SURVEY PLAN
SITE-SPECIFIC MARINE BIOLOGICAL SURVEY
SHAMROCK PROJECT
LEASE OCS P-0440 AND PIPELINE CORRIDORS
FOR EXXON COMPANY U.S.A.

APRIL 2, 1984

MINERALS MANAGEMENT SERVICE
PACIFIC OCS REGION
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FIELD OPERATIONS
LOS ANGELES

Dames & Moore
MARINE SERVICES
LOS ANGELES, CALIFORNIA

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April 25, 1988

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Exxon Company, U.S.A.
Attention: Mr. D. F. Jarnett
P.O. Box 6752
Thousand Oaks, California 91360

re: [illegible], Biological Survey,

Gentlemen:

This confirms our verbal approval of Exxon Company, U.S.A.'s "Survey Plan, Site-specific Marine Biological Survey, Pedernales Project, Lease [illegible] and Alcalde Carriers" as delivered to this office on April [illegible], 1988. Arrangements have been made for a Minerals Management Service representative, Ms. Donna Cooksey Brewer, to participate in the survey.

Sincerely,

[signature]

Thomas C. [illegible]
Chief, Environmental Supervisor
Field Operations Section

LOS ANGELES, California

bcc: File: Pt. Pedernales Field, POO Corres.
Chron
RII
L&E0--Chief, Env Ops Sect
Ms. Donna Cooksey Brewer
F&O--Ops Rev & App Sect

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1.0 INTRODUCTION

Exxon's Shamrock project includes the installation of a platform on Lease OCS P-0440 and a pipeline corridor either generally eastward to Union Oil Company's proposed Platform Irene or south toward Chevron's proposed Platforms Hidalgo and Hermosa. Dames & Moore will carry out the site-specific marine biological survey of the platform site and alternative pipeline corridors. The program proposed in this Survey Plan has been designed to meet MMS standards, the requirements of NTL 78-1, and to conform with programs accepted by federal and state agencies for recent, similar projects in the southern California OCS.

The platform site lies in 80-90 m of water within an area of soft bottom habitat northwest of Point Arguello in the northeast quadrant of Lease P-0440 (Figure 1). Bathymetric data show no steep topography at the platform site and the exploration geohazards map shows no rock outcrops near the platform site. The head of a submarine canyon occupies the southwest quadrant of the lease, well outside the proposed pipeline corridor and about 2 mi from the platform site. Isolated rock pinnacles were observed in the canyon head area during the exploration geophysical survey. A brief review of directly measured, satellite inferred and geostrophic calculated currents suggests that the predominant surface current direction is to the north and west, however the site appears to be in a location with highly variable currents. Bottom currents appear to be more toward the south and east.

The survey report will include a review of the marine biological data from the western Santa Barbara Channel and southern Santa Maria Basin regions. Those data include the BLM Benchmark sample transects off Point Conception, the SCCWRP 60-m trawl stations number 1-4, the State of California grab samples between Point Conception and Point Arguello,

Dames & Moore's trawl and grab samples from the Platform Hermosa site, the recently completed survey of Union's Platform Irene site to the east, the ongoing MMS reconnaissance survey, Dames & Moore's video survey of Leases P-0446, -0447, -0450, -0451, and -0452, and more generic sources. The P-0440 exploration environmental report contains regional biological information, but no comparable site-specific data.

2.0 STUDY PLAN

Dames & Moore will carry out a site-specific marine biological survey of Lease P-0440 and the alternate pipeline corridors using both video and grab/trawl sampling. In this section of the survey plan, we have described the purpose of the survey and the details of our proposed scope of work.

2.1 Purpose

The purpose of this program is to meet the requirements of NTL 78-1. The purpose of the field portion of this project is to mobilize and carry out a marine biological survey of the platform site on Lease P-0440 (Figure 1) and two alternative pipeline corridors. The principal survey elements include: a video survey of the head of the submarine canyon in the southwest quadrant of the lease; and, quantitative infaunal samples and semi-quantitative trawl samples of the macroepifauna at the platform site, at the head of the canyon and along the pipeline corridors. In addition, 35-mm photodocumentation of sampled habitats and supporting physical and chemical measurements will be made.

2.2 Video Survey

2.2.1 Operations Plan

We will conduct six video transects in the head of the submarine canyon in the southwest quadrant of P-0440 (see Figure 1). Four will be run parallel to depth contours and intended to intersect the apparent outcrop features detected during the exploration geohazards survey. Two others will be run down slope along the approximate axis of the canyon and on its southern flank (where no rocky features are indicated).

Each dive would encompass 30 minutes of reconnaissance video record in addition to any ~~time spent~~ collecting samples. Representative still color photos of indicative fauna will be taken. We estimate 30 to 50 per dive. We will use the black-and-white video camera for habitat perspective overviews (it will have a greater depth of field) and the color camera for faunal identification and closer views of the habitat. Rock and specimen samples will be collected. We would expect to collect between 5 and 10 rock samples.

We will initiate the survey as soon after completion of the ongoing shallow hazards survey as a ~~weather~~ window will allow. We expect that to be about April 16. We will complete video surveys on a priority basis as weather conditions allow. If weather prevents submersible operations, but does not require the Aloha to leave station we will take grab samples while waiting for weather conditions to improve. Once the video work is completed, we will demobilize the Aloha and finish the grab/trawl work from the R/V Seawatch (Section 2.3).

2.2.2 Surface Support Vessel

Dames & Moore proposes to use the M/V Aloha as its surface support vessel. The Aloha is a 143-foot research support vessel available in California (home-ported in Ventura) from International Underwater Contractors (IUC). The Aloha is specially fitted out to provide support for submersible operations and has ample aft deck space and a hydraulic A-frame ("U"-frame") to support benthic sediment sampling. The vessel is powered by twin diesel engines to twin screws and has a 360° trainable bow thruster which is capable of moving the vessel (on its own) at 4 knots and which will be used to maintain position on station. Figure 2 shows a side view and plan of the Aloha and lists her specifications. A precision recording fathometer is located in the bridge and will provide us with a station-by-station paper copy of depth readings.

The Aloha meets the following specifications:

- Sufficient size to support all operations and to maintain station in unfavorable weather.
- Equipped with bow thruster for station-keeping, especially during submersible operations.
- Sufficient working space to provide ample working room on deck for sample handling and ample space in a sea-tight room for the video observation team.
- Experience in submersible operations.
- Sufficient berthing capacity for crew, the Dames & Moore team and observers.
- Stores, fuel and water sufficient for more than three times the expected cruise duration.

- o Minimum logistical requirements (winches, port-a-cabins, A-frame, crane and other major hardware requirements).

- o Sufficient cruising speed to cover the more than 200 nautical miles of cruise track with a minimum of delay.

The presence of the bow thruster is, in our opinion, critical to station keeping. The Aloha's bow thruster is steerable to provide maximum assistance in maintaining position. There is a 500 ft^2 (20 x 25 ft) clear aft working area and 50 ft of clear deck behind the area used for the submersible (Recon IV, see below). We have not proposed to use the untethered submersible Mermaid which is usually used aboard the Aloha. This frees the after area for sediment sample handling.

There is ample clear, easily accessible closed work space immediately forward of the submersible launching position ("client work area" in Figure 2), which will be used for the video observation space. The Aloha has 23 berths, and her crew will use only 10 of these. Dames & Moore plans a crew of 5, which leaves ample space for observers.

The Aloha is specifically outfitted for submersible operations. All required winches, cranes, power, supplies and support equipment for diving operations are in place and require no mobilization time or costs. She has supported more than 500 prior diving operations. Her skipper, Randy Stinnet, has operated the Aloha for more than 30 diving operations, and has 8 years of live-boat experience in supporting related kinds of diving surveys.

IUC will mobilize a light-wire, highspeed winch to support grab sampling and trawling. It will be operated through the Aloha's aft "U-frame" (see Figure 2). Specific samplers are discussed below.

The Aloha makes 12 knots cruising speed. We estimate that this will keep cruising time to under 25 percent of field time. The remaining field time will be about equally divided between station-keeping and drifting, both of which have much lower fuel consumption rates (= cost per hour) than cruising time.

Since the Aloha can hold sufficient fuel and stores for more than three times the planned cruise duration, there will be no time loss for returning to port for provisioning. This is especially important when working in an area remote from a port facility. She is large enough to support both the submersible and sediment sampling activities and to carry the necessary ship's and scientific party to accommodate all planned operations.

2.2.3 Submersible

Dames & Moore proposes to use the unmanned, tethered submersible Super Recon IV to provide the visual surveillance of hard bottom (and associated soft bottom) habitats, and to collect rock samples. The SR IV is capable of working to depths of 700 m, more than twice the depth of the deepest station we have proposed. She is equipped with a manipulator arm, and will be carrying both a black-and-white and color television camera and a 35-mm still camera. The SR IV is shown in Figure 3, which also details its specifications.

When reviewing submersible options for this project, Dames & Moore called upon its experience in carrying out the Chevron Hermosa Platform and Arguello Exploration Area site-specific marine biological surveys. The principal advantages conveyed by the use of a tethered vehicle are:

- Ease of launch/recovery reduces handling time and greatly broadens the operational weather window.

- The continuous connection to the support boat minimizes safety concerns both in at-depth operations (the SR IV can be winched aboard in the event of total loss of vehicle operability), and in eliminating the need to secure a line to the submersible in high seas at the end of the dive.

- Most critically, all reasonably costed untethered submersibles are restricted to a single technical observer (plus the pilot); this provides a strong source of taxonomic bias; the umbilical provides a live feed to the surface so that a suite of taxonomic experts and the MMS observers can all have the same live view of the bottom; the "live" character allows observers to stop, slow or redirect the submersible to obtain a better view of species of interest.

The live feed to the surface will output at 13" color monitors in the vehicle control shack and (two) in the observation team's work area (as well as in the galley to keep interested off-duty personnel away from the work area). Communication between the Chief Scientist and the observation team will allow optimum input to the pilot for controlling speed of the vehicle through the study area, for control of where and when to take closer views or different angles, of where to collect samples. The umbilical system will also minimize both unproductive operational time and risk.

The SR IV is outfitted with thrusters vectored for both vertical and transverse movement, digital depth gauge, separate black and white and color TV and a 35mm 250 exposure camera. The Aloha is uniquely outfitted to make maximum use of the live video and unlimited umbilical power of the SR IV system. The launch and retrieval systems installed for each vehicle, combined with the trainable bow thruster, allow operation in Sea State 4 without risk of entanglement in ships

propellors. The use of the RS-7 tracking system with SR IV allows the Aloha to maintain best position to help manage the umbilical and to keep from pulling SR IV off course (see Navigation, below).

Video feed from the SR IV will be played through a VHS Video Tape Recording System (with complete backup). This system is the same type we used in our prior survey and is compatible with MMS equipment. A time/date generator and a character generator will be available to label the tape. We will provide 20 hours of blank color videotape (for best resolution we will use high speed time, which will require 10 two-hour tapes). A microphone will be installed in the active recorder for voiceover in-field comments by the Chief Scientist. As soon as any tape is concluded, the preloaded standby recorder will be switched on so that there is no loss of coverage. All completed tapes will have their tabs pulled immediately to avoid the possibility of subsequent erasure or tape-over. The tapes will be labeled and stored in the observation team work area.

The color still camera (Photosea 1000 system) will be triggered directly from the surface. The Chief Scientist will direct its use with input from the observational team. A still photo log will be kept by a designated member of the observation team. Each triggered shot will be given film roll number and sequence number. Completed rolls will be labeled and refrigerated. When the accession number approaches the end of a roll, we will change film before the next dive.

Based upon our experience with other remotely piloted submersibles, we have designed a sample holding system which will work well with the form of the SR IV submersible. The frame will bolt to the manipulator arm. The opening in the top will be 10 x 12 in. The frame will have a rigid vertical support of 16 in to keep samples from being pushed out of the

bag when the vehicle is resting on the bottom. The bags will be made of 18 oz plastic and will have a double mesh panel (1/8 in over 1/16 in) on the outer face near the bottom of each. The bags will have eyes in the seams at the top and rings sewn to the bottom. Through these the bags will be tied into the frames.

The vehicle will stop when directed, settle to the bottom and pick up two specified rock samples, one of which will be placed in each bag. As the entire system (vehicle, arm and sample container) will be a single unit, the relative motion problems of a remotely piloted vehicle and a separate container are removed. The flexible sides of the bag will minimize post-collection damage to specimens and specimen escape, and the depth of the bag will eliminate most of the problems of the samples being washed by the vehicle's movement.

Upon reaching the surface, the water will drain through the screen panels. On deck, the bags will be untied and the rock removed and placed in a 5-gallon bucket of seawater. Then the bag will be inverted into the bucket and gently washed to remove retained, loose epifauna which came from the rock. The observation team (and especially Dr. Hochberg; see Section 2.4, below) will make notes on the live materials and will make 35-mm photographic records of each rock. Each rock will be separately labeled with station and sample number and with a reference to notes made. Delicate specimens will be placed in separate jars, labeled identically and the jars included in the bucket containing the rock. These samples will all be preserved in buffered (Borax) seawater formalin (c.10%), and stored in the paint locker.

The observation team will also keep notes during each dive. Reconnaissance observation periods on each dive will be limited to 30 minutes (exclusive of sample pick up time). Notes will be made of species, habitat types, levels of

abundance and habitat conditions. The Chief Scientist will provide a direct depth readout into the voiceover on the tape and to the observation team whenever there is any significant change (>1 m) or at five minute intervals, whichever comes first. There will be a navigation system repeater in the observation team's work room, and one member of the team will be responsible for recording fixes at photo locations, at sample pickup points, at significant habitat change points, (e.g., outcrops, hard-to-soft bottom transition, artifacts), at least once each five minutes (= 100 to 250 feet), and at the start and stop point of each dive.

2.2.4 Navigation

The Aloha is equipped with a Honeywell RS-7 acoustic navigation system for providing ship/submersible relative position. In addition, a Mini Ranger III system will be used to calculate ship/shore position. A post plot of actual submersible position will be produced from these data.

2.2.5 Sample Handling

Rock samples will be delivered to Marine Ecological Consultants (MEC) for sorting. Species groups will be divided between MEC and the Santa Barbara Museum of Natural History (SBMNH). Specimens will be identified to the species level or to the lowest practicable taxonomic level when specimen condition, immaturity, systematic unclarity or other problems prevent species identification. Vouchers will be maintained at the SBMNH.

Video data will be reviewed in the office and species identified to as low a level as practicable. A description of faunal associations and habitats will be prepared. These data will be compared to similar studies in the region.

2.3 Grab/Trawl Survey

The following outline provides the details of the planned grab/trawl survey of the platform site and pipeline corridors:

1. Infaunal samples will be collected in triplicate with a Smith-McIntyre grab sampler; nested 1.0 and 0.5-mm screens will be used for sieving; the 1.0-mm fraction samples from each of seven stations (Figure 1) will be analyzed for all three replicates; identification will be to the lowest practicable taxon with the species level being the target; depth distribution of samples will be between 70 and 200 m.

2. Paired, parallel trawl samples will be taken using a 30-foot otter trawl for 5- to 10-minute tows at each of the 4 stations shown in Figure 1 for a total of 8 trawls (depths of approximately 80 to 150 m). Samples with insufficient recoveries as determined by the Chief Scientist's experience will be repeated until a sufficient sample has been collected or until no improvement in recovery is observed. All field identifiable specimens (to the species level) will be measured, counted and identified aboard the survey vessel. Representative specimens of each species will be retained as vouchers and the remainder returned overboard. Specimens not identifiable to the species level on station will be retained for laboratory processing to the lowest practicable taxonomic level.

3. Bottom still photographs will be taken using a Benthos 35-mm remote camera. A series of 5 to 6 frames will be attempted at each grab sample station. Based on our prior work over these sedimentary bottoms, we find that species identification is as good

with black and white film as with color, and we recommend its use because of its better resolution and higher percentage of data return.

4. Sediment subsamples will be taken from the grab sample for characterization of sediment quality. Sediments will be analyzed for oil and grease, total organic carbon and grain size. We will report grain size as percent sand, silt and clay. For any stations with less than 50 percent fines, we will subdivide the sand fractions by percent whole phi units. We will analyze grain size for every replicate (21 samples) and TOC/oil and grease from one replicate at each station and all three replicates at the platform site (9 samples).

5. We will collect surface and near-bottom water samples with Van Dorn bottles and measure dissolved oxygen, temperature and salinity on deck with portable calibrated meters (YSI DO and T/S meters). Surface and bottom samples will be collected at each grab sample station (7 samples each). We will make qualitative observations of the presence or absence of signs of deleterious dissolved oxygen levels on the bottom (black sediment in the grab; hydrogen sulfide odor in sample) and will supplement any positive observations with additional dissolved oxygen measurements taken from the Van Dorn sampler and using the YSI DO meter.

6. All observations of marine mammals will be recorded. Species will be identified to the extent that critical features are visible. All bird species observed will also be recorded, and general levels of abundance and frequency of sighting will be logged. As a minimum, twice daily records of weather conditions

and sea state will be kept. Whenever weather affects operations, a record will be made of the source of the delay and its duration.

7. Demersal and pelagic fish data will be derived from four sources. At-sea observations of surface fish (principally sharks and molas) and fishing activity will be kept. California Fish and Game catch statistics from fish blocks 643-645 will be summarized for the three most recent years of available data (1976, 1977 and 1981). Key species for each fishery type (e.g., thresher shark for the drift gill net fishery) will be reviewed in the context of the entire California catch. Between these three sources, a background data base will be built. The eight trawls will collect the best data on demersal fish (see Item 2, above).

We anticipate using the 58-foot R/V Seawatch for this work. The Seawatch is equipped with a hydraulic A-frame and winch which are more than sufficient to meet the needs of this survey. The Seawatch has been used to perform the grab/trawl portion of the Hermosa survey as well as similar scopes-of-work on other Dames & Moore surveys. She has ample laboratory, deck and berthing space to support such operations. We will use Mini Ranger III for navigation during this cruise. We anticipate mobilization immediately following the video survey. The Seawatch can accommodate both Exxon and agency representatives. We plan to work three full daylight days (c. 14 hrs) and expect about 15 hours of travel time each way between departure from and return to San Pedro. We have scheduled a port call at Santa Barbara to embark/debark the scientific crew.

We have selected grab sample station distribution to provide an overview of the site and pipeline routes. One

station is positioned at the planned location of the platform, and four at 2 mi intervals toward the Hermosa platform site. The two other stations are located in the canyon head axis and midway to the Platform Irene site. Three replicates is the minimum number from which variance estimates can be calculated.

For trawling we have located stations at the platform site, at the second and fourth grab stations toward the south, and at the canyon head station. These are all in corridors of known sediment habitat. In open sediment bottoms which we have sampled by trawling in similar depths in the Channel, we have found the demersal fish and megafauna to be very similar along depth contours within the depth ranges encountered here. We therefore think that neither more samples nor closer spacing will increase the value of the trawl collected data. We will review ongoing surficial geophysical survey data before the cruise begins and may wish to relocate trawling stations if those data indicate snags in the areas we have proposed. Paired trawls at each station are preferable in order to gain some qualitative estimate of the reliability of the relative abundances of species captured by the trawls.

2.4 Marine Biologists

Dames & Moore will use Dr. Thomas Scanland as the Program Manager and Principal Investigator for this project. He will be Chief Scientist on both the grab/trawl and video cruises. Dr. Scanland is a Partner in Dames & Moore and Manager of the Marine Services group in Dames & Moore's Western Region. He received his Ph.D. degree from the Scripps Institution of Oceanography in marine biology, and has 14 years of consulting experience since leaving Scripps. His masters and doctoral theses were on marine benthic hard bottom community ecology, and he has been the principal investigator for several field benthic ecological studies in the Channel area including the

LNG terminal studies at Point Conception, the Gina-Gilda studies off Ventura, the Burmah Oil terminal project off Goleta, the Santa Ynez Unit surveys and the Chevron Hermosa and Arguello area marine biological surveys. Dr. Scanland is a registered professional ecologist with the Board of Professional Certification of the Ecological Society of America.

Dr. Doug Diener of Marine Ecological Consultants (MEC) will be the senior assistant on board the grab/trawl cruise and will also participate on the video cruise. He received his Ph.D. degree from Scripps in 1975. He has been working with MEC for more than 7 years carrying out field and laboratory identifications of marine invertebrates and fishes. He has been co-principal investigator on the identification of infaunal and epifaunal samples from the Point Conception and Gina-Gilda surveys and was principal investigator for laboratory identifications and confirmation of field identifications of fishes and invertebrates from the Santa Ynez Unit work and for the Hermosa and Arguello studies for Chevron.

Dr. Diener will take the lead in the laboratory identifications of sediment bottom samples for this survey and the sorting of the rock sample fauna. Table 1 provides a list of the experts used by MEC by taxonomic group when required.

Dames & Moore/MEC will provide two staff oceanographers to fill out the crew of the grab/trawl cruise and video cruise. Both will be experienced in both grab sample and trawl sample collection in the California OCS. The Seawatch will provide two deck hands for helping with gear handling and winch operations. IUC will provide all the crew for operating, launching and recovering the SR IV from the Aloha.

On the video survey, Dr. Scanland will also be assisted by Dr. Eric Hochberg. Dr. Hochberg is curator of invertebrates of the SBMNH. He received his Ph.D. from the University of California Santa Barbara and has been at the SBMNH for more than 10 years since receiving his degree. He has worked with Dr.'s Scanland and Diener in reviewing the video coverage of the Hermosa and Arguello area surveys and has provided laboratory identification of hard bottom fauna from surveys in the area. He will work with MEC in the identification of groups of the rock sample fauna from this survey.

TABLE 1

LIST OF TAXONOMIC EXPERTS

Sorting Group	Taxonomic Group	Taxonomic Expert
"Others"	Porifera	Karen Green
"Others"	Cnidaria	Dr. Eric Hochberg John Ljubenkov
"Others"	Nemertea	Dr. Bruce Thompson
"Others"	Sipuncula	Dr. Bruce Thompson
"Others"	Phoronida	Karen Green Dr. Doug Diener
"Others"	Echiura	Dr. Bruce Thompson
"Others"	Ectoprocta	Dr. Tom Scanland
"Others"	Urochordata	Dr. Bruce Thompson Karen Green
Polychaetes	Annelida	Larry Lovell Karen Green
Molluscs	Mollusca	Jay Shrake
Arthropods	Arthropoda	Dr. Doug Diener Dr. W. Newman
Echinoderms	Holothuroidea	Mary Bergen
Echinoderms	Ophiuroidea	Dr. Doug Diener
Echinoderms	Asteroidea	Dr. Doug Diener
Echinoderms	Echinoidea	Dr. Doug Diener Dr. Bruce Thompson
"Others"	Chordata	Dr. Doug Diener
"Others"	Brachiopoda	Dr. Doug Diener Jay Shrake

FIGURE 2

M/V Aloha and Specifications

The Aloha:
IUC's Submersible/RCV Diving Support Vessel

The Aloha:

The Aloha has been carefully designed and outfitted as a support vessel to accommodate IUC's full range of deep diving and offshore survey services. The Aloha is ideally designed for projects requiring a large work platform for extensive periods of offshore work. Fully air-conditioned living quarters can comfortably accommodate a crew and client complement of 22 for periods of up to 30 days at sea.

The versatility of the Aloha is enhanced by dual lift systems, an aft-mounted heavy lift system and a hydraulic crane, midship, on the starboard side.

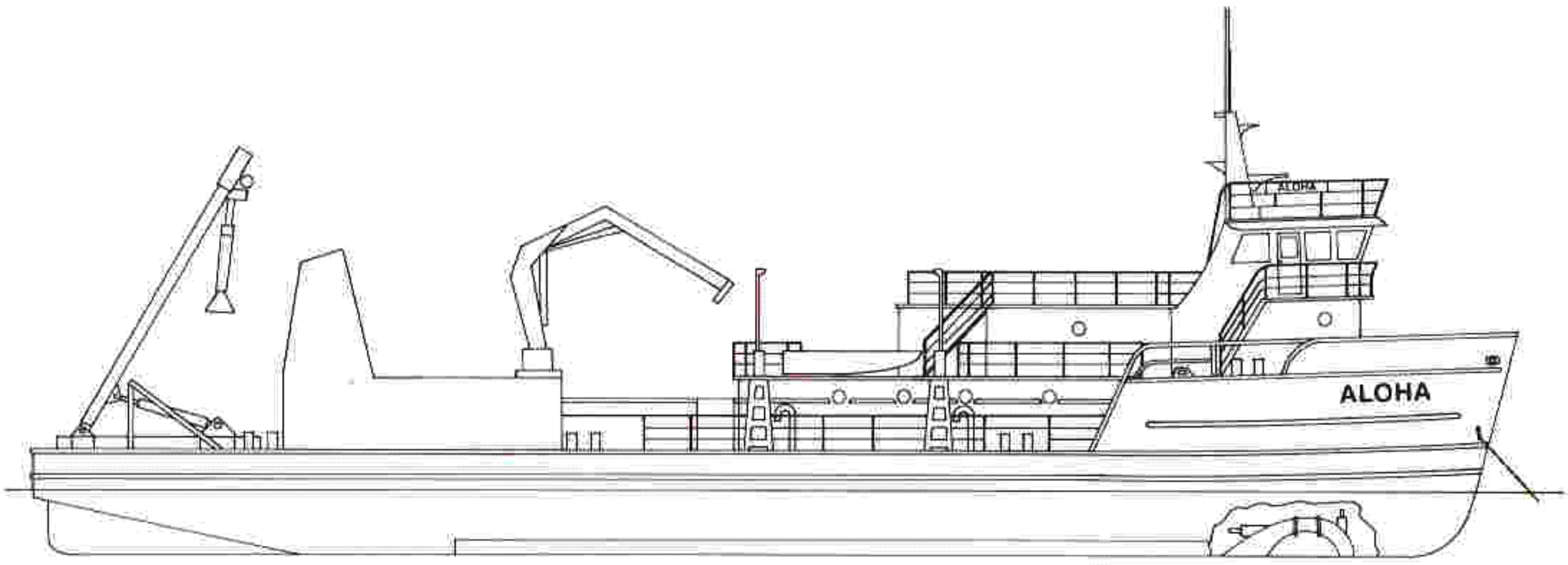
Aloha's aft-mounted heavy launch and recovery system has been designed and built to handle large systems safely over the stern, such as IUC's 1,000-foot (305-meter) submersible Mermaid II or diving bell. The system consists of a swingable U-Frame, with a static capacity of 15 tons (13.6 metric tons), powered by 2 hydraulic rams, which move the frame structure through an angle of 80°. This allows the submersible or diving bell to be moved through an arc from a position over the water to one over the support vessel deck. The power for raising or lowering the submersible or diving bell is supplied by a high speed winch.

The aft-mounted heavy launch and recovery system has been designed for normal operations in up to a sea-state 4 over the stern. In the event sea conditions deteriorate, it will, if necessary, operate safely in a sea-state 5.

A 10-ton (9.1-metric ton) hydraulic Hiab crane is mounted on the forward position of the starboard stack house. With a reach of over 30 feet (9.1 meter), this crane provides an ideal launch and recovery system for IUC's "Mantis", a one-atmosphere tethered diving system, or a remote controlled vehicle such as IUC's Hydro Products RCV 225 or Benthos RPV.

The Aloha carries extensive communications and navigation equipment as well as gear to support a wide range of underwater activities. Major features of the vessel are: 360° slewable bow thruster; Honeywell RS-7 Acoustic Tracking and Positioning System; primary and back-up Loran C; radar and radio equipment; Autopilot; Gyrocompass, and high resolution 2,400-foot (732-meter) Raytheon recording fathometer. In addition, special equipment can be easily installed either within a 10-foot × 20-foot (3.0-meter × 6.1-meter) air-conditioned client work area or in the 14-foot × 17-foot (4.3-meter × 5.2-meter) pilot house. In addition, there is a full machine shop with lathe and drill press, milling machine, and an electrical test lab.

With Aloha's range of 6,000 nautical miles (11,114 kilometers), a wide variety of missions may be undertaken including: inspection and survey; search and recovery; diving support; oceanographic geophysical and bathymetric surveys; medium and long range research programs; installation and retrieval of sensor packages and systems.



Specifications:

General

Length o.a.:	143 feet (43.6 meter)
Breadth:	32 feet (9.8 meter)
Draft (loaded):	8 feet 4 inches (2.5 meter)
Tonnage, gross:	165 tons (149.7 metric tons)
Tonnage, net:	119 tons (108 metric tons)
Accommodations:	22 persons
Propulsion:	Twin screw
Main engines:	2 Caterpillars (3412) 520BHP each
Cruising speed:	12 knots
Auxiliary power:	Two 75kW generators
Fuel capacity:	24,000 gallons (90,840 liters)
Fresh water:	14,000 gallons (52,990 liters)

Navigation & Communications

Loran C:	■ Micrologic ML-1000 (primary) ■ Morrow LCM-950 (backup)
Gyrocompass:	■ Sperry Mk-24
Autopilot:	■ Decca Arkas 550G
Radar:	■ Konel Furuno FR-116 (16 miles, 25.7 kilometers) ■ Konel Furuno FRN-64 (64 miles, 103 kilometers)
Echosounder:	■ Raytheon DE-731 (2,400 feet, 732 meter)
Radio:	■ SSB-Intech Mariner 1600 (12 channel, 150 watt), unlimited range (primary) ■ DBS-Simpson (100 watt, 500 mile, 805 kilometer), (backup) ■ VHF-Konel KR-153V (10 channel, 100 watt) ■ Oki 1010 VHF (all channel, 25 watt)

Underwater Navigation & Tracking

Equipment:	■ Honeywell RS-7 Acoustic Tracking and Positioning System ■ ELA series 20, long base line, bottom mounted acoustic transponder system ■ Fathometer DE-731 Raytheon (2,400 feet, 732 meter)

Lift Systems

Hydraulic Crane:	■ 10 ton (9.1 metric ton) Hiab hydraulic crane with a reach of 30 feet (9.1 meter). ■ 50 foot (15.2 meter) reach with boom extenders.
Heavy Duty Lift:	■ Swingable U-Frame with a static capacity of 15 tons (13.6 metric tons), powered by 2 hydraulic rams, 30 feet (9.1 meter) high by 25 feet (7.6 meter) wide, which move the frame structure through an angle of 80°.

Additional Services Available

Manned Submersible: (Free-Swimming)	■ IUC's "Mermaid II", a manned 1,000-foot (305-meter) submersible, designed for a broad range of undersea assignments including close-up inspections in minimal visibility, utilizing a 30-inch (762 millimeter) bow window, obstacle avoidance sonar, and external color closed-circuit television camera on a pan and tilt.
Manned Submersible: (Tethered)	■ IUC's "Mantis", a one-atmosphere diving system capable of undertaking a wide range of tasks including mid-water work. The vehicle has a depth rating of 2,300 feet (701 meter) and is outfitted with dual 6 function manipulator, interchangeable tools, and color television camera monitored by both the operator and surface personnel.
Remote Controlled Vehicles:	■ IUC operates the Hydro Products RCV 225 and Benthos RPV. Both are highly maneuverable and easily deployed vehicles.
Deep Diving Services:	■ IUC's full range of diving services from shallow water work to deep diving with special diver breathing gas mixing equipment.

IUC's Worldwide Diving Services

IUC for more than 20 years has been recognized as one of the world's leading diving companies. Independently owned and highly diversified, its capabilities range the entire sub-sea spectrum: from shallow water work to deep sea drilling support with the "Pisces VI" submersible, more than one mile down.

Standard IUC services include:

- Dives on tri-mix (helium/nitrogen/oxygen) gas to 600-feet with IUC's unique gas mixing equipment and especially developed decompression tables.
- Saturation diving to 1,000 feet.
- All types of sub-sea inspections utilizing either manned submersibles, remote controlled vehicles or divers employing closed-circuit television (color or black & white) with simultaneous video and audio recording.
- Submersibles with diver lock-out and dry transfer capabilities.
- Construction and salvage.
- Research and development.
- Diver Training (Professional Diving School of New York).

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City Island, New York 10464
Phone 212-885-0600
Telex 147242 IUC INC NYK

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Houston, Texas 77002
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New Orleans: 404 Glenmeade
Gretna, Louisiana 70053
Phone 504-392-1472

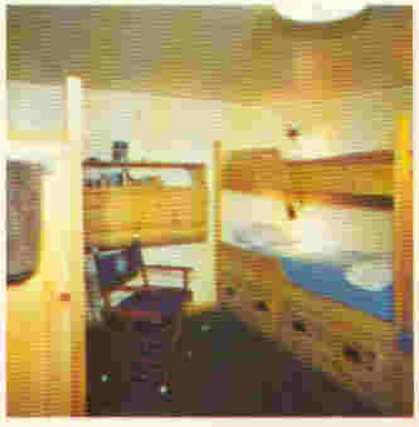
Morgan City: Rural Route 4, Box 770
Morgan City, Louisiana 70380
Phone 504-631-0004

*The equipment and services described in this brochure are provided by IUC Inc. and Deepsea International Inc., a wholly owned subsidiary of IUC International Inc.

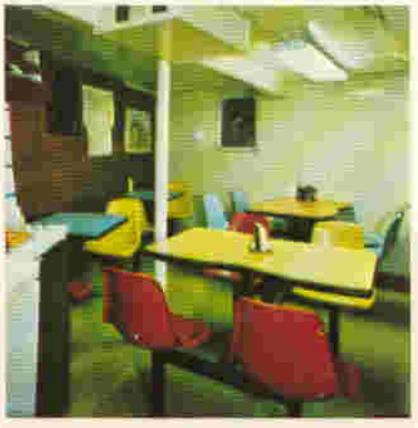
Client's Stateroom

Pilot House

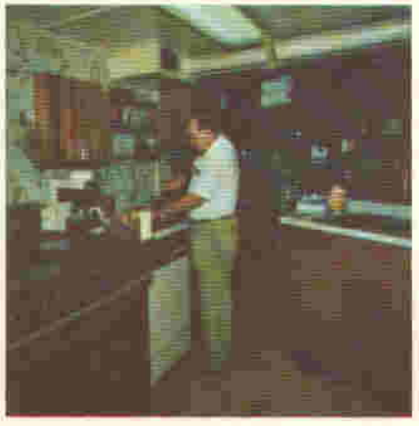
Navigation & Communications Center



Crew's Quarters



Galley with seating for 12

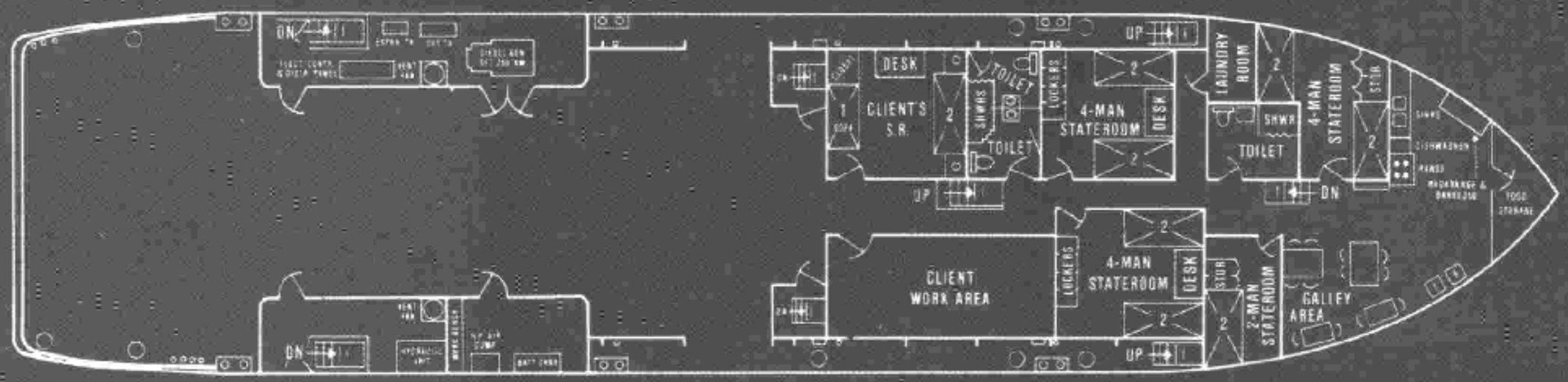


Galley

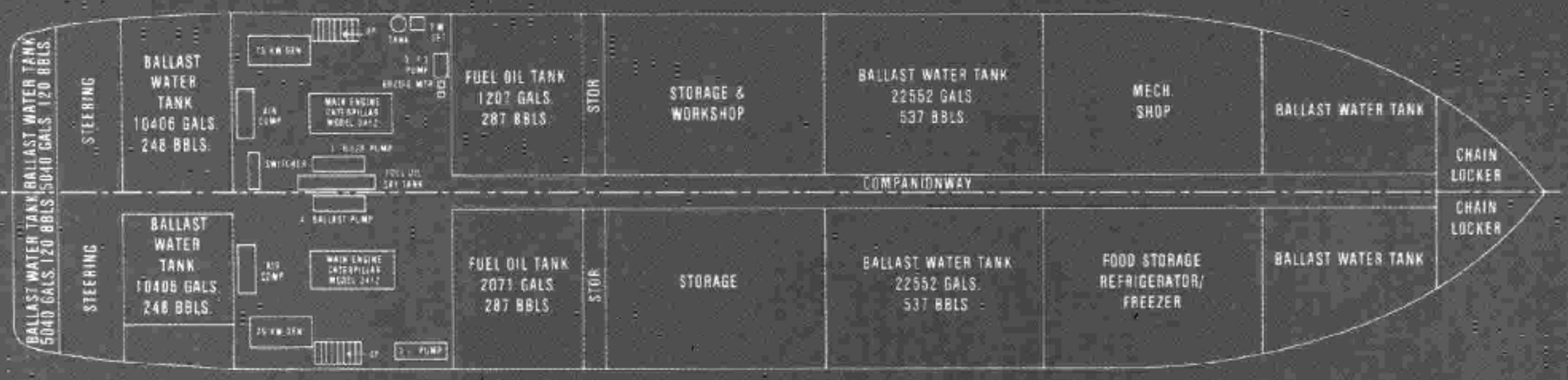
Aft-deck showing installation of IUC's Hydro Products RCV 225 remote controlled underwater vehicle

Aft-lift system shown launching IUC's 1,000-foot (305-meter) submersible Mermaid II.

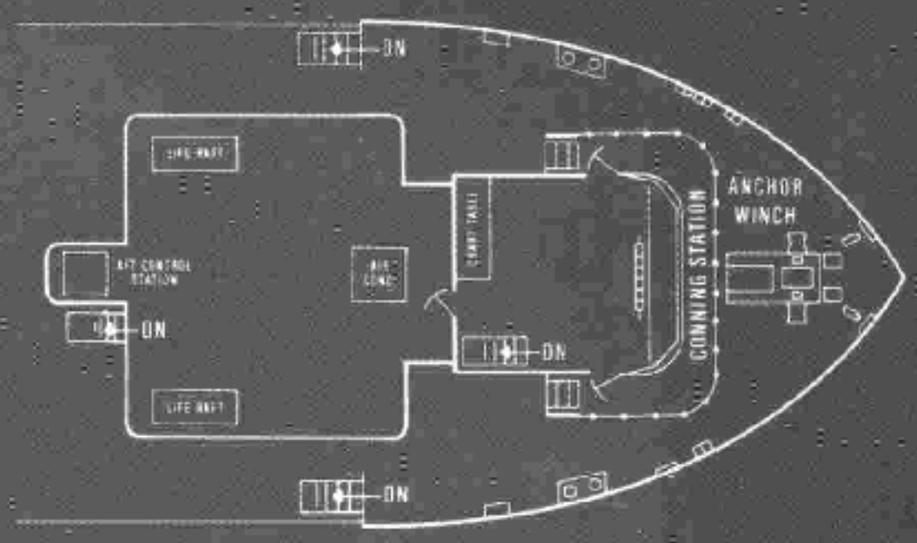
Aft-deck showing the hydraulic crane and IUC's Manta, 2,300 foot (700 meter) one-atmosphere tethered diving system



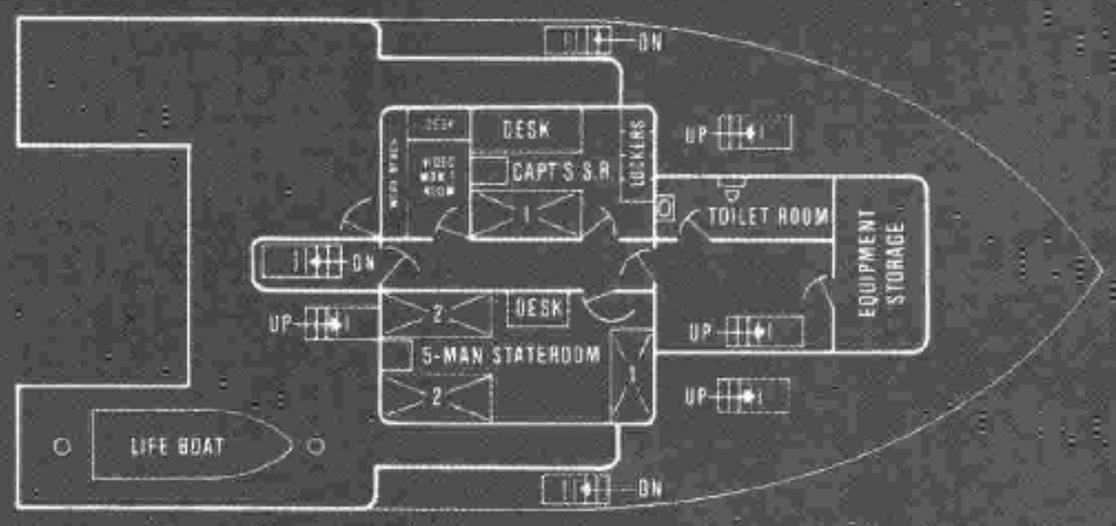
Main Deck



Lower Deck



Pilot House

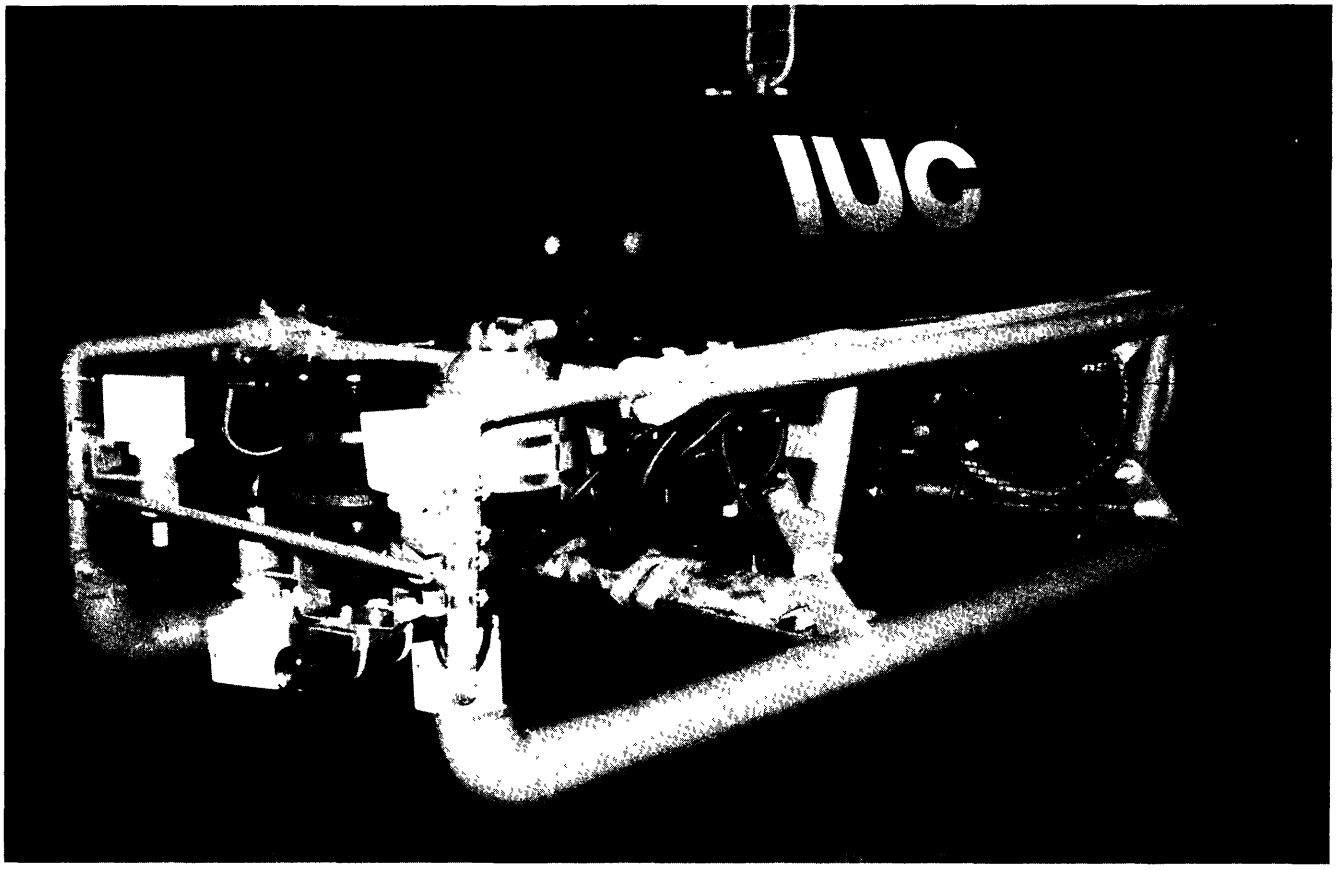


Boat Deck

FIGURE 3

Submersible SR IV and Specifications

Recon IV:
2,300-Foot Remotely Operated Vehicle *Now Available!*



IUC's Recon IV is the first of a series of deep-water Recons capable of work to 2,300 feet (701 meters). The Recon IV is a versatile, reliable vehicle, that has proven and demonstrated it's capabilities

Recon can easily accept an assortment of bolt-on options to enhance its capabilities, including a twin manipulator/ hydraulic assembly and an anode attachment package

IUC's Recon comes standard with Harco silver-silver chloride cathodic protection probe and color video, with character generation, enhancing the quality of documentation for all types of inspections

The Recon IV is one of the few RCVs designed with all its electronic components in the control console on the surface, eliminating the risk of water infiltration, which is a major factor in vehicle downtime.

Forward, lateral and horizontal thrust is provided by four 1-HP motors with specially designed shrouds and propellers to produce up to 80 pounds of thrust which allows the vehicle to move at three knots The vertical thruster can be controlled manually or automatically to provide constant depth hover control.

The Recon IV comes complete with its Tether Management System (TMS) and Handling System (HS). The TMS is a proven concept, acting as an umbilical depressor, allowing the vehicle to be de-coupled from the ship's motion during live boat operations. Another advantage of the TMS is that the vehicle mates below the cage which eliminates the need for it to orient itself to the cage. During recovery, in strong current, considerable time is therefore saved.

IUC's Recon IV capabilities include visual/Non-Destructive Testing (NDT) inspection, installation, maintenance, repair and salvage, on a variety of projects including production facilities, exploration rigs, pipeline and wrecks By no means is the Recon IV limited to these tasks and IUC's vehicle engineers will be pleased to demonstrate Recon's capabilities for you on your next ROV requirement.

Additional equipment includes:
- Twin Manipulator Package
- Anode Placement Package
- Additional NDT Equipment
- Stereo 35mm or 70mm Camera
- Pipe Tracking Navigation System
- Assortment of Special Tools, including Cutters, Grinders and Wire Brushes

Specifications:

General

Operating depth:	2,300 feet (701 meters)
Length o.a.:	6.5 feet (1.98 meters)
Breadth:	3 feet (.9 meters)
Height:	2.75 feet (.84 meters)
Weight in air (gross):	900 pounds (410 kilograms)
Speed, forward:	3 knots
Speed, lateral:	2 knots
Payload (wet):	250 pounds (114 kilograms)
Depth control:	Automatic or manual
Thrusters:	Four 1-HP electric (80 pound thrust)

Control Consoles (Pilot and Auxiliary)

Height:	5.75 feet (1.75 meters)
Width:	3.75 feet (1.14 meters)
Depth:	3.5 feet (1.07 meters)
Weight:	1,800 pounds (816 kilograms)
Power requirements:	20 KVA, 60 Hz, 230 v 3-phrase
Portable consolette:	50 feet (extended) reach with controls for thrust pan, tilt, camera focus, flying tether payout, vehicle lighting and manipulator

Tether Management System

Operating depth.	2,000 feet (610 meters)
Diameter:	4.58 feet (1.4 meters)
Height:	4.33 feet (1.3 meters)
Weight in air (gross):	1,650 pounds (748.42 kilograms)
Tether drive motor:	1-HP electric (100 pounds pull)
Tether payout indicator:	Digital surface meter

Tether (Vehicle to Cage)

Length:	400 feet (121.9 meters)
Breaking strength:	4,000 pounds (1,814 kilograms)
Strength member:	Braided Kevlar
Weight in water.	Neutrally buoyant

Main Umbilical (Winch to Cage)

Length:	2,200 feet (670.56 meters)
Diameter:	1.25 inches (3.18 centimeters)
Breaking strength:	30,000 pounds (13,607.8 kilograms)
Armor:	Contrahelically wound improved plough steel, two layers

Handling System

Type:	Hiab 1870 series Articulating Crane
Reach:	28 feet (9.14 meters)
Turning radius:	390 degrees
Capacity:	10 tons (9,071.85 kilograms)
Power:	Electric/Hydraulic-220/440 v 3-phase
Umbilical winch:	High strength steel, torque hub drive
Umbilical winch (capacity):	2,200 feet of 1.25 inch (670.56 m. of 3.18 centimeter) diameter cable
Dimension:	5 feet x 5 feet (1.52 m. x 1.52 m.)
Line speed (full drum):	100 feet/min. (30.48 meters/min.)

Work & Documentation

Manipulator:	one 4-function, two 5-function or one 7-function
Tools:	Hydraulic disk cutters, cable cutters, impact wrench, and other necessary tools
Television camera:	CM-8, CM40, CM50 or Osprey available (color or black & white)
Video recorder:	Two ½ inch cassette units
Video monitor:	12 inch (30.48 centimeters) color
Video annotation:	Date, time, depth, heading and CP
Remote video monitor:	Color or black & white at up to 50 feet (15 24 meters) away
Lighting:	Two 250 watt incandescent (variable-intensity), Mercury vapor option
Pan & tilt:	270 degrees pan, 180 degrees tilt
Pan & tilt (speed):	45 degrees per second
Still camera:	35mm, 70mm, or 35mm stereo camera available with strobe
NDT:	CP Probe Harco Model 1HRP-803

Navigation

Sonar:	Straza 250A
Compass:	Digicourse-Magnetic
Depth sensor:	0-2300 feet (0-701 meters) ± 0.5% of full scale

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Louisiana
559 Holmes Boulevard, Suite 106
Gretna, Louisiana 70053
Phone 504-361-9946

PROPOSED SURVEY PLAN
EXXON SHAMROCK PROSPECT P-0440

KEY:

☐	PLATFORM SITE LOCATIONS
G	PROPOSED GRAB SAMPLE STATIONS
⌶	PROPOSED PAIRED TRAWL SAMPLE LOCATIONS
S	PROPOSED SUBMERSIBLE DIVE LOCATIONS
U	UNION OIL IRENE SAMPLE STATION LOCATIONS
M58	MMS(SAI) RECONNAISSANCE STATION LOCATIONS
A	AHF FULLY SORTED GRAB SAMPLE STATION
C	CHEVRON HERMOSA GRAB SAMPLE STATIONS
⌓	CHEVRON SUBMERSIBLE STATIONS
(R)	MMS REPLICATE SAMPLE STATION
⁂	P-0440 ROCK BOTTOM HABITAT LOCATIONS

2 0 2 MILES

12,000 0 12,000 FEET

Water Depth in Meters

N

M52

CONTINUED UNION TRANSECT

SHAMROCK ☐GII

IRENE

M58

GI

M64

M65

GII

HIDALGO SURVEY AREA

HIDALGO

HARVEST SURVEY AREA

HARVEST

HERMOSA

M73(R)

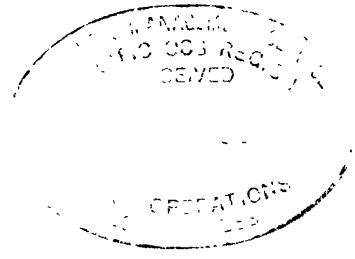
CONTINUED CHEVRON HERMOSA TRANSECT I & II

CONTINUED CHEVRON HERMOSA TRANSECT I & II

Pt. Arguello

Pt. Conception

50 100 150 200 250 300



SITE-SPECIFIC MARINE BIOLOGICAL SURVEY
SHAMROCK PROJECT
CENTRAL AND SOUTHERN SANTA MARIA BASIN
FOR EXXON COMPANY, U.S.A.

October 1984

Dames & Moore

7.42/1-COVER

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ABSTRACT

A site-specific marine biological survey has been carried out to meet the requirements of NTL 78-1 for Exxon's proposed Shamrock project. The survey included an RCV mediated video survey of the Platform site and the two submarine canyons which intersect the western portion of Lease OCS P-0440. In addition grab, trawl, water and sediment quality samples were collected at the platform site and along two proposed pipeline corridors.

The project area is predominantly in soft bottom habitat of about 90-100 m depths. Sediments are clayey silts with fine sand. The infauna, epifauna and demersal fish of the project area form a broadly similar set of species associations over the entire area surveyed. These assemblages are similar to those reported from slightly shallower depths in the western Santa Barbara Channel. Depth and grain size both appear to affect species associations.

The southern of the two submarine canyons surveyed has predominantly clay walls with very little rock outcrop. The low relief and small area of the outcrops support a relatively impoverished epifauna overwhelmingly dominated by plumose anemones (Metridium senile). Slump features form areas of moderate shelter below the canyon's northern face. Upper slopes appear to be more densely populated than lower slopes or the canyon bottom. The south wall of the northern canyon has well developed rock outcrop features in 120-140 m (400-450 ft). These outcrops support a fauna similar to that observed in hard-bottom surveys near Point Conception and Purisima Point; i.e., a fauna with much greater species variety of macroepibiota than on the surrounding soft bottom habitat.

There do not appear to be any sensitive underwater features within 1000 m of the platform site. The nearest detected hard bottom features are at the head of the southern canyon (which is the nearest canyon), 1.8 km from the platform site. No unique habitats or faunal associations were observed. The uniformity of the faunal associations in the area would suggest that there are sufficient suitable sources locally to repopulate areas of impacts, whether they are short-term or long-term.

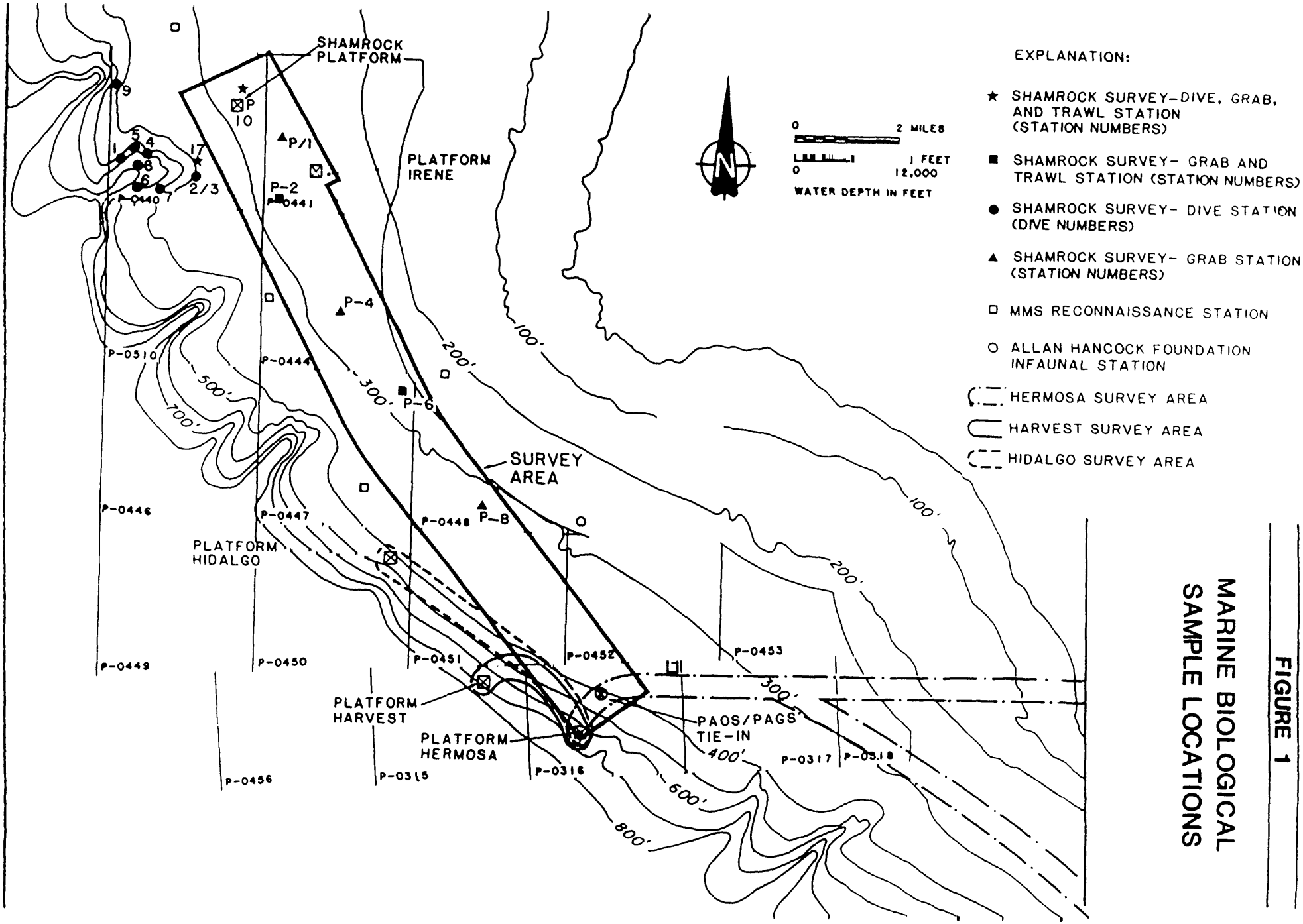
SITE-SPECIFIC MARINE BIOLOGICAL SURVEY
SHAMROCK PROJECT
CENTRAL AND SOUTHERN SANTA MARIA BASIN
FOR EXXON COMPANY, U.S.A.

1.0 INTRODUCTION

Exxon Company, U.S.A. (Exxon) proposes to develope oil and gas reserves on its Leases OCS P-0438 and P-0440 in the central Santa Maria Basin, offshore central California. Exxon's Development and Production Plan (DPP) calls for installation of one drilling and production platform and associated pipelines in one or two corridors. None of the proposed facilities would be sited on Lease P-0438. For details of Exxon's proposed development, the reader should refer to the DPP or to Section 2 of the Environmental Report (Production). One corridor leads to the vicinity of Chevron U.S.A.'s proposed Platform Hermosa site about 21 km (about 11.5 nmi) to the south and one to the site of Union Oil Company's proposed Platform Ireen about 3.5 km (about 1.9 nmi) to the southeast. Figure 1 shows the proposed platform site and corridors.

Although the platform site area and most of the pipeline corridors are located in soft bottom habitat, the westernmost portion of Lease P-0440 and certain areas near the southern end of the proposed pipeline corridor to the Platform Harvest vicinity contain hard-bottom habitats. Lease P-0440 also contains the heads of two submarine canyons in the northwest and southwest corners. The Minerals Management Service (MMS) has outlined survey procedures in NTL 78-1 ("Minimum Requirements for Biological Surveys") for obtaining marine biological data for platform and offshore pipeline projects in these kinds of habitats.

Exxon retained Dames & Moore to carry out a marine biological survey of the platform site, pipeline corridors, and the portions of the canyons on Lease P-0440 for their proposed Shamrock project. Using NTL 78-1, Dames & Moore developed a draft survey plan. Meetings were held with MMS in March and April 1984 to discuss the proposed survey methods. The revised Survey Plan "Site-Specific Marine Biological Survey, Shamrock Project, Lease OCS P-0440 and Pipeline Corridors" dated 2 April 1984 was approved by MMS and forms the basis for the survey described in this report.



MARINE BIOLOGICAL SAMPLE LOCATIONS

FIGURE 1

Between 22 April and 23 May, two field cruises of two legs each were carried out to meet the requirements of NTL 78-1. The specific purposes of the cruises were to make a visual reconnaissance of selected submarine canyon habitats and to collect infaunal, epifaunal, and demersal fish samples at the platform site, along the two pipeline corridors shown in Figure 1, and at a station in the vicinity of the head of the canyon nearest the platform site (2.8 km; about 1.5 nmi). The principal tools used in the survey were a submersible remote controlled vehicle (RCV) and standard grab and trawl sampling equipment. The RCV was equipped with both television and still cameras to provide photodocumentation of habitats and species observed (see Section 2.0). Biological, water quality, and sediment samples were collected to support the visual observations.

This report presents the results of the cruises and related information required of reports prepared under NTL 78-1. A methods section (2.0) contains details of the survey equipment and operations. The results and discussion section (3.0) provides information on numbers of samples collected, weather and sea-state observations, water and sediment quality sample analyses, and contains a description of the habitats, faunal assemblages, and species observed. A brief review of the marine bird and mammal observations is also included.

Three related products have been submitted to the MMS to supplement this text. One is a complete copy of the videotape record from the RCV survey. It has introductory voice-over narration to provide an index to each tape and to provide a location and general habitats setting. The second product is a condensed version of the extended tape coverage. The condensed tape provides an overview of all habitat types and the principal faunal elements observed at the platform site and along the walls of the canyons. The voice-over narration defines the nature of the survey and the location, describes the habitats and identifies the species shown. The third product is a photo atlas of 35-mm color slides which includes still images of representative habitats and fauna. These three products provide the visual documentation required by NTL 78-1 and reference to them will assist the reader in understanding this document and the marine biology of the survey area. They are on file at the MMS office in Los Angeles and may be inspected by appointment.

2.0 METHODS

2.1 VESSELS AND EQUIPMENT

2.1.1 RCV Cruise

The support vessel used for the RCV cruise was the M/V Aloha, a 143-foot research support vessel available through International Underwater Contractors (IUC). The Aloha is specifically fitted out to provide support for submersible operations. The vessel is powered by twin diesel engines to twin screws and has a 360° trainable bow thruster which is capable of moving the vessel at 4 knots. The Aloha has ample berthing requirement for the vessel's crew and the scientific party, and comfortable working space for remote observers to monitor the video output and maintain visual observation notes and logs.

Vessel navigation was provided by a Mini-Ranger III system supported by three shore stations. The submersible's position relative to the support vessel was monitored using a Honeywell RS-7 acoustic navigation system. Video output from this system allowed post plots to be developed showing the submersible's position relative to the bottom. This system also provided input on the bridge to aid in keeping the support vessel from towing the submersible.

The heart of the operation was IUC's Recon IV submersible system. The RCV system is self-contained and includes its own power system, main winch, A-frame, launcher, and tether winch. The main winch has 2,000 feet of cable and is used to deploy and retrieve the launcher, which is a protective cage from which the Recon IV operates. With the launcher deployed and lowered to near the bottom, the vehicle departs the cage on a buoyant tether cable. This cable is 400 feet in length and provides the system connections from the on-deck control station to the vehicle.

The RCV's sensors include both black-and-white and color television cameras with pan and tilt capability. Video feed to the observers and pilot can be switched on surface command from one to the other. The black-and-white unit could be used to provide gross navigational aid (nearfield obstruction avoidance) and greater depth of field. The color unit provided 10 to 150-cm (4 to 60-inch) range coverage of the bottom and resolution of details to less than 0.5 cm.

In addition to these principal visual aid sensors, the Recon IV was equipped with a sonar unit. The sonar signal assisted vehicle navigation by detecting targets at 300 to 600-foot distances. A Photosea 2000 35-mm stereo camera was also mounted on the Recon IV, parallel to the color television camera's usual position. Other sensors (e.g., depth, heading, pitch, roll, and internal system monitors) aided vehicle operation.

The Recon IV was equipped with a three-function manipulator arm capable of grasping objects up to about 15 cm (6 inches) in maximum dimension and about 4.5 kg (10 pounds) in maximum weight. There was very little hard bottom encountered and fragments of the few outcrops observed could not be detached from the bottom. As a result, although several attempts were made to pick up objects, none were successfully brought up to the surface.

The Recon IV is rated at a forward speed of 3 knots and a lateral speed of 2 knots, but was used at speeds of about 0.1 to 0.2 knot over rocky, steep, or unusual bottom conditions, and about 0.2 to 0.5 knot for cruising over "typical", flat mud bottoms.

The RCV control room was operated by two persons, the pilot and the chief scientist. The pilot controlled all RCV movements and operated its cameras and manipulator. The chief scientist directed the pilot's course, directed use of cameras and coverage (stop, go back, turn, tilt, close-up, color or black-and-white, still photo, go ahead, closer or farther from bottom), coordinated launch and recovery and maneuvering with the ship's navigator and skipper, kept the videotape record, made tape voice overs and kept a running log of observations.

Upon the vessel's arrival in the project area each morning a standard weather observation was recorded (time, date, general location, visibility, cloud cover, wind speed and direction, precipitation, sea and swell height, direction and either wave length or period, presence and frequency of white caps). In addition, the presence of any other vessel traffic was noted. At the same time, two of the scientific personnel (Diener and Shileikis; see Section 2.2), using field binoculars made a variable length (minimum 5 minutes), qualitative search for marine birds and mammals. Identification to as low a taxon as possible for the conditions and distances was made and an estimate of

the numbers of individuals sighted was noted. Also at this time any surface tar balls, oil slicks, sea grass, kelp, surface swimming fish (e.g., sharks and molas), and other surface objects were noted. This same suite of observations was repeated between RCV dives and at the end of the day before leaving the project area. The navigation coordinator (Hayward; see Section 2.2) also noted passing vessels and alerted the observation group to any mammals and any unusual bird observations during the dives.

2.1.2 Grab/Trawl Cruise

The support vessel used for the grab/trawl cruise was the University of Southern California's R/V Seawatch. The Seawatch is a 65-foot research vessel powered by twin diesel engines. She is equipped with a light hydrowinch and davit for hydrocasts and a main winch with more than 2000 feet of 1/2-inch cable feeding through a hydraulic stern mounted A-frame for trawl and grab sampling or coring. There are presently eight berths forward and nine aft. The Seawatch is fuel and water limited to about six days of typical offshore survey work before requiring return to port for reprovisioning.

Navigation was provided by a Mini-Ranger III system supported by three shore stations during grab sampling on 9 and 10 May. During trawls and water quality sampling on 22 May, navigation was supplied by a Loran C unit equipped with a latitude-longitude converter. The navigator, Mini Ranger, and Loran C units were positioned in the wheelhouse where there was a hailing system for communications with operations on deck.

Infaunal samples were collected using a Smith-MacIntyre grab sampler. Three replicate samples were taken at each station. Sample condition was checked for washout and surface appearance before processing. Each sample was then placed into a container for volume measurement. A subsample from each sample was then removed (approximately 0.5 liter) for grain size analysis. One of these subsamples from each station was also used for determination of total organic carbon (TOC) and oil and grease. The remainder of the sample (minimum target sample size was 3.0 liters) was then processed on a sorting table containing two large diameter nested sets of 1.0 and 0.5-mm screens. Sediment/TOC

samples were labeled and frozen. Infaunal samples were labeled, preserved in 10 percent seawater/formalin, and boxed for inventory and shipment. The 0.1 mm fraction was sorted with organisms counted, identified to the lowest practicable level and "group" wet weight biomass determined. The 0.5 mm fraction was archived.

Trawl samples were collected using a 30-foot otter trawl with 1-1/2 inch bar mesh and 1/2-inch liner in the cod end. Wire to depth ratios of 3:1 were used. Two trawls, each with approximately 10 minutes of bottom towing time, were taken at all trawl stations. Samples were sorted into buckets on deck by taxonomic and abundance categories. Common and easily identifiable invertebrates were counted at the species level and discarded. Less common field identifiable species were treated similarly, but with at least one voucher retained. Abnormalities such as parasites or disease were noted. All specimens not definitely identified at the species level were vouchered for laboratory identification. Fish were treated similarly except that all individuals were measured to the nearest 0.5 cm on a measuring board. Measurements were of standard length for teleosts (bony fish) and total length for cartilagenous fish (sharks, rays, chaemeras and hagfish).

Water quality samples were collected using Nisken-type water samplers. Dissolved oxygen, temperature, and salinity were measured in the field using a YSI Model 57 DO meter and a YSI Model 33 SCT meter. Temperature was calibrated using a thermometer and dissolved oxygen by saturation.

Weather, traffic, marine bird and mammal and other surface observations were taken each day as with the RCV cruise (Section 2.1.1), with formal observations repeated between stations. As the observation crew were on deck for most of this cruise, "informal" sightings of birds were much more frequent than during the RCV cruise.

2.2 PERSONNEL

Cruise scientific personnel and assignments are presented below.

22, 23 April and 27-30 April (RCV Cruise, Legs I and II)

Dr. Thomas Scanland	Chief Scientist
Dr. Doug Diener	Principal Investigator: Fishes and Invertebrates
Mr. Gary Hayward	Communications and Navigation
Mr. Dale Shileikis	Still Photo Log and Bird Observations
Mr. Brien Reep	Exxon Observer
Ms. Donna Brewer	MMS Observer (Leg I only)
Mr. Tom Hammel	Navigator OSI

The RCV crew included one supervisor, a pilot, and three support technicians. The Aloha was under the direction of Captain Randy Stinnet and crewed by an engineer, two deck hands, a mate, and a cook.

8-10 and 21-23 May (Grab/Trawl Cruise Legs I, grabs, and II, trawls)

Dr. Thomas Scanland	Chief Scientist
Dr. Doug Diener	Principal Investigator: Fishes and Infauna
Mr. Ray de Wit	Marine Biologist (VTN)
Mr. Gary Hayward	Water Quality, Navigation Leg II
Mr. Dale Shileikis	Marine Biologist
Mr. Tom Hallet	Navigator Leg I (OSI)

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

2.3 AREA SURVEYED

The survey area and grab sample locations are shown on Figure 1. Grab sample stations were located at the Shamrock platform site (Station P), at the mid-point (P/I) between Station P and the Platform Irene site, at 2, 4, 6, and 8 nautical mile distances from Station P (P-2, P-4, P-6, P-8) along the corridor to the Platform Hermosa vicinity, and at the head of the submarine canyon nearest Station P. This station corresponded with one of the RCV dive targets and was given the same designation (17). Appendix A lists the positions of these stations.

Trawls were taken at four of these stations--P, P-2, P-6 and 17. Prior video (Dames & Moore, 1983a) and trawl (Engineering Science, 1984) surveys have already characterized the macrofauna of the southern end of the corridor leading to the Platform Hermosa vicinity.

Plate I (pocket in back) shows the tracks of the ten submersible dives. Station 7 (Dive 1) was a small, high relief feature on the north wall of the southern canyon as were Stations 9 and 10 (Dives 5 and 8). Station 11 was a long feature near the axis of a branch of the north wall of the southern canyon (Dive 8). Dive 4 was made on the north wall of the southern canyon inshore of Stations 10 and 11. Dives 2 and 3 were made at the head of the south canyon near a small rock outcrop (Station 14). Dive 6 was made on the south wall of the southern canyon at its steepest point (Station 16) and near the western edge of Lease P-0440. Dive 7 was located at Station 13, a small steep-walled feature on the south wall of the southern canyon midway between Station 16 and the canyon head.

With very little rock outcrop encountered in the southern canyon, a decision was made to look at the south wall of the northern canyon. One dive (No. 9) was made there spanning the area between Stations 3, 4, and 5. All appeared to be rocky habitats. A final dive (No. 10) was made near the platform site.

2.4 SCHEDULE OF EVENTS AND DOWNTIME

Table 1 is an annotated calendar of events on the RCV cruise. There was no time loss due to support vessel downtime or navigation (Mini-Ranger) downtime. However, slight delays were incurred (maximum of two hours total) when the Honeywell RS-7 acoustic signal (between submersible and support vessel) malfunctioned and repairs and/or adjustments to the system had to be made. About half of the first day at sea (Leg I) was lost due to a combination of severe weather and an electrical short.

Minor delays were also incurred during retrieval of the submersible on some dives during Leg II. The tether (between the launcher and the submersible)

TABLE 1

CALENDAR OF EVENTS: RCV SURVEY

Date	Event
04-22	Mobilize all personnel and gear at Ventura Marina by 1600*. Depart fuel dock on R/V Aloha at 1820 for Point Arguello.
04-23	0630 at Station No. 7; combined sea and swell 7-11'; launch 0705; 0745 complete dive; still camera not operating; tether wrapped around cage; worm tubes brought up by basket from vehicle dragging on canyon wall; short in system. Worsening weather and poor forecast (35 kt winds 14-18' sea and swell) combined with lack of resolution of short leads to decision to return to Ventura to await better weather; 42 marine birds recorded in two observation periods. 2100 arrive at berth in Ventura Marina, and demobilize crew.
04-27	Remobilize crew for Leg II at 1600; underway from Ventura Marina at 1830; light rain.
04-28	0500 combined sea and swell 5-9', wind 15 kt NW; approaching Station 14; launch Dive No. 2, 0556; Honeywell RS-7 down most of dive; still camera not functioning; complete dive 0627; 23 marine birds observed before dive. 0806 launch Dive No. 3 south of Station 14; 0958 complete dive; no still photos; 8 marine birds observed before dive. Approach Stations 10/11, 1200; skies clearing, sea and swell 4-5', wind 10-15 kt NW; 1211 launch Dive No. 4; complete dive at 1407; no still photos; 6 marine birds observed before dive. On station west of Stations 10/11, 1520, sea and swell 3-6', wind 10 kt NW; launch Dive No. 5, 1523; end dive 1657; no still photos, no video 1520-1600; 5 marine birds observed before dive, 3 after. Secure under Point Arguello for the night.
04-29	On location southeast of Station 16, 0530; sea and swell 4-6', wind 15-20 kt NW, overcast; 0532 launch Dive No. 6; 0716 end dive; still camera operating; 10 marine birds observed before dive. On location Station 13 0745; sea and swell 4-6', wind 15 kt NW, clearing; launch 0746; 0756 short detected and vehicle recovered. Repair made and second launch Dive No. 7 made 0817; complete Dive No. 7, 0929; 4 marine birds observed before dive. 0945-1130 changing strobe batteries. Launch Dive No. 8 1137;

* Time in PST.

TABLE 1 (continued)

Date	Event
04-29 (cont.)	sea and swell 2-4', wind calm; complete dive, 1331; 12 marine birds, drift kelp and Mola mola observed before dive. Proceeding to northern canyon 1400. On location Stations 4/5, 1415; sea and swell 2-4', wind 15-12 kt NW, clear; launch Dive No. 9, 1421; end dive 1648; 3 marine birds observed before dive; Honeywell down for brief period during dive at 1610. Proceeding to platform site 1705. On station 1729; sea and swell 3-6', wind 15 kt NW, overcast; 1730 launch Dive No. 10; 1809 end dive; 4 marine birds observed during dive. Secure from survey and return overnight to lie off Ventura.
04-30	Enter Ventura Marina at 0800 and demobilize all equipment and crew.

occasionally wrapped itself around the launcher, which required about one-half hour to correct. We estimate that this problem accounted for approximately 2-3 hours of downtime over the duration of the cruise.

An additional source of delay resulted when the trigger for the strobe on the still camera malfunctioned. This was corrected for the second full day of surveying (29 April, Dives 6-10), and repair accounted for an additional 2-3 hours of downtime during the course of the cruise.

Table 2 provides a calendar of events for field work carried out aboard the Seawatch. There was no loss of time due to vessel downtime, and no time loss due to navigational problems on either leg. However, on 9 and 10 May, strong winds and heavy sea states slowed overall working conditions and made it very difficult to maintain vessel position. It became necessary to deploy and retrieve a marker buoy at each grab station to facilitate this operation.

The Smith-MacIntyre sampler performed well in terms of reliability, repeatability, and quantity of sample recovered. High sea and swell (combined 10-14 feet) conditions on 9 and 10 May made it difficult to determine when the sampler hit bottom and if or when it triggered. As a result, several grab stations required more than three attempts to obtain satisfactory replicate samples, thus slowing overall operations.

The trawl and water quality sampling was completed on 22 May, with no vessel, equipment, or weather-related downtime.

TABLE 2

CALENDAR OF EVENTS: GRABS/TRAWLS/WATER QUALITY

Date	Event
05-08	Mobilize all personnel and gear at Santa Barbara Harbor in evening. Depart Santa Barbara at about 2100* so as to arrive at study area at daylight next day.
05-09	On station P8 at 0700; sea and swell 5-7 feet; winds 20-25 knots NW; good visibility. Three good grabs at station P8 in 4 attempts. Twenty-two marine birds noted.
	On station P6 at 0920. Three good grabs in 4 attempts. Five marine birds noted.
	On station P4 at 1100. Three good grabs in 5 attempts. Seven marine birds noted.
	On station P2 at 1300. Three good grabs in 3 attempts. Large flock (over 400) of marine birds.
	On station P (platform site) at 1440; sea and swell increasing to 10-14 ft. Three good grabs in 4 attempts. About 50 marine birds and one sea lion noted.
	At 1600 heading for Coho Anchorage. Sea and swell increasing; winds 25-30 knots NW. Swell 7-10 ft with approximate 75-foot wave lengths.
05-10	On station P/I at 0745. Weather worse, sea and swell 11-15 ft; winds 15-20 kts; good visibility. Three good grabs in 4 attempts. Over 50 marine birds and over 100 dolphins noted.
	On Station 17 at 0923. Winds and sea state increasing. Three marginally acceptable grabs in 6 attempts. Received marine forecast at 1130. 20-30 kt winds NW and combined sea and swell of 14-18 ft for next 3 days. Decision made to return to Santa Barbara Harbor to demob and wait for improved weather to complete survey.
05-21	Mobilize all personnel and gear at Santa Barbara Harbor in evening. Depart Santa Barbara at 2325 so as to be on location at daylight next day.
05-22	On station at P/I at 0600. Weather excellent, 3-5 ft combined sea and swell, winds calm, visibility good. Surface and bottom water quality completed at 0615. Six marine birds noted.

* Time in PDT.

TABLE 2 (continued)

CALENDAR OF EVENTS: GRABS/TRAWLS/WATER QUALITY

Date	Event
05-22 (cont.)	On Station P (platform site) at 0650. Surface and near-bottom water quality and two good trawls were completed by 0849. Seventeen marine birds noted.
	On Station 17 at 1050. Surface and near-bottom water quality and two good trawls completed by 1209. Nine marine birds noted.
	On Station P2 at 1315. Surface and near-bottom water quality and two good trawls were completed by 1439.
	On Station P4 at about 1510. Surface and near-bottom water quality were completed by about 1520.
	On Station P6 at 1553. Surface and near-bottom water quality and two good trawls were completed by 1658.
	On location at P8 at about 1715. Surface and near-bottom water quality completed by 1725.
	Anchor at Coho Anchorage until 0330 so as to arrive in Santa Barbara by 0900 tomorrow.
05-23	Arrive in Santa Barbara at 0845 to demob all gear and personnel. 1000 Seawatch released and underway to San Pedro.

TABLE 2 (continued)

CALENDAR OF EVENTS: GRABS/TRAWLS/WATER QUALITY

Date	Event
05-22 (cont.)	On Station P (platform site) at 0650. Surface and near-bottom water quality and two good trawls were completed by 0849. Seventeen marine birds noted.
	On Station 17 at 1050. Surface and near-bottom water quality and two good trawls completed by 1209. Nine marine birds noted.
	On Station P2 at 1315. Surface and near-bottom water quality and two good trawls were completed by 1439.
	On Station P4 at about 1510. Surface and near-bottom water quality were completed by about 1520.
	On Station P6 at 1553. Surface and near-bottom water quality and two good trawls were completed by 1658.
	On location at P8 at about 1715. Surface and near-bottom water quality completed by 1725.
	Anchor at Coho Anchorage until 0330 so as to arrive in Santa Barbara by 0900 tomorrow.
05-23	Arrive in Santa Barbara at 0845 to demob all gear and personnel. 1000 Seawatch released and underway to San Pedro.

3.0 RESULTS AND DISCUSSION

3.1 GENERAL RESULTS

Ten RCV dives were completed, amounting to over 13 hours of bottom time and resulting in 11 videotape cartridges covering 11.5 hours of record and more than 100 35-mm slides. Dives ranged in time from 20 minutes to 2 hours and 20 minutes. Video quality varied with local conditions. Four factors affected video quality and resolution: distance from the bottom, RCV bottom speed, natural or induced turbidity and RCV heading with respect to bottom current direction. At distances of more than about 1 m above the bottom a camera angle suitable for transect operations (30° to 60°) would not detect smaller (i.e., less than about 20 cm) macrofauna due to the relatively small field of illumination of the lights necessary to operate the color video camera. We avoided cruising at such heights, but surface vessel drag on the submersible resulted in about 10% of bottom time loss from "off bottom" conditions. Resolution was not limited at the nearfield end until the camera was buried in the sediment. This occurred less than 1% of the time on the bottom. RCV bottom speed when not being dragged was from 0 to about 0.5 knot (estimated from post plots), and greater speeds resulted only from dragging which in turn led to lift (as described above). Strong currents and high suspended solids concentrations limited video quality during some part of most dives. Submersible (RCV) tracks running obliquely into or across the direction of the current seemed to produce the best results. On at least two occasions the RCV was unable to make headway into the current. Loss of resolution to turbidity was a problem only about 5% of the time on bottom since directional change of the RCV would correct the problem.

Video resolution was to less than 0.5 cm during normal operations (see above) and was adequate for determining identifications of most members of the macrofauna to the generic level. Monospecific genera and those with species clearly distinguishable by large visual characters were identifiable to the species level.

Coverage of the southern canyon was more extensive than planned. The relatively unvaried fauna, lack of high relief rock outcrops, and generally

modest slopes allowed for faster cruising speeds and broader resulting coverage. The submersible was not able to make smooth descents of steep drops, in general due to the low visibility and high currents, but depths of about 100-200 m (330-660 feet) were examined. Current direction was generally offshore and down the canyon, and seemed strongest along the canyon walls. Based on post-plot calculated average and maximum RCV speeds, currents may have exceeded 0.5 knot.

With daylight remaining after all planned dives were completed, two dives additional to those proposed in the survey plan were carried out. One spanned three target areas along the south wall of the northern canyon. Two linear rock outcrops parallel to the canyon wall were observed. The final dive was made in the vicinity of the platform site. A rippled, silty, soft bottom habitat was observed.

No rock samples were collected. In general this was because of the lack of rock targets and the lack of sufficiently small, unattached pieces at the few rock targets we observed (see Section 2.1.1).

Grab samples (three at each station) were collected at all seven planned sample locations. Sediments were similar at all stations and consisted primarily of olive greenish gray clayey silts and silty clays with minor amounts of fine sandy material. The exception to this was two grab samples at Station 17 (canyon head) where significant quantities of coarser shell hash material was recovered. Total organic carbon values were slightly higher than those reported for the Point Conception area (Dames & Moore, 1983a, b; SLC, 1982) and slightly lower than those reported by Engineering Science (1984) for the Hidalgo site. Oil and grease values for stations P-4 and P-6 are high and may reflect the effects of natural oil seeps in the Point Conception region. Table 3 lists the descriptive properties of all 21 grab samples.

Trawls (two at each station) were successfully collected at all four planned trawl stations. Two small rock samples were collected in the trawls along with a large variety of fish and invertebrates.

Surface and near-bottom water quality samples were collected at seven planned locations. The results are shown in Table 4. Surface and bottom salinity values fall within 1 ppt of the 28 year average CalCOFI data for their nearest station (Lynn et al, 1982; Station 80.52). Surface disssolved oxygen values bracket the CalCOFI average but bottom values were significantly higher (however, Station 80.52 had the lowest values for the entire CalCOFI grid reported by Lynn et al.). Surface and bottom temperature values were 1 to 3 degrees C higher than the 28 year April average from CalCOFI Station 80.52. Bottom temperature during our survey (at about 90 m) approximate mid-water (50 m) April values from the CalCOFI records. Our surface temperatures were equivalent to late summer values from the regional long range average. Weather, bird, mammal, and other surface observations were recorded at all stations. They are discussed in appropriate sections of the following text.

3.2 DEMERSAL FISH

Data on fishes from the project area came from RCV observations of the submarine canyons in Lease P-0440 and trawls at the Shamrock platform site (Station P), at the southerly canyon head (Station 17) and along the pipeline corridor to the Platform Hermosa area at distances of 2 (P-2) and 6 miles (P-6) south of the Shamrock platform site. From eight trawls at these four stations in water depths of 275 to 400 ft, 20 species of fish were identified (Table 5). Two species, the Pacific sanddab (Citharichthys sordidus) and the plainfin midshipman (Porichthys notatus) accounted for more than 70% of the 2209 individuals caught. Those two species and four others (yellowchin sculpin, Icelinus quadriseriatus; slender sole, Lyopsetta exilis; Dover sole, Microstomus pacificus; and the stripetail rockfish, Sebastes saxicola) were present in every trawl.

The number of species per trawl (Table 5) ranged from 8 to 14 (mean $\pm$95% confidence limits equal 12 $\pm$4)[1] and the number of individuals ranged from 113-710 (mean 278 $\pm$365). The number of individuals per species ranged from

[1] 95% confidence limits on mean estimated as 2 x standard deviation (see Green, 1979).

TABLE 3

SOFT BOTTOM HABITAT DESCRIPTIVE PARAMETERS

STATION[a]	R[b]	DEPTH (ft)	N[c]	$\bar{N}$ ± 95 % CL[d]	S[e]	$\bar{S}$ ± 95% CL	V[f]	% SAND[g]	MED[h]	TOC[i]	O&G[j]
Platform	1	284	291		50		3.0	22.6	4.7	0.66	0.07
	2	284	266	282 ± 29	53	50.3 ± 5	3.5	20.0	4.8		
	3	284	291		48		4.0	21.6	4.8		
P/I	1	269	426		66		3.5	24.9	4.6	0.60	0.03
	2	269	298	302.3 ± 243	58	57.3 ± 18	4.0	28.8	4.5		
	3	269	183		48		3.0	30.9	4.5		
P-2	1	272	277		64		4.0	26.3	4.6		
	2	272	266	268.3 ± 16	56	57.3 ± 12	4.0	25.4	4.6	0.62	0.03
	3	272	262		52		4.0	25.7	4.7		
P-4	1	269	409		60		3.5	39.7	4.3	0.57	0.61
	2	269	293	364 ± 124	44	53.6 ± 17	4.0	44.4	4.2		
	3	269	389		57		4.0	40.9	4.3		
P-6	1	295	239		48		5.0	27.1	4.7	0.70	0.36
	2	295	373	255 ± 222	54	48 ± 12	5.0	19.7	4.9		
	3	295	153		42		5.0	29.9	4.6		
P-8	1	310	319		52		4.5	35.8	4.5	0.66	0.07
	2	310	91	234 ± 249	35	45.3 ± 18	5.0	35.5	4.5		
	3	310	292		49		5.0	31.7	4.6		
17 (Canyon)	1	392	88		33		4.0	16.1	5.4	0.72	0.03
	2	392	346	165.3 ± 314	59	41.7 ± 30	2.5	17.9	4.9		
	3	392	62		33		<1.0	26.1	4.7		

(a) See Section 2.3 for locations
(b) Replicate number
(c) Number of individuals/0.1 m^2
(d) 95% confidence limits on mean calculated as 2x standard deviation (see Green, 1979)
(e) Number of species/sample
(f) Volume of sample in liters
(g) Sand = percent dry weight of particles >64 microns in diameter
(h) Median grain size in phi units; larger numbers = smaller size; 4.0 = 63 microns, 5.0 = 30 microns
(i) Total organic carbon as percent dry weight sediment
(j) Oil and grease as percent dry weight sediment

7.42/1-T3

TABLE 4

WATER QUALITY OBSERVATIONS

Station[1]	Surface T[2]	Surface S[3]	Surface DO[4]	Bottom T	Bottom S	Bottom DO	Secchi Depth[5]
P	13.5	33.0	4.8	10.3	32.8	5.2	15
P/I	12.5	33.0	5.0	10.5	32.8	4.7	14
P-2	14.2	32.5	6.1	11.0	33.0	5.2	17
P-4	14.5	32.5	_._[6]	11.5	33.2	5.6	18
P-6	14.5	32.9	6.2	11.5	33.0	4.8	21
P-8	15.0	32.8	6.6	12.0	32.5	4.5	17
17	14.0	33.0	5.5	10.8	32.6	4.2	17

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[1] See Section 2.3
[2] Temperature in degrees Centigrade
[3] Salinity in parts per thousand
[4] Dissolved oxygen in parts per million
[5] Depth in feet below the surface at which a 12" diameter black and white painted disk can be seen from the surface.
[6] Recorded value at this station was too high to be correct.

TABLE 5

TRAWL COLLECTED DEMERSAL FISH OF THE PROJECT AREA

Species	Station P Trawl-1	P Trawl-2	P-2 Trawl-1	P-2 Trawl-2	P-6 Trawl-1	P-6 Trawl-2	17 (Canyon) Trawl-1	17 (Canyon) Trawl-2	Total	Length*
Argentina sialis	0	2	1	0	0	0	0	0	3	5-6 cm
Citharichthys sordidus	129	167	118	93	37	54	94	51	743	3-25 cm; 5, 10, 13 cm
Eopsetta jordani	0	0	0	1	1	1	1	0	4	27-32 cm
Glyptocephalus zachirus	12	4	4	6	0	1	4	4	35	5-19 cm; 14 cm
Hydrolagus colliei	0	0	0	0	0	0	1	0	1	37 cm
Icelinus quadriseriatus	2	9	3	3	1	5	6	2	31	5-6 cm; 5 cm
Lycodopsis pacifica	1	0	0	0	0	2	0	3	6	15-21 cm
Lyopsetta exilis	8	3	19	23	4	8	22	20	107	9-18 cm; 10, 13 cm
Merluccius productus	0	0	0	0	0	2	2	3	7	16-22 cm
Microstomus pacificus	7	33	10	20	7	6	14	16	113	5-22 cm; 6, 11.5 cm
Paralichthys californicus	1	0	0	0	0	0	0	0	1	48 cm
Parophrys vetulus	1	0	1	2	0	1	0	0	5	18-32 cm
Porichthys notatus	103	353	61	70	54	113	47	70	871	7-28 cm; 10, 17 cm
Raja binoculata	0	0	0	0	0	0	2**	0	2	-
Raja inornata	0	0	1	0	0	0	0	0	1	28 cm
Sebastes levis	0	0	2	0	0	0	0	0	2	7 cm
Sebastes miniatus	0	1	0	0	0	0	0	0	1	11 cm
Sebastes saxicola	11	118	42	30	8	5	18	12	244	4-10 cm; 4, 8 cm
Zalembius rosaceus	4	1	0	1	1	6	2	0	15	8-11 cm; 10 cm
Zaniolepis latipinnis	2	7	5	2	0	0	2	1	19	8-17 cm; 14 cm
SPECIES PER SAMPLE	12	11	12	11	8	12	14	11		
SPECIES PER STATION	14		13		12		14			
INDIVIDUALS PER SAMPLE	279	698	267	251	113	204	215	182		
INDIVIDUALS PER STATION	977		518		317		397			
TOTAL SPECIES 20										
TOTAL INDIVIDUALS 2209										

* Range where 2 or more individuals; range and mean where 10 or more individuals; range and modes where 100 or more individuals and more than one mode.
** Live from egg case; not measured.

1 (California halibut, Paralichthys californicus) to 871 (plainfin midshipman). Variety per station was very constant (12 to 14 species) and was reflected in the comparability of species similarities.[2] Within-station similarities were all above 0.72; values above 0.5 indicate fairly high similarity between samples (Fager, 1957; Fager and McGrowan, 1963). Within-station replicability (homogeneity) was, therefore, very strong. Between-station similarities were all higher than 0.74 suggesting that the soft bottom habitat demersal fish assemblage is very uniform over the entire area sampled, including the head of the canyon.

Species variety and dominance from these data agree very well with Engineering Science (1984) trawl data for the Platform Hidalgo site, where Pacific sanddab and plainfin midshipmen were 2 of the most abundant species and the total species count for 9 trawls over similar depths was 21. Their abundances, however, were much lower with a total of only 345 individuals (nets were comparable, and Engineering Science made slightly longer tows). Their maximum number of fish per station was 1/6 of Dames & Moore's minimum catch. Similarity values based upon species presence or absence were 0.56 and 0.57 between the Hidalgo site trawls and our nearest station and the Shamrock platform site, respectively. The proximity of their trawl collections to extensive rocky outcrops probably accounts for the lower similarity values when compared to the Shamrock within-survey results.

The video record indicated a total of 26 taxa of demersal fishes, of which 23 were associated with the eight dives on the southern canyon, 12 with the single dive on the northern canyon and 6 with the brief dive near the platform site. Sanddabs (Citharichthys sordidus) and stripetail rockfish (Sebastes saxicola) were the most frequently observed fishes, which is consistent with the trawl data. Midshipmen, which were common to abundant in the trawls, were observed at the south canyon and the platform site, but their cryptic coloration and habit of burrowing into the sediment make them difficult to observe. The

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[2] Similarity calculated as $2c/(a+b)$ where c = number of species in common between two samples and a and b are the number of species in each sample.

species most commonly observed during the dives (both canyons and the platform site), but which were uncommon in the trawls were two eel pout species (cf. Lycodopsis pacifica and Lyconema barbatum). Because of their small size and eel-like shape, they would be likely to escape the trawl through the mesh of the cod end.

Other species observed during the dives and not trawled were those associated with the steeper walls, the rock outcrops of the northern canyon, and with deeper water where trawls were not taken. These included hagfish (Eptatretus stoutii), ratfish (Hydrolagus colliei), ling cod (Ophiodon elongatus), and rockfish (Sebastes spp.). Rockfish other than S. saxicola were uncommon. The next most frequently sited species was the greenstriped rockfish (S. elongatus) which was recorded on two dives.

3.3 MARINE BIRDS

Eighteen taxa of marine birds were observed during the field survey (Table 6). The most commonly sighted taxa were the sooty shearwater (which were often seen in flocks of 40 to several hundred or more) and unidentified gulls. The sooty shearwater was also the most abundant species observed. Other commonly observed birds included western gulls, California gulls, and cormorants. Birds observed less frequently included pink-footed shearwaters, black-footed albatross, and rhinocerus auklets. Single sightings of Sabine's gull and a fulmar were made.

A 3-year seabird survey from 1975 to 1978, which included the Shamrock Project area as part of the study area, reported sooty shearwaters, pink-footed shearwaters, loons, jaegers, gulls, phalaropes, and alcids to be the most abundant taxa, regardless of season (U.C. Santa Cruz, 1981a). The mean density of seabirds for the 3-year study for the project area ranged from a high of more than 67 individuals/km^2 (April to June) to a low of 28 individuals/km^2 (July to September). A relatively high species diversity was found at all times of the year.

3.4 MARINE MAMMALS

Common dolphins (Delphinus delphis) and California sea lions (Zalophus californianus) were the only marine mammals observed during the survey. The

TABLE 6

MARINE BIRDS OBSERVED NEAR THE SHAMROCK PROJECT AREA

Common Name	(Scientific Name)
Unident. loon	Gavia sp.
Black-footed albatross	Diomedra nigripes
Fulmar	Fulmarus glaciali
Pink-footed shearwater	Puffinus creatopis
Sooty shearwater	Puffinus griseus
Unident. Petrel	Hydrobatidae
Unident. cormorants	Phalacrocorax spp.
Northern phalarope	Lobipes lobatus
California gull	Larus californicus
Heerman's gull	Larus heermanni
Herring gull	Larus argentatus
Sabines gull	Xema sabini
Western gull	Larus occidentalis
Unident. gulls	Larinae
Common murre	Uria aalge
Rhinocerus auklet	Cerorhinca monocerta
Unident. auklet	Alcidae
Pigeon Guillemot	Cepphus columba

common dolphins were observed on one occasion, numbering more than 100 individuals. Single California sea lions were observed on two occasions.

A marine mammal survey conducted from 1975 to 1978 which included the project area reported relatively low densities and numbers of sightings of pinnipeds and cetaceans in the project area in comparison with the Santa Barbara Channel (U.C. Santa Cruz, 1981b). The marine mammals most commonly sighted in the project area were the California sea lion and gray whale. Other marine mammals that could be expected to occur in the project area include the common dolphin, pacific white sided dolphin, and Dalls porpoises. Our survey was to late in the spring to be likely to observe the gray whale northern migration.

Less frequent species which could occur in the region include the northern fur seal, the northern elephant seal, blue whales, and humpback whales (U.C. Santa Cruz, 1981a).

3.5 KELP BEDS

Kelp beds in the project region typically occur in water depths from 6 to 25 m (North and Hubbs, 1968). At the shallow limit, Macrocystis overlaps with and is replaced by Egregia and in deeper waters is replaced by Pelagophycus porra. Northwest of the Santa Barbara Channel and along the coast of San Luis Obispo County, Nereocystis luetkeana is more comm (Warrick, 1978). It occurs in shallow subtidal areas out to about 15 m on rocky substrates. Nereocystis is an annual in the northern part of its range with its forest being almost completely replaced every year. It is nearly biennial in the southern part of its range (BLM, 1980). Macrocystis is a perennial, with individual plants remaining for up to 6 years (North, 1971).

The kelp beds located nearest the survey area are in the vicinity of Point Arguello about 7 miles (11 km) from the Shamrock platform site. There are extensive kelp beds between Point Arguello and Point Conception associated with nearshore rock outcrops that extend to depths of 33 to 40 ft (10 to 12 m) near Point Arguello and Rocky Point (SLC, 1982). Deeper outcrops occur offshore Point Conception. The gian kelp, Macrocystis pyrifera and the palm kelp, Pterygophora californica were reported to be the dominant species from Point

Conception to Point Arguello, but becoming more patchy near Point Conception (SLC, 1982).

3.6 INFAUNA

The 21 samples from the 7 survey stations yielded 227 taxa and 5614 individuals. Of these 84% were recognized to the species level and 74% given valid species names. Only 3% were not given at least generic identifications.

Polychaetes were the most speciose group collected comprising 45.8% of the taxa. Crustacea had the next greatest variety with 22.5% and were followed by molluscs (14.1% and echinoderms (5.3%). The sum of the several numerically smaller phyla was 12.3%, of which the cnidarians (4%) and the nemerteans (3.5%) were the most represented.

These data are comparable in variety and composition to the nearest available data set (Hidalgo survey; Engineering Science, 1984), with a greater representation in the Dames & Moore samples by polychaetes (46 vs 40%) and less by crustaceans (23 vs 32%). The Shamrock regional data averaged slightly fewer species per station (90.5 $\pm$14 vs 101 $\pm$24) and per sample (50.5 $\pm$12 vs 55.4) than the Hidalgo area survey. The lower total variety (227 species vs 243 at Hidalgo) is most likely related to the smaller aggregate sample area in our survey (2.1-m^2 vs 3.0-m^2). The difference in numbers per station is well within the confidence limits on the means ($\pm$15 to 25%) and is therefore not statistically significant.

The numbers of individuals per station in the Shamrock survey was 802 $\pm$367 with a total number of individuals of 5614. This compares with 651 $\pm$335 individuals per station from the Hidalgo survey and a total of 6509. Their larger total is related to their larger sample size (30 vs 21 replicates). The lower number per station is consistent with the lower fish abundances (Section 3.2), but again, due to the relatively high variance in abundances, is not significantly different. Station P-4 has significantly higher density (alpha = 0.10; one-tailed; double testing) than either the platform site station (P) or Station P-2. The higher percentage of sand sized particles in the sediment at Station P-4 may be the cause of the difference. Table 3 provides summary

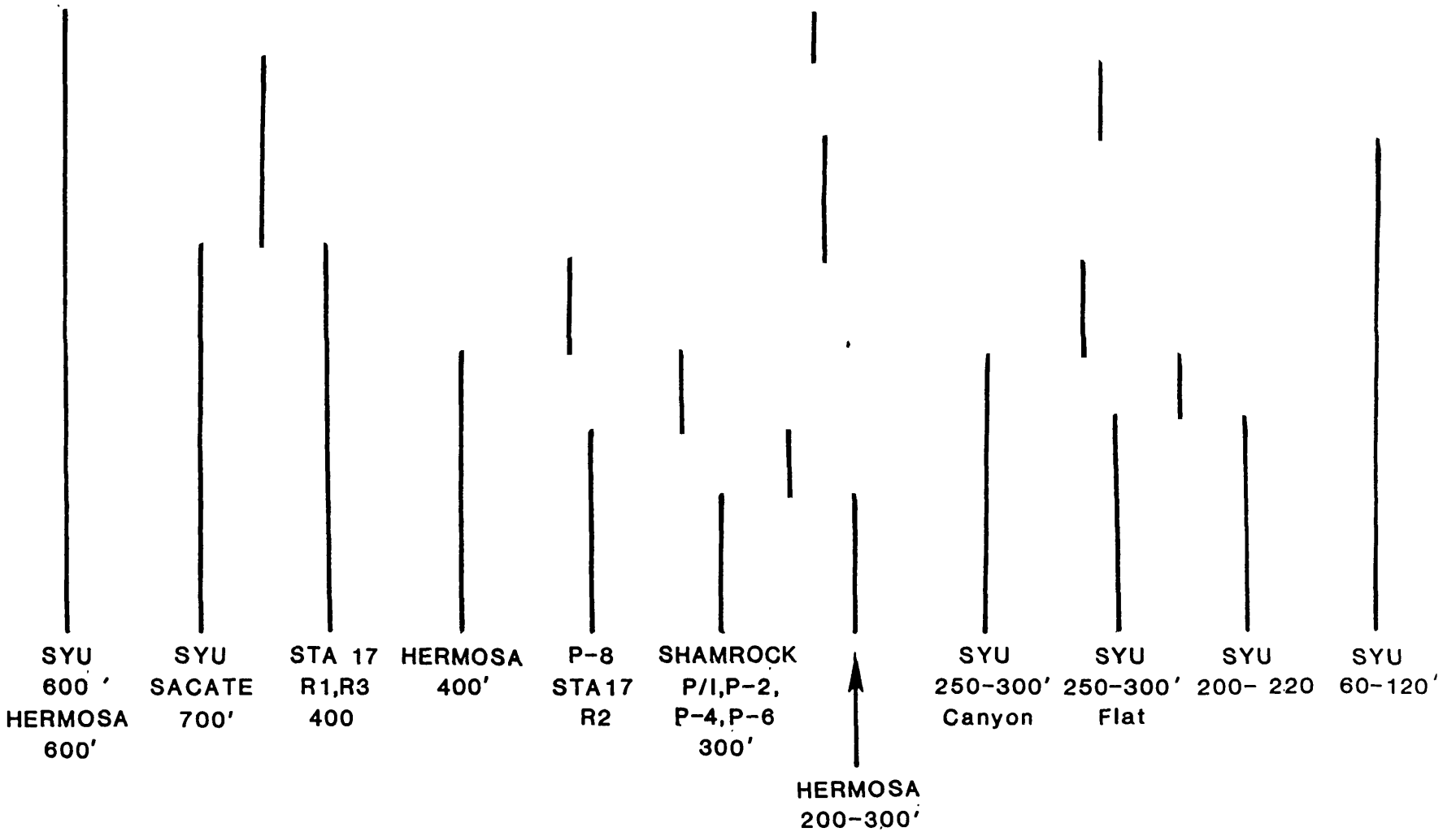
descriptive information on the soft bottom habitat parameters as measured during this survey. A species list is provided in Appendix B, and details of species counts by replicate and station are given in Appendix C.

Cluster analysis was performed on a data base consisting of infaunal data from 76 samples (30 stations) including the data from this survey and similar samples (0.1-m^2 Smith-MacIntyre grabs) from depths of 18 to 180 m (60 to 600 ft) and from Gaviota to the project site to examine gradational relationships in community composition. Results were obtained using presence-absence (Jacard) and density (Sorensen) of species as parameters. Only species whose continuity of identification over the 76 sample array was clear were used. The matrix was about 76 x 500. Figure 2 illustrates the results. Figure 3 shows the areas covered by the data base. Dames & Moore 1982 and 1983b contain specific locations of all stations included in the analysis which are not part of the Shamrock sample collection. All stations in the present survey clustered closely together using presence-absence sorting with similarities among replicates and between stations about equal. As with the fish data (Section 3.2), this indicates a broad homogeneity of species association throughout the area surveyed, including the station at the head of the submarine canyon (17). Using density of species for sorting (as illustrated in Figure 2) the two low density replicates at Station 17 (R1 and R3) relate more closely to the coarse sediment canyon area samples of the SYU. These two replicates contained large shell fragments and were partially washed out. The analysis also showed that depth of water was the most consistent sorting parameter with closest allegiance between species associations being those from similar depth ranges. The samples from this survey were most similar to the Hermosa 60-90 m (200-300 ft) depth stations. Percent sand in the sediments also appears to have an effect on sorting.

The similarity index value between the Shamrock survey infaunal species list and that from the Hidalgo survey was 0.42, indicating only moderate similarity. By contrast, all the stations in the Shamrock survey along the pipeline corridors showed values between stations of 0.52 or greater. In general, more proximate stations had higher similarities (e.g., P-8 vs P-6 = 0.65; P-8 vs P-4 = 0.56; P-8 vs P-2 = 0.55; P-8 vs P/I = 0.54; P-8 vs P = 0.53). The canyon station (17) in 120 m (400 ft) of water had lower similarities (0.42 to 0.49) to the nearer Shamrock stations (P to P-6) but had a value of 0.53 with Station P-8

FIGURE 2

REPRESENTATION OF CLUSTER ANALYSIS RESULTS *



* Data from 76 0.1m^2 Smith-McIntyre grab samples from 30 stations in the Western Santa Barbara Channel and Southern Santa Maria Basin.

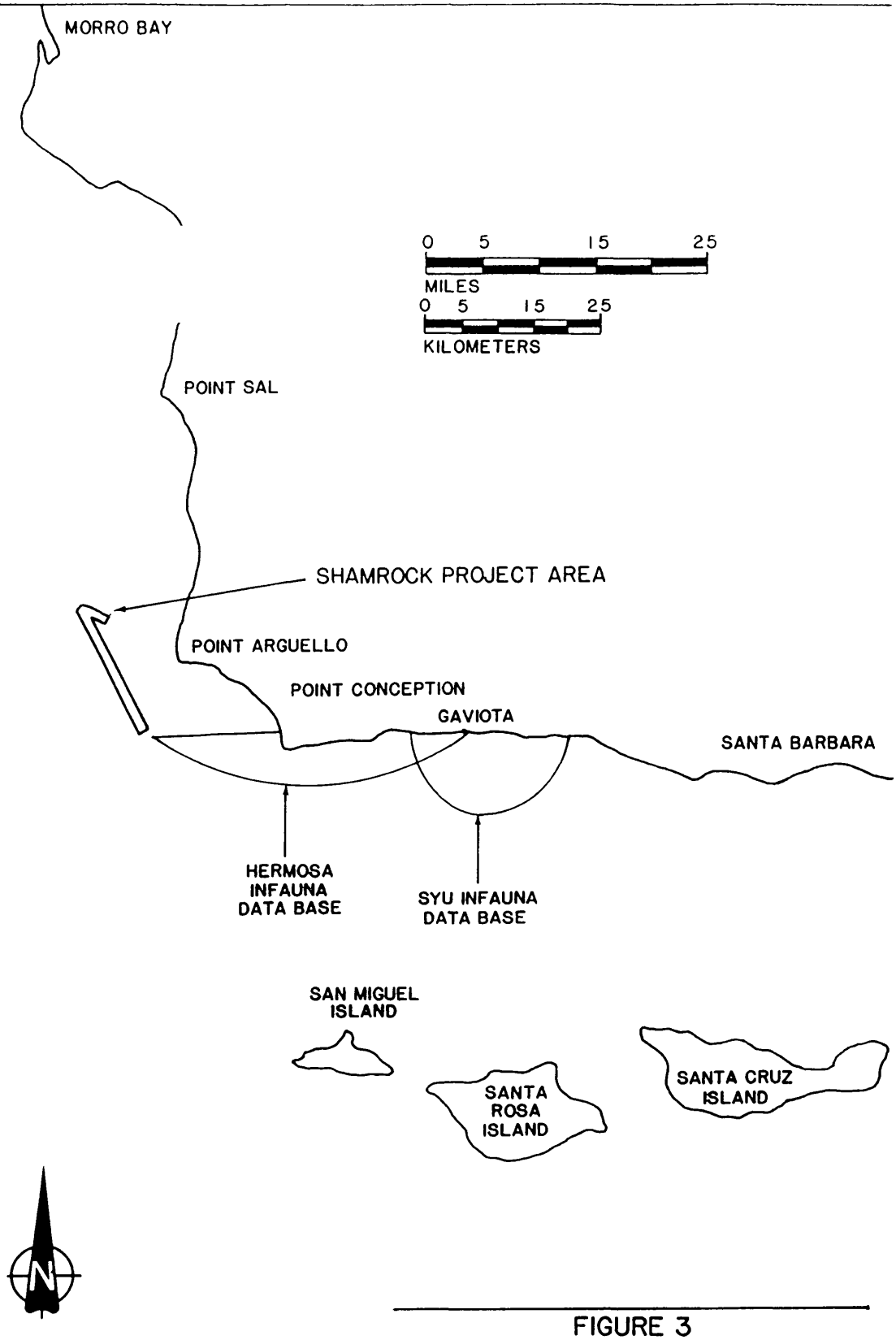


FIGURE 3

LOCATIONS OF CLUSTER ANALYSIS DATA BASE

(the closest to the Hidalgo sample area). It therefore appears that the relatively low similarity between the Shamrock and Hidalgo survey infaunal species composition is partially related to the generally deeper sample stations at Hidalgo (most $\geq$ 120 m; 400 ft) and partially to the proximity of hard substrate and its associated fauna.

Species occurrence was examined to search for frequent (occurring in all three replicates at a station), common (occurring at a density $\geq 100/m^2$ in at least one replicate), and abundant (occurring at a density $\geq 1000/m^2$) taxa (see Appendix B). Four species, all polychaetes, occurred in every sample at every station (Prionospio cirrifera, Spiophanes berkeleyorum, S. missionensis and Tharyx spp.). Three of these are in the same family (Spionidae) and all four are deposit feeders. Of these Spiophanes missionensis was also common or abundant at every station, and S. berkeleyorum common or abundant at every station but one (P/I). One additional polychaete (Mediomastus californiensis) was common at every station, but absent from some replicates. These five species accounted for nearly half of all the fauna collected and S. missionensis accounted for 30% of all individuals.

A total of 49 species (22% of all species) were frequent, common or abundant in at least one station. Of those, 35 were of frequent occurrence but with no densities $\geq 100/m^2$. All species with higher densities were also of frequent occurrence. Stations 17 and P-8 had 11 and 12 species, respectively, in the frequent, common or abundant categories. All other stations had 24 to 28 species in those categories.

Among the non-polychaetes, the ophiuroid starfish Amphiodia urtica was the most ubiquitous. It had densities $\geq 100/m^2$ in six of the seven stations (exception Station 17), and was in all three replicates at each of these six stations. It was entirely absent from Station 17. The amphipod crustaceans Heterophoxus oculatus and Rhephoxynius bicuspidatus were frequent at five of seven stations, with both present at all stations but missing from at least one replicate from two stations.

3.7 EPIFAUNA

Epifaunal data for the project site are derived from the same sources as for the demersal fish (Section 3.2). Thirty-four taxa and 984 individuals of epifaunal invertebrates were recorded from the eight trawls at Stations P, P-2, P-6 and 17. This compares with 29 species and 991 individuals of invertebrates collected in nine trawls at the Hidalgo site (Engineering Science, 1984).

Replicability between paired trawls was good with all pairs having species similarities $\geq$ 0.5. As with the fish and infaunal data, the epifaunal assemblages are relatively homogeneous over the area sampled with pairwise species similarity values for all between station comparisons $\geq$ 0.52.

The most numerous invertebrate in the Shamrock survey trawls were rock shrimp (Sicyonia ingentis), with 28 to 159 per 10-minute tow. They were present in every trawl. Species of the small shrimp genus Crangon were also present in every sample, but at lower abundances (3 to 52 per trawl). Crangon spp were also common in the Hidalgo survey.

There were 8 to 22 species per trawl and 14 to 27 per station in the Shamrock survey with the canyon station (17) having the greatest variety. These results are comparable to the Hidalgo survey (8 to 15 species per trawl and 15 to 19 per station). Abundances of 46 to 228 per trawl and 146 to 380 per station are also comparable to the Hidalgo results. Table 7 lists the trawl collected epifauna of the Shamrock project area.

The video observations around the two submarine canyons in Lease P-0440 and at the platform site provided tentative identifications for 42 invertebrate taxa of which 13 were also collected in the trawl samples (Appendix D). A combined regional macroepifauna of more than 60 invertebrate species results from the two survey methods. Cnidarians (principally sea pens and anemones) and echinoderms (principally starfish) dominate the video observation data. The slopes above the canyon edge and upper canyon slopes were generally more densely populated than the lower slopes or canyon bottom. Variety of epifauna was also greater on the upper slopes.

TABLE 7

SHAMROCK SURVEY EPIFAUNAL SPECIES DATA

Taxa	Station P Rep 1	P Rep 2	P-2 Rep 1	P-2 Rep 2	P-6 Rep 1	P-6 Rep 2	17 (Canyon) Rep 1	17 (Canyon) Rep 2
Coelenterata								
Hydrozoa								
Aglaophenia sp.	X[1]							
Anthozoa								
Acanthoptilum sp.	3	1	1	0	2	1	0	1
Anemone unid. (juv.)	0	0	0	0	0	0	0	1
Metridium senile	0	0	0	0	1	2	0	2
Stylatula elongata	0	1	6	1	1	1	1	0
Virgularia sp.	0	0	0	0	1	0	0	0
Mollusca								
Pelecypoda								
Compsomyax subdiaphana	0	0	0	0	0	0	1	0
Gastropoda								
Calliostoma gloriosum	0	0	1	0	0	0	0	0
Dendronotus sp. (unid.)	0	0	0	0	1	0	1	0
Megasurcula stearnsiana	0	0	0	0	0	0	2	2
Pleurobranchaea californica	1	1	0	0	0	0	1	2
Cephalopoda								
Loligo opalescens	0	0	11	1	8	19	1	0
Octopus rubescens	0	6	0	0	0	0	0	6
Echiura								
Listriolobus pelodes	0	0	0	0	0	0	2	0
Arthropoda Crustacea								
Cirripedia								
Arcoscalpellum californicum	X		X					
Isopoda								
Lironeca vulgaris	0	5	1	1	0	0	3	0
Decapoda								
Crangon alaskensis	3	18	3	7	2	3	38	29
Crangon spinosissima	0	0	0	0	0	0	9	11
Crangon zacae	0	0	0	0	1	1	5	8
Pleuroncodes planipes	2	11	12	1	3	38	1	1
Podochela hemphillii	0	0	0	0	0	0	1	0
Pyromaia tuberculata	1	0	6	0	0	0	0	1
Randalia ornata	0	0	0	0	0	0	0	1
Sicyonia ingentis	28	63	92	53	127	159	61	51
Spirontocaris lamellicornis	0	0	0	0	0	1	0	0
Annelida								
Polychaeta								
Aphrodite japonica	0	1	0	0	0	0	0	2
Travisia pupa	0	0	0	0	0	0	0	1

[1] X = present (colonial or aggregative species)

TABLE 7 (continued)

Taxa	Station P Rep 1	Station P Rep 2	Station P-2 Rep 1	Station P-2 Rep 2	Station P-6 Rep 1	Station P-6 Rep 2	Station 17 (Canyon) Rep 1	Station 17 (Canyon) Rep 2
Echinodermata								
Asteroidea								
Astropecten verrilli	0	0	0	0	0	0	1	1
Astropecten sp. (juv.)	0	0	0	0	1	0	0	1
Luidea foliolata	6	3	0	2	1	1	4	2
Pycnopodia helianthoides	1	0	0	0	0	1	0	0
Rathbunaster californicus	4	0	0	2	2	1	4	4
Ophiuroidea								
Amphichondrius granulosus	0	0	2	0	0	0	0	1
Ophiura lutkeni	0	0	1	0	1	1	0	1
Species Per Sample	12	11	12	8	15	13	17	22
Individuals Per Sample	46	100	129	67	152	228	133	129
Species Per Station	15		14		16		27	
Individuals Per Station	146		196		380		292	
Total Species	34							
Total Individuals	984							

The sea pens Acanthoptilum sp and Stylatula sp and the anemone Liponema brevicornis were present at nearly every site and were commonly observed at most dive sites. The multiarmed starfish (Rathbunaster californicus) was present at all dive sites around the canyons, but was not observed at the platform site. It was trawled at the platform site, however. Unidentified ophiuroids were also present at most stations, usually with only the tips of their arms exposed. Pink shrimp (or ocean shrimp; Pandalus jordani) were abundant along the south wall of the southern canyon and were common on the north wall. Spot prawns (Pandalus platyceros) were locally abundant in the vicinity of mud slumps within, but on the northern side of the southern canyon. Rock shrimp (Sicyonia ingentis) were common at the platform site, and were trawled at all four trawl stations including the canyon head (Station 17). Small Octopus (O. rubescens) were observed on the upper slope of most south canyon dives and were trawled at the platform site.

3.8 SENSITIVE UNDERWATER FEATURES

The only potentially sensitive underwater features in the Shamrock Project area are the submarine canyons in the westernmost portion of Lease P-0440 and the rocky outcrops along the southern portion of the pipeline corridor to the Platform Hermosa area. Examination of geophysical survey data collected for both the exploration and production geohazards investigations showed no rocky outcrops near the platform site or in the portion of the pipeline corridor in Lease P-0440. Evidence of relatively steep-walled irregularities in the bottom topography along the edges of and within the submarine canyons of Lease P-0440 were examined by RCV using television relay to deck monitors as the primary sensor. The nearest hard bottom habitat to the platform site observed in P-0440 was at Station No. 17 (Dive No. 3), 1.8 km southwest of the platform site. This is also the closest point of either canyon to the platform site.

In the southern canyon there were no apparent rocky outcrops on the northern wall. A small (about 15 by 50 m) area of low (less than 0.5 m) outcrop or partially exposed smooth low boulders was observed during Dive No. 3 in the axis of this canyon (Fix No. 40 in Plate I). A small, apparently in-place set of outcrops of about 1 to 3 m in basal extent and less than 1 m in height was observed during Dive No. 6 on the south wall near the western boundary of P-0440

(Fix No. 172). Along the southern wall of the northern canyon during Dive No. 9 there was considerable rock outcrop of up to 1 m in vertical relief exposed along the rim of the canyon in depths of 135 to 150 m (450 to 500 ft) (especially Fix Nos. 340-360 and 371-381 on Plate I). This outcrop appears to consist mainly of an inplace discontinuous ridge which in places has steep vertical sides, with some crevices and other limited shelter. At the southern end of the pipeline corridor to the Platform Hermosa area there are extensive open bottom rocky outcrops (see Dames & Moore, 1983 a,b).

The southern canyon protrudes a greater distance into the lease and has a deeper rim than the northern canyon. The north wall of the southern canyon contains several apparent slump features. It has a silt and loose clay veneer over consolidated clay on its sloping walls. In the area of deposition of the slump features there is considerable small scale vertical relief of 15 to 30 cm, consisting of clay lumps and pits. This partially sheltered habitat provided cover for a relatively dense population of spot prawns (Pandalus platyceros). The soft bottom habitat on the south wall of the southern canyon was relatively flat and supported large numbers of pink shrimp (also called ocean shrimp; Pandalus jordani). The walls appeared to be steeper than on the north wall and were vertical for up to 15 m in some places. In general, the shelf above the canyon edge and upper slopes of the canyon had more species and denser populations than the lower canyon walls and canyon bottom.

3.9 OVERVIEW OF THE MARINE BIOLOGY OF THE PROJECT AREA

Infauna, epifauna, and demersal fish of the project area (platform site and pipeline corridors) and of the southern canyon in P-0440 form a broadly uniform faunal association. Demersal fish are dominated by midshipmen (Porichthys notatus), flatfish (especially Citharichthys sordidus) and small rockfish (especially Sebastes saxicola). The soft bottom epifauna is dominated by anemones (Liponema brevicornis), sea pens (Acanthoptilum gracile and Stylatula elongata), brittle stars (cf. Amphiodia spp.) and multiarmed starfish (especially Rathbunaster californicus). The hard bottom epifauna is dominated

by the plume anemone, Metridium senile.[3] The infauna is dominated by deposit feeding polychaetes (especially Spiophanes missionensis).

Species associations appear strong and as high between stations as within stations. This indicates that within the limited depth range sampled that only one assemblage is found. Based on comparison with available data, it is most closely associated with assemblages from slightly shallower water farther south. The trend for the midshelf fauna to be farther offshore when moving from the sheltered Santa Barbara Channel to the more exposed Point Conception and southern Santa Maria Basin has been previously documented (Dames & Moore, 1983b). The broad uniformity of faunal associations suggests that there will be a sufficient suitable source for recruitment to repopulate areas disturbed by temporary project impacts.

The nearer (southern) submarine canyon in Lease P-0440 is predominantly clay walled. Features within the canyon with high vertical relief appear to be slump features which produce a semi-sheltered soft bottom habitat. This habitat is characterized by pink or ocean shrimp (Pandulus jordani), spot prawn (Pandulus platyceros), drift kelp, and various species of flatfish. Where there is more nearly consolidated bottom, the plumose anemone (Metridium senile) dominates.

The edge and upper slopes of this canyon are dominated by sea pens, by the anemone Liponema brevicornis sp., and by the starfish Rathbunaster californicus. Flatfish are more common in these areas than in the canyon bottom and around the slump features. Worm tubes (including Mellina heterodonta, Onuphis iridescens, and Pista fasciata) and the extended arms of ophiuroids are common in this habitat. Plate II illustrates typical habitats and the fauna of the southern canyon.

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[3] The taxonomy of this common anemone is under revision and there will probably be a change in the species name for the Pacific coast species.

PLATE II

Typical Habitats and Biota of the Canyon

A. Center, cf. Dover sole, Microstomus pacificus, and stripetail rockfish, Sebastes saxicola (top); drift eel grass upper right; short curved tips of arms of ophiuroid starfish in upper and lower right and by the tail of the Dover sole.

B. Ratfish, Hydrolagus colliei (upper left) and an unidentified poacher (cf. Xeneretmus sp.) in the right foreground; opiuroid arms in center.

C. Plumose anemone, Metridium senile (center and upper right), and peach colored anemone, cf. Tealia sp.; drift kelp blade and stipe wrapped around base of anemones; spot prawns, Pandalus platyceros, beneath and to the right side of each plumose anemone; no rock substrate visible.

D. Multiarmed starfish, Rathbunaster californicus, and sea pen, cf. Stylatula elongata on extensive bed of worm tubes; ophiuroid arms upper and lower right.

A

B

C

D

The south wall of the northern canyon has extensive rock outcrop. It is dominated by the plumose anemone (M. senile), but in our opinion supports the same sort of varied epifaunal community observed previously in hard bottom areas both north and south of this area (Dames & Moore, 1983a,b; Nekton, 1981). The conspicuous epifauna of this habitat includes cup corals (cf. Caryophila sp.), small sea fans (Eugorgia sp.), sea cucumbers (Parastichopus spp.), brittle stars (cf. Ophiocantha sp.), and several species of starfish including cf. Ceremaster sp., Henrecia sp., Linckia sp., Mediaster aequalis, and Stylasterias forreri. On sediment bottoms near the outcrops we observed the reptant gorgonian cf. Swiftia sp.

An anomalous condition was also observed during this survey. Red crabs (Pleuroncodes planipes) were collected at every trawl station. Based upon their presence in the stomachs of several trawled flatfish it is reasonable to assume that they were on the bottom and not midwater. As this species is usually associated with more southerly latitudes and found in southern California usually only in warm summers, it is speculated that these are remnants of the very warm water year of 1983. They would not be expected to be a part of this assemblage in normal years.

Sea urchins were conspicuously absent. No sea urchins were recovered in any of the eight trawls. No live sea urchins were observed in either soft or hard bottom habitats of the 10 dive locations. Several empty tests (shells) of irregular urchins (e.g., Briaster sp.) were observed indicating prior presence in the area. The depth of the survey lies offshore of the peak density area for Lytechinus and inshore of the preferred depths for Allocentrotus, Brisaster, Brissopsis and Spatangus from our western Channel surveys (Dames & Moore, 1982; 1983a,b).

Trawl caught rockfish dominate the commercial catch for the project area and the region (Dames & Moore, 1984). They would be expected to be found near the canyons and not on the open silty sand bottom of the project site and pipeline corridors. Although shrimp do not show significantly in the available catch data, they are an important regional resource. Ocean (or pink) shrimp and spot prawns are more sought after than rock shrimp. These two were observed in

the canyon area and are generally fished in water deeper than the project site (about 90 m; 300 ft). Rock shrimp were common in the trawls and in the video survey of the project site.

Offshore bird species (especially auklets and albatross) were observed during the surveys of the canyon area, but along the pipeline route and at the platform site nearshore species (e.g., gulls and cormorants) were more common. Very few marine mammals were observed.

4.0 CONCLUSIONS

1. The biota of the project area forms a broad and relatively uniform faunal assemblage which extends at least 15 km (8 nmi) along the 100-m (about 330-foot) isobath of the southern Santa Maria Basin.

2. This assemblage is similar to that found in the western Santa Barbara Channel at depths of 60-100 m (200 to 330 feet).

3. The southern submarine canyon of Lease P-0440 supports a predominantly soft bottom habitat associated fauna. Canyon head samples have a strong similarity to the southernmost pipeline route station samples (P-8).

4. The northern submarine canyon supports a hard bottom habitat associated fauna similar to that of the Point Conception to Point Arguello 100 to 150-m hard bottom fauna.

5. The nearest observed hard bottom habitat to the platform site was in the axis of the head of the nearer of the two submarine canyons, 1.8 km southwest of the platform site.

6. The lack of hard bottom habitats near the platform site, the broadly uniform faunal assemblage and the lack of significant fisheries would suggest that impacts from project construction and normal operations on the offshore marine biota and fisheries would not be significant. Marine biological impacts of the project are discussed in detail in the Environmental Report (Production).

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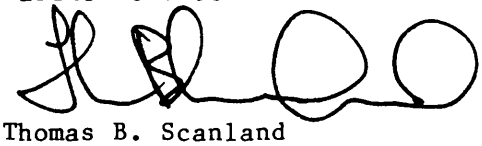
6.0 SIGNATURE

This report was prepared and the field studies carried out by and under the direction of the undersigned. See Section 2.2 for a list of project participants and their roles.

DAMES & MOORE
Marine Services



Thomas B. Scanland
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APPENDIX A

OCEAN SURVEYS, INC.

91 SHEFFIELD STREET
OLD SAYBROOK, CT. 06475

TEL: (203) 388-4631 TLX: 966429

MARINE SURVEY SERVICES
AND EQUIPMENT LEASING

SAMPLE LOCATIONS

SHAMROCK BIO-SURVEY
DAMES AND MOORE

9 MAY 1984

TIME (LOCAL)	STATION	GEOGRAPHIC LATITUDE	GEOGRAPHIC LONGITUDE	UTM (ZONE 10) EASTING (M)	UTM (ZONE 10) NORTHING (M)	REMARKS
0724	P8	34 30 39.345	120 40 44.750	713064.506	3821059.004	GRAB 1
0804	P8	34 30 40.800	120 40 45.591	713042.015	3821102.918	GRAB 2
0828	P8	34 30 40.444	120 40 44.750	713008.837	3821091.512	GRAB 3
0938	P6	34 32 18.713	120 42 13.604	710728.660	3824068.535	GRAB 1
0953	P6	34 32 18.336	120 42 13.806	710723.769	3824057.113	GRAB 2
1007	P6	34 32 18.723	120 42 13.723	710725.585	3824068.973	GRAB 3
1129	P4	34 34 11.188	120 43 25.829	708809.000	3827492.418	GRAB 1
1145	P4	34 34 11.330	120 43 25.867	708807.926	3827496.727	GRAB 2
1203	P4	34 34 11.208	120 43 25.050	708828.848	3827493.398	GRAB 3
1309	P2	34 35 58.740	120 44 38.047	706894.236	3830764.387	GRAB 1
1327	P2	34 35 59.422	120 44 37.307	706912.628	3830786.180	GRAB 2
1345	P2	34 35 59.605	120 44 37.731	706901.712	3830791.367	GRAB 3
1455	SHAM	34 37 35.877	120 45 25.953	705607.096	3830764.387	GRAB 1
1519	SHAM	34 37 35.522	120 45 25.288	705624.271	3833719.742	GRAB 2
1538	SHAM	34 37 35.237	120 45 25.454	705620.238	3833710.562	GRAB 3

OCEAN SURVEYS, INC.

MARINE SURVEY SERVICES
AND EQUIPMENT LEASING

91 SHEFFIELD STREET
OLD SAYBROOK, CT. 06475

TEL: (203) 388-4631 TLX: 966429

SAMPLE LOCATIONS
SHAMROCK BIO-SURVEY
DAMES AND MOORE

10 MAY 1984

TIME (LOCAL)	STATION	GEOGRAPHIC LATITUDE	GEOGRAPHIC LONGITUDE	UTM (ZONE 10) EASTING (M)	UTM (ZONE 10) NORTHING (M)	REMARKS
0759	P1	34 36 59.775	120 44 42.838	706730.119	3832642.279	GRAB 1
0815	P1	34 36 59.643	120 44 43.488	706713.682	3832637.916	GRAB 2
0830	P1	34 36 59.389	120 44 43.461	706714.509	3832630.336	GRAB 3
0850	H_2O	34 36 53.473	120 44 46.174	706649.503	3832446.318	WATER SAMPLE
0931	17	34 36 12.486	120 46 03.488	704708.015	3831139.590	GRAB 1
1018	17	34 36 13.329	120 46 05.299	704661.272	3831164.684	GRAB 2
1055	17	34 36 13.157	120 46 05.713	704650.861	3831158.836	GRAB 3

APPENDIX B

SHAMROCK SURVEY INFAUNAL SPECIES LIST

COELENTERATA (CNIDARIA)
- Anemone (unid)
- Cf Cactosoma
- Cerianthidae sp A
- Cerianthidae sp C
- Edwarsia sp A
- Edwarsia sp undescribed
- Halcampidae sp A
- Scolanthus sp A
- Stylatula elongata

PLATYHELMINTHES
- Flatworm 6 (unid)

NEMERTINA
- Cf Carinoma sp
- Cerebratulus spp
- Enopla unid (white)
- Lineus bilineatus
- Micrura sp (frag)
- Nemertean sp P
- Tubulanus cf nothus
- Tubulanus pellucidus

MOLLUSCA

PELECYPODA
- Acila castrensis
- Adontorhina cyclia
- Asthenothaerus villosior
- Axinopsida serricata
- Cuspidaria parapodema
- Cyclocardia ventricosa
- Mysella compressa
- Mysella tumida
- Nemocardium centifilosum
- Nuculana hamata
- parvilucina tenuisculpta
- Tellina carpenteri
- Thracia curta

GASTROPODA
- Amphissa undata
- Balcis micans
- Balcis sp A
- Bittium fetellum
- Cancellaria crawfordiana
- Cylichna diegensis
- Epitonium bellastriatum
- Epitonium sp (damaged)
- Kurtzia arteaga
- Turbonilla (chemnitzia) sp A
- Turbonilla (chemnitzia) sp C
- Volvulella cylindrica
- Volvulella panamica

SCAPHOPODA
- Cadulus quadrifissatus

APLACOPHORA
- Chaetoderma sp
- Chaetoderma sp B
- Chaetoderma sp C

ANNELIDA

POLYCHAETA
- Acesta catherinae
- Acesta simplex
- Aglaophamus dicirris
- Allia nolani
- Allia ramosa
- Amaeana occidentalis
- Amage anops
- Amage sp
- Amphicteis mucronata
- Amphicteis scaphobranchiata
- Anobothrus gracilis
- Artacamella hancocki
- Asychis disparidentata
- Axiothella rubrocincta
- Capitella capitata
- Chaetozone setosa
- Chloeia pinnata
- Chone albocincta
- Chone veleronis
- Cossura candida
- Decamastus gracilis
- Drilonereis falcata
- Drilonereis filum
- Ehlersia heterochaeta
- Ephesiella brevicapitis
- Euchone incolor
- Euchone sp
- Eunice americana
- Exogone lourei
- Glycera americana
- Glycera capitata
- Glycinde armigera
- Goniada brunnea
- Goniada sp

Gymnonereis crosslandi
Gyptis brevipalpa
Kurtziella beta
Mitrella gouldi
Harmothoe priops
Harmothoe "scriptoria"
Lanassa gracilis
Laonice cirrata
Leitoscoplos (=Haploscoloplos) elongatus
Lumbrineris bicirrata
Lumbrineris cruzensis
Lumbrineris lagunae
Lumbrineris sp D
Lysippe annectens
Lysippe sp
Maldane sarsi
Mediomastus californiensis
Melinna heterodonta
Mooreonuphis nebulosa
Myriochele heeri
Naineris sp
Nephtys cornuta franciscana
Nephtys ferruginea
Nephtys glabra
Nereis procera
Nereis sp
Ninoe gemma
Notomastus sp
Onuphis iridescens
Panthalis pacifica
Paraprionospio pinnata
Pectinaria californiensis
Petaloproctus sp
Pholoe glabra
Phyllodoce hartmanae
Phyllodoce sp
Pilargis berkeleyi
Pilargis sp
Piromis eruca
Pista fasciata
Pista moorei
Pista sp B
Poecilochaetus johnsoni
Polycirrus sp
Polydora sp
Potamilla sp
Praxillella affinis pacifica
Praxillella gracilis
Prionospio cirrifera
Prionospio steenstrupi
Sarsonuphis parva
Schistomeringos longicornis
Scolelepis tridentata
Sigambra tentaculata
Spio punctata
Spio sp
Spiochaetopterus costarum
Spiophanes berkeleyorum
Spiophanes missionensis
Sternaspis fossor
Sthenelais verruculosa
Sthenelais tertiaglabra
Sthenelanella uniformis
Streblosoma crassibranchia
Tauberia gracilis
Tauberia oculata
Terebellides stroemii (Type A)
Terebellides stroemii (Type B)
Tharyx spp
Travisia brevis
Travisia pupa
OLIGOCHAETA
Oligochaete (unid)
SIPUNCULIDA
Golgingia catherinae
Golfingia minuta
Golfingia misakiana
Ochensoma sp A
Siphonosoma sp
ECHIURIDA
Echiura unid
Listriolobus pelodes
ARTHROPODA CRUSTACEA
AMPHIPODA
Ampelisca agassizi (=A. compressa)
Ampelisca brevisimulata
Ampelisca careyi
Ampelisca cristata microdentata
Ampelisca hancocki
Ampelisca pacifica
Ampelisca pugetica
Ampelisca romigi
Byblis veleronis
Foxiphalus (=Paraphoxus) cognatus
Foxiphalus (=Paraphoxus) similis
Heterophoxus oculatus
Listriella eriopisa
Lysianassa oculata
ISOPODA
Gnathia crenulatifrons
Silophasma geminatum

Rhodine bitorquata
Melita dentata
Melita desdichada
Monoculodes norvegicus
Opisa tridentata
Orchomene decipiens
Orchomene magdalensis
Photis lacia
Phoxocephalus homilis
Protomedeia sp (frag)
Rhephoxynius (=Trichophoxus) bicuspidatus
Rhephoxynius menziesi
Synchelidium shoemakeri

CUMACEA
Diastylis californica
Diastylis sp A
Diastylis cf abbotti
Eudorella pacifica
Eudorellopsis longirostris
Leptostylis sp B
Leucon subnasica

DECAPODA
Axiopsis spinulicauda
Callianassa cf californiensis
Callianassa spp
Cancer sp
Heterocrypta occidentalis
Pinnixa occidentalis
Pinnixa cf schmitti
Randalia ornata
Synidotea media

OSTRACODA
Bathyleberis californica
Euphilomedes carcharodonta
Euphilomedes producta
Rutiderma lomae

TANAIDACEA
Leptochelia cf dubia
Leptochelia sp A
Leptognathia sp A

ECHINODERMATA
HOLOTHUROIDEA
Caudina sp
Havelockia sp
Leptosynapta sp A
Pentamera sp

OPHIUROIDEA
Amphichondrius granulosus
Amphiodia digitata
Amphiodia urtica
Amphioplus hexacanthus
Amphipholis sp
Amphiura arcystata
Amphiura sp (juv)
Dougaloplus amphacantha

PHORONIDA
Phoronis spp

HEMICHORDATA
Hemichordate unid

APPENDIX C

EXXON P-0440 INFAUNAL DATA

NODC CODE	TAXONOMIC NAME	STATION NO. P (PLATFORM SITE) REPLICATE	1	2	3
37	COELENTERATA (CNIDARIA)				
	CF CACTOSOMA		0	0	1
374301XXXX	CERIANTHIDAE SP A		1	0	2
	STYLATULA ELONGATA		1	0	0
39	PLATYHELMINTHES				
	FLATWORM 6 (UNID)		0	1	0
43	NEMERTINA				
	CF CARINOMA SP		1	2	3
	CEREBRATULUS SPP		0	1	0
4304	ENOPLA UNID (WHITE)		0	0	1
430302XXXX	LINEUS BILINEATUS		1	0	1
430201XXXX	TUBULANUS PELLUCIDUS		7	2	1
5085	MOLLUSCA				
55	PELECYPODA				
5515020201	AXINOPSIDA SERRICATA		0	1	0
5515010101	PARVILUCINA TENUISCULPTA		0	5	0
51	GASTROPODA				
51035001XX	EPITONIUM SP (DAMAGED)		0	1	0
56	SCAPHOPODA				
56000201XX	CADULUS QUADRIFISSATUS		2	2	0
50	ANNELIDA				
5001	POLYCHAETA				
5001	ACESTA CATHERINAE		0	1	0
5001	ACESTA SIMPLEX		0	1	0
50016823XX	AMAEANA OCCIDENTALIS		1	0	0
5001670701	ANOBOTHRUS GRACILIS		2	2	1
5001630802	AXIOTHELLA RUBROCINCTA		7	1	8
5001600101	CAPITELLA CAPITATA		0	0	1
50015201XX	COSSURA CANDIDA		1	5	1
5001600501	DECAMASTUS GRACILIS		0	0	1
5001270104	GLYCERA AMERICANA		0	0	1
5001270101	GLYCERA CAPITATA		3	2	0
5001280103	GLYCINDE ARMIGERA		1	3	2
50012802XX	GONIADA SP		0	1	0
5001	GYMNONEREIS CROSSLANDI		1	0	0
50016813XX	LANASSA GRACILIS		1	0	0
5001400102	LEITOSCOPLOS (=HAPLOSCOLOPLOS) ELONGATUS		4	1	2
5001310101	LUMBRINERIS BICIRRATA		3	0	1
5001310118	LUMBRINERIS CRUZENSIS		2	0	5
50013101XX	LUMBRINERIS SP D		3	3	3
5001630301	MALDANE SARSI		2	2	1
50016004XX	MEDIOMASTUS CALIFORNIENSIS		5	16	4
5001310202	NINOE GEMMA		1	1	1
50016003XX	NOTOMASTUS SP		0	0	1
50012901XX	ONUPHIS IRIDESCENS		0	2	0
5001431701	PARAPRIONOSPIO PINNATA		2	3	4
50016603XX	PECTINARIA CALIFORNIENSIS		0	3	2
50016001XX	PHOLOE GLABRA		4	8	1
50011301XX	PHYLLODOCE HARTMANAE		0	1	0

EXXON P-0440 INFAUNAL DATA (continued)

NODC CODE	TAXONOMIC NAME	STATION NO. P (PLATFORM SITE) REPLICATE	1	2	3
50011301XX	PHYLLODOCE SP		2	2	1
500146XXXX	POECILOCHAETUS JOHNSONI		0	1	0
50016808XX	POLYCIRRUS SP		1	0	0
5001630903	PRAXILLELLA AFFINIS PACIFICA		9	7	4
5001630901	PRAXILLELLA GRACILIS		0	1	0
5001430502	PRIONOSPIO CIRRIFERA		5	5	4
5001430506	PRIONOSPIO STEENSTRUPI		3	1	3
5001631001	RHODINE BITORQUATA		0	0	1
500129XXXX	SARSONUPHIS PARVA		0	1	0
50014307XX	SPIO SP		1	0	0
5001490302	SPIOCHAETOPTERUS COSTARUM		1	0	1
5001431004	SPIOPHANES BERKELEYORUM		12	7	11
50014310XX	SPIOPHANES MISSIONENSIS		130	85	130
50015901XX	STERNASPIS FOSSOR		4	4	6
50010603XX	STHENELAIS VERRUCULOSA		0	1	1
5001	STHENELANELLA UNIFORMIS		1	1	1
5001	TAUBERIA GRACILIS		6	9	1
50015003XX	THARYX SPP		5	5	5
5001580401	TRAVISIA BREVIS		1	0	0
5001580403	TRAVISIA PUPA		0	1	0
61	ARTHROPODA CRUSTACEA				
6168	AMPHIPODA				
6169020111	AMPELISCA AGASSIZI (=A. COMPRESSA)		0	1	0
61690201XX	AMPELISCA BREVISIMULATA		1	1	4
6169020101	AMPELISCA CAREYI		1	0	1
6169020113	AMPELISCA HANCOCKI		1	0	0
61690201XX	AMPELISCA PACIFICA		0	1	0
6169420930	FOXIPHALUS (=PARAPHOXUS) SIMILIS		0	0	1
6169420301	HETEROPHOXUS OCULATUS		4	4	5
61693422XX	LYSIANASSA OCULATA		0	1	0
61694210XX	RHEPHOXYNIUS (=TRICHOPHOXUS) BICUSPIDATUS		3	9	4
6154	CUMACEA				
61540501XX	DIASTYLIS SP A		0	0	1
61540501XX	DIASTYLIS CF ABBOTTI		0	0	1
6175	DECAPODA				
61830402XX	CALLIANASSA SP (FRAG)		1	0	0
6189060403	PINNIXA OCCIDENTALIS		0	1	2
6158	ISOPODA				
61590101XX	GNATHIA CRENULATIFRONS		0	2	0
6110	OSTRACODA				
	EUPHILOMEDES CARCHARODONTA		1	0	0
6155	TANAIDACEA				
61570202XX	LEPTOGNATHIA SP A		0	1	0
81	ECHINODERMATA				
8170	HOLOTHUROIDEA				
81790201XX	CAUDINA SP		2	0	0
81780102XX	LEPTOSYNAPTA SP A		5	1	2

EXXON P-0440 INFAUNAL DATA (continued)

NODC CODE	TAXONOMIC NAME	STATION NO. P (PLATFORM SITE) REPLICATE 1	2	3
8120	OPHIUROIDEA			
81290301XX	AMPHIODIA URTICA	32	41	51
81290309XX	AMPHIOPLUS HEXACANTHUS	0	1	0
81290310XX	AMPHIURA ARCYSTATA	1	0	0
	DOUGALOPLUS AMPHACANTHA	1	0	1
77	PHORONIDA			
77000102XX	PHORONIS SP (FRAG)	1	0	0

EXXON P-0440 INFAUNAL DATA

NODC CODE	TAXONOMIC NAME	STATION NO. P/I REPLICATE	1	2	3
37	COELENTERATA (CNIDARIA)				
374301XXXX	CERIANTHIDAE SP A		3	1	2
43	NEMERTINA				
4304	ENOPLA UNID		1	0	0
430302XXXX	LINEUS BILINEATUS		0	0	1
430201XXXX	TUBULANUS PELLUCIDUS		1	2	1
5085	MOLLUSCA				
55	PELECYPODA				
55200801XX	ASTHENOTHAERUS VILLOSIOR		0	1	0
5515020201	AXINOPSIDA SERRICATA		0	1	0
5515100102	MYSELLA TUMIDA		0	0	1
5515220301	NEMOCARDIUM CENTIFILOSUM		0	1	0
5515010101	PARVILUCINA TENUISCULPTA		4	0	2
5515310203	TELLINA CARPENTERI		2	2	1
51	GASTROPODA				
51100402XX	CYLICHNA DIEGENSIS		1	1	0
51035001XX	EPITONIUM BELLASTRIATUM		1	0	0
	KURTZIA ARTEAGA		0	2	0
	KURTZIELLA BETA		5	0	0
51080102XX	TURBONILLA (CHEMNITZIA) SP C		1	0	0
51101302XX	VOLVULELLA CYLINDRICA		1	0	0
56	SCAPHOPODA				
56000201XX	CADULUS QUADRIFISSATUS		0	1	0
54	APLACOPHORA				
54020101XX	CHAETODERMA SP C		0	1	0
50	ANNELIDA				
5001	POLYCHAETA				
5001	ACESTA CATHERINAE		0	0	1
50012503XX	AGLAOPHAMUS DICIRRIS		0	0	1
50016823XX	AMAEANA OCCIDENTALIS		0	0	1
5001670101	AMAGE ANOPS		1	1	0
50016701XX	AMAGE SP		2	1	1
5001670701	ANOBOTHRUS GRACILIS		1	0	0
5001	ARTACAMELLA HANCOCKI		1	0	0
5001630802	AXIOTHELLA RUBROCINCTA		8	3	6
5001600101	CAPITELLA CAPITATA		2	0	0
50017001XX	CHONE VELERONIS		0	1	0
50015201XX	COSSURA CANDIDA		4	0	0
5001600501	DECAMASTUS GRACILIS		0	1	0
5001330101	DRILONEREIS FILUM		3	0	0
50017002XX	EUCHONE SP		1	0	0
5001270101	GLYCERA CAPITATA		4	4	1
5001280103	GLYCINDE ARMIGERA		1	0	1
50010208XX	HARMOTHOE "SCRIPTORIA"		5	1	2
50016813XX	LANASSA GRACILIS		1	1	1
5001400102	LEITOSCOPLOS (=HAPLOSCOLOPLOS) ELONGATUS		2	0	2
5001310118	LUMBRINERIS CRUZENSIS		1	2	1
50013101XX	LUMBRINERIS SP D		3	4	2
5001630301	MALDANE SARSI		0	1	1

EXXON P-0440 INFAUNAL DATA

NODC CODE	TAXONOMIC NAME	STATION NO. P/I REPLICATE	1	2	3
50016004XX	MEDIOMASTUS CALIFORNIENSIS		12	7	9
50016705XX	MELINNA HETERODONTA		0	1	0
5001640201	MYRIOCHELE HEERI		1	1	0
5001250104	NEPHTYS CORNUTA FRANCISCANA		0	1	1
5001250111	NEPHTYS FERRUGINEA		0	0	1
50012501XX	NEPHTYS GLABRA		0	0	1
5001431701	PARAPRIONOSPIO PINNATA		2	2	2
50016603XX	PECTINARIA CALIFORNIENSIS		3	0	0
50016001XX	PH0LOE GLABRA		11	10	8
50011301XX	PHYLLODOCE HARTMANAE		0	1	0
50011301XX	PHYLLODOCE SP		1	1	2
50017006XX	POTAMILLA SP		3	0	0
5001630903	PRAXILLELLA AFFINIS PACIFICA		4	4	6
5001430502	PRIONOSPIO CIRRIFERA		6	6	5
5001430506	PRIONOSPIO STEENSTRUPI		4	3	0
5001631001	RHODINE BITORQUATA		0	0	2
500129XXXX	SARSONUPHIS PARVA		1	0	0
5001220201	SIGAMBRA TENTACULATA		0	0	1
5001431004	SPIOPHANES BERKELEYORUM		7	8	5
50014310XX	SPIOPHANES MISSIONENSIS		184	74	49
50015901XX	STERNASPIS FOSSOR		13	9	2
50010603XX	STHENELAIS TERTIAGLABRA		2	0	0
5001	STHENELANELLA UNIFORMIS		1	0	0
5001	TAUBERIA GRACILIS		15	7	4
5001	TAUBERIA OCULATA		1	0	1
50016901XX	TEREBELLIDES STROEMII (TYPE A)		2	1	0
50015003XX	THARYX SPP		2	3	9
5001580401	TRAVISIA BREVIS		1	0	0
72	SIPUNCULIDA				
72000201XX	GOLGINGIA CATHERINAE		0	1	0
72000201XX	GOLFINGIA CF MINUTA		0	2	0
7200XXXXXX	OCHENSOMA SP A		1	0	0
72000103XX	SIPHONOSOMA SP		0	0	1
73	ECHIURIDA				
73XXXXXXXX	ECHIURA UNID		0	1	0
61	ARTHROPODA CRUSTACEA				
6168	AMPHIPODA				
6169020111	AMPELISCA AGASSIZI (=A. COMPRESSA)		0	7	0
61690201XX	AMPELISCA BREVISIMULATA		4	0	1
6169020101	AMPELISCA CAREYI		1	0	0
6169020113	AMPELISCA HANCOCKI		1	0	1
61690201XX	AMPELISCA PACIFICA		0	0	1
6169020114	AMPELISCA PUGETICA		1	0	0
6169420930	FOXIPHALUS (=PARAPHOXUS) SIMILIS		2	0	0
6169420301	HETEROPHOXUS OCULATUS		3	4	4
61693708XX	MONOCULODES NORVEGICUS		0	1	0
61692603XX	PROTOMEDEIA SP (FRAG)		1	0	0
61694210XX	RHEPHOXYNIUS (=TRICHOPHOXUS) BICUSPIDATUS		10	14	10
	RHEPHOXYNIUS MENZIESI		1	5	0

EXXON P-0440 INFAUNAL DATA (continued)

NODC CODE	TAXONOMIC NAME	STATION NO. P/I REPLICATE	1	2	3
6154	CUMACEA				
6154040202	EUDORELLA PACIFICA		1	2	0
61540504XX	LEPTOSTYLIS SP B		1	0	0
61540401XX	LEUCON SUBNASICA		1	0	0
6175	DECAPODA				
61830402XX	CALLIANASSA SPP (FRAG+JUV)		1	1	0
6158	ISOPODA				
61590101XX	GNATHIA CRENULATIFRONS		0	1	0
	SILOPHASMA GEMINATUM		0	1	0
61620202XX	SYNIDOTEA MEDIA		0	1	0
6110	OSTRACODA				
	BATHYLEBERIS CALIFORNICA		0	1	0
	EUPHILOMEDES CARCHARODONTA		1	2	0
611106XXXX	RUTIDERMA LOMAE		1	0	0
81	ECHINODERMATA				
8170	HOLOTHUROIDEA				
81780102XX	LEPTOSYNAPTA SP A		4	3	2
8120	OPHIUROIDEA				
81290301XX	AMPHIODIA DIGITATA		0	0	1
81290301XX	AMPHIODIA URTICA		54	75	45
81290309XX	AMPHIOPLUS HEXACANTHUS		0	1	0
81290310XX	AMPHIURA SP (JUV)		1	2	1
77	PHORONIDA				
77000102XX	PHORONIS SPP		0	1	1
82	HEMICHORDATA				
	HEMICHORDATE (FRAG)		0	0	1

EXXON P-0440 INFAUNAL DATA

NODC CODE	TAXONOMIC NAME	STATION NO. P-2 REPLICATE	1	2	3
37	COELENTERATA (CNIDARIA)				
374301XXXX	CERIANTHIDAE SP A		1	0	0
374301XXXX	CERIANTHIDAE SP C		0	0	1
43	NEMERTINA				
430302XXXX	LINEUS BILINEATUS		0	1	2
430201XXXX	TUBULANUS CF NOTHUS		1	1	0
430201XXXX	TUBULANUS PELLUCIDUS		3	5	0
5085	MOLLUSCA				
55	PELECYPODA				
5515020201	AXINOPSIDA SERRICATA		0	1	0
55201002XX	CUSPIDARIA PARAPODEMA		0	0	1
5515220301	NEMOCARDIUM CENTIFILOSUM		0	1	0
5515010101	PARVILUCINA TENUISCULPTA		4	0	0
5520080204	THRACIA CURTA		2	1	0
51	GASTROPODA				
51034601XX	BITTIUM FETELLUM		0	2	0
51100402XX	CYLICHNA DIEGENSIS		1	1	0
	KURTZIA ARTEAGA		0	0	1
	KURTZIELLA BETA		2	0	0
5105030204	MITRELLA GOULDI		0	1	0
51080102XX	TURBONILLA (CHEMNITZIA) SP A		1	0	0
56	SCAPHOPODA				
56000201XX	CADULUS QUADRIFISSATUS		3	1	2
54	APLACOPHORA				
54020101XX	CHAETODERMA SP		1	0	0
50	ANNELIDA				
5001	POLYCHAETA				
5001	ACESTA CATHERINAE		1	0	0
50012503XX	AGLAOPHAMUS DICIRRIS		0	0	1
5001	ALLIA RAMOSA		0	1	0
5001670306	AMPHICTEIS MUCRONATA		0	1	0
5001670304	AMPHICTEIS SCAPHOBRANCHIATA		1	0	0
5001670701	ANOBOTHRUS GRACILIS		1	0	2
5001630802	AXIOTHELLA RUBROCINCTA		6	11	7
50017001XX	CHONE ALBOCINCTA		0	1	1
50015201XX	COSSURA CANDIDA		2	0	2
5001600501	DECAMASTUS GRACILIS		0	0	1
5001700204	EUCHONE INCOLOR		1	0	0
5001230703	EXOGONE LOUREI		0	0	1
5001270101	GLYCERA CAPITATA		1	3	1
5001280103	GLYCINDE ARMIGERA		0	0	1
5001280203	GONIADA BRUNNEA		0	0	1
5001210102	GYPTIS BREVIPALPA		0	1	0
50010208XX	HARMOTHOE PRIOPS		1	0	0
50010208XX	HARMOTHOE "SCRIPTORIA"		4	3	2
50016813XX	LANASSA GRACILIS		1	1	0
5001400102	LEITOSCOPLOS (=HAPLOSCOLOPLOS) ELONGATUS		4	2	0
5001310101	LUMBRINERIS BICIRRATA		1	1	0
5001310118	LUMBRINERIS CRUZENSIS		3	3	3

EXXON P-0440 INFAUNAL DATA (continued)

NODC CODE	TAXONOMIC NAME	STATION NO. P-2 REPLICATE	1	2	3
50013101XX	LUMBRINERIS SP D		3	5	3
5001630301	MALDANE SARSI		1	0	4
50016004XX	MEDIOMASTUS CALIFORNIENSIS		13	7	7
50016705XX	MELINNA HETERODONTA		1	1	1
5001640201	MYRIOCHELE HEERI		1	0	0
5001250111	NEPHTYS FERRUGINEA		0	2	0
50012501XX	NEPHTYS GLABRA		0	1	0
5001310202	NINOE GEMMA		1	1	1
50016003XX	NOTOMASTUS SP		0	1	1
5001431701	PARAPRIONOSPIO PINNATA		2	0	1
50016307XX	PETALOPROCTUS SP (FRAG)		1	0	0
50016001XX	PHOLOE GLABRA		9	4	5
50011301XX	PHYLLODOCE SP		1	1	4
50012203XX	PILARGIS SP (FRAG)		1	0	0
50016807XX	PISTA MOOREI		0	2	0
50016807XX	PISTA SP B		0	1	0
50016808XX	POLYCIRRUS SP		0	0	1
5001630903	PRAXILLELLA AFFINIS PACIFICA		5	4	5
5001430502	PRIONOSPIO CIRRIFERA		4	2	2
5001430506	PRIONOSPIO STEENSTRUPI		2	5	2
5001220201	SIGAMBRA TENTACULATA		0	0	2
50014307XX	SPIO SP		0	1	1
5001490302	SPIOCHAETOPTERUS COSTARUM		0	0	1
5001431004	SPIOPHANES BERKELEYORUM		6	7	18
50014310XX	SPIOPHANES MISSIONENSIS		64	79	63
50015901XX	STERNASPIS FOSSOR		2	3	10
50010603XX	STHENELAIS TERTIAGLABRA		2	1	0
5001	TAUBERIA GRACILIS		7	8	6
50016901XX	TEREBELLIDES STROEMII (TYPE B)		0	1	1
50015003XX	THARYX SPP		7	10	8
5001580401	TRAVISIA BREVIS		1	0	0
72	SIPUNCULIDA				
72000201XX	GOLFINGIA MISAKIANA		2	2	1
7200XXXXXX	OCHNESOMA SP A		1	1	0
73	ECHIURIDA				
73010204XX	LISTRIOLOBUS PELODES		0	1	0
61	ARTHROPODA CRUSTACEA				
6168	AMPHIPODA				
61690201XX	AMPELISCA BREVISIMULATA		2	1	2
6169020101	AMPELISCA CAREYI		3	0	1
6169020206	BYBLIS VELERONIS		0	1	0
6169420930	FOXIPHALUS (=PARAPHOXUS) SIMILIS		0	1	1
6169420301	HETEROPHOXUS OCULATUS		4	2	6
61694210XX	RHEPHOXYNIUS (=TRICHOPHOXUS) BICUSPIDATUS		7	5	4
6154	CUMACEA				
61540501XX	DIASTYLIS CALIFORNICA		0	0	1
6154040202	EUDORELLA PACIFICA		1	0	0
61540403XX	EUDORELLOPSIS LONGIROSTRIS		1	0	0
61540504XX	LEPTOSTYLIS SP B		1	0	0
61540401XX	LEUCON SUBNASICA		1	0	0

EXXON P-0440 INFAUNAL DATA (continued)

NODC CODE	TAXONOMIC NAME	STATION NO. P-2 REPLICATE 1	2	3
6175	DECAPODA			
	AXIOPSIS SPINULICAUDA	0	0	1
61830402XX	CALLIANASSA SPP (JUV)	1	0	0
61880301XX	CANCER SP (JUV)	0	1	0
6189060404	PINNIXA CF SCHMITTI	0	1	0
6186XXXXXX	RANDALLIA ORNATA	1	0	0
6110	OSTRACODA			
	BATHYLEBERIS CALIFORNICA	1	0	0
6155	TANAIDACEA			
61570201XX	LEPTOCHELIA SP A? (JUV)	1	0	0
81	ECHINODERMATA			
8170	HOLOTHUROIDEA			
81780102XX	LEPTOSYNAPTA SP A	4	3	6
	PENTAMERA SP	0	0	2
8120	OPHIUROIDEA			
81290301XX	AMPHIODIA DIGITATA	1	0	0
81290301XX	AMPHIODIA URTICA	58	48	56
81290309XX	AMPHIOPLUS HEXACANTHUS	1	2	1
81290310XX	AMPHIURA SP (JUV)	5	0	2
	DOUGALOPLUS AMPHACANTHA	1	0	0

EXXON P-0440 INFAUNAL DATA

NODC CODE	TAXONOMIC NAME	STATION NO. P-4 REPLICATE	1	2	3
37	COELENTERATA (CNIDARIA)				
374301XXXX	CERIANTHIDAE SP A		2	4	2
37590101XX	EDWARSIA SP A		0	1	1
43	NEMERTINA				
	CEREBRATULUS SPP (FRAG)		0	0	2
430302XXXX	LINEUS BILINEATUS		1	0	0
430302XXXX	TUBULANUS CF NOTHUS		0	1	0
430201XXXX	TUBULANUS PELLUCIDUS		3	2	2
5085	MOLLUSCA				
55	PELECYPODA				
5515020102	ADONTORHINA CYCLIA		1	0	0
5515100102	MYSELLA TUMIDA		0	1	1
5515220301	NEMOCARDIUM CENTIFILOSUM		0	2	0
5515010101	PARVILUCINA TENUISCULPTA		7	5	1
5515310203	TELLINA CARPENTERI		0	2	1
5520080204	THRACIA CURTA		1	0	0
51	GASTROPODA				
5103530102	BALCIS MICANS		0	0	1
5105030204	MITRELLA GOULDI		0	0	1
51101302XX	VOLVULELLA PANAMICA		0	0	2
56	SCAPHOPODA				
56000201XX	CADULUS QUADRIFISSATUS		2	0	0
54	APLACOPHORA				
54020101XX	CHAETODERMA SP C		0	1	2
50	ANNELIDA				
5001	POLYCHAETA				
5001	ACESTA CATHERINAE		0	0	1
50012503XX	AGLAOPHAMUS DICIRRIS		1	0	0
5001670701	ANOBOTHRUS GRACILIS		2	0	2
50016301XX	ASYCHIS DISPARIDENTATA		1	0	0
5001630802	AXIOTHELLA RUBROCINCTA		3	4	3
5001600101	CAPITELLA CAPITATA		2	1	1
50017001XX	CHONE ALBOCINCTA		1	2	0
50017001XX	CHONE VELERONIS		0	0	1
50015201XX	COSSURA CANDIDA		4	1	5
5001600501	DECAMASTUS GRACILIS		1	0	0
5001330104	DRILONEREIS FALCATA		0	0	1
5001	EHLERSIA HETEROCHAETA		0	1	1
50012603XX	EPHESIELLA BREVICAPITIS		0	1	0
5001700204	EUCHONE INCOLOR		1	0	0
5001270101	GLYCERA CAPITATA		3	4	3
5001280103	GLYCINDE ARMIGERA		3	1	1
50010208XX	HARMOTHOE "SCRIPTORIA"		1	3	3
50016813XX	LANASSA GRACILIS		1	0	0
5001430201	LAONICE CIRRATA		1	0	0
5001400102	LEITOSCOPLOS (=HAPLOSCOLOPLOS) ELONGATUS		0	1	1
5001310101	LUMBRINERIS BICIRRATA		1	0	0
5001310118	LUMBRINERIS CRUZENSIS		2	2	0
50013101XX	LUMBRINERIS SP D		5	2	1

EXXON P-0440 INFAUNAL DATA (continued)

NODC CODE	TAXONOMIC NAME	STATION NO. P-4 REPLICATE 1	2	3
50016704XX	LYSIPPE SP (FRAG)	1	0	0
5001630301	MALDANE SARSI	0	0	2
50016004XX	MEDIOMASTUS CALIFORNIENSIS	20	14	14
5001400204	NAINERIS SP (FRAG)	1	0	0
5001250111	NEPHTYS FERRUGINEA	1	1	0
50012404XX	NEREIS SP (JUV)	5	4	5
5001310202	NINOE GEMMA	1	0	1
50012901XX	ONUPHIS IRIDESCENS	1	0	0
5001431701	PARAPRIONOSPIO PINNATA	6	1	2
50016603XX	PECTINARIA CALIFORNIENSIS	1	0	0
50016307XX	PETALOPROCTUS SP (FRAG)	0	0	1
50016001XX	PH0LOE GLABRA	21	8	18
50011301XX	PHYLLODOCE HARTMANAE	2	0	0
50011301XX	PHYLLODOCE SP	3	5	5
50012203XX	PILARGIS SP (FRAG)	1	0	0
50016807XX	PISTA MOOREI	1	0	0
5001630903	PRAXILLELLA AFFINIS PACIFICA	5	5	2
5001430502	PRIONOSPIO CIRRIFERA	1	1	3
5001430506	PRIONOSPIO STEENSTRUPI	11	5	6
500129XXXX	SARSONUPHIS PARVA	0	0	3
5001490302	SPIOCHAETOPTERUS COSTARUM	0	0	2
5001431004	SPIOPHANES BERKELEYORUM	15	11	15
50014310XX	SPIOPHANES MISSIONENSIS	117	96	156
50015901XX	STERNASPIS FOSSOR	7	8	11
5001	STHENELANELLA UNIFORMIS	0	1	1
5001	TAUBERIA GRACILIS	14	2	8
50016901XX	TEREBELLIDES STROEMII (TYPE A)	0	1	1
50016901XX	TEREBELLIDES STROEMII (TYPE B)	1	0	0
50015003XX	THARYX SPP	3	2	5
5001580401	TRAVISIA BREVIS	0	2	1
72	SIPUNCULIDA			
72000201XX	GOLFINGIA MINUTA	2	1	0
61	ARTHROPODA CRUSTACEA			
6168	AMPHIPODA			
6169020111	AMPELISCA AGASSIZI (=A. COMPRESSA)	0	0	1
61690201XX	AMPELISCA BREVISIMULATA	1	2	0
6169020101	AMPELISCA CAREYI	2	0	1
6169020112	AMPELISCA CRISTATA MICRODENTATA	1	0	0
6169020113	AMPELISCA HANCOCKI	0	0	1
61690201XX	AMPELISCA PACIFICA	1	0	0
6169420301	HETEROPHOXUS OCULATUS	5	0	2
61693428XX	OPISA TRIDENTATA	0	0	1
61694210XX	RHEPHOXYNIUS (=TRICHOPHOXUS) BICUSPIDATUS	5	7	2
	RHEPHOXYNIUS MENZIESI	0	1	0
6154	CUMACEA			
61540501XX	DIASTYLIS SP A	1	0	0
61540504XX	LEPTOSTYLIS SP B	0	0	1
6175	DECAPODA			
6189060403	PINNIXA OCCIDENTALIS	0	0	1
6189060404	PINNIXA CF SCHMITTI	1	0	0

EXXON P-0440 INFAUNAL DATA (continued)

NODC CODE	TAXONOMIC NAME	STATION NO. P-4 REPLICATE 1	2	3
81	ECHINODERMATA			
8170	HOLOTHUROIDEA			
81780102XX	LEPTOSYNAPTA SP A	4	5	9
8120	OPHIUROIDEA			
81290301XX	AMPHIODIA URTICA	94	65	66
81290309XX	AMPHIOPLUS HEXACANTHUS	0	1	0
81290310XX	AMPHIURA ARCYSTATA	2	0	1
77	PHORONIDA			
77000102XX	PHORONIS SPP	1	0	1

EXXON P-0440 INFAUNAL DATA

NODC CODE	TAXONOMIC NAME	STATION NO. P-6 REPLICATE 1	2	3
37	COELENTERATA (CNIDARIA)			
374301XXXX	CERIANTHIDAE SP A	2	0	2
37590101XX	EDWARSIA SP UNDESCRIBED	0	1	0
	HALCAMPIDAE SP A	0	0	1
43	NEMERTINA			
	CEREBRATULUS SPP (FRAG)	0	1	0
430201XXXX	TUBULANUS PELLUCIDUS	3	2	1
5085	MOLLUSCA			
55	PELECYPODA			
5515220301	NEMOCARDIUM CENTIFILOSUM	0	2	1
5515010101	PARVILUCINA TENUISCULPTA	0	1	0
5515310203	TELLINA CARPENTERI	0	2	0
51	GASTROPODA			
51050301XX	AMPHISSA UNDATA	0	1	0
56	SCAPHOPODA			
56000201XX	CADULUS QUADRIFISSATUS	0	0	2
54	APLACOPHORA			
54020101XX	CHAETODERMA SP	1	0	0
	CHAETODERMA SP B	0	0	1
	CHAETODERMA SP C	0	2	1
50	ANNELIDA			
5001	POLYCHAETA			
5001	ALLIA NOLANI	0	1	0
5001	ALLIA RAMOSA	0	2	0
5001670306	AMPHICTEIS MUCRONATA	0	0	1
5001670701	ANOBOTHRUS GRACILIS	1	0	3
5001	ARTACAMELLA HANCOCKI	2	0	1
5001630802	AXIOTHELLA RUBROCINCTA	13	7	7
50015201XX	COSSURA CANDIDA	5	15	4
5001	EHLERSIA HETEROCHAETA	1	2	0
50012603XX	EPHESIELLA BREVICAPITIS	0	1	0
50013001XX	EUNICE AMERICANA	1	0	0
5001270101	GLYCERA CAPITATA	4	3	0
5001280103	GLYCINDE ARMIGERA	1	0	1
50010208XX	HARMOTHOE "SCRIPTORIA"	0	3	2
5001430201	LAONICE CIRRATA	0	0	1
5001310101	LUMBRINERIS BICIRRATA	0	1	0
5001310118	LUMBRINERIS CRUZENSIS	3	10	0
50013101XX	LUMBRINERIS LAGUNAE	0	1	0
50013101XX	LUMBRINERIS SP D	1	5	1
50016704XX	LYSIPPE ANNECTENS	1	0	0
5001630301	MALDANE SARSI	2	9	2
50016004XX	MEDIOMASTUS CALIFORNIENSIS	4	20	0
50016705XX	MELINNA HETERODONTA	0	1	0
5001250111	NEPHTYS FERRUGINEA	1	0	1
50012501XX	NEPHTYS GLABRA	1	0	0
5001240404	NEREIS PROCERA	0	0	1
5001310202	NINOE GEMMA	4	4	3
50012901XX	ONUPHIS IRIDESCENS	0	1	0
5001	PANTHALIS PACIFICA	0	0	1

EXXON P-0440 INFAUNAL DATA (continued)

NODC CODE	TAXONOMIC NAME	STATION NO. P-6 REPLICATE 1	2	3
5001431701	PARAPRIONOSPIO PINNATA	2	3	1
50016603XX	PECTINARIA CALIFORNIENSIS	1	0	0
50016001XX	PHOLOE GLABRA	8	2	4
50011301XX	PHYLLODOCE SP	0	3	0
5001220301	PILARGIS BERKELEYI	1	0	0
5001	PIROMIS ERUCA	0	1	1
5001680702	PISTA FASCIATA	0	1	0
50016807XX	PISTA SP B	1	1	0
50016808XX	POLYCIRRUS SP	0	1	0
50014304XX	POLYDORA SP	0	0	1
5001630903	PRAXILLELLA AFFINIS PACIFICA	0	3	1
5001630901	PRAXILLELLA GRACILIS	0	1	0
5001430502	PRIONOSPIO CIRRIFERA	3	5	1
5001430506	PRIONOSPIO STEENSTRUPI	3	6	3
5001631001	RHODINE BITORQUATA	0	3	0
500129XXXX	SARSONUPHIS PARVA	0	1	1
5001220201	SIGAMBRA TENTACULATA	1	0	0
5001431004	SPIOPHANES BERKELEYORUM	10	45	16
50014310XX	SPIOPHANES MISSIONENSIS	67	114	39
50015901XX	STERNASPIS FOSSOR	3	8	5
5001	TAUBERIA GRACILIS	1	17	1
50016901XX	TEREBELLIDES STROEMII (TYPE A)	0	0	1
50016901XX	TEREBELLIDES STROEMII (TYPE B)	3	2	0
50015003XX	THARYX SPP	6	8	3
72	SIPUNCULIDA			
7200XXXXXX	OCHNESOMA SP A	0	0	1
61	ARTHROPODA CRUSTACEA			
6168	AMPHIPODA			
61690201XX	AMPELISCA BREVISIMULATA	0	0	1
6169020101	AMPELISCA CAREYI	0	1	0
6169020113	AMPELISCA HANCOCKI	1	0	0
61690201XX	AMPELISCA PACIFICA	2	0	1
6169420930	FOXIPHALUS (=PARAPHOXUS) SIMILIS	3	1	0
6169420301	HETEROPHOXUS OCULATUS	4	4	3
61693708XX	MONOCULODES NORVEGICUS	1	0	0
61694210XX	RHEPHOXYNIUS (=TRICHOPHOXUS) BICUSPIDATUS	1	1	3
6169371402	SYNCHELIDIUM SHOEMAKERI	1	0	0
6175	DECAPODA			
61870112XX	HETEROCRYPTA OCCIDENTALIS	1	1	2
6158	ISOPODA			
61590101XX	GNATHIA CRENULATIFRONS	0	2	0
6155	TANAIDACEA			
6157020103	LEPTOCHELIA CF DUBIA	1	0	0
61570201XX	LEPTOCHELIA SP A	0	1	0
81	ECHINODERMATA			
8170	HOLOTHUROIDEA			
	HAVELOCKIA SP	1	0	0
81780102XX	LEPTOSYNAPTA SP A	1	2	5

EXXON P-0440 INFAUNAL DATA (continued)

NODC CODE	TAXONOMIC NAME	STATION NO. P-6 REPLICATE 1	2	3
8120	OPHIUROIDEA			
81290301XX	AMPHIODIA DIGITATA	1	0	0
81290301XX	AMPHIODIA URTICA	54	31	21
81290309XX	AMPHIOPLUS HEXACANTHUS	2	0	0
81290310XX	AMPHIURA SP (JUV)	5	6	0

EXXON P-0440 INFAUNAL DATA

NODC CODE	TAXONOMIC NAME	STATION NO. P-8 REPLICATE 1	2	3
37	COELENTERATA (CNIDARIA)			
374301XXXX	CERIANTHIDAE SP A	0	1	2
	HALCAMPIDAE SP A	1	0	1
43	NEMERTINA			
4304	ENOPLA UNID (WHITE)	1	0	0
430302XXXX	LINEUS BILINEATUS	1	0	0
430201XXXX	TUBULANUS CF NOTHUS	1	0	0
430201XXXX	TUBULANUS PELLUCIDUS	3	1	0
55	PELECYPODA			
5502020101	ACILA CASTRENSIS	0	0	1
5515020102	ADONTORHINA CYCLIA	0	0	1
55201002XX	CUSPIDARIA PARAPODEMA	1	0	0
5515170101	CYCLOCARDIA VENTRICOSA	4	1	3
5515220301	NEMOCARDIUM CENTIFILOSUM	0	1	0
5502040212	NUCULANA HAMATA	0	1	0
5515310203	TELLINA CARPENTERI	1	0	0
51	GASTROPODA			
51034601XX	BITTIUM FETELLUM	0	0	1
51080102XX	TURBONILLA (CHEMNITZIA) SP C	0	0	1
56	SCAPHOPODA			
56000201XX	CADULUS QUADRIFISSATUS	3	1	0
50	ANNELIDA			
5001	POLYCHAETA			
5001	ALLIA NOLANI	1	0	0
5001	ALLIA RAMOSA	4	0	3
5001670304	AMPHICTEIS SCAPHOBRANCHIATA	1	0	0
5001670701	ANOBOTHRUS GRACILIS	3	0	2
5001630802	AXIOTHELLA RUBROCINCTA	3	0	5
5001600101	CAPITELLA CAPITATA	3	0	1
50015201XX	COSSURA CANDIDA	23	2	12
5001600501	DECAMASTUS GRACILIS	2	0	0
5001330104	DRILONEREIS FALCATA	1	0	0
5001	EHLERSIA HETEROCHAETA	2	0	0
5001270101	GLYCERA CAPTIATA	1	0	0
5001430201	LAONICE CIRRATA	2	1	0
5001310101	LUMBRINERIS BICIRRATA	1	0	0
5001310118	LUMBRINERIS CRUZENSIS	0	1	6
50013101XX	LUMBRINERIS SP D	0	3	1
5001630301	MALDANE SARSI	1	1	1
50016004XX	MEDIOMASTUS CALIFORNIENSIS	15	0	1
50016705XX	MELINNA HETERODONTA	0	0	2
5001640201	MYRIOCHELE HEERI	1	0	3
5001250111	NEPHTYS FERRUGINEA	0	1	0
50012501XX	NEPHTYS GLABRA	0	1	0
5001240404	NEREIS PROCERA	0	0	1
5001310202	NINOE GEMMA	1	1	0
50012901XX	ONUPHIS IRIDESCENS	1	0	0
5001431701	PARAPRIONOSPIO PINNATA	1	0	0
50016603XX	PECTINARIA CALIFORNIENSIS	1	2	1
50016001XX	PHOLOE GLABRA	0	0	2

EXXON P-0440 INFAUNAL DATA (continued)

NODC CODE	TAXONOMIC NAME	STATION NO. P-8 REPLICATE 1	2	3
50011301XX	PHYLLODOCE HARTMANAE	0	0	1
50011301XX	PHYLLODOCE SP	0	1	0
5001220301	PILARGIS BERKELEYI	4	0	1
5001	PIROMIS ERUCA	1	0	0
5001630903	PRAXILLELLA AFFINIS PACIFICA	1	0	0
5001630901	PRAXILLELLA GRACILIS	0	1	1
5001430502	PRIONOSPIO CIRRIFERA	3	1	3
5001430506	PRIONOSPIO STEENSTRUPI	3	0	7
5001631001	RHODINE BITORQUATA	1	1	0
500129XXXX	SARSONUPHIS PARVA	0	0	3
50014320XX	SCOLELEPIS TRIDENTATA	0	1	0
5001220201	SIGAMBRA TENTACULATA	0	1	0
50014307XX	SPIO PUNCTATA	0	0	1
5001490302	SPIOCHAETOPTERUS COSTARUM	0	0	1
5001431004	SPIOPHANES BERKELEYORUM	60	9	55
50014310XX	SPIOPHANES MISSIONENSIS	95	28	94
50015901XX	STERNASPIS FOSSOR	7	1	7
50016825XX	STREBLOSOMA CRASSIBRANCHIA	0	1	0
5001	TAUBERIA GRACILIS	7	0	5
50016901XX	TEREBELLIDES STROEMII (TYPE A)	1	0	0
50016901XX	TEREBELLIDES STROEMII (TYPE B)	0	0	2
50015003XX	THARYX SPP	21	5	12
72	SIPUNCULIDA			
72000201XX	GOLFINGIA CATHARINAE	0	0	1
7200XXXXXX	OCHNESOMA SP A	0	1	0
61	ARTHROPODA CRUSTACEA			
6168	AMPHIPODA			
61690201XX	AMPELISCA BREVISIMULATA	7	0	5
6169020101	AMPELISCA CAREYI	0	0	1
6169020113	AMPELISCA HANCOCKI	0	0	1
61690201XX	AMPELISCA PACIFICA	0	0	1
6169020114	AMPELISCA PUGETICA	0	0	1
6169020206	BYBLIS VELERONIS	1	0	0
6169420929	FOXIPHALUS (=PARAPHOXUS) COGNATUS	0	1	0
6169420930	FOXIPHALUS (=PARAPHOXUS) SIMILIS	2	0	0
6169420301	HETEROPHOXUS OCULATUS	5	8	6
61692602XX	PHOTIS LACIA	0	0	1
6169420701	PHOXOCEPHALUS HOMILIS	1	1	0
61694210XX	RHEPHOXYNIUS (=TRICHOPHOXUS) BICUSPIDATUS	0	0	4
6154	CUMACEA			
61540501XX	DIASTYLIS SP A	1	0	0
6175	DECAPODA			
6183040204	CALLIANASSA CF CALIFORNIENSIS	0	2	0
6186XXXXXX	RANDALIA ORNATA	1	0	0
6110	OSTRACODA			
	EUPHILOMEDES PRODUCTA	1	0	1
6155	TANAIDACEA			
6157020103	LEPTOCHELIA CF DUBIA	1	0	0

EXXON P-0440 INFAUNAL DATA (continued)

NODC CODE	TAXONOMIC NAME	STATION NO. P-8 REPLICATE 1	2	3
81	ECHINODERMATA			
8170	HOLOTHUROIDEA			
	PENTAMERA SP	0	1	0
8120	OPHIUROIDEA			
	AMPHICHONDRIUS GRANULOSUS	0	0	2
81290301XX	AMPHIODIA URTICA	10	6	20
81290309XX	AMPHIOPLUS HEXACANTHUS	0	1	0
81290310XX	AMPHIURA SP (JUV)	1	1	4
	DOUGALOPLUS AMPHACANTHA	0	0	3

EXXON P-0440 INFAUNAL DATA

NODC CODE	TAXONOMIC NAME	STATION NO. 17 REPLICATE 1	2	3
37	COELENTERATA (CNIDARIA)			
3760	ANEMONE (UNID)	0	0	1
374301XXXX	CERIANTHIDAE SP A	1	0	1
375901XXXX	SCOLANTHUS SP A	0	1	0
39	PLATYHELMINTHES			
39	FLATWORM 6 (UNID)	0	1	0
43	NEMERTINA			
43030205XX	MICRURA SP (FRAG)	0	1	0
43	NEMERTEAN SP P	0	1	0
430201XXXX	TUBULANUS CF NOTHUS	0	1	0
430201XXXX	TUBULANUS PELLUCIDUS	0	1	1
5085	MOLLUSCA			
55	PELECYPODA			
55201002XX	CUSPIDARIA PARAPODEMA	0	0	1
5515170101	CYCLOCARDIA VENTRICOSA	7	0	2
5515100101	MYSELLA COMPRESSA	0	0	1
5515100102	MYSELLA TUMIDA	2	1	0
51	GASTROPODA			
51035301XX	BALCIS SP A	0	0	1
51051402XX	CANCELLARIA CRAWFORDIANA	0	0	1
56	SCAPHOPODA			
56000201XX	CADULUS QUADRIFISSATUS	0	3	0
50	ANNELIDA			
5001	POLYCHAETA			
5001	ALLIA NOLANI	0	1	0
50016301XX	ASYCHIS DISPARIDENTATA	0	1	0
5001630802	AXIOTHELLA RUBROCINCTA	2	7	1
5001500401	CHAETOZONE SETOSA	0	1	0
5001100101	CHLOEIA PINNATA	0	1	0
50015201XX	COSSURA CANDIDA	12	13	4
5001330104	DRILONEREIS FALCATA	1	0	0
50012603XX	EPHESIELLA BREVICAPITIS	1	0	1
5001700204	EUCHONE INCOLOR	0	1	0
5001230703	EXOGONE LOUREI	0	2	0
5001270104	GLYCERA AMERICANA	0	0	1
5001270101	GLYCERA CAPITATA	1	3	0
5001280103	GLYCINDE ARMIGERA	1	1	2
50010208XX	HARMOTHOE "SCRIPTORIA"	2	1	0
5001430201	LAONICE CIRRATA	1	0	0
5001310118	LUMBRINERIS CRUZENSIS	0	3	2
50013101XX	LUMBRINERIS INDEX	1	0	0
50013101XX	LUMBRINERIS SP D	0	2	0
50016704XX	LYSIPPE ANNECTENS	0	2	0
5001630301	MALDANE SARSI	0	0	1
50016004XX	MEDIOMASTUS CALIFORNIENSIS	2	35	4
500129XXXX	MOOREONUPHIS NEBULOSA	0	1	0
5001250111	NEPHTYS FERRUGINEA	0	3	0
50012501XX	NEPHTYS GLABRA	1	0	0
50016003XX	NOTOMASTUS SP	0	3	0
5001431701	PARAPRIONOSPIO PINNATA	0	1	3

EXXON P-0440 INFAUNAL DATA (continued)

NODC CODE	TAXONOMIC NAME	STATION NO. 17 REPLICATE 1	2	3
50016001XX	PHOLOE GLABRA	0	2	0
50011301XX	PHYLLODOCE SP	0	1	0
5001220301	PILARGIS BERKELEYI	1	0	1
500146XXXX	POECILOCHAETUS JOHNSONI	1	0	0
5001630903	PRAXILLELLA AFFINIS PACIFICA	0	1	0
5001430502	PRIONOSPIO CIRRIFERA	7	5	1
5001430506	PRIONOSPIO STEENSTRUPI	0	5	0
5001631001	RHODINE BITORQUATA	0	0	1
500129XXXX	SARSONUPHIS PARVA	0	1	1
50013605XX	SCHISTOMERINGOS LONGICORNIS	1	0	0
5001220201	SIGAMBRA TENTACULATA	1	0	1
5001431004	SPIOPHANES BERKELEYORUM	12	125	12
50014310XX	SPIOPHANES MISSIONENSIS	4	38	4
50015901XX	STERNASPIS FOSSOR	1	5	3
5001	TAUBERIA GRACILIS	2	13	1
50016901XX	TEREBELLIDES STROEMII (TYPE A)	0	1	0
50016901XX	TEREBELLIDES STROEMII (TYPE B)	1	4	1
50015003XX	THARYX SPP	8	13	3
5004	OLIGOCHAETA			
5004	OLIGOCHAETE (UNID)	0	2	1
61	ARTHROPODA CRUSTACEA			
6168	AMPHIPODA			
61690201XX	AMPELISCA BREVISIMULATA	0	4	0
6169020113	AMPELISCA HANCOCKI	0	2	1
61690201XX	AMPELISCA PACIFICA	0	1	0
61690201XX	AMPELISCA ROMIGI	0	1	0
6169420930	FOXIPHALUS (=PARAPHOXUS) SIMILIS	0	4	0
6169420301	HETEROPHOXUS OCULATUS	4	4	0
61693303XX	LISTRIELLA ERIOPISA	0	1	0
6169211003	MELITA DENTATA	0	0	1
6169211008	MELITA DESDICHADA	1	0	0
61693429XX	ORCHOMENE DECIPIENS	0	1	0
61693429XX	ORCHOMENE MAGDALENSIS	0	1	0
61692602XX	PHOTIS LACIA	0	3	0
61694210XX	RHEPHOXYNIUS (=TRICHOPHOXUS) BICUSPIDATUS	0	1	1
6154	CUMACEA			
61540501XX	DIASTYLIS SP A	0	5	0
61540501XX	DIASTYLIS CF ABBOTTI	1	0	0
6154040202	EUDORELLA PACIFICA	0	1	0
6175	DECAPODA			
	AXIOPSIS SPINULICAUDA	1	0	0
6189060404	PINNIXA CF SCHMITTI	2	0	0
6110	OSTRACODA			
	BATHYLEBERIS CALIFORNICA	0	1	0
	EUPHILOMEDES PRODUCTA	1	2	0
81	ECHINODERMATA			
8170	HOLOTHUROIDEA			
81790201XX	CAUDINA SP	1	0	0

EXXON P-0440 INFAUNAL DATA (continued)

NODC CODE	TAXONOMIC NAME	STATION NO. 17 REPLICATE	1	2	3
8120	OPHIUROIDEA				
	AMPHICHONDRIUS GRANULOSUS		0	1	0
81290309XX	AMPHIOPLUS HEXACANTHUS		2	0	0
81290302XX	AMPHIPHOLIS SP		0	2	0
	DOUGALOPLUS AMPHACANTHA		0	2	1

APPENDIX D

MACROINVERTEBRATES OBSERVED DURING RCV DIVES

Taxa	Location*
Porifera	
unidentified finger sponge	9
Cnidaria	
Hydrozoa	
unidentified hydroids	9
Anthozoa	
Acanthoptilum gracile	2, 3C, 4C, 5, 6C, 7, 8C, 9C, 10C
Caryophylla sp.	9
Cerianthidae	2, 3C, 4C, 5, 7C, 9, 10
unidentified cup corals	9
Eugorgia sp.	9
unidentified gorgonians	9
Liponema brevicornis	3C, 4C, 5, 6A, 7, 8A, 9C, 10C
Metridium senile	3, 4, 5, 6, 8, 9C
Ptilosarcus gurneyi	3, 5, 6, 8, 9
cf. Stomphia sp.	3, 9
Stylatula elongata	3C, 4C, 5, 6A, 7, 8A, 9C, 10C
Swiftia sp.	6, 9
Tealia sp.	6
cf. Virgularia sp.	3, 5, 6, 9, 9C, 10
Ectoprocta	
unidentified bryozoan	9
Mollusca	
Gastropoda	
Megasurcula stearnsiana	3, 5, 9, 10
Mitra idae	6?
Neptunea sp.	5?
unidentified nudibranch	6, 7
Pleurobranchus californicus	3, 6, 8
Turbonilla sp.	5, 6
unidentified snail	3, 4, 5, 6, 8, 9
Cephalopoda	
Octopus spp.	3C, 4, 6C, 7, 9, 10
Annelida	
Polychaeta	
unidentified worm tubes	3, 4, 5, 6C, 7, 8
Arthropoda	
Crustacea-Myridacea	
unidenfied mysids	4, 6
Crustacea-Decapoda	
Cancer anthonyi	9
Cancer sp.	6
Crangon spp.	8, 9
cf. Paguristes spp.	3, 4, 6, 9
Pandalus jordani	3, 4, 5C, 7A, 8C
Pandalus platyceros	4, 5A, 7, 8, 9
Sicyonia ingentis	10C
unidentified shrimp	3, 4, 6, 7, 8A, 9

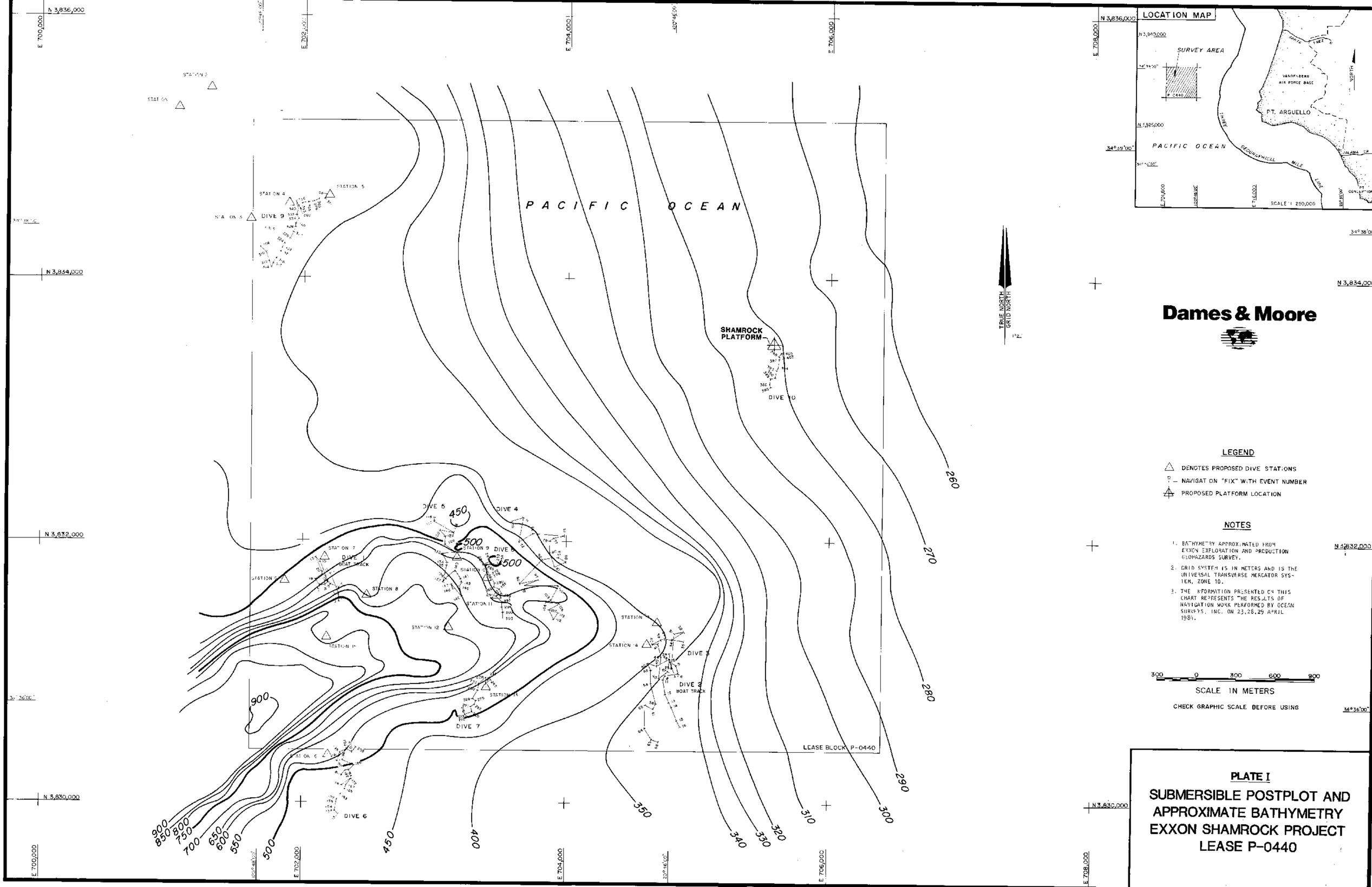
Taxa	Location*
Echinodermata	
Asteroidea	
cf. *Ctenodiscus* sp.	9
Henrecia sp.	6, 9
Linckia sp.	6, 9
Mediaster aequalis	3, 6, 9
Petalaster foliolata	4, 8, 9, 10
Pseudarchaster sp.	9
Pycnopodia helianthoides	5, 6
Rathbunaster californicus	1, 2, 3C, 4, 5C, 6A, 7C, 8C, 9A
Stylasterias forreri	9
Holothuroidea	
Parastichopus spp.	6, 9
Ophiuroidea	
Ophiocantha sp.	9
unidentified ophiuroids	2, 3, 4, 5, 6, 7, 8, 9, 10
Echinoidea	
cf. *Allocentrotus fragilis*	6

* Locations shown on Plate I; numbers refer to RCV dive number; C indicates common = noted at least 5 times during a dive; A indicates abundant = noted at least 10 times during a dive; ? indicates an uncertain identification based on video record.

APPENDIX E

TAXONOMIC EXPERTS

Taxonomic Group	Investigator
Cnidaria	J. Lubjenkov
Ectoprocta	T. Scanland
Sipuncula	B. Thompson
Polychaeta	L. Lovell
Mollusca	J. Shrake
Crustacea	D. Diener
Echinodermata	D. Diener
Others	D. Diener



LEGEND

△ DENOTES PROPOSED DIVE STATIONS

P — NAVIGAT ON "FIX" WITH EVENT NUMBER

PROPOSED PLATFORM LOCATION

NOTES

1. BATHYMETRY APPROXIMATED FROM EXXON EXPLORATION AND PRODUCTION GEOHAZARDS SURVEY.
2. GRID SYSTEM IS IN METERS AND IS THE UNIVERSAL TRANSVERSE MERCATOR SYSTEM, ZONE 10.
3. THE INFORMATION PRESENTED ON THIS CHART REPRESENTS THE RESULTS OF NAVIGATION WORK PERFORMED BY OCEAN SURVEYS, INC. ON 23,26,29 APRIL 1984.

300 0 300 600 900

SCALE IN METERS

CHECK GRAPHIC SCALE BEFORE USING

Dames & Moore

PLATE I

SUBMERSIBLE POSTPLOT AND APPROXIMATE BATHYMETRY EXXON SHAMROCK PROJECT LEASE P-0440