

NARRATIVE OF CRUISE 18

RV TE VEGA departed from Guayaquil, Ecuador, the evening of April 4, 1968, on a voyage whose projected route from northwestern Peru to Monterey, California, covered nearly 5000 nautical miles (see Map of Station Locations). The ship headed south and west toward Isla Santa Clara, lying in the mouth of the Gulf of Guayaquil some 3°10' south of the equator. The island, also called "El Muerto" from its resemblance to a shrouded corpse, is really four arid islets in a row, interconnected by shallow bars which are exposed or nearly awash at low tide. We reached the islets the morning of April 5, and the scientific party reconnoitered in three skiffs. Heavy surf prevailed all along the northern coast, but landings proved feasible at two points on the southern side, especially on the south side of the easternmost islet opposite some small huts used for temporary shelter by fishermen visiting the islands.

Field studies were carried out here for two and a half days, including one night spent ashore studying the behavior of the numerous land hermit crabs (*Coenobita*). Unprotected and protected rocky shores are present, as well as sandy beaches, providing a diversity of collecting areas for different members of the expedition, and opportunities for testing a variety of field surveying and sampling techniques to be used during the remainder of the cruise. Rich fossil beds are also present, and the cleaned shells of fossil species litter the beaches along with the shells of contemporary species. Waters inshore were too cloudy with silt and fine sand for subtidal collecting, but SCUBA dives were made in two areas of mixed rock and sandy bottom at depths of 25 to 50 feet. Gorgonians were common, along with basket stars, sea urchins, sea stars, simple ascidians and molluscs. Later in the expedition, when Isla Santa Clara findings could be compared with those of other sites, it became clear that the biota of the island is less like that of cooler northern Peru than that of warmer southern Ecuador.

The ship departed Isla Santa Clara April 7 and headed for Talara, Peru, arriving April 8. It was our intention to provide a southern "anchor" for our tropical survey by making one fairly extensive station in the temperate waters of northern Peru. We were hospitably received at Talara, but two shore expeditions and two diving trips showed that the area was not suitable for our purposes. Talara is an oil port in a desert region of the Peruvian coast, and its activities are largely those of the International Petroleum Company. Pollution of shore waters with oil is not severe, but a thin film of oil was present on all rocks examined in the vicinity of Punta Rocallosa and in the area between Punta Rocallosa and Punta Talara. Plant and animal species diversity was low, and crevice-dwelling arthropods were absent. Further south and west along the coast the rocks appeared cleaner, but collecting was prohibited by high surf. Diving trips were carried out to inspect the pilings of Pier No. 1, and a submerged reef near the harbor entrance. Visibility was limited, as was faunal diversity, and the water was slightly oily to smell and taste.

To obtain conditions more suitable for ecological and biotic comparison with more tropical situations in Ecuador, the expedition moved south late on April 9, and arrived at Paita, Peru early April 10. In almost every respect Paita proved excellent for our purposes. The town itself lies in a protected bay backed by 200-foot yellow sandstone cliffs, while to the south and west, lower cliffs and intertidal reefs are formed of black metamorphic rock. Rocky shores and sandy beaches displaying all degrees of protection from wave action are available. Local officials were most cooperative. Commercial operations involving exploitation of the sea (whaling, fishing, collection of guano, production of fish meal, and harvesting of marine algae) have not resulted in more than very localized pollution, and the bay seemed extraordinarily full of fish. While rainfall and runoff from land are close to zero, the water of the bay proved too turbid for diving close inshore, and offshore the bottom, where inspected, consisted of a very soft and easily stirred-up silt. Water above the bottom was clearer here, but very extensive and conspicuous red tides were of daily occurrence during our stay and these often cut visibility to a few inches in offshore regions. Ceratium is the most abundant phytoplankter in the red water. Local residents noted that the red waters moved in and out of the bay at all times of the year with no apparent harm to fishes.

The expedition worked in the vicinity of Paita for four days, and carried out night studies of molluscs and intertidal insect activity ~~ashore~~. Most available sandy beaches were sampled, and rocky shore studies concentrated primarily on Telegraph Point, secondarily on Punta Colón. Marine biologists Percy Cano I. (who speaks excellent English) and Enrique Sanchez V. of the local fisheries station (Lab. Regional de Paita, Instituto del Mar del Peru) took the scientific party on a tour of their facilities. At present they are mainly concerned with recording and analyzing local catch records of fishes and whales, but are trying to establish a collection of common local marine organisms. They loaned us useful publications, offered us the use of their laboratory if we needed it, and took us on tours of the fishmeal factory and of the whaling station (the latter operated under lease by a Japanese concern).

TE VEGA departed Paita the evening of April 13, and headed northward on a course toward Punta Santa Elena and Salinas, Ecuador. During the trip up the Peruvian coast and across the mouth of the Gulf of Guayaquil, sea surface temperature was monitored not only by recording thermograph (which shows considerable lag) but also by bucket thermometer. All faculty and students stood two-hour temperature watches. Considerable fluctuation was noted as TE VEGA crossed the area between Paita Harbor and the open sea to the west (between 16.5 and 19°C). Thereafter on the track north there appeared two regions where temperatures rose very rapidly with change in latitude: one was at 4°00'--4°10' S. lat., about 35 nautical miles west of the Mancora--Punta Sal region of Peru, near the southern end of the Gulf of Guayaquil; the other was at 2°20'--2°35' S. lat., just south and west of the northern lip of the Gulf of Guayaquil. Temperatures in between these regions on our track showed almost no change with latitude (see figure at end of Station Summary for Paita, Peru).

A bit north of the first region of rapid temperature rise, the ship passed for nearly one hour through a remarkable series of discontinuous patches of red water, separated by relatively sharp boundaries from a continuous phase of blue water. Patches varied from a few square meters to several acres in extent. There was virtually no swell and only light breezes (force 1-2), and for nearly an hour before noon we passed at 6 knots over a sea that seemed infected with giant measles. The region centered on 4°16'S. and 81°32'W., an area some 45 nautical miles off Punta Picos on the Peruvian coast. Microscopic examination of centrifuged samples from the red patches was made by Robert Waaland. The principal phytoplankton was a ciliate identical in form and behavior with Cyclotrichium meunieri as described by Kuenzler and Barr in an unpublished MS "Observations and impressions on a 'red tide' bloom 21 February 1968, at 2°35'S., 82°01'W.," pp. 218-224 in mimeographed report, Stanford Oceanographic Expeditions Cruise 17, Jan 3--Mar 24, 1968. The evening of the same day (April 14) sunset-watchers were rewarded; the ship's log recorded a "very distinct green flash."

The vessel arrived at Salinas, Ecuador, the morning of April 15 and remained at anchor there for four days. The Commandant of the Escuela Naval Militar at Salinas gave the expedition permission to use the landing there, to collect on Punta Mandinga, and to occupy other portions of the Naval Reservation for either day or night work. The scientific party thus had ready access to both highly protected and violently surf-beaten rock shores and sandy beaches. The rocky reef at Punta Mandinga, covered at high water but at low tide providing acres of exposed reef with tidepools, pinnacles, and many rocks that could be turned over, proved a marvelously rich area for most of the scientific party, and three different trips to this reef were made during our stay. During one day a chartered bus took the expedition to "Blue Beach" and "Punta de los dos Medicos," both on Punta Centinella, 10 km to the north of La Libertad. Both of these spots proved good, though less extensive and less rich than Punta Mandinga. No sharks or rays were noted close inshore, though rays were reported by residents to be very numerous in the beaches just south of Punta Mandinga, and sharks not uncommon north of Punta Mandinga and Punta Santa Elena. Diving activities in the area were limited not only by cloudy water but by temporary breakdown of the ship's air compressor. Personnel of Escuela Naval Militar under supervision of Lt. George Barriga used their compressor to fill all of our SCUBA tanks. Reciprocally, on 16 April, Lt. Enrique Gallegos and 17 midshipmen from the Escuela Naval came aboard TE VEGA. We all enjoyed showing them around, but for some reason the midshipmen responded best to tours of the ship conducted by the two girls of the scientific party.

The ship departed from Salinas late on April 18 and sailed northeast to Manta, arriving early the next day. To explore the coast for collecting later in the day, two taxis were hired, and most of the scientific party drove along the coast both north and south of the city, to the points where the roads ended. At both ends and in the central region, explorations of the shore were made. The most extensive rock

formation in Manta itself is the great breakwater, extending out nearly a mile from shore. A reef, at the fishing village of Jaramijo, to the east, appeared too limited and sand-scoured to be very rewarding. The rock-walled waterfront of Manta itself is nearly bare of life. The breakwater supports a fairly varied rock fauna, rather different on the two sides; the protected (eastern) side shows evidences of oiling, the western side none, though surf action limited collections on the outer portions here. A magnificent broad sandy beach, potentially perhaps one of the finest recreational beaches in the region, extends for more than a mile to the west of the city. Beyond Punta Murcielago and especially well developed in the region of Punta Mal Paso, elevated and tilted rock strata occur in the intertidal and offer good collecting at low tide. SCUBA diving at 20-40 feet in the bay revealed a sand-gravel bottom littered with bivalve shells and bearing egg collars of polynicid snails. Sea cucumbers were common on the rocks of the breakwater at 20 feet; sea urchins, gorgonians, and fishes dominated at lower levels.

Two days work in the Manta area proved sufficient to accomplish our objectives, and the ship departed late on April 20 for Punta Galera. Early the next morning TE VEGA crossed the equator, and with the first gray of dawn Neptunus and his court came aboard and took over the ship. Policeman (Chief Mate) Boysen with his cat-of-9-tails and his sturdy guards (the crew) woke the 12 pollywogs aboard with unearthly howls, and herded them (where necessary carried them) into the chain locker forward. The indignities began here, and one by one the pollywogs were brought through an obstacle course to the fantail where they were forthrightly bathed, shaved, charged with crimes, diagnosed by the doctor, treated with appropriate medicine, and at last advanced to shellback status. Court officials included Neptunus (Chief Scientist Abbott), Davy Jones (Senior Scientist Bovbjerg), the Doctor (Senior Scientist Evans), the Barber (Technician Samuel), the Captain (as himself), and Neptune's queen (Ship's Cook Munkittrick). Faculty and crew put considerable advance thought and effort into providing a colorful and thoroughgoing version of the "traditional ceremonies," and those on the receiving end generally agreed that the crossing had been celebrated in an unforgettable manner.

Not long afterward, as the new shellbacks were being washed up and the decks washed down, TE VEGA arrived off Punta Galera, Ecuador. The shore, we could see as we closed in, has an appearance very different from the arid desert coast of northern Peru and southern Ecuador. Even the Manta region, while it supports considerable scrub vegetation, is relatively dry. Punta Galera, on the other hand, is north of the point where the "rain line" intersects the coast, and a lush green forest of trees, shrubs, ferns, orchids, and hanging vines surmounts and creeps down the rocky cliffs that descend into the sea. The weather was choppy and the surf forbidding along the shore in most areas, so initial exploring activities were limited to one skiff with faculty and crew. In the lee of

punta Galera things grew calmer, and the skiff entered a cove with a broad curving beach backed by coconut trees and green forest. In the center lay the tiny village of Galera. The setting was very reminiscent of a south Pacific atoll village, viewed from the lagoon side. At a distance a great fleet of canoes appeared to be drawn up on the beach; on closer view the "canoes" turned out to be mostly cows and pigs on the sand. A small crowd from the village gathered on the shore as our skiff beached in calm water, and 2nd mate Ayala proved a fine ambassador for the ship. The people in this region, where soil and rainfall are favorable, are farmers rather than fishermen. We asked questions about sharks and rays (no danger from either inshore), and told the group what we would like to do around the rocky point and beach. They, in turn, were most agreeable and began dickering to sell the ship coconuts, papaias, and other produce. We left the beach and tried to scout the coast farther east, for no detailed charts of this region are available, but continued rough weather outside the cove drove us back to the ship.

Next day, April 21, the sea was calm and all went ashore for the low tide, working on both exposed and protected sides of Punta Galera, on sandy beaches and rocks. The tide was not particularly good, but the fauna was moderately rich. A special feature of the more protected rocky shore was the presence of great masses of the sandy tubes of a Sabellariid polychaete (Phragmatopoma?). Ghost crabs (Ocypode) were common on the beach, and the village pigs prowling about on the sand, proved quite adept at locating these, digging them up with their snouts, and eating them. Waters immediately adjacent to shore proved either too rough or too murky for effective snorkel diving. Visibility was better one-half mile offshore and on sandy bottom; here were found sea pens, sea pansies (Renilla), oliviid snails, and other sandy bottom forms.

At noon we moved the ship eastward a few miles to the vicinity of Súa, the terminal village on the dirt road that leads to the city of Esmerelda, still farther to the east. Esmerelda, in turn, is linked by road to inland cities. There is no road from Súa to Galera, but one can walk along the beach at low tide from one village to the other. In the afternoon the sea became too rough for use of the Boston Whalers, but the longboat was able to make a run into Súa Bay for a reconnaissance, and anchoring in protected waters offshore the shore party rode to the beach in dugout canoes which came out to meet the longboat. A river opens into the western side of Súa Bay, and the rocky shore on this side, while laden with littorines, barnacles and limpets, is basally much scoured with sand and not very extensive.

Ashore we also got information on Atacames Reef, located farther to the east and said to be a coral reef. Arrangements were made to rent a sailboat belonging to some visiting fishermen from Manta, a vessel big enough to accommodate the whole scientific party, along with the owner and his crew to run it, and an old man from Súa who was familiar with Atacames Reef. The sailboat approached TE VEGA

that evening and tied to our stern about midnight. Long before dawn we moved aboard her with our gear and sailed for the reef, with two of our skiffs in tow. The fishing vessel was a picturesque ship some 35 feet long. The hull, made of miscellaneous planks, some hand-hewn, and ribbed with logs which had been finished only on one surface, was sturdy but only half decked over, and was well populated with large roaches. The weather was miserable (it rained nearly all morning, both before and after dawn) but the trip was rewarding. We anchored over the reef at dawn and began work. The "reef," at least in the area examined, is not a true coral reef but a series of rocks and rock ledges bearing corals, primarily Pocillopora, Porites, and Astrangia. Divers sent up nets containing numerous coral heads, living and dead, and rocks richly covered with marine life. These were carefully picked over for fauna and flora by those remaining on deck. Many reef fishes were observed, though few were taken. Some coral heads were carefully bagged underwater and brought up to preserve intact their associated invertebrate inhabitants. When air tanks were exhausted, the party headed for TE VEGA. Wind was poor for the return trip, and most of the way back the two skiffs towed the sailboat. A small shore contingent which had remained behind for work on the beaches and rocky shores of Súa Bay returned bedraggled to TE VEGA, reporting that the marine fauna ashore was poor, but the beer excellent.

On the afternoon of April 23 we sailed for Buenaventura, our port of entry for Colombia. Next day at noon we passed Isla Gorgona some 5 miles long, and its small sister island to the south, Gorgonilla. The islands are precipitous peaks whose rugged rocky shores are interrupted by occasional short stretches of sandy beach. Above the shore the steep hillsides are covered with a dense rain forest, and the highest peaks (up to 1300 feet) are often shrouded in cumulus clouds. We rounded the north end of the island and sailed south on the eastern shore far enough to see an excellent landing pier and numerous buildings ashore. Second mate Ayala said he had heard that the island was used as a prison; the Sailing Directions and other information available to us did not mention this. The island is especially important to us as a place to study rocky shores and sandy beaches at this latitude, for the shores of the continent nearby are extensive swamps, with shallow mud flats, a good deal of freshwater drainage, and large stands of mangroves, interesting biologically but poor situations for our work on this trip.

We arrived at Bahia Buenaventura early on April 25, and sailed up the deep estuary where the city and harbor lie. Along our course we took salinities and temperatures, and with binoculars surveyed the shores for possible working sites. We anchored in the harbor, and ashore the Captain obtained clearance for the ship and for scientific work in Colombia. Isla Gorgona is indeed a prison island but National Police officials gave the expedition permission to go ashore and work there. Later we looked over the city of Buenaventura, the largest port between Balboa, Panama and Guayaquil, Ecuador. Some of the party had evening drinks and dinner in the faded elegance of

the Hotel Estacion, were drenched in one of the downpours that give Buenaventura its more than 300 inches of rainfall a year, and returned to the ship with reasonable decorum. Others were reported to have spent the evening investigating certain notorious establishments in "La Pilota" district of the city; rumors that the visit was very educational could not be confirmed in detail the next day, but aside from one shirt there were no notable casualties.

We sailed early the next day and made a first Colombian station near Punta Barca on the northern shore of Bahia Buenaventura, in a region where the surface salinity offshore was 22 o/oo. Our skiffs landed at low tide at the sandy beach entrance to a deep cove flanked by mudstone cliffs heavily perforated by rock-boring clams (Lithophaga and Adula). Isopods (Ligia), grapsoid and other crabs, barnacles (including Tetraclita), limpets, and littorinid and neritid snails were among the more common forms present, and in general the fauna was more diverse than we had expected in a brackish area. Further inland the cliffs closed in on either side, and with them the tropical forest. Penetrating up the narrowing gorge to the small stream at its head one could see the jungle at close range without actually being in it. The place was extraordinarily attractive, well worth more time than we were able to give it.

On our return to the ship we sailed for "Isla Prision Gorgona." In exchange for permission to visit the island and work there the Captain had agreed to transport six policemen to the Prison, and they were aboard, polite and unobtrusive, with their guns and other gear stacked in the dry lab.

We arrived at the island in the rain at 0800, April 27, got permission to land at the prison pier at the southeastern shore, and spent the rest of the morning collecting on the steep rocky shore to the north of the prison and on the sand-and-pebble beach to the east. Collecting was not particularly rich. We were late for the tide, the shore waters were murky and rough, and both beach and shore were traversed by numerous freshwater streams. Prison Commandant Major Julio César Baquero B. and his second-in command Lt. Luis Maria Burtrago M. were guests at dinner aboard TE VEGA. Two well-educated and highly trained professional police officers, they proved interesting and entertaining visitors. Their charges on the island are male felons serving sentences of 12 to 70 years, and include no political prisoners.

Next day, with an early start, we worked for several hours in the rocky straits between the islands of Gorgona and Gorgonilla. Skiffs entered a cove at the eastern end of the straits and anchored in protected shallows, and work parties dispersed ashore. This region at low tide has extensive exposed rock reefs, large isolated pools, broad boulder flats with rocks of assorted sizes to roll, and beaches differing in degree of exposure to surf. It proved superbly rich and varied, one of the finest marine collecting areas visited so far by the expedition. After our return we visited the prison store inside the electrified enclosure, to purchase articles made by the prisoners

in the prison work and hobby shops. Conditions inside the enclosure were neat, clean, and of Spartan simplicity. Life must be uncomplicated here. Fearfully so. We returned to the ship and shortly before dusk sailed northward toward Cape Corrientes, Colombia, our next planned stop.

April 29 we moved all day in continual rain and heavy overcast, unable to get a reliable position fix. After dark, with some reluctance, we decided to bypass Cape Corrientes and make Solano Bay the next stop.

We rounded Punta San Francisco Solano at dawn on April 30, anchored in the calm water of the southern end of Solano Bay near the village of Mutis, and soon were off in skiffs and longboat to reconnoiter the whole western shore of the bay. Here stretches of steep rock shore or cliff and rocky reef alternated with smaller sandy covers. Several hours were spent working on the semiprotected rocky reef, tidepool area, and boulder flats on the west side of the tip of Punta S.F. Solano, altogether an excellent general marine collecting area for fishes, invertebrates, and algae.

Late in the afternoon we visited the village and were conducted through the small tidal recording station operated by Government tidal observer Francisco Rojas G. of Mutis. He and the local police chief were our guests for dinner aboard the ship. Señor Rojas, an enthusiastic skin diver, was interested in everything aboard. He had brought to us a Colombian tide table with corrections for Solano Bay, which we did not have. Since his name appears in it as observer for Solano, we asked him to autograph it for the ship's library. After some hesitation and thought he inscribed it thus: "En honor a la comicion cientifica del RV Te Vega que surca los mares del mundo en pos de acumular condeimientos para la felicidad de la umanidad. Honorrosamente, Francisco Rojas Gonzales." Deserved or not, this is surely the finest compliment the expedition has received.

On May 1 the scientific group split for further work in Solano Bay. SCUBA divers and shore collectors worked at Punta Cotudo on the western shore, a good spot for both activities for coral grows in protected areas within easy reach of divers and the shore biota is extensive. Another party explored and collected at sandy beaches along the eastern and more exposed shores of the bay. In the evening we sailed for Bahia Cupica, a few miles to the north, and anchored there after dark.

That evening and early the next morning visitors from a nearby village arrived at the ship in dugout canoes. The people were anxious to get salt, sugar, and coffee, for a supply ship expected a couple of weeks before had not arrived. The Captain employed a few people for deck chores, and agreed to pay them in money and the items desired

The scientific party spent much of the day in the region of Punta Cruces (locally called Punta Cupica), at the outer lip of Cupica Bay. Here offshore islets offer some protection from the open sea. Rock reefs and extensive tidepools are exposed at low water, as well as many rocks capable of being rolled for the under-rock organisms. Here, as everywhere else on our trip, we collaborated in mapping a profile of the shore and plotting the distribution and vertical zonation of the commonest sedentary and slow-moving organisms, the littorinid and neritid snails, the acmaeid and siphonarid limpets, attached bivalves like the mussels, barnacles of several sorts, sea anemones, conspicuous algae, and other things prominently present in bands or belts on the rocks. Thereafter, while Dr. Bovbjerg, our chief cartographer, worked on a local site map, the rest of us followed our specialities of the cruise, collecting ascidians (Abbott and Hardin), insects and other land arthropods dwelling in rock crevices (Evans), intertidal fishes, especially blennies and clingfishes (Lehner and Romero), mollusca in general and information on the local geology (Terry), molluscs with egg masses (Smith), and algae of various sorts (Waaland). SCUBA divers (Yarnall, Youngbluth, Ball, and sometimes Smith) worked suitable subtidal areas, collecting corals, echinoderms (especially sea stars, sea urchins, and brittle stars), and hermit crabs, as well as subtidal ascidians and other creatures desired by those working inshore. In turn, inshore collectors took shallow water echinoderms, hermit crabs, and corals for the divers. Physiological studies relating to temperature tolerances of several intertidal molluscs were carried out on the rocks (Markel). Members of the expedition concerned with the biota of sandy beaches worked in nearby areas, sampling hippid sand crab populations (Eickstaedt) and taking samples of the sand itself for physical and chemical analysis as well as for its interstitial fauna of collembolar and other forms (Rosenberg). As time allowed at some stations (but not here at Cupica Bay) studies of the land hermit crab Coenobita were carried out at night (Ball), and night collections of beach insects made (Evans). We returned to the ship, and, as always after such trips, collated field notes, subjected some collections to immediate scrutiny, and preserved other organisms for later study. Then, while field observations were still fresh in mind, we met as a group to review and discuss our findings. Pooling our results, and discussing each new region in relation to other spots previously visited, gave us insights that would have been difficult to gain otherwise.

The ship departed Cupica Bay, Colombia, late in the afternoon on May 2, and arrived at Balboa, Canal Zone in the evening on May 3. It remained at Balboa until noon on May 7. May 4 was a day of liberty for most, and a day of reconnoitering for the faculty. Mrs. Carmen Glynn (at one time a Spanish teacher at Pacific Grove High School, California, and now wife of Dr. Peter Glynn of the Smithsonian Tropical Research Institute) took us to visit two of the favorite local marine collecting localities, Culebra islet, just off Naos Island at Fort Amador, and Punta Paitilla, across town and forming the eastern lip of Panama City Harbor. She also took us to the Smithsonian Tropical Research Institute laboratories, which are housed at Naos Island in a

renovated underground ammunition bunker and some structures formerly used for studies of corrosion. Surprisingly, these facilities have proved excellent and easily adapted to the needs of marine biologists. Scientists encountered here included Dr. Ira Rubinoff, working with fertility and interbreeding of similar gobies from the two sides of the isthmus, Dr. Robert Ricklefs, an ornithologist and former Stanford student, a graduate student in ichthyology, Mr. Robert Topp, and others.

May 5 and 6 were spent in trips to Culebra Island and Punta Paitilla, respectively. Transportation in both cases was provided by taxis. Collecting was only fair. In both areas water was too turbid to permit effective diving, and at Punta Paitilla the smell and taste of the water suggested some pollution by sewage. In the latter area a great intertidal rock flat several acres in extent is exposed at low tide. The fauna is very heavily dominated by filter feeders (barnacles, oysters, filter-feeding snails, clams, sponges, and the like), but also includes large populations of carnivorous snails which probably feed on barnacles and molluscs. At Culebra I. the water was somewhat cleaner, and the fauna more diverse. Ecological profiles were taken in both areas. Dr. Peter Glynn (former doctoral student at Hopkins Marine Station, Pacific Grove) arrived back from the Atlantic coast of Panama in time to participate in both trips, and spent considerable time talking with junior scientists and advising them on their problems.

May 7, after lunch, TE VEGA left Balboa and sailed south to Taboguilla Island in Panama Bay. One skiff with SCUBA divers worked on the protected northern side of the lighthouse point on the eastern coast, while the rest of the party landed at the protected rocky coves and beaches on the northwestern side. The biota here proved much richer in terms of numbers of species than that along the shores of the mainland, and all worked till dark obtaining material. We returned and the ship sailed immediately for Isla Montuosa, an island on our path to Puntarenas, Costa Rica.

We reached Isla Montuosa the morning of May 9. The island, shaped somewhat like a derby hat, is some 500 feet high in the center and about a mile in greatest diameter. Surrounding the island, and especially on the south and west, is a very extensive rocky reef. Against its exposed knobs, buttresses, and pinnacles the Pacific swell breaks with such force that on the windward side the spray and spume mists the air to a height of 200 feet, and the sea surface is a turbulent white for a long distance from shore. The northeastern side lies in the lee of the swell, but the island is small enough that the protection afforded is not great. Study with binoculars revealed a small coconut leaf shelter on the beach, and two places where gaps in the rocks might permit landing. The faculty and diving officer reconnoitered these in a skiff, but at high tide the surge was considerable, and an attempt to swim ashore was cut short by a flare signal from TE VEGA warning a shark had been spotted nearby. A heavy rain, accompanied by a falling tide, eased the surf on the lee side,

and a second attempt to land (by the Chief mate, Dr. Bovbjerg, and a crewman, in dugout canoes) proved successful. By mid-afternoon landing in the narrow passageway through the reef near the shed on the beach was easy, and the whole scientific party went ashore. The island, with its sandy beach, coconut laden shore, and wet inland forest proved an excellent collecting area, not outside the pattern of areas previously investigated but with a marine biota reflecting the extraordinary development and extent of the rock reef defending the coast, and the tremendous force of the surf. Enormous specimens of the limpet Siphonaria gigas (up to 2 inches long) and large specimens of the snail Nerita scabricosta were very abundant, and in places formed conspicuous horizontal bands on the rocks. Barnacles were scarce. In general, the higher rocks were dominated by forms which scrape the algal film from rocks, and filter feeders were uncommon in the clean water. We collected till nearly dark, feasted on coconuts and the large Siphonaria, watched the very abundant land hermit crabs (Coenobita) clean up the scraps, and returned to the ship. A course was set for Puntarenas, Costa Rica. The trip there provided an opportunity, not only to work up collections, but also to present seminars on current work and to discuss in detail the organization and preparation of the final report of the expedition.

TE VEGA passed into the Gulf of Nicoya at dawn on May 11. We scouted the shore with binoculars as we entered. On much of the coastline the surf was fairly heavy, but the places which, from the nautical charts, had looked best for our work--the Islas Negritos and Isla Cedra--still looked excellent on closer inspection. The lee sides of the islands were well protected and calm enough to work in, though the tidal rip between islets was quite strong, and the channels here were full of boiling "witches cauldrons."

We obtained clearance at the port city of Puntarenas and returned to the Negritos Islands for work the rest of the day. In the evening we went ashore and walked around the town, sampling the beer and sights. The city is long and narrow, built on a peninsula projecting into the gulf. It proved one of the pleasantest cities we have visited thus far. It was a warm Saturday evening, and people were out enjoying it. Whole families strolled along the shore, or sat out in front of their houses in residential sections; couples danced to a combo at a large waterfront pavilion; unescorted women and children walked the streets late in the evening. Most stores, except the Chinese stores, were closed, but windows were lighted to display merchandise, and none were protected by the bars and grills that are so common on the stores in some other Latin American cities we have seen. Our impression was of a peaceful, friendly place.

The next day the early tides were excellent. The waters ebbing from the Gulf poured past us as we moved TE VEGA to a point off the Negrito Islands and went ashore on the north coast of Negrito Adentro. The rocky shore here slopes down relatively steeply but shelves off more gently below the low water line. There are plenty of places for the organisms that live on open surfaces, in crevices, under boulders, and on subtidal ledges and cliffs, and the fauna was both abundant and

diverse. Particularly striking were giant tunicates, attached like leathery bags the size of two fists to rocks only a few feet below the surface at low water, and hydroids, looking like pale feathers, which delivered a moderate sting to unprotected skin.

Around noon we departed the Gulf of Nicoya for Brasilito Bay, near the northern end of Costa Rica on the Pacific side. We arrived at dawn on May 13. Brasilito (or Braxilito on some charts) Bay is reminiscent of Galera on the northern coast of Ecuador, but with a dry deciduous forest and scrub in place of the wet jungle. Most of the bay is fringed by a curving sandy beach, back of which a few houses are visible. As we entered the bay a mounted cowboy was driving a herd of cattle along the beach toward a hillside pasture.

We dispersed in skiffs, in three working groups aimed respectively at the rocky shores, the sandy beaches, and the subtidal reefs. The divers found plenty of dead coral, the sandy beach investigators located beaches bearing the sand crabs whose distribution and reproductive cycles are being followed on the trip, and the rocky shore group settled on a small uninhabited islet near the northern end of the bay. The islet proved enormously rich in nearly all the groups we are concerned with: inshore fishes, tunicates, molluscs, algae, crevice-dwelling insects, and the like. This would be a magnificent location for a marine station. The rocky spurs and channels on the windward shores of the islet were much like those of the rocky shore by Asilomar in Pacific Grove, California. A bonus was the presence of large numbers of the interesting and primitive barnacle Catophragmus, a form in some respects intermediate between the goose neck and the acorn barnacles as was recognized long ago by Darwin.

As soon as the field work at Brasilito Bay was secured we sailed for the Gulf of Fonseca, where we planned to work in El Salvador waters. The trip took a day and a half. We made our approach to the Gulf after supper on May 14, as we sat on the fantail enjoying a seminar on the biology of the land hermit crab Coenobita. The evening was warm and muggy, and the ocean swell diminished as we passed the headlands. Repeated lightning flashes within towering cumulus clouds silhouetted the conical volcanic peaks that guard the entrance to the Gulf. We had scarcely dropped anchor in the outer anchorage when a "Chubasco" struck the area, a sudden squall with gusty winds and driving rain. It lasted only a few minutes, and the rest of the night was quiet. Early next morning a small patrol boat arrived, bringing us a pilot. The boat's 50 cal. machine gun was loaded and manned, but the reception was cordial, and we moved through the pass between Punta Chiquirin and Zacate Reef to the inner anchorage by La Unión (rumors that we took the pass to the east of Isla Zacatillo are not true; the TE VEGA and its inhabitants were never in Dyre Straits while in the Gulf of Fonseca). We sampled the water and studied the shores with binoculars as we moved. The salinities showed no significant drop, but turbidity increased markedly, and it appeared that diving in the area could accomplish little. Clearance of the ship and its personnel caused little delay and we soon had permission to work anywhere we wished in the El Salvador sector of the Gulf.

Sandy beach workers took a skiff to Chiquirin Bay (literally "sandcra bay or "Emerita" bay), while for rocky shore studies a promontory just north of Punta Chiquirin was chosen. Chiquirin Bay lived up to its name, and supplied us with plenty of chiquirinos and chicquirinas, while the rocky promontory to the north proved quite reminiscent of punta Paitilla in Panama Harbor. The water was calm and muddy, and the rocks exposed near the waters edge at low tide were crowded with the kinds of animals which feed by filtering fine plankton and particles of edible detritus from the water; barnacles, crepidulid and vermetid snails, small mussels and other clams, sponges, and both simple and colonial ascidians were common here. On the other hand, larger algae were sparse, perhaps in part because penetration of sunlight must be rather slight in the turbid water. Field work was completed in time to allow a visit to the small town of La Unión, about a mile down the road from the dock, and to meet representatives of the Peace Corps and the Interamerican Geodetic Survey who were assigned to the area.

Before dawn next day an observer was put ashore at Chuchito (Speck) I. to watch the morning movement of the Coenobita population from the open beaches to secluded hiding places among trees and bushes on land. He was picked up when TE VEGA moved from La Unión to the outer anchorage later in the morning. The sandy beach workers departed by skiff for a look at unprotected shores on the western side of the Gulf, but engine failure forced them to call by Walkie-Talkie for a tow home. Rocky shore work concentrated on the southern shores of Chiquirin Bay. Here, even with low tide and a relative calm the waters surged in on a great slope of hard, water-smoothed boulders at the foot of a low cliff. The water was murky but not really muddy, and the assemblage of rocky intertidal organisms was similar to that we had encountered in many places on the cruise. Numerous limpets were present, as well as a good Tetraclita zone. Some unusual features included the presence of batfishes in the crevices and pools between large boulders at the waters edge, and the occurrence of the calcareous green alga Halimeda, found heretofore on this trip only at our two Stations in Costa Rica.

Field work was completed by 1300 on May 16 and shortly thereafter we departed for Salina Cruz, our proposed port of entry for Mexico and the home base of Mexican fisheries biologist Hector Romero, one of the junior scientists aboard.

The next three days were spent at sea, sailing along the coasts of El Salvador and Guatemala and crossing the Gulf of Tehuantepec off southern Mexico. We were fortunate in having good weather all the way. Mexico is only 140 miles wide at the Isthmus of Tehuantepec, and there is a conspicuous gap in the Sierra Madre del Sur range here. Northerly gales from the Gulf of Mexico frequently sweep across the Isthmus and make life difficult for seamen in the Gulf of Tehuantepec, especially in the winter. Our own crossing of the Gulf, while slow, was not disturbed by any Tehuantepecers (as the "Sailing Directions" familiarly labels these storms) and we were able to proceed with microscopic examination of specimens, analysis of sand

samples, physiological experiments with gastropods, compilation of data for our final report, and a series of seminars including one by Dr. Bovbjerg on food and habitat choice experiments he has carried out with the snail Lymnaea.

All hands were up early the morning of May 20, to watch our approach to Salina Cruz and to survey the coast with binoculars for possible working sites. From a distance we could see lines and fountains of white water everywhere along the sandy beaches and rocky promontories, and it looked as though the only protected intertidal area might be inside the big stone breakwater sheltering the harbor.

We passed the dredging ship "Presidente Aleman," at work near the harbor mouth, and entered the outer harbor which is separated from a protected inner anchorage by a line of large modern warehouses. Waiting for officials and clearance took longer than expected, but by noon we were free to go to work. Divers took a skiff and equipment to search the sandy bottom, inside and outside the harbor, for the curious flattened starfish Platasterias, a "living fossil" somasteroid which we would like very much to study in life. They found none. The rest of the party took equipment for field work and went ashore directly to the Estacion de Biologia Pesquera, an attractive two-storey structure near the western shore of the outer harbor.

The Estacion has a staff of seven, including two marine biologists (Director Hector Romero R., and Acting Director Isaias Reyna C.), a biological assistant, two technicians, a secretary, and a watchman. Space is generous and a small reference collection of fishes and invertebrates is available, but laboratory equipment and library are still minimal.

Taxis were arranged to provide land transportation to collecting sites, and most of the party headed for Ventosa, a small beach resort on Ventosa Bay, a few kilometers to the east of Salina Cruz. This is one of the few places where the shoreline is sheltered from heavy swell and breakers. When we arrived children were swimming off the beach and farther out skin divers were hunting for edible bivalves. South of the resort area the shore changes character from a sandy beach to a steep slope of rounded cobbles, and then to an exposed coast of coarse boulders and steep cliffs as one nears and rounds the headland of Cerro Morro. Despite surge and waves the rocky shore yielded a fair fauna of molluscs, shore fishes, and crevice-dwelling insects. In the subtidal shallows the sea urchin Echinometra was common, and many of the rocks on the bottom were covered with colonies of a mottled blue and white didemnid ascidian.

Returning to the Estacion the party examined rocks forming the harbor breakwater and natural rock formations west of the breakwater. The region yielded little, and we went back to the ship. Some members of the staff of the Estacion came aboard TE VEGA for supper, and along with them we had two other guests: Hector Romero's beautiful fiancée,

Olalla Guevara, and visiting algologist Laura Huerta of the Department of Botany, Escuela Nacional de Ciencias Biologicas in Mexico City. After supper we went ashore and strolled about town, a pleasant place of about 15,000 with a mercado, a square, a church, and little stores somehow like those of many other Latin American towns yet different, too. The last liberty boat returned to TE VEGA at 2400, and shortly after midnight we sailed.

May 21 and 22 were spent at sea. Work on collections, seminars, and writing occupied the cruise. Late in the day on the 22nd we brought the ship into waters 12-14 fathoms deep off Punta Maldonado and Tartar Reef and lowered a small otter trawl in the hopes of catching some Platasterias on the sandy bottom. In three separate tows we took plenty of bottom fishes, small jacks, shrimps, brittle stars, and colonial ascidians, but none of the desired sea stars. However, there were enough shrimp to inspire the steward's department to concoct a first rate ceviche.

TE VEGA arrived at Acapulco Bay the morning of May 23. We approached after sunup, and surveyed the coast on both sides for possible working sites as we moved in, a little dismayed perhaps at the extent to which the shores and hills were festooned with hotels, highrise apartments, palatial homes, and billboards. We tied up stern first at the dock, got our clearance, and with great delight received a large box of mail--our first real mail delivery on this trip. There were letters for everyone, and even a copy of MAD magazine for the Chief Scientist from his daughter. Our Chief Officer Carl Boysen left on vacation, and we were joined by a new Second Officer Oscar Castañeda of Monterey; in keeping with our international tradition he is from the Philippines, though a permanent resident of the U.S. Our 2nd engineer Eduardo Tenorio, who had left the ship in Panama and vacationed with his family and relatives in Mexico City, rejoined us at the same time.

The afternoon was spent working in the field. A taxi appeared the best transportation for those working sandy shores, and the beach workers took off in one. One skiff and the longboat with the rest of the scientific party left for the northeastern end of the offshore islet La Roqueta and the rock El Moro nearby. Much of the lee shore of La Roqueta is a public beach; it had been deserted early in the morning, but now it was crowded with a thousand vacationers. We worked on rocks to the east of the beach, a region where low cliff and giant boulders line the coast and glass-bottomed boats full of tourists cruise offshore. Rocky intertidal inhabitants above the waterline were very sparse, consisting of a few littorines and Nerita with siphonariid limpets becoming more abundant lower down. Subtidally, at depths of a few feet the rocks were covered with an algal mat interspersed with colonies of sponge. Sea urchins were abundant, Echinometra in the higher holes and crevices, Diadema on shaded surfaces and ledges, and Toxopneustes on the tops and exposed sides of boulders. Sea cucumbers, brittle stars of several kinds, and white didemnid ascidians were prominent under stones. A large offshore rock subjected to considerable surge bore specimens of the giant

solitary tunicate first noted at the Islas Negritos in the Gulf of Nicoya. Divers, working in the deeper waters off the rock El Moro found the greatest variety of echinoderms encountered in any single spot on the entire cruise.

Work parties went out the next morning again, to beaches, islands, and rock shores. The largest group investigated Teacos, a small baylet on the southeastern shore of Acapulco Bay. A shore profile was made at this point, on upthrust boulders a short distance from the beach. With the small tidal amplitude here (spring range only 1.8 ft.) and protection from strong wave action, the zones are compressed into relatively narrow bands; the upper edge of the zone of coralline algae, marking approximately the 0.0 tide level, lies only 1.7 ft. below the lower limit of the littorines. Tetraclita forms a prominent belt, but one extending only from 0.9 to 1.6 ft. Subtidally clusters of the urchin Diadema occupy shaded spots, and simple ascidia sit on exposed rocks or lie buried in the purple encrusting sponges that form mats here and there. Brittle stars are plentiful in cryptic habitats.

We thought we had picked a comparatively deserted shore for our work, but within an hour our base was invaded by nearly 100 happy and squealing young girls from a nearby school, out for a well-chaperoned swim. A rotenone station was underway, and the girls did prove of some help in gathering in the fishes.

Late in the afternoon all of us met in the bar at Sanborn's near the dock, for a farewell drink with Dr. Richard Bovbjerg who was scheduled to leave the expedition here and return to the University of Iowa to prepare for summer classes at the Lakeside Laboratory. We departed Acapulco about 1630, very sorry to leave Bo behind, and sailed northward toward Tenacatita Bay, Jalisco, Mexico.

The trip took 2.5 days. During this time each junior scientist submitted a proposed outline for his final report, and conferred with the faculty on this and on his research to date. Compilation of the Station Data Log continued. A high point of the voyage was a seminar by Hector Romero on his work to date on the distribution, food niches, and habitat niches of the clingfishes (Gobiosocineae) of the eastern tropical Pacific. He gave it in "Special Spanish," patterned after the "Special English" news broadcasts of the Voice of America. Vocabulary and constructions used were somewhat simplified, Spanish/English cognates were used where feasible, diagrams helped to explain the more complex points, and above all the words were spoken very slowly and clearly. The seminar went extremely well, and most of us were delighted to find we could understand most of what was said, and nearly all of the important points.

Noon of May 27 saw us passing Graham Head and heading for the striking landmark of Navidad Head at the southern boundary of Tenacatita Bay. We were behind schedule and moving slowly in a calm sea, so to save working time two skiffs with divers and sand beach investigators took

off ahead of the ship before we rounded Navidad Head. TE VEGA continued on, entered the outer part of the bay, then lowered the longboat with all of the rocky shore workers.

The village at the eastern end of the Bay is La Manzanilla (not Tenacatita, as it is mislabeled on nearly all charts and maps of this area; Tenacatita lies at the western end of the bay); it was the southernmost base camp of the Stanford Mexican Expedition of 1966. Four members of the present cruise were on that expedition, and for them this stop was almost a homecoming. We took the longboat in and anchored off the eastern end of the beach, then loaded our buckets and packs into that useful rubber liferaft the "Tambulero" and swam ashore towing the gear, as we have done at many another landing in the surf on the present trip. Hours of daylight remaining were short, but we knew exactly where to go this time, on the rocky southern shore between La Manzanilla and Tamarind Point. The tide was rising, and the bulk of our collections here were made by diving and bringing up rocks, piling them in the "Tambulero," then bringing them ashore for close examination and removal of adhering plants and animals.

The rocks here at depths of a few feet were covered above with the brown seaweed Padina and numerous other algae, and the commonest organism on their undersurfaces was the purplish colonial ascidian Cystodytes. While rocky shore work went on, other members of the expedition collected Emerita and sundry other inhabitants of the beaches, and the diving group occupied a station near the inner end of Navidad Head.

As the daylight began to fail we gathered on the village beach and walked down to the small "Motel Costa Verde" where the Stanford group had stayed in 1966. We quenched our thirsts with the beverages available, then went out to gather a good sample of land hermit crabs (Coenobita) which were beginning to leave their daylight hiding places among the roots of trees and bushes and move down the beaches to the water. It was dark by the time we got back to TE VEGA at anchor. The boats were hoisted and we set sail immediately for Cape San Lucas and Magdalena Bay, Baja California.

The trip to Magdalena Bay was a long one, with its manic and depressive stages. We had hoped for a good wind and a speed of six knots. Instead for two days both wind and swell were against us and we averaged three. The stop originally scheduled for Cape San Lucas was scrubbed first, then the arrival at Magdalena Bay was extended a day. However, everyone aboard was busy with specimens or typewriters, for we had set June 3 as a deadline for submitting drafts of final reports. Evening seminars were given by the faculty, on diving in the DSL and O₂ minimum layer, and the biology of intertidal terrestrial arthropods. On May 30, the third day out, a good wind arose, and with Baja California in sight things looked brighter. Red galatheid "crabs" (Pleuroncodes planipes) showed up in large numbers in the late afternoon and we slowed the ship for a few minutes to dipnet them.

In the evening the wind increased and shifted. All night and most of the next day we battled contrary wind and chop, making very little progress, at least in the right direction. Red crabs continued to be abundant, and were seen in greatest numbers in the late afternoon. In the evening Technician Samuel gave a talk and demonstration of some of the oceanographic gear which has been aboard but not used on this trip. Next day, June 1, things calmed and we arrived at Magdalena Bay after sunset. The navigation light on Punta Redonda was out, as was our radar set, but there was enough moonlight to take bearings on the headlands that flank the entrance of the bay, and we went in and anchored about 2130. We had covered the 530 miles from Tenacatita Bay at an average speed of 4.4 knots.

That evening we planned our trip for the next day, then put a night light over the side to see what would move in. Pleuroncodes came in numbers, and swarms of polychaetes, but there were few fishes. The night was chilly, and no one seemed really enthusiastic about the 15°C water after our conditioning to temperatures of 27°C and above.

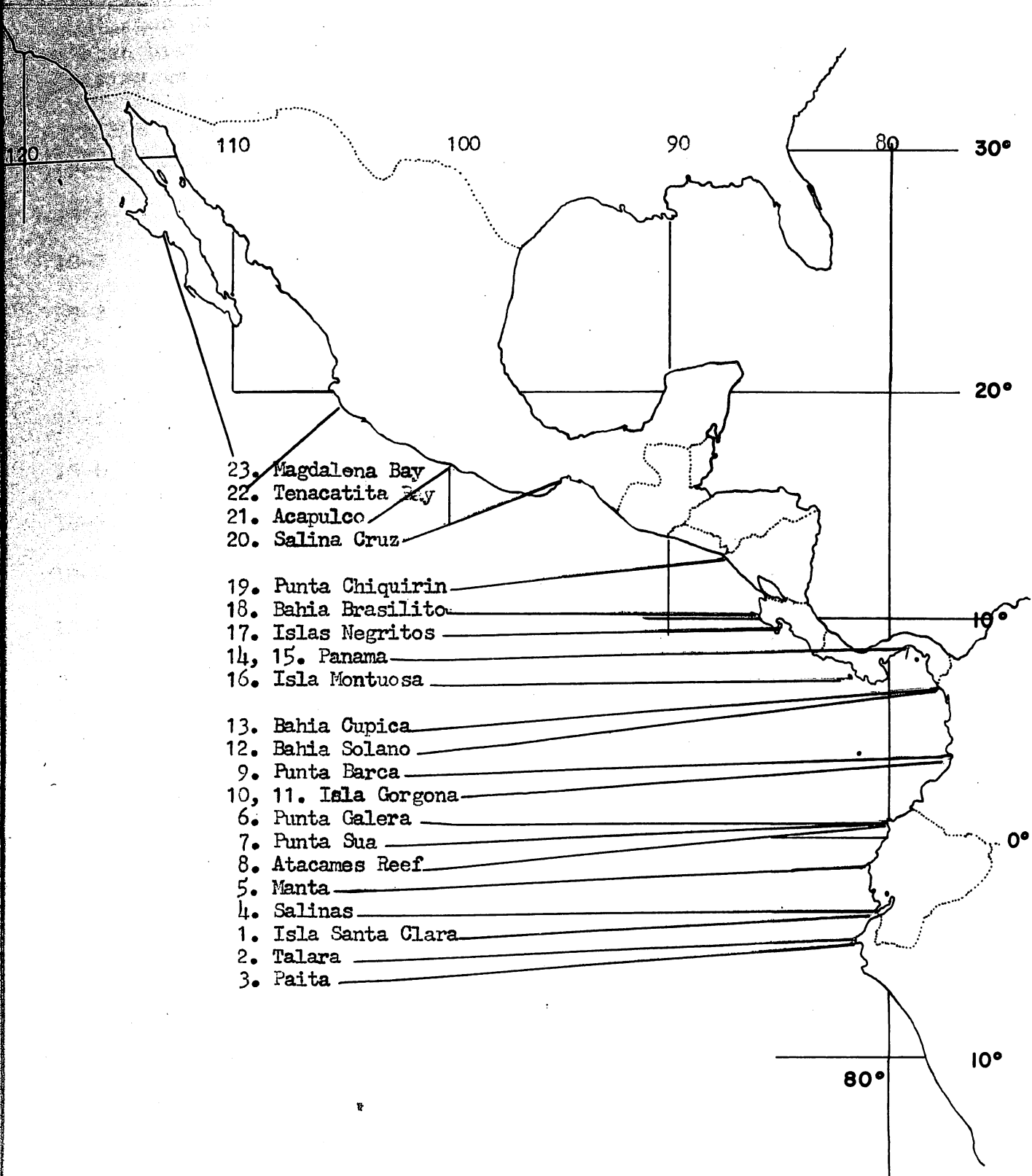
June 2 we were up at 0500 and on stations before 0600. The sand investigators worked just south of Punta Belcher. The long beach here was somewhat gravelly just below the surface and no sand crabs of any sort were found, though some intertidal collembolans showed up. The rocky shore group landed near some stone reefs another half mile to the south, and found rich collecting. Reminiscent of the cold water biota of California were the eelgrass at and below the 0.0 level, the stony masses formed by the polychaete Dodecaceria (much like those under Fisherman's Wharf at Monterey), the red and green gill filaments of the worm Cirriiformia protruding from the sandy bottoms of tide pools, and the abundance of colorful encrusting sponges and colonial tunicates. But some familiar tropical forms were still there, such as the dark, zebra-striped snail Littorina aspersa, the snail Nerita funiculata a bit lower down, and the sea urchin Echinometra in crevices near the zero tide level. High on the beach were kitchen middens where people had recently feasted on turtles, lobsters, fishes, and larger snails.

The divers picked two spots in the lee of Punta Entrada, not far north of the entrance. Here a slope of bedrock and large boulders gave way at about 25 feet to a sandy bottom. Eelgrass and the larger algae adorned the tops and sides of rocks, respectively, while the more deeply shaded areas were populated with brightly colored sponges and tunicates. Brittle stars were very numerous, along with hydroids and the sea urchins Echinometra and Eucidaris. Spiny lobsters and rays (Raja) were plentiful on the bottom (we had both lobster and steak for supper the next day), and in the water there were numerous surgeon fishes, bright orange Garibaldi, and hound sharks (Heterodon).

We were sorry to see the last of the field work, but it was a splendid trip to wind things up. We moved out of the bay at noon and pointed the bow toward home.

The trip to San Diego took nearly five days. There was time to work up the results of our last stations, and also for discussing results, writing, and editing. At first we moved so slowly that the Captain stopped the ship so the propeller could be inspected for barnacles by Diving Officer Jack Yarnall and Junior Scientist Eldon Ball. Some barnacles were found, and our average speed the day after scraping was nearly half a knot better than the day before. We arrived in San Diego early the morning of June 8th, and air transportation was provided from there to Monterey, California, where the last of the scientific reports were completed.

MAP OF STATION LOCATIONS



- 23. Magdalena Bay
- 22. Tenacatita Bay
- 21. Acapulco
- 20. Salina Cruz

- 19. Punta Chiquirin
- 18. Bahia Brasilito
- 17. Islas Negritos
- 14, 15. Panama
- 16. Isla Montuosa

- 13. Bahia Cupica
- 12. Bahia Solano
- 9. Punta Barca
- 10, 11. Isla Gorgona
- 6. Punta Galera
- 7. Punta Sua
- 8. Atacames Reef
- 5. Manta
- 4. Salinas
- 1. Isla Santa Clara
- 2. Talara
- 3. Paita

80° 10°

TABLE OF STATION LOCATIONS

A single station number was assigned to each general area in which field work was done (e.g., 18-3 for Paita, Peru). The approximate coordinates given below establish roughly the centers of these areas. Coordinates of more specific sites within each Station area are either listed here (see a., b., etc., this table) or are indicated on maps appearing in the Data Summary for each individual Station.

STATION NUMBER	NAME OF LOCATION	DATE 1968	APP. COORDIN.		HO. CHART NO.
			LAT.	LONG.	
18-1	Isla Santa Clara, Ecua.	5-7 Apr	3°10'S	80°26'W	5948
18-2	Talara, Peru	8-9 Apr	4°34'S	81°17'W	5514
18-3	Paita, Peru	10-13 Apr	5°05'S	81°07'W	5703
18-4	Salinas & vicinity, Ecua.	15-18 Apr	2°11'S	80°59'W	1123
18-5	Manta, Ecua.	19-20 Apr	0°56'S	80°43'W	Ecua #501
18-6	Punta Galera, Ecua.	22 Apr	0°50'N	80°05'W	1176
18-7	Punta Súa, Ecua.	23 Apr	0°52'N	79°55'W	1176
18-8	Atacames Reef, Ecua.	23 Apr	1°00'N	79°54'W	1176
18-9	Punta Barca, Bahía de Buenaventura, Colombia	26 Apr	3°50'N	77°16'W	1786
18-10	Punta Mono, Isla Gorgona Col.	27 Apr	2°57'N	78°12'W	1176
18-11	Straits between Isla Gorgona & Isla Gorgonilla, Col.	28 Apr	2°56'N	78°13'W	1176
18-12	Bahia Solano, Col.	30 Apr-	6°20'N	77°20'W	1818
a.	Punta San Fran. Solano	1 May	6°18'N	77°29'W	1818
b.	Punta Cotudo		6°16.4'N	77°26'W	1818
c.	Punta Nabuga		6°22.8'N	77°23.7'W	1818
18-13	Bahia Cupica, Col.	2 May	6°40'N	77°28'W	0814
a.	Punta Cruces		6°39.3'N	77°30.6'W	0814
b.	Chicocoro Bay		6°41'N	77°24.5'W	0814
18-14	Balboa, CZ, Pan. City, Pan.	5-6 May	8°57'N	79°32'W	5584
a.	Naos & Culebra Islets, CZ		8°54.8'N	79°31.9'W	5006
b.	Punta Paitilla, Pan. City		8°58.1'N	79°31'W	5584

18-15	Isla Taboguilla, Bay of Panama	7 May	8°48'N	79°31'W	5006
18-16	Isla Montuosa, Pan.	9 May	7°28'N	82°14'W	1018
18-17	Area of Islas Negritos & Isla Cedra, Gulf of Nicoya, CR	11-12 May	9°50'N	84°51'W	1060
18-18	Bahia (Brasilito) Bay, CR	13 May	10°25'N	85°49'W	1031
18-19	Punta Chiquirin & vic., El Sal., Gulf of Fonseca	15-16 May	13°18'N	87°47'W	973
18-20	Salina Cruz & vic., Oaxaca, Mexico	20 May	16°10'N	95°12'W	0876 2424
a.	Bahia Ventosa	20 May	16°10.1'N	95°09'W	0876
b.	Shore west of Salina Cruz Harbor	20 May	16°09.5'N	95°12.6'W	2424
18-21	Acapulco & vic., Guerrero, Mexico	23 May	16°50'N	99°55'W	872
a.	NE corner-La Roqueta I.	23 May	16°49.25'N	99°55.5'W	872
b.	Ieacos Bay on SE corner of Bahia de Acapulco	24 May	16°50'N	99°52.7'W	872
18-22	Tenacatita Bay, Jalisco, Mexico	27 May	19°17'N	104°50'W	936
18-23	Magdalena Bay, Baja California, Mexico	2 Jun	24°24'N	112° 4'W	1664