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May 17, 1984
Job No. 05830927

U.S. Minerals Management Service
Pacific OCS Region
1340 Sixth Street
Los Angeles, CA 90017

Attention: Mr. Thomas Dunaway
Regional Supervisor

Gentlemen:

Site-Specific Marine Biological Survey
Union Oil Company of California
Platform Irene Project
Santa Maria Basin, California

Transmitted with this letter are 20 copies of the Final Report referenced above. This report has incorporated your review comments contained in your letter to Mr. R.S. Gillen of Union Oil Company of California dated April 27, 1984. This report was designed to conform to the intent of USGS NTL 78-1 (October 23, 1978) utilizing input and direction from the MMS and other reviewing Federal, State, and local agencies.

Should you have any questions or comments, concerning this report, please do not hesitate to contact us.

Very truly yours,

McCLELLAND ENGINEERS, INC.

Ian C. Macfarlane

Ian C. Macfarlane
Manager of Environmental Services

ICM/jen
Attachment

FINAL REPORT

SITE SPECIFIC MARINE BIOLOGICAL SURVEY

UNION OIL COMPANY OF CALIFORNIA

PLATFORM IRENE PROJECT

SANTA MARIA BASIN, CALIFORNIA

May 1984

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EXECUTIVE SUMMARY

A biological characterization of Union's proposed Platform IRENE site, and its associated pipeline and powercable corridors to shore was undertaken during September 1983. The project is within the Santa Maria Basin area of Pacific OCS Lease Sale 53 and California State Tidelands. The proposed platform site is located on OCS Lease P-0441 where the pipeline and power-cable corridor originates. Approximately 11,000 feet of the more than 50,000 foot corridor occurs on Lease P-0441 while the remainder occurs in State waters.

The biological survey included: reconnaissance of the platform and pipeline areas using a remote operated vehicle (ROV) with attached underwater color and black and white video cameras and a 35 mm color still camera, infaunal grab sampling, water quality and sediment chemistry, otter trawling, current measurements, and underwater observations by marine biologist-divers. In addition, daily observations were made on meteorological conditions and sea state, and surface marine biota including marine mammals, birds and pelagic fish. A Cruise Report detailing events of the survey was submitted to the Minerals Management Service (MMS) on October 12, 1983.

ROV reconnaissance and bottom still photography indicates a relatively featureless seafloor consisting of medium to fine grain sand and sedimentary materials. The grain size gradually increases as the depths decrease toward shore. It is also apparent that the benthic zones in the project area are part of a high energy environment existing in the Santa Maria Basin. This is due in part to high current speeds and strong surge activity propagated by storm waves and long period sea swells. Currents measured near the platform site showed maximum speeds of 0.89 knots (half-hourly average = 0.85 knots) at the bottom and 1.47 knots (half-hourly average = 1.39 knots) at midwater. Sand waves caused by current and surge activity become more apparent as depths decrease toward shore.

Observations indicate that project area epifauna are dominated by the starfish (Petalaster foliolata) and the sea pen (Stylatula elongata) at water depths in excess of 150 feet. Nearshore epifauna are dominated by the sand dollar (Dendraster excentricus) and the starfish (Pisaster brevispinus).

Epifauna, especially demersal fish species, were also sampled at four locations by trawling; one at the proposed platform site, and three along the

pipeline corridor. The specklefin midshipman (Porichthys notatus) and the Pacific sanddab (Citharichthys sordidus) were the predominant biota collected at the three offshore stations at depths of 150 feet, 200 feet and at the platform site (approximately 244 feet). At 100 feet the dominant species collected was the spotfin surfperch (Hyperprosopon anale). The midshipman and sanddab were not sampled at this station.

Infauna was sampled at 17 stations in water depths from 260 to 25 feet. It has been surmised from the data collected that there are three distinct benthic communities. The two communities offshore are dominated by species of polychaete. The nearshore community is fairly depauperate, but the predominant infaunal organisms appear to be the crustaceans followed by species of Ophiuridea (brittle stars).

Although the project area is located on soft bottom benthos, rocky areas were observed along the pipeline corridor in about 30 feet of water. The epifauna of the hard substrate is comprised of a few sponges, ectoprocts, and sparsely situated red algae. The lack of biota is considered to be due to the heavy surge activity and sand movement which causes scouring of the rock surfaces. The rocky outcrop offers habitat and protection to a few individuals of rockfish (Sebastes spp.).

The data collected gave no indication that the proposed project will appreciably impact the biota in the study area. There are no long term significant impacts expected to be associated with the construction of the platform and pipeline. The fin whale, California brown pelican and California least tern, all listed as endangered species, were observed in the project vicinity. One species of nudibranch was collected which may be determined to be a new genus. The genus, hereafter refered to as Corambe, has been collected less than 12 times previously offshore California. It has been collected as far north as Fort Bragg and Palos Verdes in the south. It has been taken in water depths of 200 to over 1000 feet (60 to 340 meters). The presence of this nudibranch is not expected to be reduced by the project development.

The conclusion of this report is that no long term significant impacts should result to the marine benthic environment from the placement of Platform IRENE and its associated pipelines and powercable to shore. In addition

to this report, a Photo Atlas and a set of videotapes including an edited summary of observations have been submitted to MMS. A site specific geo-hazards report and cultural resources report were also submitted to the MMS in connection with this project.

1.0 INTRODUCTION

Union Oil Company of California ("Union") will be the operator of the oil and gas development and production platform proposed on OCS Lease P-0441 for co-lessees; Union Oil Company of California, Gulf Oil Corporation, and Superior Oil Company. Union is in the process of preparing the plans and permits required for construction and operation of the platform and its ancillary offshore pipeline and powercable corridors. The development plan details the installation and operation of a production platform to be designated IRENE with three pipelines and one powercable to shore. The corridor alignment runs northeast to a position near the mouth of the Santa Ynez River, where the three pipelines will be separated from the power cable. The pipeline landfall will be approximately 2000 feet north of the river mouth, while the powercable's landfall will be approximately 2500 feet to the south. Essentially all of the project area is located on sedimentary benthic habitats. However, a few exposed rocky outcrops were observed in the nearshore area.

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 for the proposed platform site and offshore pipeline and powercable corridors. MEI, in conjunction with MMS and other reviewing federal, state, and local agencies, developed the scope of the survey plan, and this plan was delivered to MMS on August 18, 1983.

Following approval of the survey plan, the site-specific marine biological survey was conducted between the dates of September 1, 1983 and September 22, 1983. The specific purpose of the survey was to characterize the benthic habitats in the area of the proposed platform and pipeline corridor. This was accomplished using a remote operated vehicle (ROV) with black and white and color video cameras, and a 35 mm color still camera. Also, biological sampling operations included grab sampling, otter trawling, diver collection and observations, surface observations of weather conditions, and presence of marine mammals and other sea life. In addition to the biological information collected, physical parameters including currents, dissolved

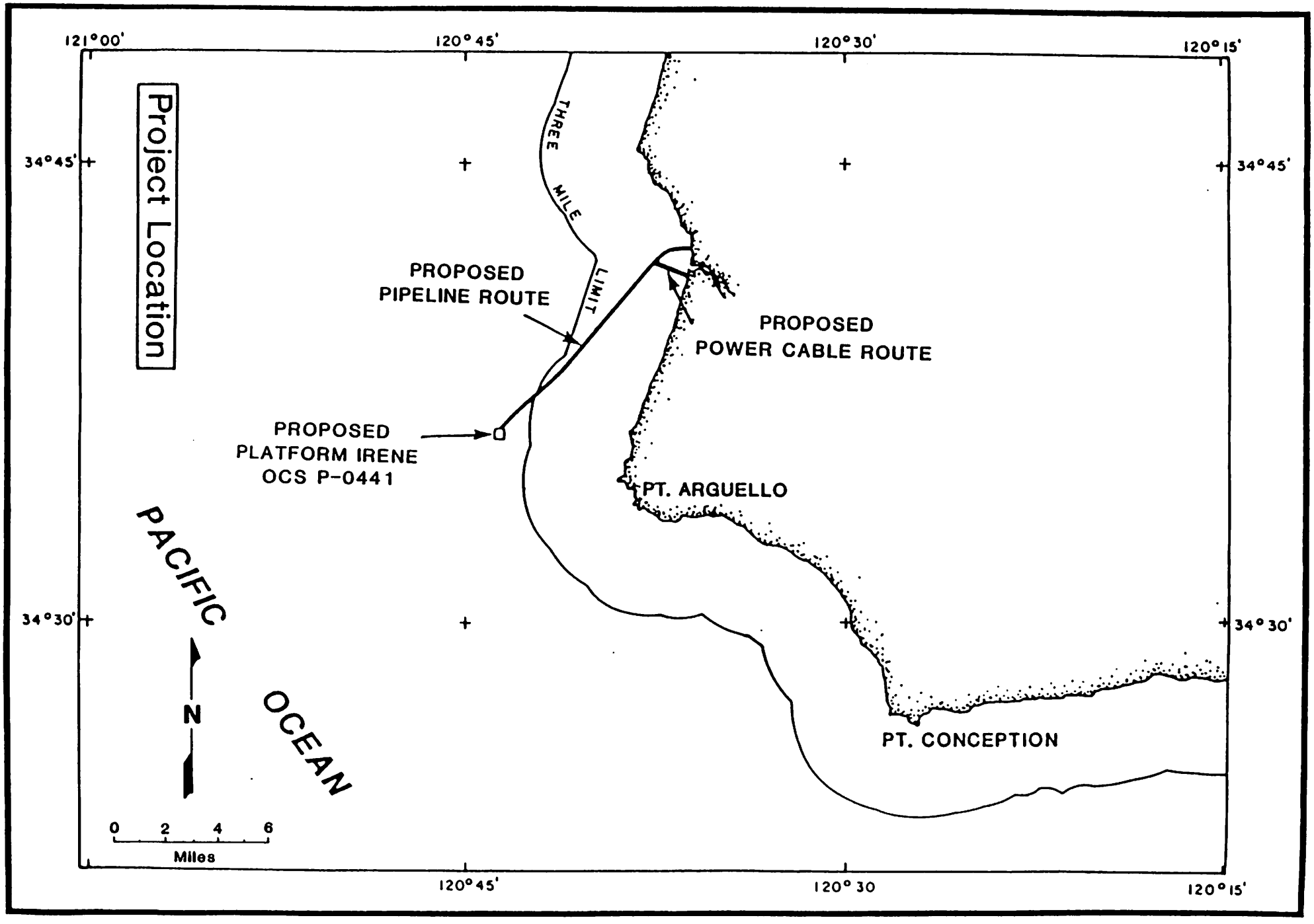
121°00'
120°45'
120°30'
120°15'
34°45'
34°30'
Project Location
THREE MILE LIMIT
PROPOSED PIPELINE ROUTE
PROPOSED POWER CABLE ROUTE
PROPOSED PLATFORM IRENE OCS P-0441
PT. ARGUELLO
PT. CONCEPTION
PACIFIC OCEAN
N
0 2 4 6
Miles

Figure 1.1

oxygen, salinity, temperature and pH were also measured.

The results of the survey are presented in this report as well as related information required by NTL 78-1. The methods section (2.0) contains details of survey equipment and operating procedures. The results and discussion section (3.0) presents the date collected and reports the diversity of infaunal habitats, and the physical parameters measured during the survey. Section 4.0 (Potential Impacts and Conclusions) presents the potential impacts of the proposed project and an overall characterization of the project area.

Supplementary to this report and as specified by NTL 78-1, three additional products have been produced. A complete copy of the videotape reconaissance taken along the pipeline corridor was delivered to MMS along with an edited version. The edited version provides a brief synopsis of the project area as seen by the ROV video cameras. This version has a voiced-over narration which provides an overview of habitat types and principal faunal elements. The third product is a photo atlas. The atlas is a copy of all useable slides produced and in addition, a summarized photographic presentation of general habitat type and common fauna observed during the survey.

2.0 METHODS

2.1 VESSEL AND EQUIPMENT

The support vessel for the site-specific marine biological survey of Union's OCS Lease P-0441 platform site and pipeline and powercable corridors was the R/V Seawatch. The Seawatch is a 65-foot research vessel powered by twin-diesel engines, equipped with an 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.

An area in the galley was set aside for observers to monitor the video output from the remote vehicle. Visual observation notes and the still photo record log were maintained in this area. The vessel had ample deck space, storage space and laboratory space to meet all the requirements of the survey.

Navigation was provided by Navigation Services, Inc. (NSI) utilizing a Motorola Mini-Ranger III supported by three shore stations. The Mini-Ranger III System is capable of noting the position of the survey vessel within ±3 meters (10 feet). During remote operated vehicle (ROV) operations, positioning of the ROV relative to the survey vessel was monitored in shallow water (less than 150 feet) using a buoy attached to the ROV, and in deeper water (greater than 150 feet) by utilizing the acoustic navigation system, Honeywell RS-7.

Video output from the RS-7 system on the bridge allowed the pilot of the survey vessel to maintain a position directly over the ROV. This system measures and displays the position of subsurface vehicles and equipment with an accuracy on values of slant range water depth of one to four percent error (horizontal position) and on an azimuth of less than five degrees.

Subsurface vehicles used in conducting the underwater surveillance were the ROV RASCL, which completed lines 1 through 13 and the ROV Telesub, which completed Lines 14 though 19 (Plate 1).

The survey was begun using the ROV RASCL. The submersible carried two externally mounted 250 watt variable intensity halogen lights which provided sufficient illumination to videotape the biota. The RASCL has four thrusters, two aft, one verticle, and one lateral which gave the vehicle a top speed of two knots. The color video system on the RASCL was provided by an

Aqua Air Color video camera which gave coverage of up to 150 cm of the bottom and resolution of details to 5 cm.

A Photosea 1000 35-mm camera was also mounted on the RASCL at a position directly above the black and white camera used by the ROV pilot for navigation. The Photosea was also utilized during operations with the second ROV, Telesub.

The Telesub the second ROV used on the survey was manufactured by Remote Ocean Systems, Inc., and is capable of diving to 2000 feet with a design maximum speed of 2.3 knots. The survey was generally conducted at speeds less than 1 knot to promote video coverage sufficient for characterization of observed features. Attached to the ROV was a Sub-Sea System CM-8 black and white camera for pilot navigation and a Sub-Sea Systems CM-40 color video camera for biological observations.

Infaunal samples were collected using a $0.1m^2$ Smith-MacIntyre grab sampler. Each sample was transferred to a calibrated container for volume measurement and the removal of subsamples for grain size, total organic carbon (TOC) and oil and grease analysis. The remainder of the sample (minimum total sample size = 3 liters) 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 labled, and infaunal samples preserved in 10 percent formalin buffered with seawater. The samples were then boxed for shipment to a taxonomic lab.

Black and white photographs were taken at all 17 stations using a Benthos 35-mm, mechanically triggered, remote still camera. A distance setting of 6 ft was adjusted on the camera, providing an area of view of about 20 square feet. Due to low visibility, the pictures were not of sufficient quality to characterize the habitats.

Water quality profiles were taken at the 17 grab sample stations (Plate 2) using a Martek Mark VIII water quality analyzer. Physical parameters of temperature, salinity, dissolved oxygen and pH were recorded at surface, mid-depth and bottom positions.

Paired trawls were collected at four stations (Plate 2). 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 from ten-to-twenty minutes

at a speed of approximately two knots was run in all cases. The cable length was four times the water depth.

In addition to the underwater reconnaissance provided by the ROV's, marine biologist-divers made direct observations and notes along transects (Plate 2) from the 80-foot isobathymetric contour to shore. Observations were made in the rocky areas near the pipeline corridor and to the north, as well as to the south along the powercable corridor. The divers also were towed along 3 additional transects and made spot check and collection dives at various locations (Plate 2).

An array of three current meters were deployed near the proposed platform location (Plate 2). These meters were moored at depths of 35 ft (10.6m), 115 ft (35m) and 220 ft (67m), respectively. The near surface meter employed 2 pairs of horizontally opposed electromagnetic sensors, however, this meter (Interocean S-4) failed and no data was recovered. The midwater and bottom current meters (Endeco 174) employ a neutrally bouyant tethered ducted impellor sensor. These meters recorded 11 days of current speed and direction measurements. In addition, temperature and salinity measurements were recorded by the Endeco 174.

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. Jay Shrake	Marine Biologist
Mr. Jon Swidler	Biologist
Mr. Frank Gremse	Oceanographer
Mr. Steve Alcorn	MMS Observer
Mr. Jack Wilson	Navigation

The crew for the RASCL included one pilot/supervisor, one RS-7 operator/ROV pilot, and one tender. The crew for the Telesub also consisted of

three individuals; one pilot/electronic technician, one pilot/tender and an additional tender.

The Seawatch was under the direction of Captain Steve Gregson and crewed by a mate, cook and two deck hands.

Laboratory taxonomic analyses were conducted under the direction of Dr. Doug Diener at Marine Ecological Consultants, Inc. in Solamar Beach, California. (Resumes of the taxonomic experts employed for analyses were included in the detailed survey plan submitted to MMS dated August 18, 1983).

2.3 OPERATIONS

2.3.1 ROV Reconnaissance

Normal ROV reconnaissance operations were conducted during daylight hours to facilitate launch and recovery operations. Generally the survey vessel proceeded to the beginning of an ROV track line where a check of net drift of the surface vessel was made. Drift of the survey vessel was taken into consideration such that the ROV would be in a position to begin video-coverage as it reached the bottom at the beginning of the ROV track line.

The navigator provided a compass bearing to the ROV pilot at the beginning of the track line. The ROV pilot would maintain that heading unless corrected by the navigator. The surface vessel would remain directly over the ROV during operations so that navigation of the ROV and the survey vessel were concurrent. This navigation was managed by employing a buoy attached to the vehicle in shallow water and using the acoustic navigation system in deeper water. At the completion of the track line the ROV would be brought onboard and the survey vessel would proceed to the next track line.

During this procedure, the biologist observers on the survey vessel kept notes on faunal/habitat characteristics, videotaped and took still photographs for documentation. Due to the videotaping and the necessity of taking still photographs, a working speed of less than 1.0 knot was realized.

2.3.2 Infaunal Sampling

Three replicate samples at seventeen stations were taken off the stern of the survey vessel. Preplotted sample stations were occupied during each replicate. Each sample was measured for volume, and a subsample was removed, sieved through 0.5 and 1.0 mm screens, and preserved and stored for subsequant analysis. 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 was removed for sediment chemistry analysis.

2.3.3 Trawling

Preplotted trawl lines were used to navigate during trawling. All trawl runs were along the isobathymetric contours at the station. At the completion of the trawl, the net was brought onboard and cleared of all organisms. The sample was 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. Specimens not identified to the species level were retained for later taxonomic analysis.

2.3.4 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. Additionally, fish observed on the surface were noted.

2.3.5 Diving

Nearshore biological habitats were characterized by marine biologist-divers who made direct observations and notes along preplotted transects in the shallower (<80 ft) portions of the pipeline and powerline corridors. Positions were noted (minirange coordinates) where the divers entered and exited the water. While submerged, the divers swam a compass course provided by the navigator. The dive was given a number which was recorded by the navigator. Observations and biota noted or collected were recorded in the log.

Long diver transects were observed by a diver-biologist towed on a sled at a speed less than 2 knots by the survey vessel from offshore to onshore. The biologist made observations and notes on underwater paper attached to the sled. Notes were transfered to the log at the end of each dive.

Interesting or significant observations (e.g. presence of a hard bottom) were noted by releasing a buoy from the diver at the location and having the

navigator chart the coordinates. Specimens collected were labeled, preserved in formalin buffered with seawater and stored for analysis.

2.4 Data Analysis

Office analysis of the underwater reconnaissance was accomplished in several steps. First, a quick survey of the videotape was made to develop a list of its contents. Secondly, the tapes were rerun to develop a complete species list viewed at the platform and pipeline areas. A third and final preview was done noting interesting or significant features which will be used to adequately characterize the habitats and to provide an edited version of the video tape coverage for review.

Still photographs and slides were inspected for use in identifying previously unrecorded species and for a different perspective of benthic habitats. Inspection revealed many duplications and some nondescript or substandard photographs. These were set aside or discarded. Representative photographs and slides were catalogued and a photo atlas prepared.

In addition to the inspection of video-tapes and photographs, analysis of the trawl and diver collected samples was accomplished, including compilation of taxonomic lists. The level of identification was to the most practicable taxon with species being the target.

Taxonomic analysis was also carried out on infaunal samples. The samples were sorted to phyla, biomass determined, and then identified to the species level where possible. Species diversity was also measured.

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 infarred gas analyzer to measure CO_2 release after oxidation for organic carbon. Determination of oil and grease content was procured by a Soxhlet extraction, followed by gravimetric analysis. The results of these tests were then arranged in a table (Table 3.2) depicting the changes through depth variation.

3.0 RESULTS AND DISCUSSION

A site specific marine biological survey was conducted on Union Lease P-0441 at the location of the proposed Platform IRENE and its associated pipeline and powercable corridors to shore. The results include analyses from approximately 22 hours of ROV-generated videotape, 17 grab sample stations, (including sediment and water quality parameters), 4 stations of paired trawls, and 16 dives by marine biologists. The locations sampled by these methods are shown on Plates 1 and 2.

Twenty days of observations for meteorologic and sea conditions were recorded during this survey. Generally the winds were from the northwest and the swells were from the west-northwest. Wind speeds normally were 5-10 knots. On two days, however, speeds in excess of 25 knots were observed. Swell height was usually 3 feet or less for the survey. The maximum swell height observed during the survey was 6 feet.

3.1 ROV RECONNAISSANCE

The 22 hours of videotape coverage were conducted over 80,000 feet (24.4km) of the benthos in the vicinity of the platform site and along the pipline corridor between water depths of 260 to 128 feet and a nearshore segment north of the pipeline corridor in 40 to 55 feet (Plate 1). The species observed during this survey are shown in Table 3.1. Predominant epifauna were photographed and appear in the Photo Atlas (McClelland 1983) submitted to MMS. In general, the habitats observed can be divided into three types dictated by substrate. In the deep water zone, depths greater than 200 feet, the benthic substrate is biodisturbed with numerous small (less than 6 inches) mounds and holes. Shallower than 200 feet, the benthic substrate is sandier (see Section 3.5) and sand waves become apparent. Hard bottom substrate is observed in nearshore environments in water depths less than 60 feet and makes up the third substrate type.

Predominant epifauna at the platform site and along the pipeline corridor to a water depth of approximately 200 feet (deep water zone) were the starfish Petalaster foliolata and the sea pen Stylatula elongata. These 2 species were common but not abundant in the survey area. Other species

TABLE 3.1
ROV Observed Species
Platform IRENE and Pipeline Route

TAXA

FLORA

PHAEOPHYTA

Egregia menziesii (drift kelp)

Macrocystis sp (drift kelp)

RHODOPHYTA

Acrosorium sp.

Gigartina sp.

Rhodymenia sp.

FAUNA

PORIFERA

cf *Verongia* sp.

CNIDARIA

Acanthoptilum sp.

Actinaria unidentified

Cerianthidae unidentified

Epiactis prolifera

Hydrozoa unidentified

Metridium senile

Ptilosarcus gurneyi

Stylatula elongata

cf. *Virgularia bromelyi*

MOLLUSCA

Gastropoda

Kelletia kelletii

Megasurcula carpenteriana

Pleurobranchaea californica

Polinices sp.

Cephalopoda

Loligo opalescens

Octopus sp.

ARTHROPODA

Crustacea

Cancer spp.

Unidentified crab

Unidentified Galatheidae

Unidentified hermit crab

Loxorhynchus sp.

Unidentified shrimp

ECHINODERMATA
- Asteroidea
  - *Astropecten* sp.
  - *Pisaster brevispinus*
  - *Petalaster* (*Luidia*) *foliolata*
  - *Pycnopodia helianthoides*
- Ophiuridea
  - Unidentified ophiuroids
- Holothuroidea
  - Unidentified holothuroids

CHORDATA
- Pisces
  - Unidentified Agonidae
  - *Chilara taylori*
  - *Citharichthys sordidus*
  - *C.* cf. *stigmaeus*
  - *Cymatogaster aggregata*
  - *Engraulis mordax*
  - *Eptatretus stoutii*
  - cf. *Galeorhinus zyopterus*
  - *Genyonemus lineatus*
  - *Paralichthys californicus*
  - *Parophrys vetulus*
  - *Peprilus simillimus*
  - *Pleuronichthys* sp.
  - *Poichthys* sp.
  - *Scomber japonicus*
  - *Sebastes caurinus*
  - *Sebastes* spp.
  - *Synodus lucioceps*
  - *Zalembius rosaceus*
  - *Zaniolepis frenata*
  - *Z. latipinnis*
- Mammals
  - *Zalophus californianus*

present in this zone were the sea pens, Ptilosarcus gurneyi and Acanthoptilum sp., the octopus, Octopus sp., and the pink surfperch, Zalembius rosoceus. Various species of flatfish were observed infrequently. These species probably include those species collected and identified during trawling (Section 3.2) and are dominated by the Pacific sanddab (Citharichthys sordidus and the English sole (Parophys vetulus).

The second habitat type occurs along the pipeline corridor in water depths shallower than 200 feet. This zone is typified by sand waves and a courser sand substrate probably due to high current speeds and strong surge activity propagated by storm waves and long period sea swells. Epifauna is less abundant and although the deep zone fauna are present, the predominant species are no longer the same. Characteristic species from 200 foot water depths to approximately 130 foot depths are Cancer spp (Market crabs) and unidentified hermit crabs. Pleurobranchia sp (nudibranch) is observed during the ROV reconnaissance in water depths of 150 to 128 feet.

From approximately the 128 foot isobathometric contour to the proposed landfall of the pipeline, ROV reconnaissance was not feasible due to extreme low visibility and turbulence created by wave action. The epifauna of the area can be characterized by trawl samples and diver-biologists. Predominant epifauna sampled include the spotfin surfperch (Hyperprosopon anale) and the shiner surfperch (Cymatogaster aggregata). The dominant invertebrate collected were shrimp (Crangon spp.)

A short reconnaissance effort was made over a hard bottom area north of the pipeline landfall (Plate 1). A single small rocky outcrop was observed at a water depth of approximately 55 feet. The rocky outcrop appeared to be severly scoured due to current and wave action. Predominant fauna on the hard substrate included the Cnidaria (Corynactis california), the hydroid (Aglaophenia sp), an unidentified yellow sponge, and an unidentified rockfish (Sebastes sp.).

3.2 TRAWLING

During the project survey four paired trawls were taken. The predominant fish taken in all trawls was the Pacific sanddab (C. sordidus). Demersal fish species accounted for allmost the entire sample collection during trawling. The predominant invertebrate taxa collected were shrimp

(Crangon spp.). A few specimens were acquired of the seastars Petalaster foliolata and Astropecten sp. Table 3.2 shows the taxa captured in all trawls.

The rate of capture of fish species during trawling increased with water depth. At the platform site, Trawl Station A (depth=244 ft) (Plate 2) showed a rate of capture of 14.3 fish per minute of trawling. This is compared to Trawl Stations B, C, and D which had rates of capture of 9.7, 3.2 and 2.5 fish per minute, respectively. The predominant fish species taken at Station A was the specklefin midshipman, Porichthys notatus, which comprised more than 46% of the fish taken at this station. Trawl Stations B and C showed the speckled sanddab, Citharichthys sordidus to be the predominant species. At Station B, 71.6 percent of the fish taken were the sanddab while at Station C, 37.8 percent of the fish taken were the sanddab. Fish capture rates were lower at Station C and the predominant species of fish was also different. The predominant fish at Stations A, B and C (P. notatus and C sordidus) were not taken at Station D. The predominant fish taken at Station D was the spotfin surfperch, Hyperprosopon anale, which comprised 67.4 percent of the catch.

3.3 MARINE MAMMALS

The Bureau of Land Management (BLM) summarized data collected by the University of California, Santa Cruz (UCSC) on marine mammal sitings in the regional offshore areas (1980). At least one species of fissiped, 5 species of pinniped, and 22 species of cetacean can be expected to migrate through or utilize the region. Table 3.3 lists the species expected to occur in the area of Lease P-0441 and along the nearshore pipeline corridor.

During the project survey, three cetaceans and one pinniped were sighted (Table 3.4). The fin whale (Balaenoptera physalus) was sighted on two occasions with another unconfirmed siting. Large pods (greater than 10 individuals) of Pacific white-sided dolphins (Lagenorhynchus obliquidens) were seen on two occasions and once a group was seen with less than 10 individuals. Common dolphins (Delphinius delphis bairdii) were sited on one occasion. Unidentified cetaceans, possibly Pacific white-sided dolphins, were sited on one occasion and appeared to be feeding on a school of bonita (Sarda chiliensis). On every survey day, California sealions (Zalophus californianus) were observed in the project area. Of the mammals sited, only

TABLE 3.2

DIVE AND TRAWL OBSERVED AND COLLECTED FAUNA

TAXA

FLORA
Division RHODOPHYTA
Halymenia coccinea
Rhodymenia pacifica

FAUNA
Phylum PORIFERA
Unidentified sponge sp A (orange)
Unidentified sponge sp B (white)

Phylum CNIDARIA
Class Hydrozoa
Aglaophenia sp

Class Anthozoa
Corynactis californica
Tealia sp
Unidentified anemone

Phylum PLATYHELMINTHES
Unidentified flatworm

Phylum ANNELIDA
Class Polychaeta
Diopatra ornata
D. splendidissima
Sabellaria alcocki
S. cementarium
S. Gracilis

Phylum MOLLUSCA
Class Gastropoda
Hermissenda crassicornis
Nassarius fossatus
Neverita (*Polinices*) *reclusianus*
Pleurobranchaea californica

Class Bivalvia
Solen sicarius (razor clam)

Class Polyplacophora
Mopalia acuta (chiton)
cf. *Mopalia* sp.

Table 3.2 (continued)

Class Cephalopoda
Loligo opalescens (market squid)
Octopus rubescens
Rossia pacifica (short squid)

Phylum ECTOPROCTA
unidentified ectoproct

Phylum ECHINODERMATA
Class Asteroidea
Astropecten armatus
A. verrilli
A. sp. juv
Leptasterias sp. juv
Patiria miniata
Petalaster foliolata
Pisaster brevispinus
P. giganteus
P. orchraceus
Pycnopodia helianthoides

Class Echinoidea
Dendraster excentricus (sand dollar)

Phylum ARTHROPODA
Class Crustacea
Arcoscalpellum californicum
Balanus sp.
Cancer anthonyi
C. gracilis
Crangon alaskensis elongata
C. nigromaculata
Heterocrypta occidentalis (elbow crab)
Isocheles pilosus (hermit crab)
Pyromaia tuberculata
Sicyonia ingentis

Phylum CHORDATA
Class Ascidiacea
Styela montereyensis
cf. *Archidistoma* sp.

Class Pisces
Argentina sialis (Pacific argentine)
Chilara taylori (Spotted cusk-eel)
Citharichthys sordidus (Pacific sanddab)
Cymatogaster aggregata (Shiner surfperch)
Damalichthys vacca (Pile surfperch)

Table 3.2 (continued)

Embiotoca jacksoni (Black surfperch)
Eopsetta jordani (Petrale sole)
Genyonemus lineatus (White croaker)
Hyperprosopon anale (Spotfin surfperch)
Icelinus guadriseriatus (Yellowchin sculpin)
Microstomus pacificus (Dover sole)
Paralichthys californicus (California halibut)
Parophrys vetulus (English sole)
Peprilus simillimus (Pacific butterfish)
Pleuronichthys decurrens (Curlfin turbot)
Porichthys notatus (Specklefin midshipman)
Raja inornata (California skate)
Scorpaenichthys marmoratus (Cabezon)
Sebastes auriculatus (Brown rockfish)
S. miniatus (Vermilion rockfish)
S. saxicola (Stripetail rockfish)
S. serranoides (Olive rockfish)
Seriphus politus (Queenfish)
Spirinchus starksi (Night smelt)
Squatina californica (Angel shark)
Syngnathus californiensis (Kelp pipefish)
Synodus lucioceps (Lizardfish)
Torpedo californica (Electric ray)
Zalembius rosaceus (Pink surfperch)
Zaniolepis latipinnis (Long spined combfish)

Table 3.3
MARINE MAMMALS EXPECTED IN THE PROJECT AREA

Common Name	Scientific Name[2]
Pinnipeds	
California sea lion	Zalophus californianus
Steller sea lion	Eumetopias jubatus
Northern fur seal	Callorhinus ursinus
Guadalupe fur seal	Arctocephalus townsendi
Northern elephant seal	Mirounga angustirostris
Harbor seal	Phoca vitulina
Fissipeds	
Southern sea otter	Enhydra lutris nereis
Cetaceans	
Minke whale	Balaenoptera acutorostrata
Blue whale	Baleonoptera musculus
Sei whale	Balaenoptera borealis
Fin whale	Balaenoptera physalus
Humpback whale	Megaptera noveangliae
Gray whale	Eschrichtius robustus
Common dolphin	Deophinus delphis bairdi
Pacific pilot whale	Globicephala macrorhynvcha
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	Physeter catodon
Phymy sperm whale	Kogia breviceps
Baird's beaked whale	Berardius bairdii
Cuvier's beaked whale	Ziphius cavirostris
Pacific right whale	Balaena glacialis
Beaked whale	Mesoplodon carlhubbsi

Table 3.4
BIOLOGICAL OBSERVATIONS OF SURFACE FAUNA

Marine Mammals
- Order Cetacea
  - *Balaenoptera physalus* (Fin whale)
  - *Delphinus delphis bairdi* (Common dolphin)
  - *Lagenorhynchus obliquidens* (Pacific white-sided dolphin)
- Order Pinnipedia
  - *Zalophus Californianus* (California sea lion)

Marine Birds
- *Brachyramphus marmoratum* (Marbled murrelet)
- *Larus argentatus* (Herring gull)
- *L. delawarensis* (Ring-bill gull)
- *L. heermanni* (Heerman's gull)
- *L. occidentalis* (Western gull)
- L. spp. juv
- cf *Lobipes lobatus* (Northern phalarope)
- *Pelecanus occidentalis* (Brown pelican)
- *Phalacrocorax penicillatus* (Brandt's cormorant)
- *Puffinus* sp (Shearwater)
- *Sterna albifrons* (Least tern)
- *Uria aalge* (Common murre)

Marine Fish
- *Engraulis mordax* (Northern anchovy)
- *Mola mola* (Common mola)
- *Sarda chiliensis* (Pacific bonita)

the fin whale is classified as endangered, but all marine mammals are fully protected by the Federal Marine Mammal Protection Act.

3.4 MARINE BIRDS

Marine birds of the region have been surveyed and reported by UCSC, 1978 and summarized by BLM, 1980. In summary, approximately 0.5 percent of the breeding individuals of central and northern California are located in the marine waters between Point Conception and Point Estero. However, non-breeding birds utilizing the area include the endangered California brown pelican and the California least tern which utilizes the area around the mouth of the Santa Ynez River.

The Santa Ynez River mouth area (proposed area of Union's pipeline and powercable landfall) is considered an area of high utilization by marine coastal avifauna. This is due principally to being a wetland area. During Union's Biological and Endangered Species Survey (1983), 42 species of avifauna were observed and identified in this wetland area. Of these species, 8 were observed and identified on this survey.

Eleven marine birds identified during the September, 1983 survey are shown in Table 3.4. The brown pelican was commonly observed in the project area. The California least tern was also sited once. Gulls were the most numerous of the sited birds, and the brown pelican the most numerous single species identified.

3.5 BENTHIC INFAUNA

Infaunal samples were collected at the seventeen stations shown on Plate 2. Of the seventeen stations, three replicates were collected at 16 stations, and two replicates were collected at station 17. This was due to the hard packed sandy material of the station which resisted penetration by the grab sampler.

At each grab station subsamples were removed from each replicate and analyzed for total organic carbon (TOC), oil and grease, and grain size. Averages per station for these parameters are given in Table 3.5. Sediment TOC decreased from about 0.5 percent at the deep water stations to less than 0.1 percent at the nearshore stations. Oil and grease showed a slight decline from the platform site to shore with a significant increase at

TABLE 3.5
Sediment Chemistry Parameters
by Station/Depth (MLLW)

STATION/DEPTH (ft)	AVERAGE TOC[1]	AVERAGE OIL & GREASE (mg/l)	AVERAGE GRAIN SIZE Ø[2]
1/235	0.438	0.285	4.637
2/235	0.456	0.351	4.712
3/259	0.510	0.448	4.876
4/235	0.533	0.483	4.643
5.217	0.426	0.527	4.502
6/242	0.504	0.352	4.662
7/195	0.317	0.197	4.150
8/173	0.213	0.278	4.016
9/153	0.198	1.020	3.942
10/134	0.176	0.175	3.770
11/122	0.135	0.175	3.656
12/109	0.121	0.203	3.401
13/93	0.103	0.277	3.496
14/65	0.072	05.26	2.968
15/28	0.062	0.206	2.623
16/66	0.066	0.192	2.967
17/25	0.047	0.193	1.712

1. TOC = Total organic carbon shown as % Carbon

2. Ø = Phi sizes (1.0 to 4.0 = sand; 5.0 to 8.0 = silt; >8.0 = clay)

station 9. Average grain size showed a definite increase with decreasing depths. Sediment parameters samples are comparable to those values reported for Chevron's "Hermosa" Project (Chevron 1983).

Additionally at each grab station, water quality parameters were taken for surface, midwater and bottom conditions. Parameters measured included temperature, dissolved oxygen, pH and salinity. Salinity and pH remained constant at all stations with measurements of 33.4 parts per thousand and 7.8, respectively. Dissolved oxygen values at the bottom ranged from 4.6 mg/l to 5.2 mg/l, while surface values ranged from 4.9 mg/l to 5.3 mg/l. A pattern was not discernable from these values. Bottom temperatures ranged from 12.1°C at the proposed platform site to 17.9°C at a depth of 25 feet. Surface temperature ranged from 15.7°C to 19.3°C. Surface temperatures fluctuated as a function of time of day and date. No anomalous observations were made for any water quality parameters on this survey.

The infauna collected in this survey encompass three distinct benthic communities. The nearshore community, inhabiting the depth zone from 25 to 100 feet, is an assemblage of organisms adapted to a high energy, unstable environment. The offshore community, inhabiting the depth zone from about 100 to 200 feet, is a transitional community between the high energy environment of the nearshore and the more stable sedimentary environment of the third community, the continental shelf community. This last community comprises the habitat of the proposed platform IRENE site.

The communities, while being distinct, represent a continuous assemblage of biota that intergrade with each other. The dominant benthic infauna grade from filter or suspension feeders in the sandy nearshore waters to deposit feeders in the deeper, more sedimentary zones. (DOI, 1981). The depth division for these communities as compared to similar communities will vary with topography, geography and exposure to Pacific storms. For example, similar communities (sediment bottom) in Southern California are generally found in shallower water depths because they are not exposed to the same intensity storms. Exxon (1984) characterized the nearshore infaunal samples (less than 33 foot water depth) in the Santa Barbara Channel by the polychaetes Owenia collaris and Prionospio pygmaeus. These polychaetes were not observed in this survey until the 65 and the 93 foot isobathometric contour, respectively.

The nearshore community (stations 12-17) can be characterized by a few abundant species generally limited to shallow water depths. This includes: three amphipods, Eohaustorius sencillus, Monodulodes spinipes and Rhepoxynius abronius, several crabs including Lepidopa myops and Blepharipoda occidentalis; the cumaceans of the genus Diastylopsis; the sand dollar Dendraster excentricus; and a gastropod Olivella pycna. The polychaetes were poorly represented in the nearshore community, with only a few specimens of Dispio uncinata and Hesionura coineau (typically found in coarser sediments). These were restricted to shallow depths.

The offshore community (stations 7-11) was well represented by a large number of species forming a distinct community. An example of these species include: the amphipods Monoculodes hartmanae, Rhepoxynius daboius and R. stenodes; the mollusks Siliqua lucida and Tellina modesta; the ophiuroid Amphiloplus hexacanthus and the polychaetes Poecilochaetus johnsoni and Thalenessa spinosa.

The continental shelf community, representing the platform area (stations 1-6), contained the amphipods Heterophoxus oculatus, Protomodeia articulata and Rheposynius bicuspidatus; the mollusks Parvilucina tenuisculpta and Mysella tumida; the ophuiroids Amphiodia urtica and A. digitata and Amphiura arcystata; and the polychaetes Prionospio steenstrupi, Phloe glabra, Praxillella affinis, Spiophanes missionensis and Sternaspis fossor.

A total of 346 taxa were identified, represented by 10,654 individuals from 50 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 because of immature or damaged specimens. A summary of the infaunal diversity (number of taxa/sample) and abundance is presented in Tables 3.6, 3.7 and 3.8. The lists of infauna by station are presented in Appendix A.

Table 3.6 gives an overall summary of the infauna data. Polychaetes were the most diverse (38.4% of the taxa) and abundant (41.9% of the individuals) group of organisms sampled. The crustaceans were quite diverse (26% of the taxa) but their abundance was low (13.4% of the individuals). This was in sharp contrast to the echinoderms which contained only 3.8% of the species but their abundance represented 26% of the individuals sampled. Mollusks were well represented and their diversity was 23.7% of the species sampled. Their abundance represented 10.9% of the individuals collected.

TABLE 3.6

TOTAL NUMBER OF INFAUNA TAXA AND INDIVIDUALS FOR FIFTY SMITH-MACINTYRE $0.1m^2$ GRAB SAMPLES USING A 1.0mm SCREEN
(By Major Taxonomic Group)

	Diversity Taxa/50 grab Samples	Abundance Individual/50 grab Samples
Minor Phyla	28	830
Annelida	133	4,465
Arthropoda	90	1,424
Mollusca	82	1,164
Echinodermata	13	2,771
TOTAL	346	10,654

TABLE 3.7

AVERAGE DIVERSITY (NO. OF TAXA/SAMPLE) AND
ABUNDANCE BY STATION FOR THREE REPLICATE SAMPLES

Station Number	Depth In Feet	Average Diversity	Average Abundance
1	235	80.4	394.4
2	235	85.3	357.4
3	259	78.4	430.3
4	235	88.4	436.4
5	217	87.7	368.0
6	242	86.4	431.0
7	195	75.9	213.0
8	173	70.3	231.4
9	153	61.3	162.6
10	134	51.0	116.4
11	122	38.4	79.0
12	109	26.3	70.9
13	93	25.4	58.4
14	65	18.3	56.2
15	28	11.7	20.4
16	66	19.6	126.0
*17	25	3.0	5.0

*Only two replicate samples taken.

TABLE 3.8

AVERAGE DIVERSITY (NO. OF TAXA/SAMPLE) AND ABUNDANCE FOR MAJOR TAXONOMIC GROUPS

Station Number	Depth In Feet	Minor Phyla		Annelida		Arthropoda		Mollusca		Echinodermata	
		Div.	Abund	Div.	Abund	Div.	Abund	Div.	Abund	Div	Abund
1	235	7.3	33.0	38.7	158	16.7	43.7	13.7	32.7	4.0	127.0
2	235	9.3	17.7	40.0	125	18.0	46.7	14.3	40.0	3.7	128.0
3	260	8.7	19.3	39.3	130	11.7	36.7	13.0	33.3	5.7	211.0
4	234	8.7	39.7	45.0	201	15.0	32.7	13.7	48.0	6.0	115.0
5	220	11.0	42.0	38.7	169	15.7	35.0	16.3	51.0	6.0	71.0
6	242	9.3	20.7	45.7	191	15.0	36.0	12.7	37.3	3.7	146.0
7	192	7.3	24.0	32.3	106	14.0	24.7	17.0	39.0	5.3	20.0
8	174	7.0	34.3	35.0	140	10.7	20.7	13.3	24.7	4.3	11.7
9	150	8.0	22.3	31.7	99.3	9.0	16.7	8.3	16.3	4.3	8.0
10	130	5.3	14.7	23.7	61.3	9.3	19.7	9.0	14.0	3.7	6.7
11	120	3.7	5.0	17.0	39.0	8.7	17.7	7.0	10.3	2.0	7.0
12	105	1.0	2.3	12.3	21.0	6.0	29.3	5.3	8.3	1.7	10.0
13	90	1.7	2.0	9.7	17.7	9.3	27.0	3.0	3.0	1.7	8.7
14	64	1.3	6.0	6.3	11.3	6.7	27.3	2.7	2.7	1.3	4.3
15	30	0.7	1.0	4.0	5.3	5.3	18.7	1.0	1.0	0.7	0.7
16	60	1.3	3.3	6.3	11.0	7.7	41.7	2.3	2.3	2.0	48.7
*17	20	0.5	1.0	1.0	2.5	1.0	1.0	0.5	0.5	0.0	0.0

*Only two replicates.

From Tables 3.7 and 3.8 it can be easily seen that there is a strong onshore-offshore gradient of diversity and abundance. That is, the nearshore community has lower diversity and abundance than the deeper communities. The onshore-offshore gradient was pronounced in the infaunal samples. This distribution of organisms is largely due to the physical forces (predominantly wave energy effects) that disrupt the sedimentary environment. It should be noted that since the nearshore community is an assemblage of biota that is naturally adapted to sedimentary disturbances (burial and erosion), it will also be the community least affected by pipeline construction and burial. Because the deeper communities normally do not experience large sedimentary loads, they would be more susceptible to impacts from dredging and sediment discharges. However, this community is composed of many opportunistic species (e.g., capitellid polychaetes) which can quickly invade areas that have been disturbed. Additionally, these species have broad geographical ranges such that small local disturbances have no discernable impact on the population.

Table 3.9 provides a breakdown of the major taxonomic groups, and indicates that of the 90 taxa sampled for the Arthropods, 39 (43.3%) of them were amphipods. Cumacean diversity was high with 17 different species being sampled. One uncommon nudibranch was sampled in this survey and was tentatively assigned to the genus Corambe. This nudibranch was sampled at station 7. This is an unusual nudibranch in that it has retractable gills and a forked notum. Less than a dozen specimens have been collected from the waters offshore of California and undoubtedly represent a new genus and species. Specimens have been collected in Southern California and Northern California in deep water (200 to 1000 ft) from Fort Bragg to Palos Verde.

Wet weight biomass estimates were made for the major taxonomic groups and the data is presented in Table 3.10. Estimated biomass weights generally showed a decline in biomass with decreasing depths. The continental shelf and offshore communities had higher biomass, with domination shown by ophiuroids. Nearshore communities had low biomass estimates and were dominated by the crustacean and echinoderm taxa. Biomass estimates have not typically been included in surveys in this area and thus no comparisons can be made.

The infauna sampled in this survey were typical of the Point Conception/ Point Arguello area with most of the species having broad geographical

TABLE 3.9

SUMMARY OF INFAUNAL DIVERSITY BY TAXONOMIC GROUP

	# of Taxa
MINOR PHYLA	
Coelenterata	
Hydroidea	4
Anthozoa	7
Platyhelminthes	2
Nemertea	7
Echiura	2
Sipuculida	3
Brachiopoda	1
Phoronida	1
Hemichordata	1
ANNELIDA	
Polychaete	133
ARTHROPODA	
Amphipoda	39
Cirripedia	2
Cumacea	17
Decapoda	11
Isopoda	6
Mysidacea	2
Nebaliacea	1
Ostracoda	8
Pycnogonida	2
Tanaidacea	2
MOLLUSCA	
Bivalvia	36
Gastropoda	37
Scaphopoda	4
Apalcophora	5
ECHONIDERMATA	
Asteroidea	1
Echinoidea	1
Holothuroidea	3
Ophiuroidea	8
TOTAL TAXA SAMPLED	346

TABLE 3.10

ESTIMATED WET WEIGHT BIOMASS FOR MAJOR
TAXONOMIC GROUPS FOR EACH STATION AND REPLICATE

STATION/REP		Polychaetes	Mollusks	Others	Crustaceans	Echinoderms	Total Biomass Per Replicate
1	1	2.17	.01	1.00	.14	10.56	13.88
	2	3.11	.03	1.40	.04	8.78	13.36
	3	3.14	.03	.79	.17	3.16	7.29
2	1	4.91	.15	.45	.10	7.09	12.70
	2	2.47	.08	.64	.13	5.39	8.71
	3	10.39	.20	.46	.09	4.88	16.02
3	1	1.10	.35	5.10	.18	5.45	12.18
	2	1.75	.45	.34	.04	4.95	7.53
	3	2.84	.27	.70	.08	9.34	13.23
4	1	1.82	.52	1.81	.20	5.93	10.28
	2	1.28	.21	2.08	.06	5.30	8.93
	3	2.45	.26	3.28	.14	3.52	9.65
5	1	1.98	.31	1.48	.13	2.43	6.33
	2	2.63	.24	.65	.03	11.19	14.74
	3	1.26	.47	3.06	.06	3.34	8.19
6	1	2.53	.48	1.40	.02	14.02	18.45
	2	1.94	.32	.49	.14	10.03	12.92
	3	5.50	.26	.76	.05	5.39	11.96
7	1	2.40	.28	1.46	.02	4.71	8.87
	2	1.22	.37	.41	.01	1.68	3.69
	3	2.08	.23	.48	.05	3.32	6.16
8	1	.60	1.43	1.47	.02	1.25	4.77
	2	1.01	.83	.81	.01	1.01	3.67
	3	.65	.35	1.46	>.01	.78	3.25
9	1	.67	1.29	.94	.01	2.82	5.73
	2	.32	.72	.20	>.01	4.01	5.26
	3	.71	.99	.43	>.01	6.85	8.99
10	1	.78	.25	.40	>.01	6.18	7.62
	2	1.75	.18	.57	.02	1.69	4.21
	3	.33	.31	1.32	.03	1.44	3.43
11	1	.15	.20	>.01	.02	.10	.48
	2	.27	.18	.02	.02	.09	.58
	3	.71	.37	>.01	.08	.52	1.69

TABLE 3.10 (Continued)

STATION/REP		Polychaetes	Mollusks	Others	Crustaceans	Echinoderms	Total Biomass Per Replicate
12	1	.57	.30	>0.1	10.65	.05	11.58
	2	.09	.47	0.1	.13	.04	.74
	3	1.25	.10	0.2	.03	.04	1.44
13	1	.04	.52	>.01	.01	.06	.64
	2	.03	.04	>.01	.03	.07	.18
	3	.39	.21	>.01	.02	.04	.67
14	1	.04	>.01	>.01	.09	.04	.19
	2	.01	.07	>.01	.05	.05	.19
	3	.02	.56	.02	.07	.01	.68
15	1	>.01	>.01	0	.04	>.01	.07
	2	>.01	>.01	.02	.13	>.01	.18
	3	.26	.04	.04	.02	0	.36
16	1	>.01	>.01	.01	.05	.14	.22
	2	.02	.06	>.01	.01	.04	.14
	3	.07	>.01	>.01	.07	.05	.21
17	1	>.01	>.01	>.01	0	0	.03
	2	.02	0	0	>.01	0	.03
TOTAL		69.77	14.26	36.09	13.54	157.85	291.51

distributions. Some species, however, may be limited to the area defined as the "California Transition Zone." This zone centers on Point Conception and runs north and south approximately 150 miles in both directions. (Morris, et.al., 1980). Species inhabiting this zone may be considered short-range endemic species, although identification would be difficult due to the lack of specific knowledge on ranges of the species captured.

A comparison of the results of this survey with the Platform "Hermosa" survey (Chevron, 1983), approximately 12 miles south, exhibits a high degree of similarity in terms of species at comparable habitat and depth ranges. Because a direct comparison is not possible due to the lack of specific species capture locations in the "Hermosa" report, these conclusions are based on the experience and knowledge of the biological investigators involved in these analyses for the species of the area. In general the characteristic fauna of the soft bottom habitats observed during the Platform Hermosa survey along the proposed pipeline routes in less than 100 m (330 ft) water depths include the sea pens (Acanthoptilum gracile) and Stylatula elongata), shrimp (Crangon spp.), starfish (Petalaster (Luidea) foliolata), and the Pacific sanddab (Citharichthys sordidus). These fauna were also characteristic of the Project Irene area.

The habitat and biota observed in this survey were not unique to this area and it was generally apparent that there was a similiarity of species composition for surveys conducted in the Point Conception and Point Arguello areas. Most of the biota recorded from this survey are expected to have broad geographical ranges. Those species that may represent endemic species from the "California Transition Zone" are expected to exist along the entire range (approximately 300 miles) considered as part of the zone.

3.6 NEARSHORE HABITATS

The proposed pipeline and powercable corridor in the nearshore area is over a region of predominantly dense packed sand. During the survey, observations of the nearshore environment were conducted using marine biologist-divers. Typical conditions for the nearshore area were generally reported as heavy surge and low visibility. Species observed during diving operations are shown in Table 3.2 and include both rocky and sandy substrate observations.

A small area (approximately 50 x 75 feet with relief of 0-5 feet) of exposed rocky substrate was observed in the pipeline corridor in approximately 30 foot water depths. The surface of the rocky outcrop showed signs of scouring, probably due to high wave energy. Typical species observed on the top of this rocky area included red algae, with less than 5 percent coverage and the chiton (Mopalia acuta), which were present but not common. Both species are considered normal residents of intertidal habitats on exposed rocky coastlines, and as such, are able to endure the high surge conditions (Ricketts and Calvin, 1968). Below the surface on more protected areas, the predominant biota were Corynactis californica with up to 20 percent coverage and several unidentified species of sponges with less than 5 percent coverage. Several species of rockfish (Sebastes sp.) were observed infrequently. No abalone or lobster were noted.

Nearshore sandy bottoms comprised the majority of the survey area. The energy exposed in the area was evidenced by the presence of sand waves of approximately 0.5 inches in height and 6 inches apart at a depth of 60-80 feet, and 1-2 feet high and 3-6 feet apart at a depth of 20 feet. Predominant inhabitants of the sandy areas were the starfish (Pisaster brevispinus), hermit crabs (Isocheles pilosus), and large beds of sand dollars (Dendraster excentricus). Sand dollar beds were the most dense (estimated at approximately 300-500 individuals/m^2) at 40 feet. Inshore of 10 feet, the wave energy was too great for divers and therefore no observations were conducted. It is expected that few epifaunal organisms reside in this wave dominated area.

3.7 CURRENT REGIME

The characteristics of the currents in the area are determined by the alignment of the coast, the width of the continental shelf, oceanic currents, topography, bathymetry, winds, tides, water density, waves and river discharge. Generally, the California current is the dominant current, moving in a southerly direction along the coast of California, during the oceanic period from the end of August through the middle of November (Reid, et al., 1958). The speed of the California current is relatively constant with a yearly average of 0.2 knots (11 cm/sec) in the survey area. Schwartzlose and Reid (1972) reported maximum short-term speeds of up to 1 knot (50 cm/sec).

However, the current measurements, recorded from 1 September 1983 through 11 September 1983, exhibit strong northerly and northwesterly flow as might be expected from the Davidson current. The near bottom current meter (220 feet, MLLW) recorded a maximum half-hourly average speed of 0.85 knots. (44 cm/s) with an associated direction of 35 degrees (T); and the midwater (115 feet, MLLW) current meter recorded a maximum half-hourly average speed of 1.39 knots (72 cm/s) with an associated direction of 311 degrees (T).

The near bottom current meter record shows that approximately 54.1 percent of the current speed measurements are greater than 0.2 knots (10 cm/s) and 7.2 percent of the measurements are greater than 0.5 knots (26 cm/s) (Table 3.11). The current directions at times exhibited a rotory characteristic although this is not a predominate characteristic of the measurements. Approximately 54.2 percent of the measured directions are between 247.6 and 360.0 degrees (T) (Table 3.11). The average direction in this sector is between 290 and 295 degrees (T).

The mid-depth current meter recorded speeds which are moderately strong. Approximately 67.7 percent of the measurements are greater than 0.2 knots (10cm/s) and 10.1 percent are greater than 0.5 knots (26 cm/s) (Table 3.12). The current direction measurements at this depth are more northerly and exhibit less of a rotary characteristic than the near bottom measurements. Approximately 69.9 percent of the current direction measurements are between 315.1 and 45.0 degrees (T) with the average direction in this quadrant between 355 and 360 degrees (T) (Table 3.12).

While the data acquired during the September survey are accurate, they may represent an anomalous condition due to non-normal climatic conditions. Until long-term regional or site-specific current measurements can be conducted, further details will not be available.

TABLE 3.11
% OCCURRENCE OF CURRENT SPEED VS. DIRECTION
BOTTOM METER (220 FEET)

DIRECTION (DEGREES TRUE)

SPEED (KNOTS)	0-22.5	22.6-45	45.1-67.5	67.6-90	90.1-112.5	112.6-135	135.1-157.5	157.6-180	180.1-202.5	202.6-225	225.1-247.5	247.6-270	270.1-292.5	292.6-315	315.1-337.5	337.6-360	TOTAL%
0-0.10	1.0	0.4	0.4	0.6	0.2	1.4	1.2		1.2	0.4	0.4	0.6	1.2	0.4	1.0	2.3	12.7
0.11-0.20	3.5	1.4	2.0	1.8	1.2	1.2	1.4		0.6	1.4	1.4	3.7	4.3	2.9	3.5	2.9	33.2
0.21-0.30	0.6	2.3	1.2	0.6	1.4	1.0	0.6	0.2	0.2	0.2	2.0	2.6	4.9	2.8	1.8	2.0	24.4
0.31-0.40	0.4	1.0	0.2	0.4	0.8	0.6	0.2	0.2	0.6	0.2	1.4	1.6	1.2	2.4	1.2	1.4	13.8
0.41-0.50	0.8		0.2	0.4	0.2	0.6			0.2	0.8	0.6	0.6	1.0	1.2	0.4	0.4	7.4
0.51-0.60		0.4								0.8		0.4	0.6	1.2	0.2	0.4	4.0
0.61-0.70		0.2									0.2	0.4	0.6	0.8		0.2	2.4
0.71-0.80														0.4			0.4
0.81-0.90		0.02														0.2	0.4
0.91-1.00																	
1.01-1.10																	
1.11-1.20																	
1.21-1.30																	
1.31-1.40																	
1.41-1.50																	
TOTAL%	6.3	5.9	4.0	3.8	3.8	4.8	3.4	0.4	2.8	3.8	6.0	9.9	13.8	12.1	8.1	9.8	

TABLE 3.12
% OCCURANCE OF CURRENT SPEED VS. DIRECTION
MIDWATER METER (115 FEET)

DIRECTION (DEGREES TRUE)

SPEED (KNOTS)	0-22.5	22.6-45	45.1-67.5	67.6-90	90.1-112.5	112.6-135	135.1-157.5	157.6-180	180.1-202.5	202.6-225	225.1-247.5	247.6-270	270.1-292.5	292.6-315	315.1-337.5	337.6-360	TOTAL%
0-0.10	0.6	1.0	0.2	0.2	0.4		0.2	0.4	0.2	0.4		0.2	0.2	0.2	0.4	0.6	5.2
0.11-0.20	3.9	3.1	1.4	1.6	1.0	0.8	1.0	0.6	1.6	0.8	0.6	0.4	1.4	1.8	1.8	5.3	27.1
0.21-0.30	6.8	3.3	0.4	0.6	0.8	0.8	0.8	1.4	0.4	0.4	0.4	0.4	0.2	0.6	4.7	5.3	27.3
0.31-0.40	5.1	2.7				0.2	1.2	0.6	1.8	0.2	0.4			0.8	1.2	4.7	18.9
0.41-0.50	4.3	0.4						0.4	0.4						1.0	4.9	11.4
0.51-0.60	1.0														1.0	1.6	3.6
0.61-0.70	0.4														1.4	1.0	2.8
0.71-0.80															0.4	0.8	1.2
0.81-0.90															0.4		0.4
0.91-1.00															0.2	0.2	0.4
1.01-1.10															0.2		0.2
1.11-1.20														0.2			0.2
1.21-1.30															0.2		0.2
1.31-1.40														0.2			0.2
1.41-1.50																	
TOTAL%	22.1	10.5	2.0	2.4	2.2	1.8	3.2	3.4	4.4	1.8	1.4	1.0	1.8	3.8	12.9	24.4	

4.0 POTENTIAL IMPACTS AND CONCLUSIONS

4.1 PLATFORM SITE

Construction of Platform IRENE will disturb the benthic infaunal and epifaunal habitats of the platform area by the placement of piles for platform support and the placement of anchors from the construction barge(s). Infaunal and epifaunal biota around the anchor locations are expected to be dislocated or eliminated during anchoring operations. The predominant infaunal species that would be dislocated or eliminated during construction will be the ophuiroid, Amphiodia urtica, the polychaetes, Prionospio steenstrupi and Spiophanes missionensis, the amphipod, Rhepoxynius bicuspidatus, and the mollusk, Parvilucina tenuisculpta. Predominant epifaunal species expected to be dislocated are the starfish, Petalaster foliolata, and the fish, Porichthys notatus and Citharichthys sordidus. Impacts resulting from these operations are expected to be insignificant due to the relatively small area affected. Recruitment from nearby populations is expected to be rapid after completion of construction activities.

There will be a permanent loss of benthic habitat at the point of placement of the platform piles. This loss of habitat will be mitigated by the presence of the platform which will furnish significantly more surface area for habitation in the form of the hard substrate contributed by the platform legs. This hard substrate will probably be inhabitated by the Cnidaria, Corynactis californica and Paracyathus stearnsii, the starfish, Pisaster giganteus and Patiria miniata, the crustaceans, Cancer spp. and Paguristes spp., and the fish, Ophiodon elongatus and Sebastes spp. Additionally, the platform contributes significantly more vertical relief, which has been shown to attract a more abundant and varied biota than that of a sedimentary bottom as exists at the platform site (Carlisle, et al., 1964; Turner, et al., 1969).

During drilling activities a variety of wastes are generated including drill cuttings and used drilling muds. Drill cuttings may bury epifauna or infauna which are incapable of burrowing rapidly enough through the cuttings mound to escape being smothered or trapped. At the completion of drilling activities, repopulation of the affected area by infaunal and macroepifaunal species should occur rapidly.

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) that the drilling muds will kill marine organisms, produce harmful sublethal responses to various biota, or alter the ecosystem; and (2) that some of the drilling muds contain heavy metals and organic compounds which may accumulate in the marine organisms to concentrations that could harm them, their predators or even humans.

Knowledge of the impacts to the benthic fauna inhabiting sedimentary bottoms resulting from the toxicity of drilling muds is generally unavailable. Preference has been given to those species inhabiting hard substrate areas. Presently, it can generally be concluded that drilling muds discharged into the ocean will create short-term localized impacts, primarily on the phytoplankton, due to increased turbidity. Long-term sublethal effects of chronic exposure to low levels of the toxic fractions may be incurred by the sedimentary bottom dwellers. However, current regimes at the platform site are expected to dilute the muds sufficiently to minimize environmental damage. Additionally, the advances in technology and research in toxicities of the drilling muds to benthic fauna are rapidly decreasing the potential impacts.

4.2 PIPELINE AND POWERCABLE CORRIDOR

Construction impacts associated with the pipeline will be similar to those associated with the construction of the platform. Again, repopulation of the disturbed areas will occur shortly after completion of construction activities with the exception of the area directly beneath the pipelines.

The pipeline creates a positive impact due to the presence of hard substrate and vertical relief which can be utilized by many types of marine fauna, including abalone, lobster and various species of fish. Areas of high relief (relative to surrounding habitat) support a greater abundance and diversity of organisims than do flat sediment areas (Thorson, 1957). The proposed pipelines and powercable will result in a low relief hard substrate suitable for colonization by a large number of marine organisms including the Cnideria, Aglaophenia sp. and Corynactis californica and the mollusk, Haliotis rufescens, as well as various species of sponge. (Carlisle, et al, 1964). Additionally, the lobster, Panulirus interruptus, and various species

of rockfish, Sebastes spp., will utilize the pipeline for protection and shelter. The net long-term impact of the pipelines will be to replace horizontal substrates that currently support a restricted biota, with vertical substrate capable of attracting a more abundant and varied biota. Studies have been completed which suggest that the benefit gained by the placement of artificial underwater structures for sport and commercial fisheries more than offset other possible negative biotic effects (Carlisle, et al, 1964; Turner et al, 1969).

In nearshore waters where the pipeline and powercable come ashore, the area is considered as a very high energy environment. Due to this high energy the pipelines and power cable will be weighted and buried. The burial of these pipelines and powercable will result in a short-term impact to disturbed infaunal species. However, this survey has shown that the nearshore waters (not including rocky habitat) have very sparse populations of organisims residing in that habitat, and insignificant impacts will occur. The pipeline corridor intersects with an outcropping of rocky substrate at a depth of about 30 feet. To reduce impact, the pipelines should be moved south to avoid this rocky area.

4.3 RARE, ENDANGERED OR UNUSUAL SPECIES.

Habitats were not unique in this area, nor were the fauna of the project area unique or unusual. No Vema or Allopora were observed. One nudibranch was collected which previously had been collected less than 12 times in southern and northern California. The rare incidence of capture may be related to its small size or the fact that it is found only on certain types of sedimentary bottoms which have lacked sampling effort. No rare, threatened or endangered species were collected in the benthic survey. The fin whale, California brown pelican, and California least tern, all listed as endangered were observed in the project area.

4.4 OVERALL CONCLUSIONS

The project area lies in a transition zone and as such it is characterized by species from northern and southern California. It has been suggested that this faunal zone may extend 150 miles in either direction from the project area (Newman, 1979). The habitats and biota observed during the

survey at the proposed platform site and pipeline corridor (Figure 1.1) are similar to those observed in other surveys in Santa Maria Basin for similar depths and benthic substrates. There are no sensitive or unique habitats or biota associated with the project area.

The project will create short-term construction impacts to the benthic fauna from platform and pipeline placement and from construction barge anchors. Possible long-term impacts will result from the toxicities of the drilling muds discharged but are expected to be minimal. Additionally, positive impacts from the presence of the platform and pipeline will mitigate the loss of sedimentary benthic habitat. The conclusion of this marine biological report is that no significant long-term adverse impacts will result to the biota from the placement of Platform Irene and its associated pipelines and powercable to shore. This assumes that the pipeline corridor will be realigned to avoid the rocky substrate present at 30 feet.

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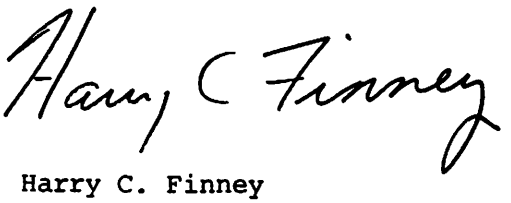
6.0 SIGNATURE

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

UNION STATION 1 SPECIES LIST

	Rep 1	Rep 2	Rep 3
COELENTERATA			
Aglaophenia sp. frag. hydroid	1		
Cerianthidae unid.		5	2
Anemone unid. Edwardsiidae		1	
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B	2		2
Micrura sp. frag.		1	
Nemertean frags.	5	2	3
Tubulanus pellucidus	2	2	2
Tubulanus cf. nothus			1
ECHIURA			
Listriolobus pelodes	5	9	6
SIPUNCULA			
Golfingia catharinae	1		
Golfingia sp.		1	
Sipunculid unid.		1	
PHORONIDA			
Phoronis sp.	2		4
ANNELIDA			
Polychaeta			
Acesta catherinae	6	2	1
Acesta simplex			1
Allia nolani	1	2	
Allia ramosa	3		2
Amaeana occidentalis	1	4	1
Amphicteis sp.	1		
Ampharetidae	1		
Anobothrus gracilis	1		
Asychis disparidentata		1	
Chone veleronis	1		
Chone sp.	1		
Cossura candida	3	1	1
Ephesiella brevicapitis		1	
Eteone sp.		1	
Euchone incolor			1
Exogone lourei		3	
Exogone molesta	1		
Glycera americana			1
Glycera capitata	5	4	3
Glycinde armigera	1		
Gyptis brevipalpa	1		
Harmothoe "lunulata"	2	4	2
Lanassa gracilis			2
Lumbrineris bicirrata	1		
Lumbrineris cruzensis	2	2	2

STATION 1 cont.	Rep 1	Rep 2	Rep 3
Lumbrineris limicola		1	
Lumbrineris spp.	4	11	7
Lumbrineris sp. D	1		
Magelona pitelkai			1
Maldanidae		2	
Maldane sarsi	4		1
Mediomastus ambiseta	3		2
Mediomastus californiensis	1		
Mediomastus sp.	20	9	10
Melinna oculata	1		1
Myriochele heeri	1		
Nephtys caecoides	2	1	
Nephtys cornuta franciscana	1		
Nephtys ferruginea			1
Nephtys sp., juv.	3	2	1
Nereis procera	1		
Ninoe gemma			2
Paraprionspio pinnata	4	1	6
Pectinaria californiensis	10	6	6
Pholoe glabra	20	15	10
Pionosyllis sp.		1	
Piromis eruca	1	1	
Pista fasciata	1	1	2
Pista sp. B	2	1	1
Pista sp.			1
Polycirrus sp.		2	1
Polynoidae		1	1
Praxillella affinis pacifica	10	6	2
Prionospio cirrifera	15	8	2
Prionospio steenstrupi	23	9	11
Scoloplos armiger	6	2	2
Sigambra tentaculata	1		
Spio sp.	1		
Spiophanes berkeleyorum	1		
Spiophanes bombyx	1		1
Spiophanes kroeyeri			1
Spiophanes missionensis	27	13	10
Spiochaetopterus costarum			1
Sternaspis fossor	6	12	2
Sthenelais verruculosa			2
Sthenelanella uniformis		1	1
Streblosoma crassibranchia		1	
Tauberia gracilis	8	2	2
Thalenessa spinosa	1		
Tharyx spp.	6	3	1
Travisia pupa	1	2	

STATION 1 cont.	Rep 1	Rep 2	Rep 3
ARTHROPODA			
Amphipoda			
Ampelisca agassizi			1
Ampelisca brevisimulata	6	4	
Ampelisca pugetica	2		
Ampelisciphotis podophthalma	1		
Byblis veleronis	2	1	3
Heterophoxus oculatus	3	3	3
Monoculodes norvegicus		1	1
Protomedeia articulata			1
Rhepoxynius bicuspidatus	12	7	10
Rhepoxynius menziesi	9	7	3
Westwoodilla caecula	1	2	2
Cumacea			
Campylaspis rubromaculata			1
Diastylis sp. A (Given MS)		1	
Diastylis sp. E (New Species?)	2	1	3
Eudorella pacifica			1
Hemilamprops californica			1
Leucon subnasica			1
Mesolamprops bispinosa			1
Decapoda			
Callianassa sp. juv.		1	1
Pinnixa occidentalis	3		3
Randallia sp. juv.		1	1
Isopoda			
Gnathia crenulatifrons	1	2	
Silophasma geminatum	1		1
Ostracoda			
Euphilomedes carcharodonta	3		2
Parasterope barnesi			1
Pycnogonidae			
Anoplodactylus pacificus = A. erectus?			1
Tanaidacea			
Leptochelia dubia		1	1
Leptognathia? spp.	4		1
MOLLUSCA			
Bivalvia			
Cooperella subdiaphana	1		
Macoma sp.			1
Modiolus neglectus	1	1	1
Mysella tumida	6	2	2
Nemocardium centifilosum	1	1	2
Nuculana hamata		1	
Parvilucina tenuisculpta	23	13	5
Paramya sp.A	3		

STATION 1 cont.	Rep 1	Rep 2	Rep3
Psephidia ovalis		2	1
Tellina carpenteri		3	
Gastropoda			
Acteocina culcitella			1
Balcis micans		1	
Clathurella sp.			1
Eulima almo		2	
Kurtzia arteaga		1	1
Kurtziella beta		3	
Mitrella gouldi			1
Turbonilla (Chemnitzia) sp. B		1	
Turbonilla (Chemnitzia) sp. D			1
Volvulella californica			2
Volvulella cylindrica		2	1
Scaphopoda			
Cadulus quadrifissatus		10	2
Dentalium sp.			1
Aplacophora			
Chaetoderma sp.		1	
ECHINODERMATA			
Asteroidea			
Asteroid juvs. (probably Astropecten)	1		2
Holothuroidea			
Leptosynapta ? sp.		1	
Pentamera populifera = Eupentacta sp. Chevron 1982	1		
Ophiuroidea			
Amphichondrius granulosus		3	
Amphiodia urtica	69	78	50
Amphiodia spp. juv.	33	37	18
Amphipholis squamata			2
Amphiura arcystata	4	4	4
Ophiuroid unid. juv.	34	27	13
HEMICHORDATA			
Hemichordate unid. frags.	2	1	3

UNION STATION 2 SPECIES LIST

	Rep 1	Rep 2	Rep 3
COELENTERATA			
Cerianthidae unid.	2	1	2
Scolanthus sp. A. = Isoedwardsia sp. A	1	2	
Anemone unid. Ewardsiidae		2	
Anemone #45 unid.			1
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B	2		
Cerebratulus sp. frag.		1	2
Enopla unid.			1
Lineus bilineatus	1		
Tubulanus pellucidus	1	4	3
Tubulanus cf. nothus	1		
Nemertean frags.		2	
ECHIURA			
Listriolobus pelodes	1	3	2
SIPUNCULA			
Golfingia catharinae	1		
BRACHIOPODA			
Glottidia albida	1	3	4
PHORONIDA			
Phoronis sp.	1	1	4
ANNELIDA			
Polychaeta			
Acesta catherinae	2	2	2
Acesta, nr. catherinae			1
Allia nolani	2		
Allia ramosa		3	
Amaeana occidentalis	4	3	3
Ampharetidoe, juv.	1		
Amphicteis scaphobranchiata	1		
Anobothrus gracilis	1	2	
Asychis disparidentata		1	
Brada villosa		1	
Capitella capitata			1
Chone albocincta	1		1
Chone veleronis	2		
Chone sp. juv.			
Cossura candida	1		3
Ephesiella brevicapitis	1		
Glycera americana	1		
Glycera capitata	2	5	
Glycinde armigera	1		2
Goniada maculata		1	
Harmothoe "lunulata"	1	4	
Harmothoe priops		1	1

STATION 2 cont.	Rep 1	Rep 2	Rep 3
Lanassa gracilis			3
Lumbrineris bicirrata		1	1
Lumbrineris californiensis			1
Lumbrineris cruzensis	3	2	5
Lumbrineris limicola	1		
Lumbrineris spp.	3	6	6
Lysippe annectens			1
Magelona pitelkai			1
Maldane sarsi	1		1
Maldanidae	2		1
Mediomastus sp.	1	2	10
Melinna oculata			1
Mooreonuphis nebulosa			1
Myriochele heeri		1	
Nephtys ferruginea	3	1	
Nephtys parva			1
Nephtys sp. juv.	1	1	3
Ninoe gemma	1	3	1
Notocirrus californiensis			1
Onuphidae, juv.	1		
Onuphis iridescens			2
Paraprionspio pinnata	4	5	3
Pectinaria californiensis	6	1	4
Pholoe glabra	13	12	13
Phyllodoce (Anaitides) papillosa	1		
Phyllodoce (Aponaitides) hartmanae	1		2
Pista fasciata	3	2	1
Pista sp. B		2	2
Polycirrus sp.	1		
Polydora neocardalia			1
Polynoidae	3	2	4
Praxillella affinis pacifica	4	4	8
Potamethus sp.		1	
Prionospio cirrifera	1	2	2
Prionospio steenstrupi	7	3	11
Rhodine bitorquata	1		
Samytna californiensis		1	
Sarsonuphis parva			1
Scoloplos armiger	4	5	2
Sigambra tentaculata			1
Spiophanes berkeleyorum	1	1	3
Spiophanes bombyx			1
Spiophanes missionensis	12	21	8
Spiochaetopterus costarum	1		1
Sternaspis fossor	5	8	5
Sthenelais verruculosa	1	1	
Sthenelanella uniformis	2	2	
Streblosoma crassibranchia	1		
Tauberia gracilis	1	1	2
Thalenessa spinosa	1	1	
Tharyx spp.	6	4	2
Travisia pupa	2		3

Station 2 cont.	Rep 1	Rep 2	Rep 3
ARTHROPODA			
Amphipoda			
Ampelisca agassizi			1
Ampelisca brevisimulata	1	1	1
Ampelisca cristata microdentata	1		
Ampelisca pugetica		3	
Byblis veleronis			1
Foxiphalus similis	1		2
Heterophoxus oculatus	2	7	3
Lysianassa oculata			1
Nicippe tumida		1	
Photis sp. juv.	1		
Protomedeia articulata	2	1	
Rhepoxynius bicuspidatus	13	13	13
Rhepoxynius menziesi	8	2	6
Synchelidium shoemakeri	1		
Westwoodilla caecula	2	2	2
Cirripedia			
Arcoscalpellum californicum		1	
Balanus sp.	1		
Cumacea			
Diastylis sp. A (Given MS)			1
Diastylis sp. E (New Species?)	1	2	1
Eudorella pacifica	2		2
Mesolamprops bispinosa	1		2
Decapoda			
Callianassa sp. juv.		2	1
Crab Zoea	1		
Pinnixa occidentalis	2		1
Isopoda			
Gnathia crenulatifrons			1
Synidotea media			1
Ostracoda			
Euphilomedes carcharodonta	8	4	4
Parasterope barnesi	1	1	
Rutiderma rostratum	1		
Pycnogonidae			
Anoplodactylus pacificus = A. erectus?		1	
Tanaidacea			
Leptochelia dubia	1		
Leptognathia ? spp.	2	2	

STATION 2 cont.	Rep 1	Rep 2	Rep 3
MOLLUSCA			
Bivalvia			
Axinopsida serricata		1	
Compsomyax subdiaphana	1		
Macoma yoldiformis	1		
Modiolus neglectus			1
Mysella compressa	3		1
Mysella golischi		2	
Mysella tumida	1	3	4
Nemocardium centifilosum	1	1	4
Parvilucina tenuisculpta	16	14	21
Paramya sp.A	1		1
Psephidia ovalis	2	5	1
Saxicavella pacifica	1		1
Tellina carpenteri	1	2	3
Gastropoda			
Cylichna attonsa	3	2	4
Epitonium sawinae			1
Gastropteron pacificum			1
Kurtziella beta	2		
Mitrella gouldi	2		2
Volvulella californica		1	
Volvulella panamica	1		1
Scaphopoda			
Cadulus fusiformis	1		
Dentalium sp.	2		
Aplacophora			
Chaetoderma sp.	1	1	
Chaetoderma sp. F	1		
Chaetoderma sp. J			1
ECHINODERMATA			
Holothuroidea			
Leptosynapta ? sp.	3	1	
Ophiuroidea			
Amphiodia digitata	3	2	2
Amphiodia urtica	69	54	69
Amphiodia spp. juv.	27	27	27
Amphiura arcystata	2	4	4
Ophiuroid unid. juv.	41	23	25
HEMICHORDATA			
Hemichordate unid. frags.	3		1

UNION STATION 3 SPECIES LIST

	Rep 1	Rep 2	Rep 3
COELENTERATA			
Cerianthidae unid.	1	1	3
Anemone #45 unid.			1
Anemone #48 unid.	1		
PLATYHELMINTHES			
Flatworm sp. #6	2		
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B		2	3
Cerebratulus sp. frag.			1
Enopla unid		1	
Lineus bilineatus	1		2
Tubulanus pellucidus	2	4	1
Nemertean frags.	4	4	2
ECHIURA			
Listriolobus pelodes	8		1
SIPUNCULA			
Goldfingia catherinae		1	
Goldfingia sp. frags.		1	
Onchnesoma sp. A	1		
PHORONIDA			
Phoronis sp.	3	2	1
ANNELIDA			
Polychaeta			
Acesta catherinae		1	1
Acesta, nr. assimilis	1		
Aglaophamus dicirrus	2		
Allia nolani			1
Allia ramosa		2	2
Amaeana occidentalis		2	3
Ampharetidae, juv.		1	
Amphicteis scaphobranchiata	2		
Asychis disparidentata	1		
Capitella capitata	1	1	
Chloeia pinnata	1		
Chone albocincta		2	
Chone veleronis		3	
Clymenura gracilis			1
Cossura candida	4	3	3
Ephesiella brevicapitis			1
Euchone incolor			1
Glycera capitata	3	2	3
Glycinde armigera	1		1
Goniada maculata		1	2
Gyptis brevipalpa	1		
Harmothoe "lunulata"	7	1	6

STATION 3 cont.	Rep 1	Rep 2	Rep 3
Lumbrineris bicirrata			1
Lumbrineris californiensis	1		
Lumbrineris cruzensis		3	4
Lumbrineris lagunae		1	
Lumbrineris limicola	1	1	
Lumbrineris sp. D		2	
Lumbrineris spp.	11	7	8
Magelona pitelkai		1	
Maldane sarsi		4	2
Maldanidae	6	5	
Mediomastus ambiseta	1		1
Mediomastus sp.	5	2	2
Melinna oculata		1	1
Nephtys ferruginea	1	2	2
Nephtys sp. juv.		1	1
Ninoe gemma	3	2	3
Onuphis iridescens			1
Panthalis pacifica		1	
Paraprionspio pinnata	3	9	2
Pectinaria californiensis	4	6	4
Petaloproctus sp.	1		
Pholoe glabra	18	10	16
Phyllodoce (Aponaitides) hartmanae	1		1
Piromis eruca		1	1
Pista fasciata		2	2
Pista sp. B		2	1
Poecilochaetus johnsoni			1
Polycirrus sp.			1
Polynoidae	1	1	
Praxillella affinis pacifica	13	7	13
Prionospio cirrifera	1	2	1
Prionospio berkeleyorum	2	1	
Prionospio steenstrupi	11	18	11
Samytha californiensis	1		1
Scoloplos armiger	1		2
Sigambra tentaculata			1
Spiophanes bombyx			1
Spiophanes kroeyeri	3	2	1
Spiophanes missionensis	33	24	26
Spiochaetopterus costarum	3	3	1
Sternaspis fossor	8	5	8
Sthenelais verruculosa	2		
Sthenelanella uniformis		1	
Tauberia gracilis	3	4	
Terebellides sp. B		2	
Tharyx spp.	3	8	2
Travisia pupa		4	1

STATION 3 cont.	Rep 1	Rep 2	Rep 3
ARTHROPODA			
Amphipoda			
Ampelisca brevisimulata	3	1	4
Ampelisca careyi = A. macrocephala		1	2
Byblis veleronis	5		1
Foxiphalus similis		1	1
Heterophoxus oculatus		3	
Monoculodes norvegicus	1	1	
Nicippe tumida		1	
Rhepoxynius bicuspidatus	13	15	14
Rhepoxynius menziesi	3	1	
Synchelidium shoemakeri	2		
Westwoodilla caecula	1		
Cumacea			
Diastylis sp. A (Given MS)	2	1	1
Diastylis sp. E (New Species?)			
Eudorella pacifica	3	2	1
Eudorellopsis longirostris	1		
Leucon subnasica	1		
Mesolamprops bispinosa	1	1	
Decapoda			
Callianassa sp. juv.			1
Isopoda			
Gnathia crenulatifrons	4	1	
Silophasma geminatum		1	
Synidotea media		1	
Ostracoda			
Euphilomedes carcharodonta	2	2	1
Parasterope barnesi	1		
Sarsiella sp. A		1	
Tanaidacea			
Leptochelia dubia		1	
Leptognathia ? spp.	1		1
MOLLUSCA			
Bivalvia			
Axinopsida serricata	4	2	2
Cooperella subdiaphana		1	
Mysella tumida	3	3	3
Nemocardium centifilosum	6		2
Nucula tenuis	1		
Nuculana hamata		1	
Nuculana taphira		1	
Parvilucina tenuisculpta	10	7	9
Psephidia ovalis	2		2
Saxicavella pacifica	3		1
Tellina carpenteri		3	5
Tellina modesta			1
Thracia sp.		1	

STATION 3 cont.	Rep 1	Rep 2	Rep 3
Gastropoda			
Amphissa undata		1	
Bittium fetellum	1		1
Cylichna attonsa	2	2	4
Epitonium sawinae			1
Kurtzia arteaga	1		
Kurtziella beta			1
Volvulella panamica	2	2	4
Scaphopoda			
Cadulus quadrifissatus		1	
Aplacophora			
Chaetoderma sp. F		1	1
ECHINODERMATA			
Asteroidea			
Asteroid juvs. (probably Astropecten)		1	
Holothuroidea			
Leptosynapta ? sp.	2	1	2
Molpadia intermedia	1		
Pentamera populifera = Eupentacta sp. Chevron 1982		1	
Ophiuroidea			
Amphiodia digitata	4	3	1
Amphiodia urtica	104	91	108
Amphiodia spp. juv.	51	50	54
Amphioplus hexacanthus			1
Amphipholis squamata			1
Amphiura arcystata	4	4	5
Ophiuroid unid. juv.	38	50	57
HEMICHORDATA			
Hemichordate unid. frags.	2	1	1

UNION STATION 4 SPECIES LIST

	Rep 1	Rep 2	Rep 3
COELENTERATA			
Cerianthidae unid.	5	3	6
Scolanthus sp. A. = Isoedwardsia sp. A	1		
Anemone #46 unid.			1
PLATYHELMINTHES			
Flatworm sp. #6	1		
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B	3	8	4
Lineus bilineatus	7	2	
Tubulanus pellucidus	2	5	3
Tubulanus cf. nothus	1		
Nemertean frags.	1		
ECHIURA			
Listriolobus pelodes	5	21	19
SIPUNCULA			
Golfingia sp.			1
BRACHIOPODA			
Glottidia albida	4		9
PHORONIDA			
Phoronis sp.	2	4	3
ANNELIDA			
Polychaeta			
Acesta catherinae	1	4	3
Acesta simplex		1	
Allia nolani			2
Allia ramosa	1		1
Amaeana occidentalis	4	3	11
Amage scutata			1
Ampharete artica			1
Asychis disparidentata			1
Brada villosa		1	
Capitella capitata	1	2	2
Chone albocincta		2	1
Chone veleronis	1	1	
Cossura candida	1		1
Ephesiella brevicapitis			1
Glycera branchiopoda		1	
Glycera capitata	1	4	4
Glycinde armigera		1	1
Gyptis brevipalpa	2		
Harmothoe "lunulata"	1	5	9
Harmothoe priops	1		
Lanassa gracilis	1		
Leitoscoloplos mexicanus			1

STATION 4 cont.	Rep 1	Rep 2	Rep 3
Lumbrineris californiensis	1		1
Lumbrineris cruzensis	3	2	2
Lumbrineris lagunae		1	
Lumbrineris sp. D			2
Lumbrineris spp.	2	2	2
Magelona pitelkai	1	2	4
Maldane sarsi	1		2
Maldanidae	4	2	2
Mediomastus ambiseta	1	2	2
Mediomastus californiensis		1	
Mediomastus sp.	7	9	19
Melinna oculata		1	
Myriowenia californiensis			1
Nephtys caecoides	1		1
Nephtys cornuta franciscana			1
Nephtys ferruginea			2
Nephtys punctata			
Nereis procera		2	
Notocirrus californiensis			1
Notomastus sp.	1		1
Onuphis iridescens	1	1	
Ophelina acuminata			1
Paraprionspio pinnata	5	3	
Pectinaria californiensis	4	6	2
Petaloproctus sp.	1		
Pholoe glabra	24	22	32
Phyllodoce (Anaitides) medipapillata	1		1
Phyllodoce (Anaitides) papillosa		1	
Phyllodoce (Aponaitides) hartmanae	1	3	
Phyllodoce (Phyllodoce) sp.		1	
Pilargis maculata			
Pionosyllis sp.	2		1
Pista fasciata		3	3
Pista sp. B			2
Polycirrus sp.	1		
Polynoidae	2	4	6
Potamilla sp.		1	
Praxillella affinis pacifica	5	8	7
Prionospio cirrifera	4	5	4
Prionospio steenstrupi	2	11	21
Rhodine bitorquata	2		
Scalibregma inflatum		1	
Scoloplos armiger	1	4	6
Sigambra tentaculata			1
Spiochaetopterus costarum	1	3	2
Spiophanes berkeleyorum	2	5	5
Spiophanes bombyx	1	2	3
Spiophanes missionensis	38	53	51
Sternaspis fossor	5	2	3
Sthenelanella uniformis	2	1	2
Streblosoma crassibranchia			1
Tauberia gracilis	3	2	6
Terebellides sp. B		1	

STATION 4 cont.	Rep 1	Rep 2	Rep 3
Thalenessa spinosa	1	2	3
Tharyx spp.	4	3	3
Travisia pupa	2	1	1
ARTHROPODA			
Amphipoda			
Ampelisca agassizi			1
Ampelisca brevisimulata	4	1	3
Ampelisca pacifica		1	
Ampelisca pugetica	2	1	
Ampelisciphotis podophthalma			1
Byblis veleronis	4	1	3
Foxiphalus similis			1
Heterophoxus oculatus		2	
Protomedeia articulata	1	1	
Rhepoxynius bicuspidatus	8	11	6
Rhepoxynius menziesi	2	4	5
Synchelidium shoemakeri	1		
Westwoodilla caecula	1	1	1
Cumacea			
Diastylis californica	1		
Diastylis sp. A (Given MS)	1		1
Eudorella pacifica	1	1	
Decapoda			
Callianassa sp. juv.			1
Pinnixa occidentalis	1	2	1
Randallia sp. juv.			1
Isopoda			
Gnathia crenulatifrons	2	1	
Ostracoda			
Euphilomedes carcharodonta	4	2	5
Parasterope barnesi	1	1	
Pycnogonidae			
Anoplodactylus pacificus = A. erectus?			1
Tanaidacea			
Leptognathia? spp.		1	2
MOLLUSCA			
Bivalvia			
Axinopsida serricata		2	1
Compsomyax subdiaphana	2		
Modiolus neglectus	1		
Montacutidae unid.		1	
Mysella compressa			1
Mysella tumida	1	3	
Nemocardium centifilosum	1	1	2
Nucula tenuis			1

STATION 4 cont.	Rep 1	Rep 2	Rep 3
Parvilucina tenuisculpta	19	25	23
Paramya sp.A	1	2	4
Psephidia ovalis		2	
Saxicavella pacifica		48	2
Tellina carpenteri	1	1	
Thracia curta			1
Gastropoda			
Bittium quadrifilatum		1	
Cylichna attonsa	2	1	1
Epitonium sawinae		1	1
Kurtzia arteaga	1		
Kurtziella beta		3	
Mitrella gouldi		1	
Nassarius perpinguis		1	
Sulcoretusa xystrum		1	
Turbonilla (Chemnitzia) sp. D	1		
Volvulella californica	1		
Volvulella cylindrica		1	
ECHINODERMATA			
Asteroidea			
Asteroid juvs. (probably Astropecten)	1	2	2
Holothuroidea			
Leptosynapta ? sp.	1	1	2
Molpadia intermedia		1	
Pentamera populifera = Eupentacta sp. Chevron 1982	1		
Holothuroid unid.		1	
Ophiuroidea			
Amphiodia digitata	5	5	3
Amphiodia urtica	76	40	66
Amphiodia spp. juv.	25	16	22
Amphioplus hexacanthus			1
Amphiura arcystata	3	3	2
Ophiuroid unid. juv.	16	16	33
HEMICHORDATA			
Hemichordate unid. frags.	2		1

UNION STATION 5 SPECIES LIST

	Rep 1	Rep 2	Rep 3
COELENTERATA			
Cerianthidae unid.	8	6	5
Scolanthus sp. A. = Isoedwardsia sp. A		2	
Anemone #48 unid.		1	
PLATYHELMINTHES			
Flatworm sp. #6	1	2	
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B		1	
Cerebratulus sp. frag.	2		2
Enopla unid.			1
Lineus bilineatus		1	3
Tubulanus pellucidus	1	3	3
Tubulanus cf. nothus	1		1
Nemertean frags.	3	6	4
ECHIURA			
Listriolobus pelodes	4	3	15
Arhynchite. ? sp. juv.	1		1
SIPUNCULA			
Golfingia sp. juv.	1		
BRACHIOPODA			
Glottidia albida	15	2	5
PHORONIDA			
Phoronis sp.	1	4	10
ANNELIDA			
Polychaeta			
Acesta catherinae	3	5	8
Acesta, nr. catherinae			1
Allia ramosa			2
Amaeana occidentalis	2		1
Ampharete sp.	1		
Ampharetidae		1	
Amphicteis scaphobranchiata	1		
Asychis disparidentata		2	
Capitella capitata			1
Caulleriella gracilis	1		
Chone albocincta		1	
Cossura candida		1	3
Drilonereis falcata		2	
Euchone incolor			1
Glycera capitata	1	2	
Goniada maculata	2		
Gyptis brevipalpa	3		
Harmothoe "lunulata"		1	1
Harmothoe priops	1		

STATION 5 cont.	Rep 1	Rep 2	Rep 3
Lanassa gracilis	2	3	2
Laonice cirrata		1	
Lumbrineris cruzensis		2	2
Lumbrineris limicola	1		
Lumbrineris sp. D		1	
Lumbrineris spp.	4	2	2
Magelona pitelkai	5	4	6
Maldane sarsi	1	1	
Maldanidae	2	1	1
Mediomastus ambiseta	3	2	4
Mediomastus californiensis			2
Mediomastus sp.	5	8	9
Melinna oculata	1		
Mooreonuphis nebulosa			2
Nephtys caecoides	1	1	1
Nephtys cornuta franciscana		1	1
Nephtys ferruginea	1	1	
Nephtys sp. juv.		1	
Nereis procera		1	
Notocirrus californiensis		1	
Onuphidae, juv.		1	1
Onuphis iridescens		1	1
Paraprionspio pinnata	4	2	3
Pectinaria californiensis	3	3	1
Pholoe glabra	9	13	9
Phyllodoce (Anaitides) medipapillata	1		
Phyllodoce (Aponaitides) hartmanae		2	3
Pionosyllis sp.		1	1
Piromis eruca	1		
Pista fasciata	1	1	1
Pista sp. B	4		1
Polycirrus sp.	1		
Polynoidae	3		3
Praxillella affinis pacifica	7	7	14
Prionospio cirrifera		1	4
Prionospio steenstrupi	11	21	16
Rhamphobranchium longisetosum	1		
Scalibregma inflatum			1
Scoloplos armiger	1		
Siglionidae, juv.	1	1	
Sigambra tentaculata		1	
Spiochaetopterus costarum	1	3	4
Spiophanes berkeleyorum	3	5	2
Spiophanes bombyx	3	5	5
Spiophanes kroeyeri		1	
Spiophanes missionensis	40	36	38
Sternaspis fossor	8	7	7
Sthenelais verruculosa	1		
Sthenelanella uniformis	8	7	2
Tauberia gracilis	2	1	2
Terebellidae		2	
Terebellides sp. A		1	
Thalenessa spinosa	3		3

STATION 5 cont.	Rep 1	Rep 2	Rep 3
Tharyx spp.	3	2	2
Thelepus sp.		1	
ARTHROPODA			
Amphipoda			
Ampelisca agassizi	1		
Ampelisca brevisimulata	3	4	4
Ampelisca careyi = A. macrocephala	4	1	2
Ampelisca pugetica	1	2	2
Byblis veleronis	1	1	
Listriella cf. diffusa			1
Protomedeia articulata	1	2	1
Rhepoxynius bicuspidatus		6	1
Rhepoxynius menziesi	9	6	7
Rhepoxynius stenodes	3	1	
Synchelidium shoemakeri	1	2	
Westwoodilla caecula	1	2	
Cumacea			
Diastylis californica			1
Eudorella pacifica			1
Hemilamprops californica			1
Decapoda			
Callianassa sp. juv.	1		
Pinnixa occidentalis	4	1	2
Pinnotheridae juv.			1
Randallia sp. juv.	1		
Isopoda			
Gnathia crenulatifrons	3	1	1
Synidotea media			1
Ostracoda			
Bathyleberis californica	1		
Euphilomedes carcharodonta	2	2	4
Tanaidacea			
Leptochelia dubia			1
Leptognathia? spp.		3	3
MOLLUSCA			
Bivalvia			
Axinopsida serricata	1	1	1
Asthenothaerus villosior			1
Cooperella subdiaphana	2	1	
Modiolus neglectus	1		
Mysella golischi	1		
Mysella tumida	2	3	3
Nemocardium centifilosum	1		1
Nucula tenuis	1		
Nuculana taphira			2

STATION 5 cont.	Rep 1	Rep 2	Rep 3
Parvilucina tenuisculpta	39	16	15
Paramya sp.A			5
Psephidia ovalis	3	1	3
Saxicavella pacifica			2
Tellina carpenteri	1	2	
Thracia curta	1		
Gastropoda			
Acteocina sp.	1		
Cavolinia sp.			2
Epitonium sawinae	2	1	
Kurtzia arteaga	1		
Kurtziella beta	2	2	5
Scaphopoda			
Cadulus fusiformis	3	2	3
Cadulus quadrifissatus			1
Dentalium neohexagonum	1		
Aplacophora			
Chaetoderma sp. C	1		
Chaetoderma sp. F	2		2
ECHINODERMATA			
Asteroidea			
Asteroid juvs. (probably Astropecten)	1	1	1
Holothuroidea			
Leptosynapta ? sp.	3		1
Ophiuroidea			
Amphiodia digitata	5	6	8
Amphiodia urtica	32	39	35
Amphiodia spp. juv.	10	15	12
Amphioplus hexacanthus	1	1	1
Amphiura arcystata	5	6	2
Dougaloplus amphacantha			1
Ophiuroid unid. juv.	12	6	9
HEMICHORDATA			
Hemichordate unid. frags.	3	1	3

UNION STATION 6 SPECIES LIST

	Rep 1	Rep 2	Rep 3
COELENTERATA			
Cerianthidae unid.	2	5	3
Scolanthus sp. A. = Isoedwardsia sp. A		1	
Anemone #47 unid.		1	
Halianthella sp. A		1	
PLATYHELMINTHES			
Flatworm sp. #1			1
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B	1		
Enopla unid.	1	1	1
Lineus bilineatus	1	1	1
Tubulanus pellucidus	2	3	4
Tubulanus cf. nothus	1	1	
Nemertean frags.	3	2	6
ECHIURA			
Listriolobus pelodes	3	2	1
SIPUNCULA			
Golfingia catharinae	1		
BRACHIOPODA			
Glottidia albida	1		
PHORONIDA			
Phoronis sp.			4
ANNELIDA			
Polychaeta			
Acesta catherinae	1	4	1
Acesta, nr. catherinae		1	1
Allia nolani	1	2	
Allia ramosa	3	1	
Amaeana occidentalis	4	4	3
Axiothella rubrocincta	1		
Anobothrus gracilis	1		
Arabellidae			1
Artacamella hancocki		2	1
Aschyis disparidentata		1	
Brada villosa		1	
Capitella capitata		1	
Chloeia pinnata			1
Chone albocincta	1	2	
Chone veleronis		1	2
Cossura candida	3	6	1
Ephesiella brevicapitis	4	5	
Glycera capitata	2	6	1
Glycera robusta		1	
Glycera sp.			1

STATION 6 cont.	Rep 1	Rep 2	Rep 3
Glycinde armigera	1	2	2
Goniada maculata		1	
Gyptis brevipalpa	1	2	3
Harmothoe "lunulata"			1
Lanassa gracilis	1		1
Lumbrineris cruzensis		1	6
Lumbrineris lagunae			1
Lumbrineris sp D			2
Lumbrineris spp.	8	8	3
Magelona pitelkai	1		
Maldane sarsi	4	4	3
Maldanidae	3		
Mediomastus ambiseta	8	4	4
Mediomastus californiensis		4	
Mediomastus sp.	10	9	7
Myriochele heeri			2
Nephtys cornuta franciscana			1
Nephtys ferruginea	2		
Nephtys sp. juv.	2	3	3
Nereis procera			1
Ninoe gemma		3	2
Notomastus tenuis		1	
Notomastus sp.		1	
Onuphis geofiliformis		1	
Onuphis iridescens		1	
Paraprionspio pinnata	1	4	7
Pectinaria californiensis	8	12	5
Pherusa papillata		1	
Pholoe glabra	22	25	20
Phyllodoce (Anaitides) cuspida	1		
Phyllodoce (Aponaitides) hartmanae	1		1
Phyllodoce (Genetyllis) castanea			1
Pilargis maculata		1	
Pionosyllis sp.	1		
Piromis eruca			
Pista fasciata	1	2	1
Pista sp. B	1	1	1
Poecilochaetus johnsoni	1		
Polynoidae	3	2	
Pseudomalacocerus sp.		1	
Praxillella affinis pacifica	5	7	6
Prionospio cirrifera	2	13	6
Prionospio steenstrupi	8	8	5
Rhodine bitorquata	1		
Samytha californiensis		1	
Scoloplos armiger	2	3	3
Sigambra tentaculata	1	2	1
Spiochaetopterus costarum	1		
Spiophanes berkeleyorum	1	2	
Spiophanes bombyx			1
Spiophanes kroeyeri	2	1	3
Spiophanes missionensis	28	25	30
Sternaspis fossor	11	6	5

STATION 6 cont.	Rep 1	Rep 2	Rep 3
Sthenelanella uniformis	3		
Tauberia gracilis	4	7	2
Terebellides sp. A	1		1
Terebellides sp. B	1		
Terebellidae	1	1	
Tharyx spp.	7	9	9
Travisia pupa	3	3	3
ARTHROPODA			
Amphipoda			
Ampelisca brevisimulata	4	1	1
Ampelisca careyi = A. macrocephala			2
Ampelisca pacifica		1	
Byblis veleronis		1	2
Foxiphalus similis	1	1	2
Heterophoxus oculatus	2	1	1
Monoculodes norvegicus	1	1	
Protomedeia articulata	1	1	
Rhepoxynius bicuspidatus	14	19	9
Rhepoxynius menziesi	2	4	2
Westwoodilla caecula			2
Cumacea			
Campylaspis rubromaculata		1	
Diastylis cf. abbotti		1	
Diastylis sp. A (Given MS)		1	
Diastylis sp. E (New Species?)		1	1
Eudorella pacifica	1		
Leptostylis sp. B	1		
Leucon subnasica		1	
Mesolamprops bispinosa	1	1	
Decapoda			
Callianassa sp. juv.		2	
Pinnixa occidentalis		2	
Isopoda			
Gnathia crenulatifrons			2
Ostracoda			
Euphilomedes carcharodonta	5	3	1
Euphilomedes producta			1
Rutiderma lomae		1	
Tanaidacea			
Leptochelia dubia	1		
Leptognathia? spp.	2		2

STATION 6 cont.	Rep 1	Rep 2	Rep 3
MOLLUSCA			
Bivalvia			
Axinopsida serricata		1	
Cooperella subdiaphana			1
Hiatella artica	1		
Modiolus neglectus			1
Mysella compressa	3		1
Mysella tumida	4	3	7
Nemocardium centifilosum		3	
Parvilucina tenuisculpta	16	13	9
Psephidia ovalis	2		1
Tellina carpenteri	7	2	2
Thracia curta	2		
Gastropoda			
Aglaja ocelligera	1		
Bittium quadrifilatum		3	
Cylichna attonsa		4	1
Epitonium sawinae		1	2
Kurtzia arteaga		2	1
Kurtziella beta		3	1
Mitrella gouldi	1	4	
Odostomia (Evalea) sp. A			1
Turbonilla (Chemnitzia) sp. A			1
Volvulella californica	1		
Volvulella cylindrica			1
Volvulella panamica		1	
Scaphopoda			
Cadulus quadrifissatus	1		2
Aplacophora			
Chaetoderma sp. F		1	1
ECHINODERMATA			
Holothuroidea			
Leptosynapta ? sp.		1	1
Ophiuroidea			
Amphiodia digitata		3	3
Amphiodia urtica	79	79	71
Amphiodia spp. juv.	29	40	27
Amphioplus hexacanthus		1	
Amphiura arcystata	10	8	9
Ophiuroid unid. juv.	34	22	22
HEMICHORDATA			
Hemichordate unid. frags.	2	2	3

UNION STATION 7 SPECIES LIST

	Rep 1	Rep 2	Rep 3
COELENTERATA			
Cerianthidae unid. at least 2 species	7	14	9
Scolanthus sp. A. = Isoedwardsia sp. A	1	2	1
Anemone unid. Edwardsiidae			1
Anemone #44 frags.	1		
PLATYHELMINTHES			
Flatworm sp. #6	1		
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B	1	1	1
Micrura sp. frag.		3	1
Nemertean frags.		1	1
ECHIURA			
Listriolobus pelodes		3	
SIPUNCULA			
Golfingia sp. frag.		1	
BRACHIOPODA			
Glottidia albida	2	5	3
PHORONIDA			
Phoronis sp.		1	5
ANNELIDA			
Polychaeta			
Acesta catherinae	7	3	11
Acesta, nr. catherinae	1		3
Acesta horikoshii		1	1
Aedicira pacifica			1
Allia nolani			1
Allia ramosa	1		
Amaeana occidentalis	1		
Amphicteis scaphobranchiata		1	
Ampharetidae, juv.	1		
Asychis disparidentata	2		4
Chaetozone setosa	2		1
Chone albocincta			2
Chone veleronis	1		1
Clymenella longiceps		1	
Cossura candida	2		5
Glycera capitata		1	
Glycinde armigera	3	1	
Gyptis brevipalpa		1	1
Harmothoe "lunulata"		5	
Leitoscoloplos mexicanus		1	1
Lumbrineris cruzensis		1	
Lumbrineris spp.	2	5	4

STATION 7 cont.	Rep 1	Rep 2	Rep 3
Magelona pitelka	10	9	7
Maldanidae	1		1
Maldane sarsi			1
Mediomastus ambiseta	5	1	1
Mediomastus sp.	7	11	7
Nephtys caecoides	1	1	
Nephtys ferruginea		1	
Nephtys parva	1		
Nephtys sp. juv.	3	4	2
Notocirrus californiensis		1	
Notomastus sp.			1
Onuphis iridescens	3		
Paraprionspio pinnata	2	1	4
Pectinaria californiensis	5	3	2
Pholoe glabra	11	6	5
Phyllodoce (Anaitides) medipapillata	1	1	
Phyllodoce (Aponaitides) hartmanae			2
Pista fasciata	2		1
Pista sp. B	1	2	2
Polynoidae	4		1
Praxillella affinis pacifica	3	9	11
Prionospio cirrifera	1		
Prionospio steenstrupi	22	13	19
Spiophanes berkeleyorum	8	7	11
Spiophanes bombyx	2	3	4
Spiophanes missionensis	23	11	24
Spiophanes sp.			1
Spiochaetopterus costarum	3	1	2
Sternaspis fossor	4	7	4
Sthenelanella uniformis		3	3
Streblosoma crassibranchia			1
Terebellidae			1
Thalenessa spinosa	4	3	2
Tharyx sp.			1
Thelepus sp.			1
ARTHROPODA			
Amphipoda			
Ampelisca agassizi			1
Ampelisca brevisimulata	1	3	2
Ampelisca careyi = A. macrocephala		1	
Ampelisciphotis podophthalma			2
Amphideutopus oculatus	1		
Byblis veleronis			1
Foxiphalus obtusidens			1
Listriella cf. diffusa	1		
Protomedeia articulata	1		
Rhepoxynius bicuspidatus		2	2
Rhepoxynius daboius	1		1
Rhepoxynius menziesi	4	7	5
Rhepoxynius stenodes	2	2	4
Westwoodilla caecula	1	3	1
Amphipod frag. unid.	1		

STATION 7 cont.	Rep 1	Rep 2	Rep 3
Copepoda			
Harpacticoid unid.			1
Cumacea			
Campylaspis canaliculata		1	
Hemilamprops californica	1	1	
Decapoda			
Callianassa sp. juv.			1
Cancer sp. juv.			1
Crab Zoea	1		
Opisthopus transversus		1	
Pinnixa occidentalis	1		
Isopoda			
Gnathia crenulatifrons			2
Ostracoda			
Asteropella slatteryi	1		
Euphilomedes carcharodonta	1		4
Parasterope barnesi		1	
Rutiderma rostratum			1
Tanaidacea			
Leptognathia? spp.	2		
MOLLUSCA			
Bivalvia			
Axinopsida serricata	1	1	
Cooperella subdiaphana	1		
Compsomyax subdiaphana	3	3	
Crenella divaricata	1		
Macoma carlottensis	3	1	
Modiolus neglectus	2		
Mysella tumida	3		
Nucula tenuis		1	2
Parvilucina tenuisculpta	6	9	5
Siliqua lucida	1		
Tellina carpenteri	2	3	1
Thracia curta			1
Gastropoda			
Acteocina culcitella		1	1
Balcis micans		2	1
Bittium quadrifilatum	1		
Corambe sp. A			1
Cylichna attonsa	2	3	2
Epitonium sawinae	1	4	1
Eulima almo	4		2
Kurtziella beta	7	2	5
Nassarius perpinguis	1		1
Sulcoretusa xystrum		2	
Turbonilla (Chemnitzia) sp. A	1		
Turbonilla (Chemnitzia) sp. D	1		

STATION 7 cont.	Rep 1	Rep 2	Rep 3
Volvulella californica	1	2	2
Volvulella panamica		1	
Scaphopoda			
Cadulus fusiformis	2	4	5
Dentalium sp.	1		
Aplacophora			
Chaetoderma sp. F	2		
ECHINODERMATA			
Asteroidea			
Asteriod juvs. (probably Astropecten)			2
Holothuroidea			
Pentamera populifera = Eupentacta sp. Chevron 1982		1	
Ophiuroidea			
Amphiodia digitata	5	4	5
Amphiodia urtica	2	2	2
Amphiodia spp. juv.	2		2
Amphioplus hexacanthus	8	2	7
Amphipholis squamata	1		
Amphiura arcystata	1	3	1
Ophiura lutkeni		2	
Ophiuroid unid. juv.	2	3	3
HEMICHORDATA			
Hemichordate unid. frags.	3		3

UNION STATION 8 SPECIES LIST

	Rep 1	Rep 2	Rep 3
COELENTERATA			
Cerianthidae unid. at least 2 species	9	8	12
Scolanthus sp. A. = Isoedwardsia sp. A	2	1	1
Anemone unid. Edwardsiidae			1
Anemone #44 frag.	1		
PLATYHELMINTHES			
Flatworm sp. #1		1	
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B	1		4
ECHIURA			
Listriolobus pelodes	16	6	12
SIPUNCULA			
Golfingia sp frag.		1	
BRACHIOPODA			
Glottidia albida	9	9	5
PHORONIDA			
Phoronis sp.			1
ANNELIDA			
Polychaeta			
Acesta catherinae	3		2
Amaeana occidentalis	1	3	
Amphicteis scaphobranchiata		2	
Ampharetidae, juv.		1	1
Axnothella rubrocinctai	1		
Aricidea wassi		1	
Asychis disparidentata		1	
Brada villosa	3	1	
Chaetozone setosa	1	3	1
Chone veleronis	2	2	1
Chone sp.	1		
Diopatra sp. juv.			1
Ehlersia heterochaeta			1
Glycinde armigera	1	3	1
Harmothoe "lunulata"			2
Harmothoe priops			1
Lumbrineris sp.		2	1
Lysippe sp.		1	
Magelona pitelkai	5	4	4
Magelona sacculata	1	1	
Magelona sp.		2	
Maldanidae	3		2
Marphysa sp. juv.		2	
Mediomastus sp.			1
Mediomastus californiensis		1	1

STATION 8 cont.	Rep 1	Rep 2	Rep 3
Melinna oculata	1	1	2
Myriochele sp. M	2	2	
Nephtys caeroides	1	1	2
Nephtys ferruginea	1	2	
Nephtys sp. juv.	1	1	
Notomastus sp.		1	1
Onuphidae, juv.	3	2	
Onuphis iridescens	4	5	5
Paraprionspio pinnata	1	2	1
Pectinaria californiensis	1	1	1
Pholoe glabra	2	4	2
Phyllodoce (Anaitides) medipapillata	1	2	1
Phyllodoce (Aponaitides) hartmanae			1
Phyllodoce sp. juv.	1		
Pista fasciata	1	4	1
Pista sp. B	1		3
Pista sp. juv.	1		
Polycirrus sp.	1		
Praxillella affinis pacifica	1	3	3
Polynoidae	7	3	3
Prionospio steenstrupi	7	20	13
Scoloplos armiger		1	1
Scolelepis sp.	1		
Spiophanes berkeleyorum	3	5	3
Spiophanes bombyx	2	5	3
Spiophanes missionensis	51	63	40
Spiophanes sp.			1
Spiochaetopterus costarum	1	5	4
Sternaspis fossor	1		2
Sthenelais verruculosa	1	1	1
Sthenelanella uniformis		1	2
Streblosoma crassibranchia		1	
Thalenessa spinosa	3	7	1
ARTHROPODA			
Amphipoda			
Ampelisca brevisimulata		1	1
Ampelisca pugetica	1		1
Ampelisciphotis podophthalma	2		
Foxiphalus cognatus			1
Foxiphalus obtusidens	1		
Hippomedon zetesimus			1
Monoculodes hartmanae		1	2
Rhepoxynius daboius	1	3	1
Rhepoxynius menziesi		2	
Rhepoxynius stenodes	3	4	1
Westwoodilla caecula	3	2	
Cirripedia			
Arcoscalpellum californicum		8	
Cumacea			
Hemilamprops californica	2		2

STATION 8 cont.	Rep 1	Rep 2	Rep 3
Decapoda			
Callianassa sp. juv.	1	1	
Pinnixa tubicola	1		
Ostracoda			
Asteropella slatteryi	2		
Euphilomedes carcharodonta	4	4	2
Pycnogonidae			
Ammothea cf. spinoseta			1
Tanaidacea			
Leptognathia? spp.		1	1
MOLLUSCA			
Bivalvia			
Asthenothaerus villosior		1	1
Cooperella subdiaphana		1	
Leptopecten latiauratus		1	
Macoma carlottensis		3	
Modiolus neglectus		2	1
Mysella tumida		1	
Nuculana taphira	1	2	
Parvilucina tenuisculpta	2	3	2
Paramya sp.A	1	2	
Saxicavella pacifica		2	
Siliqua lucida	6		3
Tellina carpenteri		1	
Gastropoda			
Armina californica	1		
Balcis micans		1	1
Cylichna attonsa	1	3	2
Crepidula nummaria			2
Epitonium sawinae	1	1	
Eulima almo	1		
Kurtziella beta		1	
Mitrella gouldi			1
Nassarius perpinguis			3
Rictaxis punctoeaelatus		1	
Sulcoretusa xystrum	1		
Turbonilla (Chemnitzia) sp. A		1	
Turbonilla (Chemnitzia) sp. D	1		
Volvulella californica		1	
Volvulella sp.			1
Scaphopoda			
Cadulus fusiformis	6	6	
Aplacophora			
Chaetoderma sp. F		2	

STATION 8 cont.	Rep 1	Rep 2	Rep 3
ECHINODERMATA			
Asteroidea			
Asteroid juvs. (probably Astropecten)	2	1	
Holothuroidea			
Pentamera populifera = Eupentacta sp. Chevron 1982	1		1
Ophiuroidea			
Amphiodia digitata	5	3	2
Amphiodia urtica		1	
Amphioplus hexacanthus	4	5	4
Amphiura arcystata		1	2
Ophiuroid unid. juv.			1
HEMICHORDATA			
Hemichordate unid. frags.		1	1

UNION STATION 9 SPECIES LIST

	Rep 1	Rep 2	Rep 3
COLENTERATA			
Cerianthidae unid	7	3	5
Anemone unid. Edwardsiidae	2	1	4
Euphysa sp. A hydroid frags.		1	
PLATYHELMINTHES			
Flatworm sp. #1			1
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B	3	2	2
Cerebratulus sp. frag.	1		
Lineus bilneatus	2		
Nemertean frags.	1	1	3
ECHIURA			
Listriolobus pelodes	3		3
SIPUNCULA			
Golfingia sp.		1	1
BRACHIOPODA			
Glottidia albida	3		4
PHORONIDA			
Phoronis sp.	4		2
ANNELIDA			
Polychaeta			
Acesta catherinae	2	2	6
Amaeana occidentalis	1	1	2
Ampharetidae, juv.	1		
Amphicteis scaphobranchiata		3	
Axiothella rubrocincta			1
Asychis disparidentata	1		1
Carazziella cirtona		1	
Chaetozone setosa	4	3	2
Chone veleronis	2	1	1
Glycinde armigera	2	3	4
Goniada maculata			1
Gyptis brevipalpa	1		
Leitoscoloplos mexicanus		1	
Lumbrineris californiensis		1	
Lumbrineris sp.			1
Magelona pitelkai	6	2	4
Magelona sacculata	5	2	3
Maldanidae	1	1	1
Mediomastus californiensis		1	
Mediomastus sp.	3	3	5
Melinna oculata	1		4
Myriochele sp. M			2
Nephtys caecoides			1

STATION 9 cont.	Rep 1	Rep 2	Rep 3
Nephtys cornuta franciscana			1
Nephtys ferruginea			1
Nephtys sp. juv.		1	
Notocirrus californiensis	1	1	1
Onuphis iridescens	1	2	1
Parandalia fauveli			1
Paraonidae			3
Paraprionspio pinnata	2	3	3
Pectinaria californiensis	2		
Pholoe glabra	5	4	1
Pista fasciata	5	1	4
Pista sp. B			1
Polycirrus sp.		1	2
Polynoidae	1		1
Praxillella affinis pacifica	1	3	
Prionospio cirrifera	1		1
Prionospio pygmaea	2	1	1
Prionospio steenstrupi	7	4	11
Scoloplos armiger	3	2	3
Spiophanes berkeleyorum	3	2	5
Spiophanes bombyx	1	1	1
Spiophanes missionensis	37	10	16
Spiochaetopterus costarum	11	6	3
Sternaspis fossor	1		
Streblosoma crassibranchia		1	
Thalenessa spinosa	4	3	6
Travisia pupa	1		
ARTHROPODA			
Amphipoda			
Ampelisca brevisimulata	1		
Ampelisca careyi = A. macrocephala			1
Ampelisca pugetica	1		
Foxiphalus obtusidens		1	
Monoculodes hartmanae		1	
Rhepoxynius daboius	3	2	
Rhepoxynius lucubrans	1		
Rhepoxynius menziesi	4	4	4
Rhepoxynius stenodes	1	4	4
Rhepoxynius variatus	3		
Synchelidium shoemarkeri	1		
Amphipod frag. unid.		2	1
Cumacea			
Hemilamprops californica	2	1	1
Decapoda			
Pinnixa cf. franciscana		1	
Pinnotheridae juv.	2	1	
Isopoda			
Silophasma geminatum		1	

STATION 9 cont.	Rep 1	Rep 2	Rep 3
Ostracoda			
Asteropella slatteryi	1		
Euphilomedes carcharodonta	1		
MOLLUSCA			
Bivalvia			
Compsomyax subdiaphana	2		
Ensis myrae	1		
Mysella tumida	2	1	1
Nucula tenuis	1	2	1
Siliqua lucida	5	1	5
Solen sicarius	1		
Tellina carpenteri	1		1
Gastropoda			
Balcis rutila		1	
Cylichna attonsa	2		1
Epitonium lowei	1		
Kurtziella beta		1	
Nassarius perpinguis	2		
Turbonilla (Chemnitzia) sp. D		2	
Scaphopoda			
Cadulus fusiformis		9	3
Dentalium sp.		1	
Aplacophora			
Chaetoderma sp. F			1
ECHINODERMATA			
Echinoidea			
Echinoid juvs. (probably Dendraster)	1	1	2
Asteroidea			
Asteroid juv. (probably Astropecten)	1		
Ophiuroidea			
Amphiodia digitata		1	1
Amphiodia urtica	2	1	1
Amphioplus hexacanthus	3	6	1
Amphiura arcystata			1
Ophiuroid unid. juv.	1	1	
HEMICORDATA			
Hemichordate unid. frags.	3	2	2

UNION STATION 10 SPECIES LIST

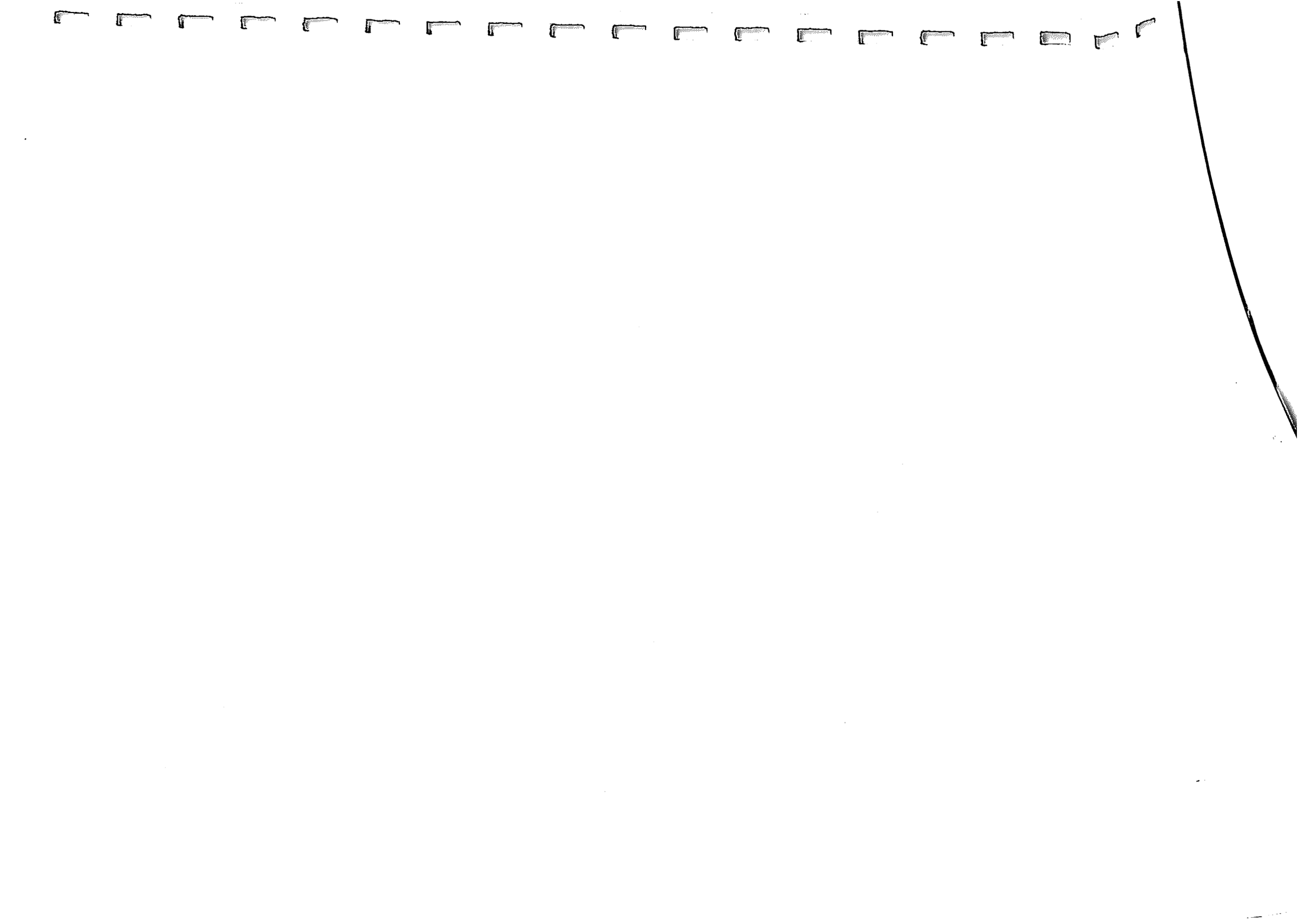
	Rep 1	Rep 2	Rep 3
COELENTERATA			
Cerianthidae unid.	3		1
Anemone unid. frags.		1	
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B		2	
Cerebratulus sp. frag.			5
Tubulanus pellucidus			1
ECHIURA			
Listriolobus pelodes	4	8	5
SIPUNCULA			
Golfingia sp. juv.			1
BRACHIOPODA			
Glottidia albida		1	7
PHORONIDA			
Phoronis sp.	2		
ANNELIDA			
Polychaeta			
Acesta, nr. catherinae		1	
Amaeana occidentalis	1		1
Ampharetidae, juv.			1
Amphicteis scaphobranchiata		2	1
Arabellidae			1
Brada villosa		1	
Chaetozone setosa	1	1	
Chone albocincta	1		
Diopatra sp.			1
Ephesiella brevicapitis	1		
Glycinde armigera	1	2	2
Harmothoe priops		1	
Hesionidae		1	
Lumbrineris spp.	1		
Magelona pitelkai	1		1
Magelona sacculata		4	1
Maldanidae			1
Mediomastus sp.			1
Melinna oculata		1	1
Nephtys caecoides	1	1	
Nephtys cornuta franciscana	1	1	
Nephtys sp.		1	1
Nephtys sp. juv.			2
Notomastus sp.			1
Onuphis iridescens	1	1	1
Paraprionspio pinnata		2	4
Pectinaria californiensis	1		
Pholoe glabra	2	7	2

STATION 10 cont.	Rep 1	Rep 2	Rep 3
Pista sp.	1		
Polynoidae	2	4	1
Praxillella affinis pacifica		1	
Prionospio cirrifera		1	
Prionospio pygmaea		1	1
Prionospio steenstrupi		2	1
Scoloplos armiger		1	4
Spiophanes berkeleyorum	1		3
Spiophanes bombyx	4	2	1
Spiophanes missionensis	20	15	18
Spiochaetopterus costarum	5	5	3
Sthenelanella uniformis		1	1
Streblosoma crassibranchia	1		2
Thalenessa spinosa	6	4	3
Typosyllis farallonensis	1		
ARTHROPODA			
Amphipoda			
Ampelisca cristata microdentata			1
Foxiphalus obtusidens	1		
Listriella melanica	2		
Monoculodes hartmanae	1	1	
Rhepoxynius daboius		1	1
Rhepoxynius lucubrans			1
Rhepoxynius menziesi		4	5
Rhepoxynius stenodes	7	5	9
Rhepoxynius variatus	1	2	1
Westwoodilla caecula	1		
Cirripedia			
Arcoscalpellum californicum			2
Cumacea			
Hemilamprops californica	1		1
Decapoda			
Pinnixa cf. franciscana	2		
Pinnotheridae juv.	1		
Ostracoda			
Asteropella slatteryi		1	1
Euphilomedes carcharodonta	1	1	3
Tanaidacea			
Leptognathia? spp.			1
MOLLUSCA			
Bivalvia			
Cooperella subdiaphana			1
Compsomyax subdiaphana			1
Ensis myrae			1
Macoma carlottensis			1
Nuculana taphira	1	1	1

STATION 10 cont.	Rep 1	Rep 2	Rep 3
Paramya sp.A		1	
Siliqua lucida	1		
Tellina modesta	2	3	2
Gastropoda			
Balcis micans	1		1
Nassarius perpinguis	1		
Olivella baetica		1	
Turbonilla (Chemnitzia) sp. D	1		
Turbonilla (Chemnitzia) sp. E	1	1	1
Volvulella californica		1	
Volvulella cylindrica	1		2
Scaphopoda			
Cadulus fusiformis	5	2	6
ECHINODERMATA			
Echinoidea			
Echinoid juvs. (probably Dendraster)	1	1	
Asteroidea			
Asteroid juvs. (probably Astropecten)	1	1	
Ophiuroidea			
Amphiodia urtica			2
Amphioplus hexacanthus	2	1	2
Amphiura arcystata	2	1	1
Ophiuroid unid. juv.	2		
HEMICHORDATA			
Hemichordate unid. frags.	1	1	1

UNION STATION 11 SPECIES LIST

	Rep 1	Rep 2	Rep 3
COELENTERATA			
Cerianthidae unid.		1	1
Hydroid frags.		1	
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B		3	
ECHIURA			
Listriolobus pelodes		1	
SIPUNCULA			
Golfingia catharinae		1	
BRACHIOPODA			
Glottidia albida	1	3	1
PHORONIDA			
Phoronis sp.	1		
ANNELIDA			
Polychaeta			
Ampharetidae, juv.		1	
Chaetozone setosa			1
Chone veleronis	1		
Glycinde armigera	1		2
Goniada maculata			2
Lumbrineris sp. D		1	2
Magelona pitelkai			1
Magelona sacculata			1
Mediomastus sp.		1	
Melinna oculata	1		
Notomastus sp.			2
Onuphis iridescens	1	2	5
Owenia collaris		1	
Paraprionspio pinnata	3	2	
Pholoe glabra			1
Phyllodoce (Anaitides) medipapillata		1	1
Phyllodoce (Anaitides) papillosa	1		
Pista fasciata		2	
Poecilochaetus johnsoni	1	7	11
Polynoidae		2	1
Potamilla sp.	1		
Praxillella affinis pacifica		1	2
Prionospio pygmaea	1		
Prionospio steenstrupi	1		2
Scoloplos armiger	1		1
Spiophanes berkeleyorum	4	1	3
Spiophanes bombyx		1	
Spiophanes missionensis		9	
Spiochaetopterus costarum	1	6	
Sthenelanella uniformis		1	



STATION 11 cont.	Rep 1	Rep 2	Rep 3
Terebellidae	1		
Thalenessa spinosa	10	7	2
Travisia gigas			1
ARTHROPODA			
Amphipoda			
Ampelisca careyi = A. macrocephala			1
Foxiphalus obtusidens			1
Hippomedon zetesimus			1
Megaluropus longimerus			1
Photis californica			1
Rhepoxynius abronius	1	4	7
Rhepoxynius daboius	1		
Rhepoxynius menziesi	4	3	4
Rhepoxynius stenodes	1	3	2
Rhepoxynius variatus	1	1	1
Cumacea			
Cyclaspis sp. C			1
Decapoda			
Heterocrypta occidentalis	1		
Pinnotheridae juv.	1		
Randallia sp. juv.			1
Ostracoda			
Asteropella slatteryi		2	
Euphilomedes carcharodonta	5	5	1
MOLLUSCA			
Bivalvia			
Cooperella subdiaphana			1
Mysella golischi		1	2
Mysella tumida			
Parvilucina tenuisculpta			1
Siliqua lucida	1	1	1
Solen rosaceus		1	
Tellina modesta	1	1	1
Gastropoda			
Balcis rutila	1		
Cylichna attonsa		2	2
Neverita reclusiana	1		
Turbonilla (Chemnitzia) sp. D	1		
Turbonilla (Chemnitzia) sp. E		1	
Scaphopoda			
Cadulus fusiformis	3	3	2
ECHINODERMATA			
Echinoidea			
Dendraster excentricus		5	

STATION 11 cont.	Rep 1	Rep 2	Rep 3
Asteroidea			
Asteroid juvs. (probably Astropecten)	1		
Ophiuroidea			
Amphiodia digitata		2	1
Amphiodia urtica		1	
Amphiodia spp. juv.	1	1	1
Ophiuroid unid. juv.	1	2	4
HEMICHORDATA			
Hemichordate unid. frags.		1	

UNION STATION 12 SPECIES LIST

	Rep 1	Rep 2	Rep 3
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B	1	1	5
ANNELIDA			
Polychaeta			
Caulleriella gracilis	1		
Glycinde armigera		1	1
Goniada maculata	1		1
Harmothoe priops	1		
Leitoscoloplos elongatus	1		
Leitoscoloplos mexicanus		1	
Lumbrineris cruzensis	1		
Lumbrineris sp.	1		
Magelona sacculata	1	3	2
Nephtys caecoides		1	1
Notomastus sp.			1
Onuphis iridescens		4	2
Paraprionspio pinnata	3	5	2
Pectinaria californiensis			1
Poecilochaetus johnsoni	3		2
Praxillella affinis pacifica		1	
Prionospio pygmaea		1	2
Prionospio steenstrupi		1	
Scoloplos armiger		1	1
Scolelepis squamata	1		
Spiophanes bombyx	1	1	
Spiophanes missionensis		2	5
Sthenelais verruculosa			1
Thalenessa spinosa	1		3
ARTHROPODA			
Amphipoda			
Eohaustorius sencillus	6	2	3
Foxiphalus major	1	1	1
Megaluropus longimerus	1		
Monoculodes spinipes		1	1
Rhepoxynius abronius	6	12	7
Rhepoxynius menziesi		2	
Decapoda			
Cancer gracilis	1		
Isopoda			
Tecticeps cf. convexus		20	
Ostracoda			
Euphilomedes carcharodonta	4	11	7

STATION 12 cont.

MOLLUSCA			
Bivalvia			
Cooperella subdiaphana			3
Mysella golischi		2	2
Nuculana taphira		1	
Siliqua lucida	1	2	1
Gastropoda			
Kurtziella beta	1		
Nassarius perpinguis	1		1
Olivella baetica	1		
Turbonilla (Chemnitzia) sp. E	6		
Volvulella cylindrica		2	
Scaphopoda			
Cadulus fusiformis	1		
Dentalium sp.			1
ECHINODERMATA			
Echinoidea			
Dendraster excentricus	7	8	8
Ophiuroidea			
Amphiodia digitata	1	1	
Ophiuroid unid. juv.	4	1	

UNION STATION 13 SPECIES LIST

	Rep 1	Rep 2	Rep 3
COELENTERATA			
Campanularia sp. A hydroid	1		
Corymorpha nr. bigelowi hydroid	1		
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B	2	1	1
ANNELIDA			
Polychaeta			
Glycinde armigera	1		1
Goniada maculata			1
Goniada sp.		1	
Magelona pitelkai			3
Magelona sacculata	2	2	4
Nephtys parva	1		
Nephtys sp.		1	
Onuphis iridescens	1	1	
Orbiniidae		1	
Paraprionspio pinnata	3	3	6
Praxillella affinis pacifica		1	
Prionospio pygmaea	1	2	2
Spiophanes bombyx		2	
Spiophanes sp.	1		
Sthenelais verruculosa			1
Terebellidae, juv.	1		
Thalenessa spinosa	2	1	3
Travisia gigas	1		1
ARTHROPODA			
Amphipoda			
Ampelisca careyi = A. macrocephala	6	2	
Eobrolgus spinosus	1		
Eohaustorius sencillus	8	8	1
Megaluropus longimerus	1	3	
Monoculodes spinipes	1	4	1
Rhepoxynius abronius	11	3	9
Rhepoxynius menziesi	4	1	3
Synchelidium shoemakeri		1	
Cumacea			
Mesolamprops dillonensis		1	1
Decapoda			
Crab Zoea	1	1	
Isopoda			
Edotea sublittoralis			1
Tecticeps cf. convexus			1
Mysidacea			
Neomysis kadiakensii			1

STATION 13 cont.	Rep 1	Rep 2	Rep 3
Ostracoda			
Euphilomedes carcharodonta	2	1	3
MOLLUSCA			
Bivalvia			
Siliqua lucida	1	1	1
Gastropoda			
Nassarius perpinguis	1	1	
Neverita reclusiana	1		
Olivella pycna		1	
Turbonilla (Chemnitzia) sp. E	1	1	
ECHINODERMATA			
Echinoidea			
Dendraster excentricus	7	8	8
Ophiuroidea			
Ophiuroid unid. juv.		1	2

UNION STATION 14 SPECIES LIST

	Rep 1	Rep 2	Rep 3
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B	1	2	11
Nemertean frags.	1		2
PHORONIDA			
Phoronis sp.		1	
ANNELIDA			
Polychaeta			
Glycinde armigera	1		
Magelona sacculata		1	2
Mediomastus acutus	1		
Nainereis uncinata			1
Notomastus sp.		1	
Onuphis iridescens	1	1	2
Owenia collaris		1	
Paraprionspio pinnata	2		1
Poecilochaetus johnsoni			3
Polynoidae			1
Spiophanes bombyx	1		1
Thalenessa spinosa	1	3	6
ARTHROPODA			
Amphipoda			
Ampelisca agassizi			1
Eohaustorius sencillus	10	12	19
Foxiphalus major	4		
Monoculodes spinipes	2		
Rhepoxynius abronius	7	6	9
Rhepoxynius menziesi		1	
Rhepoxynius sp. A		1	
Synchelidium shoemakeri			1
Cumacea			
Mesolamprops dillonensis			1
Decapoda			
Isocheles pilosus	1		2
Lepidopa myops			1
Opisthopus transversus			1
Isopoda			
Tecticeps cf. convexus	1	1	
Mysidacea			
Acanthomysis davisi		1	

STATION 14 cont.	Rep 1	Rep 2	Rep 3
MOLLUSCA			
Bivalvia			
Macoma sp.	1		
Mysella golischi			2
Siliqua lucida			1
Yoldia cooperi		1	
Gastropoda			
Nassarius perpinguis		1	
Olivella pycna	1	5	10
ECHINODERMATA			
Echinoidea			
Dendraster excentricus	2	5	4
Ophiuroidea			
Amphiodia digitata	1		
Ophiuroid unid. juv.	1		

UNION STATION 15 SPECIES LIST

	Rep 1	Rep 2	Rep 3
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B		1	
Micrura sp. frag.			1
Nemertean frags.		1	
ANNELIDA			
Polychaeta			
Dispio uncinata		1	1
Eteone dilatae		1	
Magelona sacculata			7
Nephtys parva	1		1
Prionospio pygmaea			1
Spio filicornis		2	
Spiophanes bombyx			1
Spiophanes missionensis			1
Spiochaetopterus costarum			1
ARTHROPODA			
Amphipoda			
Eohaustorius sencillus	5	5	3
Megaluropus longimerus		3	
Monoculodes spinipes	1	1	
Rhepoxynius abronius		1	
Rhepoxynius menziesi		1	
Cumacea			
Diastylopsis dawsoni	2	13	
Diastylopsis tenuis		1	
Lamprops tomalesi		3	
Decapoda			
Blephariopoda occidentalis		1	1
Isopoda			
Tecticeps cf. convexus	8	8	
MOLLUSCA			
Gastropoda			
Olivella pycna	1	1	1
ECHINODERMATA			
Echinoidea			
Dendraster excentricus	1	1	

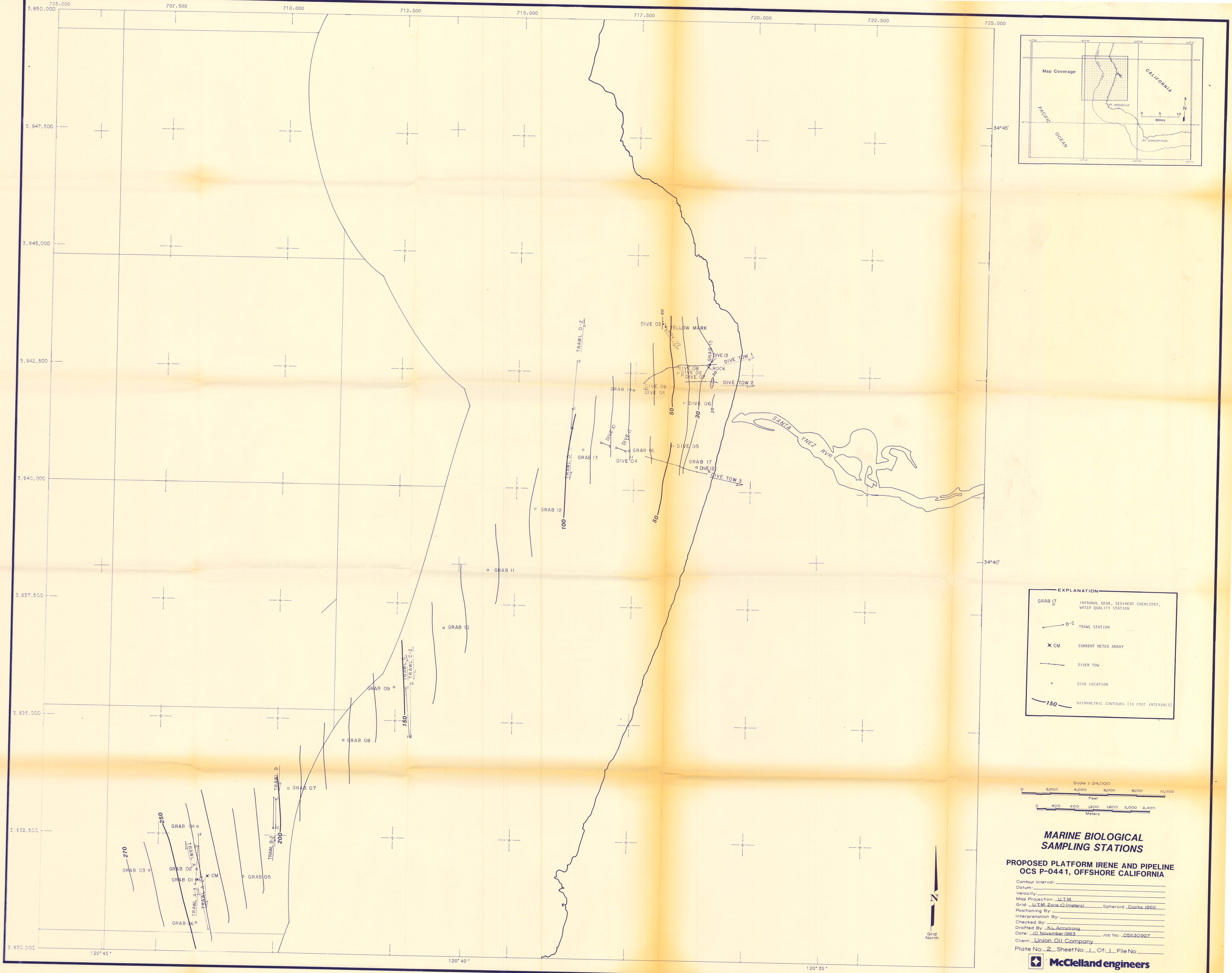
UNION STATION 16 SPECIES LIST

	Rep 1	Rep 2	Rep 3
COELENTERATA			
Anemone unid. frags.			1
NEMERTEA			
cf. Carinoma sp. = Nemertean sp. B	4	1	4
ANNELIDA			
Polychaeta			
Capitellidae		1	
Chaetozone setosa	1	1	
Dispio uncinata			1
Glycinde armigera	1		
Megalona pitelkai		2	
Nephtys sp.		5	1
Onuphis iridescens	3	1	1
Poecilochaetus johnsoni			1
Polynoidae, juv.		1	
Scoloplos armiger	1	3	
Thalenessa spinosa	1	5	2
Typosyllis sp.		1	
ARTHROPODA			
Amphipoda			
Eohaustorius sencillus	26	8	32
Foxiphalus major	1	1	4
Mandibulophoxus gilesi		4	
Megaluropus longimerus	1		
Monoculodes spinipes			2
Photis lacia		6	
Rhepoxynius abronius	9	9	10
Cumacea			
Mesolamprops dillonensis			1
Decapoda			
Lepidopa myops	1		1
Shrimp frags.	1		
Isopoda			
Bathycopea daltonae	1	1	1
Tecticeps cf. convexus			2
MOLLUSCA			
Bivalvia			
Macoma sp.			1
Modiolus neglectus		1	2
Tellina bodegensis			1
Thecodonta oblongus		9	

STATION 16 cont.	Rep 1	Rep 2	Rep 3
Gastropoda			
Neverita reclusiana	1		
Olivella pycna	49		
ECHINODERMATA			
Echinoidea			
Dendraster excentricus (mostly juveniles)	6	131	6
Ophiuroidea			
Ophiuroid unid. juv.	1	1	1

UNION STATION 17 SPECIES LIST

	Rep 1	Rep 2
NEMERTEA		
cf. Carinoma sp. = Nemertean sp. B	2	
ANNELIDA		
Polychaeta		
Hesionura coineau difficilis	2	
Nephtys sp.		3
ARTHROPODA		
Amphipoda		
Eohaustorius sencillus		1
Decapoda		
Shrimp frags.		1
MOLLUSCA		
Gastropoda		
Olivella pycna	1	



Map Coverage
CALIFORNIA
PACIFIC OCEAN
PT. ARGUELLO
PT. CONCEPTION
Miles
EXPLANATION
GRAB 17 INFAUNAL GRAB, SEDIMENT CHEMISTRY, WATER QUALITY STATION
B-2 TRAWL STATION
CM CURRENT METER ARRAY
DIVER TOW
DIVE LOCATION
150 BATHYMETRIC CONTOURS (10 FOOT INTERVALS)
SANTA YNEZ RVR
YELLOW MARK
ROCK
DIVE TOW 1
DIVE TOW 2
DIVE TOW 3
GRAB 03
GRAB 02
GRAB 01
GRAB 04
GRAB 05
GRAB 06
GRAB 07
GRAB 08
GRAB 09
GRAB 10
GRAB 11
GRAB 12
GRAB 13
GRAB 14
GRAB 16
GRAB 17
TRAWL B
TRAWL B-2
TRAWL D-2
TRAWL C-2
CM
DIVE 01
DIVE 02
DIVE 03
DIVE 04
DIVE 05
DIVE 06
DIVE 08
DIVE 09
DIVE 12
DIVE 13
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200
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100
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707.500
710.000
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717.500
720.000
722.500
725.000
34°45'
34°40'
120°45'
120°40'
120°35'
N
Grid North

Scale 1:24,000

0 2,000 4,000 6,000 8,000 10,000 Feet

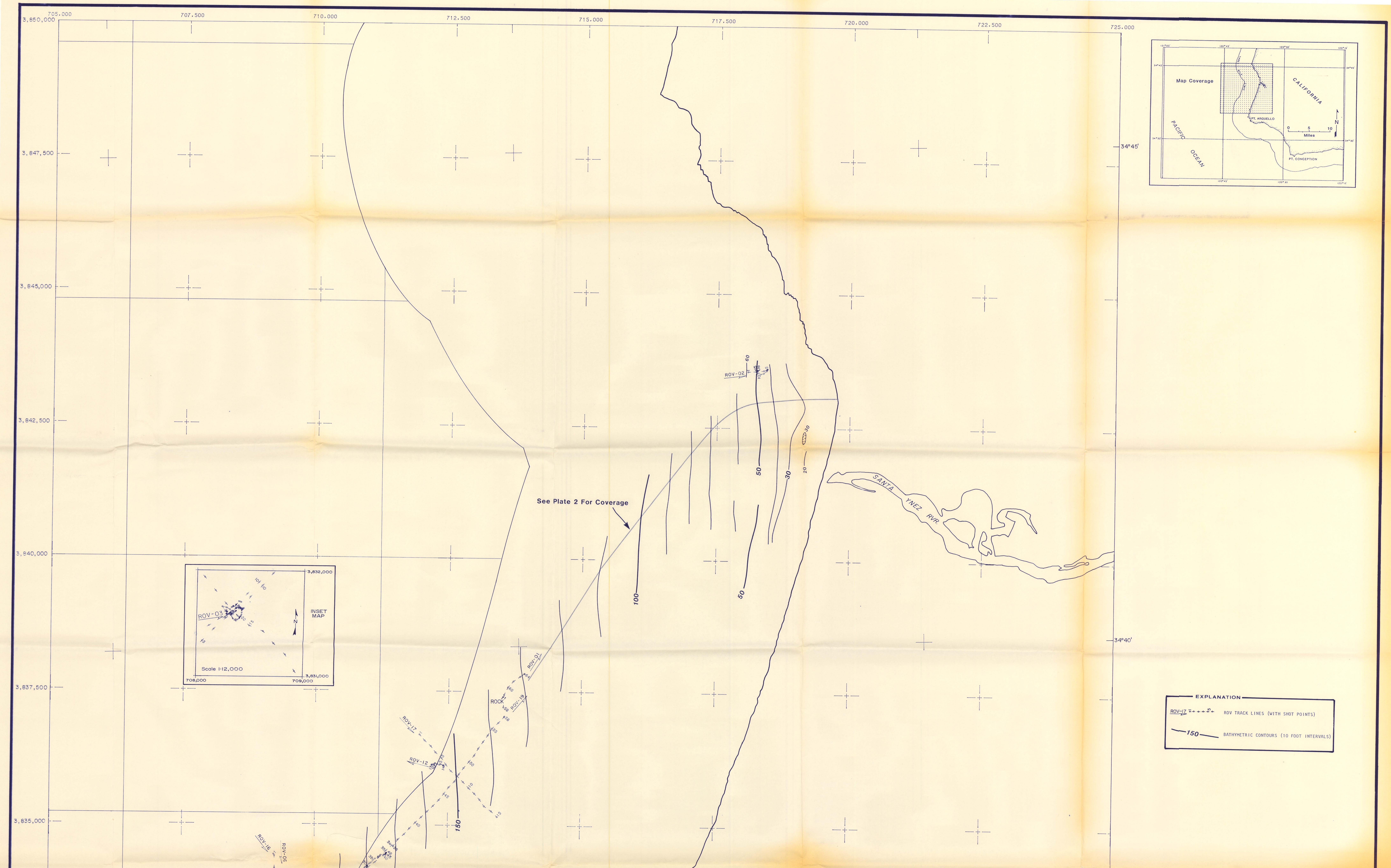
0 400 800 1,200 1,600 2,000 2,400 Meters

MARINE BIOLOGICAL SAMPLING STATIONS

PROPOSED PLATFORM IRENE AND PIPELINE OCS P-0441, OFFSHORE CALIFORNIA

Contour Interval:
Datum:
Velocity:
Map Projection: U.T.M.
Grid: U.T.M. Zone 10 (meters) Spheroid: Clarke 1866
Positioning By:
Interpretation By:
Checked By:
Drafted By: K.L. Armstrong
Date: 10 November 1983 Job No.: 05830927
Client: Union Oil Company
Plate No: 2 Sheet No: 1 Of: 1 File No:

McClelland engineers



EXPLANATION

ROV-17 ROV TRACK LINES (WITH SHOT POINTS)

150 BATHYMETRIC CONTOURS (10 FOOT INTERVALS)

Scale 1:24,000

0 2,000 4,000 6,000 8,000 10,000
Feet

0 400 800 1,200 1,600 2,000 2,400
Meters

ROV RECONNAISSANCE TRACK LINES

PROPOSED PLATFORM IRENE AND PIPELINE OCS P-0441, OFFSHORE CALIFORNIA

Contour Interval:
Datum:
Velocity:
Map Projection: U.T.M.
Grid: U.T.M. Zone 10(meters) Spheroid: Clarke 1866
Positioning By:
Interpretation By:
Checked By:
Drafted By: K.L. Armstrong
Date: 10 November 1983 Job No.: 05830927
Client: Union Oil Company
Plate No.: 1 Sheet No.: 1 Of: 1 File No.:

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