and more frequent inspections were conducted. Experience is and has been the most useful source for identifying the need for change. But, because experience is ever-changing and enlarging, it is virtually impossible to derive statistically valid "probability of accident occurrence" figures from the data gathered over a 17-year period.

Table III-1 does not include such considerations as:

- Advances in technology which have ocurred during the 17 years in which the data were gathered.
- The effect of the issuance of USGS OCS Orders in the latter part of the time period.
- The effect of recent revisions in the Federal regulations, increased number of USGS inspections, and increased numbers of inspecting personnel.
- The comparability of environmental conditions from where data were gathered, i.e., Pacific Coast as opposed to Gulf of Mexico, distance from shore, water depths, currents, storms, etc.

2. Onshore and Offshore Accident and Oil Spill Data

Data are presented in tables III-1 and III-2 and III-3 on the history of accidents and oil spills associated with offshore oil production.

TABLE III- 1

OCS OIL SPILL STATISTICS

CAUSE	SPILLS PER SIZE CATEGORY (BARRELS)					TOTAL NUMBER OF SPILLS	TOTAL VOLUME BARRELS
	50-1,000	1,001-10,000	10,000-50,000	50,001-150,000	150,000-up		
Pipeline Break by Anchor Dragging	1	1			1	3	166,719
Fire/Explosion	1		1	1		3	83,600
Blowout	3	2	1			6	26,363
Pipeline Leaks	8	2				10	14,209
Producing/Workover/ Abandonment Operations	15	1				16	12,208
Hurricanes and Storms		3				3	11,869
Barge Damage	1	1				2	7,100
Ship Collision		1				1	2,559
	29	11	2	1	1	44*	324,627

*These 44 spills occurred between 1964 and 1973. OCS oil spill records prior to 1964 are limited.

TABLE III-2

ANNUAL SUMMARY OF WORK INJURIES-1972

	All Ind.(6)	Mining(6)		Petroleum Industry (1)		
		Under-ground	Strip	All Functions	Prod.(5) Dept.	Prod.(4) Only
Number of Hours Worked (M Hrs.)				791.1	104.7	85.4
Disabling Injuries(2)				5,624	899	607
Fatalities				66	6	3
Frequency Rate(3)	10.17	37.41	9.24	7.11	8.58	7.11

(1) 239 Companies Reporting - API Statistics
(2) Includes Deaths
(3) Disabling Injuries Per Million Hours Worked
(4) Excludes Drilling and Natural Gas Processing
(5) Includes Drilling and Natural Gas Processing
(6) National Safety Council Safety Facts

U. S. Geological Survey
Conservation Division
July 29, 1971

TABLE III-3

RECORDED OIL SPILL INCIDENTS INVOLVING 1,000 OR MORE BARRELS SINCE 1957

NAME	DATE	CAUSE OF SPILL	MATERIAL	BARRELS	REMARKS
Tanker, Torrey Canyon, England	03-18-67	Grounding	Crude	700,000	1
Tanker, World Glory, South Africa	06-13-68	Hull failure	Crude	322,000	1
Tanker, Keo, Mass.	11-05-69	Hull failure	#4 F. O.	210,000	1
Storage tank, Seewarren, N. J.	11- -69	Tank failure	Crude	200,000	1
Pipeline, West Delta Area, La., OCS	10-15-67	Anchor dragging	Crude	160,000	3
Tanker, R. C. Stoner, Wake Island	09-06-67	Grounding	Mixed	143,300	1
Tanker, Anne Mildred Brovig, North Sea	02-20-66	Collision	Crude	125,000	1
Tanker, Andron, W. Coast of Africa	05-05-68	Sinking	Crude	117,000	1
Pipeline, Persian Gulf	04-20-70	Break	Crude	95,000	8
Tanker, Ocean Eagle, Puerto Rico	03-03-68	Grounding	Crude	83,400	1
Oil tank, Indiana	11-23-70	Tank collapse	Bunker C	83,333	6
Tanker, Polycommander, Spain	05-05-70	Grounding	Crude	82,500	8
Waste oil reservoir, Penn.	11-13-70	Ruptured dike	Waste oil	71,428	6
Tanker, Tampico, Baja, Calif.	03- -57	Grounding	Diesel	60,000	1
Platform, Shell ST 26 "B", La., OCS	12-01-70	Fire damaged wells	Crude	53,000	3
Tanker, Arrow, Nova Scotia	02- -70	Grounding	Bunker	35,700	8
Platform, Chevron MP 41 "C", La. OCS	03-10-70	Fire damaged wells	Crude	30,500	3
Tanker, General Colocotronis, Bahamas	03-07-68	Grounding	Crude	30,000	1
Tanker, Esso Essen, South Africa	04-29-68	Grounding	Crude	30,000	1
Tanker, Argea Prima, Puerto Rico	07-17-62	Grounding	Crude	28,000	1
Tanker, Ocean Grandeur, Australia	03-03-70	Grounding	Crude	22,000	8
Tanker, Oregon Standard, Calif.	01-18-71	Collision	Bunker	20,000	5
Storage tank, Conn.	06-15-70	Human Error	#2 F.O.	19,048	6
Tanker, Esso Gettysburg, Conn.	01-22-71	Grounding	Kerosene & #2 F.O.	18,583	7
Pipeline, Buckeye, Lima, Ohio	01-14-69	Unknown	Crude	16,500	2
Refinery, Moron, Venezuela	03-29-68	Spilled thru sewers	Crude	16,000	1
Tanker, Witwater, Canal Zone	12-13-68	Hull failure	Mixed	15,000	1
Oil trans. line, Alabama.	12-10-70	Rupture	Navy distillate fuel	14,000	6

TABLE III-3 (Continued)

RECORDED OIL SPILL INCIDENTS INVOLVING 1,000 OR MORE BARRELS SINCE 1957

NAME	DATE	CAUSE OF SPILL	MATERIAL	BARRELS	REMARKS
Tanker, Benedicte, Sweden	05-31-69	Collision	Crude	14,000	1
U. S. Navy, Florida	11-30-70	Intent'l dumping	Bilge oil	11,900	5
Platform, Union "A", Santa Barbara Calif. OCS.	01-28-69	Blowout	Crude	10,000	3, 4
Tanker, Evje, Alaska	05-02-67	Grounding	Jet Fuel	6-10,000	8
Pipeline, Chevron MP 299, La., OCS	02-11-69	Unknown	Crude	7,532	3
Tank barge, Tim, Penna.	02-18-68	Sank	#6 F.O.	7,000	1
Industrial site	05-18-70	Unknown	Tallow	6,190	6
Pipeline, Gulf ST 131, La., OCS	03-12-68	Anchor dragging	Crude	6,000	3
Platform, Signal SS 149 "B", La., OCS	10-03-64	Hurricane	Crude	5,100	3
Tanker, Hamilton Trader, Liverpool Bay	04-30-69	Collision	Residual	5,000	1
Barge, New York	12-27-70	Grounding	#2 F.O.	4,800	6
Tank barge, Robert L. Polling, N.H.	05-10-69	Collision	#2 F.O.	4,700	1
Tanker, Marita, Calif.	09-20-62	Collision	Bunker C	4,300	1
Three barges, Tenn.	12-09-70	Grounding	Mixed	4,190	6
Tank barge Florida, W. Falmouth, Mass	09-16-69	Grounding	#2 F.O.	4,100	7
Tanker, Algol, New York	02-09-69	Grounding	#6 F.O.	4,000	1
Tank barge, Tenn.	01-03-70	Sank	Diesel	3,929	6
Tank barge, New York Bay	05-22-70	Collision	#6 F.O.	3,190	6
Transfer Pipeline, New Jersey	08-10-70	Equip. Failure	Gasoline	3,100	6
Platform, Continental EI 208 "A", La. OCS	04-08-64	Collision--freighter	Crude	2,559	3
Barge, Calif.	02-21-70	Struck jetty	Gasoline	2,547	6
Drill rig, Mobil SS 72, La., OCS	03-16-69	Storm shifting	Crude	2,500	1
Storage tank, Sears Oil Col, N.Y.	01-07-69	Unknown	Ballast	2,381	2
Terminal, Massachusetts	06-07-69	Unknown	#2 F.O.	2,381	2
Pipeline, N. Dakota	05-04-70	Unknown	Oil	2,381	6
Chrysler Corp., Mich.	04-22-69	Unknown	Industrial Cutting oil	2,262	2
Washington Natural Gas, Puget Sound	01-02-69	Unknown	Diesel	2,143	2
Pipeline, Wyoming	03-03-69	Break	Crude	2,000	2
Pipeline, Immigration Canyon, Utah	07-09-69	Rupture	Oil	2,000	2
Barge and tug, Florida	05-26-70	Collision	Gasoline	2,000	6

TABLE III-3 (Continued)

RECORDED OIL SPILL INCIDENTS INVOLVING 1,000 OR MORE BARRELS SINCE 1957

NAME	DATE	CAUSE OF SPILL	MATERIAL	BARRELS	REMARKS
Storage tank, Kodiak Naval Sta., Alaska	04-04-70	Overflow	Jet fuel	1,905	6
Barge, Louisiana	05-23-69	Unknown	#2 F.O.	1,800	2
Tank barge, Maryland	07-12-70	Human Error	#6 Heating	1,600	7
Barge, Texas	11-09-70	Collision	Ethyl Hexanol	1,690	6
Barge, Louisiana	05-26-70	Collision	Crude	1,600	6
Platform, Tenneco SS 198 "A", La.,OCS	10-03-64	Hurricane	Crude	1,589	3
Refinery, Humboldt Bay, Calif.	12- -68	Hose rupture	Diesel	1,430	1
Storage tank, Niagara River	12-22-70	Unknown	Oil	1,429	6
Pipeline, Indiana	01-09-70	Leak	Residual oil	1,429	6
Tank, Connecticut	11-16-70	Human error	#2 F.O.	1,310	6
Storage tank, Texas	02-01-70	Failure	Oil	1,300	6
Drainline, Ohio	01-18-70	Rupture	Gasoline	1,190	6
Tanker, Yukon, Alaska	03-04-69	Grounding	Crude	1,000	2
Dutch Coast spill	02-16-69	Unknown	Crude & F.O.	1,000	1
Tank barge, Kentucky	01-11-70	Struck sbmrgd.pier	Gasoline	1,000	6
Tanker, Kenai Peninsula, Penn.	11-05-68	Collision	Crude	800-1,000	6

(1) Dillingham Corp., Analysis of Oil Spills and Control Materials
(2) Oil Spills Table, Senate Report 91-351
(3) U. S. Geological Survey
(4) Subsequent seepage 8,500 bbls.
(5) Company figure
(6) U. S. Coast Guard
(7) Office of Water Programs, EPA
(8) Various published sources

Note: The estimated annual seepage rate from natural seeps at Coal Oil Point, California is 18,500 barrels.

TABLE III-3 (Continued)

OIL SPILL INCIDENTS RECORDED INVOLVING 1,000 OR MORE BARRELS SINCE 1957

NAME	DATE	CAUSE OF SPILL	MATERIAL	BARRELS	REMARKS
Tanker, Atlantic Ocean	03-27-71	Sinking	#6 Oil	220,000	7
Tanker, Japan	11-30-71	Tanker broke in half	Crude	149,080	6
Storage Tank, Ohio	01-31-71	Rupture	Crude	63,000	7
Oil Tank, Puget Sound	04-26-71	Human error	Diesel	5,500	7
Tanker, Manatee, Calif.	08-27-71	Human error	NFO	5,463	7
Pipeline, Michigan	10-07-71	Human error	#2 F.O.	4,975	7
Pipeline, Tennessee	10-06-71	Break	Diesel	4,285	7
Pipeline, Louisiana	03-17-71	Unknown	Crude	3,690	7
Storage Tank, Minn.	02-28-71	Unknown	Jet Fuel	3,571	7
Pipeline, Missouri	12-20-71	Human error	Gasoline	3,523	7
Pipeline, Texas	12-06-71	Rupture	Unknown	3,315	7
Pipeline, Kansas	10-18-71	Rupture	Diesel	2,786	7
Pipeline, Illinois	07-23-71	Break	#2 F.O.	2,568	7
Pipeline, Tennessee	12-26-71	Vandalism	Diesel	2,381	7
Storage Tank, Ohio	09-27-71	Unknown	Oil	1,900	7
Barge, Cook Inlet, Alaska	03-01-71	Collision w/tug	Gasoline	1,800	7
Pipeline, Virginia	05-06-71	Rupture	Oil	1,785	7
Navy Barge, NE/Puerto Rico	01-14-71	Unknown	Diesel	1,619	7
Tanker, Calif.	06-24-71	-	Crude	1,553	7
Pipeline, Illinois	07-08-71	Break	Crude	1,490	7
Oil Tank, New York	03-25-71	Overflow	#6 Oil	1,428	7
Pipeline, Indiana	05-09-71	Break	Oil	1,428	7
Mississippi	11-15-71	Unknown	#5 Oil	1,310	7
Pipeline, Miss.	03-05-71	Break	Crude	1,300	7
Barge, Rhode Island	05-12-71	Hit Race Rock	Kerosene & #2 F.O.	1,100	7
Tank, North Slope, Alaska	06-04-71	Struck by Bulldozer	JP #4 F.O.	1,071	7
Storage Tank, New York	09-04-71	Safety plug blew out	Gasoline	1,071	7
Pipeline, Texas	11-21-71	Break	Diesel	1,000	7
Pipeline, Pennsylvania	11-28-71	Break	#2 F.O.	1,000	7
Pipeline, Texas	06-23-71	Struck by Bulldozer	Crude	1,000	7
Pipeline, New Mexico	07-14-71	Unknown	Diesel	1,000	7

Pollution statistics for the period being considered are available only for those accidents involving the loss of 50 barrels or more of oil, condensate, or diesel fuel. These statistics indicate an estimated 324,627 barrels entered the marine environment because of oil and gas related accidents.

In some cases it is difficult to categorize the primary cause of a polluting incident. For example, it is sometimes difficult to determine if the pollution occurred because of a fire which caused a blowout or a blowout which resulted in a fire. Table III-1 reflects the best estimate of the primary causes of the polluting accidents.

See section III.L.1.a. for 1974 Coast Guard spill statistics for the Channel Area off Santa Barbara and Ventura Counties and also for the National Academy of Sciences (1975, p. 6) estimates of petroleum hydrocarbons introduced into the world oceans by source.

3. Council on Environmental Quality 1974 Report--Statistics on OCS Accident, Oil Spill, and Chronic Discharges

Following is an excerpt from the Council on Environmental Quality Report to the President on environmental impacts that might result from oil and gas operations in the Atlantic OCS and the Gulf of Alaska. The remainder of this subsection is reproduced directly from this CEQ report, pp. 4-24 through 4-37 (therefore table numbers and references differ in format).

OCS Accidents, Oil Spills, and Chronic Discharges

From 1953 through 1972 -- when nearly all the wells were drilled in the U.S. OCS, 43 major accidents occurred (see Table 4-2). [22] Nineteen were associated with drilling, 15 with production, and 4 with pipelines. Over the 19 years, there has been an average rate of 0.005 (0.5 percent) drilling and production accidents per successful OCS well drilled. During the same period, 8 blowouts were recorded in state waters. [23]

The frequency of OCS accidents generally increased as activity increased until 1968, when the accident frequency peaked. It has been decreasing since then. The 1969 Santa Barbara blowout -- in releasing from 18,500 to 780,000 barrels of oil -- raised serious questions on the adequacy of OCS technology. Since Santa Barbara, three major production platform accidents have occurred in the Gulf of Mexico. In the Shell accident (1970), estimates of oil lost

TABLE 4-2

Major Accidents on the U.S. Outer Continental Shelf, 1953-1972

Results	Drilling	Production	Pipeline	Collision	Weather	Total
Number	19	15	4	2	3	43
Oil	0	3	4	1	3	11
Oil and gas	2	7	0	0	0	9
Gas	17	2	0	0	0	19
Other	0	3	0	1	0	4
Oil spills	2	10	4	1	3	20
Oil volume (thousand barrels)	18.5-780	84-135.4	175	2.6	9.2-9.7	290-1,100
Deaths	23	33	0	0	0	56
Injuries	7-8	91-100	0	0	0	98-108
Fires	7	12	0	1	0	20
Major rig/platform damage	4	9	0	2	0	15
Duration	2 hrs.-5.5 mos.	10 min.-4.5 mos.	1-13 days	1 day	1-3 days	10 min.-5.5 mos.

Sources: University of Oklahoma Technology Assessment Group, *Energy Under the Oceans: A Technology Assessment of Outer Continental Shelf Oil and Gas Operations* (Norman: University of Oklahoma Press, 1973), using U.S. Geological Survey, U.S. Coast Guard, *Offshore*, and *Oil and Gas Journal* data.

range from 53,000 to 130,000 barrels. The Chevron accident (1970) resulted in loss of 30,500 barrels. Finally, the Amoco accident (1971) resulted in loss of 400 to 500 barrels.

The diminishing number of drilling accidents since 1968 reflects improvements in both technology and practice. The frequency of production accidents has not decreased so markedly, perhaps because old offshore production facilities and pipelines do not, in all instances, meet the specifications now called for in new facilities and pipelines.

Oil Spills

Although accidents during offshore operations account for only a small portion of the oil that is spilled, locally they can be significant. Their frequency and magnitudes and the fate and effects of the oil are important factors in OCS development decisions. The Council on Environmental Quality contracted with ECO, Inc. and with the Massachusetts Institute of Technology to analyze the probability of offshore oil spills. The results of their efforts are summarized in this section. Sources of data used in their study were:

- Coast Guard Pollution Incident Reporting System
- ECO, Inc., data base on tanker casualties (1968-1972)
- Petroleum Systems Reliability Analysis data base generated by Computer Sciences Corporation for the Environmental Protection Agency
- M.I.T. data base on large spills
- A sample of 300 spills at single point moorings worldwide, principally from testimony at hearings before the House of Lords on a proposed Anglesey, England, terminal.

The most important general features of oil spill statistics are the following:

- The size range of individual spills is extremely large, from a fraction of a barrel to over 150,000 barrels.
- Most spills are at the low end of this range; in 1972, 96 percent was less than 24 barrels (1,000 gallons) and 85 percent was less than 2.4 barrels (100 gallons).

- A few very large spills account for most of the oil spilled (the TORREY CANYON accident of 1967 spilled twice as much oil as was reported spilled in the United States in 1970. In 1970 and 1972, three spills each year accounted for two-thirds of all oil spilled in the United States in those years.

These facts are highlighted in order to point out the meaninglessness of estimating "average" amounts of oil that might be spilled at particular steps in the development process. Amounts spilled can vary by a factor of 1 million, and single spills like the TORREY CANYON distort the statistical distribution of spill magnitudes. Further, as shown in Table 4-3, fluctuations from year to year are quite large.

Certain patterns emerge from the statistical analysis of oil spills. For the four major sources of offshore oil pollution, Table 4-4 shows a remarkable similarity in the number of oil spills in each volume category for 1971 and 1972. The data suggest that the same processes, equipment inadequacies, and operator errors are causing the spills. Computer Sciences Corporation, under contract to EPA, recently analyzed the failures and errors that have caused these spills. [25] Although restricted by the limited data base, the study suggests that remedy of certain technological and operational inadequacies could significantly reduce the number and size of oil spills. Similarly, USGS has analyzed its oil spill data and is incorporating the results into the Federal inspection and enforcement program.

Platforms and Pipelines. Between 1964 and 1972, there were relatively few large spills from platforms and pipelines (Table 4-5 lists the spills of more than 1,000 barrels of oil). For an oil field find of medium size,* there is about a 70 percent chance that at least one platform spill over 1,000 barrels will occur during the life of the field. For a small oil field find, there is about a 25 percent chance of one platform spill over 1,000 barrels and for a large oil field find, there is over a 95 percent chance of a platform spill over 1,000 barrels, during the life of the fields. The probability of pipeline spills follows the general pattern exhibited by platform spill statistics. Figure 4-12, which shows the volume of oil handled on a platform between successive spills, indicates that there is about a 40 percent chance

*A medium find was defined by M.I.T. as 2 billion barrels of oil in place and a gas/oil ratio of 1,000:1. A small find was defined as 500 million barrels of oil and 500 billion cubic feet of gas and a large find as 10 billion barrels of oil.

TABLE 4-3

Oil Spill Statistics

[Barrels]

Type of spill	1971	1972
Petroleum industry-related spills		
Terminal		
Number	1,475	1,632
Volume	125,800	54,700
Ships (offshore)		
Number	22	32
Volume	400	51,600
Offshore production facilities		
Number	2,452	2,252
Volume	15,600	5,700
Onshore pipeline		
Number	74	162
Volume	8,700	29,300
Total		
Number	4,023	4,078
Volume	150,500	141,300
All spills		
Number	7,461	8,287
Volume	205,000	518,000

Source: The Massachusetts Institute of Technology Department of Ocean Engineering, 1974, "Analysis of Oil Spill Statistics," prepared for the Council on Environmental Quality under contract No. EQC330, using U.S. Coast Guard data.

TABLE 4-4

Petroleum Industry-Related Oil Spill Volumes

[Gallons] [1]

Facility	0-1	1-10	10-100	100-1,000	1,000-10,000	10,000-100,000	100,000-1,000,000	1,000,000-10,000,000
Terminal								
1971	384	247	458	282	77	19	7	1
1972	351	347	544	298	71	16	5	0
Ship (offshore)								
1971	4	6	8	0	4	0	0	0
1972	15	2	10	3	0	0	1	1
Pipeline								
1971	222	403	496	257	41	13	2	0
1972	15	24	61	61	32	7	3	0
Platform								
1971	227	304	395	146	13	2	0	0
1972	431	784	728	244	20	4	0	0
Total								
1971	837	960	1,357	685	135	34	9	1
1972	812	1,157	1,343	606	123	27	9	1

[1] Forty-two gallons equals 1 barrel. Gallons, rather than barrels, are used to illustrate the fact that most spills involve a small volume of oil.

Source: The Massachusetts Institute of Technology Department of Ocean Engineering, 1974, "Analysis of Oil Spill Statistics," prepared for the Council on Environmental Quality under contract No. EQC330, using U.S. Coast Guard data.

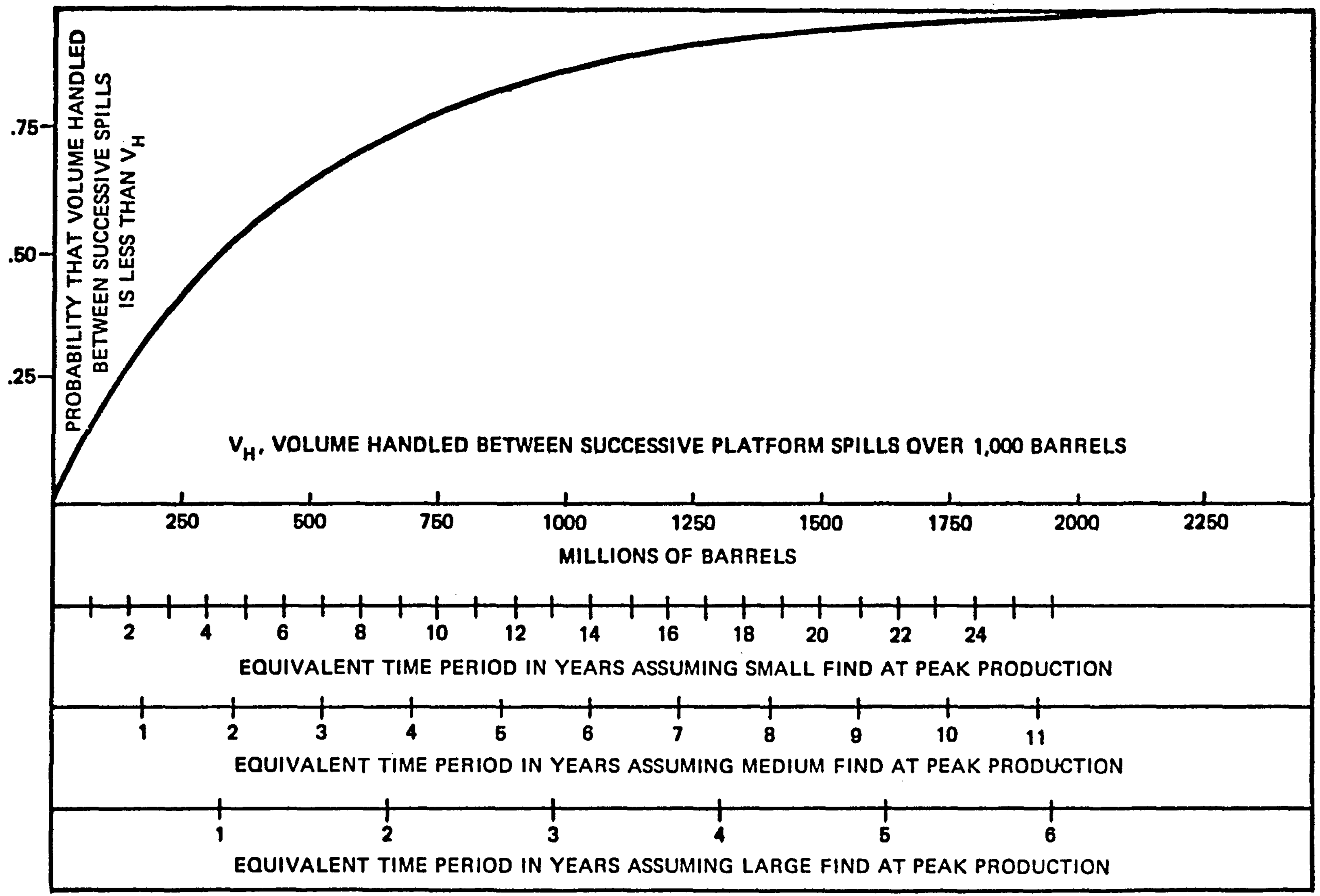
TABLE 4-5

Major Oil Spills from Offshore Production Facilities, 1964-1972[1]

	Cause	Date	Amount reported (barrels)
Offshore platforms			
Union "A," Santa Barbara	Blowout	January 28, 1969	77,400
Shell ST 26 "B," La.	Fire	December 1, 1970	52,400
Chevron MP 41 "C," La.	Fire	March 10, 1970	30,950
MP gathering net and storage, La.	Storm	August 17, 1969	12,200
Signal SS 149 "B," La.	Hurricane	October 3, 1964	5,000
Platform, 15 miles offshore	–	July 20, 1972	4,000
Continental EI 208 "A," La.	Collision	April 8, 1964	2,600
Mobil SS 72, La.	Storm	March 16, 1969	2,500
Tenneco SS 198 "A," La.	Hurricane	October 3, 1964	1,600
Offshore pipelines			
West Delta, La.	Anchor dragging	October 15, 1967	157,000
Persian Gulf	Break	April 20, 1970	95,000
Coastal channel, La.	Hit by tug prop	October 18, 1970	25,000
Chevron MP 299, La.	Unknown	February 11, 1969	7,400
Gulf ST 131, La.	Anchor dragging	March 12, 1968	6,000
Coastal channel, La.	Equipment failure	December 12, 1972	3,800
Coastal waters, La.	Leak	March 17, 1971	3,700
Coastal channel, Tex.	Leak	November 30, 1971	1,000
Coastal channel, La.	Leak	September 28, 1971	1,000

[1] Over 1,000 barrels.

Source: The Massachusetts Institute of Technology Department of Ocean Engineering, 1974, "Analysis of Oil Spill Statistics," prepared for the Council on Environmental Quality under contract No. EQC330.



Source: The Massachusetts Institute of Technology Department of Ocean Engineering, 1974, "Analysis of Oil Spills," prepared for the Council on Environmental Quality under contract No. EQC330.

Figure 4-12. Cumulative Volume of Oil Handled Between Platform Spills Larger than 1,000 Barrels that 250 million barrels of oil will be handled between large spills . If a large platform spill does occur, there is an 80 percent chance that the volume will exceed 2,380 barrels and a 35 percent chance that it will exceed 23,800 barrels.

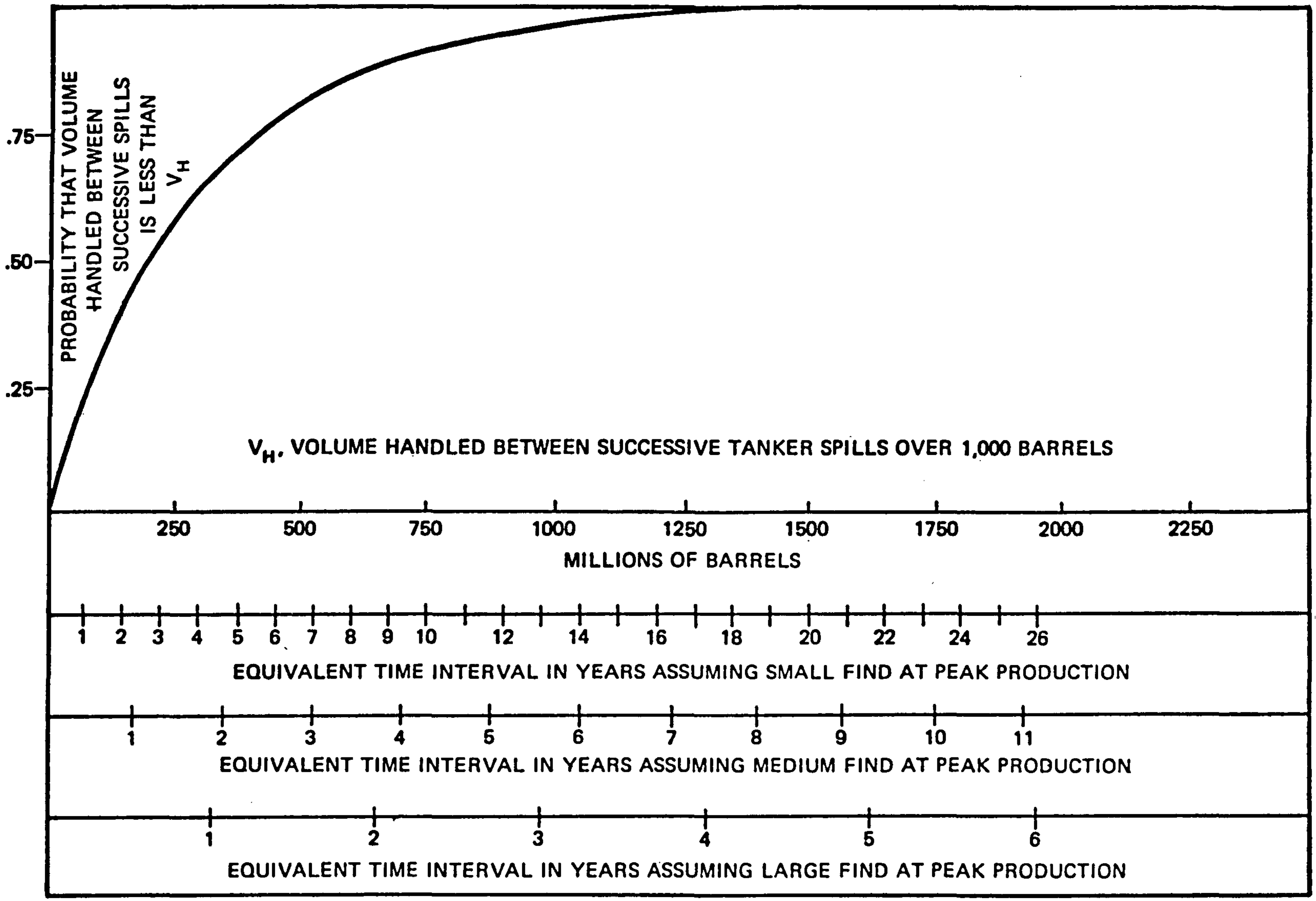
Figure 4-12 also shows that the probability of successive spills increases rapidly as the size of the find increases. Conversely, this means that large spills will occur more often -- for an equal increase in probability of a spill, 4.5 years will elapse in a small find and only 1.0 year elapses in a large find. Biologically, the time between large spills may be at least as important as the number of such spills. The ability of ecosystems to recover between successive oil spills is discussed in Chapter 6.

Tankers. About 98 percent of all the oil spilled by vessels is from incidents over 1,000 barrels. Most large tanker spills occur within 50 miles of land. Most result from groundings, rammings (the vessel hits a fixed structure), or collisions. Groundings and rammings occur nearshore, and collision frequency depends on traffic density, which is highest nearshore.

Analysis of tanker spill statistics indicates that if tankers are used to transport the oil to shore,the probability that there will be one tanker spill over 1,000 barrels is about 27 percent during the life of a small find, about 85 percent for a medium find, and nearly 100 percent for a large find. As the size of the find increases, so do the number of expected spills and the overall probability that a spill will occur (see Figure 4-13).

The possibility of more frequent or larger oil spills resulting from use of single point moorings was also analyzed. One might expect more spillage at SPM's than at fixed berth facilities because the SPM adds ship motion, flexible hoses subject to wave action, and possible loss of mooring to normal loading operations.

There have been 108 SPM spills in 5,578 ship calls, or 1 spill for every 50 calls. By comparison, the fixed berth terminal at Milford Haven, England's largest oil port, reports 1 spill every 60 ship calls through 1972. Individual SPM's may not do so well. An unloading SPM at Durban, South Africa, reported 1 spill every 5 ship calls in 1971. The data that M.I.T. collected show little difference in the size of spills from SPM's and fixed berth moorings. The average spill at SPM's is about 7 barrels, roughly equal to Milford Haven's experience at fixed berth terminals. [26]



Source: The Massachusetts Institute of Technology Department of Ocean Engineering, 1974, "Analysis of Oil Spills," prepared for the Council on Environmental Quality under contract No. EQC330.

Figure 4-13. Cumulative Volume of Oil Handled Between Tanker Spills Larger than 1,000 Barrels

Total Volume of OCS Oil Spills

The total volume spilled over the life of a field, although not as important as the frequency and magnitude of individual spills, is of interest. Table 4-6 shows that the number and total volume of spills for platforms, pipelines, and tankers are of the same order of magnitude for a given field size. Platforms have the lowest frequency and volume and tankers the highest.*

If the oil from a small field is transported by tanker, the probability that there will be no spill over 1,000 barrels is 52 percent; if oil is transported by pipeline, the probability is 75 percent. There is a higher probability of an extremely large spill from large pipelines than from tankers. Thus, if massive (above 240,000 barrels) spill volumes, which have a low (less than 1 percent) probability of occurring, are the main concern, tankers may be preferred over pipelines.

In interpreting these data, one must keep in mind that they are based on past experience and do not adjust for future improvements or production economics. If low-productivity OCS fields are discovered, replacement of pipelines 15 to 20 years into the field's life may be uneconomical; this could lead to higher incidence of pipeline leaks. Pipeline spill data include three major shallow water spills which may not be relevant to the Atlantic or Gulf of Alaska. The tanker spills include those from ships registered in all nations; however, American ships have a better record than all others.

Chronic Discharges

Several routine OCS operations result in discharges of oil and other materials to the water. Unlike that for accidental spills, their probability is 1.0 -- they have a 100 percent chance of occurring. Some scientists believe that over the life of a field these intentional releases may damage the environment as much as the large accidental oil spill.

Securing platforms with pilings or anchors, anchoring vessels, and burying pipelines offshore disturbs bottom sediments and increases turbidity.

In most drilling operations, cleaned drilling mud and drill cuttings are discharged overboard. Drill cuttings are shattered and pulverized sediment and native rock. Drilling mud may consist of such substances as bentonite

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*Although the M.I.T. approach does not consider average spillage rates valid, mean spill rates were derived at the request of the Council. M.I.T.'s computed ratio of the mean spill rate to the total volume of oil handled for platforms is 0.006 percent, for offshore pipelines is 0.011 percent, and for tankers is 0.016 percent. [27]

Table 4-6. Oil Spilled Over the Life of a Field

	Number of spills	Total volume (barrels)
Small Find		
Platform	0.28	7,200
Pipeline	0.31	13,900
Tanker	0.41	19,900
Medium Find		
Platform	1.3	33,300
Pipeline	1.4	62,900
Tanker	1.9	92,400
Large Find		
Platform	4.7	120,500
Pipeline	5.2	233,300
Tanker	6.9	335,700

Source: The Massachusetts Institute of Technology Department of Ocean Engineering, 1974, "Analysis of Oil Spill Statistics," prepared for the Council on Environmental Quality under contract No. EQC330.

clay, caustic soda, organic polymer, proprietary defoamer, and ferrochrome lignosulfonate. During the course of drilling an average 15,000-foot well, approximately 110 tons of commercial mud components and 950 tons of drill cuttings are discharged overboard. [28] In its environmental impact statement on the proposed OCS lease sale in the northeast Gulf of Mexico, the Bureau of Land Management estimated that a maximum of 1 million tons of drill cuttings and 123,000 tons of mud would be discharged in the area as a result of drilling 1,120 wells to an average depth of 15,000 feet. [29]

During operations, waters from the geological formations are often produced. The waters may be fresh or may contain mineral salts such as iron, calcium, magnesium, sodium, and chloride. Their discharge increases the mineral content and lowers dissolved oxygen levels in the area of operations. The waters often contain small amounts of oil. The potential impacts of continuous discharges are discussed in Chapter 6.

20. Energy Under the Oceans, supra note 3, at 74.

21. Id. at 76.

22. Id. at 284.

23. Id. at 304.

24. The Massachusetts Institute of Technology Department of Ocean Engineering, 1974, "Analysis of Oil Spill Statistics," prepared for the Council on Environmental Quality under contract No. EQC330.

25. Computer Sciences Corporation, Petroleum Systems Reliability Analysis, Volume I -- Engineering Report, prepared for the Environmental Protection Agency under contract No. 68-01-0121, EPA-R2-73-280a (Raleigh, N.C.: Environmental Protection Agency, 1973).

26. The Massachusetts Institute of Technology Department of Ocean Engineering supra note 24, at 57.

27. Id. at 118.

28. Department of the Interior, "Final Environmental Impact Statement on Proposed 1973 Outer Continental Shelf General Lease Sale Offshore Mississippi, Alabama, and Florida," Oct. 16, 1973.

29. Id. at

4. Santa Barbara Channel Spill Probability and Maximum Credible Spill Volumes - Dames and Moore, August, 1975, Critique for Western Oil and Gas Association

Dames and Moore was contracted by Western Oil and Gas Association (WOGA) to critique certain portions of this statement in draft form. This Dames and Moore critique in bound form was submitted to the Geological Survey by WOGA.

Dames and Moore stated the CEQ (see previous subsection) spill probabilities are based largely on world-wide statistics and, therefore, are not applicable to the Santa Barbara Channel. The following tabulation compares the rates presented in the CEQ Report (see previous subsection) to the spill rates Dames and Moore derived from data Dames and Moore believed more applicable to the Santa Barbara Channel.

Spill Source	Barrels spilled per million barrels handled: CEQ	Barrels spilled per million barrels handled: Dames and Moore
Tankers	160	88
Pipelines	110	13
Platforms	60	61

Dames and Moore also expressed concern as to the maximum potential oil spill volumes expressed in table III-17 at the end of this section. Dames and Moore recommended the "maximum credible spill" approach as being more useful than the "maximum potential oil spill". Dames and Moore and WOGA recommended the following maximum credible spill estimates for the Santa Barbara Channel OCS.

Spill Source	Maximum Credible Spill Volume (Barrels)
From platforms	75,000
From onshore facilities	100
From a sea floor pipeline to shore	250
From onshore portion of pipelines	500
From marine vessels	60,000

Dames and Moore and WOGA derived the spill rate and maximum credible spill figures in the two above tabulations from analysis of historical spill data applicable to the Santa Barbara Channel. An assumption was then made that advanced technology would reduce the historical spill rate and volume by a certain percent. For a detailed presentation of the Dames and Moore spill probability methodology including the spill rate reduction percentages assumed for each type of spill due to improved technology, see Dames and Moore's critique on the Bureau of Land Management draft statement for southern California OCS Lease Sale No. 35. This Dames and Moore critique is presented in section IX of FES-75-38 for OCS Lease Sale 35.

The Geological Survey recognizes the methodology used to derive the above Dames and Moore-WOGA spill estimates as one method by which to predict the amount of oil that might be spilled as a result of oil and gas activities related to the possible levels of Santa Barbara Channel development. It is also agreed that advancement in technology and more stringent regulations should result in more favorable spill statistics than those of historical record. However, the Geological Survey does not necessarily concur with "improved technology spill reduction percentages" specifically assigned for each type of spill. This lack of concurrence is not due to disagreement with any one particular assigned spill reduction percentage, but rather a question of the merit in making such specific estimates as to the exact amount that improved technology might reduce each type of spill.

The Geological Survey does concur with the following interesting consideration in the Dames and Moore critique:

> *"We believe that the oil spill potential of future OCS operations from platforms will be more likely a function of the number of opportunities for spills to occur (platform-year method) than of the volume of oil produced. For example, we would expect the spillage from ten wells, each producing 1,000 barrels per day, to be less than that from 100 wells, each producing 100 barrels per day (even though the volume produced is 10,000 barrels per day in each case). Because the first case has fewer wells and fewer independent units subject to failure, opportunities for spills would be correspondingly less. Likewise, we would expect the spillage from one 30-well platform to be less than from five 6-well platforms. The single, large structure would be less susceptible to ship collision and would have fewer independent mechanisms subject to failure."*

In the Booz, Allen and Hamilton risk-cost analysis of OCS oil transportation (July 1975) prepared for EPA, a similar interesting point was made in regard to the relationship of spills to volume of oil handled and to vessel movements as follows.

> *"Certain accidents that result in spills are more closely related to the volume of oil handled, such as loading and unloading accidents. Furthermore, there is evidence that, due to reduced maneuverability, large tankers have higher collision and grounding rates than small tankers. On the other hand, many accidents that result in spills are more closely related to vessel movements than to volume handled. If the relationship between tanker size and collision rate is a weak one, for example, then more spills should be associated with a system involving a large number of small tanker movements than with a system involving a small number of large tanker movements."*

L. Impact of Major and Minor Oil Spills on Marine and Littoral Environments

The occurrence of a major oil spill resulting from future Santa Barbara Channel petroleum production and transportation activities cannot be precluded. This subsection assesses the impacts of oil spills regardless of source. As indicated by the references following section III, the fate of oil in the marine environment and the impacts on marine organisms are the subjects of ongoing research by many investigators.

1. Formation and Drift of Oil Spills

a. Minor Oil Spills

Oil spilled in the ocean from Santa Barbara Channel operations may be in the form of a large, short-term oil spill from a blowout, pipeline rupture, or tanker collision. Such accidents although widely publicized, are infrequent and small in comparison to the total amount of oil produced without incident. Less publicized, but more frequent, are the small or recurrent oil spills that occur during normal operations. These small spills normally are no more than a few barrels of oil and affect only those waters or land areas immediately adjacent to the scene of the spill.

The effect of minor oil spills on the marine environment of the Santa Barbara Channel can be compared to that of the natural oil seeps of the area. These seeps are wide-spread in the Channel. They contribute small, but continuing, amounts of oil to Channel waters. The oil from natural seeps at Coal Oil Point forms oil slicks and contaminates shorelines. Man-caused spills from Channel oil and gas production activity are probably much less important than natural seepage to the Channel, as indicated in the following paragraphs.

Statistics on Man-Caused Spills and Natural Seepage

Eight pages of computer-derived statistics on polluting incidents for calendar year 1974 were supplied by the Eleventh Coast Guard District. These statistics were compiled for internal use and are considered unofficial. (Personal communication, 1975)

The volume from the 65 polluting incidents reported in 1974 in the Channel area off Santa Barbara and Ventura Counties was 2,118 gallons or 52 barrels.

Fisher (1975) estimated total natural seepage in the Channel to be on the order of 200 to 250 barrels per day, or a low estimate of 73,000 barrels per year.

Mikaolaj, Allen, and Schlueter (1972) estimate natural seeps at Coal Oil Point at 50 to 70 barrels per day or a low estimate of 18,000 barrels per year.

The National Academy of Sciences (1975, p. 6) estimates of petroleum hydrocarbons introduced into the world oceans by source are presented in the following table:

Budget of Petroleum Hydrocarbons
Introduced into the Oceans

	Input Rate (mta)[a]	
Source	Best Estimate	Probable Range
Natural seeps	0.6	0.2-1.0
Offshore production	0.08	0.08-0.15
Transportation		
LOT tankers	0.31	0.15-0.4
Non-LOT tankers	0.77	0.65-1.0
Dry docking	0.25	0.2-0.3
Terminal operations	0.003	0.0015-0.005
Bilges bunkering	0.5	0.4-0.7
Tanker accidents	0.2	0.12-0.25
Nontanker accidents	0.1	0.02-0.15
Coastal refineries	0.2	0.2-0.3
Atmosphere	0.6	0.4-0.8
Coastal municipal wastes	0.3	–
Coastal, Nonrefining, industrial wastes	0.3	–
Urban runoff	0.3	0.1-0.5
River runoff	1.6	–
TOTAL	6.113	

[a] mta, million metric tons.

A precise ratio of man-caused spills to natural seeps is not attempted here because of lack of long-term data and the possibility of unreported or undetected polluting incidents in the Channel.

As stated later (section III.L.2.), worldwide natural seepage rates have been variously estimated at 600,000 metric tons per year (Wilson et al., 1974) and 225,203 barrels per year sustainable for 879 million years (Sweet, 1974). Also see section III.O.5. for California annual cycle characteristics. See table II-71 for oil and grease in southern California municipal waste waters, surface runoff, and industrial waste.

b. Major Oil Spills

It is difficult to predict exactly what would happen to an oil slick resulting from a major oil spill in the Santa Barbara Channel, but observations made after the January 28, 1969 spill provide an historical example. The results of future major spills might be radically different, however, due to different causes of spillage (e.g., tanker collision or pipeline failure, rather than blowout), different weather conditions, different geographical locations, or to containment and clean-up capability now, as opposed to early 1969.

The type of initial spreading of oil most often observed is a thin slick produced when wind and/or currents are strong enough to sweep the surface clear as the oil surfaces above the seepage zone. Rising oil then reaches an oil-free surface and spreads out into thin irridescent patches. Occasionally, however, when wind and currents are slack, oil that reaches the surface does not spread out into a thin patch but remains as a thick heavy mass of oil over the seepage zone.

As the oil spill drifts with the wind or currents, various physical processes act to modify it. Probably the most important, from an environmental standpoint, is evaporation which tends to remove the volatile, lighter fractions from the oil. Turbulent mixing, however, acts to break the oil into many finely divided particles which become dispersed throughout the water column where evaporation of volatiles ceases and solution begins. Allen (1969) studied the 1969 spill from Platform A and observed details of the formation and drift of the oil slick. Due to a storm in early February 1969, turbulent mixing was an important process in dissipating the oil from the Platform A spill. If the oil slick is thin, evaporation is rapid, but, if the oil is in heavy masses, the lighter volatile fractions evaporate slowly and leave a thick, tarry material that may persist for a long period, and may be carried onto the beach.

As the oil spill drifts, it moves at a speed of three to four percent of the wind speed. In studying the spill in 1970 from the Chevron platform off the Mississippi River delta in the Gulf of Mexico, Sonu, Murray, and Smith (1971) found that the correlation between the wind vector and the drift of the oil slick was higher in times of strong winds (i.e., over 10 to 15 knots) and of steady wind direction.

The direction of movement of a future oil spill in the Santa Barbara Channel is difficult to predict because the wind at the time of the spill may be from any direction. Hence, spilled oil might drift in any direction and for planning purposes, the possibility of oil washing up on any beach in the entire Channel and adjacent areas should be considered. The prevailing winds, however, in the Santa Barbara Channel are from the west or northwest and thus the oil spill would most likely drift in a southeastwardly direction toward the Port Hueneme coast or the Channel Islands of Santa Cruz and Anacapa. The mainland beaches from Point Conception to Ventura might also be subject to oil spilled from the Santa Barbara Channel operations. In the absence of wind, westerly-moving inshore currents of the Davidson current might carry spilled oil around Point Conception and north toward Point Arguello and the beaches near Santa Maria during the winter.

After the January 28, 1969 spill at Platform A, the winds were from the north and northwest and the spilled oil remained at sea. A storm moved through the area during the period February 4 to February 7, and caused the winds to shift from a southeasterly direction clockwise to the west. Due to this wind shift, the spilled oil moved north toward Santa Barbara and the mainland beaches, starting on February 4 (Straughan, 1971).

There are five general types of possible accidents that can cause spillage of oil. They are as follows:

- Platform spills (including major spills as from a blowout or collision by ships against the platform, and minor spills from valve leakage, service vessel operations, spills from offshore treatment and storage facilities, etc.
- Spills from transportation of hydrocarbons to shore facilities. These would include pipeline ruptures caused by anchor dragging or earthquake, or small spills due to minor pipeline leaks as a result of corrosion or other factors.
- Spills at onshore facilities. Such spills would be terrestrial in nature but might result in some oil entering the surf zone.
- Spills during marine loading operations. These spills would result from faulty connection and disconnection of loading hoses

or due to ballast pumping.

- Spills during marine transit. Such spills would occur by ship collisions, groundings, and other transport-related vessel accidents.

The specific probability of each type of spillage is difficult to estimate, however, spills due to marine loading and transit probably would be more likely than platform or pipeline spillages, as suggested by CEQ and Dames and Moore estimates given on an earlier page. This is particularly true in the years since 1969 as platform and pipeline operations in the Santa Barbara Channel are now more strictly regulated than previously, and there have been significant technology improvements which affect safety and spill mitigation.

Six areas might be considered as possible oil spill sites. Three of these are areas where offshore platforms presently exist or might be likely and, thus, are where platform-type spills may occur:

Area 1 - Dos Cuadros Offshore Field including the related Carpinteria Offshore field and the Pitas Point lease area,

Area 2 - Santa Ynez Unit, including the Hondo, Pescado and Sacate offshore fields, and

Area 3 - Santa Clara Unit including three unnamed fields in the area.

Two areas are considered as possible sites of oil spills from marine product transportation. These are:

Area 4 - The sea lanes north of Santa Cruz Island, and

Area 5 - The sea lanes near Anacapa Island and the Santa Clara Unit.

The sixth area, where oil spills might occur onshore or at marine-loading terminals, encompasses the coastline (primarily the State tidelands) from Gaviota to Ventura. Spills in these inshore waters, as a result of production offshore in Federal waters, probably would be of minor size but might be of a recurring nature. (See plate 1 for location of the six areas)

There are various sophisticated, mathematical models that can be used to make oil spill trajectory predictions. The Bureau of Land Management and the Environmental Protection Agency have supported a recent study (Devanney, 1975) entitled "Estimates of Spill Trajectory Likelihoods for the Southern California OCS" that makes such trajectory predictions in areas south of the Channel Islands in support of BLM Lease Sale 35. Use of such a prediction model in the Santa Barbara Channel would be possible in the future. Preliminary spill trajectory estimates for the Santa Barbara Channel can be made, however, from wind and current information. Because of the complexity of the geography, the variability of winds from place to place within the Channel, and the lack of detailed data, such preliminary estimates are perhaps as accurate as results that could be obtained from implementation of the more sophisticated computer-modeling techniques.

As has been mentioned, oil spills normally drift in the direction of the wind at three to four percent of the wind speed. When winds are calm, the oil drifts with the prevailing currents. Under such conditions, the drift is relatively slow and containment relatively easy due to calm seas.

Predictions are needed of oil spill trajectories resulting from higher wind speeds. Thus, by reviewing the average condition wind streamline diagrams shown in figures II-18b and II-18c, predictions can be made where oil spills would drift ashore from the six area categories discussed above. This would, of course, be valid only for the average wind conditions shown. Any other wind conditions would naturally result in other trajectories.

For the average conditions, oil spilled in the Santa Ynez Unit area would likely drift eastward during daylight hours and, thus, would impact on the shore from Gaviota to Santa Barbara. Offshore breezes at night would hold the oil away from the coast and would result in southeastwardly drift. Winds would carry spills toward Santa Cruz Island in winter (January) and toward Ventura in summer (July).

Oil spilled in the Dos Cuadros offshore region would drift toward the northeast toward Carpinteria under onshore breezes during daylight hours. During the night, however, offshore breezes would move the oil toward Anacapa Island during winter and during summer in a local eddy, or toward Ventura.

Oil spilled in the Santa Clara Unit would drift eastward toward Ventura and Port Hueneme in most situations, except during nighttime in winter when northeasterly winds would carry the oil southwestward toward Anacapa Island and into an eddy off Point Mugu.

Oil spilled in the sea lanes north of Santa Cruz Island during marine product transportation would most likely move southeastward under north-westerly winds. These winds would carry the oil toward Santa Cruz or Anacapa Islands or farther south along the coast.

Oil spilled in the sea lanes near Anacapa Island would move southeastward along the coast under most situations, except during winter nights when northerly winds would carry it offshore or toward Anacapa Island. If carried offshore, it would probably come ashore farther south in the Los Angeles Bight.

Oil spilled from onshore or along the shoreline and from marine-loading operations would be very subject to day-night wind variations or sea breezes. In the area from Point Conception to Carpinteria, onshore winds during daytime would carry the oil onshore within a short distance of the point of spillage while nighttime winds would carry the oil offshore and to the southeast. From Carpinteria to Point Mugu, winds would carry the oil onshore within a short distance, except during winter nights when northerly winds would carry it offshore and south along the coast.

It is again emphasized that predictions of oil spill drifts can be only gross estimates and actual trajectories may be significantly different depending on actual wind and current conditions occurring at the time of the spill. An example is the aforementioned drift of the oil spilled in 1969 from Platform A. Changing winds caused it first to move southerly and then northerly.

2. Fate of Spilled Oil

A wide variety of physical, chemical, and biological processes act on oil spilled in the marine environment. Physical spreading acts in concert with the wind and the currents to move the spilled oil possibly many miles. The spreading of the oil on the ocean surface affects the width of the oil slick and thus, the length of shore that might be affected. Moore, et al., (1972) have postulated that the spreading of an oil slick takes place in three distinguishable phases: at first, a buoyancy-induced spreading force of the oil is balanced by the oil's inertia, later this is replaced by the water's viscous drag; finally, the spreading rate is determined by the balance between the surface tension spreading force and the water's viscous drag. Each of these spreading regimes will persist for varying lengths of time, depending on how much oil is initially released. After some time all spreading ceases because the hydrocarbons responsible for the observed surface tension are lost either by evaporation to the atmosphere or by dissolution into the water.

These processes of evaporation and dissolution act rapidly (48 to 96 hours) to remove selectively the low boiling, more soluble hydrocarbons. Both processes are aided by high wind speeds because of increased turbulence and mixing in both the air and water. Temperature also has an important effect on the rates of evaporation and dissolution of hydrocarbons. The actions of the wind, waves, and currents break apart large rafts or patches of spilled oil into progressively smaller and smaller patches. This separation increases the total area of sea surface affected by the spill. Oil is physically mixed into the water column by turbulence due to breaking waves or surf near shore. The depth to which this wave-induced turbulence penetrates varies with the wave conditions but is normally in the range 10 to 30 meters. Some solution and downward diffusion also occurs even on a calm surface.

The hydrocarbons in the surface slick and in the water column are susceptible to oxidation by biological and chemical processes. ZoBell (1972) states that "more than 200 species of bacteria, yeasts and filamentous fungi have been shown to metabolize one or more kinds of hydrocarbons ranging from CH_4 to compounds containing more than 40 carbon atoms." He further states that the microorganisms that can oxidize various hydrocarbons are widely distributed in soils and natural waters but are most varied and numerous in places that have been subjected to persistent oil pollution either from natural oil seeps or by the activities of man.

The rate at which spilled oil is oxidized by microorganisms depends not only on the chemical composition of the oil and on the numbers and kinds of microorganisms present but also on a number of environmental factors. Studies on the chemistry of stranded crude oil deposits over an extended period have shown that degradation processes can proceed extremely slowly. The complete degradation of a given oil deposit may even take several years (Dames & Moore, 1974).

ZoBell (1972) listed some of the major factors that influence the rate of degradation processes.

- Oxygen--An adequate supply of dissolved oxygen in the water is essential. Concentrations of dissolved oxygen in the surface waters in the Santa Barbara Channel are normally in the range 4 to 6 ml/l which is well oxygenated. (Other authorities use higher values to define well oxygenated conditions, for beneficial uses.)

- Dispersion--Biodegradation of oil is aided by dispersion of the oil in the water.
- Temperature--Although biodegradation of oils has been observed at temperatures ranging from -2 to + 70^{o} C, most species are most active at temperatures 20 to 35^{o} C. Surface waters in the Santa Barbara Channel are commonly in the range 12 to 20^{o} C which although cool is near the optimum.
- Salinity--Marine microorganisms oxidize oil at all salinity values encountered in the Santa Barbara Channel.
- Microbial Predators--Cyptophagic protozoans and certain other invertebrates in oil-polluted environments may limit the populations of microorganisms by predation.

Other processes also are important in oxidizing oil. For example, autoxidation of hydrocarbons occurs in the presence of sunlight and inorganic catalysts, if proper temperatures are attained. Autoxidation may occur at rates 10 percent to 50 percent as rapid as biodegradation and, like evaporation, continues as long as the oil is exposed to the atmosphere. Also part of the oil or its oxidation products may be ingested by organisms and may undergo some degradation by certain animals.

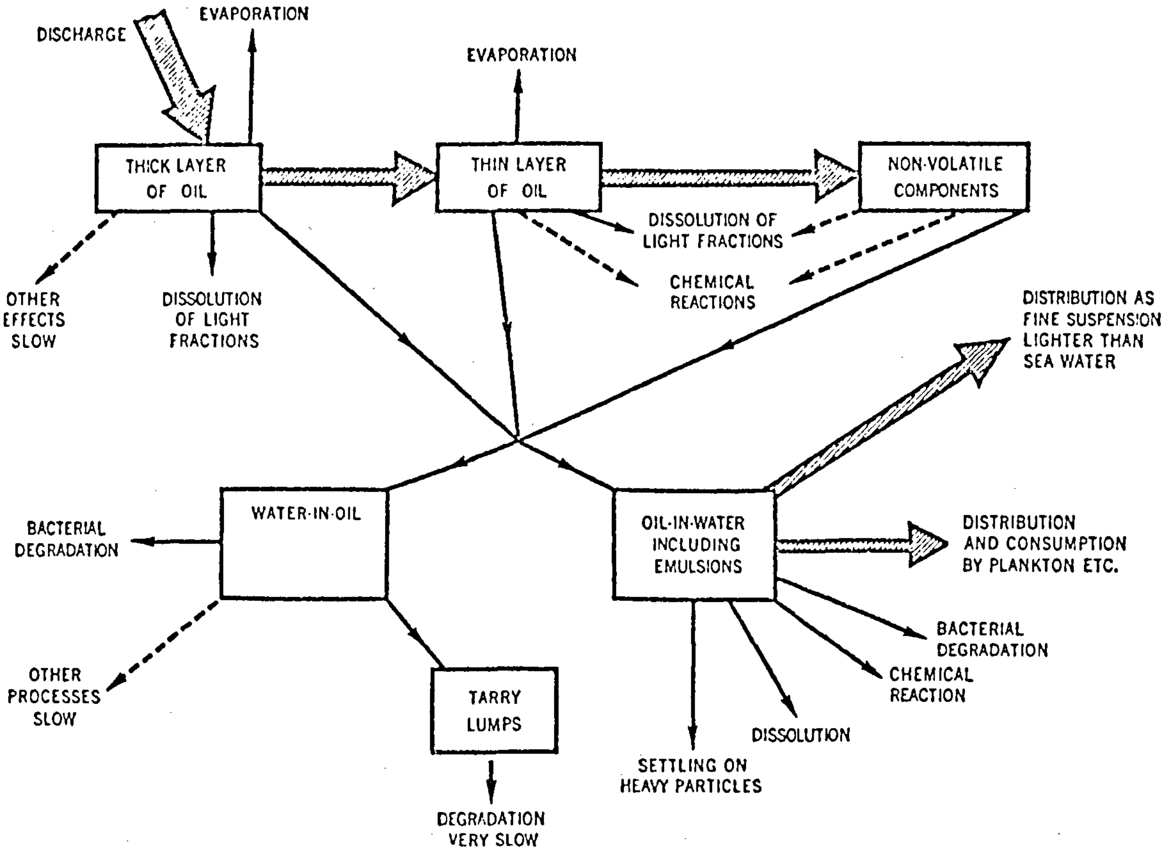
Quoting from Dames and Moore, 1974:

"Pipel (1968) discusses the relative importance of some of the various factors that cause decomposition of oil. Parker et al. (1971) also gives an overall picture of possible methods of biological immobilization and degradation of oil in the sea (figure III- 11). Ultimately many of the higher density components of spilled oil become associated with suspended solids and tend to sink. This is fortunate, because the largest populations of microorganisms capable of oxidizing hydrocarbons occur on the ocean floor, especially in shallow water (ZoBell, 1972), unless dissolved oxygen or nutrients are lacking. Kolpack (1971) studied the absorption of oil on flocculated suspended particles following the 1969 spill at Platform A. He found that oil slicks extended only short distances into areas of high concentrations of suspended

FIGURE III-11

From Dames and Moore, 1974, Figure A1 (manuscript in preparation)

Processes leading to the consumption of crude oil at sea. (from Parker, et al., 1971)



sediments. These areas resulted from river discharge during flood conditions immediately prior to and during the 1969 blowout. Nelson-Smith (1970) states that sedimentation of oil is more effective in water of low salinity. This agrees with Kolpack as the areas of high suspended sediment that he observed were probably of low salinity as they were plumes of river discharges. As the heavy components of the oil sink and become associated with sand, silt, shell fragments, or other detritus, tarballs may form. These are believed to originate around small pieces of bituminous material which accumulate concentric layers of detritus as they are rolled about by currents on the ocean floor. Some of these tarballs are washed ashore and probably many more are transported to deeper water (ZoBell, 1972).

"Kolpack (1971) states that 'much of the oil deposited at the sediment-water interface was removed from the area of initial deposition and into deeper water. The pattern that evolved showed alignment of higher oil concentrations within the main avenues of sediment transport toward the central basin. Oil deposited in areas of net sediment accumulation, however, remained buried at the end of June, 1970.'"

The final depositional site for much of the undegraded fraction of the spilled oil from Platform A is the sediments of the central basin of the Channel (Kolpack, 1971). Since the deep waters of the central basin have only low concentrations of dissolved oxygen, the oil probably is not significantly oxidized after deposition and is ultimately buried by later sedimentation.

Any oil spilled from Santa Barbara Channel operations would add to the total amount of oil discharged into the ocean from natural and man-caused sources. A wide variety of processes occur in nature to break down these oils or to trap them in the sediments. As a result of man's activities, the amount of oil spilled in the oceans is increasing. The long-term effects of this spilled oil are a matter of controversy. Floating tar balls have been observed in mid-ocean and the biological effects of these are almost unknown. Since the tar balls were found in association with plastic and other man-related pollutants, it was assumed that the tar balls were also man-related. However, Sweet (1974, p. 651-655) suggests that pervasive seepage of the world's potential Continental Shelf petroleum-bearing area may account for a quantity of hydrocarbons at least equal to that resulting from man's activities (i.e., 225,205 barrels/year sustainable for 879 million years). Also, Wilson, et al. (1974, p. 857-864) state the best estimate for present marine seepage worldwide is on the order of 0.6×10^6 (600,000) metric tons per year, with the circum-Pacific area contributing about 40 percent of the world's total.

The problem of oil spills is a part of the larger problem of increasing discharges of all manner of waste products into the oceans. Studies of the environment to understand the natural processes and their ability to assimilate wastes should be continued. At the same time, all waste discharges not necessary to proper functioning of our society should be severely restricted.

3. Impact of Oil Spills on Air Quality

This subject is addressed in section III.LL.1.d.

4. Impact of Oil Spills on Water Quality

An oil spill would have several impacts on the water quality of the Santa Barbara Channel. One impact is a reduction of sunlight which penetrates the sea surface and which is needed for growth by phytoplankton. Observations by Smith and others near Platform A on February 11, 1969, indicate that a surface oil slick can reduce light levels to 10 percent of values at the same depth just outside the oil slick. The effect of this reduction of light on phytoplankton populations is expected to be minor, because surface oil slicks move downwind faster than the water below the surface where the main phytoplankton concentrations are located.

A second effect would be a decrease in the concentrations of dissolved oxygen of the surface waters under the oil spill. Based on studies of the 1969 oil spill from Platform A, Kolpack (1971) noted that oxygen profiles in the Santa Barbara Channel were "normal" in May 1969, except that the concentration of dissolved oxygen in the upper 30 meters of the water column beneath an oil slick was lower than it was in unpolluted areas. Studies by the University of California at Santa Barbara, however, noted an unusually high concentration of dissolved oxygen at 100 to 400 meter depths during the period February to March 1969 (Ebeling, et al., 1971). This increase was related to partial flushing of Channel waters above the sill depth by intense winter storms and was not related to the oil spill. Smith (1969) reported that during the 1969 spill concentrations of dissolved oxygen "were significantly lower under the heavy oil slick than in clear water." Possible causes of the reduction in dissolved oxygen could be due to shading of light and consequent reduction of photosynthesis or due to an actual decrease of oxygen as a result of biodegradation of the oil.

Another effect would be the increase of hydrocarbon concentrations in waters adjacent to the spilled oil. Little data exist on typical hydrocarbon concentrations in water affected by oil spills. This may be due to measuring difficulties of hydrocarbon concentrations in the field, or to difficulties in sampling water that has been in contact with spilled oil for known periods of time. As discussed earlier, hydrocarbons dissolved in sea water from an oil spill are subject to a variety of processes (evaporation to the atmosphere, oxidation, and biodegradation) which reduce the concentrations of hydrocarbons in the water with time.

5. Impact on the Beaches and Littoral Zone[1]

When an oil slick reaches the coast, its behavior depends on the nature of both the oil and the shore. Much of the oil will be carried to the highwater marks of the strandline by successive tides. Well-weathered or heavy oil becomes mixed with mineral or vegetable particles during this process, forming oil cakes. The cakes that are thin, because they are composed of freshly spilled oil or because of hot sun action, may create problems by sinking into sand and gravel or clinging to marine plants.

The most troublesome beach to clean is one composed of large pebbles, between which oil may sink to a depth of several feet. Oil does not readily sink into wet sand, but breakers may throw fresh sand over it, burying it in layers. Thus, a badly polluted beach may appear clean shortly after an oil slick is stranded. The buried oil may be revealed later by the removal of surface layers during storms or in seasonal sand-movements.

Habitat types which tend to be especially vulnerable to oil pollution

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[1] Much of this material was abstracted from Nelson-Smith, 1970.

include wetlands, estuaries, marshes, mudflats, sandflats and enclosed or partially enclosed bays, lagoons, harbors, and marinas. Long-lasting effects on wetlands have occurred under certain conditions, e.g., damage from a spill of No. 2 fuel oil in a West Falmouth boat harbor and marsh could be detected by decreased biological diversity and productivity five years after the spill.

Oil may persist on dry rock surfaces or seaweed, barnacles, and mussels, where in addition to biological activity, it is slowly removed by drying, hardening and the incorporation of sand particles, finally eroding or flaking off. Although it fails to wet the mucous body surfaces of animals or the mucilaginous surface of seaweed, some oils cling to the byssus-threads of mussels, the hard outer layer of shells and the weeds which have a naturally oily surface.

If oil were to impinge on tidal marsh or wetland areas, local marine grass population could suffer. However, the damage would depend on the type of oil involved and the duration of coverage. Recovery of marsh plants is dependent upon whether or not oil penetrates into the sediment surrounding the root system of the plant. According to Dames and Moore (1974): "Baker's (1971a) experimentation with salt marsh plants has revealed an interesting effect: i.e., growth stimulation. Possible causes include increased water retention of oiled marsh soil, release of nutrients due to decomposition of oil-killed animals, nutrients or growth regulators in the oil, or nitrogen fixation by oil-degrading micro-organisms. Other work by Baker (1971b) indicates that salt marsh plants could probably survive two or three fresh oil dosings a year, providing that such dosings are followed by a recovery period. More frequent spills would eventually degrade the marsh, however."

Tide-pools become covered with a thick film of oil, but this has a surprisingly small influence on gas-exchange across the surface. For example, during a 24-hour test, water depleted of oxygen by boiling reached 99 percent oxygen saturation below a film of diesel oil 0.002 mm thick and 60 percent saturation below an 0.03 mm layer. A layer of crude oil 0.5 mm thick reduced the rate at which boiled seawater absorbed oxygen to 85 percent of that of an uncovered control during a six-day test. Over a two-day period, a 1.4 mm layer had no detectable effect; at worst, the amount of oxygen absorbed through the oil was 75 percent of that taken up by the control sample. Water beneath a 17 mm layer absorbed 73 percent as much as the control.

As mentioned earlier, light intensities are severely reduced beneath an oil spill. Although it seems probable that a layer of dark colored oil would raise the water temperature by its absorption of solar energy in the day and by reducing heat loss from the surface of the pool at night, measurements or estimates of the magnitude of this effect are not available.

Some of the impacts of the spill at Platform A on the beaches of Santa Barbara Channel were described by Holmes (1969) who found that:

> "On many rocky surfaces the entire plant and animal communities have been killed by a layer of encrusting oil which is often 1 to 2 centimeters thick. We have not observed any recolonization of either animals or plants on these oil covered surfaces. On other rocky surfaces a pronounced mortality of some of the high living barnacles of the genus *Cthalamus* have been observed. Oil adheres readily to the local eel grass (a higher plant) and a species of red alga (*Endocladia sp.*) resulting in the death of these species. Although oil is trapped in massive quantities in the kelp (*Macrocystis*) beds it does not seem to have caused appreciable damage to healthy plants. Otherwise intertidal organisms do not at the present time exhibit severe damage due to pollution. Some effects may take much longer to become visible than the 3½ months since January 28, 1969. Similarly, there may

be effects upon reproduction, migratory behavior, and life cycle phenomena which have been unnoticed or undetectable in the initial surveywork. Continuing study is required for some time in the future to evaluate the full impact of the oil spill upon the biology of the Santa Barbara area."

Straughan (1973) has attempted to determine the influence of the Platform A spill on the intertidal distribution of marine organisms. In analyzing data from surveys conducted in 1969, 1970 and 1972, she concluded that, with respect to rocky shore areas, sand movement and substrate stability were the two most important factors affecting the distribution and abundance of organisms. The effects attributable to oil were limited to isolated areas in the upper intertidal zone (*Chthamalus* mortality) and low tide pools (*Phyllospadix* dieback). Her preliminary work on sandy beach areas indicates that against the background of large seasonal environmental fluctuations and associated natural biota fluctuations no correlation could be found between the Santa Barbara oil spill and/or natural seepage and the distribution and abundance of sandy beach macrofauna.

Brisby (1973) summarizes the impacts on Rincon Island based on pre-existing and continuing studies:

"Our studies of the biotic community on Rincon Island were started a year and a half prior to the Santa Barbara oil spill, continued during the spill, and are still taking place today. In these studies, we have found that there was minimal effect to the life by the crude oil, primarily due to the ability of the organisms to migrate down to greater depths, close up their shells until high tide, or produce a mucus-like coating for protection. The storm which occurred at the time of the spill seemed to cause more damage to the marine life than the spill because of silting and the mechanical abrasion caused by floating debris. The biotic population continues to increase in both numbers and varieties. The population appears to be reaching a climax condition with over three hundred species present at this time, compared to some thirty species when the island was built some sixteen years ago."

Investigators with the California Institute of Technology (Jones et al., 1969) also studied the Santa Barbara spill at the peak of the problem and found that damage to the marine environment attributable to oil was very light.

Chan (1973), in studying the effects of the San Francisco Bay spill, recorded repopulation on rocky surfaces through settlement of normal numbers of marine larvae on the first spawning cycle after the spill. He concluded that there appeared to be no permanent damage from this spill of #6 fuel oil which was potentially more damaging than crude oil.

6. Impact on Birds

The most obvious damage to marine ecosystems from oil spills is to populations of aquatic birds. Little information is available to correlate the size of an oil spill to the extent of damage to bird populations. Very large spills have killed many birds, and it is possible that numbers killed may be roughly proportional to the size of the spill, but a variety of other factors also would influence the results. The abundance and species of birds present in the area will be a dominant factor determining the impact.

Bourne (1968) and Nelson-Smith (1970) have summarized physiological effects and behavioral aspects of birds in relation to vulnerability to oil spills. Species that swim at the surface such as cormorants are more susceptible than waders or species such as terns which dive from the air. This was the case in the Santa Barbara Channel oil spill, where swimming species had the highest mortality rates (Straughan, 1971).

A primary effect of oil on birds is the matting of feathers. Oil allows the penetration of air spaces by water, which eliminates heat insulation and reduces buoyancy. In large quantities, the oil impedes swimming movements. Straughan (1971) presented detailed survival data for oiled birds treated at the A. Child's Estate in Santa Barbara. Gulls had the highest survival rate (61 percent), while brandt cormorants, eared grebes, and ruddy ducks had zero percent survival rate. Impact of the oil spill depends on the number of birds present. During the spring and fall, bird populations are at a peak while, during the summer, populations are much lower. The number of birds killed during the 1969 spill was much lower than would be expected due to low population levels for that time of year.

Judging by the low survival rate of treated birds, treatment cannot be considered as a viable mitigative measure. The California Division of Fish and Game has stated: "It appears that humane disposal of oil-soaked birds is best, pending public acceptance." (California Resources Agency, 1971). During the Oakland Estuary spill which occurred in January 1973, almost 50 percent of the birds survived that were picked up alive. Improved techniques for cleaning and caring for oiled birds have improved the survivor rate from about five percent in 1971 to 41 percent in 1973. The results of ongoing research in improved cleaning agents, cleaning methods and after care is expected to further mitigate damage to wildlife as a result of oil spills. (Smith, D. C., 1975)

7. Impact on Mammals

a. Whales and Dolphins

Eight dead whales and eight dolphins were found on California beaches after the Santa Barbara oil spill. However, 1969 gray whale strandings were not significantly different from previous years, and it seems whales were unharmed by the spill. (Brownell, in Straughn, 1971, p. 271-276)

Orr (1969) indicates that 3 gray whales and 1 sperm whale were found dead along the central California coast and 1 pilot whale and at least 1 common dolphin were found along the southern California coast in February and March 1969. He also felt that the number of dead gray whales was not unusually high when compared to the numbers of gray whale carcasses reported for the previous 10 years. Autopsies performed on 2 male gray whale carcasses found in the San Francisco Bay area were inconclusive because the carcasses were decomposed. Some oil was noted on the baleen of 1 whale. The author felt it likely that the oil entered the mouth of the dead whale while the carcass floated on the sea surface. No oil was found in the gut or respiratory tract. Analysis of tissue samples sent to the Federal Water Pollution Laboratories disclosed no oil or chemical pollutants. The report concluded with the following statement:

> "One could conclude this account by saying that no positive evidence was obtained to show that any gray whales died on their northbound migration from the effects of crude oil pollution."

The California Division of Fish and Game reported that 4 porpoises were washed ashore during the period January 28 through March 31, 1969.

Autopsies performed on two of the carcasses failed to positively relate their death to oil.

Although the above reports do not attribute the whale and dolphin deaths to the oil spill, it cannot be stated that oil spills in the Santa Barbara Channel would not affect these mammals. Information is needed regarding subtle and long-term effects that oil spills have on these animals. In addition, the direct effects of oil on these animals are insufficiently documented.

b. California Sea Lions

California sea lions were one of the pinnipeds studied during the Santa Barbara oil spill of January 1969. The following quoted material is from the Allan Hancock report: (Straughan, 1971) "Contamination with crude oil did not have a marked effect on pup deaths on the rookery at San Miguel Island during the 1969 breeding season."

The following quoted material describes a study by LeBoeuf & DeLong (Straughan, 1971) dealing with sea lion pup mortality on San Miguel Island related to oil contamination from the Santa Barbara oil spill:

> "In an attempt to assess the effect of oil on *Zalophus* pup mortality, LeBoeuf and R. L. DeLong censused the pup population at Northwest Cove on June 16, 1969, by walking the length of the cove counting all live pups and pups that had died within the last two weeks (inferred from carcass decomposition). Both living and dead pups were divided into two categories: oily and non-oily. Oily pups were defined as pups with 25% or more of their bodies covered with crude oil. Pups with 25% or less of their bodies covered with crude oil were defined as clean. The results are shown below:

Total pups = 881

Total dead = 112 or 12.7% of total pups
Oily dead = 76 or 67.8% of total dead

Total living = 769 or 87.3% of total pups
Oily living = 352 or 45.8% of total living

In spite of the fact that 46% of the living pups and 68% of the dead pups were oily, the mortality rate was less than 13%. This figure is well within the normal limits alluded to earlier in this paper. The higher number of oily animals in the dead category may have been due to the fact that they had moved around the rookery and become more soiled than younger, living animals before they succumbed. On the basis of the above data, one still cannot exclude the possibility that oil contamination had a deleterious effect on pup health and in some way increased the probability of death. If this occurred, the effect was unquestionably very small."

Other reviewers dispute this conclusion on the basis of statistical tests. "The chi-square value was 19.08, which, with one degree of freedom yields $p < .001$ . . . . indicating that one could expect such a result to occur by chance . . . less than once in a thousand such censuses." (Connell, 1973)

However, a high level of pup mortality is normal. Bonnot, Clark, and Hatton (1938) reported an estimated 25 percent pup death on rookeries. They also reported that less than 50 percent of the pups produced reach the age of one year.

In 1968, a series of censuses were conducted on San Nicolas Island by R. W. Schreider and R. L. Brownell (first census only). From May 29 to August 22, the overall average of dead to living pups was 21 percent. Due to a variety of factors, it was felt that this figure was probably high.

O'Dell studied California sea lions during the 1969 and 1970 breeding seasons on San Nicolas Island and reported a pup mortality of more than 15 percent. He also reported that most carcasses washed out to sea quickly.

On San Miguel Island 697 pups were tagged during July 1970. Within two months, 15 percent of those tagged were found dead. It was stated that previous tagging studies conducted during a three-year period indicated that 3 percent of the dead could be attributed to tagging activities.

It was surmised that the causes of pup mortality on the rookery were similar to those reported by Keyes (1965) for the northern fur seal: "Malnutrition, trauma, parasitism, miscellaneous infection and gastrointestinal infections."

c. Elephant Seals

Between March 25 and March 28, 1972, over 100 elephant seal pups on San Miguel Island were observed to be coated with oil, sand, and detritus. The National Park Service subsequently requested an investigation of the situation. The results suggested that: "The oil caused neither illness nor mortality." (Straughan, 1971). In commenting on the study, LeBoeuf indicated that because 90 percent of the pups had already been weaned when the oil came ashore shortly before March 17, 1969, the problems of the pups ingesting the petroleum did not occur. One can presume that a problem of unknown proportions could occur as a result of the ingestion of oil by suckling pups if nursing females were contaminated.

Peterson and LeBoeuf (in Straughan, 1971) conducted a tagging study of weaned pups on San Miguel Island. Between March 25 and March 26, 1969, 714 weaned pups were tagged. Fifty-eight weaned pups and five yearling pups which were at least 75 percent covered with oil were tagged at the contaminated North West Cove. An equal number of clean pups was tagged at the uncontaminated West Cove. Two hundred and twenty-two out of a total 714 tagged weaned pups were sighted at least once along the California coast between April 1969 and June 1970. The overall return rate was 31 percent; the experimental group return rate was 40 percent and the control group return rate was 25 percent.

Observations indicated that all animals from both groups were in "apparent good health" (except for one animal from the experimental group). The observation of eight animals from both groups at least 408 kilometers north of San Miguel Island is an indication of the good health of the animals. One individual from each group was observed at San Nicolas Island, 120 kilometers south of San Miguel Island. LeBoeuf summed up the study as follows:

> "These data support the conclusion that the crude oil which coated many weaned elephant seals at San Miguel in March and April 1968, had no significant immediate nor long-term (1 to 15 months later) deleterious effect on their health. Had the rookery been contaminated earlier in the season when females were nursing, pups might have ingested the crude oil and more serious consequences might have ensued."

d. <u>Summary of Impacts on Marine Mammals</u>

The effect of crude oil on marine mammals is generalized below.

The Bureau of Sport Fisheries and Wildlife previously indicated that, since the Channel Islands serve as rookeries for some marine mammals, the threat of an oil spill there could be severe.

Apparently, birds and mammals on the open ocean avoid oil to some degree. The following supporting statement is from the California Division of Fish and Game, Progress Report on Wildlife Affected by the Santa Barbara Oil Spill, January 28, through March 21, 1969: "The number of birds and marine animals observed within the 780-square-mile study area---appeared to remain relatively stable, with birds and mammals moving away from the oil slick itself."

Because of many variables, it is difficult to assess the effect of petroleum contamination on marine mammals in quantitative terms. Studies have not detected significant adverse effects upon marine mammals; however, they have not excluded such possibilities either.

Kenyon (1971) states that fur seals on migration infrequently come in contact with petroleum products; however, when they enter busy shipping lanes, oil contamination may be significant. Kenyon also suggests that oil contaminated seals apparently do not survive to return to breeding grounds; and, since fur seals usually occur well offshore and the body is of greater specific gravity than water, dead animals would sink and thus would rarely be found on beaches.

Younger animals, especially pinnipedia pups, are small, inexperienced, comparatively helpless, and left alone for varying periods of time. A particular problem could be the ingestion of oil by suckling pups from the contaminated teats of nursing females.

The severity of impact should vary seasonally with most species. For example, cetaceans such as the gray whale would be vulnerable to oil spills during the migrating season. Pinnipeds, such as the California sea lion and elephant seals, would be most vulnerable during the breeding season when they are concentrated on the rookery and in the surrounding waters. Because of the normally high death rate among pups, it is difficult to determine the stress caused by oil spills on pinnipedia pups.

Existing data indicate that past petroleum contamination has not had marked adverse effects upon mammals within the Santa Barbara Channel. However, this does not mean that future instances of contamination would not have such an effect. There are many variables associated with an oil spill and a single variable or combination of several might create a situation where serious adverse effects would occur.

8. Impact on Marine Organisms

a. Nature of the Problem

Pollution of the ocean and the multitude of possible impacts of pollutants on marine ecosystems are worldwide problems of growing concern to many nations. The magnitudes of the problems are recognized by international governments and industry, and have been the subject of several national and international conferences in recent years.

A wide range of professional conclusions have been expressed regarding the impact of oil spills on marine and marine-related organisms. These differences result from: differences in the sampling and analytical techniques used; type and concentration of petroleum fraction used or observed; experimental organisms used or observed; laboratory vs on-site observations; and extremely important, on the meteorological, oceanographic, and geographic conditions and the composition of biota present.

Hydrocarbons are not foreign to the marine environment; they are synthesized by most, if not all, living organisms. Unicellular algae can produce normal paraffin hydrocarbons from carbon dioxide, water and nutrients; paraffinic hydrocarbons are found in most living organisms of the sea (Clark and Blumer, 1967). Even carcinogenic hydrocarbons may be synthesized by bacteria, algae and higher plants (ZoBell, 1971).

There are certain characteristic differences, however, between biologically produced hydrocarbons and petroleum hydrocarbons, both in the distribution of various hydrocarbon classes and in the molecular size of the hydrocarbons. Crude oil and petroleum products are complex mixtures that contain molecules of different sizes in a fairly even distribution whereas living organisms utilize specific biosynthetic pathways that produce hydrocarbons of specific size groups. Thus, biogenic hydrocarbons have a more uneven distribution of sizes and types than do those of petroleum.

Blumer (1970, p. 12) summarized some of the potential impacts of pollution with crude oil and oil fractions on marine ecosystems as follows:

- Direct kill of organisms through coating and asphyxiation.
- Direct kill through contact poisoning of organisms.
- Direct kill through exposure to the water-soluble toxic components of oil at some distance in space and time from the accident.
- Destruction of the generally more sensitive juvenile forms of organisms.
- Destruction of the food sources of higher species.
- Incorporation of sublethal amounts of oil and oil products into organisms resulting in reduced resistance to infection and other stresses (this is the principal cause of death in birds surviving the immediate exposure to oil).
- Incorporation of carcinogenic and potentially mutagenic chemicals into marine organisms.
- Low level effects that may interrupt any of the numerous events necessary for the propagation of marine species and for the survival of other species in the marine food web.

There are many known effects of different concentrations of hydrocarbons on various marine organisms. Moore et al.(1973) have summarized the relative toxicity tolerance levels of various groups of marine organisms to various petrochemical substances. Their data are shown in table III-4 (as given by Dames and Moore, 1974).

Quoting from Dames and Moore (1974): "It appears that marine larvae are among the most sensitive components of the ecosystem, although pelagic crustaceans and benthic invertebrates other than molluscs also appear to exhibit a high sensitivity. Larvae have been determined to be 10 - 100 times more sensitive than adults by some investigators, and larvae tend to be more sensitive than eggs (Moore, et al., 1973). Gastropods seem highly resistant to hydrocarbon toxicity, while bivalve molluscs appear somewhat less resistant. Data for fish are somewhat inconclusive, but there is evidence that, by virtue of their sensory capability and mobility, they can avoid contaminated areas in nature. This factor might carry important implications for migratory behavior of fish in the field."

Much of the toxicity tolerance information available is based on laboratory studies under controlled conditions. It is very difficult to extrapolate these data to the field, however, to predict the biological effects of an oil spill. A variety of oil spill sources are possible (e.g., pipeline rupture, barge collision, and blowout) and thus a variety of initial spill locations and spill volumes must be considered. Weather and oceanographic conditions at the time of a spill are extremely important in determining the concentration and distributions of the various oil components. Thus a variety of conditions must be considered for each possible type of spill. The time that a spill occurs is important because of temporal variations in the abundance of marine organisms and seasonal cycles of reproductive phases

TABLE III-4

SUMMARY OF TOXICITY DATA
(From Dames and Moore, 1974, Table A-7)
(manuscript in preparation)

Class or Organisms	Estimated Typical Toxicity Ranges (ppm) for Various Substances			
	SAD[1]	#2 Fuel Oil/Kerosene	Fresh Crude	Weathered Crude
Flora	10-100	50-500	$10^4 - 10^5$	Coating More Significant than Toxicity
Finfish	5-50	25-250	"	
Larvae (all species)	0.1-1.0	0.5-5	$10^2 - 10^3$	
Pelagic Crustaceans	1-10	5-50	$10^3 - 10^4$	
Gastropods (snails, etc.)	10-100	50-500	$10^4 - 10^5$	
Bivalves (oysters, clams, etc.)	5-50	25-250	"	
Benthic Crustacaens (lobsters, crabs, etc.)	1-10	5-50	$10^3 - 10^4$	
Other Benthic Invertebrates (worms, etc.)	1-10	5-50	$10^3 - 10^4$	

1 - Estimated concentration (ppm) of Soluble aromatic derivatives (aromatics and napthenoaromatics) causing toxicity

(nests, eggs, pups, larvae, etc.). An evaluation must be made of the occurrence of significant biota in areas containing hydrocarbons.

Extrapolation of laboratory data to the field only leads to a prediction of the immediate effects of hydrocarbons on organisms. It is even more difficult to predict the long-term or sublethal effects which may affect the marine ecosystem. The possibilities of such effects are largely speculative but have been the subject of concern to some ecologists.

Data gathered from on-site surveys of previous oil spills must be used with caution for prediction of effects of other spills even in the same place. Straughan (1971) reporting on investigations of the 1969 Santa Barbara oil spill noted the unusually heavy winter runoff at the time of the spill which reduced salinities, and increased sedimentation. Storms and high waves at the time reduced the volume of the oil by greater than normal rates of evaporation and dissolution. In addition, Ebeling et al. (1971) found that the few anomalies of macroplankton distribution which they were able to observe in the Santa Barbara Channel following the 1969 spill were related to climatic anomalies and not to the spill.

Compounding the problem of prediction of effects are other fluctuations of both vertebrate and invertebrate population levels that occur naturally. Thus qualitative or quantitative observations of a biological community might reveal normal conditions, unless a very large change was observed to correlate with the spill. Holmes (1969, p. 26), commented upon his own observations that phytoplankton abundance and species composition were not much changed following the Santa Barbara oil spill noted, " . . . the effects of oil pollution upon the phytoplankton cannot be detected with the methods employed." Various effects of oil on marine organisms are discussed below as 1) acute effects, and 2) sublethal and possible long-term effects.

(1) <u>Acute Effects</u>

Saturated hydrocarbons characterized by a low-boiling point are related to the fat-soluble anaesthetics and have a narcotic effect on a wide variety of animals. In lower animals at low concentrations they often cause inactivity or reversible insensibility. At high concentrations they cause cell damage and death, especially in larval and juvenile stages of marine organisms.

Low-boiling point aromatic hydrocarbons comprise the most toxic petroleum fractions. These, such as benzene, toluene and phenols, are poisonous to man and marine organisms alike. Low-boiling point aromatics, even more water-soluble than the saturates, can cause mortality of marine organisms by contact, even with dilute solution (Blumer, 1970, p. 3).

The higher-boiling point aromatics act more slowly than the lower-boiling aromatic hydrocarbons, but they may have adverse impacts. On the other hand, higher-boiling point saturated hydrocarbons occur naturally in many organisms and are probably very low in toxicity.

Some concept of the acute effects of petrochemicals on specific marine organisms may also be gained from table III-5 from Dames and Moore (1974). The figures presented in the table are based on laboratory studies and while they may serve as a guideline to understanding the general effects of petrochemical types on marine organisms it should be reiterated that physical and chemical factors in the natural marine environment could significantly alter any predicted effects.

In addition to the natural factors which may alter predicted oil spill

TABLE III-5

From Dames and Moore, Table A-6
(Manuscript in Preparation)

SUMMARY OF LABORATORY TOXICITY EXPERIMENTATION--EFFECTS OF CRUDE OIL AND PETROLEUM DERIVATIVES ON MARINE ORGANISMS

(ADAPTED FROM MOORE, et al, 1973)

Common Name	Scientific Name	Substance and Reported Amount	Estimated Hydrocarbons in Solution	Duration	Response	Reference	Remarks
Phytoplankton	Chlorococcum Sp.	Soluble extract from 50 ml in 1 liter water 0,25,50,75, 100% "saturation"	1-5 ppm 100% "saturation"	10 days	No response	(Moore, et al. (1973) Kauss, et al. (1972))	
Phytoplankton	Cosmarium Sp.	Soluble extract from to ml in 1 liter water 0,25,50,75, 100% "saturation"	1-5 ppm "saturation"	12 days	Growth inversely proportional to percent saturation	(Moore, et. al. (1973) Kauss, et al. (1972))	
Phytoplankton	Chlorella vulgaria	Soluble extract from 50 ml "Gulf" crude in one liter water 0, 10, 25, 50, 75, 90% "saturation"	1-5 ppm 100% saturation	10 days	Growth suppressed	(Moore, et al. (1973) Kauss, et al. (1972))	Suppression attributed to a decrease caused by oil
Phytoplankton	Chlorella vulgaria	Benzene	25-500 ppm 500-1744 ppm	10 days 10 days	Initial inhibition for 2 days, then growth Lethal toxicity	(Moore, et al. (1973) Kauss, et al. (1973))	Four day LD_{50} 650 ppm (estimate from Kauss data)
Phytoplankton	Chlorella vulgaria	Tuluene	25-250 ppm 500 ppm	10 days 10 days	Slight inhibition Lethal toxicity	(Moore, et al. (1973) Kauss, et al. (1972))	Four-day LD_{50} 175 ppm (estimate from Kauss data)

Phytoplankton	Chlorella vulgaria	Benzene	25-500 ppm 500-1744 ppm	10 days 10 days	Initial inhibition for 2 days, then growth Lethal toxicity	(Moore, et al. (1973) Kauss, et al. (1973))	Four day LD_{50} 650 ppm (estimate from Kauss data)
Phytoplankton	Chlorella vulgaria	Tuluene	25-250 ppm 500 ppm	10 days 10 days	Slight inhibition Lethal toxicity	(Moore, et al. (1973) Kauss, et al. (1972))	Four-day LD_{50} 175 ppm (estimate from Kauss data)
Phytoplankton	Chlorella vulgaria	O-Xylene	25-50 ppm	10 days	Slight inhibition Lethal toxicity	(Moore, et al. (1973) Kauss, et al. (1972)	Four day LD_{50} 70 ppm

Table III-5 continued

Common Name	Scientific Name	Substance and Reported Amount	Estimated Hydrocarbons in Solution	Duration	Response	Reference	Remarks
Phytoplankton	Chlorella vulgaria	Seven Alberta crudes concentrations unknown		10 days	Two-day inhibition then stimulation	(Moore, et al. (1973) Kauss, et al. (1972))	
Phytoplankton	Chlorella vulgaria	Smiley Colville (an Alberta crude) soluble extract		10 days	Slight inhibition over 10-day period		
Phytoplankton	Numerous species	"oil" .00001-1.0 ml/l; most used .001-1. ml/l	(.01-1000 ppm)	5 days	Death 1 ml/l. (1000 ppm) delayed cell division 1.0-.001 ml/l (10-.01 ppm)	Mironov (1970)	Does not describe oil used or whether concentrations quoted are soluble or not
Kelp	Macrocystis angustifolia	Diesel fuel .01%-1% emulsion	1-100 ppm	7 days	Loss of photosynth ability	North et al (1964)	Tampico Maru spill resulted in kills to members all phyla.
Kelp	Macrocystis angustifolia	Benzene n-hexane toluene	10 ppm 10 ppm 10 ppm	96 hrs. 96 hrs. 96 hrs	Slight photosynth inhibition. No effect. Visible injury, 75% reduction in photosynth	Wilber (1968)	
Coelenterate	Tubularia corcea	Crude 0.1-5%			"Quickly lethal"	Nelson-Smith in Hepple (1971)	
Coral	Several species	Corexit (0-500 ppm) crude oil 0-500 ppm (slick) and mixtures		24 hrs.	Harmful at 100-500 ppm (not necessarily completely in solution) dispersant more toxic than oil	Lewis (1971)	Crude oil concentrations given were not completely dissolved
Sandworm	Nereis virens	Crude oil B			96 hr LD_{50} 6100 ppm	LaRoche, et al. (1970)	
Limpet Perwinkle Periwinkle	Patella vulgata Littorina littorea Littorina littoralis	Various crudes		Sprayed on for 1 hr.	1-89% mortality for L. littoralis L. littorea very resistant. P. vulgata very sensitive	Ottway in Cowell (1971)	High mortality correlates with asphaltenes and low boiling compounds (aromatics, especially).
Periwinkle	L. littorea	Crude oil weathering BP 1002			Weathered oil less toxic than oil and BP 1002	Perkins in Carthy & Arthur (1968)	Oil weathered for 24th in lab. Simulated tidal washing in lab.

Table III-5 continued

Common Name	Scientific Name	Substance and Reported Amount	Estimated Hydrocarbons in Solution	Duration	Response	Reference	Remarks
Mussels	Mytilus edulis	1000 ppm crude emulsion	60 ppm		No deaths, but mussels could not attach properly	Smith (1968)	
Cockles	Cardium edule	Phenol			$48LD_{50}$ - 500ppm	Nelson-Smith in Hepple (1971)	
Mussles	Mytilus edulis	"Laboratory" weathered (24 hours) Arabian crude plus Correxit or Dispersol approximately .5ml/cm^2 + 10% dispersant		Four tidal cycles	No toxicity for crude oil only; 50% mortality with dispersol plus oil		Simulated tidal conditions
Mussels	Mytilus californianus	0-10^5ppm Santa Barbara crude (as surface film)	0-100ppm	34 days	10^4 and 10^5ppm caused significant mortality	Danter, Straughan, and Jessee (1971)	Individual from area (Coal Point) subject to natural seeps possibly less susceptible than those from other areas; data not conclusive
Mussels	Mytilus edulis	1000mg/l mineral oil (paraffin only) 1-8mg/l heptadecane 100ppm tetralin 1ppm loluene, napthalene, 3,4-benzpyrene	0 0 100ppm 100ppm 1ppm	Up to 6 days Up to 6 days Up to 6 days Up to 6 days	No mortality No mortality Toxic Not toxic	Lee (1972)	Primarily an experiment to investigate uptake and incorporation
Lobsters	Homarus americanus	.001 - .1 ml/l Venezuelan crude	(.01-1 ppm)	24-96 hrs.	$96LD_{50}$ .03 - 002 ml/l	Wells (1972)	.001 ml/l had little effect; .1 ml/l very toxic
Lobsters	Homarus americanus	Bunker C and various dispersants		7-14 days	4-day LD_{50} for Bunker C 10,000 ppm	Scarratt et al (1970)	Lobster fishery of Chedabucto Bay not damaged by Arrow spill; lobsters considered very resistant

Table III-5 continued

Common Name	Scientific Name	Substance and Reported Amount	Estimated Hydrocarbons in Solution	Duration	Response	Reference	Remarks
Barnacle	Balanus balanoides	Crude oil	2ppm		2% is toxic	Nelson-Smith in Hepple (1971)	
Barnacle	Balanus sp.				Larvae 100 times more sensitive than adults	Mironov, (1970)	No information on experimental methods
Barnacle	Elminius modestus	0-100ppm BP1002 1000 ppm Kuwait	0 - 20 ppm	Various	0-3 ppm BP1002 increase mortality some reduction of activity	Corner, et	Original article contains much more data on other dispersants and other tests; adults resistant up to 100 ppm BP1002
Barnacle	Elminius modestus	100ppm film of Kuwait	.1ppm	24 hours	Some inhibition of cirral beat	Corner, et al (1968)	
Copepod	Several species	.001-.1/1 "oil"	(possibly 1-100 ppm)		Insensitive to .001 ml/1, 100% death	Mironov (1969), cited in Mironov (1970)	Experimental methods not described
Shrimp	Panaetus sp. Palaemonetes	Crude oil plus emulsifiers (1-100 ppt)	(1-100 ppm)		$48LD_{50}$ = 1-40 ppt crude oil $48LD_{50}$ = .5-5 ppt crude plus Corexit	Mills and Culley (1971)	See reference for detailed breakdown; oils with higher proportion of aromatics most toxic
Sea Urchin	Strongylocentro purpuratus	Extracts of 25ml crude and bunker C oils in 500ml sea water 6.25% - 50% dilutions	(.1-1ppm)		Fertilization not affected; lowest dilutions interfere with fertilized egg development	Allen (1971)	Urchins generally very sensitive
Atlantic Salmon	Salmo salar	1-10,000 mg/1 temporary emulsion Bunker C	0-1 ppm	7-14 days	4 day LD_{50} 10,000 mg/1 7 day LD_{50} 2,000 mg/1	Sprague and Carson (1970)	
Plaice	Rhombus	"oil" 10^{-4} -10^{-5} ml/1		2 days	Lethal toxicity to eggs	Sprague and Carson (1970)	
Shad	Alosa	Gasoline #2			LD_{50} 24 48 96 Gas 91 91 - #2 204 167 - C -2, 417 1,952	Tagatz (196)	Loss of toxicity by

Table III-5 continued

Common Name	Scientific Name	Substance and Reported Amount	Estimated Hydrocarbons in Solution	Duration	Response	Reference	Remarks
Mullet	Mugil cephalus Micropogon undulatus	#2 Diesel oil .01-10% emulsified	.002-2 ppm		LD_{50} (48 hrs) 420 ppm (acute) LD_{50} (chronic) 42 ppm	Texas Instruments (1971)	Safe at 4.2 ppm
Plaice	Rhombus maeoticus	"oil" 10^{-4}-10^{-5} ml/1			40 to 100% hatched prelarvae perished	Micronov (1968)	No information on experimental methods
Cod and Flounder		Bunker C film - 100 ppm	0	96 hours	35% pulled in stagnant water, not affected in running water	James (1926) reported in Kuhnhold (1970)	No information on experimental methods
Black Sea		10-100 ppm dispersion of Russian crude	.01 - 1ppm	2-3 days	100% eggs killed	Mironov (1967) Kuhnhold (1970)	No information on experimental methods
Herring		10^3 and $2x10^4$ ppm film		2.5 - 3.5 days	100% eggs killed	Kuhnhold (1969) reported in Kuhnhold (1970)	No information on experimental methods
Cod	Gadus morrhua	Extract of Venezuelan oil in water		100 hours	40% higher mortality than control	Kuhnhold	Libyan (high paraffin content) did not cause increases in mortality;
		10^4ppm	.10ppm		10-20% increase in mortality		
		10^2ppm					
		Extracts of Iranian crude					
		10^4ppm	10ppm		99% killed		
		10^3ppm	1ppm		63% killed		
		10^2ppm	.1ppm		33% killed		
		Control			21% killed		
Cod	Gadus morrhua	Extracts of Iranian crude in water		1-10 days	Time to death for larvae exposed for 1 day	Kuhnhold	Young larvae less resistant than embryo; Herring less resistant;
		10^4ppm	10ppm	4.2 days			Plaice more resistant Libyan crude affected more than embryos
		10^3ppm	1ppm	8.4 days			
		10^2ppm	.1ppm	14 days			
			control	14 days			
		10^3 plus 10-100ppm Correxit 7664	100-1000ppm	3 to 6 hours			
		10-100ppm Correxit 7664	0	No effect			

effects would be the introduced unnatural effects from the application of any chemicals used in the cleanup process. St. Amant (1970) summarized some of the adverse effects which may occur when detergent or dispersant chemicals are employed:

- Detergents or dispersant chemicals may cause the oil to adsorb on mud and silt particles which sink to the substrate or float in the water column where they are more available to filter feeders.
- Adsorbed oil on bottom particles appears to take longer to degrade.
- The use of chemicals to disperse the oil involves placing an additional load of foreign and undesirable material in the ecosystem. Many of the dispersants tested proved to be far more toxic than oil. On the other hand, third generation dispersants have been developed that are effective and have very low toxicity when properly applied.
- Dispersal of oil does not allow proper mapping or study of polluted areas.
- Floating oil is probably the least damaging position for oil to occur in the ecosystem. Here it degrades more rapidly--its only effect is at the interface and, except in intertidal areas and marshes, it will usually dissipate, degrade and be mechanically dispersed by wave action with little apparent effect on the ecosystem.

Table III-6 which follows is taken from Moore, et al. (1973/1974) and represents a compilation of much of the work to date on the toxicities of various chemical cleanup materials. It should be noted, however, that stringent regulations are in effect regarding the use of any chemicals for oil spill containment or cleanup (Council on Environmental Quality, 1973).

(2) <u>Sublethal and Possible Long-Term Effects</u>

The long-term impact of the acute effects would probably be insignificant for most species in, and for the general ecology of, the Santa Barbara Channel. Specific predictions of the long-term effects of an oil spill in the Channel are difficult because of the complexity of the factors involved.

In areas where an oil spill occurs and rapid dispersal is inhibited by

TABLE III-6

From Dames and Moore, Table A-11
(Manuscript in Preparation)

TABLE A11 - SUMMARY OF LABORATORY TOXICITY EXPERIMENTATION--EFFECTS OF OIL SPILL CLEAN-UP AGENTS ON MARINE ORGANISMS

(ADAPTED FROM MOORE, et al., 1973)

Organism							
Common Name	Scientific Name	Substance and Reported Amount	Estimated Hydrocarbons in Solution	Duration	Response	Reference	Remarks
Phytoplankton	Various species	BP 1002 Emulsifier without kerosene	1.2×10^{-3} ppm 1.2 ppm		Generation time and lag phase lengthened below 1.2 ppm lethal toxicity	(see Moore, et al., 1973)	Brackish water species better able to withstand membrane damage caused by emulsifier (solution in lipid layer)
Coral	Several species	Corexit (0-500 ppm) Crude oil 0-500 ppm (slick) and mixtures		24 hours	Harmful at 100-500 (not necessarily completely in solution) dispersant more toxic than oil		Crude oil concentrations given were not completely dissolved
Coral Coelenterate	Calliactis parasitica	BP 1002	5ppm		24 Hr. LD_{50} = 25	Smith (1968)	
Anemones	2 species	BP 1002	5-10 ppm		24 Hr. LD_{50} = 25-50ppm	Smith (1968)	
Polychaete Annelids	Cirriformia tentaculata	BP 1002 Essolvene Corexit 7664			24 Hr. LD_{50} (ppm) BP / Essolvene / Corexit C. tentaculata: 30 / 63 / 100,000 C. cirratus: 129 / 162 / 100,000	George (1970)	
Polychaete annelid	Arenicola marina	BP 1002	6 ppm		96 Hr. LD_{50} = 30ppm	Perkins in Carthy & Arthur (1968)	
Polychaete annelid	Nereis diversicolor	BP 1002	5 ppm		24 Hr. LD_{50} = 25ppm	Smith (1968)	
Sandworm	Nereis virens	"BP"			96 HR. LD_{50} = 165ppm	LaRoche et al. (1970)	Only code names of 10 dispersants are given. Sandworm is one of the most valuable marine products in New England.
Polychaete	Sabellaria spinulosa	.5 - 1 ppm BP 1002	.1 - .2 ppm	Several hours to several days	1ppm caused 100% mortality; .5ppm caused abnormal development	Wilson (1968)	Death definitely due to kerosene solvent in BP 1002

Table III-6 continued

Organism: Common Name	Organism: Scientific Name	Substance and Reported Amount	Estimated Hydrocarbons in Solution	Duration	Response	Reference	Remarks
Cockles	Cardium edule	Detergents	0-20ppm	Variable	$48LD_{50}$ for BP 1002 81ppm	Portmann & Connor (1968)	$48LD_{50}$ for many detergents given
Mussel	Mytilus edulis	BP 1002	.4ppm		$24LD_{50}$ = 90ppm $48LD_{50}$ = 2ppm	Perkins (1968)	
Cockle	Cardium edule	BP 1002	.4ppm		$24LD_{50}$ = 20ppm	Perkins (1968)	
Mussel	Mytilus edulis	0-100ppm BP 1002	0-20ppm	24 hours	5ppm BP 1002 not lethal in 24 hours 10ppm BP 1002 lethal	Smith (1968)	Also obtained information on sublethal concentrations
Periwinkle	Littorina neritoides Littorina saxatillis	BP 1002 BP 1002			Toxicity dependent on season: least toxic in winter (water temp. 10°C) highest in summer (water temp. 18°C) BP 1002 much more toxic than BP 1100	Crapp in Crowell (1971)	Data difficult to summarize by species; experiments were [illegible] small scale and contained many uncontrolled variables, making quantification of results difficult
Limpet	Patella vulgata						
Dogwhelk	Thais lapillus Gibbula umbillicalis Littorina obtusata						
Razor clam	Ensis siligua	BP 1002			24 Hrs. LD_{50}=0.5ppm	Smith (1968)	Subtidal speciel
Queen scallop	Chlamys opercularis				24 Hrs. LD_{50}=1ppm		
Oysters	Crassostrea gigas	Various detergents 0 - 3ppm	0 - .5 ppm	24 hours	3ppm of all detergents toxic	Smith (1968)	Also similar results for many other marine invertebrate larvae
Periwinkle	Littorina littoren	BP 1002		24 hours 24 hours	LD_{50} 100 ppm LD_{50} 100 ppm	Smith (1968)	Intertidal species periwinkles may recover from 100 ppm all detach from substrate before dying
Dog Whelk	Nucella lapillus	0-100 ppm	0-20 ppm		LD_{50} = 100 ppm		
Top-shell	Monodonta lineata				LD_{50} = 5 ppm		
Limpet	Patella vulgata						
Limpet	Patella vulgata	BP 1002 0-200 ppm			96h LD_{50} = 5 ppm	Perkins in Carthy & Arthur (1968)	Data supports Ottway's conclusions

Table III-6 continued

Organism: Common Name	Organism: Scientific Name	Substance and Reported Amount	Estimated Hydrocarbons in Solution	Duration	Response	Reference	Remarks
Periwinkle	Littorina littoralis	BP 1002			24 LD_{50} = 250 ppm		
Periwinkle	L. littorea	BP 1002			24 LD_{50} = 2000 ppm		
Oysters		BP 1002	2-20ppm		10-100ppm BP 1002 lethal	Simpson (1968)	
Periwinkle	L. littorea	Crude oil weathering BP 1002			Weathered oil less toxic than oil & BP 1002	Perkins in Carthy & Arthur (1968)	Oil weathered for 24h in lab. simulated tidal washing in lab.
Mussel	Mytilus edulis	"laboratory" weathered (24 hours) Arabian crude plus Correxit or Dispersol approximately .5ml/cm^2 + 10% dispersant		4 tidal cycles	No toxicity for crude oil only; 50% mortality with Dispersol plus oil	Nelson-Smith in Hepple (1971)	Simulated tidal conditions
Barnacles	Balanus balanoids	BP 1002	2 ppm		100% survival at 10ppm	Perkins (1968) in Carthy & Arthur (1968)	
Hermit Crab	Eupagurus bernhardus	BP 1002	1ppm		96 hours LD_{50} = 5ppm		
Crab	Carcinus maenas	BP 1002	6ppm		96 LD_{50} = 30ppm		
Crab	Cancer pagures	BP 1002	2ppm		24 LD_{50} = 10ppm	Smith (1968)	
Shrimp	Crangon vulgaris	BP 1002	4ppm		24 LD_{50} = 2ppm		
	Carcinus maenas	BP 1002	5ppm		24 LD_{50} = 25ppm		
Copepod	Calanus finmarchicus	1-50 ppm BP 1002 Gamlen Dasic Molyslip Houghton Solvent 112	.2-10 ppm	1 hour 3 days	50 ppm detergent caused 100% mortality in an hour; 5-10 ppm detergents caused high mortality in 3 days; 1 ppm was injurious	Smith (1968)	
Copepod	Acartia clausi	5-100 ppm BP 1002	1-20 ppm	10-1000	Lethally toxic at all concentrations	Smith (1968)	BP 1002 5 times as toxic as Dasic; Acartia much less resistant than Calanus; suggests small animals toxicity is related to size

Table III-6 continued

Organism		Substance	Estimated Hydrocarbons in				
Common Name	Scientific Name	and Reported Amount	Solution	Duration	Response	Reference	Remarks
Pink Shrimp	Pandalus	BP 1002			48 hr. LD_{50} = 5.8 ppm	Portmann and Connor (1968)	
Hermit Crab	Diogenes pugilator	BP 1002	5ppm		$24LD_{50}$ = 25ppm	Smith (1968)	
Crustaceans	Several	1-10 ppm BP 1002	.2 - 2 ppm		1ppm BP 1002 lethal	Portmann & Connor (1968)	Larvae 10-100 times as sensi-. tive as adults
Shrimp	Crangon crangon	Various emulsifiers	1ppm	48 hours	$48LD_{50}$ for FP 1002 = 5.8ppm	Portmann & Connor (1968)	
Shore crab	Carcinus maenas	Various emulsifiers	3ppm	48 hours	BP 1002 $48LD_{50}$ - 15ppm		
Lobster	Homarus gammarus	Various emulsifiers	4ppm	48 hours	BP 1002 $24LD_{50}$ - 20ppm		
Barnacles	Elminius modestus	1-100ppm BP 1002	0-20ppm	48 hours	100% mortality with 100ppm; 5ppm shows sub lethal effect	Corner, et al. (1968)	
Barnacle	Elminius modestus	0-100ppm BP 1002 1000ppm Kuwait	0-20ppm 1ppm	Various	0-3ppm BP 1002 in-crease mortality some reduction of activity	Corner, et al. (1968)	Original article contains much more data on other dispersants and other tests; adults resis-tant up to 100 ppm BP 1002
Shrimp	Penaetus sp. Palamonetes sp.	Crude oil plus emulsifiers (1-100 ppt)	(1-100ppm)		$48LD_{50}$ = 1-40 ppt crude oil $48LD_{50}$ = .5-5 ppt crude plus Corexit	Mills and Culley (1971)	See reference for detailed breakdown; oils with higher proportion of aromatics most toxic
Lobsters	Homarus americanus	Bunker C and various dispersants		7-14 days	4 day LD_{50} for Bunker C 10,000ppm	Scarratt et al. (1970)	Lobster fishery of Chedabucto Bay not damaged by Arrow spill; lobsters considred very resistant
Starfish	Asterias rubens	BP 1002	6-8ppm		24 hr. LD_{50} = 40ppm 96 hr. LD_{50} = 30ppm	Perkins in Carthy & Arthur (1968)	
Starfish	A. rubens	BP 1002	5ppm		24 hr. LD_{50} = 25ppm	Smith (1968)	
Brittlestar	Ophiocomina nigra	BP 1002	1ppm		24 hr. LD_{50} - 5ppm	Smith (1968)	

Table III-6 continued

Organism		Substance and Reported Amount	Estimated Hydrocarbons in Solution	Duration	Response	Reference	Remarks
Common Name	Scientific Name						
Atlantic Salmon	Salmo salar	Corexit 8666 1-10,000 mg/l complete emulsion		7-14 days	4 day LD_{50} 10,000 mg/l	Sprague & Carson (1970)	Authors point out probability of sublethal-long-term effects of oil dispersant at lower conc
Atlantic Salmon	Salmo salar	1-10,000 mg/l complete emulsion BP 1100 B BP 1100 Gulf agent 1009 Naphtha gas Dispersant 88 Dispersol SD BP 1002 XZIT x-1-11	2-200ppm	7-14 days	4 day LD_{50} 1-100 mg/l		Authors believe Corexit is micorially degraded; the by-products of this process, either from Corexit or waste from microbes, are toxic after 7 days building in test tank
Atlantic Salmon	Salmo salar	Bunker C and Corexit 866		7-14 days	4 day LD_{50} 7 day = 100-1000 mg/l	Sprague & Carson (1970)	
Flounder	Pseudopleuronectes americanus	Bunker C and Corexit 866		7-14 days	4 day LD_{50} 10,000 mg/l 7 day LD_{50} 1000 mg/l	Sprague & Carson (1970)	
Cod	Gadus morrhua	Extracts of Iranian crude in water 10^4 ppm 10^3 ppm 10^2 ppm 10^3 plus 10-100ppm Correxit 7664 10-100ppm Correxit 7664	10ppm 1ppm .1ppm control 100-1000ppm	1-10 days 4.2 days 8.4 days 14 days 14 days 3 to 6 hours No effect	Time to death for larvae exposed for 1 day	Kuhnhold	Young larvae less resistant than embryo; Herring less resistant; Plaice more resistant; Libyan crude affected larvae more than embryos
Plaice	Pleuronectas platessa	0-10ppm	0-2ppm	1-30 days	10ppm BP 1002 killed 100%; 2.5ppm BP 1002 reduced survival by 50%	Wilson (1970)	See original article for consierably more detail; some mortality delayed due to effects on feeding and larval development

geographic or oceanographic factors, very long recovery periods may be involved. However, since the area affected directly by a spill is usually relatively restricted, once the oil has been removed, community replenishment through natural recruitment processes is usually rapid. Most of the marine organisms would be reestablished by either active migration of juvenile and adult forms, or planktonic drift of larval stages. While current knowledge of subtle extended effects of spilled oil is poor, it would be difficult to show that damage from oil spills greatly exceeds that which may be attributed to the natural catastrophies of weather (i.e. storms, warm spells, cold spells, etc.). (Dames and Moore, 1974)

Lewis (1970, p. 6) commenting on approaches to the study of recurrent pollution states " . . . that without a massive expansion of ecological and reproductive data by simultaneous multi-disciplinary studies not only will we be unable to detect the significant long-term changes, but we will even remain unaware of the most suitable or important species and methods to build into a monitoring program." Also noted was the general lack of understanding of community structure and population dynamics which limits the interpretation of data and predictive ability.

Chemical pollution of the tissues of organisms can be detected by advanced analytic methods such as those employed by Blumer, Souza, and Sass (1970). Their work suggests that the consequences of pollutant hydrocarbons in marine ecosystems is as yet not understood.

Blumer's (1969, p. 10) studies on organic compounds in the marine food chain found that hydrocarbons, once they are incorporated into a particular marine organism, are relatively stable, and he hypothesized that they may pass through many members of the marine food chain without alteration and be concentrated in tissue. Smith (1968, p. 49) reported that the presence of oil and benzene-ring compounds in the feces of limpets browsing on an oily deposit has been demonstrated chemically; similar observations have been made on top-shells, *Monodonta,* and limpets, *Patella,* living on oily rocks. He reported, ". . . the proportion of oil in material ingested by these animals was estimated as about 20 to 30 percent in *Patella* and 5 to 50 percent in *Monodonta*." Lee, Sauerheber and Benson (1972) have shown that the mussel *Mytilus edulis* can rapidly take up a wide range of hydrocarbons from solution. Most of this is discharged if the animals are placed in clean water but significant amounts persist for an undetermined period. These authors reported that the mussels were unable to metabolize the hydrocarbons.

The same carcinogenic hydrocarbons found in crude oil are synthesized by plants, phytoplankton, and bacteria. The amounts formed by marine plants, which are the first step of the food chain, are many orders of magnitude greater than the amounts present in the oil which might enter the sea. Yet there are no cases of cancer attributed to eating seafood. They are present in marine organisms in areas where no oil was present. Systematic studies have been carried out along the coast of France (Mallet, 1961) and the Bay of Naples (Bourcart and Mallet, 1965) in developed areas where petroleum products are likely to be entering the water. The west coast of Greenland, a practically unpopulated coast with very little shipping, has also been studied (Mallet, Perdriau, and Perdriau, 1963).

Samples of molluscs and mussels from Greenland waters contained equal or greater amounts of the carcinogenic hydrocarbon 3-4 benzpyrene than did similar organisms from either the Bay of Naples or the coasts of France. This suggests that nature not oil is really controlling the distribution of carcinogenic hydrocarbons in marine organisms. Whenever one has looked carefully for carcinogenic hydrocarbons in organisms, he has found them whether oil was present or not.

Some doubt remains as to the direct carcinogenicity of crude oil and crude oil residues in marine organisms (Blumer, 1969, p. 9), but evidence is accumulating according to Blumer, (1970, p. 40). There are many other natural and manmade sources of carcinogens in the sea (ZoBell, 1971). A literature search and evaluation conducted for the U. S. Coast Guard by Batelle Memorial Institute (1967, pp. 6-19) noted that shellfish, although alive, may be unfit for consumption because of the carcinogenic hydrocarbons 3, 4-benzpyrene found in their bodies. Oysters that were heavily polluted and contaminated with ship fuel oil were also reported to contain 3, 4-benzbyrene. The Batelle review also reported barnacles attached to creosoted poles located in marine waters contained the same carcinogenic hydrocarbon (3, 4-benzpyrene), and it elicited sarcomas in mice when extracts from the barnacles were injected into the mice. The endemic occurrence of papillary tumors around the rectal opening of soft shells clams (*Mya arenaria*) was reported, but the author (Batelle Memorial Institute, 1967, pp. 6-19) did not feel these were due to oil pollution, even though the clams were taken from waters adjacent to areas highly polluted by ship fuel oil.

Recent laboratory studies by Anderson (1973) and Lee (1972) and co-workers demonstrate that marine organisms can rapidly purge themselves of hydrocarbons when they are placed in clean water. According to Anderson it is unlikely that hydrocarbons would be retained long enough to build up in the food chain. The work of other scientists support this viewpoint. Burns and

Teal (1973) concluded that "there was no relation between the hydrocarbon content of the animals and their supposed position in the food chain" after they had analyzed various members of the pelagic Sargassus community. Other papers by Lee (e.g. 1972) report that fish can through action of the gall bladder change a carcinogenic hydrocarbon into a hydrocarbon which is not carcinogenic and that this product is lost through the fish's urine. Seafood has been exposed to natural oil seeps in the Santa Barbara Channel and elsewhere for many years.

Another postulated sublethal effect is that dissolved hydrocarbons may interfere with chemo-receptors, the sensory system used by some organisms for locating food, responding to sex attractants, and identifying migration routes (Blumer, 1969, p.7; 1970, p.6). It must be pointed out, however, that responses of animals apparently are very specific to chemical stimuli and that masking or mimicking these may, therefore, be considered highly improbable.

Another possible long-term effect that could possibly arise from recurrent oil pollution is the tainting of fishery products. Cartley and Arthur (1968) state that tainting becomes more apparent when there is a persistent low level of oil contamination. This does not appear to have been a problem in the Santa Barbara Channel and the possibility seems to be remote, considering the large volume of water involved and the relatively great interchange with the Pacific Ocean waters.

Exposure of sublethal concentrations of oil has shown no effect on growth rate of oysters (Anderson, 1973) and shrimp (Cox, 1974). The results agree with those obtained by Mackin and Hopkins (1962) who found no difference in the growth rate between oysters growing in an area subjected to oil contamination and that of control oysters in an uncontaminated area. Straughan (1974) did not find that the natural oil seeps near Santa Barbara affected the growth rate of marine organisms living in the area. Batelle-Northwest studios (1974) at Lake Maracaibo exposed lisa, a fish native to that area, to Tia Juana Medium crude oil. No effect on growth rate was observed. Growth rate integrates many life processes and physiological factors.

Still another possible long-term effect is the ability of oils to concentrate dangerous chlorinated hydrocarbons, such as DDT. Their higher solubility in oil than in water enables emulsified oil to remove these pollutants from the water column and concentrate them either at the surface (Seba and Corcoran, 1969) if the oil later floats, or at the bottom (Hartung and Klinger, 1970) if the oil later sinks. Use of DDT has been curtailed in the United States but this persistent pesticide is still concentrating in the ocean from past use. In addition the same concentrating mechanism presumably will also apply to PCBs which are entering the ocean from industrial and other sources. PCBs are chemically similar to DDT and may have some of the same undesirable effects.

The persistence of spilled oil in the marine environment is difficult to quantify. Certainly much of the lighter fractions are lost due to evaporation, however some may be trapped for extended periods in tar balls. ZoBell (in press) indicates that virtually all types of hydrocarbons are susceptible to microbial degradation under favorable conditions. However, optimum conditions are never found in nature and limiting factors such as temperature, available nutrients and oxygen as well as the toxicity of some of the hydrocarbons themselves reduces the rate of biodegradation. Johnston (1970) found, for example, that 90 percent of the crude oil covered by sand decomposes slowly even with added nutrients. On the other hand, normal beach processes usually mix and shift the sands during the year increasing the rate of degradation. Also autoxidation (non-biological oxidation) and photochemical breakdown occur. Some spilled oil sinks due to adhesion to sediments and other processes where physical transport tends to move it toward deeper waters (Kolpack, 1971).

Accumulation of petroleum derived hydrocarbons may not be an adverse impact. For example, Dames and Moore (1974) state: "Although marine organisms appear to take up and transfer petrochemicals, there is little evidence as yet of food chain magnification." Much of the concern about uptake of petrochemicals is based on the fact that some of the polycyclic aromatic hydrocarbons are carcinogenic or are potentially toxic. Many of these same chemicals are found widely in nature. According to the National Academy of Sciences (1975): "There is no evidence for food web magnification in the case of petroleum hydrocarbons in the marine environment. On the contrary, evidence is strongest that direct uptake from the water or sediments is more important than from the food chain, except in special cases."

b. Probable Impacts of Oil Spills from Santa Barbara Channel Operations

Since the 1969 Santa Barbara oil spill, better prediction of impacts of possible future oil spills in the general area is possible (Straughan, 1971; Kolpack, 1971).

(1) Littoral and Benthic Organisms

Initial effects of the 1969 Santa Barbara spill on these organisms was relatively slight and recovery from damage was rapid. There was some initial damage to surfgrass (*Phyllospadix)* the brown alga *Hesperophycus* and to red alga *Endocladia sp.*, the first two of which rapidly recovered (California Department of Fish and Game, 1969; Holmes, 1969). Algae of the higher tidal zone *(Enteromorpha, Chaetomorpha, Ulva, Ralfsia, Porphyra, Endocladia, Hildenbrandia* and *Rhodoglossum)* were also either covered or damaged by oil (Foster, Neushul and Zingmark, 1971). Some high tide zone animals, particularly the small barnacle *Chthamalus fissus,* were the only other notable mortalities in this zone. Tide pool animals were not affected for the most part, probably because the oil floated over them (Cimberg, Mann and Straughan, 1971). In general, the principal mode of damage was from smothering. This requires that the surface of the organism be wettable by oil. Apparently surfgrass is penetrable even when submerged. Some of the other plants (primarily algae) are protected by mucus while wet but not when dry. Animals large enough to protrude through encrusting oil, such as *Balanus glandula* are less affected even though subject to drying.

The only sublethal effect observed in the studies was reduced breeding in the low intertidal stalked barnacle *Pollicipes polymerus* and the mussel *Mytilus californianus* in local areas (Straughan, 1971, pp. 223-244). Reproduction of several species of barnacles and limpets apparently were unaffected.

Benthic animals of the subtidal and bathyal zones were apparently little, if any, affected (California Department of Fish and Game, 1960; Straughan, 1971).

As already mentioned, the possible effects of potential spills could result in greater damage than that described above, depending on meterological and oceanographic conditions. In general, one might expect results similar to what was found in 1969, but possibly more intense in the intertidal, subtidal and wetland areas.

(2) Pelagic Organisms

The impact on plankton and fishes was very slight. Oguri and Kanter (in Straughan, 1971) and Holmes (1969) were unable to detect any major lasting effect on phytoplankton. Morin (in Kolpack, 1971) found no mortality in foraminifera attributable to oil pollution. Ebeling, Warner, and DeWitt (1971), studying near-shore macroplankton and fish, found no effects except a temporary reduction in a kelp-associated mysid shrimp. As pointed out earlier, drifting oil accumulated in kelp canopies before reaching shore. Either this action affected the mysids habitat or directly affected the mysids in a significant way but did not permanently eliminate the species.

California Department of Fish and Game (1969) assessed damage to fish by several trawling and sonar transects. They were unable to detect any damage from the oil spill and did not note any oil contamination of bottom trawling gear. In addition, the Department observed fish in the Underwater Gardens aquarium in Santa Barbara harbor, which they considered a large bioassay of the effect of dissolved petroleum components. No adverse effects were found.

There appears to have been no significant occurrence of flesh tainting of fishery products as a result of the 1969 oil spill (personal communication from Jack Schott, California Department of Fish and Game, February 27, 1973). Some complaints of tainting were made but it was believed these resulted from hauling the catch directly through an oil slick.

9. Socio-economic Impacts of a Major Oil Spill

The social and economic cost of a major spill is difficult to assess even after the event, but a reasonable approximation may be obtained. A major oil spill resulting from implementation of continued Santa Barbara Channel operations is possible. If such a spill did occur, it probably would not have the same economic impacts as the 1969 spill from Platform A because of the probable different location and geological conditions involved. In addition, the existence of more effective containment and clean-up capabilities would prevent oil from reaching the beaches in many cases. The social and economic cost of an oil spill is further discussed under the subheading Socio-economic Impacts (section III.N.6.e.).

LL. Impacts on Air Quality

The effects on air quality that could be expected from possible expanded oil and gas activity in the Channel are presented here. The information is summarized in the following three sections titled "Individual Facility and Occurrence Emissions", "Potential Levels of Development of the Channel", and "Overall Impacts of the Potential Levels of Channel Development." A detailed analysis of each potential source of emission products is provided in the first section.

An emission inventory was prepared and it appears in the third section.

1. Individual Facility and Occurrence Emissions

Air pollutant emissions and impacts resulting from the various potential levels of development of the Santa Barbara Channel can be predicted by reviewing the emissions rates, and characteristics of several types of oil recovery facilities and potential accidents.

Possible normal emission sources from offshore activities, onshore treating and storage facilities, and marine tanker terminal operations are discussed herein. Accidental and emergency releases occurring from oil spills, oil and gas fires, and occasional flaring of hydrocarbons during process malfunctions are also covered.

To determine the effects of the potential levels of Channel development, the effects of individual facilities must be related to environmental conditions and the number and location of each facility type that would be required for the various levels. A description of conditions and the range of potential levels and the necessary numbers of each facility type follows in the section on "Potential Levels of Development of the Channel."

The Emissions Inventory Table and a discussion of it are presented in the section titled "Overall Impacts of the Potential Levels of Development."

a. Offshore Exploration, Development, and Production

Significant portions of this section were excerpted from the "Final Environmental Impact Report on Resumption of Drilling Operations in the South Ellwood Offshore Oil Field from Platform Holly, 1974."

Exploration and Development

Short-term, small incremental increases in offshore traffic would be associated with the exploratory and development drilling phases of the various possible levels of development of the Channel. Emissions from gasoline and diesel-powered sources on supply and drilling ships and platforms would have a minor, short-term adverse impact on air quality. Since no terrain would be disturbed, no dust production is envisioned. Debris burning will not be allowed.

Drilling operations will be designed to avoid gas leakage from wells or spill of liquids from which vapors would evaporate. Therefore, no significant impact on air quality is anticipated during normal operations. Applicable laws, regulations, and inspection procedures would be followed. Although unlikely, the possibilities of well blowout (with or without ignition) and oil spill during the drilling phase cannot be ruled out. Impacts upon air quality associated with these events are discussed in the oil spill air impacts section.

Production

For the purpose of assessing impact upon meteorology/air quality associated with increased petroleum production in the Channel area, the process flow diagrams and individual pieces of equipment associated with existing offshore facilities in the Channel were studied to identify actual and potential emission sources. Appropriate available data concerning each identified sources were obtained from various operations in the Channel area.

The production systems that would be associated with the various levels of development are designed for total containment, and no substantial emission sources would be operative during normal operations.

In the event of upsets, the frequency of which cannot be predicted at this time, emergency flare stacks would be operative for periods of a minute or two before production would be shut down. During operation, the incineration of hydrocarbon gases at flare stacks would produce an effluent to the atmosphere. The composition and flow rate of this effluent would depend upon the type and amount of production at the time. Substantial amounts of sulfur dioxide, nitrogen oxides, and other combustion products would be liberated to the atmosphere per unit time.

Impacts from Offshore Activity

During normal operations, production from offshore platforms would have little, if any, adverse impact upon air quality.

In the event of an upset requiring use of the emergency flare stack, substantial quantities of various pollutants (described above) per unit time would be liberated to the atmosphere for a period up to several minutes. Ambient air quality standards probably would be exceeded in the vicinity of the platform during this operation. However, given the short duration of emission and the long distances to shore, it is unlikely that air quality standards would be exceeded at the coastline. Although operation of the flare stack produces a short-term adverse impact on air quality, its use is designed to avoid malfunctions capable of producing more serious adverse impacts.

Applicable laws, regulations, and inspection procedures would have to, of course, be followed. Although unlikely, the possibilities of well blowout (with or without ignition) and oil spillage associated with increased production from platforms cannot be ruled out. Impacts on air quality associated with these events are discussed in the oil spill air impacts sections.

b. Onshore Treating and Storage Facilities

The information presented in this section was mainly excerpted with some modification from "Report - Review of Daniel, Mann, Johnson, & Mendenhall EIR Meteorology/Air Quality - Exxon Treatment Facilities Canada del Corral for Exxon Co., U.S.A." prepared by Dames and Moore.

Onshore treating and storage facilities for liquids and gases will generate air emission products. The types, quantities, release regimes, and impacts expected for an 80,000 bbl/day onshore facility are discussed here. The model for the analysis is similar to that proposed for the Santa Ynez Unit onshore facility at Las Flores Canyon by Exxon.

Construction

The construction and operation of a petroleum production facility would be planned in three phases: (1) construction of the oil treatment and storage facility; (2) operation of the oil facility and concommitant construction of the gas treatment, sulfur recovery, and LPG recovery facilities; and, (3) operation of both oil and gas facilities accompanied by increases in capacity until the maximum design capacity was reached about five years later. The projected work force and approximate time span for each phase are listed below. Phase (1) 85 persons, seven months; Phase (2) 115 persons (65 construction, 50 operating), eight months; Phase (3) 50 persons, 40 years (U.S.G.S., 1974).

Construction and fabrication operations would have to be conducted in accord with County APCD rules and regulations. Cleared vegetation and construction debris would be removed from the property to an approved dump site. Dust associated with terrain modification would be confined largely to the immediate area and would be minimized by a watering program. Emissions associated with paints, solvents and other volatiles would be minimized.

Emissions associated with vehicular traffic generated by commuters as well as those produced by gasoline- and diesel-powered trucks used to market sulfur and LPG products would be considered as new traffic in the area (table III-6a). Movements of construction equipment were considered as redistributed traffic in the area. Emission factors reflecting reduced emissions from passenger vehicles during the 1975-1980 period were used.[1] In addition to the primary air contaminants shown in the table, small quantities of sulfur oxides and suspended particulates would be produced.

The estimated emissions associated with the various phases of a construction project would represent a very minor, incremental increase in present mobile source emissions in the Channel area (table III-6a). The same situation would be true when the project traffic is compared, on an equal trip length basis, to existing traffic either near the average commuter trip end in the urban area or on U. S. Highway 101 in the area. The percentage increase for emissions in rural areas is higher than that in urban areas, but it nevertheless is small (table III-6a).

On-site construction activity would produce short-term, minor adverse impacts on local air quality. Vehicular emissions associated with such a project would produce oxidant precursors in urbanized areas where ambient air quality standards for oxidants are exceeded. However, the small magnitude of these emissions militates against significant adverse impacts being

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[1]Truck emission factors for 1980 were unavailable. The use of 1973 values for trucks accounts for the high NO_x values in the 1980 estimates.

TABLE III-6a

ESTIMATED VEHICULAR EMISSIONS AND EMISSION COMPARISONS, CONSTRUCTION AND OPERATION OF THE ONSHORE PETROLEUM PRODUCTION FACILITIES, BY PHASES

	Vehicle Type and miles per day[1]		Emissions (Tons per day)[2,3] Carbon Monoxide (CO)	Reactive Hydrocarbons (HC_R)	Nitrogen Oxides (NO_X)	% Increase of Present Mobile Emissions in Region[4]	% Increase of Present Mobile Emissions in Urban Areas near Trip End[5]	% Increase of Present Mobile Emissions in Rural Area[6]
Phase 1	Auto	3400	0.094	0.013	0.022	0.11	0.29	1.19
Phase 2	Auto	4600	0.127	0.017	0.029	0.14	0.39	1.60
Phase 3	Auto	2000	0.031	0.004	0.009			
	Truck	684	0.015	0.003	0.026			
			0.046	0.007	0.035	0.16	NO_X 0.30 0.12 CO & HC_R	NO_X 1.24 0.49 CO & HC_R
	Auto	2000	0.031	0.002	0.006			
	Truck	3116	0.070	0.014	0.123			
			0.100	0.016	0.129	NO_X 0.58 0.08 CO & HC_R	NO_X 0.90 0.19 CO & HC_R	NO_X 3.75 0.80 CO & HC_R

LEGEND TO TABLE III-6a

[1]Based on work force and likely LPG/sulfur production projections, and average trip lengths of 20 and 38 miles for commuter traffic and product hauling trucks, respectively. Distances of 20 and 38 miles represent trip lengths from the El Capitan area to Santa Barbara and the eastern Santa Barbara County line, respectively.

[2]Tons per day = number of vehicles per day x number of miles per round trip x emissions per vehicle mile.

[3]Phase 1 and 2 auto emissions based on 1973 SCOTS emission factors. Auto emissions for initial and maximum design capacity stages of Phase 3 based on 1977 and 1980 emission factors, respectively (SCOTS, 1974). Truck emissions based on factors for heavy-duty, diesel-powered vehicles (U. S. Environmental Protection Agency, 1973).

[4]Based on Air Quality (baseline).

[5]Based on 60,000 trips per day and 1973 SCOTS emission factors (SCOTS, 1974).

[6]Based on 14,400 trips per day and 1973 SCOTS emission factors (SCOTS, 1974).

produced upon either regional or local air quality.

Production

For the purpose of assessing impact upon air quality associated with petroleum production at an 80,000 BBL/Day facility, a process flow diagram and individual pieces of equipment were studied to identify actual and potential emission sources. Production processes were categorized into three groups for analysis and discussion purposes: (1) oil treating and storage facilities; (2) natural gas treating and sulfur recovery facilities; and, (3) liquid petroleum gas (LPG) recovery facilities. An emission inventory was prepared and individual sources were grouped by frequency of occurrence. These groups included continuous and periodic scheduled sources associated with normal operations and unscheduled sources associated with emergency events. Appropriate available data concerning the process flow diagram and emission inventories were provided by Exxon Company, U.S.A.

An array of prevailing and "worst case" meteorological conditions applicable in the onshore study area was developed from the synoptic climatology presented in the Meteorology Section. Given the available equipment specifications and the array of prevailing and "worst case" meteorological conditions, appropriate diffusion formulas were utilized in order to conservatively estimate ambient ground level concentrations of various pollutants in the vicinity of the project. These concentrations were then compared to Federal/State air quality standards and estimates of local air quality in order to determine if the standards would be exceeded. Impact on the atmospheric environment of both normal operations and emergency events were considered.

Oil Facilities

Process flow and air pollution control features are shown in figure III-13. As shown in figure III-11a, oil and water emulsion enter the facility through a pipeline from the offshore platform. The oil has been heated and gas separated from oil on the platform, and oil vapor pressure has been reduced below atmospheric pressure to preclude vapor evolution from the onshore tankage. The oil enters two 10,000-barrel surge tanks, which utilize both a floating roof and a closed cover to trap any vapors. The oil is pumped out of the surge tanks through a heat exchanger into electric treaters where the oil-water emulsion is broken by heating and electrostatic action. The eight treating vessels are direct-fired vessels, which burn sweet natural gas and operate with sufficient excess air to avoid emissions of hydrocarbons or carbon monoxide. All of the tankage is vented through a closed collection system to a Vent Vapor Incinerator.

Oil from the treaters is collected in four closed floating-roof storage tanks, which are connected to the vapor collection and incineration system. Periodically, oil is pumped from the storage tanks to a Marine Terminal.

The water separated from the oil in the treaters is piped to two 10,000 barrel Dirty Brine Storage Tanks. These closed tanks are blanketed by sweet natural gas to exclude oxygen and the tanks are connected to the closed vent collection system. Any excess vapor resulting from tank filling is burned in the Vent Vapor Incinerator. Water is pumped to a Coalescer Filter where solids and any minor remaining quantities of oil are removed. The Filter is periodically backflushed with bed agitation by sweet natural gas. This gas is collected and incinerated. The filtered brine is collected in a closed tank prior to pumping into a sub-surface disposal well. Oil removed by the Coalescer, backwash brine, and any remaining oil are piped to a closed Brine

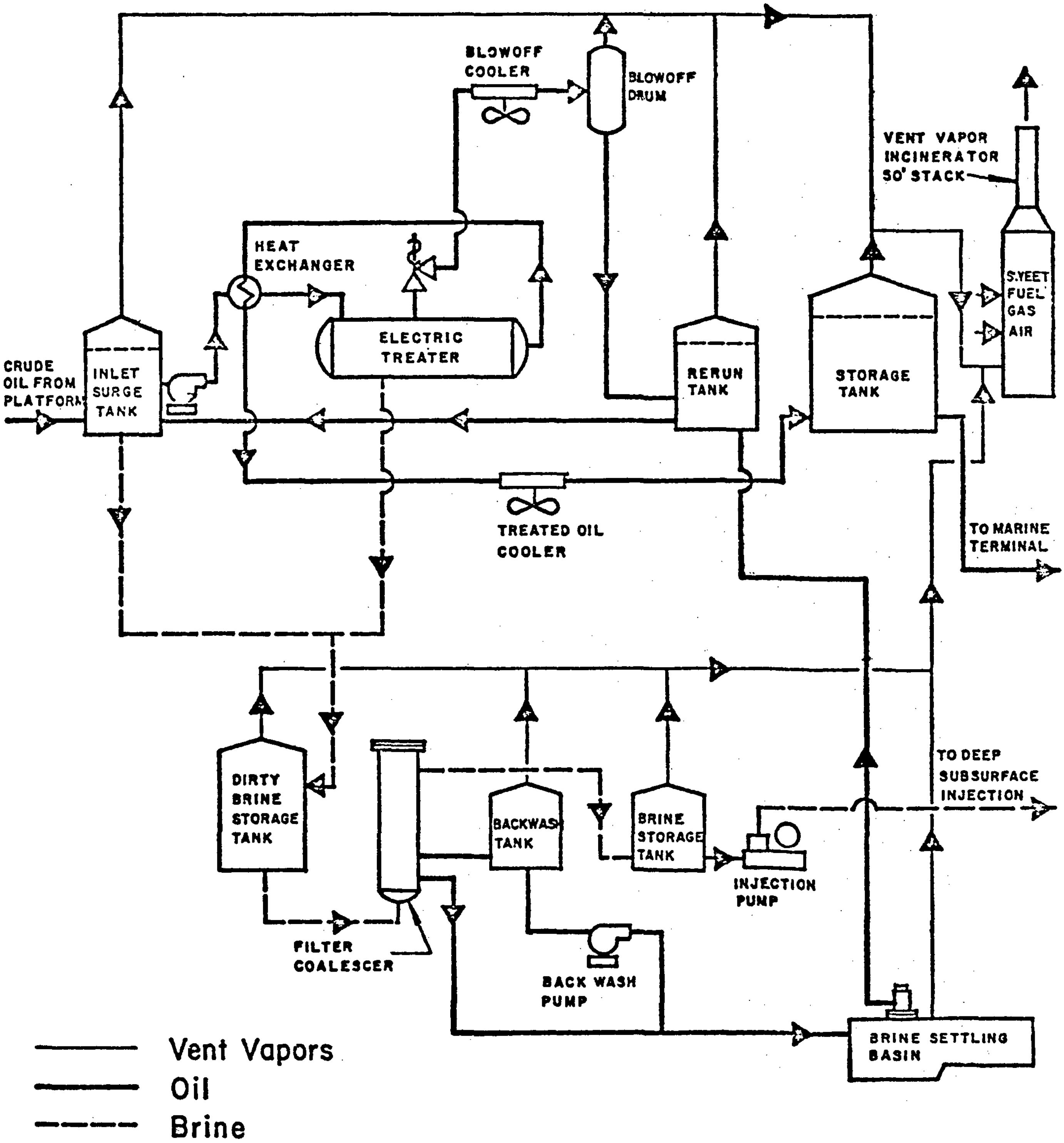

FIGURE III-11a

SIMPLIFIED PROCESS FLOW DIAGRAM
OIL TREATING AND STORAGE FACILITY

Settling Basin, where oil can be salvaged and brine can be rerun through the Filter. The closed basin is blanketed by sweet natural gas and any vapors which may be released are taken to the Incinerator.

The closed vapor collection system from all tanks, sumps, and the filter coalescer is routed to the Vent Vapor Incinerator, which exhausts to the atmosphere through a 50-foot stack. Air in the required quantities is blown into the Incinerator to convert any hydrogen sulfide to water and sulfur dioxide, and to burn any hydrocarbons to water and carbon dioxide. There are normally only minor volumes of combustible gases feeding the Incinerator, since hydrocarbon vapors have been removed from the crude oil on the platform. Only a small pilot flame and an annular burner, fueled by sweet natural gas, are burned continuously to maintain the required temperature of 1400^{o}F.

Hydrocarbon Pumps are equipped with dual mechanical seals which prevent any significant leakage of oil or vapor. Drains from all vessels are piped in a closed system to the Brine Settling Basin. Vessel emergency relief valves are piped to a knockout drum which separates oil from vapor in the event of an emergency over-pressure. Liquids from the knockout drum enter the Brine Settling Basin, via the closed drain system, and vapors are routed to the Incinerator. Pressure, level and temperature sensors will sound alarms and alert the operator to emergency conditions or excessive vapor incineration.

An emergency generator for operation of alarms, controls, and shutdown equipment after an electrical power outage is included in the facilities. This generator is powered by a 300-horsepower gas turbine fueled by sweet natural gas. The generator will be run about four hours per week to confirm its operability. A fire water pump driven by a 50-horsepower natural gas or diesel fueled engine will similarly be run four hours weekly.

Gas Treating and Sulfur Recovery Facilities

This discussion covers operation of the facilities at a maximum production rate of 90 million Standard Cubic Feet per Day. Sour gas produced on an offshore platform and transported to shore through an underwater pipeline enters an inlet separator, where any liquids which may have condensed in the pipeline are collected (figure III-11b). The gas is heated and enters a vessel where it is contacted with a diethanolamine (DEA) solution. This solution removes the carbon dioxide and hydrogen sulfide from the gas. The treated gas leaving the DEA unit enroute to the LPG Recovery System has a sulfur content of less than 1 grain (.00014 pound) per 100 Standard Cubic Feet. The carbon dioxide and hydrogen sulfide ("acid" gases) are stripped from the DEA solution in a still and the "acid" gas enters the Sulfur Recovery Unit.

The three-stage Claus Sulfur Recovery Unit recovers elemental molten sulfur from the hydrogen sulfide contained in the "acid" gas effluent from the DEA Unit. This unit recovers 95-96 percent of the inlet sulfur. The sulfur is collected in a closed Sulfur Tank. The main effluent stream from the Claus Plant enters the Tail Gas Cleanup Unit, a proprietary unit licensed by Institute Francais du Petrole (IFP). This unit recovers sulfur in molten form and brings total sulfur recovery to 99.3 percent. Sulfur produced by this unit is drained to the closed Sulfur Tank.

Effluent vapor from the IFP Tail Gas Cleanup Unit and any vapors from the Sulfur Tank are incinerated in a Tail Gas Incinerator. "Acid" gas from relief valves which would operate in the event of overpressure in the low pressure "acid" gas section of the DEA Unit are also piped to the Incinerator.

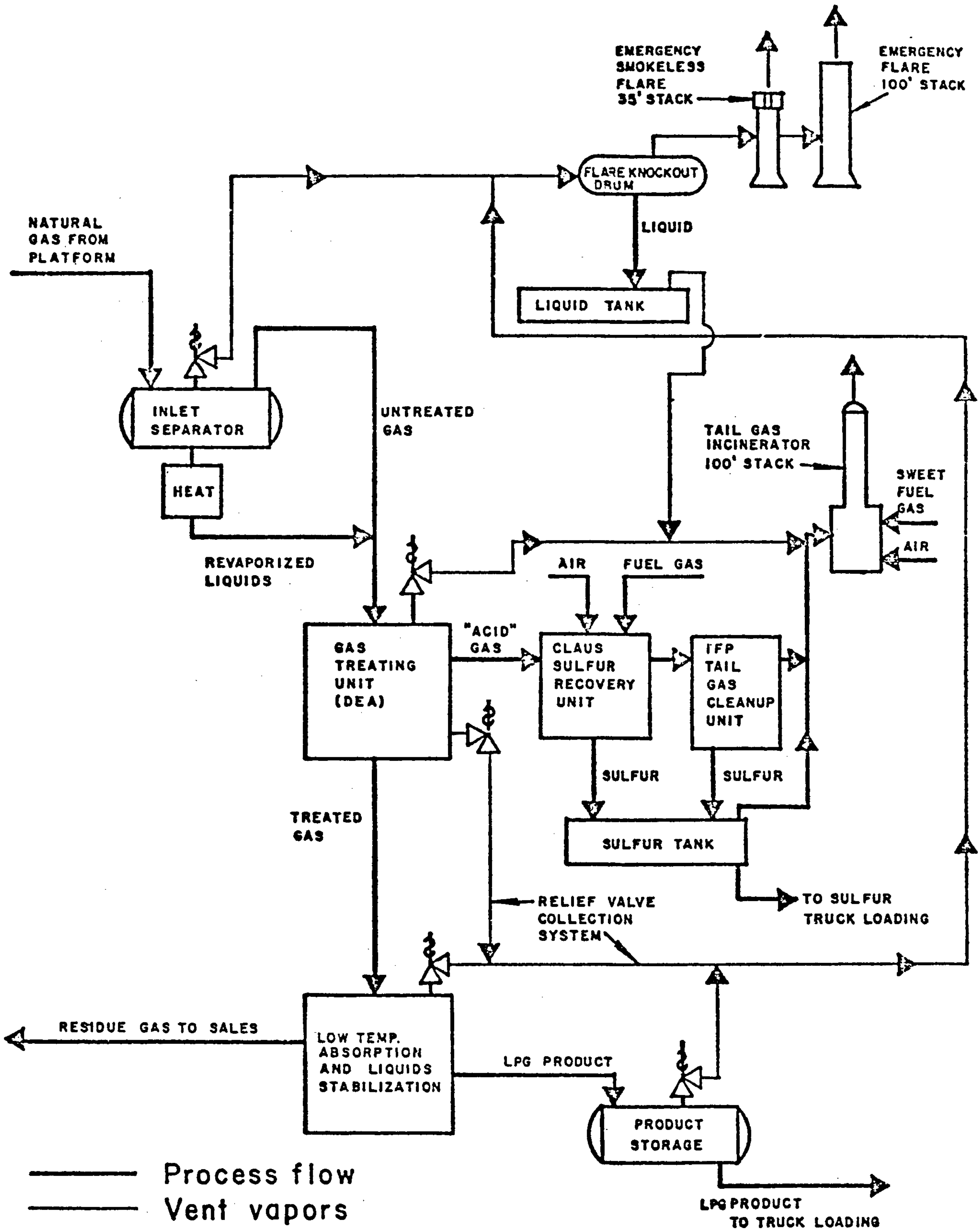

FIGURE III-11b

SIMPLIFIED PROCESS FLOW DIAGRAM

NATURAL GAS, TREATING, SULFUR RECOVERY, AND LPG RECOVERY FACILITIES

The Tail Gas Incinerator burns unrecovered hydrogen sulfide into sulfur dioxide. Sulfur Dioxide in the Sulfur Recovery Plants' effluent is mixed with the incinerator feed gas. The outlet from the Tail Gas Incinerator is vented from a 100-foot stack. The Tail Gas Incinerator operating temperature is controlled at 1200^{o}F to insure complete conversion of the hydrogen sulfide to sulfur dioxide. Sweet natural gas is used for fuel in the incinerator.

Emergency relief valves from the various systems are piped to a closed flare collection system which will contain any vapor released through accidental overpressure. The flare collection lines enter a flare knockout drum where entrained liquid is removed to prevent entry and subsequent smoke production in the flare stack. The vapor from the flare knockout drum enters a flare system consisting of a fan-assisted smokeless flare stack for rates up to 22 million Standard Cubic Feet per Day. Above this rate, vapor enters a 100-foot emergency flare stack. Liquids from the flare knockout drum enter a closed collection tank. Vapors from this tank are vented to the Tail Gas Incinerator stack. Drains from the amine system vessels are collected in a closed amine tank, and any vapors which evolve from this tank go to the Tail Gas Incinerator stack. None of the vessel drains are continuous; they are only used intermittently for maintenance or operational tests. All vents and drains not frequently used are plugged. Frequently used valves (such as for sampling) will be double-valved to eliminate leakage.

Level, pressure, flow, and temperature sensors are connected to audible and visual alarms which alert the operator to off-normal conditions, excessive incineration (indicating above-normal venting) or improper equipment operation. The Claus Plant operation will be continuously monitored to assure adequate sulfur removal. Sulfur production rate is checked to confirm recovery. Gas treating is monitored by a hydrogen sulfide detector on the gas outlet from the treating plant.

Hydrocarbon Recovery Facilities

Sweetened gas from the Gas Treating Unit at the rate of 87 MMCFD enters the Hydrocarbon Recovery Facilities. This plant consists of a refrigerated absorption process which recovers propane and heavier hydrocarbons from the gas and fractionates the recovered hydrocarbon liquids into two products: 111,000 gallons per day of commercial propane and 107,000 gallons per day of butanes-plus liquid.

All hydrocarbon vapors discharged from the facility either by safety relief valves or by manual or automatic control valves will be collected in a flare system and routed to the knockout drum and smokeless flare (figure III-11b). Emergency flares of gas from the hydrocarbon recovery facilities will not contain any appreciable quantities of hydrogen sulfide, so essentially no sulfur dioxide will be generated if a flare occurs. The combustion products (nitrogen, water, and carbon dioxide) will be vented to the atmosphere. Liquid drains from all vessels will be into a closed drain system terminating in a Hydrocarbon Vent Tank. Vapors from this tank will be burned in the Tail Gas Incinerator. Open drain lines will be sealed so that Vent Tank vapors cannot backflow through open drains.

Refrigeration service will be provided by three 1100 horsepower gas turbines fueled by sweet natural gas. The exhaust from these units, consisting primarily of air, will be routed to waste heat recovery furnaces. Supplemental gas fuel will be added to provide the required heat duty. The effluent from this furnace will consist of the turbine exhaust plus the combustion products of the supplemental fuel (air, carbon dioxide, water, nitrogen, and small quantities of NO_x)

Direct-fired furnaces will be used for standby glycol dehydration, sulfur plant heaters, and Amine Still reboilers. These units will be operated with controlled combustion and adequate excess air to maintain complete combustion of the sweet natural gas fuel. Stack constituents will be water, nitrogen, carbon dioxide, air, and small quantities of NO_x.

All hydrocarbon pumps will be equipped with tandem mechanical seals which, in service will exhibit practically no leakage. All vents and drains not normally used frequently will be plugged. Frequently used vent valves (such as for sampling) will be double-valved to eliminate leakage. Pressure, level, temperature, and flow sensors will be connected to visual and audible alarms to alert the operator of abnormal conditions such as impending process upsets or flaring, so that corrective action can be taken. Periodic stack gas surveys and flame and burner visual inspections will be made to assure correct combustion in fired equipment.

Product propane and butanes-plus liquid will be contained in pressure vessels with no vapor emission. Truck loading procedures will provide for vapor return to storage tanks so that no hydrocarbon is vented during the loading operations.

Emissions from the Onshore Facility

Estimated Emissions Inventory associated with petroleum production activity from the described facility are indicated in tables III-6b and III-6c. These emissions pertain to the maximum proposed design capacity of the facility as discussed in the Process Flow Section.

Emissions associated with normal, day-to-day operations are shown in table III-15b. Sources are categorized on the basis of petroleum production function and frequency of occurrence. Table III-6c shows emissions

TABLE III-6b

EMISSION INVENTORY - ONSHORE FACILITY, SCHEDULED SOURCES

SOURCE	ESTIMATED EMISSIONS-POUNDS PER DAY				
	HYDROCARBON	HYDROGEN SULFIDE	SULFUR DIOXIDE	NITROGEN OXIDES	CARBON MONOXIDE
CONTINUOUS SOURCES					
Oil Facility					
Crude Oil Heaters (8 units)	--	--	4.8	152.0	--
Vent Vapor Incinerator (Includes tank vents for oil and water storage tanks and drain sump vents)	--	--	22.0	4.0	--
Gas/Sulfur/LPG Treating Facility					
Tail Gas Incinerator	--	--	384.0	12.0	--
Gas Turbine/Waste Heat Recovery Furnace	--	--	5.0	302.0	173.0
Amine-Reboilers (2 units)	--	--	4.0	106.0	--
Sulfur Plant Feed Heater (2 units)	--	--	0.4	1.2	--
Converter Gas Reheaters (2 units)	--	--	0.2	0.6	--
General					
Minor Process Leaks, (Valve Packing pump seals, sampling, etc.)	36.0	1.0	--	--	--

TABLE III-6b (Continued)

SOURCE	ESTIMATED EMISSIONS-POUNDS PER DAY				
	HYDROCARBON	HYDROGEN SULFIDE	SULFUR DIOXIDE	NITROGEN OXIDES	CARBON MONOXIDE
NON-CONTINUOUS (PERIODIC) SOURCES					
Standby Boiler (48 Hours/Year)	--	--	negl.	0.1	--
Emergency Generator (200 Hours/Year)	--	--	negl.	negl.	0.4
Firewater Pump (200 Hours/Year)	--	--	negl.	negl.	negl.
TOTALS-POUNDS PER DAY	36.0	1.0	420.4	577.9	173.4

TABLE III-6c

EMISSION INVENTORY, ONSHORE FACILITY, UNSCHEDULED EVENTS

	ESTIMATED EMISSIONS-POUNDS (EACH EVENT)				
SOURCE-EVENT	HYDROCARBONS	HYDROGEN SULFIDE	SULFUR OXIDES	NITROGEN OXIDES	CARBON MONOXIDE
Minor Upset/Unscheduled Maintenance					
Flare Off-Specification Sales Gas (2 hours)	--	--	17.0	636	--
Emergency smokeless flare stack - maintenance depressuring of Amine Contactor (1 hour)	--	--	32	5.5	--
Major Malfunction					
Emergency smokeless flare stack - inlet gas flare (1 hour)	--	--	2400	399	--
Tail Gas Incinerator Stack - Process upset; flare Amine still overhead vapor (30 minutes)	--	--	1100	0.3	--

associated with unscheduled events, as categorized and defined in the table. Vehicular emissions associated with both the construction and operation of the proposed project are found in table III-6a.

Impacts on Air Quality from the Onshore Facility

In order to assess the impact of facility operations on air quality, a matrix form containing information pertaining to emission sources, prevailing and "worst case" meteorological conditions, and the topography of the study area was developed. Given the information in this form, appropriate diffusion formulas were utilized in order to estimate conservatively ambient ground level concentrations of various pollutants in the vicinity of the onshore facility. The concentrations were then compared to Federal and State air quality standards and estimates of local air quality to determine if the standards would be exceeded. Impact upon the atmospheric environment of both normal operations and emergency events were considered.

Investigative Procedures

Each of the types of information used in the matrix is reviewed briefly below to provide insight into the nature of the impact assessments.

Atmospheric Conditions and Terrain

The discussion of circulation patterns characteristics of the area (Meteorology Section) was used to develop a combination of prevailing and "worst case" weather regimes. These regimes were categorized into northerly or southerly flow as defined in table III-6d. A stability class and wind speed were ascribed to each weather regime. These stability-wind speed combinations included so-called "worst case" conditions (F stability, 1 m/s). An inversion height of 100 meters was assumed in the southerly flow sea breeze regimes. In the absence of site specific background air quality data,

TABLE III-6d

HOURLY AVERAGE GROUND-LEVEL POLLUTANT CONCENTRATIONS ($\mu g/m^3$) FOR SCHEDULED EMISSION SOURCES, BY WEATHER REGIME AND TERRAIN SLOPE AT THE ONSHORE FACILITY

	SOUTHERLY FLOW (SE cw to SW)											
	Summer Sea Breeze afternoon			Summer Sea Breeze morning			Summer light winds			Pre-Storm Southeasters		
Stability; windspeed m/s	(A) 4			(D) 2			(F) 1			(D) 15		
Terrain Slope	1/5	1/10	0	1/5	1/10	0	1/5	1/10	0	1/5	1/10	0
SULFUR DIOXIDE												
Tail Gas Incinerator	10	4	8	170	55	6	750	250	1	85	25	6
Other Sources[1]	4	1	3	30	9	1	80	27	T	40	12	3
Total	14	5	11	200	64	7	830	277	1	125	37	9
NITROGEN DIOXIDE												
All Sources[1]	6	1	5	48 (1080)[2]	13	2	140 (2040)	46 (4200)	T	55 (330)	7	4
CARBON MONOXIDE												
Gas/Turbine Waste Heat Recovery Furnace	19	4	14	140	41	6	350	120	T	210	65	21

1. See text for explanation
2. Distance of maximum ground level concentration (feet)

TABLE III-6d (Continued)

	NORTHERLY FLOW (NW cw to NE)			
	Cold Air Drainage	Gradient Flow	1% "max.-hr." background	State/ federal ambient air quality standard
Stability; windspeed m/s	(F) 1	(D) 15		
Terrain Slope	0	0		
<u>SULFUR DIOXIDE</u>			zero[3]	1,310
Tail Gas Incinerator	1	6		
Other Sources[1]	T	3		
Total	1	9		
<u>NITROGEN DIOXIDE</u>			260[4]	470
All Sources[1]	T	4		
<u>CARBON MONOXIDE</u>			19,700[4]	40,000
Gas/Turbine Waste Heat Recovery Furnace	T	21		

3. Appendix F.

4. Santa Barbara (California ARB, 1974)

T - Trace (less than 0.5 $\mu g/m^3$)

"worst case" estimates were made by using mean 1% "max-hour" values derived from the stations and years. However, background sulfur dioxide concentrations were estimated on the basis of early results from ARB air quality monitoring in Refugio State Beach Park during November-December 1974.

Assuming the onshore facility site were situated in a canyon within the foothills on the south side of the Santa Ynez Mountains, an estimate of terrain effects was appropriate. Slopes were grouped into three categories: (1) relatively steep, slope 1:5 or less, (2) moderate slope, slope between 1:5 and 1:10; and (3) relatively flat, slope greater than 1:10.

Emission Sources and Dispersion Estimates

Since the continuous sources would be in reasonable proximity on the production site and many would have similar stack characteristics, emissions from the facility were considered as originating from four points. These include: (1) Tail Gas Incinerator (SO_2); (2) All other stacks (SO_2); (3) All NO_X producing stacks; and (4) Gas Turbine/Waste Heat Recovery Furnace (CO). Stack characteristics used for the hypothetical stacks were dictated by the stack emitting the major contribution of emissions. In the case of NO_X emissions, it was assumed that 10% of the total NO_X emitted would be present in the form of NO_2 in the vicinity of the facility. Those unscheduled emission sources which, when operating, emit substantially more emissions than the continuous point sources mentioned above were also evaluted. Computations of plume rise were made according to methods recommended in Briggs (1969).

Pollutant concentrations were computed using the standard Pasquill-Gifford-Turner correlations (Turner, 1967) as developed from data over relatively flat terrain. To account for effects of mountainous terrain, ground-level concentrations were also determined by considering plume impaction against steadily rising moderate (slope 1:10) and steep (slope 1:5) slopes. These computations assumed horizontal plume transport from a source located at an elevation equal to the stack height plus ultimate plume rise.

Based upon recently reported studies of plume dispersion within mountain canyons and over rough terrain, the above calculations are expected to yield conservative estimates of ground-level pollutant concentrations. Hovind et al., (1974) measured concentrations in rugged open terrain (Pasquill D stability) that were six times lower than calculated; in a confined canyon under F stability, measured values were 10 times lower than calculated. Similarly, Start et al., (1974) measured rough-terrain dilution factors of nearly four for B and C stability, five for D stability, and 15 for F stability. This accelerated pollutant dispersion is believed due to enhanced mechanical turbulence, not necessarily reflected in the vertical temperature profiles, that arises from a variety of terrain-related factors.

Scheduled Sources

Based on the dispersion estimates indicated in the matrix form, it appears that normal, day-to-day operations of the described onshore facilities would have relatively little adverse impact upon air quality. Concentrations of sulfur dioxide, nitrogen dioxide, and carbon monoxide are well below ambient air quality standards, even when "worst case", 1% "max-hour" values are added to the maximum ground level concentrations produced by the project (table III-6d).

Unscheduled Events

Based on dispersion estimates indicated in table III-6e, it appears that minor upsets and major malfunctions at the facilities would

TABLE III-6e

HOURLY AVERAGE GROUND-LEVEL POLLUTANT CONCENTRATIONS ($\mu g/m^3$) FOR UNSCHEDULED EMISSION SOURCES, BY WEATHER REGIME AND TERRAIN SLOPE AT THE ONSHORE FACILITY

SOUTHERLY FLOW (SE c to SW)

	Summer Sea Breeze afternoon			Summer Sea Breeze morning			Summer light winds			Pre-Storm Southeasters		
Stability; windspeed m/s	(A) 4			(D) 2			(F) 1			(D) 15		
Terrain Slope	1/5	1/10	0	1/5	1/10	0	1/5	1/10	0	1/5	1/10	0
Minor Upset												
Flare-Off-Specification Sales Gas (2 hours)												
Sulfur Dioxide	10	3	8	110	33	4	950	310	3	90	20	4
Nitrogen Oxides	35	11	31	390	120	14	350	110	110	250	70	15
	(900)[4]		(840)	(1400)	(2760)		(1400)	(2760)		(570)	(1140)	
Major Malfunction												
Emergency Smokeless Flare Stack-inlet gas flare (1 hour)												
Sulfur Dioxide	260[1]	800	230[1]	300[2]	900[1]	100[1]	250[3]	850[2]	840	190[2]	550[1]	110[1]
Nitrogen Oxides	45	13	38	490	150	18	440[1]	140[1]	14	320	90	19
	(900)		(840)	(900)	(2700)		(1380)	(2760)		(570)	(1140)	
Tail Gas Incinerator Stack-process upset; amine still overhead vapor (30 minutes)												
Sulf Dioxide	950	500	110[1]	120[2]	390[1]	780	110[3]	340[2]	110	130[2]	360[1]	780
				(2250)	(4500)		(2250)	(4500)		(1380)	(690)	

(See Footnotes on Second Page)

TABLE III-6e (Continued)

	NORTHERLY FLOW (NW cw to NE)	
	Cold Air Drainage	Gradient Flow
Stability; windspeed m/s	(F) 1	(D) 15
Terrain Slope	0	0
Minor Upset		
Flare Off-Specification Sales Gas (2 Hours)		
Sulfur Dioxide	3	4
Nitrogen Oxides	11	15
Major Malfunction		
Emergency Smokeless Flare Stack - inlet gas flare (1 hour)		
Sulfur Dioxide	840	110[1]
Nitrogen Oxides	14	19
Tail gas Incinerator Stack - process upset; flare amine still overhead vapor (30 minutes)		
Sulfur Dioxide	110	780

1 X 10
2 X 10^2
3 X 10^3
4 distance of maximum ground level concentration (feet)
[ ] Exceeds ambient air quality standard, given assumptions stated in text

produce significant short-term adverse impacts upon air quality, at least during certain weather conditions.

The estimated concentrations do not exceed ambient air quality standards during periods of flow from the north, even when "worst case" 1% "max hour" background levels are considered. Periods of northerly flow include cold air drainage and gradient winds. Cold air drainage is a common night-time occurrence in the area, especially in winter. Gradient winds influence the area perhaps 10-15% of the time with a maximum frequency of occurrence in the spring.

The dispersion estimates indicate that a major malfunction occurring during periods of southerly flow would result in ground level concentrations of sulfur dioxide in excess of air quality standards on sloped terrain north of the facility. A similar situation is true for nitrogen oxides during either an inlet gas flare or a flare of off-specification sales gas during neutral or stable conditions. The distances associated with the high maximum ground level concentrations on sloped terrain indicate that the high values would occur in the nearby hills just north of the facility. The concentrations given in table III-6e are center line values and it has been assumed that direct impaction occurs. The methods and assumptions used give very conservative (i.e., high values) results, as indicated by recent studies cited above.

The weather regimes classified as southerly flow include both prevailing and relatively infrequent, short-term weather events. The first three regimes in tables III-6d and III-6e represent various conditions representative of the diurnal trend in the typical summer stratus regime. Prestorm southeasters occur during winter for relatively short periods.

The impact of unscheduled events on air quality depends upon both their duration and frequency of occurrence. The duration of an inlet gas flare is one hour (table III-6c). This event is likely to occur several times during start up and commissioning of the gas treating facility, but after one to two months the frequency should not exceed two events per year. The duration of flaring Amine Still overhead vapor is anticipated at 30 minutes. The frequency of this event is two or less times per year. The flaring of off-specification sales gas could occur during process upsets, and would be initiated only if short-term flaring could avert shut-down and/or inlet gas flaring. No more than 50 (total) hours per year of residue gas flaring is expected, and a maximum time of two hours per event is anticipated.

In summary, impacts associated with unscheduled events are seen as short-term, adverse impacts of high magnitude and significance. However, they occur relatively infrequently and are associated with the use of safety equipment designed to avoid escalation of process upsets.

24-Hour Sulfur Dioxide Concentrations

Analysis and interpretation of the 24-hour average ground-level sulfur dioxide concentrations associated with continuous and infrequent, discontinuous emission sources at the onshore facility indicate that the new (adopted October 1974) 24-hour State ambient air quality standard for sulfur dioxide (262 $\mu g/m^3$) would be exceeded only rarely, if at all, during operation of such a facility.

Combinations of emission source, weather regime, and slope favoring possible high sulfur dioxide concentrations exceeding the standard are shown by solid underlining in table III- 6f. These include only periods dominated by southerly wind flow during which unscheduled flaring occurs. The distances

TABLE III- 6f

TWENTY-FOUR-HOUR AVERAGE GROUND-LEVEL SULFUR DIOXIDE CONCENTRATIONS ($\mu g/m^3$) FOR SCHEDULED (CONTINUOUS) AND UNSCHEDULED (INFREQUENT DISCONTINUOUS) EMISSION SOURCES, BY WEATHER REGIME AND TERRAIN SLOPE AT THE ONSHORE FACILITY SITE

	SOUTHERLY FLOW (SE cw to SW)											
	Summer Sea Breeze afternoon			Summer Sea Breeze morning			Summer light winds			Pre-Storm Southeasters		
Stability; windspeed m/s	(A) 4			(D) 2			(F) 1			(D) 15		
Terrain Slope	1/5	1/10	0	1/5	1/10	0	1/5	1/10	0	1/5	1/10	0
SCHEDULED SOURCES												
Tail Gas Incinerator	6	2	4	95	31	3	420	140	1	48	14	3
Other Sources[1]	2	1	2	17	5	1	45	15	T	22	7	2
Total	8	3	6	112	36	4	465	155	1	70	21	5
UNSCHEDULED SOURCES[2]												
Emergency Smokeless Flare Stack-inlet gas flare (1 hour)	63	19	54	710	210	23	5800	2000	20	460	130	26
Tail Gas Incinerator Stack-process upset; amine still overhead vapor (30 minutes)	11	6	13	140	46	9	1300	400	1	150	42	9
Flare-Off-Specification Sales Gas (2 hours)	1	T	T	5	2	T	44	14	T	3	1	T

See footnotes on following page

TABLE III-6f (Continued)

	NORTHERLY FLOW (NW cw to NE)	
	Cold Air Drainage	Gradient Flow
Stability; windspeed m/s	(F) 1	(D) 15
Terrain Slope	0	0
SCHEDULED SOURCES		
Tail Gas Incinerator	1	3
Other Sources[1]	T	2
Total	1	5
UNSCHEDULED SOURCES		
Emergency Smokeless Flare Stack-inlet gas flare (1 hour)	20	26
Tail Gas Incinerator Stack-process upset; amine still overhead vapor (30 minutes)	1	9
Flare-Off-Specification Sales Gas (2 hours)	T	T

See footnotes on following page

LEGEND FOR TABLE III-6f

[1]See text for explanation.

[2]Flaring volumes are increased during startup and commissioning, but emissions are reduced by about two-thirds because of reduced volume, compared to maximum capacities used in diffusion calculations.

——— Could exceed ambient air quality standard, given assumptions stated in text.

– – Does not exceed ambient air quality standard, given assumptions stated in text.

T Less than 0.5 $\mu g/m^3$

associated with the high concentrations indicate that these concentrations would occur only on sloped terrain north of the facility area nearby. Since long periods (12 hours or more) dominated by the weather regimes favoring high concentrations are relatively rare and flaring occurs infrequently, concentrations exceeding the air quality standard are expected to occur only very rarely or probably not at all.

Table III-6f shows the 24-hour concentrations for various weather regimes. If each weather regime existed for a 24-hour period, then continuous operations and/or operation of certain unscheduled sources would produce concentrations in excess of the 24-hour ambient air quality standard on sloping terrain near the facility during certain southerly wind regimes (solid and dashed underlining in table III-6f). While the summer light wind regime may very rarely occur for extended periods, the normal situation is for two or more regimes to occur during a typical diurnal sequence. For example, the land-sea breeze regime which occurs on about 70% of the days results in a diurnal variation of the southerly wind regimes (exclusive of pre-storm southeasters) as well as northerly downslope wind. Neither the afternoon sea breeze condition nor night-time land breeze conditions favor high pollutant concentrations, on a 24-hour basis. If it is assumed, as a "worst case", that conditions favoring high concentrations occur half the time, then the values in table III-6f can be halved. Greater reductions would be appropriate for most combinations of weather regimes.

The 24-hour average background concentration at the facility would be estimated at zero $\mu g/m^3$, based on recent ARB monitoring at Refugio State Beach Park. When this value is added to halved values in table III-6f, only those emission source - weather regime - slope combinations with solid underlining are likely to result in 24-hour concentrations of sulfur dioxide in excess of the ambient air quality standard. Normal, day-to-day operations without flaring are not included in these combinations. Note that emissions associated with flaring are for maximum capacity conditions. During the initial startup and commissioning of the facility, flares are likely to occur more often, but emissions would be reduced by about two-thirds because of lower operating volumes.

As background to the impacts assessment presented in this section, air quality data for the Refugio area are provided here.

At the request of the Santa Barbara County APCD, the California ARB initiated an ambient air quality monitoring program at Refugio State Beach Park during late November - December 1974. Parameters sampled include carbon monoxide, nitrogen oxides, sulfur oxides (SO_X), total hydrocarbons (THC) and hydrocarbons less methane, ozone, and total suspended particulates including lead. The following data sheets (SO_X, THC, and HC less methane) were obtained from the offices of the Santa Barbara APCD. The copies reproduced here were the most legible available at the time of acquisition.

Although the sample is very small, the results indicate that background sulfur oxide concentrations in that area are essentially zero, and that hydrocarbon concentrations are very low.

TOTAL SULFUR ~~SULFUR DIOXIDE~~ TOTAL SULFUR – FLAME PHOTOMETRIC

(Variable 12)

HOURLY AVERAGE AND PEAK CONCENTRATION BY DAY

(Parts per hundred million)

Data for Month of NOV- DEC, 1974 Station Number 42601

Station Location REFUGIO STATE BEACH

Reporting Agency ARB - DTS

Read by D. S. PIERCE Checked by ______ Date: ______

DAY	CLOCK HOUR (Standard Time)																								DAILY PEAK	
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Conc.	Time
Nov 12 1																										
13 2																										
14 3																										
15 4																										
16 5																										
17 6																										
18 7																										
19 8																		0	0	0	0	0	0	0		
20 9	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1315
21 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
22 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
23 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
24 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
25 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0												
26 15																			0	0	0	0	0	0		
27 16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
28 17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
29 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
30 19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
DEC 1 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
2 21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
3 22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
4 23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
5 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
6 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
7 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
8 27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
9 28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0001
10 29																										

TOTAL HYDROCARBONS

(Variable 31)

HOURLY AVERAGE AND PEAK CONCENTRATION BY DAY

(Parts per million)

Data for Month of [illegible], 19[illegible] Station Number [illegible]

Station Location REFUGIO STATE BEACH

Reporting Agency ARB-DTS

Read by D. ST. PIERRE Checked by ______ Date ______

DAY	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Daily Peak Conc.	Daily Peak Time
NOV 27	2.2	2.2	2.1	2.3	2.4	2.3	2.4	2.4	2.2	1.9	2.0	1.8	2.0	2.0	1.8	1.8	1.8	1.8	2.2	2.3	2.2	2.2	2.1	2.2	2.7	1130
28	2.1	2.1	1.8	1.8	1.9	1.9	1.9	2.0	2.0	2.1	2.0	2.0	2.0	2.1	2.0	2.0	2.0	2.0	2.1	2.2	2.3	2.2	2.1	2.1	2.4	1740
29	2.0	2.0	1.9	1.9													2.0	2.1	2.1	2.2	2.2	2.2	2.2	2.1		
30	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.2	2.3	2.3	2.0	1.9	1.9	1.9	1.9	1.9	1.9	2.0	2.1	2.1	2.0	2.0	2.0	2.0	2.4	0930
DEC 1	1.9	1.9	1.9	1.9	1.9	1.9	2.0	2.0	2.2	2.1	2.1	2.0	1.9	1.8	1.8	1.8	1.8	2.1	1.9	1.9	1.9	1.8	1.8	1.8	2.3	0820
2	1.8	1.8	1.7	1.7	1.7	1.7	1.8	2.2	2.1	2.0	1.9	1.8	1.8	1.9	1.9	1.8	1.8	1.8	1.7	1.7	1.6	1.6	1.6	1.8	2.3	0800
3	1.8	1.8	1.8	1.8	1.8	1.7	1.8	1.8	1.8	1.9	1.9	1.9	1.8	1.8	1.8	1.8	1.8	1.7	1.8	1.8	1.8	1.7	1.7	1.7	2.2	1220
4	1.6	1.6	1.6	1.7	1.6	1.6	1.6	1.6	1.7	1.6	1.7	1.6	1.7	1.7	1.7	1.7	1.6	1.6	1.7	1.7	1.7	1.7	1.8	1.8	2.0	2355
5	1.8	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.9	1.8	2.0	2.0	1.9	1.9	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.9	1.9	2.1	0830
6	1.8	1.9	1.8	1.8	1.7	1.9	2.0	2.2	2.2	2.0	2.0	2.1	2.1	2.3	2.1	1.9	1.8	1.9	1.9	2.0	1.9	1.9	1.9	2.0	2.4	1330
7	1.8	1.8	1.9	2.1	1.9	1.9	1.9	2.2	1.8	1.9	2.2	2.2	2.2	2.3	2.1	2.1	1.9	2.0	1.8	1.9	2.3	1.9	1.9	1.9	3.1	1120
8																										
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F-3

NOV - DEC

NON-METHANE HYDROCARBONS
(Variable 34)
HOURLY AVERAGE AND PEAK CONCENTRATION BY DAY
(Parts per million)

Station Location [illegible]
Reporting Agency [illegible]
Read by [illegible] Checked by ______ Date ______

DAY	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Daily Peak Conc.	Daily Peak Time
Nov 27 1	.2	.9	.8	.8	.9	[illegible]	.9	.9	.7	.6	.6	.5	.7	.7	.5	.6	.6	.6	[illegible]	[illegible]	.7	[illegible]	.6	[illegible]	[illegible]	[illegible]
28 2	.7	.7	.5	.5	.6	.6	.6	.6	.6	.7	[illegible]	.6	[illegible]	.7	.6	.6	[illegible]	[illegible]	[illegible]	.7	.5	[illegible]	.7	.7	.9	[illegible]
29 3	.7	.7	.6	.6													.5	.6	.5	.5	.6	.5	.5	.5		
30 4	.4	.4	.5	.5	.5	.4	.5	.5	.6	.6	[illegible]	.4	.4	.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.5	[illegible]	.6	.5	.5	.7	[illegible]
Dec 1 5	.4	.5	.4	.5	.5	.5	.5	.6	.6	.5	.5	.4	.5	.4	.4	.5	.5	.7	[illegible]	.5	.5	.5	[illegible]	[illegible]	[illegible]	[illegible]
2 6	.5	.5	.4	.4	.4	.4	.4	.6	.5	.5	.5	.5	.4	.5	.5	[illegible]	.5	.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.8	[illegible]
3 7	.4	.4	.4	.4	.4	.4	.4	.4	.5	.5	.5	.5	.4	.5	.5	.5	.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.4	[illegible]	[illegible]
4 8	.3	.3	.3	.4	.3	.3	.3	.3	.4	.3	.4	.3	[illegible]	[illegible]	.4	.4	.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5 9	.4	.4	.3	.4	.4	.4	.4	.4	.4	.4	.5			.4	.4	.4	.5	.5	.5	[illegible]	[illegible]	.3	.5	.4	[illegible]	[illegible]
6 10	.4	.4	.4	.4	.3	.4	.5	.4	.4	.4	.5	.6					[illegible]	.6	[illegible]	[illegible]	.4	.3	.4	.5	[illegible]	[illegible]
7 11	.3	.4	.4	.5	.4	.4	.4	.3	.4	.4	.5	.5	.7	[illegible]	[illegible]	.5	[illegible]	.4	[illegible]	.5	.6	[illegible]	[illegible]	[illegible]	1.1	[illegible]
12																										
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c. Marine Loading Terminal

The material presented in this section was mainly excerpted with minor changes from "Preliminary Air Quality Assessment, Marine Terminal Operations, Corral Canyon, Santa Barbara County, California. Prepared for Exxon Company, U.S.A., by Dames and Moore."

Tanker loading terminal operations will generate air emission products. The types, quantities, release regimens and impacts expected for a loading facility handling 40,000 and 80,000 bbl/day are discussed here.

Assuming use of a 26,750 dwt oil tanker vessel, mooring at a modern, single anchor leg mooring (SALM) and loading of crude oil dewatered at an inland treating facility, marine terminal air quality effects were determined. The review was performed with the SALM being positioned about 3/4-mile offshore and about 20 miles west of Santa Barbara in a rural setting characterized by agriculture, petroleum production, and recreational activities.

Two types of emissions are associated with the tanker loading operations: (1) combustion products from the ship's boilers emitted from the stack; and, (2) ullage vapors displaced from the cargo tanks. Both types of emissions were quantified for initial production rates of 40,000 bbl/day and a potential expanded production rate of 80,000 bbl/day (table III-6g).

Local-scale impacts on air quality near the marine terminal were assessed by the use of air transport/dispersion formulas employed to estimate the concentrations of pollutants during prevailing and potential "worst case" meteorological conditions. These concentrations were added to estimates of background concentrations and the sums compared to appropriate air

TABLE III-6g

EMISSIONS INVENTORY - MARINE TERMINAL

Emission Types	Tons Per Day: @ 40,000 bbl/day Production[1]	Tons Per Day: @ 80,000 bbl/day Production[2]
Tanker Combustion Gases		
Sulfur Oxides[3]	0.03	0.05
Nitrogen Oxides	0.04	0.06
Particulates	0.009	0.013
Total Organic gases[4]	0.002	0.003
Carbon monoxide	0.001	0.001
Vented Cargo Tank Vapors		
Total Hydrocarbons	1.2	2.3
Reactive[5] Hydrocarbons	0.44	0.89
Hydrogen Sulfide	0.002	0.003

[1]Assumes 83 tanker arrivals per year with 19 hours spent in coastal waters per arrival.

[2]Assumes 166 tanker arrivals per year with 14 hours spent in coastal waters per arrival.

[3]Expressed as SO_2, based on 0.5% sulfur fuel oil.

[4]Includes unburned hydrocarbons plus aldehydes.

[5]Based on an EPA classification scheme that considers all components heavier than propane to be reactive hydrocarbons (Dimitriades, 1974).

quality standards. Predicted concentrations of sulfur dioxide, nitrogen dioxide, and combustion particulates were well below ambient air quality standards. Predicted concentrations of hydrogen sulfide were below the State ambient air quality standard which is based on odor considerations. Therefore, local-scale impacts on air quality would be expected to be insignificant. Regional scale impacts were even more insignificant.

Nitrogen oxides and reactive hydrocarbons are unstable substances that interact within the region to produce photochemical smog. Regional emissions of nitrogen oxides would increase by 0.2 to 0.3 percent as a result of the marine terminal operations (40,000 to 80,000 bbl/day production rates). Corresponding increases of reactive hydrocarbons are two and five percent. In terms of smog formation, the paraffin hydrocarbons emitted from the cargo holds during loading are expected to yield less oxidants than an equivalent amount of vehicular emissions. Vehicular sources emit substantial amounts of aromatic and olefinic compounds, both of which yield higher oxidant concentrations than an equal amount of paraffinic compounds. Thus, marine terminal operations are expected to have only a minor impact on regional air quality. The existing smog problem in the air basin is related primarily to vehicular emissions.

The operational procedures, crude oil characteristics, and equipment specifications as provided by Exxon Company, U.S.A., were investigated in order to identify emission sources and quantify the emissions. Given the emissions inventory and appropriate baseline meteorology and air quality considerations, impacts were evaluated from both a local and regional standpoint. In the local-scale analysis, Turner (1969) methodology was employed.

The tanker combustion and ullage emission products were based upon its boilers being fired by residual fuel oil and the cargo holds being equipped with a Class A vent system.

The study region was defined as the coastal portion of Santa Barbara County south of the Santa Ynez Mountains. This area extends along the coast from near Point Arguello to a position about 12 miles east of Santa Barbara. It corresponds to the Santa Barbara County portion of the South Coast Air Basin, and thus represents a region with relatively well-defined meteorological and political bounds.

Onshore terrain near the marine terminal area would consist of a narrow coastal terrace, a broad zone of foothills, and the steep, south-facing slopes of the Santa Ynez Mountains to the north. Several north-south-oriented canyons dissect the mountains, foothills and coastal terrace along the east-west-oriented coastline.

Land use in the vicinity of the terminal probably would consist of agriculture (cattle grazing, citrus and avocado orchards cropping), petroleum production, and recreational activities. Local sources of emissions consist of the highway and railroad traffic within the transportation corridor on the coastal terrace, agricultural activities, and existing and proposed petroleum production operations. Recreationists at the State beach parks represent the primary air quality receptors. The Santa Barbara Channel represents a population exclusion zone to the south.

TERMINAL DESCRIPTION

Treated crude oil will be delivered by pipeline to a single anchor leg mooring system (SALM) marine loading terminal located approximately 1.2 km

(3/4 mile) offshore. Loading will be accomplished at a maximum rate of 15,000 bbl/hr by means of shore-based pumps.

After treating, this oil will be assumed to have a specific gravity of 18^{o} API, an average molecular weight of about 200, and would contain no more than 0.001 wt percent H_2S. At the planned storage and loading temperature of 95^{o} F, its true vapor pressure would be 11.0 psia. The composition and properties of hydrocarbon vapors in equilibrium with the treated oil under loading conditions have been computed as shown in table III-6h.

The tankers assumed to be used will have a length of 628 feet, beam of 82.5 feet, and maximum operating draft of 30 feet. The cargo holds are assumed to contain six 12,000-bbl wing tanks and six center tanks ranging from 8,000 bbl to 24,000 bbl in size. Net cargo-carrying capacity would be 175,000 bbls. Remaining tankage will be used for fully segregated ballast.

They will be powered by steam turbine engines fed from two 50,000-lb/hr boilers equipped with dual-speed forced draft air blowers. Combustion gases are released at 140 to 170^{o} C from a single stack, 1.53 m^2 in cross-sectional area, that sits 23 m from the stern and extends 20 to 23 m above the water, depending upon ballast conditions. Fuel consumption has been logged at 19 bbl/hr under full power, 12 bbl/hr at discharge ports, and 4.3 bbl/hr at loading ports.

While in the vicinity of the SALM (i.e., within three miles of the Santa Barbara coastline) the ship boilers will be operated at or near the loading port fuel consumption rates, except for a few minutes of high power output

TABLE III-6h

PROPERTIES OF HYDROCARBON VAPORS IN EQUILIBRIUM WITH TREATED CRUDE OIL UNDER LOADING CONDITIONS

Average molecular weight	35.4
Weight % in vapor[1] of:	
Methane	19.
Ethane	10.
Propane	33.
Butanes and heavier	38.
Hydrogen Sulfide	0.14

[1]At 95°F and 11.0 psia true vapor pressure. Under loading conditions of 14.7 psia, these compositions will be reduced by dilution air.

while departing. The boilers will be fired with residual fuel oil.

The class A cargo tank vent systems will have tanks which are cross-connected to a common header during tank loading. Two vent pipes, 12 m apart, are located amidships and a third is 70 m forward at centerline. Each vent pipe will be fitted with constant velocity (30 m/s) nozzles, and will extend 18 to 21 m above the water.

Assuming a 40,000 bbl/day production rate, a tanker would be expected to arrive at the loading terminal every 4-5 days, or 83 times per year. During each arrival, the tanker will spend about 19 hours in Santa Barbara coastal waters. This includes three hours for arrival, maneuvering, and connecting to the SALM, 14 hours for loading, and two hours for disconnect and departure.

The loading procedure expected to be used would be simultaneous filling and topping of all wing tanks followed by main center tanks. Final trim loading will take place in the small center tank.

The marine loading terminal, as well as the onshore treatment and storage facility, would be designed to accommodate a potential future expansion in oil production of up to 80,000 bbl/day. The expanded facilities would include an additional 10,000 bbl/hr of pumping capacity. Tanker arrivals would double, but berthing time would decrease to about 14 hours per arrival because of the higher loading rate.

Anticipated emissions to the atmosphere for 40,000 bbl/day and 80,000 bbl/day production rates were determined based upon the following information and derivations.

DERIVATION OF PROJECT EMISSION FACTORS

Combustion Gases

Emission factors applicable to steam powered tankships have been reviewed in two recent studies sponsored by the National Maritime Research Center (NMRC) and the Maritime Administration, Office of Research and Development (MARAD). Results of these studies are summarized below.

Pollutant	Emission Factor (lb/bbl fuel fired) NMRC[1]	MARAD[2]
Sulfur Dioxide[3]	3.31	3.35
Nitrogen Oxides	4.37	4.36
Particulates	0.422	0.966
Hydrocarbons	0.135	0.134
Aldehydes	---	0.084
Carbon Monoxide	0.002	0.084

[1]Reference: Linnstaedter, E. E., and G. E. Mitchell, 1974.

[2]Reference: Goodrich, R. R., and J. E. Shewmaker, 1974.

[3]Based on 0.5 percent sulfur in fuel.

The MARAD values, being slightly more conservative, were adopted for use in this study. The fuel was assumed to weigh 8 lb/gal and yield 230 SCF of stack gases per lb of fuel oil fired.

Ullage Vapors

Hydrocarbon loss experienced during the loading of tankers has been the subject of several recent investigations (Goodrich and Shewmaker, 1974; Brummage, 1971; Clamen and MacKenzie, 1975). The mechanism by which these loses occur may be described as follows.

Gaseous hydrocarbon vapors evolve from two processes during the tanker loading operation: displacement of the existing lean hydrocarbon gas-air mixture in the empty tanks, and hydrocarbon gas generation. The concentration of hydrocarbons in the ullage vapor prior to loading depends upon whether the tank has been gas-freed, partially gas-freed, ballasted, or simply left empty and uncleaned.

Hydrocarbon gas generation results from the turbulence of the cargo oil during the loading operation. Under subsurface loading conditions, the cargo is loaded via a fill pipe whose outlet is usually only a few inches from the tank bottom. The initial splashing causes intimate mixing between the air and the cargo oil resulting in volatile hydrocarbon gas generation. This gas generation usually continues until the fill pipe is completely submerged, and produces a rich hydrocarbon vapor blanket over the surface of the oil. Because this blanket is denser than air, it tends to stabilize above the liquid cargo and prevent further gas generation. Although this blanket can be expected to thicken slightly while the tank is being filled, it is not expelled through the vent system until the ullage space has decreased to three to eight feet.

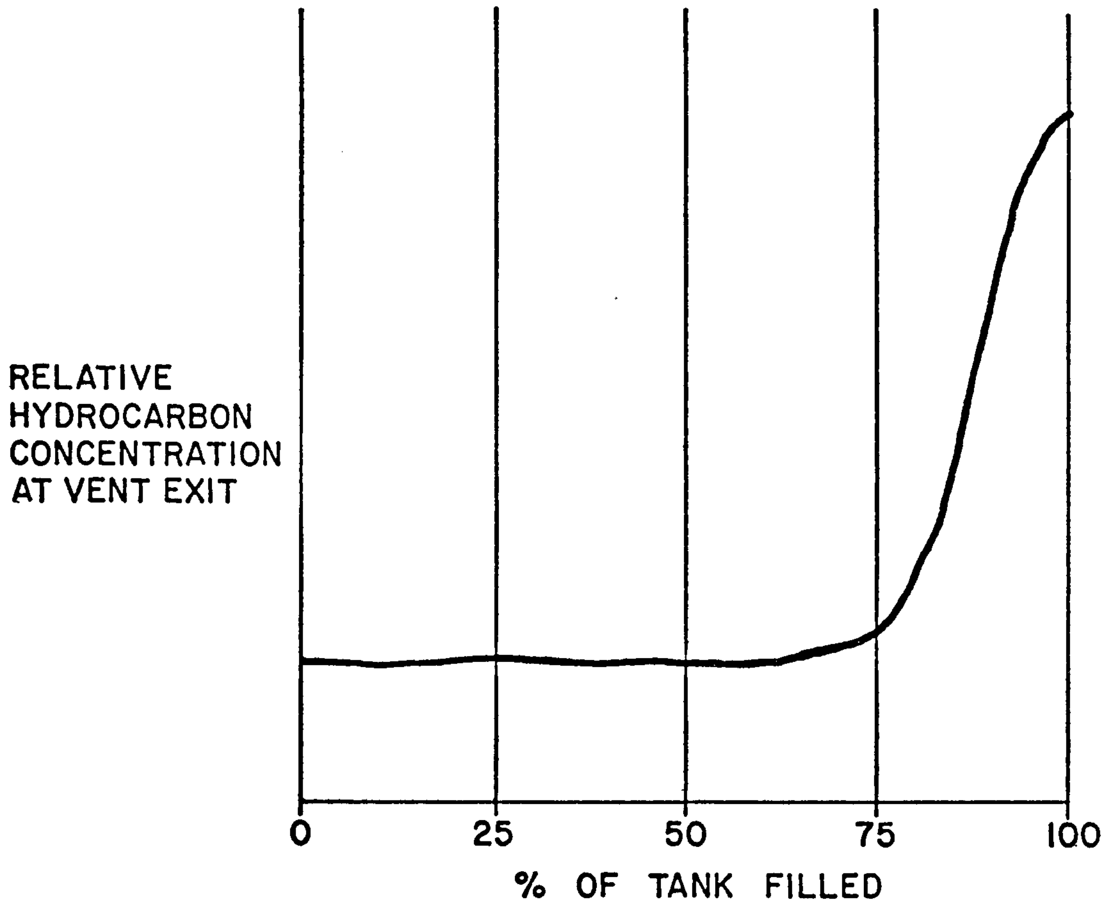
Figure III-11c, taken from Goodrich and Shewmaker (1974), shows a graphical illustration of the hydrocarbon concentration of vented ullage vapors during a typical loading operation.

Total Hydrocarbons

An emission factor for total hydrocarbon loss during tanker loading can be developed based on the vapor evolution process described above and experimental data of the type shown in Figure III- 11c.

Brummage (1971) presents data on the vapor blanket thickness and the

FIGURE III-11c



PROFILE OF HYDROCARBON CONCENTRATION IN VENTED VAPORS DURING TANK LOADING

(after Clamen and MacKenzie, 1975)

DAMES & MOORE

hydrocarbon saturation of ullage vapors at the end of loading for Kuwait crude oils and gasoline blends. His data are summarized below.

Average Property	Crude Oil	Gasoline
Vapor Blanket Thickness (ft)	4.2	5.5
Final Hydrocarbon Saturation (%)	42	66
True Vapor Pressure (psia)	14.5	10.4

The above data indicate that hydrocarbon losses from loading crude oils were generally less than gasoline loading losses.

Clamen and MacKenzie (1975) present gasoline loading loss data that are considerably more detailed than Brummage's data. Their data include empty cargo tank arrival concentrations, and a complete hydrocarbon concentration profile as shown in Figure III-11c. Consequently, these data were used to develop the emission factor used in this study. Although the data pertain to gasoline loading, they also can be expected to apply to crude oil loading and, in fact, may even be conservative in this respect.

The data presented by Clamen and MacKenzie were used to derive the following equations for computing the weight of total hydrocarbons, W_{THC}, emitted during a single tanker loading.

$$W_{THC} = 0.077(Y_A M_A + 0.15 Y_B M_B)(V_L/T_L) \qquad \text{(A-1)}$$

$$Y_B = 12 + 2.2(TVP), \qquad 5<TVP<15 \qquad \text{(A-2)}$$

$$Y_B = 4.6(TVP), \qquad TVP \leq 5 \qquad \text{(A-2')}$$

The terms in this equation are:

W_{THC} = Total hydrocarbons emitted (lbs)

Y_A = Volume percent of hydrocarbons in empty tank ullage vapors

M_A = Molecular weight of hydrocarbons in empty tank ullage vapors

Y_B = Volume percent of hydrocarbons in the generated vapor blanket

M_B = Molecular weight of hydrocarbons in the generated vapor blanket

V_L = Volume of liquid loaded (bbls)

T_L = Temperature of liquid loaded ($^oR \doteq 460 + ^oF$)

TVP = True vapor pressure of the liquid loaded at the loading temperature (psia)

Clamen and MacKenzie used their experimental data to derive an overall average hydrocarbon concentration in vented ullage vapors for three different conditions of cargo tank arrival: gas-freed, ballasted, and empty-not cleaned. This factor can also be determined from equations (A-1) and (A-2) using the average properties of the gasoline cargoes given in their study. A comparison of the two determinations is shown below.

Arrival Cargo Tank Condition	Overall Average Hydrocarbon Concentration in Vented Ullage Vapors: Determined by Clamen & MacKenzie	Determined from eq. (A-1)&(A-2)
Gas-Freed	5.5%	5.8%
Ballasted	8.0%	8.3%
Empty-Not Cleaned	10.0%	9.7%

Equations (A-1) and (A-2) reproduce Clamen and MacKenzie's results with an average accuracy of 4 percent.

With regard to the applicability to crude oil loading, equation (A-2) can be used to compute the hydrocarbon saturation of ullage vapors at the end of loading Kuwait crude for comparison with Brummage's data. This computation gives a final hydrocarbon saturation of 45 percent which compares well with Brummage's experimental value of 42 percent.

Based on these comparisons with available experimental data, the loading loss correlation given by equations (A-1) and (A-2) was adopted for use in this study. A value of Y_A = 6.5, applicable to arriving cargo tanks that are empty and not cleaned, was used, based on Clamen and MacKenzie's (1975) data. The other terms in the equations applicable to this study are:

$$M_A = M_B = 35.4$$
$$V_L = 175{,}000 \text{ bbls}$$
$$T_L = 95^{\circ} \text{ F}$$
$$TVP = 11.0 \text{ psia}$$

Using these values, the hydrocarbon concentration in the generated vapor blanket is Y_B = 36%, which corresponds to 48% saturation. The weight of total hydrocarbons emitted per tanker loading is W_{THC} = 10,200 lbs or 5.1 tons. This corresponds to 1.4 lb per 1,000 gallons loaded.

Reactive Hydrocarbons

Emissions of reactive hydrocarbons were determined from the composition of the vented vapors as shown in table III-6h of the report. Reactive components were considered to be all components heavier than propane in accordance with current EPA thinking (Dimitriades, 1974). The subject of hydrocarbon reactivity is still under research at both the Federal and State levels, and different classification schemes may be forthcoming (see, for example, California Air Resources Board, 1975).

On this basis, the vented hydrocarbon vapors contain 38 wt % reactive hydrocarbon components, giving an emission factor of 1.9 tons per tanker loading, or 0.53 lb per 1,000 gallons loaded.

Hydrogen Sulfide

The overall emission factor for hydrogen sulfide can be determined from the composition of the vented hydrocarbon vapors as shown in table III-6h. Based on a total hydrocarbon emission of 10,200 lbs, the hydrogen sulfide emission factor is 14 lbs per tanker loading.

From the odor problem standpoint, this emission factor is not informative since the rate at which hydrogen sulfide is emitted will vary during the course of the tanker loading operation. This fact can be seen by referring to figure III-11c, and recalling that the hydrogen sulfide concentration in the total hydrocarbon vapor is constant at 0.14 wt %. Thus, figure III-11c also represents the hydrogen sulfide concentration at the vent exit.

Since ullage vapors are expelled at nearly a constant rate (approximately equal to the liquid loading rate), mass emissions of hydrogen sulfide will be greater when the tank is nearly full (being topped off) than when it is initially being filled. If the total liquid flow is divided among several tanks, the net mass emission will depend upon each tank's ullage and the rate at which it is being filled. Thus, the determination of a peak hydrogen sulfide emission rate is governed by the way in which the loading operation is carried out.

For the conditions of this study, the following equation can be derived for the instantaneous net emission rate of hydrogen sulfide, Q_{H_2S}, as a function of the liquid loading rate, R_i, and the concentration of hydrocarbons in the ullage vapor, Y_i, of the i^{th} tank.

$$Q_{H_2S} = 8.6 \times 10^{-5} \sum_i Y_i R_i \qquad \text{(A-3)}$$

Q_{H_2S} is g/sec, Y_i is volume percent, R_i is in bbl/hr, and the summation is over all the tanks being loaded. In applying this equation, the assumption is made that Y_i will be either 6.5 or 36, depending upon whether arrival or generated ullage vapors are being displaced.

Based upon the project description for a 40,000 bbl/day production rate, it is expected that wing tanks will be filled first at 15,000 bbl/hr.

Topping will then be at a rate of about 7,500 bbls with the remaining 7,500 bbl/hr going to fill the empty center tanks. Under this condition, the peak hydrogen sulfide emission rate will be 0.27 g/sec. Should production expand to 80,000 bbl/day, the loading rate will be 25,000 bbl/hr. Wing tank topping will then take place at about 5,000 bbl/hr, with 20,000 bbl/hr going to the empty center tanks. The resulting peak emission rate is then 0.27 g/sec.

Final topping of the center tanks is expected to occur at about 10,000 bbl/hr maximum. Because of a final reduction in topping flow toward the end of loading, the effective final topping rate should be somewhat lower, about 9,000 bbl/hr. Under these conditions, the peak hydrogen sulfide emission rate would be about 0.28 g/s.

Based on these considerations, a peak hydrogen sulfide emission rate of 0.28 g/sec was used in the local scale analysis of air quality impact.

The duration of peak emissions can be estimated by considering the total volume of generated vapor blanket to be displaced at the given topping rate. For total wing tanks, this volume is estimated to be 10,000 bbl. The total center tank topping volume is about 15,000 bbls. At a 40,000 bbl/day production rate, two peak periods can be anticipated lasting about 80 minutes and 100 minutes. At 80,000 bbl/day, the estimated durations are 120 minutes and 100 minutes.

AIR QUALITY IMPACTS

Impacts associated with marine terminal operations were analyzed from a local and a regional standpoint. In the local-scale analysis, diffusion formulas were used to estimate the concentrations of pollutants in the immediate vicinity of the area. To assess impact, these concentrations were added to estimates of background concentrations and the resultant sums compared to appropriate air quality standards. Treating facility impacts on the SALM area were shown previously to be minimal. The regional analysis involved comparisons of the emissions of oxidant precursors (reactive hydrocarbons and nitrogen oxides) with the existing regional emissions. As indicated earlier, the region was taken as the coastal area of Santa Barbara County south of the Santa Ynez Mountains.

Local-Scale Analysis

The pollutants of principal concern in the local-scale analysis include sulfur dioxide in combustion gases from the tankship boilers, and hydrogen sulfide in the vented cargo tank vapors. Since reactive hydrocarbons present no known health effects in themselves (Public Health Service, 1970), their concentrations were not calculated on the local scale. In the local-scale analysis of nitrogen dioxide impact, it was assumed that the ratio of nitrogen dioxide to total oxides of nitrogen was 1/10.

Although offshore wind usually occurs at night, day-time sea breezes are expected to transport pollutants from the berthed tankship toward receptors onshore. To estimate the magnitude of the effect, dispersion calculations were performed using a Gaussion plume model (Turner, 1969). Plume rise was computed using appropriate formulas recommended by Briggs (1969) with stack/vent parameters as presented.

Because of the irregular coastal terrain, two adaptations of the Gaussion plume model for an elevated release were used to calculate pollutant concentrations: (1) normal ground-level concentrations, applicable to air flowing over a horizontal surface; and (2) plume center line concentrations, applicable to potential plume impaction against a rising slope. Additionally, a third computation was made for the case of transition fumigation (rapid vertical mixing of stable marine air as it passes over warmer land).

Sulfur Dioxide

One-hour sulfur dioxide concentrations were calculated under a variety of prevailing and worst case meteorological conditions (table III-6i). The downwind distances shown in the table are measured radially from the center of the SALM. The actual emission point, i.e., the tankship stack, will be displaced from the SALM by a distance of 0.2 km and an azimuthal angle governed by the wind and current prevailing at the time of berthing.

The concentrations shown in table III-6i are applicable to crude oil production rates of both 40,000 bbl/day and 80,000 bbl/day, since they are based on a one-hour averaging time.

Taking into consideration a reasonable range of background concentrations, the estimated one-hour sulfur dioxide concentrations in the area are well below the one-hour sulfur dioxide ambient air quality standard.

24-hour average sulfur dioxide concentrations were computed for several prevailing weather and wind sequences (table III-6j). These computations were based on the worst possible combinations of one-hour plume concentrations in table III-6i, wind direction overlap, and tankship arrival time. Additionally, an absolute worst case condition was postulated, consisting of persistent southerly wind at one m/s with the maximum possible duration of transition fumigation. In all the above computations, the maximum sulfur dioxide concentrations were found to occur 1.0 to 1.5 km from the SALM. Taking into account background concentrations, all concentrations

TABLE III-6i

ONE-HOUR AVERAGE SULFUR DIOXIDE CONCENTRATIONS (μg/m^3)
EXPERIENCED ONSHORE AS A RESULT OF MOORED TANKSHIP EMISSIONS

	Stability/Wind (m/s)	Maximum	Distance from the SALM (km) 1.0	1.5	2.0	2.5	3.0
Normal Ground-Level							
	F/1	10 @ 7.5 km	nil	nil	1	2	5
	F/3	8 @ 4.5 km	nil	1	4	5	6
	D/1	30 @ 1.5 km	22	30	27	24	20
	D/2	40 @ 0.8 km	38	29	22	17	14
	D/3	40 @ 0.7 km	33	23	16	12	10
	D/5	38 @ 0.5 km	24	15	11	8	6
	D/8	30 @ 0.5 km	17	10	7	5	4
Plume Center Line							
72 m above MSL	F/1	n/a[1]	n/a	225	144	107	81
56 m above MSL	F/3	n/a	n/a	75	48	36	27
64 m above MSL	D/1	n/a	n/a	49	32	24	19
Transition Fumigation							
	F/1	n/a	n/a	100	60	48	40
	F/3	n/a	n/a	41	24	19	15
	D/1	n/a	n/a	42	29	24	20
Background Concentration Estimate (Range)		0-45	0-45	0-45	0-45	0-45	0-45
Ambient Air Quality Standard		1310	1310	1310	1310	1310	1310

[1]n/a = not applicable

TABLE III-6j

24-HOUR AVERAGE SULFUR DIOXIDE CONCENTRATIONS ($\mu g/m^3$) EXPERIENCED ONSHORE AS A RESULT OF MOORED TANKSHIP EMISSIONS

	24-Hour Weather Sequence			Maximum Expected Shoreline Concentration[1]	
	Time	Direction	Stability/Wind (m/s)	@ 40,000 bbl/day Production	@ 80,000 bbl/day Production
Summer Sea Breeze Regime	6 hr 6 hr 6 hr 6 hr	E SE SW E	D/2 D/4 D/6 D/4	18	15
Winter Pre-Storm Southeaster	16 hr 8 hr	SE SE	D/4 D/8	14	11
Winter Northwester	12 hr 6 hr 6 hr	NW NW NW	D/4 D/8 D/12	n/a**	n/a
Winter Sea Breeze Regime	12 hr 6 hr 6 hr	NE SE SW	F/1 D/3 D/5	6	6
Persistent Overcast	12 hr 12 hr	SE SE	D/1 D/3	21	18
Clear Summer Day	8 hr 8 hr 8 hr	E SW SW	D/2 D/6 D/4	12	11
Possible Worst Case	8 hr 10 hr 6 hr	[SSE to SSW]	D/1 F/1* D/1	37	33
Background Concentration Estimate (Range)				0-1	0-1
Ambient Air Quality Standard				105	105

---

*Transition Fumigation

**n/a = not applicable

[1] These concentrations occur between 1.0-1.5 km from the SALM.

are well below the 24-hour ambient air quality standard for sulfur dioxide.

Annual average sulfur dioxide concentrations were estimated to be very low ($<10 \mu g/m^3$) in comparison to the Federal primary standard ($80 \mu g/m^3$).

Other Combustion Pollutants

The maximum onshore concentration of nitrogen dioxide was estimated at $30 \mu g/m^3$ (one-hour average). Given a background concentration range of 0-207 $\mu g/m^3$, the maximum expected local-scale nitrogen dioxide concentration is well below the one-hour ambient air quality standard ($470 \mu g/m^3$).

The maximum onshore concentration of combustion particulates was estimated at $11 \mu g/m^3$ (24-hour average). Background concentrations of total suspended particulates as high as $66 \mu g/m^3$ have been recorded in the area, and the 24-hour ambient air quality standard ($100 \mu g/m^3$) is exceeded in the air basin about 12 percent of the time. However, these background concentrations are significantly influenced by non-respirable soil particles and sea salt aerosol. Therefore, combustion particulates associated with the offshore loading terminal are expected to have a negligible impact on ambient air quality.

Hydrogen Sulfide

Air quality considerations resulting from the presence of hydrogen sulfide are largely associated with nuisances from odors and discoloration of some paints and metals at very low concentrations of the gas. The State one-hour hydrogen sulfide ambient air quality standard ($42 \mu g/m^3$) was developed by the California ARB based on these considerations. Odor thresholds lower than the State standard have been reported in the literature, but these studies usually have been conducted under conditions that make the results inappropriate for consideration in ambient air quality.

One-hour average concentrations of hydrogen sulfide were computed for peak emission periods under the same meteorological conditions used for combustion pollutants. The three vent pipes were treated as a single point source with plume rise equal to that expected from actual vent pipe flow (i.e., one-third of the total flow). Depending upon the orientation of the tankship (three vent pipes) to the wind, actual hydrogen sulfide concentrations could be as much as ten percent lower than shown at various distances in table III-6k. The equivalent single source may be considered to lie on a 0.1 km radial from the SALM.

Taking into consideration a reasonable range of background concentrations, the estimated one-hour hydrogen sulfide concentrations in the area are below the one-hour hydrogen sulfide ambient air quality standard. If odor were detected by receptors in the area during situations when the concentrations approach the standard as shown in the table, minor modifications in loading procedures could be implemented to avoid the situation.

Regional Analysis

The pollutants of primary concern on a regional basis are nitrogen oxides and reactive hydrocarbons. These substances are unstable chemical species that interact within the air basin to produce photochemical smog. Emissions of these pollutants are each compared to regional emissions in table III-6ℓ.

Regional emissions of nitrogen oxides would increase by 0.2 to 0.3 percent as a result of the marine terminal operations. The air quality impact of

TABLE III-6k

ONE-HOUR AVERAGE HYDROGEN SULFIDE CONCENTRATIONS ($\mu g/m^3$)
EXPERIENCED ONSHORE AS A RESULT OF MOORED TANKSHIP EMISSIONS

	Stability/Wind (m/s)	Maximum	Distance from the SALM (km) 1.0	1.5	2.0	2.5	3.0
Normal Ground-Level							
	F/1	25 @ 1.5 km	23	25	22	19	16
	F/3	11 @ 1.0 km	11	10	8	7	6
	D/1	33 @ 0.5 km	20	12	8	6	5
	D/2	25 @ 0.4 km	11	7	4	3	2
	D/3	18 @ 0.4 km	8	4	3	2	2
	D/5	12 @ 0.4 km	5	3	2	2	1
	D/8	9 @ 0.3 km	3	2	1	1	1
Plume Center Line							
26 m above MSL	F/1	n/a[1]	n/a	35	23	18	14
23 m above MSL	F/3	n/a	n/a	12	8	7	6
Transition Fumigation							
	F/1	n/a	n/a	35	23	19	16
	F/3	n/a	n/a	11	8	7	6
Background Concentration Estimate (Range)		0-5	0-5	0-5	0-5	0-5	0-5
Ambient Air Quality Standard		42	42	42	42	42	42

[1]n/a = not applicable

TABLE III-6 ℓ

COMPARISON OF OXIDANT PRECURSOR EMISSIONS FROM THE MARINE TERMINAL WITH EXISTING REGIONAL EMISSIONS

Average Emissions (Tons/Day)	@ 40,000 bbl/day Production		@ 80,000 bbl/day Production	
	Reactive Hydrocarbons	Nitrogen Oxides	Reactive Hydrocarbons	Nitrogen Oxides
Marine Terminal	0.44	0.04	0.89	0.06
Region[1]				
Total Stationary	2.6	1.7	2.6	1.7
Total Mobile	15.3	18.7	15.3	18.7
Combined Total	17.9	20.4	17.9	20.4
% Increase Due to Marine Terminal:				
In Combined Total	2.	0.2	5.	0.3

[1] Region is defined as the Santa Barbara County coastal area south of the Santa Ynez Mountains. Regional emissions are preliminary 1973 values obtained from Table 7.

this increase is considered to be insignificant.

Regional emissions of reactive hydrocarbons would increase by two to five percent as a result of the marine terminal operations. In terms of photochemical smog formation, the paraffin hydrocarbons emitted from the cargo holds during loading are expected to yield less oxidants than an equivalent amount of vehicular source emissions. Vehicular sources emit substantial amounts of aromatic and olefinic compounds, both of which have been shown to yield higher oxidant concentrations than an equal amount of paraffinic compounds (Kopczynski, et. al., 1975). Thus, the marine terminal operations are expected to have only a minor impact on regional air quality. The existing smog problem in the region is related primarily to vehicular emission sources.

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d. Oil Spills

Because of the loss of the lighter fractions by evaporation, an oil spill has an adverse impact on air quality. Roughly one third of the initial volume of spilled oil (i.e., those fractions of the crude oil boiling below about 300° C) may evaporate or sublime to the atmosphere and contribute to air pollution. Therefore, a major oil spill would, by evaporation, release large amounts of hydrocarbons into the air. About 50 to 100 pounds of hydrocarbons per barrel of oil spilled would be introduced into the air. As an example of this, Nelson-Smith (1970) presents evidence that the hydrocarbons evaporated to the atmosphere from the "*Torrey Canyon*" spill, off southern England, were approximately equal in quantity to the total amounts of sulphur dioxide and smoke in the atmosphere over Great Britain. Thus, the "*Torrey Canyon*" spill contributed substantially to air pollution, as well as water pollution for a short period of time. The deterioration of air quality and the resulting adverse impacts on populated shore areas due to a blowout or spill on an OCS platform would be reduced by the more than three miles distance from shore due to dilution in transit.

Assuming a 100,000 bbl spill, and 50 pounds of HC evaporated per bbl, and a reactive fraction of 15% (based on information by the Air Pollution Control District), the mass burden of reactive hydrocarbons (RHC) released into the atmosphere is:

$$100{,}000 \text{ bbl.} \times \frac{50 \text{ lbs.}}{\text{bbl.}} \times \frac{1 \text{ ton}}{2000 \text{ lbs.}} \times .15 = 375 \text{ tons of RHC}$$

The 375 tons of RHC would be totally volatilized within one day of a spill, and would blow into the air basin. The transport time, of course, would depend on the distance of the spill from shore. The further the spill from shore, the more dispersion of the pollutant before it entered the air basin.

Conversely, a spill immediately offshore would have less transport time and would cause more of a negative impact in the air basin. The length of time the RHC would linger over the air basin depends on the weather factors onshore. On a hot summer or fall day with wind speeds less than normal and with a low inversion system present, the longer the RHC would remain. Under those conditions, the pollutant would disperse within twenty four hours. On a winter day with opposite conditions, the RHC would be dispersed and pass over the air basin in transit.

The above spill case assumes a major spill of 100,000 bbl occurring at once. In reality, the spill would occur over a longer period of time thus introducing a steady input of RHC into the air. On the basis of the Santa Barbara spill of 1969, the spill occurred over a ten day period. Assuming that the high case of 100,000 bbl. spill was to occur over a ten day period or 10,000 bbl. per day, the resultant amount of RHC introduced into the air would be 37.5 tons daily. The amount would increase the daily amount of RHC in the South Coast Air Basin by about three percent each day for the ten day period as over 1,100 tons are released daily in the South Coast Air Basin which includes all of Ventura and Orange Counties, and portions of Santa Barbara, Los Angeles, San Bernardino, and Riverside Counties. If only Santa Barbara and Ventura County portions of the South Coast Air Basin were considered (88.9 tons/day input of reactive hydrocarbons), there would be a 43% daily increase in reactive hydrocarbons to that area over the ten day hypothetical spill period. Most of the volatilized materials, under normal atmospheric conditions, would be swept onshore to form an enlarged, but not a dispersed plume traversing the air basin. By any measure, emissions of RHC of this order of magnitude could have serious downwind consequences on oxidant levels depending on wind patterns, meteorological conditions (which also affect evaporation rates), and the actual location of the spill.

An oil well blowout which results in a fire would normally contribute a considerable amount of pollutants into the air over the lease area, but because of the distances involved from the land, and the wind patterns, the onshore impact will be lessened. The Air Pollution Control District for Los Angeles County notes that particulate matter would be introduced into the air mass and would cause a nuisance factor through soiling. If a prolonged fire were to occur, the onshore impact would be noticeable because the four percent air pollution carry over from one day to the next would be increased by the introduction from the offshore source. The four percent air pollution carry over mentioned by the Los Angeles APCD in December, 1974, has since been questioned and is being reevaluated.

The impact on the offshore islands would not be great because of the moisture content of the air, the wind patterns and air speed, and the relative location of the lease areas to the individual islands. However, in some cases the presence of moisture in the air promotes the formation of nitrous acid and sulfuric acid. A reasonable estimate of the range of emissions to the air, assuming complete combustion for each one thousand barrels burned, according to Levorsen (1958) could result in:

CO_2 : 170.0 to 173.5 tons

SO_2 : 0.31 to 17.0 tons

NO : 0.33 to 5.0 tons

Values used in the calculation are based on world averages for crude oil of 310 lb/bbl. Percent content by weight is: Carbon 82.2 to 87.1; Sulfur 0.1 to 5.5 and Nitrogen 0.1 to 1.5 .

Combustion of oil would actually be incomplete, and emissions would contain somewhat less of the above compounds. Other materials could also be present including volatilized particulates, carbon monoxide, nitrous oxide, sulfur monoxide, together with other altered or partially oxidized matter. There is no reliable way to predict in advance the relative volumes of each of these possible emissions because it would depend upon such factors as moisture content of the air, wind speed, pattern of oil spray from oil wells, number of wells involved, chemical content and physical character of the oil itself, and the types of equipment and materials other than oil which might also burn. In the case of an accidental release or the burning of natural gas, the onshore impact would be negligible. According to Ley (1935) the average composition of natural gas is:

Methane CH_4 72.3%

Ethane C_2H_6 14.4%

Carbon Dioxide CO_2 0.5

Nitrogen N_2 12.8

If the well was not burning the gases would be released into the air, and would contaminate the air since it has a 7-10% RHC factor. If the gas well was burning, combustion would essentially be complete and the emissions would consist almost entirely of carbon dioxide (CO_2) and water. The nitrogen would remain as N_2 at lower temperatures, but at higher temperatures a varying percentage of NO_x would be produced. Any sulfurous gases would be oxidized to SO_2.

2. Potential Levels of Development of the Channel

Determination of air pollution effects of the potential levels of Channel Development was based upon the development that would result from, on one hand, the low estimate of Santa Ynez Unit activity alone, and on the other, to the largest potential level which would be about three times the low estimate for the Santa Ynez Unit (SYU) alone. The low estimate for the Channel development is based upon 80,000 bbls/day production, all of which would come from SYU activity. SYU production would be onshore treated and tanker terminal loaded from the single Las Flores Canyon facility.

The high estimate is based upon enlarged SYU production of 120,000 bbl/day, all being treated at the one SYU onshore facility, along with 120,000 additional bbl/day being produced, treated, and tanker terminal loaded from four more combined onshore treating and tanker terminal locations, each of which would handle 30,000 bbl/day production. It was assumed that the expanded SYU facility and the four additional facilities would all have similar air emissions characteristics to the smaller low estimate SYU facility. What this means is that the same types and relative amounts of emissions would be produced but in quantities in proportion to production over or below the low Santa Ynez Unit estimate. Two of the additional onshore terminal facilities might be located somewhere between Santa Barbara and the Las Flores facility. The other two might be located somewhere in the south Ventura area.

Total pollutants emitted to the Santa Barbara and Ventura County portions of the South Coast Air Basin would then be three times as much for the high as for the low activity estimates. The local concentrations of pollutants would only, however, be one and one-half times as large for the high as the low estimate and would occur only at the Las Flores SYU site. The other four onshore treating and offshore terminal loading facilities would have local air pollution concentrations only 3/8 $\left(\frac{30{,}000 \text{ bbl/day}}{80{,}000 \text{ bbl/day}}\right)$ as much as estimated for the low SYU Las Flores site.

Emissions, rates, and impacts were calculated and are presented only for worst case conditions in the interests of brevity. The estimates presented in the Emission Inventory, table III-6m, are for the worst case weather, season, wind direction and stability, and location conditions. The impacts for all other cases would be less than those shown.

It was not possible to calculate or predict local pollutant concentrations from oil spills or large oil or natural gas fires because of the myriad of variables that could enter into the effects of such occurrences. Estimates for emissions from such events are, however, provided to aid general understanding of the factors involved.

3. Overall Impacts of the Potential Levels of Channel Development

The Emission Inventory, table III-6m, presents a variety of information on possible air pollution impacts from the various potential levels of development of the Santa Barbara Channel. Presented in the table for onshore facilities, marine loading terminals, oil spills, and oil fires are emission types and quantities, percent increase to emission loads of present Santa Barbara and Ventura County portions of the South Coast Air Basin, and local concentrations of pollutants. The information is provided based upon worst case conditions for low and high potential levels of development of the Channel and normal and abnormal occurrences.

A summary of the Emission Inventory table is provided in tables III-6n and III-6o.

TABLE III-6m Emission Inventory

TYPE OF FACILITY	EMISSION TYPES & QUANTITIES (TONS/DAY)	LOW 80,000 BBL/DAY / HIGH 240,000 BBL/DAY	PERCENT INCREASE TO PRESENT SANTA BARBARA & VENTURA COUNTIES PORTION OF SOUTH COAST AIR BASIN LOAD — LOW/HIGH	MAXIMUM LOCAL POLLUTANT CONCENTRATIONS AS A RESULT OF THE FACILITIES — LOW / HIGH
ONSHORE				
I Vehicle	Carbon Monoxide	0.046/0.138	.0078/.0234	Insignificant / Insignificant
	Reactive Hydrocarbons	0.007/0.021	.0079/.0237	Insignificant / Insignificant
Autos & Trucks combined	Nitrogen Oxides	0.035/0.105	.034/.102	Insignificant / Insignificant
II Production Facilities				
A. Oil Facility	CONTINUOUS SCHEDULED SOURCES			
Crude Oil Heaters (8 units)	Sulfur Dioxide	.0024/.0072		
	Nitrogen Oxides	.076/.2275		
Vent Vapor Incinerator (Includes tank vents for oil & water storage tanks & drain sump vents)	Sulfide Dioxide	.011/.033		
	Nitrogen Oxides	.002/.006		
B. Gas/Sulfur/LPG Treating Facility				
Tail Gas Incinerator	Sulfur Dioxide	.192/.575		
	Nitrogen Oxides	.006/.018		
Gas Turbine/Waste Heat Recovery Furnace	Sulfur Dioxide	.0025/.0075		
	Nitrogen Oxides	.151/.453	(SCHEDULED EVENTS)	WORST CASE HOURLY GROUND LEVEL POLLUTANT CONCENTRATIONS FROM SCHEDULED EMISSIONS
	Carbon Monoxide	.0865/.260	Hydrocarbons .0103/.0309	
Amine-Reboilers (2 units)	Sulfur Dioxide	.002/.006		
	Nitrogen Oxides	.053/.159	H_2S ---/---	SO_2 = 830/1245 µg/m^3
Sulfur Plant Feed Heater (2 units)	Sulfur Dioxide	.0002/.0006	SO_2 .078/2.30	NO_2 = 140/210 µg/m^3
	Nitrogen Oxides	.0006/.0018	NO_X 0.28/0.84	CO = 350/525 µg/m^3
Converter Gas Reheaters (2 units)	Sulfur Dioxide	.0001/.0003		
	Nitrogen Oxides	.0003/.0009	CO .0145/.0435	
C. General				
Minor Process Leaks, (Valve Packing, Pump Seals, Sampling, etc.)	Hydrocarbon	.018/.054		
	Hydrogen Sulfide	.0005/.0015		
	PERIODIC SCHEDULED SOURCES			
D. Standby Boiler (48 hrs/year)	Nitrogen Oxides	.00005/.00015		WORST CASE HOURLY GROUND LEVEL POLLUTANT CONCENTRATIONS FROM MINOR UPSET/UNSCHEDULED MAINTENANCE EMISSIONS
E. Emergency Generator (200 hours/year)	Nitrogen Oxides	negl.		
	Carbon Monoxide	.0002/.0006		
F. Firewater Pump (200 hours/year)	Nitrogen Oxides	negl.		SO_2 = 950/1420 µg/m^3
	Carbon Monoxide	negl.		NO_X = 390/585 µg/m^3
TOTALS - POUNDS PER DAY FOR SCHEDULED EVENTS	Hydrocarbon	.018/.054		
	Hydrogen Sulfide	.0005/.0015		
	Sulfur Dioxide	.210/.630		
	Nitrogen Oxides	.28895/.865		
	Carbon Monoxide	.0865/.260		
G. Minor Upset/Unscheduled Maintenance	UNSCHEDULED SOURCES			
Flare Off-Specification Sales Gas (2 hours)	Sulfide Dioxide	.0085/.0255		
	Nitrogen Oxides	.318/.960		
Emergency smokeless flare stack-maintenance depressuring of Amine Contactor (1 hour)	Sulfur Dioxide	.016/.048		
	Nitrogen Oxides	.00275/.00825		
H. Major Malfunction			(UNSCHEDULED EVENTS)	WORST CASE HOURLY GROUND LEVEL POLLUTANT CONCENTRATION FROM MAJOR MALFUNCTION UNSCHEDULED EMISSIONS
Emergency smokeless flare stack - inlet gas flare (1 hour)	Sulfur Dioxide	1.200/3.600	Hydrocarbons ---/---	
	Nitrogen Oxides	.200/.600	H_2S ---/---	
Tail Gas Incinerator Stack - Process upset; flare Amine still overhead vapor (30 minutes)	Sulfur Dioxide	.550/1.650	SO_2 6.50/19.5	SO_2 = 250,000/375,000 µg/m^3
	Nitrogen Oxides	.00015/.00045	NO_X 0.50/1.50	NO_X = 4,400/6,600 µg/m^3
			CO ---/---	
MARINE LOADING TERMINAL				
Tanker Combustion Gases	Sulfur Oxides	0.05/0.15	0.187/0.560	40/40 µg/m^3 (one-hour average)
	Nitrogen Oxides	0.06/0.18	.058/0.173	30/30 µg/m^3 (one-hour average)
	Particulates	0.013/0.039	.031/.094	11/11 µg/m^3 (24-hour average)
	Total Organic gases	0.003/.009	.00172/.00510	No impact in itself, therefore not calculated.
	Carbon Monoxide	0.001/.003	0.000167/0.00050	Insignificant
Vented Cargo Tank Vapors	Total Hydrocarbons	2.3/6.9	1.32/4.0	No impact in themselves, therefore not calculated.
	Reactive Hydrocarbons	0.89/2.67	1.0/3.0	
	Hydrogen Sulfide	0.003/0.009	Not calculated	35/35 µg/m^3
OIL SPILLS				
Spill alone				
100,000 BBL spill at rate of 10,000 BBL/ day for 10 days	Reactive hydrocarbons	37.5 tons/day for 10 days	43% increase for 10 days for Santa Barbara & Ventura Counties	No impact in itself, therefore not calculated.
Fire Combustion Products				
Oil fire assuming complete Combustion per 1,000 BBL (155 tons)	CO_2 - 170.0 to 173.5 tons	Total/1000 BBL	Negligible	No impact.
	SO_2 - 0.31 to 17.0 tons	Total/1000 BBL	1.5% to 6.4%	Not possible to predict due to variability of situations.
Crude oil	NO - 0.33 to 5.0 tons	Total/1000 BBL	0.32% to 4.9%	Not possible to predict due to variability of situations.
Offshore	Insignificant		None	Insignificant

TABLE III-6n

Total Increase in Tons Per Day of Present Emissions Load of the Santa Barbara and Ventura County Portions of the South Coast Air Basin from Normal Operations

Carbon Monoxide

Low	High
.1337	.401

Particulates

Low	High
.013	.039

Reactive Hydrocarbons

Low	High
.918	2.754

H_2S

Low	High
.0035	.0105

NO_x

Low	High
.3839	1.150

SO_2

Low	High
.260	.780

TABLE III-6 σ

Total Percent Impact on Present Emissions Load of the Santa Barbara and Ventura County Portions of the South Coast Air Basin from Normal Operations

Carbon Monoxide

Low	High
.022467	.06740

H_2S

Low	High
.013	.039

Reactive Hydrocarbons

Low	High
1.01992	3.05980

Particulates

Low	High
.031	.094

NOx

Low	High
.372	1.115

SO_2

Low	High
.967	2.860

It is important to keep in mind when reviewing the Emission Inventory that the highest emission rates and local concentrations would exist only in case of oil spill or major malfunction at an onshore treating facility. Such events would occur seldom, if ever, and would be of short duration. Normal operations would result in very minimal impact to overall basin air quality and as well as minimal local air quality effect.

In conclusion, the air emissions and air pollution impact of the low and high potential levels of development would be minor and of little importance for normal operation. The impacts of an oil spill or major onshore treatment plant malfunction would be considerable but of short duration and seldom occurrence.

M. Biological and Cultural Conservation Considerations and Concerns

Areas of primary concern in the Santa Barbara Channel area are: salt marshes and lagoons, the northern Channel Islands, aquatic birds, and archeological and cultural resources.

1. Salt Marshes and Lagoons

The dwindling salt marsh habitat presently consists of Mugu Lagoon, Carpinteria (El Estero), Goleta, and Devereaux sloughs. These fragile tidal areas provide primary habitat for two endangered and one rare bird species. The endangered and rare Belding savannah sparrow *(Passerculus sandwichensis beldingi)* is restricted to salt marsh habitat characterized by the pickleweed *(Salicornia sp.)*. Studies show there are only fifteen small areas of salt water marsh remaining between Santa Barbara County and northern Baja California, with the entire population of this sparrow restricted to these areas. In Santa Barbara and Ventura Counties, the endangered and rare light-footed rail *(Rallus longirostris levipes)* and the endangered and rare black rail *(Laterallus jamaicensis coturniculus)* are also restricted to these four salt marshes.

Bays, estuaries and marshes are critically important biologically. Estuaries and lagoons are not as large or numerous in southern California as they are in some other portions of the United States. Much of the estuarine environment has been severely altered or destroyed. Therefore, it is essential to preserve the remaining unaltered areas. (U. S. Department of the Interior - Bureau of Land Management, Final Environmental Impact Statement - Outer Continental Shelf Sales No. 35, 1975)

Additional emphasis on the value of coastal wetlands and the necessity for their conservation is indicated in the final draft of California Coastal Plan, as follows:

> "Estuaries and Wetlands Are a Vital Link between the Land and the Sea. Salt marshes are one of the most productive living systems known, ranking in productivity with intensively cultivated rich tropical agriculture. Salt Marsh plants transfer phosphorus compounds from the mud into the water, increasing the amount of this nutrient available to the microscopic plants (phytoplankton) that are a basic element in the marine food chain. Tidal mudflats support the growth of blue-green algae that fix atmospheric nitrogen

so that it can be assimilated by other plants. The estuarine system is much more extensive than the areas subject to tidal influence. The area between the upper edge of the tidal zone and the surrounding upland vegetation communities and freshwater marshes can be critical in maintaining the environmental balance in estuaries and in providing habitat for shorebirds. In addition, the amount, timing, and quality of fresh water entering an estuary is essential to the existence of plant and wildlife habitats.

"Many Fish, Bird, and Animal Habitats Are Found in Sheltered Coastal Waters. Many fish, water-fowl, shorebirds, wading birds, and other animal species use the productive coastal estuaries and wetlands either directly for spawning, nesting, resting, or feeding or indirectly as a provider of essential food through the food chain. Many rare or endangered species are entirely dependent on habitats found in California coastal waters. Because of the abundant wildlife present, estuaries and wetlands are valuable educational, research, and scenic resources.

"Estuaries and Wetlands Are Very Vulnerable to Abuse. Coastal estuaries and wetlands are particularly vulnerable to being used by man in ways that provide economic benefits but nevertheless destroy their natural values. Coastal estuaries and wetlands have been dredged for ports and marinas, subjected to sedimentation from upland erosion, filled to provide new land for development, used as sumps for domestic sewage and industrial waste, and deprived of freshwater inflow by water diversions. Of the original 197,000 acres of marshes, mudflats, bays, lagoons, sloughs, and estuaries in California (excluding San Francisco Bay), the natural productivity and open space values of 102,000 acres (52 percent) have been destroyed by dredging or filling. Of California's remaining estuaries and wetlands, 62 percent have been subjected to severe damage and 19 percent have received moderate damage. In southern California, 75 percent of the coastal estuaries and wetlands have been destroyed or severely altered by man since 1900. Two-thirds of 28 sizable estuaries existing in southern California at the turn of the century have been dredged or filled." (California Coastal Zone Conservation Commission, 1975, p. 38, 39)

2. The Northern Channel Islands

Establishment of shore processing and storage facilities on the mainland coast of Santa Barbara and Ventura Counties would have far less impact upon avian, mammalian, reptilian and amphibian faunas and plant communities than if like facilities were placed upon any of the four Channel Islands. The depauperate and spatially limited insular flora and fauna of these islands are far more fragile than their mainland counterparts and are, therefore, more readily damaged by this type of activity. The rare island fox *(Urocyon littoralis)* is also restricted to these islands.

3. Aquatic Birds

In the event of a major oil spill in the Santa Barbara Channel, the most visible damage to marine ecosystems is the damage to populations of marine birds present on the waters of the Channel at the time of a given pollution incident. Contrary to information in other publications, the January 1969 Platform A spill did not occur at the peak period of marine bird abundance in the Channel, but rather approaching the mid-level.

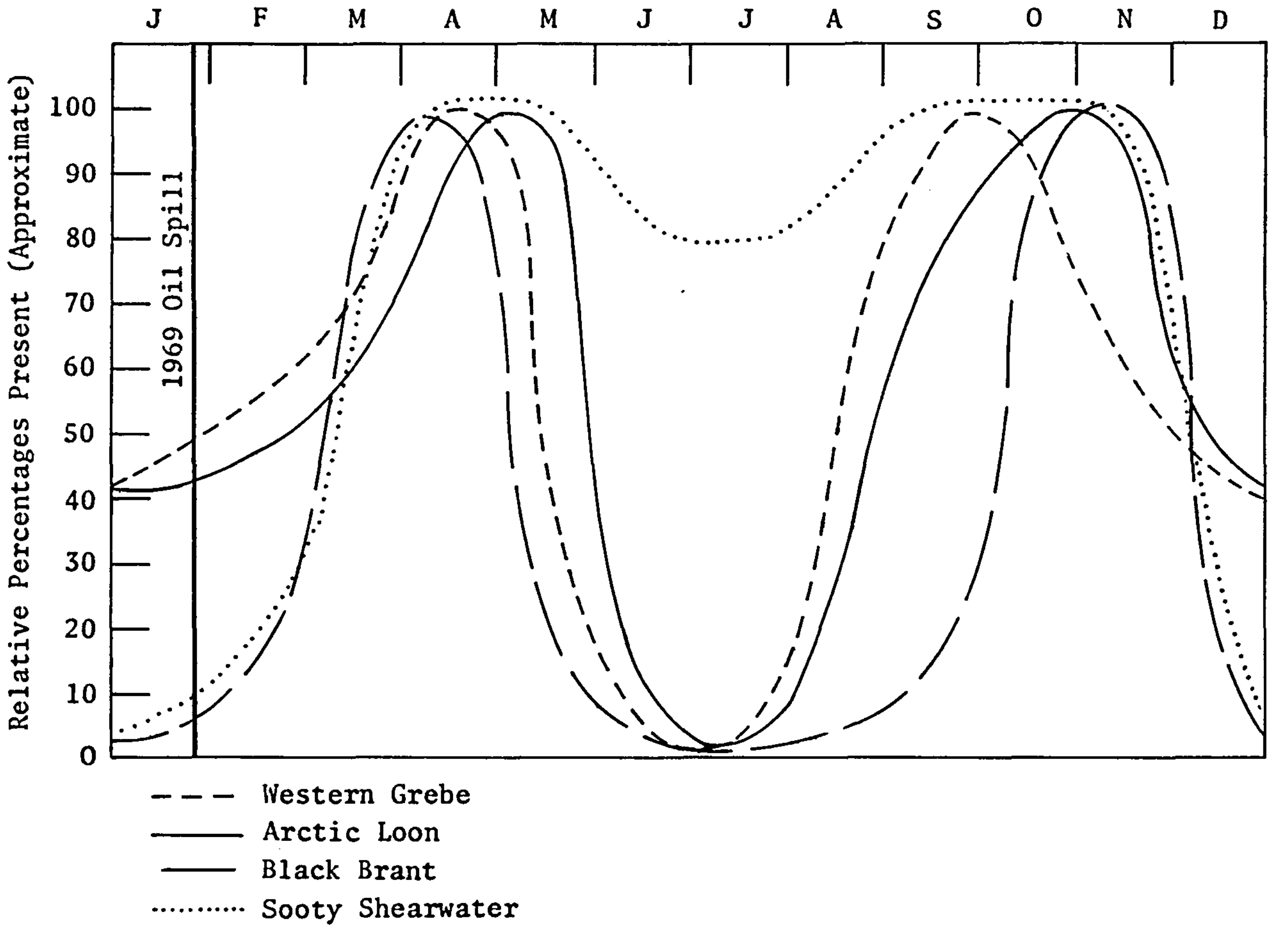
The annual cycle of aquatic migratory bird traffic in the Santa Barbara Channel is best compared to a tidal flow with definite high, low and mid-tide periods. Characteristically in the Northern Hemisphere, there is a massive exodus of aquatic bird life from arctic breeding areas in the fall. Varying with the species, this temporal wave passes down over North America, with the peak cresting at different geographic points and time periods, dependent upon the given latitude.

The peak period of the southward migration of aquatic birds in the Santa Barbara Channel area is generally October and November (see figure III-12). Large segments of the migrating populations remain in the Channel area for the winter and the remainder spread on southward along the Mexican coast. In the spring, a reverse migration takes place as these same bird species return to their breeding grounds in the arctic or north temperate areas. The southern birds (Mexican area) returning northward join the wintering birds of the Santa Barbara Channel area and, thus, cause the northward peak or crest to occur in April or May. The low point of the tidal flow, therefore, occurs during the summer months, with a mid-tide between November and April. Certain Southern Hemisphere pelagic species such as the Sooty

FIGURE III-12

Migratory Peaks of Abundance of Four Sample Species of Marine Birds in the Santa Barbara Channel

(Compiled by K. E. Stager, 1974)



Shearwater (*Puffinus griseus*) present a contrary picture in the Channel, as this species migrates northward during the Southern Hemisphere fall (March) with populations peaking along the southern California coast in April and May. Shearwaters remain numerous in the Channel through summer and peak numerically again in late August and September (see figure III-12) as the species returns to its breeding grounds in southern South America and New Zealand for the Southern Hemisphere spring (September). Fortunately, for some reason yet undertermined, shearwaters and closely related species do not seem to become involved in oil spill areas.

Certain species of aquatic birds appear to be much more vulnerable to pollution by oil spills than others. The most affected are the loons and grebes; the murres, auks and auklets; the pelicans and cormorants; and waterfowl. Except for the destruction of littoral food supplies, the effect of an oil spill on shorebirds, gulls, and terns appears to be more negligible.

4. Archeological and Cultural Resources

Most predictable destructive effects on archeological and historical resources where present would occur from ground-disturbing activities onshore and on lands submerged within the upper Pleistocene period. In view of the already heavy destruction of archeological sites onshore, further destruction of cultural material could constitute a significant loss of a non-renewable resource with potential for contributing additional knowledge about past Indian, Spanish, Mexican, and late 19th and 20th Century American populations.

Effects of off-shore facilities on submerged Indian sites and sunken historic vessels is not easily predictable since systematic study of these has been very limited. Reports by local divers indicate that because of heavy sea-action and the uneven and rocky nature sea bottom, actual inspection of the sea floor is necessary to reliably identify shipwrecks and potential submerged sites. Prehistoric sites which may be disturbed, may contain data from the earliest prehistoric period of occupation of the California Coast, not duplicated elsewhere. Sunken vessels have the potential for information on the early trade on the Santa Barbara coast which may not be duplicated elsewhere. Ground-disturbing projects which have the potential for adverse effects on these resources would be: onshore treating and storage facilities, including roads and other grading required; buried pipelines, offshore and onshore; anchor legs for near-shore loading terminals; anchor legs and submarine pipelines for offshore treating and storage facilities.

Projects having less likelihood for disturbing cultural resources, if they are confined to deep-water locations, are: production facilities, drilling operations, and platform construction.

N. Socioeconomics Impacts

In evaluating socioeconomic impacts from the potential levels of Channel OCS development, it is desirable to consider the National and State energy situation. Current U. S. and California energy outlooks have been reviewed extensively in a number of reports -- two of which are "Project Independence Report", November 1974, FEA, and "Energy Alternatives for California, Paths to the Future", December 1975, prepared for the California State Assembly by Rand Corporation.

Briefly, the situation is a mixed picture -

- tapering off of rapidly increasing petroleum use through various conservation programs,
- declining U. S. onshore oil and gas production in the southern 48 states,
- this declining production in the southern 48 states will be offset to some extent in future years by production from Alaska,
- results from accelerated exploration of OCS frontier areas are an unknown quantity at present.

1. Impact on Local Population

It is estimated that at peak employment, in year 5, a total of 100 to 200 new workers from outside the Channel area would move into the area. With an average family size of 2.4 people the additional population at peak would be from 240 to 480 people. This would be an increase of .03 percent to .07 percent of the present population of the two-county area. This impact is insignificant. If the entire peak non-construction employment force of 1,537 (see table III-8 in section III.N.2.) and their families were imported from outside the Channel area (this, of course, would not be the case, for it is estimated that 85 to 95 percent would be hired locally), the local population would increase by 3,688 persons. That represents a maximum increase of .5 percent of the present population. It would represent an even smaller percentage increase of population in year 5, when peak employment is projected, since the population of the two-county area will expand independently of possible Channel development.

It has been suggested that the entire impact of the population increase would be felt in the coastal area only, but this is not the case. Offshore employees frequently work in shifts of 7 days on and 7 days off or 14 days on and 7 days off; this enables the employees to live many miles from their place of employment since they do not commute from home to job each day. In the Gulf of Mexico some offshore employees live as far away as Arkansas and commute by air once every two weeks to their jobs.

According to Jerry Trent of the International Brotherhood of Operating Engineers, employees now living in Orange and Los Angeles counties are expected to keep their places of residence and commute to the Channel area once a week or biweekly.

For these reasons it is realistic to assume that not only the coastal but also the inland areas of Santa Barbara and Ventura Counties will absorb the increase in population that would result from the possible levels of development.

2. Impact on Regional Employment

In projecting the impact on regional employment of the possible levels of Channel development, two cases will be discussed. They are the total low estimate of possible development if cases 1, 2, 3, and 4, as outlined in table I-1, are undertaken, and the total high estimate if cases 1, 2, 3, and 4 are developed. (See section II.F.2. for current employment statistics)

In evaluating the level of potential employment several critical assumptions have been made which are discussed below. (Tables III-7 and III-8 depict a hypothetical scenario of wells, platforms, production, revenues, government royalties, and non-construction employment and wages associated with the hypothetical scenario.)

a. Exploratory Drilling Employment

Exploratory activity would be undertaken from year 1 through year 5. During this time a total of 49-165 exploratory wells would be completed. It is further assumed that one exploratory rig would complete 5 wells per year. A total of 2 rigs could be in operation for 5 years for a low level of possible development and a total of 7 exploratory rigs might be in operation for 5 years for a high level of possible development. It must be remembered that exploration could be stretched over a longer period due to governmental restrictions, environmental problems or labor strife. If any delays occur, the level of activity could be at a lower level for a longer period of time.

The peak level of employment related to exploratory drilling, including

TABLE III-7

HYPOTHETICAL SCENARIO OF WELLS, PLATFORMS, PRODUCTION, REVENUES AND GOVERNMENT ROYALTIES

Year	Cumulative Exploratory Wells		Cumulative Development Wells		Cumulative Platforms		Cumulative Onshore Facilities		Oil Production 000 BBL Per Day		Gas Production Million Cubic Feet Per Day		Total Annual Revenue at $11 BBL and $1 MCF Gas Million Dollars		Annual Govt. Royalties Millions of Dollars	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1	10	35	7	14	1	1	1	1	5	10	2.5	5	21	42	3.5	7
2	20	70	14	35	1	2	1	1	10	25	5.0	12.5	42	105	7	14
3	30	105	21	56	2	3	1	2	15	35	7.5	17.5	63	147	10.5	21
4	40	140	35	77	2	4	1	2	25	55	12.5	27.5	105	231	17.5	35
5	49	165	49	105	2	5	1	2	35	75	17.5	37.5	147	315	24.5	49
6			70	168	4	7	1	3	50	110	25.0	55	210	462	35	70
7			98	231	5	9	1	5	70	150	35.0	75	294	630	44	98
8			126	294	6	12	1	6	100	200	50	100	420	840	70	140
9			140	357	7	15	1	6	100	200	50	100	420	840	70	140
10			154	420	8	16	1	6	100	200	50	100	420	840	70	140
11			161	462	8	17	1	6	100	200	50	100	420	840	70	140
12			168	490	9	18	1	6	100	200	50	100	420	840	70	140
13			175	504	9	19	1	6	100	200	50	100	420	840	70	140
14			182	518	10	20	1	6	100	200	50	100	420	840	70	140
15			190	520	10	21	1	6	100	200	50	100	420	840	70	140
16			190	520	10	21	1	6	100	200	50	100	420	840	70	140
17			190	520	10	21	1	6	100	200	50	100	420	840	70	140
18			190	520	10	21	1	6	100	200	50	100	420	840	70	140
19			190	520	10	21	1	6	100	200	50	100	420	840	70	140
20			190	520	10	21	1	6	100	200	50	100	420	840	70	140
21			175	499	9	20	1	6	100	200	50	100	420	840	70	140
22			168	478	9	19	1	6	100	200	50	100	420	840	70	140
23			161	452	8	18	1	6	100	200	50	100	420	840	70	140
24			147	436	8	17	1	6	100	200	50	100	420	840	70	140
25			133	415	7	16	1	6	100	200	50	100	420	840	70	140
26			112	352	6	14	1	6	92	184	46	92	386	772	64.3	128.6
27			84	289	5	12	1	6	88	176	44	88	369	738	61.5	123
28			56	226	4	9	1	6	84	168	42	84	353	706	58.8	117.6
29			42	163	3	6	1	6	71	142	35.5	71	298	546	49.7	99.4
30			38	100	2	5	1	5	65	130	32.5	65	273	546	45.5	91
31			31	58	2	4	1	5	59	118	29.5	59	248	496	41.3	82.6
32			24	40	1	3	1	5	44	88	22	44	185	370	30.8	61.6
33			17	32	1	2	1	4	30	60	15	30	126	252	21	42
34			10	20	1	1	1	3	30	60	15	30	126	252	21	42
35			10	20	1	1	1	2	25	50	12.5	25	105	210	21	42
36			10	20	1	1	1	2	25	50	12.5	25	105	210	21	42
37			10	20	1	1	1	2	25	50	12.5	25	105	210	21	42
38			10	20	1	1	1	2	25	50	12.5	25	105	210	21	42
39			10	20	1	1	1	2	25	50	12.5	25	105	210	21	42
40			10	20	1	1	1	2	25	50	12.5	25	105	210	21	42
TOTALS	49	165	190	520	10	21	1	6	1.06 Billion/BBL	1.95	530 Billion cu.ft.	970	$12.19 Billion	$22.42	$2.03 Billion	$3.74

Table III-8 (Continued on next page)

NON-CONSTRUCTION EMPLOYMENT AND WAGES ASSOCIATED WITH HYPOTHETICAL SCENARIOS

	Exploratory Employment and Wages				Development Employment and Wages				Production Employment and Wages			
	Low Case		High Case		Low Case		High Case		Low Case		High Case	
Year	Employment	Wages ($M)	Employment	Wages ($M)	Employment	Wages ($M)	Employment	Wages ($M)	Employment	Wages ($M)	Employment	Wages ($M)
1	286	4.7	1001	16.4	90	1.5	270	4.5	23	0.4	23	0.4
	286	4.7	1001	16.4	90	1.5	270	4.5	23	0.4	46	0.8
	286	4.7	1001	16.4	90	1.5	270	4.5	46	0.8	69	1.2
	286	4.7	1001	16.4	180	3.0	270	4.5	46	0.8	92	1.6
5	286	4.7	1001	16.4	180	3.0	360	6.0	69	1.2	115	2.0
					270	4.5	810	13.5	92	1.6	161	2.8
					360	6.0	810	13.5	115	2.0	207	3.6
					360	6.0	810	13.5	138	2.4	276	4.8
					180	3.0	810	13.5	161	2.8	345	5.9
10					180	3.0	810	13.5	184	3.2	368	6.3
					90	1.5	540	9.0	184	3.2	391	6.7
					90	1.5	360	6.0	207	3.6	414	7.1
					90	1.5	180	3.0	207	3.6	437	7.5
					90	1.5	180	3.0	230	4.0	460	7.9
15					90	1.5	90	1.5	230	4.0	483	8.3
									230	4.0	483	8.3
									230	4.0	483	8.3
									230	4.0	483	8.3
									230	4.0	483	8.3
20									230	4.0	483	8.3
									207	3.6	460	7.9
									207	3.6	437	7.5
									184	3.2	414	7.1
									184	3.2	391	6.7
25									161	2.8	368	6.3
									138	2.4	322	5.5
									115	2.0	276	4.8
									92	1.6	207	3.6
									69	1.2	138	2.4
30									46	0.8	115	2.0
									23	0.4	92	1.6
									23	0.4	69	1.2
									23	0.4	46	0.8
									23	0.4	23	0.4
35									23	0.4	23	0.4
									23	0.4	23	0.4
									23	0.4	23	0.4
									23	0.4	23	0.4
									23	0.4	23	0.4
40									23	0.4	23	0.4
	TOTALS	23.5		82.0		40.5		114.0		82.4		168.6

TABLE III-8 (continued)

NON-CONSTRUCTION EMPLOYMENT AND WAGES ASSOCIATED WITH HYPOTHETICAL SCENARIOS

Year	Onshore Facilities Employment and Wages				Office Employment and Wages				Total Employment and Wages			
	Low Case		High Case		Low Case		High Case		Low Case		High Case	
	Employment	Wages ($M)	Employment	Wages ($M)	Employment	Wages($M)	Employment	Wages ($M)	Employment	Wages ($M)	Employment	Wages ($M)
1	20	0.4	20	0.4	21	0.4	21	0.4	440	7.4	1335	22.1
	20	0.4	20	0.4	21	0.4	21	0.4	440	7.4	1358	22.5
	20	0.4	40	0.7	21	0.4	21	0.4	463	7.8	1401	23.2
	20	0.4	40	0.7	21	0.4	21	0.4	553	9.3	1424	23.6
5	20	0.4	40	0.7	21	0.4	21	0.4	576	9.7	1537	25.5
	20	0.4	60	1.1	21	0.4	42	0.8	403	6.9	1073	18.2
	20	0.4	100	1.8	21	0.4	42	0.8	516	8.8	1159	19.7
	20	0.4	120	2.1	21	0.4	42	0.8	539	9.2	1248	21.2
	20	0.4	120	2.1	21	0.4	42	0.8	382	6.6	1317	22.3
10	20	0.4	120	2.1	21	0.4	42	0.8	405	7.0	1340	22.7
	20	0.4	120	2.1	21	0.4	42	0.8	315	5.5	1093	18.6
	20	0.4	120	2.1	21	0.4	42	0.8	338	5.9	936	16.0
	20	0.4	120	2.1	21	0.4	42	0.8	338	5.9	779	13.4
	20	0.4	120	2.1	21	0.4	42	0.8	361	6.3	802	13.8
15	20	0.4	120	2.1	21	0.4	42	0.8	361	6.3	735	12.7
	20	0.4	120	2.1	21	0.4	42	0.8	271	4.8	645	11.2
	20	0.4	120	2.1	21	0.4	42	0.8	271	4.8	645	11.2
	20	0.4	120	2.1	21	0.4	42	0.8	271	4.8	645	11.2
	20	0.4	120	2.1	21	0.4	42	0.8	271	4.8	645	11.2
20	20	0.4	120	2.1	21	0.4	42	0.8	271	4.8	645	11.2
	20	0.4	120	2.1	21	0.4	21	0.4	248	4.4	601	10.4
	20	0.4	120	2.1	21	0.4	21	0.4	248	4.4	578	10.0
	20	0.4	120	2.1	21	0.4	21	0.4	225	4.0	555	9.6
	20	0.4	120	2.1	21	0.4	21	0.4	225	4.0	532	9.2
25	20	0.4	120	2.1	21	0.4	21	0.4	202	3.6	509	8.8
	20	0.4	120	2.1	10	0.2	21	0.4	168	3.0	463	8.0
	20	0.4	120	2.1	10	0.2	21	0.4	145	2.6	417	7.3
	20	0.4	120	2.1	10	0.2	21	0.4	122	2.2	348	6.1
	20	0.4	120	2.1	10	0.2	21	0.4	99	1.8	279	4.9
30	20	0.4	100	1.8	10	0.2	21	0.4	76	1.4	236	4.2
	20	0.4	100	1.8	10	0.2	21	0.4	53	1.0	213	3.8
	20	0.4	100	1.8	10	0.2	10	0.2	53	1.0	179	3.2
	20	0.4	80	1.4	10	0.2	10	0.2	53	1.0	136	2.4
	20	0.4	60	1.1	10	0.2	10	0.2	53	1.0	93	1.7
35	20	0.4	40	0.7	10	0.2	10	0.2	53	1.0	73	1.3
	20	0.4	40	0.7	10	0.2	10	0.2	53	1.0	73	1.3
	20	0.4	40	0.7	10	0.2	10	0.2	53	1.0	73	1.3
	20	0.4	40	0.7	10	0.2	10	0.2	53	1.0	73	1.3
	20	0.4	40	0.7	10	0.2	10	0.2	53	1.0	73	1.3
40	20	0.4	40	0.7	10	0.2	10	0.2	53	1.0	73	1.3
	TOTALS	16.0		64.1		13.0		20.2		175.4		448.9

exploratory support activities onshore, would be expected to be 286 employees for low case activity and 1,001 for a high case activity over a period of 5 years (see table III-8). (Employment numbers expressed to the unit digit should not be interpreted as a degree of accuracy regarding potential employment) It must be remembered that all of these numbers are based on certain assumptions and scenarios. Only if these assumptions held true would the numbers be an accurate forecast.

b. Development Drilling Employment

Employment related to development activity would be assumed to begin in year 1 and continue through year 15. The reason that development is assumed to begin in year 1 is that platform "C" is already constructed and could be placed on the Channel floor within months should permission be granted. Therefore, development wells could be completed during the first year from that platform (see sections I.B. and III.C.3.a. for platform "C" discussion). Also the platform for the Santa Ynez Unit is being constructed and could be ready for placement in late 1976. Development related employment (including onshore service support) would be expected to reach a peak of 360 employees in year 7 and 8 for the possible low-level development or a peak of 810 people in year 6 through 10 for the possible high level of development.

c. Production and Platform Equipment

Production would be assumed to begin in year 1 and continue through year 40 with peak production of 100,000 BOPD (low estimate) or 200,000 BOPD (high estimate) commencing in year 8.

The peak level of production for both high and low estimate would be projected to continue from year 8 through year 25. It is further assumed that the life of a development well as well as a platform is 20 years. At the end of this period, the well would be plugged and abandoned and the platform would be removed.

Taking all these assumptions under consideration, it is estimated that for the low level of possible development a peak total of 230 people would be employed in production and platform operations from year 14 through year 20. For the high level of possible development, a peak of 483 people would be employed from year 15 through year 20.

d. Platform Placement Employment

To place a platform in the Santa Barbara Channel requires approximately 150 workers, mostly pile drivers, iron workers, operating engineers and welders, for a period of approximately three months. (Placement of deep water platforms, such as the one being constructed for the Santa Ynez Unit, may require up to 12 months with a wage cost of $4 million.) The average monthly wage is approximately $2,400 per worker. The high monthly income is due to the shifts that are worked i.e., twelve-hour shifts with four hours at time and a half. The approximate wage wage cost of placing a platform and hooking up facilities is $1.1 million. (This does not include laying pipelines to shore.) Using the scenario of table III-7 the employment and wages per year are depicted as follows:

Year	Employment Low	Employment High	Platform Placement Low	Platform Placement High		Wages in Millions of Dollars Low	Wages in Millions of Dollars High
1	150	150	1	1		1.1	1.1
2	0	150	0	1		0	1.1
3	150	150	1	1		1.1	1.1
4	0	150	0	1		0	1.1
5	0	150	0	1		0	1.1
6	300	300	2	2		2.2	2.2
7	150	300	1	2		1.1	2.2
8	150	450	1	3		1.1	3.3
9	150	450	1	3		1.1	3.3
10	150	150	1	1		1.1	1.1
11	0	150	0	1		0	1.1
12	150	150	1	1		1.1	1.1
13	0	150	0	1		0	1.1
14	150	150	1	1		1.1	1.1
15	0	150	0	1		0	1.1
					TOTAL	10.0	21.1

According to Local 2375 of the Pile Drivers Union all of the expected 150-450 workers would be hired from the Santa Barbara - Ventura County area. Total employment related to platform placement would be expected to only rarely reach 450 (if ever). This is due to the fact that a maximum of 3 platforms would likely be placed in any one year. In order for the placement labor force to reach 450, 3 platform placement projects would have to be ongoing at the same time. Even during a year in which 3 platforms were placed, the three projects may not occur simultaneously and if so only for a brief interval. One 150-man crew has the capability to place one platform in a 3-month period. As can be seen from the above scenario, in many years, not even one 150-man crew would be working if the low level of possible development occurred.

e. Office and Onshore Facilities Employment

In addition to the above employment, there would also be employment at onshore treatment facilities and offices. A maximum of 20 onshore facility employees and 21 office employees would be expected for a low estimate development. A maximum of 120 employees of onshore treatment facilities and 42 office employees would be expected for a high estimate of development.

f. Total Direct Employment

If the above scenario held true the maximum level of employment would occur in year 5 when all phases of employment would interact. In the low estimate of possible development the peak employment total would be projected at 576 people and for a high estimate of development 1,537 people. Depending on the level of employment these totals would be higher by at least 150 workers due to platform placement. These workers, however, might not be employed for the entire 15-year development period. (See d. above)

g. Construction Employment

Further employment would result from the construction of platforms and onshore treatment facilities but it is not possible to determine where this construction will be undertaken. It might be that platforms or parts of platforms would be built as far away as Louisiana or Vancouver, Washington. Some platforms might be built at Kaiser's facility in Oakland, California. It was thought at one time that a major portion of platform construction might be undertaken in the Los Angeles-Long Beach Harbor areas. But, present facilities there would have to be enlarged to handle construction of deep water platforms such as the Santa Ynez Unit platform being constructed for installation in 850 feet of water. That would require the approval of the California Coastal Zone Commission, which has indicated possible denial of enlargement plans. Given all of these uncertainties it is impossible to project the impact of construction activity on Santa Barbara-Ventura County employment or for that matter southern California employment. Maximum construction employment for a low case would be projected at approximately 1,000 people and approximately 2,000 employees for a high case but it is not known where this activity might take place or its duration. Platform construction costs range from 10 to 50 million dollars depending on the size and type of platform.

h. Labor Import into Santa Barbara and Ventura Counties

According to the Western Oil and Gas Association and Jerry Trent of the International Brotherhood of Operating Engineers, as few as 5 or 10 percent of required employees would be imported from other areas of the country. That means at peak employment (2,000 people in year 5) 100 to 200 new people would establish residence in Ventura or Santa Barbara County. (All 150-450 platform placement workers would likely be hired locally) The reason for this low number is twofold: first, petroleum related labor in the two-county area presently is experiencing a 20 percent unemployment rate; and second, due to the structure of their workweek, i.e., shifts are commonly seven days on and seven days off or 14 days on and seven days off, most employees living in Los Angeles and Orange County would not be expected to change their place of residence.

Summary

Since the unemployment rate throughout the two-county area presently is about 8 percent, the possible levels of development might be expected to reduce that rate by two or three percentage points if secondary employment is included. There are approximately 22,000 people unemployed in the two-county area, primary employment at peak (assuming that most employees would be hired locally) could reduce this number by 1,800. If two people are employed outside of the offshore industry for each employee in the industry an additional 3,600 people might be employed.

3. Impacts on Agriculture and Related Commerce and Industry

The direct impact of possible Channel development on the two-county-area agricultural industry could be the removal of 30 to 150 acres of farmland for onshore treatment facilities. It may be, however, that this acreage could be removed from recreational or commercial use. In either case, the direct impact would be minimal to agriculture. The removal of 30 to 150 acres from agricultural use would result in approximately $90,000 to $420,000 in annual crop revenues lost. The increased revenue generated by treatment facilities would more than offset the loss in crop revenues.

A positive impact of possible Channel development would be a source of reliable petroleum products to the California agricultural industry. The California farmer depends heavily on the availability of energy, particularly oil and oil by-products, to produce crops and to ship them to market. California agriculture used the equivalent of 51.2 million barrels of crude in 1972 and that total is expected to grow in the future. If the Channel area were fully developed, a yearly total of 73 million barrels of crude might be produced which would help meet agriculture's needs for energy. Since agriculture is, directly or indirectly, responsible for one out of every three jobs in the State, an interruption or shortage of petroleum supplies would have a massive negative impact on the State's entire economy.

The arrival of 1.2 million BPD of Alaskan crude oil in 1978 is predicted, however, this oil is also needed in the Midwest to meet energy requirements there and much of it (600,000 to 900,000 BPD) is expected to be shipped via pipeline to Midland, Texas, and then on to Ohio.

The following tabulation reflects the amount of energy used by California's agriculture, by fuel types:

Proportion of Energy Consumed by
Agricultural Industry in California

Energy source and units	State of California	California's Agricultural Industry	
	1,000,000 units		Percent
Natural gas.........THERMS	23,588.537	1,214.218	5.15
Electricity..........KWH	135,241.711	10,575.340	7.82
Diesel fuel..........GAL	2,659.356	292.584	11.00
Gasoline.............GAL	10,037.916	195.198	1.94
IP GAS...............GAL	458.933	52.629	11.47
Aviation gasoline....GAL	42.738	8.994	21.04

1,000,000 barrels of crude oil equivalent

Total direct energy use...........39.432 bbl.

Heat energy rejected in
electricity generation..........11.815 bbl.

Total energy associated with
agriculture.....................51.247 bbl.

Total energy use in
California (1972)............1,010.247 bbl.

Percent of California energy
used in agriculture..............5.072

Source: California Department of Food and Agriculture, University of California at Davis.

4. Impact of Wages on Santa Barbara-Ventura County Income

The annual total of direct wages from the possible Channel development is shown in table III-8. The total of direct wages paid over the 40-year period would be projected at $175 to $449 million, or a yearly average of $4.4 to $11.2 million for 40 years. This total would be higher if platform placement related wages are included. Over the first 15 years a total of $10 to $21 million in wages could result due to platform placement depending on the level of development.

If each dollar of direct wages (including platform placement wages) generates additional $2 of income the total effect of direct and secondary wages on income would be $654 million to $1,617 million over 40 years. If the multiplier is 2.5 then the total wages impact on income would be $545 million to $1,347 million for a low case and high case possible development, respectively.

Given the somewhat stagnant condition of the local economy at this time, this possible development would have a very positive impact and would stimulate economic recovery (see section II.F.4. and section II.F.2. for current statistics.)

5. Impact of Possible Development on Santa Barbara and Ventura Counties, 1976

During 1976, the economic impacts resulting from possible oil and gas development in the Santa Barbara Channel could be quite beneficial to local economics.

a. Non-construction Employment

Total non-construction employment related to possible low and high case development could range from 440 to 1,335 employees. The associated wages would vary from $7.4 to $22.1 million respectively (see table III-8). Given the present high unemployment rate (20-25 percent) among the crafts which would be utilized for the project, the economic benefits are evident.[1]

b. Construction Employment

Onshore oil storage and processing facilities as well as gas processing facilities for the Santa Ynez Unit are planned for construction in Las Flores Canyon. Construction is, however, subject to State Coastal Zone Commission approval. If these facilities are approved, approximately 150 people will be employed at the site itself with an additional 100-150 people being employed for the laying of pipelines and the construction of a marine terminal. One Santa Ynez Unit platform is projected for placement during 1976 which would require the services of 150 men (basically pile drivers and iron workers). The total wages generated by construction employment during 1976 would amount to roughly $7.9 million. If approval is not granted for the construction of the onshore facilities mentioned above, floating storage and terminal facilities (OS&T) located in Federal

[1]The unemployment rate cited comes from conversations with local union officials.

waters would be built. Construction of this OS&T would not occur locally, and $7.8 million in local wages would be foregone (two miles of pipeline would still be layed from the platform to the OS&T). The forced use of the OS&T would, according to industry spokesmen, preclude the construction of inland gas processing facilities. This would result in the inability to process an estimated 370 to 550 billion cubic feet of recoverable gas over the life of the potential development. The gas would then have to be reinjected.

Also, Platform C is constructed and stored at Vancouver, Washington, and could be installed in the Santa Barbara Channel during 1976, should permission be granted. (See sections I.B. and III.C.3.a. for Platform C discussion)

In general, oil and gas development in the Santa Barbara Channel during 1976 should provide positive impacts on economic activity within Santa Barbara and Ventura Counties. The level of impact will depend on whether one has low or high case development and whether onshore marine facilities are permitted to be constructed.

6. Impact on Beach and Shoreline Recreation

For the purpose of analyzing the impacts on beach and shoreline recreation, the life of possible hydrocarbon leases would be categorized by four stages: exploration, development, production and abandonment. Outdoor recreation is an important component of the southern California environment. Some opportunities are in extremely limited supply and swimming beaches are in this category. Santa Barbara area beaches are less impacted by heavy use than beaches closer to the Los Angeles Metro area. They do, however, receive heavy weekend use from Metropolitan area users. Even though beaches are abundant in southern California, the combination of auspicious climate and a large, highly mobile population creates a demand which far outstrips the supply. Any loss in opportunity for one resource such as a beach defiled by oil, will likely be made up by persons seeking alternative recreation elsewhere, such as going to another beach, going hiking in the mountains, or any of numerous other options. While this represents no net loss to society in terms of foregone opportunity, it does create a loss due to the increased crowding occasioned at the site of alternative activities selected, and thus may be a depreciation of quality for those alternatives. Capacity is limited both physically and by regulation at many sites.

Beach and shoreline activities susceptible to oil related impacts include surfing, swimming, skin and scuba diving, sunbathing, sightseeing, and fishing. Fishing can be broadly construed to include diverse activities ranging from surf fishing and clam digging, to grunion hunting.

There would be overlaps among the various possible development stages, but individual stages would tend to dominate varying periods through the life of leases.

a. Exploration

During this stage, geophysical data would be gathered. This consists of bathymetric, seismic, gravity, magnetic and presence-of-hydrocarbons information gathering. Test holes or wells may also be drilled. The greatest effect would be in increased marine traffic which would have minor affects on beach recreation. Ocean solitude would be affected somewhat by increased activity. Nearby seismic data gathering could affect divers. Onshore effects might be congestion and increased activity around airports, harbors or mustering areas.

These activities are currently engaged in in the Channel but their tempo would undoubtedly increase if any of the possible levels of development were implemented. Exploration usually lasts for about five years after the signing of leases and might be considered as part of the development process after that time period. Individual disruptions for nearby recreationists would be on a scale of a few hours and be entirely temporary. Disruption of solitude on wider areas of ocean could persist for several days to weeks at a time but be minor in overall impact.

b. Development

In the development stage of lease areas, platforms, pipelines, separation and storage and support facilities would be built. Wells would be drilled from barges and platforms. Most population increases or dislocations, if they occur, would occur at this stage, resulting in slightly increased pressure on Santa Barbara and Ventura area recreation facilities. Other onshore impacts would occur where the storage of construction material or building of mustering areas caused a change in land use or aesthetic damaage. If located near existing or potential recreation sites, their environmental quality could be degraded. Such changes in land use could also affect wildlife observation opportunities if on land which is presently undeveloped and in near-natural condition.

Possible construction of industrial sites in rural areas would result in increased pressure on existing resources, changes in aesthetic quality and higher land values. This could make recreation land acquisition more expensive. Wildlife habitat destruction or alteration through land-use change would be detrimental. Loss of open space may also occur. The possibility exists that oil-related industrial sites could be proposed for rural portions of the Ventura and Santa Barbara County coastal area. In Ventury County the loss would involve existing recreational uses in many cases.

Platforms would not physically interfere with beach or near-shore activities as they would be a minimum distance of three nautical miles offshore. The majority of them would, however, be visible a major portion of the time and have an aesthetic impact on beach users. Platform placement and attendant activities in waters near San Miguel, Santa Rosa, Santa Cruz, or Anacapa Islands might create disturbance to certain species of birds and animals indigenous to those islands.

Vessel traffic would be increased, shuttling men and equipment between shore and drilling sites. The impact would be visual and not particularly deleterious as ships and boats are generally accepted to be part of the ocean scene. Possible occasional small oil slicks from these vessels would also be considered adverse to recreational values.

Because of hazards present during development drilling, boaters may be restricted from the vicinity of platforms while such activity is underway. This wouldbe a minor loss probably more than offset by the subsequent attractiveness of the platform vicinity for sportfishing. The total amount of boating activities to be disrupted will depend on the time of the year, the size, location, and scope of the projects involved.

Impacts upon recreation activities can be caused by the many activities precipitated on shore in support of offshore drilling. Construction of equipment storage and marshalling yards, communications and navigation facilities, transportation centers and associated urban development could all affect recreation. Equipment yards could infringe upon shoreline recreation by converting the backshore to non-recreational use, restricting access to the shore, converting wildlands to industrial sites and by altering area aesthetics. Communication sites would generally be visible to all. Transportation support could remove nearby coastal land and open space from recreational use. Some induced urbanization could result from the influx of new-to-the-area workers who would be involved with an expanded oil development. A maximum increase of 2,000 workers could be expected within a 15-20 year period. These workers could increase the total population by as much as 4,800 with their families included. This type of increase places additional demands on area recreation resources. At an average of five acres of local park acreage per 1,000 people, this would create an additional need for 24 acres. This impact would be scarcely felt in Ventura and Santa Barbara Counties.

Possible onshore development which took place on any of the offshore islands would have a potentially significant impact on existing and potential recreational values there. Landings are restricted at all of the islands with the exception of two easterly islands of Anacapa. This limits the on-shore recreation benefits of those islands but does contribute to their solitude and naturalness. Negotiations with the private owners of Santa Rosa and Santa Cruz Islands may add these islands to a Channel Islands National Park at some future date. Due to the relatively pristine condition of these islands and their endemic flora and fauna, construction of any facilities on any of the islands would be considered as adverse.

San Miguel is a military reservation and could be used by private industry only with the Department of Defense's permission. Anacapa is part of the National Park System and not likely to be used for anything other than its current use. On the privately owned islands and surrounding waters to 3 NM, the California Coastal Zone Conservation Commission (or successor agency), Santa Barbara County Planning Department and State Lands Commission would have to approve any change of land use.

Santa Rosa and Santa Cruz Islands are privately owned and used for ranching purposes. Though they have been retained in rural usage, they could be used for separation and storage facilities. Santa Barbara County officials would have responsibilities along with the two State agencies for approving possible activities of this nature.

No concrete proposals to use portions of the islands for oil-related industrial sites have been presented by the industry. It is noted that such development could constitute an adverse impact probably for the duration of their existence. It would be possible to restore sites for recreational use once a facility is phased out.

If pipelines were brought ashore in a beach area used for recreation, there would be an impact on recreational activities. The area of a beach disturbed by pipeline construction will be small (about 30-50 feet wide), and the first high tides following burial of the pipeline will serve to restore the beach terrain. Restoration of the beach ridge through natural processes would take longer, most likely requiring a storm tide or high winds to obliterate the effects of excavation. Physical interference with recreational activities from excavation would be minimal and short-lived, lasting for an estimated period of one to ten weeks. Since coastal physiography generally limits the areas in which pipelines can be brought ashore to the alluvial plain areas, adverse impacts to the wetlands which often occupy these places could occur. Because of the biological value of remaining wetlands is high, activity near wetlands would be avoided to the extent possible. Since water turbidity would quickly return to normal levels, the impact would not be significant or long lasting.

If pipeline terminal or transfer facilities are located in or near a beach or other area used for recreation, there would be an adverse impact on recreational activities from disruption during the construction phase and elimination of about 30 acres per onshore facility for recreational and other uses. It is estimated a total of 30 to 150 acres could be affected. This latter impact would be long-term and restoration of the area, if attempted at all, would have to await depletion of the offshore production which the plant would be designed to serve. These impacts could also diminish the quality of the area for recreational enjoyment.

The impacts of pipeline and terminal facilities construction on recreation would be mitigated somewhat by appropriate and effective governmental zoning. The restriction by local or state authorities of construction to times when recreational use is at a minimum could help to mitigate impact.

Hydrocarbons would be transported by a combination of barges and tankers, or pipelines, and the required onshore area for support can be estimated. Barging would likely take advantage of existing port and offshore unloading facilities. These facilities exist at Port Hueneme, which already handles much oil field equipment, the marine terminal at El Segundo, the Los Angeles-Long Beach Harbor complex, and the marine terminal at San Diego/Encina. Other potential deepwater port locations in the general area are at Hueneme Canyon, offshore Port Hueneme, and at Point Fermin.

c. Production

Wells would be producing oil and gas in this phase and manpower requirements would be relatively lower than for the development stage. Repairs would probably occasionally need to be made to existing wells and pipelines. Impacts would be similar to those of the development phase except that personnel requirements would be lower, thus decreasing demand for local or regional recreation facilities. Production occurs, usually, for about 20-40 years.

d. Abandonment

Abandonment occurs after a field is exhausted. The effects would be the lowering of tax bases, with concomitant loss in bonding power to construct new recreation facilities, lessening of financial ability to maintain existing facilities, and aesthetic impacts if abandoned equipment were left scattered around. This would be prohibited in federal waters. Platforms would be dismantled and any impacts attendant thereto would be temporary disruption due to wrecking activities and transportation of salvage.

e. Oil Spills

Oil spills can occur at any stage in the life of a lease, but are more likely to occur during the development and production stages. Spills may be large and infrequent or small and persistent in occurrence. Progress has been steady in prevention and containment of spills but they do continue to occasionally occur. Statistical evidence indicates that several spills exceeding 50 bbl might occur, from the possible levels of Channel development, as well as numerous small losses from platforms and vessels. Prevailing wind and currents would cause spilled oil to reach shore eventually, if it were not contained or were not degraded by natural processes. In the worst case, a nearshore oil spill on an incoming tide with an onshore wind, could cover beaches before it was possible to mobilize containment activities. If this occurred in the summer, and particularly on a mainland shore, recreation losses would be great until beaches and nearby waters could be cleaned. Water sports, such as swimming, surfing, diving, spearfishing, underwater photography, fishing for finfish and shellfish, and boating would be directly affected.

Other seashore related activities such as beachcombing, shell collecting, painting, shoreline nature study, camping and sunbathing would be made much less attractive for an indeterminate period where an oil spill had contacted a beach.

Removal of oil from beaches used for recreation in the area under consideration would probably involve removal of the contaminated sand, and possibly replacement of the sand if needed. Sand removal necessitates a place for sand disposal and a source of replacement sand. Sand is an increasingly short commodity in southern California.

The time required for clean-up in this case would depend on the extent of beach affected. Recreational use of the area would be precluded during the time oil covered the beach and during the clean-up process also. It is estimated that the duration of such impact, if it occurred, would range from one to sixty days.

Impacts of an oil spill as discussed above would be more keenly felt if the recreation area involved were intensively used or considered to have unique or outstanding recreational values. Not only would the impact be felt by the recreational users of these areas, but the community of businesses whose economic well-being depended on use of its recreational resources by tourists would be affected as well. If an oil spill were to cover outstanding recreational beaches during the height of the tourist season, the impact could be expected to be more severe in that tourists would not be attracted to a beach area contaminated by oil or undergoing a clean-up process, and there would be a resultant economic loss. Fourteen percent of southern California's 8.5 million out-of-state visitors indicated beach or coastal visits were part of their itinerary. Thus some portion of 1,190,000 people would be affected by an oil spill. Most likely, a shift of visits to unaffected beach areas would occur but some trip cancellations could ensue. The effects would be local rather than regional in scope.

Aesthetically, considerable damage may be wrought for varying lengths of time depending upon the success of clean-up. Most losses would be temporary and partially offset, as many people would avail themselves of unaffected alternative recreation sites or activities, there thus being no net loss to society. Other losses, though temporary, are longer term and thus might represent an intrinsic loss to society. Such damages as bird kills and losses of intertidal animals and marine mammals may be restored in time but for the duration of their depletion, do represent a loss to those who enjoy studying them. A more difficult loss to quantify is the damage to the ephemeral or "spiritual" value attendant in an undefiled or untampered environment. This quality is held dear by many people.

Mead and Sorensen (1970) analyzed the cost of the Santa Barbara oil spill and took a recreation survey in the process. Their survey findings as they relate to impacts briefly indicate that: approximately 53% of the respondents stated that they used the beach less in the 12 months following the spill than in the 12 months preceding it. Four percent said they used the beach more after the spill; 37.1% said they visited the beach the same number of times. In more detail, the average (mean) number of beach visits had declined from 27.9 in the previous 12 months to 20.8 in the following 12 months. Thus, their survey indicates that area residents visited the beach fewer times (on average) in the 12 months following the spill. They therefore concluded that an aggregate net reduction of 744,000 beach visits occurred in the 12 months following the spill among Santa Barbara coastal area residents over the age of 16. The calculated total loss of recreational beaches for intermittent time periods was $3,150,000 for Santa Barbara and Ventura Counties (Mead and Sorenson, 1970).

Some tourism losses occurred as evidenced by drops in "bed tax" collections in Santa Barbara and Montecito. Offsetting gains occurred at nearby Goleta which resulted in an overall increase for Santa Barbara County for 1969. They concluded that no over-all loss occurred due to offsetting gains elsewhere within the county and region, although private losses to restaurants and motels near the beach probably did occur.

Small spills will prove to be annoyances more than anything. Beaches throughout most of the Los Angeles, Ventura and Santa Barbara County area are subjected to tar balls from natural seeps in the ocean floor and probably from ships. These frequently are found splattered on rocks, buried in the sand in the surf zone or tossed on the beach. They are capable of soiling feet or clothing and thus are undesirable.

Small spills or the remnants of large ones may contribute tar balls to the beaches and thus cause a minor impact.

Dr. Walter J. Mead, University of California-Santa Barbara, and Dr. Philip E. Sorenson, Florida State University, (Platform A: The Oil Spill that Spread Around the World, pp. 36-40), have estimated the economic costs of the 1969 oil spill. Their estimates and comments follow:

• Beach cleanup by operator	$4,887,000	
• Oil well control efforts by operator	3,600,000	
• Oil collection efforts by operator	2,000,000	$10,487,000
• All Federal agencies		382,000
• State of California[1]		200,000
• County of Santa Barbara		57,200
• City of Santa Barbara[2]		negligible
• Damage to tourism[3]		negligible
• Damage to commercial fishing industry[4]		804,250
• Property value loss[5]		1,197,000
• Fish life damage		negligible
• Bird life damage[6]		7,400
• Seal and sea lion damage[7]		negligible
• Intertidal plant and animal damage[8]	low estimate high estimate	1,000 25,000
• Value of lost oil[9]		130,000
• Recreational value lost[10]		3,150,000
	Low estimate	$16,415,850
	High estimate	$16,439,850

Comments keyed as footnoted:

[1] Mainly Department of Fish and Game expenses.

[2] No direct cost of any significance. Some minor surveillance by City officials.

[3] The community firmly believed that the spill had a pronounced effect on tourism but the study indicates the contrary. There was some diversion from motels and restaurants near the ocean to other nearby areas and some diversion from the Santa Barbara area to other recreation areas in southern California but the net effect was negligible.

[4] Although biological studies indicate no serious effects on the fish there is a social cost involved since no fishing boats operated for a period of about two months because the harbor was blocked by a boom part of the time and gear was fouled by oil for the remainder. The loss shown is for a reduction in value of the 1969 fish catch together with uncompensated damage to the commercial fishing fleet.

[5] Some beach front real estate was damaged by the spill and there was a small decline in property values but the authors consider the decline temporary and that it will dissipate within five years if no further oil pollution occurs. The loss shown is for decreased rentals. However, a class action suit has recovered $4,500,000 damages for beach front property owners and boat owners.

[6] The authors state: "Bird losses during the period when the oil spill was most serious were 'relatively moderate' according to the U. S. Bureau of Sports Fisheries and Wildlife. The California Department of Fish and Game estimated that, by March 31, 1969, bird losses amounted to 3,600, not counting birds that perished in the open water and failed to drift ashore. By May 31, 1969, known bird deaths had increased to 3,686. Due to fortuitous circumstances, the bird population was uncommonly low while the oil spill was at its worst. In the absence of any large-scale bird loss we cannot assess a significant economic charge for bird damage. We will assume that the unknown bird losses equalled in number the known bird deaths. We know of no objective means by which the economic cost of bird losses may be assessed. We believe that this unknown value is greater than zero, hence to assert a value of zero would be to insert an avoidable error in our cost estimate. Accordingly we have arbitrarily assumed that each bird loss involved a social cost of one dollar. Thus the total cost for bird damage is $7,400." The authors further state that "even if a cost of ten dollars

per bird is assumed, the bird damage is not a significant element in the total cost." However, some bird lovers would decline an estimate of value of a one dollar, or even a ten dollar, cost per bird. It is not unreasonable to assume that an avid ornithologist would place a value of $1,000 per bird, in which case this would become a significant element in the total social cost.

7 A controversial article in Life magazine (Snell, 1969), which was accepted at face value by conservationists, indicated severe oil damage to the pinniped population of San Miguel Island, but biological studies (U.S. Department of the Interior, 1969; and Allen, 1969) do not confirm this.

8 The authors admit that "it is impossible to assign a social cost representing damage to plant and animal life in the intertidal zone of the oil spill. On the other hand we can assert with some confidence that the cost is greater than zero...we have no means by which a reasonable cost estimate can be made." Therefore, they used the arbitrary values of $1,000 and $25,000.

9 Since the oil from the blowout was denied to society, the value of this oil must be taken into account. The authors accept Allen's estimate that the amount of oil spilled in the first four months was about 80,000 barrels (Allen, 1969). They calculate the "marginal social value of the oil at $2.15 per barrel rather than the 1969 market price of $3.25 per barrel" since they claim the latter is artificially high due to oil import quotas. After deducting lifting and transportation costs that the oil would have incurred if it had been used the net social cost of the lost oil is given as $130,000.

10 The cost of recreation lost was derived from a detailed survey in which residents were asked to compare the enjoyment they received from a beach visit to the enjoyment they received from going to a movie. A typical beach visit was established to be 1.74 times as enjoyable as a typical movie. In the twelve months following the spill it was estimated that there were 744,000 fewer visits to the beaches because of oil pollution.

Not all of the costs estimated by Mead and Sorenson were losses to society. The public received at least some side benefits from the expenditure of nearly $5 million for beach clean-up, during which debris from preceding floods was also removed. Payment for the use of resources that otherwise would be idle during clean-up is in some measure a benefit to society.

Resources that otherwise might have been unused include the labor used in clean-up and monitoring as well as services furnished by hotels and other local businesses.

In summary, spills can cause losses which could be major, though certainly not permanent, except where the extirpation of a species important to recreation occurs.[1]

Another important factor affecting potential impacts is changes in land use resulting in open space and recreation land loss. The creation of adequate land use plans, effective zoning and strong enforcement by enlightened local officials will play a large role in the ultimate effect of leasing on recreation and open space.

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[1] The demise of any species either totally or throughout a significant portion of its range is considered a major adverse impact. This section deals solely with recreation, hence the limitation to the recreational context.

f. Indirect Favorable Impact of OCS Federal Production on Santa Barbara Channel Area Recreation - Land and Water Conservation Fund.

The Land and Water Conservation Fund is the largest Federal grant-in-aid program of assistance to States, Counties, and Cities for the acquisition and development of public parks, open space, and recreation lands and water. In addition, the fund pays acquisition costs for authorized areas being added to the national systems of parks, forests, wildlife refuges, wild and scenic rivers, and scenic and recreation trails.

The fund, which is administered by the Bureau of Outdoor Recreation in the Department of the Interior, was established by Congress in 1964 (P.L. 88-578, September 3, 1964, 78 Stat. 897). Amendments to the original Act in 1965, 1968, and twice in 1970 (P.L. 89-72, July 9, 1965, 79 Stat. 218; P.L. 90-401, July 15, 1968, 82 Stat. 354, 355; P.L. 91-308, July 7, 1970, 84 Stat. 410; and P.L. 91-485, October 22, 1970, 84 Stat. 1084) provided that the annual income of the fund be not less than $200,000,000 for the fiscal years of 1968, 1969, and 1970 and $300,000,000 for the fiscal years of 1971 through 1989. These amendments also provided that, to the extent other appropriations are not sufficient to make the total annual income of the fund amount to these levels, an amount sufficient to cover the remainder would be credited to the fund from revenues due and payable to the United States for deposit in the Treasury as miscellaneous receipts under the Outer Continental Shelf Lands Act.

To May 31, 1974, the State of California had received approval for some 310 grants totalling $68,190,027.40 between the dates of April 15, 1966 and February 28, 1974. About half of the approved projects have been completed. Of this amount, $534,728.43 was for five projects in Santa Barbara County and $4,855,305.00 was for 14 projects in Ventura County (the Counties bordering the Santa Barbara Channel.) See our response to the Bureau of Outdoor Recreation in section IX.B. for a detailed breakdown of Coastal L&WCF-funded projects separate from the County groupings.

To December 31, 1973, the cumulative revenue from the Outer Continental Shelf, off California has been $704,362,480, consisting of $636,715,849 in bonuses, $201,695 in minimum royalties, $8,883,564 in rentals, and $58,561,372 in royalties. Exclusive of bonuses, the combined revenue from rentals, minimum royalties, and royalties has been $67,646,631.

The grants from the Land and Water Conservation Fund which the State of California has received ($68,190,027.40) amount to 9.68 percent of the total revenue from the Outer Continental Shelf, off California or 100.8 percent of the combined revenue from rentals, minimum royalties, and royalties.

7. Impact on Education

Since approximately 165,000 students are enrolled in grades 1-12 in Santa Barbara and Ventura Counties, the increase of 80 to 160 additional children of school age to the two counties' school systems would represent an increase of .05 percent to .1 percent. Assuming that these children will spread across the two counties the impact will be negligible. If all of the peak level employees (2,000) were new arrivals, the additional 2,000 students would represent an increase of 1.2 percent of the present student body. (This is assuming that each employee has an average of one school age child in his family) The impact is not expected to require the building of additional school facilities or the hiring of new teachers and associated administrative personnel.

The addition of adult students to the educational system is also expected to be of negligible impact. (See section II.F.6. for education details)

8. Impact on Research

The possible development could stimulate new research on oil pollution and, perhaps, monitoring programs on oil pollution in the Santa Barbara Channel.

According to Lawrence Leopold of the University of Southern California, Sea Grant Program, and David Coon of the University of California of Santa Barbara, Institute of Marine Sciences, new research, resulting from possible development, is not now being planned. However, the possibility of such research is not ruled out (per personal conversation).

If new research is undertaken, it will be beneficial not only to the local area but for all parts of the world in which oil pollution of the ocean is a problem. This should not be interpreted to mean that oil pollution and the resulting research are a positive impact of this possible development. In the event of a major oil spill, oceanographic and biological research other than on oil pollution could be affected or delayed.

9. Impact on Military

San Miguel Island is under U. S. Navy control and is restricted to access, including a three-mile danger area around the island. It is used for military operations and could present some potential conflict with oil and gas operations in the Channel. In addition, the extreme western part of the Channel is subject to missile overflights from Vandenburg Air Force Base. Special stipulations one and two resolve any conflict with overflights from Vandenburg in favor of military operations and, therefore, possible development is not expected to have a negative impact on military operations. However, if a conflict with military operations does occur, the military has the authority under stipulation one, to temporarily suspend any oil and gas operations, including evacuation of personnel, until the conflict is resolved.

10. Impact on Commercial Fisheries and Sport Fishing

Offshore oil and gas operations interfere with commercial fisheries in three general ways: 1) removal of sea floor and pelagic areas from use; 2) creation of obstructions on the sea floor that damage trawling nets; and 3) loss of catch due to presence of oil in waters and/or flesh. (See sections III.D.3. and III.L.8.b.(2).

a. Commercial Fishing

The following, taken from the Bureau of Land Management (1975) and the National Academy of Sciences (1975), discusses the potential impacts of oil operations on commercial fishing.

Bottom trawl fishing is not important on the Southern California Borderland south of Point Dume. The California halibut trawling grounds, established by the Department of Fish and Game, extends from Point Arguello southward to Point Mugu. Trawling is permitted beyond one mile from shore to a depth of 25 fathoms. Only between Santa Barbara and the Hueneme Canyon does this depth limit of 25 fathoms extend to or past the three-mile limit. However, it should be noted that a potential for a trawl fishery exists in all the areas. All sites occupied by drilling or production platforms and attendant service boats and barges must be avoided by trawlers. If the exploratory structures are jack-up drilling rigs or permanent production platforms, the area of the sea floor eliminated from commercial fishing would amount to two to five acres for each structure. In deeper waters (over 300 feet), a semisubmersible drilling rig with its anchoring system would occupy up to 325 acres (assuming a 1,500 foot anchoring radius). The duration of exploratory drilling ranges from under 45 days for a single well to around six months for multiple well explorations. Permanent production platforms may remain in place for 10 to over 20 years.

Purse seining is the largest commercial fishery in the area. Purse seine fishermen are at drift and almost completely at the mercy of winds and currents while the net is in the water, a period of two to four hours. Seines used by tuna fishermen are commonly 600 fathoms long and 60 fathoms deep. Mackerel seiners use smaller nets, commonly 265 fathoms by 30 fathoms. Winds of 10 to 15 knots are common and the fishing boats, even with their seines deployed, can drift up to 15 miles (local fishing organizations in cooperation with personnel of the National Marine Fisheries Service and California Department of Fish and Game).

Special configuration of the production platforms will be important to fishing operations. Clusters of platforms in small areas will be less detrimental to fishery operations than platforms equally spaced one every tract or two over larger distances. Unburied pipelines, large materials or tools accidentally dropped overboard in water depths of less than 250 to 300 feet could snag and destroy purse seine nets. Materials remaining on the sea floor at the site of abandoned and disassembled platforms at similar depths could also present snag problems (Fisherman's Cooperative Organization, personal communication, 1974).

According to O. Allen (personal communication, 1974) menhaden fishermen in the Gulf of Mexico do not complain about oil platforms interfering with their purse seining operations. This would indicate there may be no problem involved, particularly when considering the numerous complaints received concerning trawl fishing and oil operations in the Gulf. However, to more completely analyze the situation, it should be remembered that the acceleration of Gulf Coast commercial fisheries and oil operations began at the same time, just after World War II. Oil structures may simply be tolerated by fishermen even though total fishing area available to fishermen has been somewhat reduced according to R. Chapaton (personal communication, 1974). Gulf menhaden are shallow water species with the majority occurring within one mile of shore. Approximately 90 percent occur within three miles offshore. On the other hand, the southern California wetfish and tuna fishery is important in areas further removed from the coast.

The total number of platforms required to develop a leased area and their spacing relative to each other are important factors in considering potential impact on commercial fishing activities.

Large pieces of debris, such as equipment, piping, structural members, tools, and the like, may accidentally be lost off a platform or service barge. Losses off a platform may be located easily by divers and retrieved. However, if lost off a boat or barge under way, the location may not be known accurately enough to allow subsequent recovery. Depending on the size size and weight of items lost in this way, varying amounts of damage may be done to trawling nets of fishermen unlucky enough to snag them.

Attempts to quantify fisheries losses from a hypothetical oil spill can be extremely misleading because the great number of variables involved can produce drastically different results from varying circumstances. Nevertheless, to provide a very rough idea of the possible consequence of a spill, we shall assume a blowout produced spill of 100,000 barrels over 61 days. The result could be a 500 square mile oil slick, which, if superimposed on the Channel's most productive fishing blocks, <u>might</u> result in a 3,750,000-pound reduction in fish catch. (The median number of pounds/block for 1970 to 1971 to 1972 was used) This presumes that no fish are taken for 60 days and that half the median number are captured during the next 60 days. It should be pointed out that, if fishing efforts were concentrated elsewhere, outside the contaminated area, fish landings might not decrease at all. A figure of $184,600 representing the loss to fishermen as a result of a spill was based on the assumption that the catch in the affected area consisted of mackerel, anchovies and sardines. Value is assumed to be $115 per ton for mackerel and $35 per ton for anchovies and sardines. (There is a moratorium on sardines and they are only caught incidentally) The figure of $184,000 is an extremely conservative estimate because 1) some of the mackerel will be sold as live fish and not reduced or canned, thus averaging a much higher price, and 2) many fish, more valuable than anchovies, mackerels and sardines, will in fact be landed.

Some insight into the effects that long-term oil operation can have on fisheries is presented in the following material from the National Academy of Sciences (1975).

Any possible effect on fishery productivity is of prime concern in coastal areas where there are chronic inputs of petroleum hydrocarbons. One of the most extensive areas of coastal petroleum development and also an area of tremendous fishery productivity is in Louisiana. More than 25,000 producing wells are situated in coastal Louisiana, with some oil fields that have been in production for more than 40 years and many that have existed for at least 20 years. The chronic addition of oil through co-product brines is probably about twice the addition caused by accidental spills. Annual additions of petroleum at the estimated rates over the past 30 years would mean that the Louisiana coastal waters have received 1.1 million barrels of oil. However, commercial fishing catches continue high in Louisiana waters.

Oyster and Shrimp Yields in Coastal Louisiana Waters

	Oysters			Shrimp	
Year	Pounds (x 1,000)	Area in Acres	Number of Dredges	Pounds[a] (x 1,000)	Number of Boats
1939	13,586	-		88,000	1,621
1940	12,412	-		98,000	
1945	9,884	19,760	500	116,904	
1950	8,715	-		77,835	2,819
1951	8,164	36,000	226	85,718	
1955	9,396	-		83,608	
1957	10,489	-		34,103	
1960	8,311	58,000	143	61,758	4,896
1961	10,139	-		31,027	
1964	11,401	-		59,382	
1965	8,343	88,500	94	62,593	7,296
1969	-	-		89,500	10,320
1970	8,639	112,000	77	92,600	12,500
1971	9,758	113,000	86	95,000	
1972	8,947	157,000	56	87,000	14,500
1973	-	161,200			

[a]Heads on.

The following data, taken from the 1973 Department of Commerce publication "Current Fisheries Statistics No. 6131, Basic Economic Indicators, Shrimp 1947-1972", provides more information on the shrimp fishery of the Gulf Coast area.

INDUSTRY PERFORMANCE INDICATORS

Historical growth rate of Atlantic and Gulf of Mexico shrimp landings, fishermen, and vessels

Landings[1/]	1948-71	+1.6 percent per year
Fishermen[2/]	1950-69	+1.0 percent per year
Vessels[3/]	1950-69	+2.2 percent per year

[1/] Log of landings (thousand pounds) = 5.2378 + .0070 time (2.85)*

[2/] Log of number of fishermen = 4.1564 + .0042 time (5.95)*

[3/] Log of number of vessels = 3.7925 + .0096 time (10.46)*

*Indicates t value

b. Sport Fishing

A major oil spill would affect fishing adversely, although only temporarily. As discussed under impacts on commercial fisheries, quantifying fisheries losses from a hypothetical spill can be extremely misleading. However, if a hypothetical 50-square-mile circular oil spill were superimposed on the Channel's most productive sport fishing area, catch reductions of over 44,500 fish might result. (The median number of fish per block for 1971 to 1972 was used) The same assumptions made for commercial fisheries were applied here. It should be stressed that the 44,500 fish lost reflects only fish taken from commercial partyboats. There are large, but unquantifiable, numbers of fish taken from private boats/ships registered in the project area, as well as those taken from beaches and piers.

Boat fishermen would not want to soil their boats by fishing in the vicinity of an oil slick and neither boat nor surf fishermen would want to keep fish that had been coated or contaminated with oil. Therefore, sport fishing would be curtailed in the vicinity and for the duration of the spill incident. This would not preclude fishing in alternate areas even though the catches there might be lower.

We have no data to confirm the adverse impact on surf, shoreline and private boat fishing, but according to the California Department of Fish and Game (1969) the number of fish taken from partyboats operating out of Santa Barbara very definitely declined during the blowout. During the six-month period, February to July 1969, reported landings were only ten percent the size of those for the previous four years for a comparable period, and it is probably valid to estimate a similar decline for sport boats.

The major portion of this decline can be attributed to lack of fishing effort. Because of the adverse publicity of the oil spill, sportsmen fished elsewhere. The total number of boat-days during the six-month period was only thirteen percent of the average fishing effort for a comparable period during the previous four years. Only 723 sport fishermen used partyboat facilities at Santa Barbara during this period in 1969, while 5,693 used them in 1958. A comparison of sport catch to fishing effort during the six-month period, reveals that the catch per fisherman-day was 6.7 in 1969 compared to 8.9 in 1968. Catch data from 1965 indicate the catch per angler-day fluctuates widely in the area, but was slightly lower than average on the Santa Barbara partyboats in 1969.

Evidence indicates that oil and gas operations have an overall favorable impact on sport fishing activities. The favorable impact is the result of sports fish population enhancement due to the artificial reef effect of offshore platforms. In the open sea, offshore platforms provide both food and cover in areas that are largely devoid of these essentials. Myriad forms of micro-organisms in the water drift by these structures and attach themselves, soon encrusting all exposed surfaces on the platform.

11. Impact on Kelp Beds and Kelp Industry

The giant kelp (*Macrocystis spp.*) is apparently very resistant to damage from spilled oil because of the envelope of mucus which surrounds and protects it from damage (Anderson et al., 1969). No damage was reported to them as a result of the Santa Barbara blowout. Even in the Tampico spill, North reported only slight damage to marine flora of all species. A description of the kelp beds may be found in section II.E.2.a.(5) and II.F.10.

The damage to the kelp bed association, especially the epifauna, caused by an oil spill is less well known. Visibility was only three inches in mainland kelp beds during the Santa Barbara blowout, so accurate determination of damage was impossible. Anderson et al. (1969) could detect no damage to the associated fauna in the oiled kelp beds of Anacapa Island. Apparently the only damage reported to organisms of the kelp bed community was a reduction of mysids (Ebling et al., 1971).

Oil was detained from reaching shore by kelp beds in the Santa Barbara blowout (Battelle, 1970).

Impacts associated with jetting, blasting, and rip-rap have been discussed in III.1.D.b.(5).In summary, pipeline installation will cause short-term impacts along the path of the pipeline. Biological recovery of the kelp require about one to two years. If a large oil spill occurred in the Santa Barbara Channel, which would preclude kelp cutters from harvesting kelp for a period of three weeks, the impact on the kelp industry would be a loss of $270,000 to $380,000 in revenues. That is under the assumption that no harvesting would occur in the entire Channel.

12. Impacts on Archeological and Historic Resources

There are numerous known historic and archeological resources in California. There is a high probability of undiscovered archeological resources onshore and an unknown probability offshore (33 known offshore locations). Advanced techniques are available for onshore surveys; undersea techniques are less advanced although technology developed for geophysical and other undersea exploration can supply considerable information. Diving archeologists are rare and diving surveys in depths below 200 feet are expensive. Existence of significant resources at that or greater depths are possible, but are very likely restricted to sunken ships. In view of the very small amounts of seafloor disturbed by all operations other than pipelines, the adverse impacts are considered to be cumulatively very minor.

Impacts on archeological and historic resources will be minimal if the following are accomplished in areas proposed for undersea and onshore facilities: site specific surveys by professional archeologists/anthropologists utilizing reasonable state-of-the-art techniques; design of proposed plans to avoid construction or operational impact on any known resources and any resources uncovered during construction. If relocation of ground-disturbing construction/dwelling cannot be accomplished, sites should be studied in context prior to construction. Conceivably, offshore surveys could be coordinated in part with, or could utilize data obtained during, other necessary site surveys. All cultural resources discovered in the course of survey, or unexpectedly during construction, will be evaluated by the criteria set forth in Title 36 CFR Part 60 and 800, for their eligibility for inclusion in the National Register of Historic Places. Should any be determined eligible for inclusion, the procedures set forth in Title 36 CFR Part 800 will be followed and documented. Without these considerations archeological and historic resources, if present at a given location, could be irretrievably lost or damaged.

13. Impact on Aesthetic and Scenie Values and Impact on Land Use

Appreciation of aesthetic values is inextricably interwoven with many other human pursuits, some of which are measured in terms of dollars or visitor days, and numerous others which are neither measured nor susceptible to measurement. Adverse aesthetic impacts frequently do not result in total loss of the resource such as people refusing to go to a beach because of a cluttered view, but rather, some unquantifiable depreciation of their total enjoyment of the experience. Quantification of losses due to aesthetic changes must be regarded as minimal levels because of the many "users" who are never sampled. Impact on aesthetic values would occur from both normal operations as well as failures such as oil spills. Various stages of possible development within the Channel also are analyzed in terms of their impacts from normal operations, and where probable, from accidents. Visual quality is the most important aesthetic parameter of concern in this analysis, followed by sound, smell, and solitude. Analysis of visual impact must presume an observer positioned at a particular location and in this region, observers are to be found in varying numbers at nearly every conceivable position offered by southern California geography. Untold millions of observers pass by on the Coast Highway, some on commercial ventures, many commuting, pleasure driving or visiting, and numerous others sightseeing. Residents occupy areas ranging from the wet sand beaches to the commanding heights of ocean bluffs and coastal mountains, such as the Santa Ynez.
A major percentage of Santa Barbara residential properties possess an ocean view. Chief among the values of coastal homes is the ocean view and participation in the sea environment. Santa Barbara County south coast beaches, both private and public, attract thousands in excess of 2 million annual visitors during all parts of the year. Offshore, island dwellers and visitors, as well as boaters view vast expanses of the ocean. Viewers from

all of these positions derive some fraction of their enjoyment from the coastal and ocean aesthetic values. Of all of these categories, recreation visitation is the only parameter commonly monitored and it is a basis to attempt assessment of the impacts on aesthetics. Many competent economists have tried to attach dollar values to aesthetics and have been unsuccessful. Such attempts are inevitably doomed to failure for many reasons, among them being that social, economic, cultural and philosophic backgrounds vary one's perception of what is aesthetic so broadly that a standard definition from which to start is not possible. It is possible to analyze from an artistic or architectural basis what is or is not "aesthetic" but it is not possible to quantify the magnitude of non-aesthetic features. For example, if a drilling platform is adjudged a discordant feature because it presents disharmony in lines, texture, color or surroundings, it is not reasonably possible to say that its presence depreciates the aesthetic quality of the area by ten percent, fifty percent or one hundred percent, because it may not depreciate one observer's enjoyment by an iota, while conversely, totally damaging that of another. In this analysis, quantification will identify only that portion of the viewing public who may be affected in one way or another by changes in the aesthetic situation. That portion of the public using the coast's aesthetic resource, which is susceptible to some analysis, is the beach visitor, because most managing agencies keep visitation records of one form or another. Boating registration and use figures are available and can be used. Other categories of users are not readily quantifiable. Residents, for example, do not use all of their time enjoying the sea view. The figures developed subsequently should be regarded as minimum numbers as they only consider the measured portion of one segment of aesthetic users.

a. Source and Duration of Impacts on Aesthetics

Aesthetic impacts may occur both offshore and onshore and be due both to direct and indirect results of the possible development. They might range in duration from very transitory to nearly permanent. Some might be attributable to normal activity and others might be caused by unusual or accidental events.

Offshore impacts during exploration might be caused by increased vessel and air traffic engaged in geophysical data gathering. Their activities would include the tracing of grid tracks across the sea during which seismic, magnetic, hydrocarbon and gravity recording instruments would be arrayed. Some noise, occasional small explosive detonations and coring of the sea bottom would occur. This activity currently takes place, though at a lower level than it would if possible development were implemented. Later in the exploration process, test wells would be drilled and production of hydrocarbons from these wells could be either barged to shore, or flared at sea. Normal impacts accruing would be noise, increased offshore traffic, some vessel oil losses, production of some turbidity from drill cutting and mud disposal, and loss of solitude. Particulates and odors from flaring would degrade air quality to a limited extent. Loss of aesthetic values would be minimal consisting primarily of loss of solitude in the ocean areas affected by exploration. No persisting or significant losses are foreseen, with only minor disruption during normal offshore exploration activities being envisioned.

Onshore impacts during exploration could entail land use change for equipment storage, heliports, communications and navigation equipment construction. Increased traffic around harbors or marinas would have some visual impact. Construction activities could have a deleterious effect, particularly if they take place in areas which are largely natural at present. Communications facilities which occupy prominent high points have a large visual impact potential, both from the facilities themselves which occupy high topographic points, and from access road construction and site leveling. Sensitive design, siting, use of materials and landscaping could reduce the visual impact of the installations while road location, design and construction can be accomplished in a manner compatible with the terrain and hence be visually compatible. There is a distinct potential for some onshore loss of aesthetic values in localized areas due to these installations. Those affected would be boaters, possibly residents, and some beach users. The duration would extend through the life of the petroleum fields, approximately to the year 2025, with some lessening of visual impacts as disturbed soil revegetated.

Abnormal or accidental events which could occur during exploration would have adverse impacts. These include such problems as vessel loss, oil spills and landslides. Geophysical vessels or aircraft could be lost resulting in fuel and lubricating oil spills. Barges carrying test production could be lost through accident, thus resulting in oil spills, or flaring equipment could result in oil spills through malfunction. A blowout while drilling an exploratory well could produce adverse aesthetic impacts.

In summarizing, vessel losses could produce some visual impact although shipwrecks are generally accepted by most people as a "natural" part of the ocean scene when they rest in the surf zone. Oil spills from research vessels would be minor in extent and constitute little aesthetic impact. Loss of a barge filled with production would constitute a more serious problem if it occurred nearshore where containment and recovery actions could not be rapidly and successfully executed. At sea under normal conditions, a spill resulting from such a mishap would probably be successfully controlled. Nearshore where a barge may founder on rocks or in heavy surf, control of spilled oil is unlikely and aesthetic damage in the form of visual pollution by oil fouled rocks or sand and biological damage would occur. In an accident of this nature, a maximum of 2,000 - 3,000 bbl might be spilled. This would result in an instantaneous calm water spread of about 0.24 square miles or a 2900' diameter slick. In reality this slick would break up in the surf and be transported by longshore drift to come ashore at varying densities along an indeterminate length of shoreline. For purposes of this analysis we presume the slick to move directly onshore, thereby coating the minimum length of 2,900 ft (884 m) of shore. Beach capacities or beach density standards are expressed as either persons per lineal foot of public swimming beach or square feet per person. If a density standard of one person per lineal foot of shoreline is adopted, this indicates approximately 2,900 persons at one time are potentially affected by this spill. To determine the net effect in quantifiable terms, the recreation activity pattern most closely related to the aesthetic resource has been selected. This resource demand is the "Sightseeing and Study" Activity Pattern category utilized by the California Department of Parks and Recreation for its coastal recreation activity demand assessment. In 1970, twenty-seven percent of the south coastal (Pt. Conception to Mexico) state park visitors interviewed had engaged in the

"Sightseeing" sub activity portion, expending 26,190,000 activity days.[1] Updating these figures to 1975 demands yields 30,945,000 activity days. Demand by 1980 in this category should reach 35,700,000 activity days out of a projected total of 262,300,000 activity days. This represents 13.6% of total activity days. Applying the data to the test case;

2900 visitors
x.27 percent of participants
=783 visitors affected.

The persistence of the beach's oil fouling is purely conjectural as clean-up may successfully restore it within a few days. On the other hand, patches of oil may continue coming ashore for several weeks and oil which sinks into the sand may remain covered for months or years until normal periodic changes in beach sand transport mechanisms cause surfacing of the oil. If sorbents such as straw are used to collect oil, the disruption might occur for approximately one week. Sand removal and replacement could take a considerably longer time period. Based on a one week clean-up period, 4,380 visitor days[2] would be adversely affected. In addition to this category of "Sightseeing"

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[1]The "activity day" unit is very different from the "recreation day" used in demand charts. An activity day is the participation by one person in one activity on one day. Under this definition, the visitor might therefore be counted one, two, or three, or possibly even four times (though his participation in an activity had to be one of his major purposes for the visit in order to be tabulated). A visitor might surf, swim, and play volleyball in the course of his one day at the area. He would then be counted as three "activity days" because he used all of these activities.

The term "recreation days" merely expresses the number of people visiting, and reflects somewhat the popularity of an area; "activity day", on the other hand, gives some idea of the popularity of an activity and enables prediction as to the type and quantity of a natural resource needed to meet the demand for that particular activity.

[2]Visitor day is defined as one person spending 12 hours at a site, two persons spending 6 hours, etc.

several other activities are interrelated with aesthetics, among these being beachcombing, nature study, just relaxing, photography, painting, walking for pleasure and picnicking. It was not possible to determine the degree of overlap among these categories with the data we have, hence the 27% participation in sightseeing cannot be expanded to include, for example, those who indicated photography/painting as a major pursuit and who did not include sightseeing in their answer. This example is presumed to take place during the summer. Winter or other season occurrence would lower the impact due to lower off-season beach visitation.

The last source of exploration impacts is a landslide resulting from improper drainage or siting of a communications facility or other construction activity. An impact of this sort could occur in a location which would make it highly visible, thus affecting millions of viewers over a year, or it could be relatively hidden. No attempt can be made to quantify this type of impact with presently available information.

The development stage would extend approximately 30 years if all possible levels of development were implemented. During these 30 years, wells would be drilled, platforms constructed and placed, storage and processing facilities built, pipelines constructed and barging or flaring of some test or initial production would occur in the offshore area. Onshore, platforms would be constructed in dry docks, barges would be built, equipment storage and mustering yards would be built and land based processing and storage facilities constructed. Normal operations offshore would result in a relative loss of solitude in the areas affected, particularly in the less frequented areas. Shore residents, beach users, island residents and boaters would be affected. The loss of solitude would be of short duration in some cases where dry holes were encountered, persisting only a matter of weeks, or lasting for up to 60 years until abandonment of fields where sufficient hydrocarbon resources are discovered.

Visual impacts would occur in the offshore area from drilling rigs, platform placement, barges, and work vessels. Small oil slicks from work vessels would appear, particularly in harbors or other confined waters. Drilling would probably produce localized water turbidity of short duration if drill cuttings were disposed of at the site. Loss of drilling mud would affect water clarity temporarily. Pipeline construction would result in temporary turbidity, particularly where burial is required. Platform placement would affect visual quality and is discussed during the production phase. Vessels would produce the same impacts as discussed in the preceding exploration section. Flaring is also discussed in the exploration phase.

Onshore activities during this phase would involve platform and barge construction, treatment and storage facility construction and equipment storage yards. Platform construction would take place in dry docks, probably in heavily industrialized areas where it would constitute little additional visual impact. If construction facilities are developed in what is now open area, the land use change involving dredging and filling plus the clutter of the structure itself and associated cranes would be a considerable impact. Barge construction would probably take place in the industrialized sector of Los Angeles - Long Beach and thus not constitute much of an impact. Treatment and storage facilities are usually placed as close to the wells as possible which indicates either platform location or nearby shorelines. This is due to the difficulty in moving multi-phase materials through pipelines. Placement of these facilities on platforms would add somewhat to the bulk of the structures but would not appreciably affect their visual impact. The northern Channel islands are largely totally undeveloped and present views which are rare in southern California, that of primarily native vegetation on unaltered hillsides. In addition, many of them have the unique biological assemblages enumerated earlier. The placement of facilities on these islands would constitute the greatest single impact potential in terms of alteration of natural regimes, thereby changing the aesthetic environment. Visual impact could range from high to low depending upon the sensitivity of siting, earthwork quantities, jetty construction, structure design, use of colors and subsequent landscaping. Placement of these facilities in shoreline areas of the Santa Barbara Channel would affect far greater numbers of people but would effect much less change in the existing conditions than would use of islands. The duration of the impact would equal the life of the field or about 20 to 30 years. An estimated 1-5 of these facilities might be necessary. Boaters would be able to view these facilities if they were sited near the shore. We estimate that those people who listed cruising, sailing or fishing as their main boating pursuits, would in some way be affected by these facilities. Based on this, approximately 100-300 thousand visitor days would be in some way affected. No estimate can be made of the number of viewers who will be affected as residential viewers or as passersby on the Coast Highway or nearby streets.

The present pipeline carrying crude from the Santa Barbara Channel to the Los Angeles area refineries is used to capacity thus either transportation by tanker or new pipeline construction would be necessary.

Abnormal or accidental events during the development stage would potentially include loss through sinking or stranding of platforms, storage equipment and vessels. The impacts would be visual in the form of wreckage which might not be salvaged and oil spillage. Loss of platforms is construed as some accident occurring while the structure is being towed from a dry dock construction site to an installation site. Leaks from pipelines might occur and some disruption of the beach or estuary would exist for several months after pipeline construction. Oil spill dangers from barges and well blowouts persist through this phase. These risks are considered as a composite of the whole program in the following section's discussion of production.

Onshore accidents could result in impacts such as landsliding at installations and spillage of noxious or toxic substances stored or utilized there. These events would be highly unpredictable and speculative, thus no quantification of impacts can be made.

Production is the main phase of oil and gas development and would last for about 5-20 years for individual fields. Production would probably cease about 2025.

Impact producing elements during normal operations include permanent features such as platforms, pipelines, treatment and storage facilities. Significant oil spills could occur from wells, pipeline breaks and barges. Low level spillage would likely be recurrent. Barges and work boats would add to marine traffic. Periodic transitory increases in turbidity might arise from mud lost or discarded during well workover and maintenance, and from sediment resuspension in pipeline maintenance work. The presence of nearby platforms would impact on the solitude of the sea causing aesthetic degradation for some.

Platforms would cause the longest lasting most prominent visual aesthetic impact wherever they are installed. Visual impacts can be viewed in two ways: 1) impacts increase in magnitude when they occur in a totally natural environment or 2) impacts increase in magnitude when they are visible to greater numbers of people. Under these criteria, platforms furthest from shore would produce a greater impact in criterion 1 while they would produce a greater impact close to shore under criterion 2. Both criteria in combination are valid because we are analyzing these impacts in terms of the human environment, thus supporting criterion 2 where numbers become important, while simultaneously recognizing the value of an environment untrammelled by great numbers of men and unencumbered by his physical accouterments as is suggested in criterion 2.

Visibility plays an important role in the visual impact of platforms. The best visibilities occur in January but in most cases the January-July spread is only a few percentage points. See section III.C.2.a(2) for a discussion of platform visibility based upon Santa Barbara Channel monthly visibility data. At distances of 20 miles and beyond, the size of platforms would appear very small.

Platforms in the Channel within 10 miles of shore would be visible much of the time from the majority of the coastal viewpoints. They would be fairly prominent objects exhibiting vertical and angular lines and contrasting tone against the flat plane of the sea. Those within five miles of shore will be prominent objects a major portion of the time. Nowhere would they be framed by a background of similar appearance.

In portions of the Channel, distant platforms may tend to be obscured by the presence of the larger islands in the background. In some areas of the Channel, offshore wells exist in State waters thus platforms in Federal waters would constitute much less of a contrast with existing conditions than they would in areas devoid of oil development.

Approximately 3 million visitor days are expended annually at the coast of Ventura County. If approximately 27% of those are engaged in sightseeing as a major activity, then 710,000 visitor days would be affected to some degree by aesthetic alteration in the Channel. Adjusting this figure for lowered visibility indicates an annual impact of more than 600,000 visitor days without adjustment for annual growth in use. The state predicts an increase in demand of 30% to 1980 and 32% from 1980 to 1990 measured in participation days for the potentially affected portion of the coast.

Anacapa Island is part of the Channel Islands National Monument and receives visitation from private recreational boaters and commercial carriers. Total visitation to the monument averages about 42,000 assuming even allotment between Anacapa and Santa Barbara Islands. Due to the difficulty of access to the island, the casual recreationist is seldom present. Most of the visitors are primarily interested in the island's scenic and natural values and consequently susceptible to the visual impact of platforms and support vessels. There is pristine ocean around Anacapa. No buffer zone in federal waters adjoins the state waters in the Channel with the exception of the Santa Barbara-Goleta area. Platforms could be erected within 3 miles of the island itself and less than 2 miles from the Monument boundary. Should this circumstance ensue, the visual character of the Monument would be altered. Approximately 20,860 visitor days annually would be affected with 940,300 visitor days affected for the total life of potential development. It is likely that a significant percentage of southern California boaters do use this area occasionally.

Many Santa Barbara area boaters use the waters surrounding the northern

Channel Islands for weekend day use and overnight outings. Santa Cruz Island is the most popular destination. Both the islands and the surrounding area are nearly pristine. There is no federal buffer adjacent to state waters in this area, thus permitting platforms within 3 miles of the coast. The secondary impacts are potentially greater than that of potential development. If drainage of hydrocarbons from state lands occurs due to federal lease development, then leasing may occur on adjacent state lands. This could result in platforms in close proximity to the islands including San Miguel which is the site of the most valuable pinniped rookeries in the southern California Bight. Loss of this resource would constitute degradation of large magnitude.

Normal operations would result in some floating debris being cast up on beaches. This would constitute an aesthetic loss for those affected.

Aesthetic values would be impacted by accidental events which are statistically bound to occasionally happen. These would occur during drilling, well operation, storage of production, transportation and maintenance. Fires, leaks and spills might result, with concomitant visual and biological effects.

Recurrent spillage at low levels would continue throughout the life of any development resulting in small slicks or tar balls visible to boaters and cast up on beaches. Natural sources of oil already contribute to this type of pollution and it may be difficult to separate the two. The existing situation would be somewhat exacerbated.

Noise from pumping stations and other operations would constitute an aesthetic impact.

If fires occur they would produce air quality reduction on a temporary basis and usually have associated oil spills.

Spills greater than 50 bbl from all sources would likely occasionally occur with spills in excess of 1,000 bbl being less probable. These have the potential of affecting several million visitor days over the life of the possible development. Most effects would be temporary in duration. Permanent effects could ensue if certain biological resources were destroyed or if land use changes from natural conditions to industrial in conjunction with possible development persist after abandonment of the fields, as is likely.

During the final state, abandonment, there would be some risk of oil spill, but would be low. Removal of equipment would result in noise and increased traffic, temporarily. Placement of scrap equipment on land might cause an aesthetic impact. Nothing should remain in federal offshore waters after abandonment, as OCS Orders and Regulations require total removal of equipment to below the mudline.

b. Impact on Land Use

The direct impact of the possible levels of Channel development could be the removal of 30 to 150 acres of recreational, agricultural or residential property for industrial use in the construction of onshore treatment facilities. The removal of 30 to 150 acres of agricultural land for industrial use is discussed in section III.N.3. It is unlikely that the 30 to 150 acres would be removed from presently designated recreational use; since the placement of any facilities in the coastal zone would require approval by the California Coastal Zone Conservation Commission and by local zoning ordinances. If permission for onshore facilities were not granted, developers could opt for offshore treatment facilities. This could be more expensive and potentially more environmentally hazardous and would require the permission of the Geological Survey.

Since 85 to 95 percent of the potential employees would be expected to be hired locally, no further land use changes would be expected as a direct result of the possible development levels. Housing, schools, fire and police facilities, as well as recreational facilities are adequate to handle the increase of 200 to 500 additional people into the two-county area; or for that matter, the addition of 4,800 additional residents assuming that all employees and their families involved in the possible development were new arrivals (which would not be the case) into the two-county area. If the latter were the case, an additional 24 acres of recreational facilities would be needed. (See section III.N.6. for further details)

14. Impact on Mineral Resources

Refer to sections VI and VII for the impact further Channel development would have on oil and gas resources.

Presently no minerals other than oil and gas are extracted from the Santa Barbara Channel OCS. However, in the future it is possible that sand, gravel, phosphorite, manganese and other minerals will be recovered from the Channel ocean floor in paying quantities. Mining of such minerals could likely normally be accomplished with minimal conflict with existing oil and gas operations. Offshore mining technology for the retrieval of authigenic and terrigenous mineral resources is in its infancy. At such time as commercial extraction of these minerals from the ocean is more definite and techniques are defined, conditions and stipulations can then be prepared in order to minimize possible conflict with oil and gas operations.

15. Impact on Transportation

Traffic in the two-county area would be impacted by the additional driving of new workers and their families in the area and the additional truck traffic resulting from the possible levels of Channel development. Neither of these impacts is expected to be significant in light of the traffic volume and transportation networks which exist in the coastal area.

a. Exploratory Phase

During the exploratory phase the bulk of activities would occur offshore involving ocean-vessel activities with support from onshore limited mainly to sales and services activities. The number of persons involved, including employee family members would be between 680 to 2,400 new arrivals.

The impact on local traffic could be minimal since some of the employees and their families would already be living locally and therefore would have been using the existing transportation network previously. Even if the bulk of new employees moved into the area (which would not be the case, for 85 to 95 percent are expected to be hired locally), the total usage for the workers and their families would only increase the average daily traffic by about 8,000 trips, the average trip being about 15 minutes long.

b. Development Phase

During the development phase, major activities would occur both onshore and offshore and would involve approximately 80 percent more employees than employed during the exploratory phase. The increase of shore-based activities would result from increased manufacturing and construction of materials for use offshore.

A large share of those joining the labor force would already be living within the area. The number involved, including family members would total between 1,500 to 3,600 persons.

The impact on local traffic would be minimal since many of the persons are already in the area and using the existing transportation network. If the majority of the new employees were brought into the area, the total usage for the employee and family would increase the average daily traffic by about 8,000 total trips. The pattern of traffic flows would change by the increased number of trips towards the ocean area during morning work peak hours and in the opposite direction in the afternoon. The increased traffic volumes would add to the traffic flows in the shore area and would increase the probability of accidents. Increased traffic would also contribute to a degree to air pollution.

c. Production Phase

During the production phase, the relative level of physical activity would shift from the ocean to the land. Operation and maintenance crews would be on the platform and the number of workers would be substantially less than those involved during the development phase. Many wells might have subsea completions and would function without a permanent work force at the location.

On-land operations would include land transportation of gas and oil, initial treating and storage operations, land transportation and refining of the product. In addition, modifications might have to be made to existing refineries to handle increased production, or new sites and plants might have to be developed.

The number of employees required for the production phase would be about 25 percent less than that of the development phase, that is, approximately 1,100 persons. It should be indicated, however, that the three phases associated with offshore program do overlap, resulting in more workers than found in the dominant phase at the time. The maximum number of employees on the job at any given time is anticipated not to exceed more than 2,000 persons. The impact on transportation systems would not be significant.

In conclusion, even at the height of activity the impact on local traffic is expected to be minimal. No new streets or roads will be needed to handle the additional traffic. The present transportation network is considered more than adequate to accommodate the expected increased volume of traffic.

16. Impact on Government, Medical Facilities, Police and Fire Departments and U. S. Coast Guard

During exploratory drilling, it is anticipated that the impact on government and governmental functions would not be highly significant. A principal impact would result from increased vessel movements in the offshore waters which would add to the monitoring functions of the U. S. Coast Guard (see section II.F.16. for Coast Guard capabilities.) It is estimated that the additional volume of ship traffic would not be significant. The use of helicopters would add an insignificant amount to the existing air traffic. Some police and fire services would be utilized to serve the onshore facilities; security service and fire-fighting systems would also be provided by unit operators.

During the development phase of the offshore operation, the impact on government and governmental services would be greater than during the exploration phase. The ship and barge traffic increase would add to the monitoring function of the Coast Guard. The increased governmental service demands would include police and fire protection, building inspection, zoning interpretation, use permits, coastal commission and air pollution control district actions, and traffic control.

The government sector would also be impacted during the production phase. One method of measuring the impact is utilization of data derived from a cost/revenue analysis. The analysis is intended to outline the costs for services by government as opposed to income received from property taxes and fees received from the property receiving such services.

In the consideration of revenue requirements for services received from governments, industrial uses generate more tax income than is required to offset their demands. Oil-related facilities are classified as industrial uses in local governmental control ordinances and are part of the group that produced positive property taxes within a community. Two articles on cost/revenue analysis on local government, or the cost of services as offset from *ad valorem* tax revenues, indicate that industry does generate a surplus of revenues for a local government (National Tax Journal, 1963).

A recent study by the California Builders Council (1973) substantiates through cost studies in California that an industrial development will generate more income through taxes than what it costs to provide municipal services. Table III-9 presents a cash flow analysis on a California industrial project. The fiscal data projected from 1973 to 1982 indicate a composite surplus of $2,799,312, or a composite surplus discounted at 5.5 percent of $2,038,315.

Most of the surplus is a result of school taxes in which no operating or capital costs were involved. The municipal government also realizes a surplus of funds in that no capital costs are required after the third year and also that the annual operating costs are less than the amount shown under municipal revenues in table III-10.

A recent study (Development Research Associates, 1970) for the city of El Segundo, California, presents cost/revenue data in a refinery-centered town. The data in table III-10 provide an estimate of municipal relationships and a cost/revenue analysis for the 1970-1971 fiscal year. The data indicate that $2,944,000 was generated as industrial revenue, with an accompanying cost of services of $2,084,000, yielding a surplus of $860,000.

The establishment of additional oil facilities would not have a negative financial impact on the operation of local government. Studies have shown that industrial enterprises more than offset the cost of service needs by

TABLE III-9

CASHFLOW SUMMARY

INDUSTRIAL PROJECT - SANTA CLARA

1973 THROUGH 1982

YEAR	MUNICIPAL REVENUE	MUNICIPAL OPERATING COSTS	MUNICIPAL CAPITAL COSTS	MUNICIPAL SURPLUS/ DEFICIT	SCHOOL DISTRICT REVENUE	SCHOOL DISTRICT. OPERATING COSTS	SCHOOL DISTRICT CAPITAL COSTS	SCHOOL DISTRICT SURPLUS/ DEFICIT	COMPOSITE SURPLUS/ DEFICIT	COMPOSITE SURPLUS/ DEFICIT DISCOUNTED AT 5.5%
1973	$ 244389	$ 10922	$ 176240	$ 57227	$ 49508	$ 0	$ 0	$ 49508	$ 106736	$ 101171
1974	$ 73371	$ 23382	$ 4690	$ 45299	$ 147120	$ 0	$ 0	$ 147120	$ 192420	$ 172880
1975	$ 106276	$ 27947	$ 4221	$ 74108	$ 234958	$ 0	$ 0	$ 234958	$ 309066	$ 263204
1976	$ 92064	$ 16666	$ 0	$ 75198	$ 234958	$ 0	$ 0	$ 234958	$ 310156	$ 250363
1977	$ 92064	$ 16866	$ 0	$ 75198	$ 234958	$ 0	$ 0	$ 234958	$ 310156	$ 237311
1978	$ 92064	$ 16866	$ 0	$ 75198	$ 234958	$ 0	$ 0	$ 234958	$ 310156	$ 224939
1979	$ 92064	$ 16866	$ 0	$ 75198	$ 234958	$ 0	$ 0	$ 234958	$ 310156	$ 213213
1980	$ 92064	$ 16866	$ 0	$ 75198	$ 234958	$ 0	$ 0	$ 234958	$ 310155	$ 202097
1981	$ 92064	$ 16866	$ 0	$ 75198	$ 234958	$ 0	$ 0	$ 234958	$ 310156	$ 191561
1982	$ 92064	$ 16866	$ 0	$ 75198	$ 234958	$ 0	$ 0	$ 234958	$ 310156	$ 181575
TOTAL	$ 1068485	$ 180312	$ 185151	$ 703022	$ 2076290	$ 0	$ 0	$ 2076290	$ 2779312	$ 2038315

TABLE III-10

ESTIMATE OF MUNICIPAL FINANCE RELATIONSHIPS
1970-1971 Fiscal Year

	Residential			Commercial and Industrial				
	Single Family	Multiple and Other	Total	Commercial	Industrial[a]	Total	All Other	Grand Total[b]
Base Factors								
Number of Persons	11,365	5,926	17,301	--	--	--	--	17,301
Number of Units	3,196	2,290	5,486	--	--	--	--	5,486
Number of Acres	448	85	533	61	1,737	1,798	1,171	3,501
Costs of Service								
Per Capita	$ 120	$ 120	$ 120	--	--	--	--	--
Per Acre	--	--	--	$ 1,200	$ 1,200	$ 1,200	--	--
Total Costs ($000's)	1,364	711	2,075	73	2,084	2,157	$ 298	$ 4,530[b]
Revenue - Sales Tax								
Per Capita[c]	$ 3.80	$ 3.80	$ 3.80	--	--	--	--	--
Revenue - Total Sales Taxes	43	23	66	204	650	854		920
Property Taxes[d]								
Total Assessed Value ($000's)	$23,000[e]	$7,000[f]	$30,000	$25,000	$175,000	$200,000	$24,000[g]	$254,000
Property Taxes[d] ($000's)	190	58	248	206	1,444	1,650	198	2,096
Revenue - Regular Subventions								
Per Capita	$ 15	$ 15	$ 15	--	--	--	--	--
Total Subventions	170	89	259	--	--	--	--	$ 259
Revenue - Other Total	$ 80	$ 41	$ 121	$ 284	$ 850	$ 1,134[h]	--	$ 1,255
Total Revenue ($000's)	483	$ 211	$ 694	694	2,944	3,638	$ 198	4,530[i]
Net Revenue or (cost) ($000's)	(881)	(500)	(1,381)	621	860	1,481	(100)	--
Per Acre	(1,967)	(5,882)	(2 591)	10,180	495	824	(85)	--

[a] Includes manufacturing, wholesaling, refinery, and utilities.
[b] Based on 1970-1971 levels, excluding separately covered Water Department costs.
[c] Based on local resident purchases at local stores only.
[d] At current rate of $0.825 per $100 assessed valuation.
[e] Based on $7,500 per unit plus personal property.
[f] Based on $3,000 per unit plus personal property.
[g] Includes vacant land privately owned
[h] Assumed approximately three-fourths industrial and balance commercial based on detailed review of accounts.
[i] Assumed to equal costs

Source: Development Research Associates

the amount of taxes generated.

Any impact on land use would depend on the development plans of the individual oil company. If plant expansion were opted rather than construction of new facilities, the impact would be minimal since existing facilities are already within areas zoned for heavy industrial uses. If any facilities were in zones other than those which specifically permit refinery use, the legal nonconforming restrictions for expansion would apply, thus disallowing plant enlargement.

If one to six onshore treatment facilities are built, as a result of this potential development, at an average cost of $20 million, the total local property taxes collected would be approximately $480,000 to $2,900,400 assuming a tax rate of $11 per $100 of assessed valuation and a ratio of 23 percent of assessed valuation to market value.

If new sites are required for plant construction, several considerations arise. First, there appears to be a shortage of vacant usable lands zoned for heavy industry close to the coast. Second, the environment control regulations for such development must be satisfied before development can commence. The California Coastal Zone Commission must approve all development within 1,000 yards inland of the coast, and must designate such use as allowable within 5 miles inland of the coast (see section I.F.2.a.). The Air Pollution Control District must also approve a development and determine that adequate attention has been given towards maintaining the air quality. The development must also be in harmony with existing control ordinances such as zoning, performance standards, and conditional use permits.

The degree of land-use impact on local government is regulated by decisions of regulating agencies on specific proposals. If in most cases the expansion of existing facilities were opted, the impact would be minimal since existing facilities are located within the proper land-use zone. As discussed in section I.E., there is a strong trend toward minimizing facilities. Lacking specific plans, it is not possible to determine the land-use impact of the production phase. (See section III.N.13.b.)

The impact on other public and quasi-public facilities would be minimal.

With an increase of 4,800 new people (assuming all employees and their families are new arrivals, which would not likely be the case as 85 to 95% would probably be local hires) to the two-county area, the ratio of general hospital beds to population would only change from one bed per 235 population to one bed per 237 population. The ratio of police per population would likewise change from only one officer per 510 population to one officer per 512 population.

Fire fighting capabilities are adequate to control onshore development related fires. Neither the local fire departments, however, nor the U. S. Coast Guard has the capability to control offshore fires. Such fires would have to be fought by individual unit operators with the aid of contract offshore fire fighting agencies.

17. Wage Impact on Santa Barbara - Ventura County Taxable Sales

In evaluating the impact of wages from the possible levels of Channel development on taxable sales and sales tax collections, it is assumed that 60 percent of the wages earned would be spent on taxable sales in the two-county area. The other 40 percent would either be spent outside the two-county area or would leave the counties due to taxes or other leakages.

Over the 40-year life of the possible development, taxable sales would increase by $136.2 million to $338.5 million as a result of primary wages. Sales tax collections would total $8.2 million to $20.3 million over the life of the possible development (assuming a 6 percent sales tax). This would be an average of $3.4 million to $8.5 million additional taxable sales and an average of $205 thousand to $507 thousand of additional sales tax for a period of 40 years.

The peak impact of direct wages from possible development (year 5, see table III-8) on taxable sales in the two-county area would be less than $20 million. This represents approximately a 1.2 percent increase over present retail sales (see section II.F.16.a. and b. for taxable sales data).

If the total of primary and secondary wages were assumed to be a multiple of three times the primary wages, the total impact of wages on taxable sales in the two-county area would be $408 million to $1,015 million over the 40-year period. With this multiplier, sales tax collections would total $21 million to $61 million over the life of the possible development.

18. Impact on Housing

The addition of 100 to 200 employees new to the two-county area would not be expected to have a significant impact on housing since there are 248,663 housing units in the two-county area with a minimum of 5,400 units being vacant. Even if all of the peak level employees were citizens new to the two counties (which would not be the case for 85 to 95 percent as mentioned before are expected to be hired locally), the housing available is more than adequate to lodge the additional people. (See section II.F.17 for housing details)

19. Impact on Water Supply and Demand

Future water supplies for the two-county area will have to be increased due to projected population increases. The addition of even the small numbers of new people that would result from the possible levels of Channel development would add to the future water shortage. However, even without possible development-induced population increases, new facilities would be required. (Water supply and municipal waste water disposal capacity increases are detailed in section II.B.4.) Present water supplies and sewage disposal capabilities would not require expansion as a result alone of new area resident influx from the possible levels of Channel development.

O. Summary of Environmental Impacts, by Affected Resource

The purpose of this subsection is to bring together briefly the cumulative potential impacts of activities and facilities on specific aspects of the environment. References to preceding detailed discussions follow the summary discussions of potential impacts in this section. Additional references can be located in the table of contents.

1. Impacts on Water Quality

Marine

Platform installation (and removal) would result in temporary, localized water turbidity. Platform and drilling activities would result in the introduction into marine waters of small amounts of: treated sewage, inadvertent amounts of trash, garbage, diffusible or degradable toxic liquids (paint, fuel solvents, drilling mud, and oil from small recurrent spills. Treated produced waste-water discharge into OCS waters will be governed by EPA and Geological Survey regulations.

Pipeline construction by jetting, blasting, or riprap installation near shore would result in very temporary and localized turbidity. Resuspension (if present) of toxic heavy metals and persistent pesticides deposited in the area would result primarily from jetting and blasting; areal disturbance would be along narrow corridors only. Submerged production system installation would have similar effects in deeper waters over an area of about one-half acre per installation.

Operation of an offshore treating and storage facility might result in the inadvertent introduction of minor amounts of trash and garbage. Treated produced wastewater may or may not be allowed under applicable regulations then in existence. All such possibilities are believed to constitute relatively minor adverse impacts. The most significant adverse impacts would result from oil pollution from various sources. As previously noted, an oil spill could result from platform drilling and operation, and submerged production system drilling and operation; the worst case for all of these would be a major spill caused by a well blowout. Remote possibility of a major spill exists for a near-shore marine loading terminal and marine product transportation (for example, by tug-barge); minor recurrent spills would be more likely.

Fresh Water

Impacts on fresh-water quality would occur primarily from water use by an onshore treating and storage facility, and impacts would vary depending on the location of a proposed and approved site and resource availability. Site selection and planning criteria should consider both surface water and ground water.

Effects on channel flow (if a stream is nearby), adequate capacity of a collecting basin, and erosion prevention are essential surface-water considerations before and during construction of an onshore facility. During the operational phase, spills of oil or brine are potential impacts on surface water.

Ground-water contamination would not likely result from sewage disposal, waste water (brine) disposal, and water source wells because all three would be under the jurisdictional control of local and/or other appropriate governmental agencies.

The enforcement of relevant OCS orders will prevent introduction of hydrocarbons or sea water into fresh-water offshore aquifers as a result of drilling operations or well abandonment. OCS Order No. 2 requires that all wells drilled in fresh-water zones shall be cased and cemented, in accordance with the requirements of 30 CFR 250.41(a)(1). OCS Order No. 3 requires that whenever a well is abandoned, uncased portions of the well shall have cement plugs spaced to extend 100 feet below the bottom to 100 feet above the top of any fresh-water zone.

Selected Cross-references
(Water Quality)

II.D.7.	Water Characteristics
II.F.7.	Research
II.G.2.	Water Quality
II.B.4.	Hydrology
III.C.2.b.(1)	Debris and Pollutants other Than Oil
III.E.2.a.(4)(a)	Flooding, Surface Water
III.E.2.b.	Oil Spills
III.E.2.c.	Brine Spills and Sewage Disposal
III.E.2.d.	Water Source
III.P.	Summary Tabulations of Environmental Impacts
IV.A.1.d.	Environmental Protection Agency
IV.A.1.c.	Regulation of Waste Water Discharged into the Santa Barbara Channel OCS Waters
IV.A.1.g.	Pacific Area OCS Orders
IV.A.10.	Mitigating Factors Related to the Detrimental Effects of Oil Spills in the Santa Barbara Channel
IV.B.5.	Non-Use of Polychlorinated BiPhenyl Liquids
IV.B.6.	Subsurface Safety Valves
IV.B.12.	Other Current and Future Environmental Research
V.A.	Oil Pollution Effects on Marine Environment
V.G.	Debris
V.J.	Water Pollution

2. Impacts on Air Quality

Relatively minor impacts on air quality would result from: all associated sea and land vehicular traffic, platform operations, pipeline construction, onshore treating and storage facility construction and operation, oil and gas handling, and product transportation (marine loading at near-shore terminal, marine transit, land transit of gas, liquids, and sulfur). Design criteria and operating procedures for each impacting component would be designed to meet or exceed emission requirements set by governing agencies. Dust and fumes would be produced during construction phases, but could be controlled to a large degree. Minor spills of various materials handled would be rapidly dispersed in most instances and of minor impact. The cumulative impact of increased operations in the Channel on local air quality would be relatively small, but would extend throughout the period of operations. An oil spill would contribute considerably to air pollution for a short time, and could be attended by fire, but the location is likely to be greater than three miles from shore, which would serve to lessen the adverse impacts on populated shore areas because of dilution in transit. A detailed discussion of Air Quality Impacts from the various operations and facilities associated with the potential levels of Channel Development appears is section III.LL.

Existing market patterns indicate that much of the natural gas produced from the Santa Barbara Channel would be sold in nearby counties. Use of natural gas might prevent or reduce future use of less desirable alternative fuels, such as fuel oil, and thereby serve to proportionally reduce future air pollution.

Selected Cross-references
(Air Quality)

I.D.8.a.	Onshore Treating and Storage Facilities
II.G.1.	Air Quality
III.E.	Impact of Onshore Treating and Storage Facilities
III.J.1.	Impact of Product Transportation by Barge or Tanker
III.L.3.	Impact of Oil Spills on Air Quality
III.LL.	Impacts on Air Quality
III.P	Summary Tabulations of Environmental Impacts
IV.A.1.	Regulations
IV.B.13.	Air Quality Impacts Mitigations
V.B.4.	Oil Pollution Effects on Beach and Shoreline Recreation
V.E.	Effect on Truck Traffic
V.I.	Air Pollution

3. Impacts on Commercial Fishing

The average annual commercial catch for the Channel is approximately 36 million pounds. Bottom trawling accounts for 17 percent of the commercial fishing activity.

Platforms contribute additional habitat for fish and other marine organisms as artificial reefs, and from this standpoint their existence is beneficial. However, they also provide a minor adverse impact because their presence removes a small area around them from commercial fishing use. The area removed from such use is increased if the platforms are clustered.

Pipelines normally do not affect bottom trawling, but under certain conditions trawling gear could be damaged or lost.

Selected Cross-references
(Commercial Fishing)

I.E.	Estimation of the Number of Facilities that Might Be Required
II.F.9.	Commercial Fishing
III.C.	Impact of Drilling and Production Platforms
III.D.3.	Compatibility of Fish Trawling and Pipelines
III.H.	Impact of the Submerged Production Systems
III.L.8.	Impact of Oil Spills on Marine Organisms
III.N.10.	Impact on Commercial Fisheries
III.P.	Summary Tabulations of Environmental Impacts
V.A.	Oil Pollution Effects on Marine Environment
V.C.	Compatibility of Commercial Fishing

4. Impacts on Benthic Organisms

During construction (and removal) of all components resting on or buried in the ocean floor, there will be some very short-term and highly localized impact on bottom-dwelling biota. The impact will be related in proportion to the area utilized and to the abundance, diversity, and biomass of the benthos. Impacts on organisms recreationally or commercially harvested (such as lobster, abalone, kelp) are important considerations. These may be favorable, minimal, or at worst only temporarily adverse.

Abundance, diversity, and biomass are greatest in the photic zone (in the Channel, generally from the shoreline to 100 feet, for practical purposes); these decrease with depth becoming sparse at usual OCS platform depths. Components vary in the amount and configuration of bottom area required. For example: pilings occupy a minute area of the ocean floor; pipelines utilize long narrow corridors; and a subsea completion system requires approximately one-half acre each.

Emplacement of components in or on the ocean floor will destroy non-motile organisms and physiologically distress others; the area affected will include that adjacent to the component. Repopulation normally would be rapid.

During the operational phase, components such as platforms or riprap would offer additional habitat for benthic organisms. Except in the event of an oil spill, the cumulative adverse effects would be minor and short-term.

In the event of a major oil spill, those organisms most affected would be in the intertidal zone. The principal mode of damage is by smothering, and although the total impact of a spill could be substantial, the available data indicate that only short-term considerations are involved. Tidepool benthos would be less or little affected.

Selected Cross-references
(Benthic Organisms)

II.E.2.a.(1)	Benthic Habitat
II.E.2.c.	Biotic Communities of the South Coast Subprovince
II.F.7.	Research
II.G.2.b.(2)	Areas of Special (Biological) Significance
III.C.2.b.(1)(b)	Impact of Drilled Cuttings from Platforms
III.D.1.	Impact of Pipelines, Construction Phase
III.H.	Impact of Submerged Production Systems
III.L.8.b.(1)	Probable Impacts of Oil Spills on Littoral and Benthic Organisms
III.P.	Summary Tabulations of Environmental Impacts
IV.B.12.	Other Environmental Research
V.A.2.	Oil Pollution Effects on Benthic Organisms
V.B.2.	Construction and Operational Effects on Benthic Organisms

5. Impacts on Bottom Sediments

Impacts on bottom sediments from construction and operation in general would be minor. Small areas would be occupied or covered by components. The microrelief of the ocean floor would be somewhat changed, as, for example, in the ocean disposition of drill cuttings. This is considered neither beneficial nor adverse. The effects of redistributing material from the reducing zone is probably negligible. Turbidity would occur in localized areas. Near-shore turbidity resulting from suspended sediments would be analogous to the effects of a severe storm; farther offshore, rates would approximate the seasonal shifting of sediments. If riprap were placed in the inshore zones, the patterns of long-shore sediment transport and seasonal and/or offshore said transport would be affected in the vicinity of the pipelines. Because of the small mass of riprap, these effects would be of limited extent. The appearance of the bottom would be changed in the immediate vicinity.

In the event of an oil spill, many suspended solids may become associated with other suspended solids forming tarballs which may float or sink, be moved by prevailing currents, and eventually buried by sediments. Oil reaching intertidal areas may cover sediments and in turn be covered by sediments, forming a layer of weathered oil. Oil from a well blowout or spill becomes dispersed with sea water, and does not cover bottom sediments. (Onshore asphalt seeps do flow and cover surrounding soils.)

In the case of natural oil seeps, a definite annual cycle exists, with flow peaking in November. One authority estimates that the quantity of tarballs from natural seeps approximates that from man-introduced oil (crankcase oil, spilled oil); (oil seeps occur worldwide in regions where there has been no drilling or production). The State of California has contracted with the University of Southern California to investigate the possible relationship of oil extraction and oil seeps.

Selected Cross-references
(Bottom Sediments)

II.G.2.e.	Naturally Occurring Oil, Gas, and Tar Seeps
II.B.2.f.	Pleistocene Deposits (for general background)
II.B.2.g.	Holocene Deposits (for general background)

III.C.1.	Impact of Drilling and Production Platforms - Construction Phase
III.C.2.b.(1)	Debris and Pollutants other Than Oil
III.D.1.	Impact of Pipelines, Construction Phase
III.F.	Impact of Near Shore Loading Terminal
III.P.	Summary Tabulationsof Environmental Impacts
V.A.3.	Oil Pollution Effects on Bottom Sediments
V.B.3.	Construction and Operation Effects on Bottom Sediments

6. Impact on Beaches and Shoreline Recreation

During construction and operation of facilities, impacts are inversely related to the proximity of beaches and recreational areas. Increased background noise, fumes/exhaust vapors, water turbidity, and activity occur during the relatively short construction period. After construction, impacts are visual and include activity associated with platforms. Operational impacts are a matter of personal reaction ranging from: "slight irritation," "no reaction or ignoring," "moderate interest," to documented cases of "enjoyment and inspiration."

Whether from oil operations or natural seeps, even in areas without oil production, tar on beaches is an adverse impact depending on the quantity and to a degree on personal recreational uses.

Natural oil seeps can be observed on near-shore bluffs and rock formations, inland in the Channel, and in worldwide regions (including recreational). As discussed under bottom sediments, studies are underway on the potential relationship of oil extraction and oil seeps.

Severe recreational economic loss occurs if quantities of oil reach beaches and shoreline recreational areas. The impact remains until cleanup operations are completed, and for many people the memory ranges from "unpleasant to concerned outrage."

Selected Cross-references
(Beaches and Shoreline Recreation)

I.E.	Estimation of the Number of Facilities that Might Be Required
II.C.9.	Visibility
II.F.5.	Recreation and Tourism
II.F.7.	Research
II.F.12.	Aesthetics
II.G.2.e.	Naturally Occurring Oil, Gas, and Tar Seeps
III.C.2.a.(2).	Visual Impact of Platforms
III.D.1.	Impact of Pipelines - Construction Phase
III.E.2.f.	Recreation
III.P.	Summary Tabulations of Environmental Impacts
III.N.6.	Favorable Impact - Land and Water Conservation Fund
IV.B.3.	Platform Beautification Studies
IV.B.4.	Platform Removal
IV.B.12.	Other Environmental Research
V.A.4.	Oil Pollution and Effects on Beach and Shoreline Recreation
V.B.4.	Construction and Operation Effects on Beaches and Shoreline Recreation

7. Impacts on Wildlife

Onshore pipelines and facilities could have major or minor impacts on wildlife. Certain areas are more sensitive environmentally than others. Whether classified as sensitive, non-sensitive, or disturbed, the likely impacts from pipelines and facilities on wildlife present at a proposed site would be relatively minor, extending from very short-term to long-term:

- Disruption of the immediate and surrounding area during the construction phase by physical disturbance, dust, exhaust fumes, and noise.
- During the operational phase adverse impacts would include night lighting, emissions, human activity, and vehicular traffic.

Impacts of oil or brine spills could be significant in the short-term, and would be proportional to the quantity of the spill and to spill containment measures.

Indications from existing data are that past petroleum contamination has not had marked adverse effects on mammals of the Santa Barbara Channel. Young sea lions have been photographed resting on support members of offshore platforms. Harbor seals and other marine mammals have been curious observers of diving activities.

In the event of a major oil spill, the most visible and significant damage to wildlife would be mortalities among marine bird populations present on the waters of the Channel at the time. Certain species of aquatic birds appear to be much more vulnerable to oil. The most affected are: loons, grebes, murres, auks, auklets, and cormorants. Except for the destruction of littoral food supplies, the effect of an oil spill on shore birds, gulls, and terns, appears to be less.

For marine mammals the most critical time is after the birth and before the weaning of pups. If oil reaches rookeries during this time, the possibility of their ingesting oil would be greatly increased. Observational data in this matter is as yet scarce and actual effects can only be theorized.

The majority of reports do not attribute whale and dolphin deaths occurring during the 1969 oil spill to the spill. However, information is needed regarding subtle and long-term effects. Additionally, direct effects of oil on these animals are insufficiently documented. Since there are many variables associated with a spill, a single variable or combination of variables might create a situation where serious adverse effects would occur.

Selected Cross-references (Wildlife)

II.E.1.a. through e.	Terrestrial Biology
II.E.2.a.(8)	Marine Mammals
II.E.2.c.	Biotic Communities of the South Coast Province
II.F.7.	Current and Future Research
II.G.2.b.(2)	Areas of Special (Biological) Significance
III.E.1.b.	Impact of Onshore Treating and Storage Facilities, Biological Environment
III.E.2.a.(4)(b)	Sedimentation and Wildlife
III.E.2.e.	Impacts on Biota
III.L.	Impact of Major and Minor Oil Spills on Marine and Littoral Environments
III.P.	Summary Tabulations of Environmental Impacts
IV.B.12.	Current and Future Environmental Research
V.A.1.	Oil Pollution Effects on Marine-Associated Birds and Mammals
V.B.1.	Construction and Operation Effects on Wildlife along Pipeline Routes and Near-Shore Facilities

8. Impacts on Archeological and Historic Resources

There are numerous known historic and archeological resources in California. There is a high probability of undiscovered archeological resources onshore and an unknown probability offshore (14 artifacts have been recovered by divers; original source not determined). Advanced techniques are available for onshore surveys; undersea techniques are less advanced although technology developed for geophysical and other undersea exploration can supply considerable information. Diving archeologists are rare and diving surveys in depths below 200 feet are expensive. Existence of significant resources at that or greater depths are possible, but are very likely restricted to sunken ships. In view of the very small amounts of seafloor disturbed by all operations other than pipelines, the adverse impacts are considered to be cumulatively very minor.

Impacts on archeological and historic resources will be minimal if the following are accomplished in areas proposed for undersea and onshore facilities: site specific surveys by professional archeologists/anthropologists utilizing reasonable state-of-the-art techniques; design of proposed plans to avoid construction or operational impact on any known resources and any resources uncovered during construction. If relocation of ground-disturbing construction/dwelling cannot be accomplished, sites should be studied in context prior to and during salvage excavation. Conceivably, offshore surveys could be coordinated in part with, or could utilize data obtained during, other necessary site surveys. Without these considerations archeological and historic resources, if present at a given location, could be irretrievably lost or damaged.

Selected Cross-references
(Archeological and Historic Resources)

II.F.11.	Archeological Resources
II.F.11.	Historical Resources
III.M.4.	Conservation Considerations and Concerns - Archeological and Cultural Resources
III.P.	Summary Tabulations of Environmental Impacts
IV.B.9.	Mitigations - Archeological and Historical
V.F.	Archeological and Cultural Resources

9. Impacts on Human Safety

Primary threat to human safety would be to the workers at platform sites or onshore or offshore treating and storage facilities. In 1972, disabling injuries and deaths (per million hours worked) were: 7.11 for the overall petroleum production industry; 9.24 and 37.41 for the coal industry, surface mining and underground mining respectively; and 10.17 for all industries. One oil operator's rate was 3.25, lower than the 7.11 for the entire industry, indicating that training, regulation, and other mitigating measures are effective.

Major hazards from a gas line leak are fire and toxic hydrogen sulfide in the gas stream. Because of distance and the dispersive effect of offshore air currents a small leak underwater would present little danger. A larger leak should be detected readily and immediately and the line shut in. Onshore gas leaks would be detected and the pipeline shut down in the same manner as an offshore leak. However, an onshore leak could be more serious because of the proximity of generally more human activities and the danger of fire. Detailed contingency plans are needed for immediate response to gas leaks onshore or near the shoreline.

Marine transportation of additional produced crude oil would result in an increase in Channel marine traffic, posing a slightly increased risk of collisions during periods of low visibility. It is anticipated that Santa Barbara Channel OCS crude oil would be delivered to one or more of the numerous refineries and terminals in the Los Angeles and Long Beach harbor area. The U. S. Coast Guard considers that the Los Angeles and Long Beach area pilot groups, with radar, are doing an adequate and noteworthy job of policing harbor movements, which should keep the collision rate to a very low figure. Increased production could result in the construction of a pipeline from the Santa Barbara Channel area to the Los Angeles-Long Beach refineries. Such a pipeline should be designed with the capacity to handle the total Santa Barbara Channel Area production. This would virtually rule out the need for marine crude oil tanker traffic thereby lowering the associated traffic hazards.

An increase in highway traffic from truck movements of sulfur and natural gas liquids and employee transportation could have an impact on highway safety. A truck carrying natural gas liquids could become involved in a major traffic accident that might result in an explosion and/or fire. The expected frequency of accidents related to the natural gas liquids and sulfur truck movements is low, however, considering the few vehicles involved and the safety record of these types of carriers. National Safety Council statistics reflect an accident rate for intercity petroleum-marketing trucks substantially lower than the average for all categories of trucks during the same period.

Selected Cross-references
(Human Safety)

II.F.14.	Transportation
III.D.2.a.	Oil Spill Predictions and Estimates (Pipelines)
III.K.	Accidents and Oil Pollution Records
III.L.	Impact of Major and Minor Oil Spills on Marine and Littoral Environments
III.P.	Summary Tabulations of Environmental Impacts
IV.A.1.	Regulations
IV.A.2.	Inspection Programs and Approval Requirements
IV.A.4.	Contingency Plans
IV.A.6.	Mitigating Factors Involving the Relationship of Potential Activities to Shipping
IV.A.7.	Mitigating Factors Involving the Relationship of Potential Activities to Missile Overflight
IV.A.8.	Studies on OCS Management and Operating Practices
IV.A.9.	Memoranda of Understanding
IV.B.2.	Well-Control Training Programs for Operating Personnel
V.K.	Impact on Humans

10. Impacts on Marine Shipping

The remote possibility of a major seagoing vessel-platform collision exists; however, this has never occurred off the West Coast. The U. S. Coast Guard does not permit structures within one mile of shipping lanes.

The marine transportation of additional Santa Barbara Channel crude oil would probably result in approximately a five-percent increase in Santa Barbara Channel marine traffic for the life of the producing fields. The increase in traffic at the discharge port of Los Angeles-Long Beach would probably be on the order of magnitude of two percent.

Increased production would contribute toward economic justification for a pipeline from the Santa Barbara Channel area to Los Angeles-Long Beach refineries. Such a pipeline would drastically lower marine traffic in the Channel area by virtually eliminating marine transportation of crude oil.

Selected Cross-references
(Marine Shipping)

I.D.7.	Transportation of Produced Oil and Gas
I.E.	Estimation of the Number of Facilities Required in Implementing the Various Means of Increasing SBC Production
II.F.14.	Transportation
III.C.2.b.(2)(d)	Causes of Possible Major Spills from Platforms - Collision
III.J.	Impact of Product Transportation Systems
III.K.	Accidents and Oil Pollution Records
III.P.	Summary Tabulations of Environmental Impacts
IV.A.1.b.	Regulations - U. S. Coast Guard
IV.A.6.	Mitigating Factors Involving the Relationship of Potential Activities to Shipping
V.D.	Relationship to Shipping Traffic

P. Summary Tabulations of Environmental Impacts of Oil and Gas Operations in the Santa Barbara Channel OCS

Table III-16 is intended to assemble in one place potential impacts and their degree of severity on the various aspects of the environment. Because it is a general summary and admittedly subjective with respect to degree of impact, it should not be used in lieu of the text for purposes of full evaluation of impacts of possible actions. It is a qualitative synopsis demonstrating relative judgments.

Activities impacting on the environment are divided into two groups:

Rating Scale
+ Beneficial impact
0 No impact or not likely to occur
↓
5 Most impact or most likely to occur

[3] Possibility of occurrence; Rating of impact [3/3] (split cells below are written as possibility/rating)

	Terrestrial				Marine									Socioeconomic							
												Fishing			Transportation				Economic		
	Birds	Mammals	Endangered Species	Vegetation	Birds	Mammals	Benthic Organisms	Pelagic Organisms	Endangered Species	Vegetation	Bottom Sediments	Commercial	Sport	Recreation and Tourism	Onshore	Offshore	Air Quality	Water Quality	National	State	Regional
Impact of Drilling & Production Platforms																					
Construction Phase	0	0	0	0	1	1	2	2	0	1	1	3	+	1	1	1	0	1	0	+	+
Operation Phase	0	0	0	0	0	0	1	1	0	0	1	2	+	1	0	1	0	2	+	+	+
Post-Production Phase	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0
Impact of Pipelines																					
Construction Phase	2	3	0	2	1	0	3	2	0	3	1	2	2	2	1	1	1	1	0	0	+
Operation Phase	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	+	+	+
Post-Production Phase	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Impact of Marine Loading Terminal																					
Construction Phase	0	0	0	0	0	0	2	1	0	1	1	1	1	1	1	1	1	2	0	+	+
Operation Phase	0	0	0	0	+	+	1	1	0	1	1	1	0	1	0	0	1	2	0	+	+
Post-Production Phase	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Impact of Onshore Treating & Storage Facilities																					
Construction Phase	2	3	0	3	0	0	0	0	0	0	0	0	0	2	1	0	2	2	+	+	+
Operation Phase	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	2	+	+	+
Post-Production Phase	0	2	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Impact of Offshore Treating & Storage Terminal																					
Construction Phase	0	0	0	0	0	0	2	2	0	2	1	1	1	1	1	1	1	1	0	+	+
Operation Phase	0	0	0	0	+	+	1	1	0	0	1	1	1	1	0	1	1	1	+	+	+
Post-Production Phase	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Impact of Submerged Production System																					
Construction Phase	0	0	0	0	0	0	2	2	0	0	1	2	2	1	0	1	1	0	0	0	+
Operation Phase	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0
Post-Production Phase	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Impact of Oil Spills																					
Major Spills	1/3	1/3	1/1	1/4	1/5	1/4	1/4	1/4	1/3	1/3	1	1/4	1/4	1/3	2	2	2	1/3	1/3	1/2	1/4
Minor Spills	3/1	3/1	3/1	3/2	3/1	3/1	3/1	3/1	3/2	3/1	0	3/1	3/1	3	0	1	1	3/1	1	2	2
Very Minor Spills	0	0	0	2	2	2	2	1	1	2	0	2	1	2	0	1	1	1	0	0	0

TABLE III-16 IMPACT SUMMARY, PETROLEUM DEVELOPMENT, SANTA BARBARA CHANNEL OCS, OFF CALIFORNIA

(1) phase of proposal component (construction, operational, and post-operational), and (2) possible oil spills. Not all impacts indicated are inevitable. Many are potential or "threatened," and may not occur. The summary of impacts is made in the context of the entire Statement--including current engineering design criteria, consideration for areas of special significance, multi-agency jurisdictional controls, and other mitigations. It should be considered that damage to facilities or components may result without, as well as with, an adverse impact on the environment.

In rows indicated by a diagonal separation, i.e., impact of oil spills, the upper number is an estimate of the probability of occurrence (on a 0 to 5 scale); the lower number is the severity of impact (same scale). Relative ratings are indicated by a single symbol (same scale). Relative ratings may have both positive and negative considerations depending both on factual considerations and point of view.

Short-term or long-term impacts are implied by the phase of development. For oil spills, ratings are for a period of approximately up to one year.

Table III-17 summarizes quantitative ranges of cumulative impacts. The first column is a summary tabulation of estimated number of additional facilities. Note that low and high ranges are presented, based upon possible means of further development of oil production from the Santa Barbara Channel, as discussed in section I.E.5. Rationale for deriving cumulative impacts is presented in footnotes. Information from the footnotes combined with the low and high ranges of additional facilities is the rationale of deriving ranges of possible cumulative impacts. Ranges in Table III-17 may be regarded as estimated order of magnitude. Also, see tables III-7 and 8 for a forty-year hypothetical scenario of Channel facilities and activities.

TABLE III-17

RANGES OF POSSIBLE CUMULATIVE IMPACTS

ESTIMATED NUMBER OF ADDITIONAL FACILITIES[1]	Low	High	LAND REQUIRED FOR ONSHORE FACILITIES	AMOUNT OF CUTTINGS ON OCEAN FLOOR	QUANTITY OF PRODUCED WASTE WATER
A. Platforms	10	21	As a result of Onshore Facilities (B) 30 to 150 acres[4]	As a result of Exploratory & Development Wells (E&F) 146,000 tons to 419,000 tons of cuttings for total exploratory and development wells over total 15-25 years (0.2% of a single year's siltation from runoff (table II-71))[6]	As a result of Platform Production (F) 250,000 barrels to 525,000 barrels per day 180 million barrels to 390 million barrels over 20 years[8]
B. Onshore Facilities	1	5	As a result of Pipelines to Shore (D)[5] Approximately 1.5 to 9.0 miles onshore buried pipelines (approximately 12 to 16 inches in diameter)		
C. Submerged Production Systems (SPS)	0	21			
D. Pipelines to Shore Number Miles	 1 37	 6 111		As a result of Platform Development Wells (F) 10-21 mounds; each 80 to 100 feet in diameter, 20 feet high. (Total area affected by finer grade cuttings per platform is from 0.2 acres to 2.0 acres)[7]	
E. Exploratory Wells	49	165			
F. Development Wells	190	520	As a result of Oil Transportation to Refineries if by Pipeline (H) Approximately 100 to 140 miles of buried pipeline (approximately 20 inches in diameter)		
G. Oil Transportation Facilities to Refineries - If by Marine Vessel One additional tanker per day in Channel[2]					
H. Oil Transportation Facilities to Refineries - If by Onshore Pipeline One pipeline from Channel area to refinery area[3]					

FOOTNOTES

1 See section I.E.5., summary tabulation of estimated number of required facilities.

2 If additional oil was transported to refineries by marine vessels the current Channel ship traffic of 6,977 vessels per year would increase to approximately 7,350 vessels per year, or one additional vessel per day in the Channel (see section III.J.1.). If a pipeline were constructed from the Channel area to a refinery area, no additional marine traffic would be initiated. Such a pipeline would result in a substantial decrease in existing tanker traffic.

3 If additional production were transported to refineries by marine vessels, an onshore pipeline to refineries would not be required.

4 Estimated 15 acres per site plus 15 acres for buffer area and utilities.

5 Estimated 1 to 2 miles of pipeline onshore from coast to onshore facility.

6 Cuttings for a typical 8,000 foot platform well approximate 1,223,000 pounds (611.5 tons).

7 See section III.C.2.b.(1)(b). Mound size typical for a 30-well platform.

8 Varies with stage of production. Estimate 25,000 barrels/platform/24-hour period. Calculations based on number of platforms (as SPS are an alternative to platforms). Produced waste water would be disposed of by subsurface injection or discharge into the ocean. If discharged into ocean maximum oil content would be 50 ppm, and would likely average less than 25 ppm oil. A platform produced waste water discharge volume of 25,000 barrels per day would result in approximately ½ barrel of oil being released into the ocean over a 24-hour period.

TABLE III-17 (Continued)

RANGES OF POSSIBLE CUMULATIVE IMPACTS (Continued)

AMOUNT OF DRILLING FLUID (MUD) ADDITIVES LOST TO OCEAN[9]	AREA OF KELP BED DISTURBANCE	AREA REMOVED FROM COMMERCIAL FISHING	TRAWLING AREA AFFECTED BUT NOT NECESSARILY REMOVED	MAXIMUM POTENTIAL OIL SPILL VOLUMES[14]
From Drilling Exploratory and Development Wells (E&F) 11,950 barrels (30 tons) to 34,250 barrels (96 tons) drilling fluid additives, excluding sea water, lost to the ocean. (Totals for entire impacts equal approximately .00002% to .00005% of a single year's runoff)[10]	As a result of Sea Floor Pipelines to Shore (D) 0.01 sq mi to 0.06 sq mi (0.01% to 0.05% of 110 sq mi of kelp lease areas)[11] Duration of impact: 2± years before full recovery	As a result of Platform (A) 8 sq mi to 16.8 sq mi (0.5% to 1.0% of 1,750 sq mi Channel area)[12]	As a result of Platforms and Pipelines (A&D) 45 sq mi to 128 sq mi (2.6% to 7.3% of 1,750 sq mi Channel area.[10]) Trawling accounts for 17% of the Channel commercial fishing.[13]	From a Platform (A), Submerged Production System (C), or Exploratory Well (E) 100,000 barrels From Onshore Facilities (B) 110,000 barrels (spill not likely to reach the ocean) From a Sea Floor Pipeline to Shore (D) 10,000 barrels From Onshore Portion of Pipelines (D&H) 10,000 barrels (spill not likely to reach the ocean) From Marine Vessel (G) 175,000 barrels

9 Assume: 200 barrels mud lost to ocean per well drilled. 1 barrel mud weights approximately 500 pounds. Drilling fluid (mud) is made up of approximately 75% sea water and 25% mud additives (i.e., chemicals, barite, clay). Therefore, 3/4 of each barrel of mud lost to the ocean would be sea water and ¼ would be additives other than sea water.

10 Compare quantity of mud additives lost to ocean with table II-71, "Constituent Emissions" for perspective.

11 Estimate kelp bed width at 2,640 feet (½ mile); estimate 100-foot wide disturbance through bed. Kelp beds vary in width, density, and are not present throughout the entire Channel periphery.

12 Estimate 0.8 sq mi per platform. (Conservative figure, fishing has occurred adjacent to platforms). Assumes platforms are in commercial fishing area.

13 Estimate 1 sq mi per mile of pipeline, in addition to area from preceding column. Conservative figure; see section III.D.3., compatability of fish trawling and pipelines. Assumes pipelines are in trawling area.

14 The figures in this column represent the maximum spill volume that might result from an accident. No attempt is made here to predict probability of occurrence for such spills. Variance among authorities as to probability of occurrence is noted in section III.L.3. through 9.

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☆U.S. GOVERNMENT PRINTING OFFICE: 1976 - 685-077/36 Region No. 9-1