SITE-SPECIFIC MARINE BIOLOGICAL SURVEY CHEVRON U.S.A. INC. PLATFORM GAIL PROJECT SANTA BARBARA CHANNEL

for
CHEVRON U.S.A. Inc.

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by
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EXECUTIVE SUMMARY

In March 1984 Chevron retained the services of McClelland Engineers, Inc., to carry out a marine biological characterization of Chevron's proposed Platform Gail site. The project is within the Santa Barbara channel area of Pacific OCS Lease Sale 48. The proposed platform site is located on OCS Lease P-0205 (see Figure 1-1). The proposed platform site is located approximately 8.5 miles north of Anacapa Island and approximately 11 miles west of Port Hueneme Harbor.

The biological survey included: infaunal grab sampling, 35-mm still photographs of the benthos, water quality and sediment chemistry, otter trawling, and surface observations of marine mammals and avifauna. In addition, daily observations were made of meteorologic and oceanic conditions. A cruise report detailing events of the survey was submitted to Chevron on March 21, 1984.

The benthic environment at the proposed Platform Gail site as described by this biological survey is characterized by silty sand substrate dominated by various species of demersal fish and invertebrate species. The predominant fish species captured during trawling was the Pacific sanddab (Citharichthys sordidus) which comprised 38.4 percent of the total fish catch. The predominant macroepifaunal invertebrate sampled was the urchin (Allocentrotus fragilis) which was observed as common to abundant. The photographs of the seafloor support this estimate.

The site infauna was sampled at 8 stations within a 1000 meter radius of the proposed platform location. The infauna was dominated by the polychaetes in both diversity and abundance. The most abundant single species sampled during the survey was the ophiuroid, Amphiodia urtica which comprised 19.4 percent of the individuals collected during grab sampling. Dominance in diversity and abundance by the polychaetes, and A. urtica being the most abundant single species is consistent with prior surveys in the region. (Fauchald and Jones, 1979.) During the survey, a potential new cumacean species was taken at Station 8. This cumacean, hereafter referred to as Petalosarsia sp A, is the first record of this cumacean from our coast. The genus Petalosaria is common in the western Pacific and from the Atlantic Coast. Species identification for Petalosarsia sp A. is delayed until a

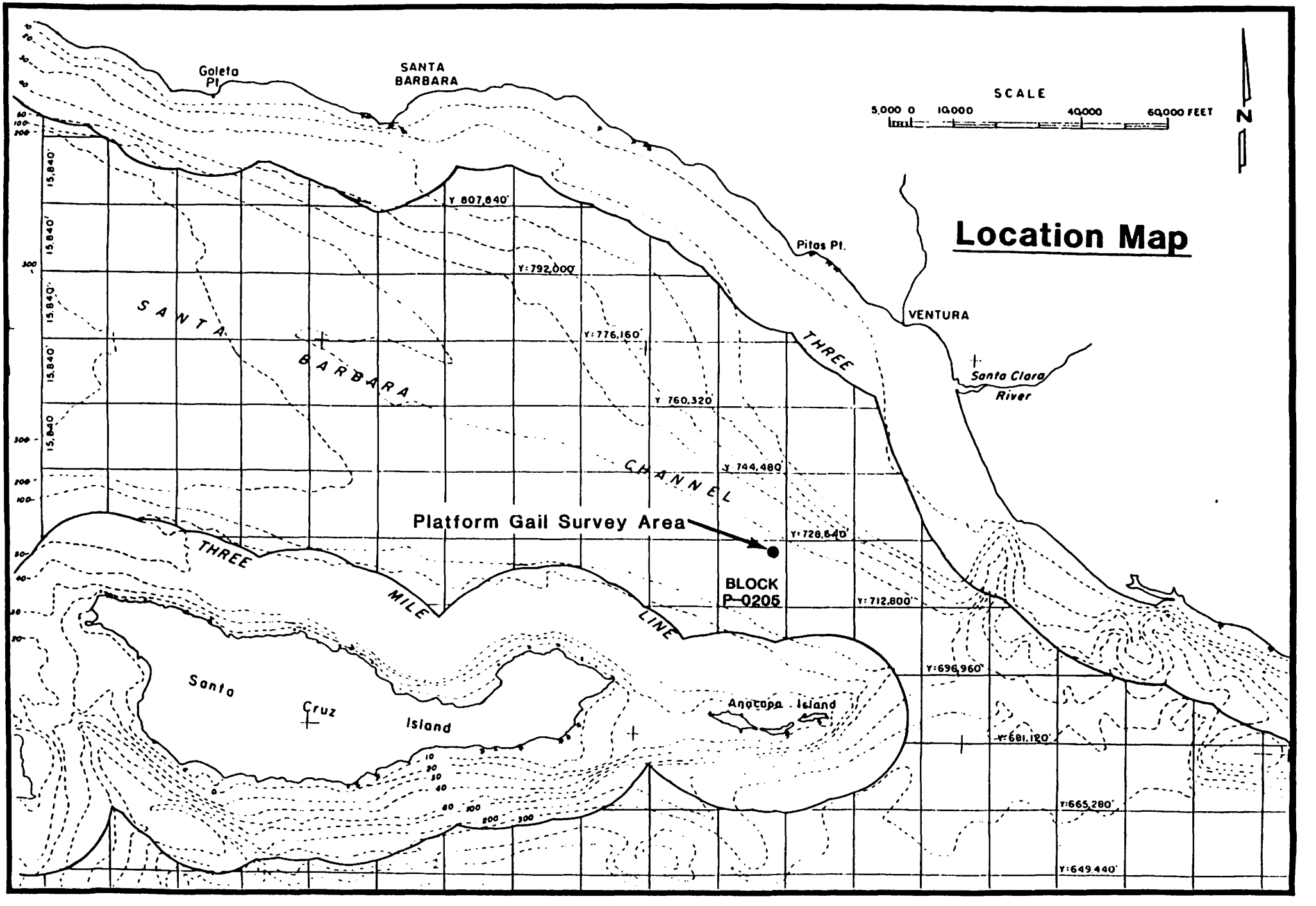


FIGURE 1-1

sufficient number of species can be described and documented by the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT) cumacean experts.

During the survey, records of observations of marine mammals and avifauna were made. A pod of three gray whales were sighted on the second day. Also during the survey several solitary California brown pelicans were sighted. The gray whale and the brown pelican are both federally and state listed as endangered species.

During platform construction and drilling phases, benthic fauna at the site will be impacted. These impacts include disturbance to the benthic fauna from platform pile placement and from construction barge anchors. Impacts will also result from the toxicities of the drilling muds discharged. Drill cuttings produced during drilling of the project wells will probably result in burial of epifauna and infauna at the platform site. During the operational life of the platform, the presence of hard substrate (the platform structure itself) will provide attachment surface for benthic organisms.

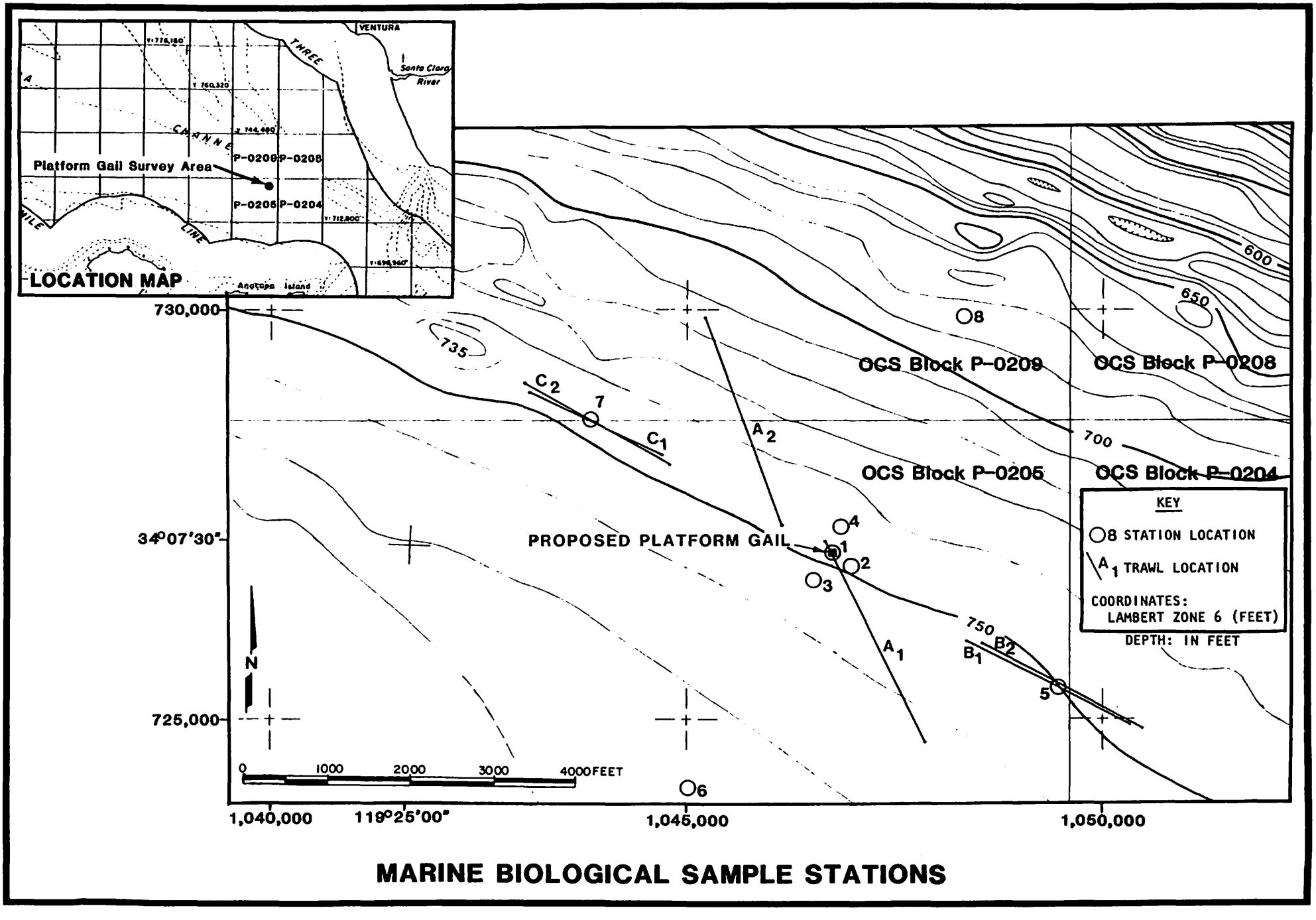
1.0 INTRODUCTION

Chevron U.S.A., Inc. (Chevron) will be the operator of the oil and gas development and production platform Gail proposed on OCS Lease P-0205. Chevron is in the the process of preparing the plans and permits required for construction and operation of the platform. The development plan details the installation and operation of a production platform to be designated Gail. The proposed platform site is located on sedimentary benthic habitat.

The Minerals Management Service (MMS) has outlined basic requirements for biological surveys in the lease area. These requirements and procedures are stated in NTL 78-1. McClelland Engineers, Inc., (MEI) was authorized to conduct the site-specific marine biological survey at the proposed platform site. MEI, in conjunction with Chevron, MMS and other reviewing federal and state agencies, developed the scope of the survey plan. This plan was submitted to MMS on March 2, 1984, was approved by the MMS and found consistent with their requirements.

Following approval of the survey plan, the site-specific marine biological survey was conducted between the dates of March 14 and March 16, 1984. The specific purpose of the survey was to characterize the benthic habitats in the area of the proposed platform (Figure 1-1). This was accomplished by obtaining soft bottom infaunal grab samples, 35-mm color still photographs of the benthos, otter trawl samples, and water quality and sediment chemistry samples. In addition, daily observations were made on meteorological conditions and sea state, and surface marine biota including marine mammals and seabirds.

The results of the survey are presented and discussed in this report and presented with related information required by NTL 78-1 and Pacific OCS Region MMS policies. The methods section (2.0) contains details of survey equipment, personnel, and operating procedures. The Results and Discussion Section (3.0) presents the data collected which characterizes the benthic habitats both infaunal and epifaunal at the proposed platform site. The characterization is generated from triplicate infaunal samples at 8 stations and paired trawl samples at 3 stations (Figure 1-2). In addition, Section 3.0 presents the data collected on the physical parameters of the benthic substrate (including grain size, total organic carbon, and oil and grease)



MARINE BIOLOGICAL SAMPLE STATIONS

FIGURE 1-2

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and of the water column (including temperature, salinity, pH and dissolved oxygen) at each of the 8 stations shown on Figure 1-2. Section 4.0 (Potential Impacts and Conclusions) presents the potential impact agents of the proposed project. Section 4.0 also details any rare, endangered or unusual species encountered during the survey as well as the overall conclusions of the proposed project by the scientific survey team.

2.0 METHODS

2.1 VESSEL AND EQUIPMENT

The support vessel for the site-specific marine biological survey of Chevron's OCS Lease P-0205 was the R/V Seawatch. The Seawatch is a 65-foot research vessel powered by twin-diesel engines, equipped with a hydraulic A-frame with a 3,000 lb. design capacity and a hydrographic davit with a lift capacity of 500 lbs. The Seawatch had berthing capabilities for the 15 personnel (including observers and vessel crew) for the survey. The vessel had ample deck space, storage space and laboratory space to meet all the requirements of the survey. (A diagram of the survey vessel is contained in the Survey Plan.)

Navigation was provided by NCS International, Inc. (NCS) utilizing a Motorola Mini-Ranger III supported by three shore stations. The Mini-Ranger III System has a stated capability of noting the position of a survey vessel within ±3 meters (10 feet). Table 2.1 shows the locations and depths at each infaunal grab station (Figure 1-2).

Infaunal samples were collected using a $0.1m^2$ Smith-MacIntyre grab sampler. Three replicate samples were taken at each station (Plate 1). Each sample was transferred to a calibrated container for volume measurement and subsamples were subsequently removed for grain size, total organic carbon (TOC) and oil and grease analysis as required (see Section 2.3.1). The remainder of the sample was then sieved on a specially constructed sieve table that allowed gentle washing of the sample through nested 1.0-mm and 0.5-mm screens. The TOC/oil and grease samples were labeled and frozen. Infaunal and sediment grain size samples were labeled, and the infaunal samples preserved in 10 percent formalin buffered with seawater. The samples were then boxed for shipment to a taxonomic laboratory.

Color slides (3 to 5 per station) were taken at all 8 stations using a Benthos 35-mm, mechanically triggered, remote still camera. A distance setting of 6 feet was adjusted on the camera, providing an area of view of about 20 square feet.

Water quality samples were collected using Niskin type water samplers at the surface (approximately 1 meter below surface) and bottom (approximately 1 meter off bottom) for the measurements of pH and dissolved oxygen (DO). DO samples were fixed using the azide modification technique and titrated after

Table 2.1
Locations and Depths
Infaunal Sample Station

Station	Depth (Ft. MLLW)	Coordinates Longitude	Latitude
1	739	34° 07' 30"	119° 24' 00"
2	739	34° 07' 29"	119° 23' 57"
3	742	34° 07' 27"	119° 24' 03"
4	734	34° 07' 33"	119° 23' 59"
5	740	34° 07' 15"	119° 23' 27"
6	764	34° 07' 02"	119° 24' 19"
7	737	34° 07' 46"	119° 24' 35"
8	675	34° 07' 59"	119° 23' 42"

the survey in the lab. pH samples were determined in the field using a Altex Monitor II System pH meter. A Plessey 9060 STD was used to determine salinity and temperature in the field.

Paired trawls were collected at three stations (Plate 1). Trawl samples were collected using a 25-foot otter trawl with 1.5 inch mesh and 0.5 inch mesh in the cod end. A bottom sampling period of ten minutes at a speed of approximately two knots was run in all cases. The cable length was approximately three times the water depth.

2.2 PERSONNEL AND ASSIGNMENTS

Survey scientific personnel and assignments for the site-specific marine biological survey were:

Mr. Ian C. Macfarlane	Principal-in-Charge
Mr. Harry C. Finney	Project Manager/Chief Scientist
Dr. Doug Diener	Principal Investigator/ Marine Biology
Mr. Gary Robinson	Marine Biologist
Mr. Larry Lovell	Marine Biologist
Mr. John Ljubenkov	Marine Biologist
Mr. Frank Gremse	Oceanographer
Mr. Maurice Hill	MMS Observer
Ms. Roslyn Muller	Chevron Observer

The Seawatch was under the direction of Captain Steve Gregson and crewed by a mate, cook and three deck hands. Navigation equipment was operated by Mr. Gary Barker and Mr. John Budack of NCS.

Laboratory taxonomic analyses were conducted under the direction of Dr. Doug Diener at Marine Ecological Consultants, Inc., (MEC) in Solimar Beach, California. Resumes of the taxonomic experts employed for analyses were included in the detailed survey plan submitted to MMS dated March 2, 1984.

2.3 OPERATIONS

Normal operations would have ordinarily proceeded along a strict schedule, completing each station before traveling to the next. However, meteorologic and oceanic conditions were such that sampling was completed as weather

and sea conditions allowed. Table 2.2 lists the chronological events of the survey including observations of wind and sea state.

Three days of observations for meteorologic and sea conditions were recorded during this survey. Generally the winds and swells were from the northwest or west. Wind speeds during the survey had a normal speed of 15 to 20 knots with gusts to 35 knots (estimated). On the third day, from 0600 to 1000 hours, the wind speed was at its lowest at 5 to 10 knots. Swell heights were generally 3 to 4 feet with an estimated maximum of 7 feet observed on the second survey day.

2.3.1 Infaunal Sampling

In discussions between McClelland, Chevron and MMS, it was determined that infaunal sampling would be conducted at 8 stations (Figure 1-2). Station 1 is located at the proposed platform location. Stations 2, 3 and 4 are located at a distance of 100 meters from the platform center and Stations 5 through 8 are located at a distance of 1000 meters from the platform site. Station locations run essentially along the same isobathometric contour or perpendicular to the isobathometric contour.

The rational for positioning the stations was the need to achieve a baseline characterization of the habitats at the platform site and in the vicinity prior to authorization from MMS for construction of the proposed platform. Those stations located within 100 meters of the proposed platform site can be used to predict potential impacts from the construction and operation of the proposed platform. The stations located at 1000 meter intervals can be expected to receive minimal impact from the proposed platform construction and operation and can be used as controls. The stations chosen for the site-specific survey were set up to facilitate long-term monitoring if it became necessary in the future. However, at this time, no monitoring is anticipated.

Three replicate samples at each of the eight stations were taken off the stern of the survey vessel with a Smith-MacIntyre grab sampler. The grab sampler was lowered over the stern using the "A" frame and winch until the sampler contacted the bottom, then retrieved. Preplotted sample stations were occupied during each replicate. After the sample was brought onboard, the sample condition was checked for washing and sufficient size (i.e., 2

Table 2.2
Chronological Events

Date	Time	Activity
March 14	0000-0700	Sea Watch transited from San Pedro to Channel Islands Harbor.
	0700-0930	Mobilized personnel, navigation and equipment.
	0930	Departed Channel Islands Harbor for site.
	1030	Arrived on site, weather conditions adverse. Wind was blowing out of the northwest at 15 to 20 knots. Swell height was 3 to 4 feet.
	1030-1100	Trawling route A was checked for subsurface obstructions.
	1100-1630	Trawling was attempted at Station A. Time delays were incurred due to adverse weather. Wind was still blowing out of the northwest at 15 to 20 knots but sea swell height increased to 4 to 6 feet. Trawling equipment was secured.
	1630-1700	Preparation of grab sampler at Station 1
	1700-2030	Attempts were made at taking infaunal grabs at stations 1 through 4. No success due to high winds and short period wave interval. Wind speeds were from 10 to 15 knots out of the west. Swells were 4 to 6 feet with a period of 5 to 6 seconds.
	2030	Aborted grab attempts due to weather, set up system for bottom photography.
	2030-2200	Transit to station 1 and attempting to sample. Significant time lost due to high winds (15-20 knots). Unable to hold to Station 1.
	2200-2300	Pictures taken at Stations 2, 3 and 4. Transit time and maneuvering difficulties caused excessive delays due to weather conditions. Wind speeds were from 15 to 20 knots and swell height 4-6 feet.

Date	Time	Activity
	2300-2400	Changing film and battery charging required for camera. The trawl net was set for sampling at Station B. Trawling is the only sampling procedure which can get adequate samples because of the adverse weather conditions. Winds from the west at 15-20 knots, swells 4 to 6 feet.
March 15	0000-0800	Trawling completed at stations B and C. Winds to 25 knots and sea swell heights of up to 6 feet resulted in significant time delays.
	0900	Mr. Maurice Hill, MMS representative, arrived from Channel Islands Harbor.
	0800-1100	Wind speeds dropped to 10 to 15 knots and swell heights decreased to 3 to 4 feet. Grab sampling was completed at Stations 2 and 3 and 1 replicate was taken at Station 1.
	1100-1200	Weather conditions deteriorating (wind speed increasing to 15 to 25 knots). Camera system and water quality system being set up for deployment at Station 1.
	1200-1452	Rapid deterioration of weather conditions. Winds gusting to 35 knots, swell height ranges from 5 to 7 feet with a period of 5 to 6 seconds. Small craft warnings in effect for the Santa Barbara Channel area. All grab sample attempts at Station 1 failed due to the weather.
	1500	Decision by R. Muller and H. Finney was made to delay survey due to weather. Seawatch proceded to Channel Islands Harbor. Down for weather.
	1545	Arrived Channel Islands Harbor.
	1545-	
March 16	0100	Waited in harbor until weather conditions improved.
	0100	Weather conditions improved. Wind decreased to 10 to 15 knots, swell height to 3 to 4 feet. Departed harbor for site.

Date	Time	Activity
	0100-0230	Travel to site, weather conditions still adverse but improving. Winds 10 to 15 knots, swell height from 3 to 4 feet.
	0230-1030	Completed final 17 replicates of infaunal grabs at Stations 1 (2 replicates), 4, 5, 6, 7 and 8. Weather conditions were adequate between 0600-1000 hrs. Winds decreased to 5 to 10 knots and swell height decreased to 2 to 3 feet.
	1030-1100	Set up camera and water quality systems. Weather conditions deteriorating. Wind speed increasing to 15 knots.
	1100-1605	Water quality and photography completed at all 8 stations. All sampling completed. Weather delays occurred during the final 3 hours of the survey. Wind increased to 20 knots and swell heights increased to a maximum of 5 feet.
	1605-1710	Transited to Channel Islands Harbor.
	1710-1800	Demobilization. Samples transported to respective laboratories for analysis.
	1800-	
March 17	0100	Sea Watch transited from Channel Islands to San Pedro.

liters was considered sufficient). If the sample was disturbed or of insufficient size (less than 2 liters), the sample was discarded and a new sample taken. Due to severe ocean and meteorologic conditions (sea swells and wind) numerous retakes of samples were required. Additionally the benthic substrate was composed of packed silty sand (see Section 3.3.2) which impeded the ability of the grab sampler to take a sample of sufficient size. After an adequate sample was acquired, the sample was measured for volume, had a subsample removed, and was then sieved through 0.5 and 1.0 mm screens to retain the fauna and discard the sediment. The collected biota was preserved in a buffered formalin solution and stored for subsequent analysis. At the MEC laboratory, taxonomic analysis was performed on the 1.0mm sieved samples whereas the 0.5mm sieved fractions were archived pending future requirements for 0.5 mm data. From each replicate sample, a subsample (approximately 50 grams) was removed for grain size analysis. From one replicate sample at each station, a subsample (approximately 50 grams) was removed from an undisturbed portion of the sample for determination of TOC and oil and grease levels in the sample area.

2.3.2 Trawling

Preplotted trawl lines were used to navigate during trawling. All trawls were run along approximately the isobathymetric contour at each station. The rationale for running along the isobathymetric contour at each station is primarily for reducing the probability of the net coming off the bottom (i.e., same depth along the trawl route) and to eliminate variances associated with a change of depth. Trawl A was run at a slight angle to the isobathymetric contour at the site due to extreme wind conditions pushing the survey vessel to the south. At the completion of each 10 minute trawl, the net was brought onboard and cleared of all organisms. The samples were rough sorted and all field identified specimens were recorded and counted onboard. Representative specimens were retained for vouchers and the remainder of the sample was returned to the ocean. Specimens not identified to the species level were retained for later taxonomic analysis.

2.3.3 Field Observations

During all phases of the field survey, extralimital observations of sea state, weather, and marine fauna were recorded. Marine mammals were identified to the extent that critical features were evident. All bird species observed were identified where possible and recorded. Records of the observations were taken for time of day and the approximate vessel location (i.e., near which station).

2.4 Data Analysis

Taxonomic analysis was performed on infaunal and trawl samples. The level of identification was to the most practicable taxon with species being the target. Infaunal samples were sorted to phyla, wet-weight biomass determined, and then identified to the species level where possible. Species diversity and abundance was also measured.

In the event that a species could not be identified to the species level due to insufficient expertise, the species were sent to the taxonomic experts shown in the site-specific marine biological survey plan. However the inability to identify the specimens collected during the field survey to the species level was due primarily to immature or damaged specimens. One species which is considered new to this coast has been identified to the level practicable (Genus). Complete classification will have to wait until a descriptive key to the species can be completed by SCAMIT cumacean experts.

After compilation of taxonomic analysis of the survey records and samples, the data was subjected to basic summary statistics. Basic summary statistics include population data for individual stations, mean number of individuals (average density) and species diversity.

At the conclusion of data analysis, and all numbers of individuals and species were compiled and totaled, vouchers of each species were prepared. These vouchers will be sent to the Santa Barbara Natural History Museum for archiving.

Still photographs were inspected for use in identifying previously unrecorded species and bottom conditions in general. A copy of the photographs were submitted to Chevron, and are submitted as part of this document.

Laboratory analysis was performed on sediment samples for grain size, total organic carbon (TOC) and oil and grease content. Grain size analysis

was accomplished using sieving and a modified pipette analysis which resulted in a breakdown of the grain size to percent sand, clay and silt. Grain size was analyzed for mean and median grain size, as well as sediment distribution, skewness and kurtosis. The TOC was analyzed by a total organic carbon analyzer which uses an infrared gas analyzer to measure CO_2 release after oxidation for organic carbon. Determination of oil and grease content was by Soxhlet extraction, followed by gravimetric analysis.

3.0 RESULTS AND DISCUSSION

The results of site-specific marine biological survey conducted on Chevron's Lease P-0205 at the location of the proposed Platform Gail include analyses from 8 grab stations (including infaunal samples, sediment and water quality parameters, and 35 mm still photographs), and 3 stations of paired trawls. The locations of the grab and trawl stations in relation to the southern California coastline and the Channel Islands are shown on Plate 1 (attached).

3.1 MARINE MAMMALS

The U.S. Bureau of Land Management (BLM) summarized data collected by the University of California, Santa Cruz on marine mammal sitings in the regional offshore areas within the southern California Bight (UOC, 1979). Six species of pinnipeds and 24 species of cetaceans can be expected to migrate through or utilize the region. Table 3.1 lists the species expected to occur in the area of OCS Lease P-0205.

During the project survey, few marine mammals were sighted. A pod of 3 gray whales were sighted northeast of the platform location on the second day. A lone California sea lion was observed on each of the survey days and a pod of 4 unidentified dolphins were observed approximately 1 mile away. Of the two species of marine mammal identified, only the gray whale is federally and state listed as endangered; however, all marine mammals are fully protected by the Federal Marine Mammal Protection Act.

3.2 MARINE BIRDS

A three year, comprehensive survey of marine seabirds of the southern California Bight was conducted by the University of California, Santa Cruz from 1977 through 1979. This survey provides the best available data for the Santa Barbara Channel Region.

The Santa Barbara Channel supports a diverse and abundant seabird population. Gulls (Larus sp), cormorants (Phalacrocorax sp.), the western grebe (Aechmorphus occidentialis) and the California brown pelican (Pelecanus occidentalis) are common to the OCS Lease P-0205 project region (Dames & Moore, 1979). During the project survey, 4 species of seabirds were identified. These included the western gull (Larus occidentalis), the Heermans

Table 3.1
MARINE MAMMALS EXPECTED IN THE PROJECT AREA

Common Name	Scientific Name[1]
Pinnipeds	
California sea lion[4]	Zalophus californianus
Steller sea lion	Eumetopias jubatus
Northern fur seal[3]	Callorhinus ursinus
Guadalupe fur seal[3]	Arctocephalus townsendi
Northern elephant seal	Mirounga angustirostris
Harbor seal	Phoca vitulina
Cetaceans	
Minke whale	Balaenoptera acutorostrata
Blue whale[2]	Baleonoptera musculus
Sei whale[2]	Balaenoptera borealis
Fin whale[2]	Balaenoptera physalus
Humpback whale[2]	Megaptera noveangliae
Gray whale[2] [4]	Eschrichtius robustus
Common dolphin	Delphinus delphis bairdi
Pacific pilot whale	Globicephala macrorhynchus
Risso's porpoise	Grampus griseus
Pacific white-sided dolphin	Lagenorhynchus obliquidens
Northern right whale dolphin	Lissodelphis borealis
Killer whale	Orcinus orca
Harbor porpoise	Phocoena phocoena
Dall's porpoise	Phocoenoides dalli
False killer whale	Pseudorca crassidens
Pacific bottlenose dolphin	Tursiops gilli
Sperm whale[2]	Physeter catodon
Pygmy sperm whale	Kogia breviceps
Baird's beaked whale	Berardius bairdii
Cuvier's beaked whale	Ziphius cavirostris
Pacific right whale[2]	Balaena glacialis
Hubbs' Beaked whale	Mesoplodon carlhubbsi
Beaked whale	Mesoplodon ginkodens
Northeastern Pacific long-finned pilot whale	Globicephala melaena scammoni

[1] Scientific Names taken from Daugherty, 1966.
[2] Federally listed as endangered.
[3] Nominated for the federal list of threatened or endangered. State listed as endangered
[4] Observed in the project vicinity during survey

gull (L. Heermanni), the western grebe, and the California brown pelican. These were only observed near the survey vessel when trawl samples (discarded fish) were being returned to the marine environment.

The only marine avifauna observed that is federally and state listed as threatened or endangered is the California brown pelican. In California this species only breeds on the Channel Islands (primarily Anacapa Island), but is common during the fall and summer seasons throughout the Santa Barbara Channel (DOI, 1981). The proposed development of Lease P-0205 is not expected to affect the breeding or feeding habits of marine avifauna in the area. However, in the unlikely event of a major oil spill, pelagic birds are believed to be the most susceptible to contamination by oil (DOI, 1983).

3.3 BENTHIC HABITAT

3.3.1 Trawling

Paired trawls were run at three stations (Plate 1). Table 3.2 lists the taxa collected in the trawls. The station and replicate counts on individuals taken in the trawls are shown in Appendix B. The predominant fish taken in these trawls was the Pacific sanddab (Citharichthys sordidus), which represented 38.4 percent of the fish species collected. The five most dominant fish collected in the trawls are shown in Table 3.3. These five species represent more than 94 percent of the fish captured. The predominant non-fish species taken was the urchin (Allocentrotus fragilis). This urchin was common to abundant in the trawl samples with a mean number and standard deviation of individuals collected at 185 ± 69.6. It is estimated from the trawls that this urchin occurs on the site at the rate of 0.04 individuals per square meter*.

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*Trawl areas were computed by length of trawl times 20 feet (25 foot otter trawl allows an approximate mouth opening of 20 feet due to pull on net). 6 trawls were run over a total of 13,600 feet. Therefore, 20 feet (6.1 meters) x 13,600 feet (4145.3 m) = 25,269.6 m^2. 1110 individuals ÷ 25,269.6 m^2 = 0.04 individuals/m^2.

TABLE 3.2

TRAWL COLLECTED EPIFAUNA

PLATFORM GAIL SURVEY

TAXA

Phylum COELENTERATA

Class Anthozoa

Acanthoptilum sp. frag.

Phylum MOLLUSCA

Class Cephalopoda

Octopus sp.

Phylum ECHINODERMATA

Class Echinoidea

Allocentrotus fragilis

Brisaster latifrons

Brissopsis pacificus

Spatangus californicus

Class Asteroidea

Astropecten ornatissimus

A. verrilli

Hippasteria spinosa

Petalaster foliolata

Phylum ARTHROPODA

Class Crustacea

Argis californiensis

Cancer anthonyi

Crangon nigromaculata

Lopholithodes foraminatus (California king crab)

Pandalus jordani (prawns)

P. platyceros

Paguristes turgidus

Pleuroncodes planipes (Pelagic crab)

Muricea gaudichaudii

Class Isopoda

Lironeca vulgaris
(fish lice)

Phylum CHORDATA

Class Pisces

Argentina sialis (Pacific argentine)

Aprodon cortezianus (Bigfin eelpout)

Chilara taylori (Spotted cusk-eel)

Citharichthys sordidus (Pacific sandab)

Glyptocephalus zachirus (Rex sole)

Hydrolagus colliei (Rat fish)

Lyopsetta exilis (Slender sole)

Lyconema barbatum (Bearded eelpout)

Merluccius productus (Pacific hake)

Microstomus pacificus (Dover sole)

Parophrys vetulus (English sole)

Raja kincaidii (Sandpaper skate)

Sebastes diploproa (Splitnose rockfish)

S. jordani (Shortbelly rockfish)

S. saxicola (Stripetail rockfish)

Xeneretmus latifons (Blackedge poacher)

Zaniolepis frenata (Shortspine combfish)

Table 3.3

Number and Percentage of Five Dominant
Fish Caught During Trawling
Platform Gail Survey
By Station

TAXA	Paired[1] Trawl A	Paired Trawl B	Paired Trawl C	Total Abundance	Percentage
Citharichthys sordidus (Pacific sanddab)	186	167	111	464	38.4
Sebastes saxicola (Stripetail rockfish)	111	105	55	271	22.4
Microstomus pacificus (Dover sole)	38	30	121	189	15.6
Parophrys vetulus (English sole)	36	60	46	142	11.7
Lyopsetta exilis (Slender sole)	27	26	21	74	6.1
Totals	413	405	391	1209	94.3

[1] Two trawls were run consecutively at each station. Numbers are combined catch for both trawls.

The macroepifaunal components of the site can be characterized by the demersal fish species of C. sordidus, Sebastes saxicola, Microstomous pacificus, Parophrys vetulus and Lyopsetta exilis. Collection percentages for these species are shown in Table 3.3. Invertebrate species are dominated by A. fraglis but the heart urchin (Brisaster latifrons) and the prawn (Pandalus jordani) were also observed as common to the area. The results of the site-specific survey are similar to those reported by the Southern California Coastal Water Research Project (SCCWRP, 1973). C. sordidus was ranked 2nd in abundance in the above survey whereas it was number 1 in abundance in the site-specific survey for Platform Gail. Three of the five dominant fish species from the Platform Gail survey appeared among the 10 dominant fish species in the SCCWRP study. The differences are due primarily to the fact that the SCCWRP study was conducted predominantly in shallower water. Both studies were conducted over soft bottom benthos, and as expected, demersal fish species were the predominant species captured.

During the survey approximately 24 pictures were taken at 8 stations (Appendix C). Sediment type observed in the photographs show predominantly silty sand substrate with abundant shell debris. Biodisturbance is apparent in several photographs due in part to the trails left by heart urchins.

The predominant species observed in the photographs (Appendix C) was the urchin (Allocentrotus fragilis). Other species identified include the sanddab (Citharichthys sp), The starfish (Astropecten sp.), the heart urchin (Brisaster latifrons), and the sea pen (Acanthoptilum sp.). In addition 2 species of fish were observed at Station 7 which may include the poacher (cf. Xeneretmus latifrons) and the eelpout (cf. Aproden cortezianus).

3.3.2 Benthic Infauna

Infaunal samples were collected at the eight stations shown on Plate 1. Three replicates were taken at each station and sieved through 1.0 mm screens. The infauna collected at these stations in the Santa Barbara Channel represent infauna of the mainland shelf slope communities. (Fauchald and Jones, 1978, 1979).

A total of 151 taxa were identified, represented by 2,381 individuals from the 24 grab samples. The term taxa is used here instead of species because not all organisms can be identified to the species level. This is

primarily due to immature or damaged specimens. This is shown in Appendix A as a genus or species name being preceded by a question mark. A summary of infaunal compositions and diversity as well as abundance are shown in Tables 3.4, 3.5, 3.6 and 3.7. The lists of infauna taxa by station are presented in Appendix A.

The characteristic infauna in the vicinity of the platform site (Stations 1 to 4) includes the polychaetes, Spiophanes berkeleyorum and Decamastus gracilis, the echinoderm, Amphiodia urtica, the mollusk, Huxleyia munita and the amphipod, Rhepoxynius daboius. The characteristic infauna of stations 5 through 8 (approximately 1000 meters from platform site) are very similar with several additional species becoming common. These species include the polychate Prionspio steenstrupi and the ostracod Euphilomedes producta. The reason for these species increasing in abundance at Stations 5 through 8 is not clearly understood, although E. producta appears to favor the finer grain sizes of Stations 7 and 8. All species collected are representative of soft bottom habitat.

In addition to these species, a potential new species was recorded at Station 8. This species (Petalosarsia sp. A) is a cumacean which has not been recorded from the eastern Pacific coast. The genus Petalosarsia is common to the western Pacific. Petalosarcia is probably a member of the epibenthic fauna similar to mysids. This cumacean feeds on available forage such as detritus, phytoplankton or other algaes. Their importance ecologically is as a minor member of the food chain (i.e. they eat smaller individuals or materials, and are eaten by larger organisms). The presence or absence of this cumacean is not expected to directly affect the benthic community.

Table 3.4 gives the total number of taxa and individuals and the percentage of the total by major taxonomic group. Polychaetes (Annelids) were the most diverse (46.4% of sampled taxa) and most abundant (39.7% of the total sampled individuals) taxonomic group of organisms sampled. Crustaceans (Arthropoda) were diverse (29.8% of the taxa) but their abundance was low (16.8%). This was in sharp contrast to the Echinoderms which represented only 4.6% of the taxa sampled but contained over 35% of the individuals taken. This was primarily due to the presence of the brittle star Amphiodia urtica which was the most abundant single species (taxa) collected. A. urtica represented 19.4% of the total number of individuals collected.

TABLE 3.4

Total Number of Infauna Taxa and Individuals
for Twenty-four Smith-MacIntyre 0.1 m^2
Grab Samples Using a 0.1 mm Screen
(By Major Taxonomic Group)

	Total Taxa/24 grab samples	%/total	Total Abundance/24 Grab Samples	%/total
Annelida	70	46.4	945	39.7
Arthropoda	45	29.8	400	16.8
Mollusca	20	13.2	169	7.1
Echinodermata	7	4.6	835	35.1
Other Taxa	9	6.0	32	1.3
Total	151	100.0	2381	100.00

TABLE 3.5

Average Diversity (No. of Taxa/sample) and Abundance (No of Individuals/sample) By Station for Three Replicate Samples

Station Number	Depth (In feet MLLW)	Average Diversity (Number of taxa/sample)	Average Abundance (Number of individuals/sample)
1	739	28.7	62.3
2	739	26.0	75.7
3	742	27.3	74.3
4	734	35.7	126.0
5	740	27.7	84.0
6	764	24.3	37.3
7	737	28.0	103.3
8	675	51.7	219.0

Table 3.6
Ten Most Abundant Infaunal Taxa Sampled[1]
and Their Average and Greatest Densities /m²

Taxa	Total Individual Collected (24 replicate samples)	Ave. No. Individual/m²	Computed Greatest Density at 1 Station Ind./m² (Station)
Amphoidia urtica (ophiuroid)	462	192.5	300.0 (8)
Spiophanes berkeleyorum (polychaete)	174	72.5	243.3 (8)
Decamastus gracilis (polychaete)	112	46.7	116.7 (8)
Euphilomedes producta (ostracod)	107	44.6	220.0 (8)
Prionospio steenstrupi (polychaete)	73	30.4	53.3 (8)
Huxleyia munita (bivalve)	73	30.4	76.7 (5)
Rhepoxynius daboius (amphipod)	70	29.2	63.3 (4)
Rhepoxynius bicuspidatus (amphipod)	58	24.2	60.0 (8)
Tellina carpenteri (bivalve)	52	21.7	40.0 (7)
Lanassa gracilis (polychaete)	43	17.9	56.7 (8)

[1]All samples were taken with 0.1m² Smith MacIntyre Grab Sampler.

Table 3.7
Average Taxa and Abundance Per Liter
by Station

Station	Taxa/liter	Abundance Individual/liter
1	14.3	31.2
2	10.4	30.3
3	11.7	31.9
4	10.2	36.0
5	8.3	25.2
6	10.4	16.0
7	7.6	28.2
8	11.9	50.5

Molluscs were represented by 13.2 percent of the total taxa and 7.1 percent of the total individuals.

The 10 most abundant infaunal taxa sampled at all stations are shown on Table 3.6. Additionally, Table 3.6 shows the average density for these taxa per square meter as well as the computed greatest density sampled at a single station. Station 8 recorded the greatest densities for 7 of the 10 most abundant infaunal species.

Table 3.7 shows the average diversity (number of taxa per replicate) and average number of individuals per replicate at each station. Stations 1 through 7 are very similar whereas Station 8 shows a marked increase. Table 3.8 shows the average number of taxa and individuals per liter of collected benthos. Station 8 is seen to be similar in taxa per liter but still shows a greater abundance. This is in sharp contrast to Station 6 which has a much lower abundance. This might be explained by the sediment characteristics at each station where Station 8 with its finer sediment is more suitable for infauna habitat. Sediment characteristics are discussed in Section 3.3.3.

Table 3.8 shows the estimated wet weight of biomass per liter for the major taxonomic groups at each station. Total biomass/liter ranged from 1.12 grams to 3.36 grams without a discernable pattern due to depth or station orientation. At each station the dominant biomass contributor was the Echinoderms led by the brittle star A. urtica. Echinoderms contributed 89.9 percent of the total biomass. This is in sharp contrast to the polychaetes (Annelids) which were the most diverse and abundant major taxonomic group, but contributed only 3.4 percent of the total biomass. Mollusks contributed 4.2 percent while the Crustaceans only contributed 1.1 percent. The remaining percentage (1.4%) was contributed by other taxa. Only one species was taken that remains undescribed (Petalosarsia sp. A) that is not due to immaturity or damage. Final identification is pending on this cumacean pending arrival at MEC of pertinent descriptive taxonomic materials.

Fauchald and Jones (1978, 1979) reported on the infaunal communities of southern California and represent the only data available for benthic fauna of similar depths near the project site. Two high density sampling areas (HDSA), Pt. Dume and Coal Oil Point are the nearest of all the HDSA's to the Chevron survey area (Fauchald and Jones, 1978). Six additional stations were sampled in the vicinity of the Chevron site but primarily at much shallower

Table 3.8
Estimated Wet Weight Biomass Per Liter for Major
Taxonomic Groups for Each Station
(Wet Weight in Grams/Liter)

Station	Polychaetes	Mollusks	Crustaceans	Echinoderms	Others	Total
1.	0.07	0.05	0.02	3.21	<.01	3.36
2.	0.05	0.04	0.02	1.01	<.01	1.12
3.	0.13	0.10	0.02	1.75	<.01	1.99
4.	0.03	0.10	0.02	1.90	0.21	2.26
5.	0.05	0.09	0.02	1.45	<.01	1.61
6.	0.04	0.15	0.02	0.94	0.01	1.16
7.	0.04	0.04	0.02	2.23	<.01	2.32
8.	0.10	0.06	0.02	1.00	<.01	1.18

depths (Fauchald and Jones, 1979). The findings of these studies show A. urtica (the dominant individual species in the Chevron survey) to be dominant in silty sandy areas generally much shallower than Chevron's survey area. Dominant fauna at similiar depths was difficult to characterize because of so few stations. However, polychaetes formed an important faunal componant at all depths.

Crustaceans were numerically prominant especially in deep water (288m, 945 ft) where they comprised over half the number of specimens and more than 40% of the species (Fauchald and Jones, 1979). Echinoderms, mollusks and other minor phyla were less important faunal components at the deepwater stations.

Sediment parameters sampled in the western Santa Barbara Channel at similar depths are generally finer and therefore the infauna associated were dissimilar to those sampled during the Platform Gail survey (Dames & Moore, 1983, Neklon, Inc., 1983, and Engineering Science, 1984). Table 3.6 shows the 10 most abundant infaunal species collected during the Platform Gail Survey. Of the 10 species, only 4 were representative of areas in the Point Arguello Field. The species similar to both areas were the ophiuroid Amphiodia urtica, the polychaete Spiophanes berkleyorum, the bivalve Tellina carpenteri, and the ostracod Euphilomedes producta.

3.3.3 Sediment Chemistry

A subsample from each replicate at all eight stations was removed for grain size determination. Average grain size parameters are shown in Table 3.9. The sediment grain size does not follow the usual pattern of increasing mean diameter with decreasing depth. Station 8 (shallowest station) has the smallest mean particle diameter. The increase in silt content of Station 8 probably allows greater population density. At all stations, the benthos was represented by silty sand substrate.

In addition to the grain size, subsamples were removed from one replicate at each station for determination of total organic carbon (TOC). The recorded parameters are given in Table 3.9. Sediment TOC remained constant at Stations 1 through 7 but were observed to be greater at Station 8. TOC measures the gross concentration of organics present in the surficial sediments present at the site, but give no indication of the composition of those

organics. TOC measurements can be used as indicators of the amounts of food energy available to detritus feeders. Additionally TOC can usually be used to correlate biological oxygen demand (BOD) or chemical oxygen demand (COD). The higher the value of TOC correlates to a higher value of BOD or COD.

Subsamples were also removed from one replicate at each station for determination of oil and grease concentrations. These concentrations are shown in Table 3.9. Oil and grease measurements were similar at all stations. Oil and grease measurement offer a baseline observation of contamination of the sediment prior to the installation of the proposed platform. Oil and grease measurements after installation can show any changes due to platform development and production.

3.4.4 Water Quality

At each station, water quality parameters were taken for surface and bottom conditions. Parameters measured included temperature, dissolved oxygen, pH and salinity. Surface and bottom temperatures remained constant at 15.5°C (59.9°F) and 8.9°C (48.0°F), respectively. All measurements were taken during the day between 1200 and 1500 hours. Dissolved oxygen values at the bottom ranged from 4.0 to 4.8 milligrams per liter, and 7.9 to 8.2 milligrams per liter at the surface. The values recorded for pH ranged between 7.75 and 7.90 without a discernable pattern between surface and bottom conditions. Salinity remained constant at all stations with measurements of 33.1 parts per thousand at the surface and 33.5 parts per thousand near the bottom. No anomalous observations were made for any water quality parameters on this survey.

Table 3.9

Sediment Chemistry Parameters
By Station and Depth

Station/Depth	TOC[1]	Oil & Grease (mg/l)	Median Grain Size (ϕ)[2]
1/739 ft	0.14	0.20	2.577
2/739 ft	0.14	0.39	2.521
3/742 ft	0.14	0.20	2.472
4/734 ft	0.17	0.19	2.609
5/740 ft	0.10	0.19	2.297
6/764 ft	0.17	0.21	2.398
7/737 ft	0.16	0.18	2.782
8/675 ft	0.31	0.38	3.370

1. TOC = Total organic carbon shown as % Carbon (dry weight)

2. ϕ = Phi sizes (1.0 to 4.0 = sand, diameter = 500 to 62.5 microns; 5.0 to 8.0 = silt, diameter = 31.25 to 3.9 microns; >8.0 = clay)

4.0 POTENTIAL IMPACTS AND CONCLUSIONS

4.1 PLATFORM SITE

The purpose of the site-specific survey was to identify species characteristic of the project area and to determine potential impacts that would result due to platform installation, development and production at the project site. Impacts to the benthic biota could result during the construction, drilling and operation phases of the platform and during catastrophic events (i.e. oil spills).

4.1.1 Construction Related Impacts

During the installation (construction) phase of Platform Gail, potential impacts on the marine environment will result from physical placement of the platform's jacket legs on the seafloor. Non-motile epifaunal and infaunal organisms at impact points will be lost. No hard-bottomed areas are located within 1,000 m (3,280 ft) of the platform site. Barges are used during actual installation of the platform and their anchor mooring points would disturb or eliminate epifaunal and infaunal organisms similar to these mentioned above at any point of contact. The loss of habitat due to the platform legs will be mitigated by the presence of the platform and will furnish significantly more surface area for habitation in the form of the hard substrate contributed by the platform legs.

4.1.2 Drilling and Operation Related Impacts

During drilling activities a variety of wastes are generated including drill cuttings and used drilling muds. Ocean discharge of drilling fluids is intermittent. Drill cuttings may bury epifauna or infauna which are incapable of burrowing rapidly enough through the cuttings mound to escape being smothered or trapped. Grain size redistribution due to presence of drill cuttings and muds may change infaunal and epifaunal species composition (Wolfson, 1979). Cuttings settle by gravity to the ocean bottom and are distributed by subsurface current movements according to their settling rates which are dependent upon particle size and density. The vast majority of cuttings discharged into the water column settle near the discharge point (NRC, 1983).

Drilling muds discharged into marine waters pose different problems. There are two major concerns about the discharge of drilling muds into the marine environment. They are: (1) possible biological effects induced by chemical contamination of the water column and sediments (whole mud toxicity), and (2) possible bioaccumulation of heavy metals in the tissues of marine invertebrates. Other concerns of less significance from the discharge of drilling muds are the physical act of burial of marine organisms and the disruption of feeding and breathing mechanics. Chronic effects of drilling mud components are difficult to determine and long-term sublethal effects on organisms from continued exposure is still being researched. The National Research Council (NRC) found that most of the drilling muds used in the federal OCS "have low acute and chronic toxicity to marine organisms" (NRC, 1983).

Simulation of mud disposal was carried out by Chevron (1984) using a variety of oceanographic conditions including temperature/density, current speed and direction. The results of the simulation indicate that the soluble fraction of the mud is diluted to 1000:1 in 2.9-4.2 minutes at a distance of 82 to 91 feet (24.6-27.3 m) from the discharge point. The solid phase had slightly different dispersion characteristics than the soluble phase since it dispersed both horizontally via currents and vertically due the particulate weight. Under the six simulated conditions the solid phase component reached 1000:1 dilution in 3.6-13.4 minutes at a distance of 73-138 feet (22-42 m). Based upon these plume simulation results, dispersion of the plume to 1000:1 is expected to occur within 150 feet (45 m) of the discharge point.

Presently, it can generally be concluded that drilling muds discharged into the ocean will create localized impacts, primarily on the phytoplankton in the water column, due to increased turbidity. Rapid dilution of the low toxicity fractions of drilling muds will significantly reduce any potential impact with the benthic environment. Current regimes in combination with the deep water (739 feet) at the platform are expected to dilute the muds sufficiently to minimize environmental damage.

Other drilling and operational discharges that may affect the site biota include completion fluids, sanitary and domestic effluents, produced water, seawater distillation brine, washwaters from deck, engine and pump rooms, and

cement slurrys. These discharges are discussed in Chevron (1984) Environmental Report for Platform Gail and Subsea Pipelines.

4.1.3 Catastrophic Events

The only catastrophic event that would impact biota from the project area would be a large-scale oil spill. The effect of oil on marine organisms has been the subject of numerous publications and generally the most direct measurable impacts of the majority of oil spills have been on populations of marine birds (particularly pelagic birds), shallow water benthic organisms, and some marine mammals.

In the event of a catastrophic oil spill, birds and some marine mammals may come into contact with the oil either on the water surface or along the shoreline. The numbers of individuals and species affected will depend on their behavioral patterns and natural history as well as the volume of the spill, weather conditions, and predominant direction of spill.

The marine birds most seriously affected by oil spills are the pelagic birds who spend the majority of their time in the water both for feeding and resting. These birds have a tendency to lose buoyancy and natural insulation when they become contaminated with oil.

Information concerning marine mammals and the effect of oil spills is sparse. Contact with floating oil can foul the fur of pinnipeds and ingestion of oil by both cetaceans and pinnipeds can affect these animals internally.

4.2 RARE, ENDANGERED OR UNUSUAL SPECIES

Habitats were not unique in the project area, nor were the fauna unique or unusual. No Vema or Allopora were observed. No rare, threatened or endangered species were collected during the survey. The gray whale and the California brown pelican, both listed as endangered, were observed in the project area.

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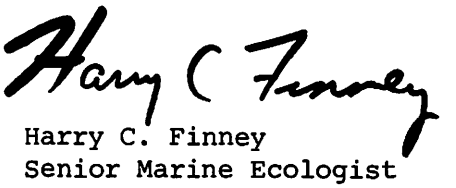
6.0 SIGNATURE

This report was prepared under the direction of the undersigned who was also Chief Scientist in charge of the field survey. Section 2.2 lists the survey personnel and their assignments.

McCLELLAND ENGINEERS, INC.



Harry C. Finney
Senior Marine Ecologist

APPENDIX A

Infaunal Species Lists
By Station

Chevron Gail Station 1

	Rep. 1	Rep. 3	Rep. 4
NEMERTEA			
Nemertean juvs. unid.	2		1
ANNELIDA			
Polychaeta			
Ampharetidae, juv.		2	
Anobothrus gracilis		1	
Aricidea? pseudoarticulata	1		
Aricidea wassi			1
Chaetozone armata			1
Chaetozone setosa		1	
Decamastus gracilis	2	1	
Glycinde armigera	1		
Lanassa gracilis	2		2
Maldane sarsi	1		1
Maldanidae, unid. juv.	1	1	4
Marphysa sp. juv.			1
Mediomastus ambiseta	1		
Mediomastus californiensis			2
Mediomastus sp. ant. frag.	1		2
Mooreonuphis? litoralis		1	1
Nephtys ferruginea	2	1	2
Notomastus sp.		1	
Onuphidae, juv.	1		1
Ophelina acuminata	1		
Pectinaria californiensis	1		1
Pholoe glabra	1		
Phylo felix			1
Polycirrus sp.			1
Praxillella affinis pacifica			1
Prionospio steenstrupi	1		1
Scoloplos armiger		1	
Spiophanes berkeleyorum	14	5	7
Spiophanes kroeyeri			1
Spiophanes missionensis		1	
Terebellides "stroemii"			2
Tharyx spp.	1		
MOLLUSCA			
Bivalvia			
Axinopsida serricata	1		
Cuspidaria parapodema	1		1
Huxleyia munita	shell only	1	
Tellina carpenteri		1	1
Gastropoda			
Amygdalum pallidulum	1		
ARTHROPODA			
Amphipoda			
Ampelisca hancocki		1	
Hippomedon columbianus	1	1	
Rhepoxynius bicuspidatus	2	2	4
Rhepoxynius daboius		2	4
Cumacea			
Eudorellopsis longirostris			1
Isopoda			
Pleurongonium cf. rubicundum	1		

Silophasma geminatum	1		1
Tanaidacea			
Leptochelia sp. A			2
Leptognathia sp. B			2
Tanaidae sp. C			1
ECHINODERMATA			
Echinoidea			
Brissopsis pacifica		1	1
Spatangus californicus		2	1
Ophiuroidea			
Amphiodia urtica	1	10	23
Amphiodia spp. juv.	2	8	8
Ophiuroidea juv.	1	6	4
CHORDATA		1	
Pisces			
Engraulis mordax			1

Chevron Gail Station 2

	Rep. 1	Rep. 2	Rep. 3
NEMERTEA			
Lineus bilineatus	1		
Nemertean juvs. unid.	2		1
ANNELIDA			
Polychaeta			
Anobothrus gracilis			1
Decamastus gracilis	2		7
Lanassa gracilis	4	1	6
Laonice cirrata			1
Magelona berkeleyi	1		3
Maldanidae, juv.	3	1	
Maldanidae, unid. frag.	1		
Mediomastus californiensis			1
Mediomastus sp. ant. frag.	2		1
Mooreonuphis? litoralis	1	2	
Nephtys ferruginea			1
Notomastus sp.			2
Onuphidae, juv.	1		2
Paraprionospio pinnata			1
Pectinaria californiensis		1	
Pista sp. B	1	1	
Praxillella affinis pacifica	1		
Prionospio steenstrupi	4		4
Scoloplos armiger	1		4
Scoloplos sp.		1	
Spiophanes berkeleyorum	7	3	7
Spiophanes kroeyeri	1		1
Terebellides "stroemii"			1
Thalenessa spinosa		F	
MOLLUSCA			
Bivalvia			
Tellina carpenteri	3	2	4
Huxleyia munita	4	2	7
Parvilucina tenuisculpta	1		
Cardiomya cf. californica juv.	1		
Gastropoda			
Eulima sp. juv.	1		
ARTHROPODA			
Amphipoda			
Ampelisca brevisimulata			1
Foxiphalus obtusidens frag.	1		
Hippomedon columbianus			4
Photis lacia		1	1
Rhepoxynius bicuspidatus	1	2	2
Rhepoxynius daboius	4	1	5
Rhepoxynius stenodes damaged	1		1
Isopoda			
Gnathia crenulatifrons		1	
Ostracoda			
Euphilomedes producta		1	1
Tanaidacea			
Leptochelia sp. A	1		1
Leptognathia sp. B			1
ECHINODERMATA			

Echinoidea			
Brissopsis pacifica	1		1
Ophiuroidea			
Amphiodia urtica	19	4	26
Amphiodia spp. juv.	6		7
Ophiuroidea juv.	6	2	12

Chevron Gail Station 3

	Rep. 1	Rep. 2	Rep. 3
NEMERTEA			
Lineus bilineatus			1
Nemertean juvs. unid.			1
NEMATODA			
Nematode unid.	1		
SIPUNCULA			
Golfingia sp. frags.	2		
ANNELIDA			
Polychaeta			
Acesta catherinae		2	1
Amage anops			1
Arabellidae		F	
Capitella capitata			1
Chaetozone setosa			1
Decamastus gracilis	4	4	3
Glycinde armigera		2	
Magelona berkeleyi	1	1	
Marphysa sp. juv.	1		
Mediomastus californiensis	1	1	
Mediomastus sp. ant. frag.		5	
Melinna sp. juv.			1
Nephtys ferruginea			2
Nephtys sp. juv.	1		
Notomastus sp.	2	2	
Ophelina acuminata	1		
Paraprionospio pinnata			1
Pectinaria californiensis		1	1
Pholoe glabra		1	
Phylo felix	1		
Pista sp. B	1	1	
Praxillella affinis pacifica	1	1	
Prionospio steenstrupi	1	1	2
Scolelepis sp. ant. frag.	1		
Scoloplos armiger	1	1	1
Scoloplos sp.		1	
Spiophanes berkeleyorum	2	2	1
Spiophanes kroeyeri		2	1
Terebellides "stroemii"			1
Thalenessa spinosa	1		
Tharyx spp.			1
MOLLUSCA			
Bivalvia			
Tellina carpenteri	1	2	2
Huxleyia munita	6	5	2
Parvilucina teniusculpta	1		
Gastropoda			
? Bulla sp.			1
ARTHROPODA			
Amphipoda			
Hippomedon columbianus	1		
Orchomene decipiens		1	
Photis lacia		1	
Rhepoxynius bicuspidatus	4	1	1
Rhepoxynius daboius	5	3	2

Isopoda			
Gnathia crenulatifrons			3
Decapoda			
Crab megalops	1		
Ostracoda			
Euphilomedes producta		1	
Tanaidacea			
Leptognathia sp. B	1		
ECHINODERMATA			
Echinoidea			
Brissopsis pacifica	1	2	
Ophiuroidea			
Amphiodia urtica	23	19	25
Amphiodia spp. juv.	1	5	3
Ophiuroidea juv.	9	6	12

Chevron Gail Station 4

	Rep. 1	Rep. 2	Rep. 3
NEMERTEA			
Nemertean juvs. unid.	5	2	
NEMATODA			
Nematode unid.			1
ECHIURA			
Nellobia sp.		1	
ANNELIDA			
Polychaeta			
Acesta catherinae	2	1	1
Acesta sp. B	3		
Amaeana occidentalis		2	
Chaetozone setosa	3	1	
Chone albocincta		1	
Decamastus gracilis	13	4	3
Goniadidae		F	
Lanassa gracilis	1	5	
? Lysippe sp.		1	
Magelona berkeleyi	1	6	3
Maldanidae, unid.		1	
Mediomastus ambiseta	2		1
Mediomastus sp. ant. frag.	10	1	1
Notomastus sp.	1	1	
Onuphis geophiliformis			2
Onuphidae, juv.			2
Paraonidae, unid.	1		
Paraprionospio pinnata	1		
Pectinaria californiensis	1	1	
Pholoe glabra	1		1
Pista sp.	1		
Praxillella affinis pacifica	1	2	1
Prionospio cirrifera	2		
Prionospio steenstrupi	2	2	2
Rhodine bitorquata		1	
Scoloplos armiger	3	1	
Spiochaetopterus costarum	1		
Spiophanes berkeleyorum	14	6	4
Spiophanes missionensis	1		
Streblosoma crassibranchia		1	
Tharyx spp.	1		1
MOLLUSCA			
Bivalvia			
Cuspidaria parapodema	1		
Huxleyia munita	4	10	3
Paravilucina tenuisculpta		1	1
Tellina carpenteri	2	5	2
Gastropoda			
Acteocina df. inculta juv.	1		
Aceteocina sp. juv.		1	
Cylichna diegensis	1		
Solariella sp. A		1	
Volvulella cylindrica	4	1	
Scaphapoda			
Dentalium cf. vallicolens			1
ARTHROPODA			

Amphipoda			
Ampelisca brevisimulata			1
Ampelisca careyi	1		
Anonyx carinatus		1	
Listriella diffusa		1	
Photis lacia		1	1
Rhepoxynius bicuspidatus	1	4	3
Rhepoxynius daboius	7	7	5
Decapoda			
Pinnixa occidentalis		1	
Crab megalops unid.		1	
Crab zoea unid.	1		
Isopoda			
Silophasma geminatum	1		1
Ostracoda			
Euphilomedes producta		4	3
Tanaidacea			
Leptochelia sp. A	5		
Leptognathia sp. A	1	2	
ECHINODERMATA			
Echinoidea			
Brissopsis pacifica		2	1
Spatangus californicus		1	
Ophiuroidea			
Amphiodia urtica	27	22	25
Amphiodia spp. juv.	12	8	11
Ophiuroidea juv.	15	15	11
Dougaloplus amphiacantha		1	

Chevron Gail Station 5

	Rep. 1	Rep. 2	Rep. 3
NEMERTEA			
Nemertean juvs. unid.		1	
ANNELIDA			
Polychaeta			
Acesta catherinae		1	
Aphrodita sp. juv.			1
Aricidea wassi		1	
Artacamella hancocki		1	
Decamastus gracilis	4	4	4
Glycera capitata	1	3	
Glycera oxycephala		1	
Glycera armigera	1		
Glycera sp. unid.			1
Lanassa gracilis		1	1
Laonice cirrata		1	
Magelona berkeleyi		3	5
Mediomastus sp. ant. frag.	1	1	
Melinna oculata			1
Mooreonuphis? litoralis	5	4	3
Nephtys ferruginea	1		1
Notomastus sp.	3		
Onuphidae, juv.		1	1
Ophelina acuminata			1
Polycirrus sp.	1	1	
Polynoidae	1		
Praxillella affinis pacifica	1	2	
Prionospio steenstrupi	4	8	3
Scoloplos armiger	1	2	2
Spiophanes berkeleyorum	3	7	3
Spiophanes kroeyeri		1	
Terebellidae	F		
Terebellides "stroemii"			1
Tharyx spp.		1	
MOLLUSCA			
Bivalvia			
Cuspidaria parapodema		1	
Huxleyia munita	3	13	7
Tellina carpenteri		1	3
Scaphapoda			
Dentalium cf. vallicolens			1
ARTHROPODA			
Amphipoda			
Ampelisca agassizi		1	
Ampelisca careyi		1	
Foxiphalus obtusidens			1
Photis lacia			1
Rhepoxynius bicuspidatus	1	1	1
Rhepoxynius daboius		3	1
Isopoda			
Gnathia crenulatifrons			1
Silophasma geminatum		1	
Tanaidacea			
Leptochelia sp. A	1	10	2
Leptognathia sp. A	1	2	

Leptognathia sp. B			2
ECHINODERMATA			
Echinoidea			
Brisaster latifrons	2		
Brissopsis pacifica	1	1	frag.
Ophiuroidea			
Amphiodia urtica	9	24	11
Amphiodia spp. juv.	2	9	8
Ophiuroidea juv.	4	15	6

Chevron Gail Station 6

	Rep. 1	Rep. 2	Rep. 3
NEMERTEA			
Micurura sp.			1
Nemertean juvs. unid.	1		
SIPUNCULA			
Golfingia sp. frag.			1
ANNELIDA			
Polychaeta			
Acesta catherinae			1
Acesta sp. B	1		
Ampharetidae, juv.		1	
Decamastus gracilis	1	1	3
Goniadidae			F
Lanassa gracilis	2		1
Magelona berkeleyi		1	2
Maldanidae, unid. juv.	1	F	
Mediomastus ambiseta	2		
Mediomastus sp.	1		
Mooreonuphis? litoralis		1	2
Nephtys ferruginea	1	1	
Nephtys sp. juv.	1		
Pholoe glabra		1	
Pista sp. B		1	
Polycirrus sp.	1		1
Prionospio steenstrupi	3	2	3
Scoloplos armiger			2
Spiophanes berkeleyorum	2	1	1
Spiophanes kroeyeri			2
Tauberia, nr. brevibranchiata	1		
Tharyx spp.	1		1
MOLLUSCA			
Bivalvia			
Huxleyia munita		3	2
Parvilucina tenuisculpta		1	4
Tellina carpenteri	2	1	
Gastropoda			
Cylichna diagensis		1	
Scaphapoda			
Dentalium sp. A		1	
Eulima sp. juv.			1
ARTHROPODA			
Amphipoda			
Ampelisca agassizi			1
Ampelisca brevisimulata			1
Ampelisca careyi		1	
Foxiphalus obtusidens		1	
Heterophoxus oculatus		1	
Hippomedon columbianus		1	
Photis lacia			1
Rhepoxynius bicuspidatus			3
Rhepoxynius daboius	2	1	4
Ostracoda			
Euphilomedes producta	1		
Euphilomedes carcharodonta			1
Tanaidacea			

Leptochelia sp. A	2	1	3
Leptognathia sp. A			1
Leptognathia sp. B		1	
ECHINODERMATA			
Echinoidea			
Brissopsis pacifica			2
Ophiuroidea			
Amphiodia urtica	5	9	19
Amphiodia spp. juv.	2	3	4
Ophiuroidea juv.	2	2	8

Chevron Gail Station 7

	Rep. 1	Rep. 2	Rep. 3
NEMERTEA			
Micrura sp.			1
Nemertean juv. unid.	2		
ANNELIDA			
Polychaeta			
Acesta catherinae	1		
Capitella capitata		1	
Chaetozone setosa		1	1
Cirrophorus ? lyra	1		
Decamastus gracilis	9	4	4
Glycera capitata			1
Magelona berkeleyi	2	4	1
Maldanidae, unid.	1		
Mediomastus ambiseta	1		
Mediomastus californiensis	2		
Melinna oculata	1		
Mooreonuphis? litoralis	1	1	
Nephtys ferruginea		1	
Nephtys sp. juv.		1	
Nereidae, juv.		1	
Odontosyllis phosphorea		1	
Pectinaria californiensis	2	2	
Pholoe glabra	2	1	
Pista sp. B		1	
Praxillella affinis pacifica	1		2
Prionospio cirrifera	1		
Prionospio steenstrupi	5	6	3
Scoloplos armiger		2	
Spiochaetopterus costarum	1		
Spiophanes berkeleyorum	2	9	1
Spiophanes kroeyeri	1		
Spiophanes missionensis		2	
Thalenessa spinosa	1		
Tharyx spp.		1	
MOLLUSCA			
Bivalvia			
Axinopsida serricata			1
Huxleyia munita	1		
Parvilucina tenuisculpta			1
Tellina carpenteri	7	3	2
ARTHROPODA			
Amphipoda			
Ampelisca careyi	2	1	
Foxiphalus obtusidens		1	
Heterophoxus oculatus		1	
Hippomedon columbianus	1	1	
Photis lacia		1	
Rhepoxynius bicuspidatus	4	1	2
Rhepoxynius daboius	6	3	5
Tiron biocellata		1	
Westwoodilla caecula			1
Cumacea			
Eudorella pacifica	1		
Mysidacea			

unid. frag.		1	
Isopoda			
Silophasma geminatum		2	
Ostracoda			
Euphilomedes producta	18	8	4
Tanaidacea			
Leptognathia sp. A			1
Leptognathia sp. B	1		
ECHINODERMATA			
Echinoidea			
Brissopsis pacifica	2		3
Ophiuroidea			
Amphiodia urtica	30	23	18
Amphiodia spp. juv.	5	9	2
Ophiuroidea juv.	23	14	9

Chevron Gail Station 8

	Rep. 1	Rep. 2	Rep. 3
COELENTERATA			
Anthozoa			
Edwardsiidae frag.		+	
Hydrozoa			
Tubularia spp.			+
NEMERTEA			
Nemertean frag.		1	
SIPUNCULA			
Sipunculid juv. frag.	1		
ANNELIDA			
Polychaeta			
Acesta catherinae	1	6	1
Ampharetidae juv.		1	1
Axiothella rubrocincta	1		
Brada villosa			1
Drilonereis falcata	1		
Decamastus gracilis	4	16	15
Eunice americana			1
Exogone lourei	2	1	
Glycera capitata	2	2	3
Lanassa gracilis	1	10	6
Lumbrineris sp. ant. frag.	1	1	
Magelona berkeleyi		2	
Maldane sarsi		2	1
Maldanidae, unid. juv.	2	1	
Maldanidae, unid. ant. frag.		10	4
Mediomastus ambiseta			1
Mediomastus californiensis	1		
Mediomastus sp. ant. frag.	1	2	2
Mooreonuphis? litoralis	4	10	8
Mooreonupis nebulosa	1	1	1
Myriochele heeri	1		
Nephtys ferruginea		3	
Nephtys sp. juv.			2
Nereidae unid.			1
Notomastus sp.	1	1	1
Onuphidae, juv.	3	1	1
Onupis iridescens			1
Panthalis mortenseni	1		
Paraprionospio pinnata	1	1	1
Pectinaria californiensis	7	12	11
Pholoe glabra	3	1	
Pista sp. B	1	3	3
Polynoidae unid.	1		
Praxillella affinis pacifica	1	7	12
Prionospio steenstrupi	2	7	7
Rhodine bitorquata	1		
Scoloplos armiger		1	
Spiophanes berkeleyorum	27	27	19
Spiophanes kroeyeri	3	4	3
Spiophanes missionensis			1
Spiochaetopterus costarum		1	
Sternaspis fossor		1	
Tauberia gracilis		1	

Terebellidae		F	
Terebellides "stromei"		1	
Tharyx spp.	3	11	8
MOLLUSCS			
Tellina carpenteri	4	2	2
Eulima sp. juv.	1		
? Kurtziella sp.	1		
Cylichna diegensis		1	
Parvilucina tenuisculpta		1	2
Epitonium sp. juv.		1	
Pectinidae juv.		1	
Axinopsida serricata			1
Amygdalum pallidulum			1
ARTHROPODA			
Amphipoda			
Ampelisca brevisimulata	1	3	1
Ampelisca careyi	1	2	
Ampelisca furcigera		6	
Ampelisca pacifica		1	
Byblis veleronis	1		
Gammaropsis ociosa			1
Heterophoxus oculatus	1	3	
Hippomedon columbianus			2
Orchomene decipiens		1	
Photis sp. frag.			1
Rhepoxynius bicuspidatus	2	6	10
Stenothoe cf. frecanda			2
Cumacea			
Diastylis a. sp. n		3	2
Eudorella pacifica		5	1
Eudorellopsis longirostris		2	
cf. Petalosarsia sp. A (first record of this genus from our coast)	1		1
Procampylaspis sp. A		1	
Isopoda			
Gnathia crenulatifrons		5	2
Silophasma geminatum	1	6	
Ostracoda			
Bathyleberis californica		1	
Euphilomedes longiseta		4	
Euphilomedes producta	6	42	18
Parasterope barnesi		1	
Rutiderma lomae		2	
Tanaidacea			
Leptochelia sp. A		1	
Leptognathia sp. A		1	1
Leptognathia sp. B		1	1
ECHINODERMATA			
Echinoidea			
Brissopsis pacifica	1	1	1
Spatangus californicus			frag.
Ophiuroidea			
Amphiodia urtica	26	26	38
Amphiodia spp. juv.	4	6	6
Ophiuroidea juv.	14	11	5

APPENDIX B

Trawl Species Lists
By Station

TRAWL COLLECTED EPIFAUNA
PLATFORM GAIL SURVEY

TAXA	TRAWL STATION A Rep 1	A Rep 2	B Rep 1	B Rep 2	C Rep 1	C Rep 2
Phylum COELENTERATA						
Class Anthozoa						
Acanthoptilum sp. frag.		1	2	1	1	
Phylum MOLLUSCA						
Class Cephalopoda						
Octopus sp.	1					
Phylum ECHINODERMATA						
Class Echinoidea						
Allocentrotus fragilis	309	190	161	205	128	117
Brisaster latifrons	48	3	8	3	11	2
Brissopsis pacificus						1
Spatangus californicus		2	6	2		5
Class Asteroidea						
Astropecten ornatissimus	21			5	1	2
A. verrilli	16	1			1	1
Hippasteria spinosa			1			
Petalaster foliolata	2			1		
Phylum ARTHROPODA						
Class Crustacea						
Argis californiensis		1		1		
Cancer anthonyi					2	
Crangon nigromaculata	1					
Lopholithodes foraminatus (California king crab)		1		1		
Pandalus jordani (prawns)	50	46	17		4	5
P. platyceros	2			1		1
Paguristes turgidus			1			
Pleuroncodes planipes (Pelagic crab)	3	6	26	9	7	
Muricea gaudichaudii			1	1		
Class Isopoda						
Lironeca vulgaris (fish lice)		1				

	TRAWL STATION					
	A		B		C	
TAXA	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2
Phylum CHORDATA						
Class Pisces						
Argentina sialis						
(Pacific argentine)					1	
Aprodon cortezianus						
(Bigfin eelpout)	1			9		2
Chilara taylori						
(Spotted cusk-eel)		3	1	11	7	4
Citharichthys sordidus						
(Pacific sandab)	39	147	87	80	52	59
Glyptocephalus zachirus						
(Rex sole)	1	1	1			
Hydrolagus colliei						
(Rat fish)	1	3	3	4	4	3
Lyopsetta exilis						
(Slender sole)	18	9	13	13	16	5
Lyconema barbatum						
(Bearded eelpout)					3	10
Merluccius productus						
(Pacific hake)	2	4	2	2	7	
Microstomus pacificus						
(Dover sole)	10	28	20	10	66	55
Parophrys vetulus						
(English sole)	14	22	29	31	30	16
Raja inornata						
(California skate)					1	
R. kincaidii						
(Sandpaper skate)	2	2	2	2	1	1
Sebastes diploproa						
(Splitnose rockfish)	26		12	26	9	
S. jordani						
(Shortbelly rockfish)	1					
S. saxicola						
(Stripetail rockfish)	63	48	62	43	27	28
Xeneretmus latifons						
(Blackedge poacher)	6	10	4	6	9	
Zalembius rosaceus						
(Pink surfperch)	1					
Zaniolepis frenata						
(Shortspine combfish)	1	4	4	2	5	3