

OCCASIONAL PAPERS
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CALIFORNIA ACADEMY OF SCIENCES

No. 86, 37 pages, Frontispiece, 21 figures.

THE SEFTON FOUNDATION *ORCA* EXPEDITION TO THE GULF OF
CALIFORNIA, MARCH-APRIL, 1953. GENERAL ACCOUNT

By

Paul H. Arnaud, Jr.

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FRONTISPIECE. Mr. Joseph W. Sefton, Jr. Born on September 4, 1882, at Dayton, Ohio. Died on March 3, 1966, at San Diego, California. To whom this report is respectfully dedicated. (Photograph taken by Dr. G. E. Lindsay.)

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INTRODUCTION

The 1953 Sefton Foundation *Orca* Expedition was a sea voyage for the biological investigation of the waters and the islands of the Gulf of California and the adjacent shores of Baja California and Sonora. Emphasis was placed on the collection of arachnids, fishes, insects (primarily Diptera), mollusks (recent and fossil), and reptiles, with the objective of studying the effects of insular isolation on the populations of the land forms and of comparing the present and past distribution of the marine invertebrate faunas.

The Gulf of California (Golfo de California) or Sea of Cortez (Mar de Cortez), is an elongate body of water some 650 miles in length and from 50 to 150 miles in width, dotted primarily on its western side and to a lesser degree elsewhere with islands which vary considerably in size. This is an almost unique living biological laboratory which is infrequently duplicated in other parts of the world.

The expedition was sponsored by the J. W. Sefton Foundation of San Diego, California, which furnished its research ship *Orca*, a twin-screw steel-hulled motor ship, 98 feet overall, with 23 foot beam (fig. 1) especially fitted for biological research. In addition to a large laboratory, its equipment included a heavy dredging winch, dredges, and various marine collecting gear. It was also equipped with two motor launches and various smaller boats. The *Orca* is now operated by the Scripps Institution of Oceanography, La Jolla, California.

The 1953 Sefton Foundation *Orca* Expedition to the Gulf of California was the second expedition to the Gulf of California to be sponsored by the Sefton Foundation. The first, in 1952, under the leadership of George E. Lindsay

(1952: 1-98), sailed from San Diego, California, on March 26, 1952, and was out 61 days. Mr. Sefton was unable to accompany the *Orea* in 1952, but in 1953 he accompanied the expedition and took an active and enthusiastic part, aiding in the collecting activities whenever possible.

The officers of the *Orea*, Captain Stanley Ellis, Engineer James McNeilage, and crewman Joe Wall, were most capable and aided in all ways to attain the expedition's objectives. Mr. Webster Jackson, Mr. Sefton's personal cook, provided excellent meals to the personnel of the expedition. The scientific personnel also served as crew members whenever necessary.

Three groups of biologists utilized the research ship *Orea* in the Gulf of California in 1953. This report intends to cover the exploration of two portions of the trip, the first from March 9 through April 5, 1953, and the second from April 6 through 15, 1953. Exploration undertaken subsequently into May by members of the University of California, Los Angeles, is not considered in this report.

The scientific personnel (with their fields of interest indicated within parentheses) for the first portion (March 9 - April 5) of the trip consisted of: from the California Academy of Sciences, Dr. G Dallas Hanna (paleontology, conchology) and Mr. Joseph R. Slevin (herpetology); from Stanford University, the then graduate students in biology, Paul H. Arnaud, Jr. (entomology), John C. Briggs (ichthyology), Frank S. Cliff (herpetology), John P. Figg-Hoblyn (Coleoptera, herpetology), Bruce L. Firstman (arachnology), and Alan E. Leviton (herpetology); and from the San Diego Zoological Society, Mr. Joseph Ball (herpetology). It was a pleasure for the younger biologists to have Dr. Hanna and Mr. Slevin, both experienced field zoologists, as associates on this expedition. Mr. Slevin, 32 years earlier, had been in charge of the 87 day California Academy of Sciences' 1921 expedition to the Gulf of California (Slevin, 1923: 55-72), aboard the *Silver Gate*. In the following year, 1922, Dr. Hanna (1925: 217-275) had explored the Island of Guadalupe and other Pacific islands on the *Tecate*.

The scientific personnel for the second portion (April 6-17) of the trip consisted of Dr. Hanna and Mr. Slevin who continued on the expedition, and Dr. Rolf F. Bolin of Hopkins Marine Station (ichthyology). Two San Diego residents were also aboard.

ACKNOWLEDGMENTS

The J. W. Sefton Foundation of San Diego, California, provided the research ship *Orea*, its crew, as well as fuel and food. To the late Mr. J. W. Sefton, Jr. (frontispiece), formerly President, San Diego Trust and Savings Bank, must be acknowledged our gratitude for his establishing the Sefton Foundation, and for the rebuilding of the ship *Orea* for the specific purpose of advancing biological research, thereby making this expedition possible. This report is dedicated to Mr. Sefton, but this can only express a small token of our thanks. Dr. George E. Lindsay made all the

advance arrangements, even though he could not accompany the expedition, and he also invited the participants. Dr. G Dallas Hanna and Mr. J. R. Slevin kindly made their field notes available, which permitted this report to be written. Dr. Hanna originally planned, in cooperation with Mr. Slevin, to prepare a general account of this expedition, but preoccupation with other research prevented his undertaking this project. Credit for all information of geological, conchological, and other invertebrate coverage (other than insects which are those of the writer) should be given to Dr. Hanna. Dr. Laurence Binford, Mrs. Lilian Dempster, Dr. William Eschmeyer, Dr. Leo G. Hertlein, Dr. Elizabeth McClintock and Mr. Allyn G. Smith of the California Academy of Sciences kindly confirmed some of the scientific names. Finally, thanks are extended to all members of the scientific party and crew for their cooperation and dedication in making this expedition a success.

LOG OF THE TRIP

Part I. March 9 - April 5, 1953

March 9, 1953. Monday. San Diego, California to Cabo Colnett, Baja California Norte.

We left the dock at San Diego at 0600. A low thin fog was present until mid-afternoon when it lifted. A fair wind and gentle following sea were with us. We dropped anchor under the lee of Cabo Colnett for the night at 1800. From the ship, in dim light, the cape seemed to be a mass of yellow, horizontal, poorly bedded, hard, and concretionary sandstone about 100 feet thick, capped with a volcanic flow rock about 50 feet thick at the point and thinning to the east and north. We anchored opposite a gully which would afford access to the water line. Otherwise the cliffs are vertical. No shore collecting was undertaken. A night light hung over ship side attracted larval fishes (probably anchovies) and many reddish worms. Other forms were less abundant. Many fish were seen swimming at depth but could not be captured. A good series of pipe fish, a small slender species, was taken. The depth of water at anchorage was three fathoms. Temperature about 58° F. from 1900 to 2100.

March 10, 1953. Tuesday. Cabo Colnett, Baja California Norte to Isla San Geronimo.

We left Cabo Colnett anchorage at 0600 with fine weather and sunrise, and a light fair wind and small following sea. We passed close to Isla San Martin at 1000 to 1100 hours and it looked enticing for a collector. Very little sea life was seen on the way. At 1400 we arrived and made anchorage under the lee of Isla San Geronimo. On this small island, which is about 100 feet high, we found a Mexican colony of lobster fishermen with their families, and their domesticated pigs and chickens. We did not know the number of residents of the colony, but they had 31 skiffs and a launch on the beach. All collectors went ashore on the

south end of the island. The north end, a refuge inhabited by many cormorants, is forbidden to trespassers because of a guano concession. Two species of lizards were taken. Large series of seashore Diptera -- *Canaceoides nudatus* and *Aphrosylus* -- as well as other insects and spiders, were collected. Hanna collected a few representative rocks and shells. Mollusks seen were the usual ones found from Santa Barbara to San Diego. The tide was high. The island is primarily a mass of yellow sandstone dipping northwest 10 to 20 degrees, somewhat cross bedded. No traces of fossils could be found except a little wood. Some strata are somewhat shaly with limey concretions but these have no fossils. Beaches are composed of pebbles of very dark meta volcanics and very hard igneous rocks. An irregular layer of these covers much of the surface of the south half of the island. Immediately below this layer the contact is marked by highly bored sandstone, showing clearly that the island has been elevated from the sea bottom. No land shells were found. There were many burrows of Cassin's Auklets (*Ptychoramphus aleutica*) with eggs. No fish were caught on the hooks at the ship.

March 11, 1953. Wednesday. Isla San Geronimo to Bahía del Sur, Isla de Cedros.

We left anchorage at 0600 under clear skies. There were moderate swells with a brisk wind of 20 miles from the northwest. Near San Geronimo were sighted about 100 cormorants with white flank patches -- the pelagic cormorant (*Phalacrocorax pelagicus*). By mid-afternoon Isla de Cedros and the Islas San Benito came in sight. Two trolling hooks failed to catch anything, and there was little life in sight. We passed on the western side of Isla de Cedros and dropped anchor at 1730 in its Bahía del Sur (South Bay). There was a heavy ground swell. The air and water were cold and the wind did not slacken. The entire southwest corner of Cedros seemed to be volcanic, judging by the red cinder cones seen from the ship. On the west side, a few miles north, there is a flat-topped area which looked like a terrace about 100 feet high but the remainder of the shore line is not like this. No shore collecting was undertaken. We tried hook and line at the anchorage with various baits including live smelt but did not have a strike. At the night light many five-inch smelt came in and these were netted for bait. One large pipe fish which was dark brown dorsally with ten light yellowish brown cross bars was caught. Red worms swarmed about the light.

March 12, 1953. Thursday. Bahía del Sur, Isla de Cedros to Bahía San Bartolomé, Baja California Sur.

In the morning a landing party consisting of Leviton, Firstman, Figg-Hoblyn, Ball, and Arnaud tried to row ashore. The surf was so high that the large skiff was overturned, bow over stern. No one was injured, but all got coldly soaked and some equipment was lost -- including two 22 caliber rifles, cameras, boots, and other clothing. No collecting was attempted. After this the party returned to the *Orca*. We sailed at 1030 and passed to the north of

Isla Natividad where there is a lighthouse and what appears to be a weather station. Several large giant cacti (*Pachycereus pringlei*) were noted. This island seemed to be all sedimentary as observed with 7 X 50 binoculars; the dips and strikes being variable from nearly horizontal to nearly vertical. We ran through two schools of porpoises. Upon arrival at Bahía San Bartolomé (Turtle Bay) at 1430, all nine collectors went ashore on the north side, with no striking success. Some land shells, *Micrarrionta* species, were collected. The only marine forms noted on the beach were *Astraea*, *Purpura*, *Tegula*, and *Aemaea* -- the last two represented by living individuals. There were dead shells also of two specimens of *Haliotis* and some rock borers. Diptera collected on the beach included a series of a new sphaerocerid fly, named by Dr. O. W. Richards (1963: 239-240) as *Leptocera (Thoracochoeta) arnaudi*. The strata on this side of the bay appear to be Cretaceous but no fossils were found. About 100 feet above the present shore line there is a late Pleistocene deposit with many bay-type shells. This is overlain by about 50 feet of talus debris from the neighboring mountain. The estimate of the lateness of the shell deposit is based upon the color retention of the shells. Around the night light great numbers of smelt milled about. Nothing would take our bait on the hooks.

March 13, 1953. Friday. Bahía San Bartolomé, Baja California Sur to Punta Abreojos, Baja California Sur.

We hoisted anchor at 0600 and set course for Bahía de Ballenas. At 1030 we passed Punta San Roque. On the way several schools of the pacific dolphin (*Delphinus bairdii*) and two specimens of *Rhyncus* were seen. One of the former was harpooned by the chief with a hand harpoon but it got under the ship and the line was cut. Later, at anchorage, Briggs had a very cold swim to cut free the entangled line from the propeller shaft. No fish struck our trolling lines. No flying fish were seen. We dropped anchor at Punta Abreojos about 1600. Here there are two lighthouses, a large hangar, and dwellings. The water was very cold and has been so all the way down, not warmer than 58° F. Just after anchoring, six rock fish (*Sebastes* species) were caught. When four sea lions appeared, no more bites occurred. One sea lion caught a fish of about three pounds and played with it a few moments before swallowing it. The bottom at anchorage is rock in four fathoms. No shore collecting was undertaken. Around the night light many smelt were again attracted, and two octopuses, one kelp fish, two half beaks, and three pipe fish were collected. Many large forms were seen but could not be reached.

March 14, 1953. Saturday. Punta Abreojos, Baja California Sur to Bahía Santa María, Baja California Sur.

We hoisted anchor at 0300 and set course for Bahía Santa María. A 14-hour run was made, with the sea being very rough until noon when it calmed down. To this point the weather has been very cold with northerly winds up to 20 miles an hour. The water has also been cold, thus we have

seen no flying fish and caught nothing on the trolling lines. We saw no porpoises and only a few sea lions all day. Birds were also scarce, but we were pretty far off shore, having lost sight of land for a time. At 1700 we passed Cabo San Lázaro Light and rounded the cape, anchoring in Bahía Santa María at 1800. At the anchorage the water was very quiet. No shore collecting was undertaken. No fish were caught at the hand lines. Only a few things appeared about the night light. A few half beaks about a foot in length were seen.

The mountain mass behind our anchorage did not appear to be sedimentary in any part. Various shades of red and green are present and some of it may be serpentine.

March 15, 1953. Sunday. Bahía Santa María, Baja California Sur toward Cabo San Lucas, Baja California Sur.

Seven collectors went ashore (with Hanna and Briggs remaining aboard) at the Santa María anchorage at 0700 and a good collection of four species of reptiles and many insects and spiders were obtained. *Burragea glabra* was in bloom and this proved highly attractive to various Diptera and other Insecta. The trip's best collection of the parasitic fly family Tachinidae was encountered at these flowers. Briggs and Hanna caught a number of croakers on hand lines as well as a 2 1/2-foot horn shark (*Heterodontus* species). A 4-foot hammer head (*Sphyrna* species) was also hooked and brought to the surface but it escaped. The small boat dredge was hauled several times by carrying it out from the ship and hauling aboard. The bottom was soft muddy sand but a small collection was obtained. One abalone shell (*Haliotis*) was found on shore. The weather turned warmer during the night and has been delightful since. At 1300 we hoisted anchor and set course for the overnight trip to Cabo San Lucas.

March 16, 1953. Monday. Bahía Santa María, Baja California Sur to Cabo San Lucas, Baja California Sur.

Under way all night. At 0700 we had Cabo Falso Light abeam and made anchorage shortly thereafter at Cabo San Lucas. After clearance of the ship by Mexican officials, all collectors went ashore. The beaches are nearly barren but a good lot of small echinoids were obtained. They had recently been driven ashore. Among the Diptera collected was the robber fly (*Lissoteles vanduzeei*) which was relatively abundant on the sand dunes, a new subspecies of a minute bee fly (*Mythicomyia scutellata binotata* Melander, 1961: 251-252), a new species of scenopinid fly of the genus *Brevitrichia* (determined by Dr. Kelsey), and a series of a new marine shore fly (*Canaceoides spinosus* Wirth, 1969: 567-568). Some spiders were collected by Firstman in a house on the walls behind pictures, etc.

Some of the collecting in the afternoon was done at low tide in a pool at Los Frailes Rocks where Hanna got a nice lot of chitons. A very large number of species of fishes were obtained. Many were very brilliantly colored. We appeared to be too early for reptiles. Nothing worth taking was found by six night collectors.

There is very little evidence of the great storm which hit this part of the peninsula about 15 years ago and washed the village away. There is a mark on the vegetation inland which must be at least 50 feet above sea level.

March 17, 1953. Tuesday. Cabo San Lucas, Baja California Sur.

The herpetologists, Cliff, Figg-Hoblyn, Slevin, and Ball, worked hard ashore but had very mediocre success. They obtained a few small snakes and a few lizards, all common species. None of the rarer forms seem to be out as yet and it is agreed that we are about a month too early for this location. The entomological collections were productive as usual. Briggs, Cliff, Hanna, and Leviton took the launch several miles southeast of our anchorage where they dropped the dredge in 40 fathoms. The chart said sand bottom but they hit rocks at once, the dredge fouled, the wire line broke and only through the fortune of having a recovery line did they save the dredge. In it were some gorgonians which were obviously rock dwellers. In the afternoon Sef-ton accompanied the group to Los Frailes Rocks (not to be confused with Los Frailes). A fine assemblage of semi-tropical reef fishes was obtained. Upon returning to the ship, a couple of hauls with the small dredge from the ship were made with a quart of shells and sand collected. The night light attracted a variety of small fishes and squid.

March 18, 1953. Wednesday. Cabo San Lucas, Baja California Sur to Los Frailes, Baja California Sur.

We left anchorage at Cabo San Lucas at 0510 and anchored at Los Frailes by 1030. Slevin and Arnaud went ashore while all other members of the party left for El Pulmo Reef. On shore, Slevin and Arnaud obtained a bat in the thatch of one of the few houses. Insects collected included representatives of two new species of minute bee flies -- two specimens of *Mythicomyia cruralis* (Melander, 1961: 201) and several hundred specimens of *Mythicomyia tubicen* (Melander, 1961: 257-258), and a series of new robber fly (*Parataracticus arenicolus* Martin, 1968: 182-183) (fig. 5). Two specimens of a new genus of the parasitic fly family Tachinidae were also collected; one of which was sitting on the trunk of a fig tree (*Ficus* species).

The launch and two skiffs were taken by the party for the five miles to El Pulmo Reef. The arrival was about one and a half hours before a low tide, which gave the herpetologists time to collect a snake and several lizards. At low tide, about 1330, about 20 fish were obtained. The reef is merely a ledge of hard conglomerate dipping southwest about ten degrees and striking northwest. Boulders up to 6 inches in diameter were noted. On top of the reef there were barnacles and specimens of *Chama* and *Acmaea*. With a diving mask, Hanna went down along the leeward side, and toward the base there were gorgonians in abundance and coral heads here and there (*Porites?*). These are also found over the sandy bottom between the reef and shore. It is definitely not a coral reef. On shore, Hanna found *Pinna*, *Strombus galeatus*, *Melohgena*, *Murex* (pink), *Pecten*

subnodosus, and *Chama* represented, along with a large circular species of *Ostrea*, many pearl oysters and a few other bivalves, most badly worn.

The headland just up the coast from the reef is old, porphyritic volcanics, judging by the shingle on the beach. The fish night light was unproductive.

March 19, 1953. Thursday. Los Frailes, Baja California Sur.

This was the day off for the crew of the *Orca*. The collectors went ashore at the usual time after breakfast with poor results as far as reptiles were concerned. Hanna found a good series of the large *Bulimulus montezuma*, all dead, around the great granite mass which forms the headland. They were mostly in the interstices where wood rats had nests. Figg-Hoblyn collected a few immature specimens of this species under fallen tree trunks. In the afternoon Hanna and Slevin dredged out to 40 fathoms, with results that were not especially good but one chiton and many specimens of *Calyptraea* were obtained. Along the rocky shore many species of fish were collected.

March 20, 1953. Friday. Los Frailes, Baja California Sur to Punta Gordas, Isla Cerralvo.

We left our Los Frailes anchorage at 0600 bound for Isla Cerralvo. After leaving, the ship was slowed down while the dredge wire was played out and respooled. At about 1600 we arrived and anchored at Punta Gordas, which is on the southwestern portion of Isla Cerralvo (Cerralvo Island). Hanna, Leviton, Slevin, and Arnaud rowed ashore at 1630, while the other members of the party took a skiff with outboard motor to collect north of our anchorage. The motor failed and they returned after dark after a long row against the tide. The land party at the anchorage had success. In an hour, Hanna had collected about 20 specimens of *Bulimulus ceralboensis* and many marine shells. Pearl oysters were common on the beach. The tide was not low enough to collect living shells. A great number of sea hares (*Dolabella*) had drifted ashore and had dried leaving the shells available. Leviton and Slevin collected about a dozen lizards including geckos. Three specimens of a new bee fly of the genus *Lordotus* (*L. arnaudi* Johnson and Johnson, 1959: 13-14) were discovered. At the *Orca's* night light there were few fish but a series of marine water striders (*Halobates sericeus*) were collected when they came to the night light.

Cerralvo is a medium-sized Gulf island some 18 miles in length and 4 1/4 miles wide. At our anchorage the rocks on shore were micaceous schist with minor granitic intrusions. Quartz seams up to 6 inches across and pockets are common, but Hanna saw no mineral segregations.

March 21, 1953. Saturday. Punta Gordas, Isla Cerralvo.

Our anchorage was about 1 mile southeast of Punta Gordas in 10 fathoms. In the forenoon the tide pools straight in from the anchorage were collected for fish by Briggs with the aid of other members of the party with moderate success.

After this, Hanna and Sefton collected chitons and shells in the tide pools, and following lunch, they went to the sand pit at Punta Gordas and collected a great many beach shells, most of which were part of the rock dwelling fauna. On the low bluffs back of the beach there were huge quantities of pearl oysters, large flat ostreas, and a few pectens. This probably was a divers camp. There are conglomerate reefs jutting out from the point dipping southwest about 10 degrees, with boulders up to 6 inches in diameter. This material is believed to be a part of the raised beach Pleistocene formation which in front of the anchorage is 50 feet above high tide. At the last point, it was followed up a canyon to the bed rock contact and it contained a great many shells in hard sand. Specimens of *Strombus galeatus*, *Pecten*, *Macrocallista*, etc. were abundant, but the rock was too hard and the shells too fragile for extraction. Evidence of mice was common and five skeletons of cats, presumably of the house variety, were found.

March 22, 1953. Sunday. Punta Gordas and Isla Cerralvo to Isla Espiritu Santo.

We left the anchorage at 0700 and proceeded up the west side of Isla Cerralvo to Rancho Ruffo (also known as El Mostrador). The ship stood off because there was no salt water shallow enough to anchor and permit a swing. The Rancho is at the mouth of a very large canyon. There were three thatched shelters, a stone corral, and a well. The last is about 20 feet to water, is bricked up, and has cement troughs. Two large bats flew out as we came up. The place was abandoned but many turtle and goat bones indicated periodic occupancy. Collections were made up the canyon. Hanna collected about 100 land shells belonging to two species of *Bulimulus*, and he also collected a single specimen of rattlesnake which later became a paratype of *Crotalus enyo cerralvensis* (Cliff, 1954: 82-84). Specimens of the robber fly *Lissoteles vanduzeei*, as well as a new species of the bee genus *Perdita* (*P. arnaudi* Timberlake, 1958: 388), were found.

All the rocks up the west side of the explored canyon appeared to be schist intruded by granitic rock. Some of the masses of granite (a gray hornblende diorite) were very large. Just north of the canyon there is a mass of sedimentary rock elevated to a height of about 500 feet. It consists of conglomerate, agglomerate, brown and white sandstone, and limy sand. Some strata of the latter are 10 feet thick and contain fossils of various kinds. Several species of *Pecten* were the most common and these indicated Pliocene age. One echinoid was seen but the rock was so hard and tough that extraction was very difficult. This material extends north of the canyon about 1/2 mile and up the canyon about the same distance. The collections assembled by Hanna and Slevin have been studied and reported on by Hertlein (1957, 1966) and Emerson and Hertlein (1964). The dip is eastward about 20 degrees. The heavy boulders all seemed to be the same as the metamorphic and igneous material which forms the remainder of the island. Obviously it is a block faulted up. From the ship the remainder of the island to

the northward looked to be the same schist and granite which was found to the southward.

We left at 1300 and reached the indentation which separates on the east side Isla Espíritu Santo from Isla Partida at 1630. Hanna, Slevin, Figg-Hoblyn, and Arnaud went ashore to collect. Rabbits must be extremely abundant judging by the signs.

Coming up the east side of Isla Espíritu Santo a large area of sand dunes was noted at the south end. The rocks from there northward for 3 or 4 miles could not be determined, but they appeared to be very massive. At the first large bight with a boulder beach there is a sudden change to stratified material. This appeared to be volcanics and extends northward to the present anchorage. After we got ashore, the volcanic determination was verified, some layers being a red vitrophyre.

March 23, 1953. Monday. Isla Espíritu Santo and Isla Partida.

Isla Espíritu Santo and Isla Partida to the north are almost connected by bars (fig. 6). There are coves on each side with a bar running out from each island and a narrow, shallow channel between. Collecting was undertaken on both islands. Hanna collected numerous chitons and other marine forms at low tide. On the sand flats in the narrow channel there were windrows of minute shells washed up. Several specimens of the well known *Bulimulus veseyanus* as well as one small narrow one were found. Most of these were taken by Ball and Figg-Hoblyn. In addition to the shells collected, many others were seen. *Dolium*, *Strombus*, and *Pinna* are used by occasional visitors for food and the shells are usually broken. Large circular ostreas and pearl oysters were common as well as several kinds of clams. These were all dead shells. The fish collectors aiding Briggs filled three gallon bottles. The herpetologists got a rattlesnake, a racer (the third known specimen of *Masticophis barbouri* was collected by Figg-Hoblyn), and many lizards. Three specimens of a new scenopinid fly were collected. Dr. L. P. Kelsey has described and dedicated this new species to Mr. Sefton, naming it *Scenopinus seftoni* (Kelsey, 1969: 152-153). On the Isla Partida sandbar, several tiger beetles of the genus *Cicindela* were also collected. This island also yielded 6 specimens of a new therevid fly of the genus *Psilocephala*, near *P. tepocae*, as well as other desirable forms. The Captain, Chief, and Jackson went trolling and stocked the larder with sierra and skipjack (*Euthynnus*).

The most conspicuous rocks are the red lava at the top and the white rhyolitic ash at sea level with a black phase in between. The sea cliff just south of the anchorage is about 750 feet high.

March 24, 1953. Tuesday. Isla Espíritu Santo to Isla San Francisco to Bahía de Amortajada, Isla San José.

At 0700 we hoisted anchor and set course for Isla San Francisco. Anchorage was made there at 0900. This is a small irregular island with an area of about 1 1/2 square miles and about 100 feet high. Our anchorage on the south-

ern end required a climb up a steep cliff (fig. 8) to make our collections. All biologists went ashore. A fair collection of reptiles was made. Firstman got a small rattlesnake, and Figg-Hoblyn got a spotted night snake. Figg-Hoblyn and Hanna made a thorough search for land shells and succeeded in finding only three immature and long dead shells. Three species of marine shore flies collected were new (the type series of 17 specimens of *Canaceoides tenuistylus* (Wirth, 1969: 568-569), and paratypes of *C. angulatus* (Wirth, 1969: 556) and *C. setosus* (Wirth, 1969: 565). The island was very dry. Originally San Francisco was two islands but the sea has built up a bar between the high parts. There is a salt flat on the bar now. Some salt is harvested here from five pools each about 10 by 20 feet. Along the seepage which comes through the breakwater, Hanna found a good set of *Cerithidea*.

The island is wholly volcanic, there having been three periods of activity, each separated by an unconformity. The oldest is a rhyolitic ash consolidated into a very hard and tough white rock. Next there are flows of bright green rocks with cavities sometimes filled with milky white chalcedony. The topmost layers are bright red, somewhat vesiculated lava. All the forms are agglomeratic, but it is doubtful if deposition was submarine.

We left San Francisco at 1600 and arrived at Bahía de Amortajada, Isla San José about 1700, too late to do any work ashore. On San José there is a considerable establishment with 27 men engaged in harvesting salt from ponds behind the high sand beach.

March 25, 1953. Wednesday. Bahía de Amortajada, Isla San José.

Isla San José is 19 miles long, and 6 1/2 miles at its greatest width, with one mountain peak 2,080 feet high. All biologists went ashore after breakfast. Mammals and land birds were abundant. No snakes were seen, although there is plenty of food and cover. The herpetologists agree that we are one to two months too early for good collecting. Hanna found one specimen of a globose *Bulimulus* and Figg-Hoblyn and Ball got one also. Eight, very fragile shells of a high-spined *Bulimulus* were also collected. Hanna worked the hills about 2 miles back of the beach while Figg-Hoblyn and Ball went to the top of the mountains. These mountains are almost certainly granitic judging by the float which has come down from them. The frontal hills, however, are all volcanic, mostly reddish brown andesite with a minor amount of green. The age is very uncertain, but the island has no resemblance geologically to the beautifully stratified section exposed on the adjacent peninsula. In the afternoon, Hanna, Briggs, and Wall went out in the launch dredging, and after making 2 hauls on sand bottom the motor stopped and they were lucky to get back to the ship. The water pump had failed. Nevertheless they got an excellent collection of small shells.

Good spider collections were made by Firstman. Among the many insects collected was a single specimen of the parasitic fly family Tachinidae which was designated as a

paratype of *Muscopteryx petensis* (Reinhard, 1958: 280). It was collected on the leaves of ironwood. A series of specimens of the bee fly *Lordotus junceus* provided a 600 mile southward extension to its recorded range.

March 26, 1953. Thursday. Bahía de Amortajada, Isla San José to Isla Santa Cruz to Bahía Agua Verde, Baja California Sur.

We left Isla San José at 0700 and reached Isla Santa Cruz about 0900. All biologists went ashore. The *Orca* did not anchor, but stood off and waited for us.

Santa Cruz is a steep rugged island a little less than 4 miles long, about 1 1/2 miles wide, and about 1500 feet high. It is deeply cut by many canyons, the erosion of which indicates great precipitation at one time. Isla Santa Cruz is entirely a granodiorite with aplite dikes and a few veins of quartz up to 8 inches thick. Some epidote and copper-stained rock was picked up as float and north of our southwest landing place there is a zone which from the ship looked like it might be highly mineralized. No sedimentary or volcanic rocks were noted.

We found three Mexicans camped ashore in a cave. They were fishermen and said they spent about 3 months each year here. The surrounding waters were literally alive with fish. The only land bird seen was a hummingbird. With the help of Figg-Hoblyn, Ball, and Arnaud, Hanna got over 100 specimens of *Bulimulus santacruzensis*. Slevin found the skeleton of a snake. This was a new distributional record. Insects were relatively scarce. Only about 50 specimens were collected. The party was picked up at 1150.

On the way to Bahía Agua Verde we coasted along the east side of the peninsula, pretty far out, but with glasses the shore line looked like a great escarpment with beautifully exposed stratification. This is probably the same volcanics as at Bahía Agua Verde. The exposed rocks are reddish brown volcanic agglomerate. We arrived at Bahía Agua Verde at 1530 and rowed ashore and started to collect by 1600. There are several large palms around the small village. Members of the party ashore worked up a canyon on the north side of the great stream valley where Hanna found about 100 specimens of *Bulimulus*. Mr. Sefton took about a dozen chitons, and there was fair success in collecting fish. There were many insects flying about a mesquite tree in bloom, and about 700 specimens were collected. The insects collected included 2 species of small bees of the genus *Perdita* (*P. punctosignata punctosignata* Cockerell and the new species *P. duplicans* Timberlake) as well as the unique holotype male of the small bee fly *Mythicomyia aperta* (Melander, 1961: 183).

March 27, 1953. Friday. Bahía Agua Verde, Baja California Sur to Isla Santa Catalina to Bahía Ballandra, Isla de Carmen.

At 0700 we hoisted anchor and set course for Isla Santa Catalina, arriving at a poor anchorage beside a boulder spit on the northeast side of the island at 0900, anchoring in 8 fathoms. This is another rugged island, about 7 1/2

miles long, 2 miles wide, and 1,500 feet high. At the landing place the rocks were of many kinds -- granite with feldspar and epidote dykes, shist of many forms, and at least one thick mass of crystalline limestone. Samples were taken of the various forms. No sediments were seen. A primitive landing strip had been cleared across the inside flat area of the boulder spit.

Firstman, Briggs, and Cliff collected specimens of a new species of rattlesnake, described as *Crotalus catalinensis* by Cliff in 1954. In turning over rocks Leviton was stung on the finger by a small slender-tailed scorpion, without serious consequence. A single web-spinner of the order Embioptera was collected under a large rock, the first record of this order from this island. Slevin collected a tenebrionid beetle in alcohol before returning to the *Orca*. On the return to the ship a live maggot was discovered and removed from the alcohol, having emerged from the beetle. The maggot pupated with a female sarcophagid fly later emerging. Over 220 specimens of a new marine shore fly (*Canaceoides setosus* Wirth, 1969: 565-567) (fig. 9) were swept from coastal rocks. With the help of Leviton, Hanna collected both *Bulimulus johnstoni* and *Pupoides catalinensis* which have been reported. They also found a specimen of *Gastrocopta*, which Figg-Hoblyn and Arnaud also collected. The shells of *Bulimulus* were everywhere -- they were more abundant than Hanna had ever known land shells to be. Live ones were under the first rocks in slides, and he often took 4 to 6 off one rock. The only evidence of mammals was one cat skull picked up by Hanna, and Figg-Hoblyn saw a dead cat.

The collecting party was called off shore and departed at 1330 and set course for Bahía Ballandra, Isla de Carmen. As seen from the *Orca* far out to the east, the south end of Carmen seemed to be sediments dipping south about 30 degrees. We rounded the north point and coasted down the west side of the island to the pretty little landlocked Bahía Ballandra, noting only what appeared to be volcanics except for an occasional light patch of sediments of very small extent. We arrived and made anchor at 1830. There is only one house at the bay. No shore collecting was undertaken.

March 28, 1953. Saturday. Bahía de Ballandra, Isla de Carmen, to Loreto, Baja California Sur.

The collectors all went ashore after breakfast. Mr. Sefton made a fine collection of intertidal chitons in the bay. Briggs, Cliff, Wall, and Hanna seined a mangrove pool back of the beach and took about 50 fish in half an hour. Briggs, Cliff, Leviton, Slevin, and Hanna worked on the reef most of the forenoon. It is exposed on the beach to an elevation of about 50 feet and appears to be Pleistocene; some of the shells, such as those belonging to *Glycymeris gigantea*, still retain a little color, and the assemblage is the same as those living in the area at the present time. This particular reef is on the south side of the bay. On the north side there is first a mangrove swamp, then a flat valley with a canyon at the head. On the borders of this

little valley there are similar reefs, 5 of them on each projecting point and at the head there is an obvious old beach line. The bounding basement rocks are rhyolites and possibly andesites. Chalcedony seams are common at the head of the valley. Near the first-mentioned reef and on the beach cliffs there are seams or veins of a white mineral. In the afternoon Briggs, Leviton, Wall, and Hanna went dredging outside the bay and made four hauls in 25-35 fathoms. The bottom was muddy sand with much broken shell. Some good mollusks were obtained, but in general it was dead bottom. The Captain and Chief caught a fine lot of fish in the forenoon by trolling near shore. One was a 30-pound grouper. Figg-Hoblyn, Ball, and Arnaud hiked overland (figs. 10-12) to the ridge which overlooks the extensive salt works. They met several residents with their loaded burros on the trail. The entomological collecting at mesquite flowers, along the mangroves, and along the shore resulted in the discovery of 5 taxa of minute bee flies, *Mythicomylia*, including the unique male type of *M. munda* (Melander, 1961: 228-229), the paratype series of *M. rhaeba* (Melander, 1961: 246-247) and *M. tenthes* (Melander, 1961: 253-254), the allotype of *M. scutellata binotata* (Melander, 1961: 251-252), and *M. scutellata* Coquillett.

Left anchorage at 1600 and anchored at Loreto, Baja California Sur, on a very quiet and glassy sea at 1800. The younger members of the expedition rowed ashore after dinner to the very dark beach and visited the town.

March 29, 1953. Sunday. Loreto, Baja California Sur.

This was lay day for the crew and only limited work was done ashore. Slevin and Hanna stayed aboard and got their collections attended to and equipment repaired and altered. It was a generally cloudy day with wind, which whitecapped the Gulf at the anchorage in the afternoon and early evening. Figg-Hoblyn, Ball, Wall, and Arnaud went ashore about 0900. They met a bearded American who gave them a short ride about town in his "command" car. They visited the old mission which was in the process of being restored. After collecting they had dinner and a few beers at the modern Sportsmans Lodge. In the evening there was a dance in the town square.

A borrego (bighorn sheep, *Ovis canadensis*) was kept on a rope as a pet at one of the houses.

March 30, 1953. Monday. Loreto, Baja California Sur to Isla Ildefonso to Punta Pulpito, Baja California Sur.

We hoisted anchor at 0700 and set course for Ildefonso, on a bright sunny day. The sea was whitecapped due to a brisk head wind. There was a sheltered lee at the south-east end of Ildefonso where we dropped anchor at noon, and the biologists rowed ashore by 1230. This is a small island, a little more than a mile long, about half a mile wide, and attains a height of 387 feet, the top being rather flat. The island is volcanic with many caves and cliffs. Apparently an agglomerate at an elevation of about 100 feet represents an old beach deposit but it contained no shells. In some of the rocks there are irregular masses of white

chalcedony. Copper stains were noted in a few places. Obsidian fragments were found over the lower southern slopes but no source could be found. It was not a pure material but was not incrustated or weathered. It may have been carried there by egg hunters.

Bushes of *Sympetaleia aurea* were conspicuous with their orange flowers. There was some fresh water caught in rock basins, and Figg-Hoblyn collected two mosquitoes. Hanna was bitten by mosquitoes quite a few times and reported later that these produced good sized welts. The herpetologists got two lizards and a gecko. Tide pooling resulted in 2 gallons of small fish, and the Captain and Chief caught 7 groupers. A thorough search for land shells was made, but none found. Several bags of fine material were taken to search for small species. Insect and spider collecting was excellent. Over 370 specimens of a new species of marine shore fly, described by Dr. W. W. Wirth as *Canaceoides scutellatus* (1969: 563-569), were swept from coastal rocks. Collections also included a new species of therevid fly of the genus *Pherocera*. There was a large colony of Heermann's Gulls (*Larus heermanni*) on the southern slope. Blue-footed Boobies (*Sula nebouxii*) (fig. 13) nested on the cliff and had young. The gulls and pelicans had not laid eggs. A sparrow and a kingfisher were seen. A young Osprey (*Pandion haliaetus*) (fig. 14) in a nest was photographed while a parent circled overhead. We hoisted anchor at 1630 and anchored at Punta Pulpito, Baja California Sur at 1745. After dinner, Hanna and Slevin went ashore on the south side and with a flashlight collected specimens of several species of fossil Mollusca. In the Pulpito cliff, south side, there is a mass of vein-like black crumbly obsidian. This vein shows in the photograph (fig. 15). Since all the fossils seen were in sea cliffs and thus hard to collect, it was decided to stay another day to hunt for some canyons which have weathered down to the fossil bearing strata.

March 31, 1953. Tuesday. Punta Pulpito, Baja California Sur to Isla San Marcos.

The collecting parties left the *Orca* before 0800. The morning was mostly overcast and cool. Cliff, Slevin, and Hanna went northwest on the tableland until they came to a canyon, about a mile back, which had cut down into the fossil-bearing beds. There was an unbelievable number of fossils, the most conspicuous belonging to a large species of *Pecten* and to *Dosinia*, but many other groups were represented. Many forms seemed to have grown to larger size than at present. One poorly preserved abalone was found. It appears to be referable to *Haliotis fulgens* (Hertlein, 1957: 68-69). This is the first specimen recorded with certainty as a fossil from the Gulf of California. Small forms were scarce. Only a few echinoids, representing 3 species, were collected. The beds are nearly horizontal and are faulted off on the east toward the Punto Pulpito which forms a large and very conspicuous promontory. Whether they are faulted on the landward side could not be determined in the available time. The insect collecting included 2 species of scenopinid fly -- a new species of

Brevitrichia and *Metatrichia bulbosa* and 4 new species of minute bee flies -- the unique holotype of *Mythicomyia gynandra* (Melander, 1961: 211), the holotype and 2 specimens of *M. humeralis* (Melander, 1961: 213-214) and paratypes of *M. annulata* (Melander, 1961: 181-182) and *M. irrupta* (Melander, 1961: 218-219). The shore parties returned to the *Orca* at 1100. By 1130 we were under way and set course for Isla San Marcos. We dropped anchor at the southwest end of Isla San Marcos at 1630. Figg-Hoblyn and Ball left at once for the northern part of the island. They found about 15 specimens of *Bulimulus*, 3 of which were alive, and reported a great profusion of flowers, estimated at 40 different kinds. When they returned to the ship at 2030, Ball was ill, probably from overexertion on the hike.

Leviton, Hanna, and Arnaud also went ashore for 1 hour of collecting about the boat landing. On the conglomerate which forms the southwest corner of the island they collected about 50 specimens of *Bulimulus*, 1 gecko, and some insects.

The gypsum for which this island is famous is found well distributed over the south end and samples of it were collected. The quarries which are operated commercially were not visited. Isla San Marcos is almost 6 miles long and 2 1/2 miles wide; its highest peak being slightly less than 900 feet.

April 1, 1953. Wednesday. Isla San Marcos to Isla San Esteban.

We hoisted anchor at 0615 and set course for Isla San Esteban. After a long run through glassy calm seas we arrived at San Esteban at 1700, south side. San Esteban is about 4 miles long, 3 miles wide, and attains a height of 1,772 feet. East of our anchorage, rip tides, due to fast tidal currents, caused whitecrested turbulent water. The shore was a boulder beach, quite barren of chitons and barnacles. Evidently it is a severe beach in a southwest storm. There is much evidence of volcanic activity ashore, but at the landing there were some fossiliferous layers, the fossils not being well preserved or easy to get out. The beds are tipped at a high angle and have boulder beach deposits on top. A wide canyon extends back into the center of the island. In an hour ashore, Hanna collected 2 representatives of *Micrarionta* under volcanic slabs on the west side of the canyon as well as a lot of pupillids. Some insects and reptiles were also collected. One was a snake which Figg-Hoblyn collected at night. It was a calm night with cool air.

April 2, 1953. Thursday. Isla San Esteban.

The temperature is now cooler. At 0700, it was 58° F. in the pilot house, and the water temperature was 60° F. This day was cool with only a slight wind. All biologists went ashore early. Figg-Hoblyn, Firstman, Hanna, and Arnaud collected up the main canyon to the north (figs. 16 and 17) about 2 1/2 miles expecting to find water, but there was none. There had been a little rain not very long ago, but evidently there was no runoff. There was some

moisture down about 6 inches below the surface and many of the plants were in flower. The elephant trees, however, had seed almost ripe and the agaves had dried stalks. The very docile chuckwalla, *Sauromalus varius* (fig. 18) was abundant. They could be easily picked up by hand without the collector being bitten. Live specimens of these were collected for display at the San Diego Zoo and elsewhere. In retrospect, these should not be collected for this purpose and they should be a protected species. A few specimens of the "aggressive" *Ctenosaura hemilopha* were seen and photographed. Several geckos and two racers were collected by the herpetologists. Insect and spider collecting was productive. One of the two minute bee flies collected proved to be new to science, being described as *Mythicomylia fumipennis* (fig. 19) by Melander (1961: 207-208) from the unique holotype. Later in the day, Hanna and Leviton dug a deep hole in a rock slide on the west side of the canyon and collected about 40 specimens of *Micrariontas*, but still they could not find any living ones.

The island has some fossil-bearing beds at the south anchorage which may be as old as upper Pliocene, but the fossils are very poorly preserved. It is difficult to believe that all of the erosion which is evident in the main canyon could have taken place without a geological period of heavy rainfall. There are box canyons cut in hard volcanic rock 40 feet deep.

April 3, 1953. Friday. Isla San Esteban to Isla San Pedro Martir to Bahía San Pedro, Sonora.

We hoisted anchor after 0600 and arrived at Isla San Pedro Martir about 0830 (fig. 21). The *Orca* stood off while the biologists went ashore. There is no good landing where the cliffs can be scaled, so that the collectors went ashore from the skiffs by jumping out on rocks. This is a bird island with much evidence of guano collecting in the past. It is a small high island, being somewhat triangular in shape and less than a mile across and more than 1,000 feet high. The island is wholly volcanic with patches of stratified material interbedded with massive flows. The chemical effect of the guano on the volcanic rocks is very interesting. It has modified the rocks and altered their composition profoundly. Judging by the extent of this alteration it would seem that it has been a bird island for a long time. California sea lions have 2 rookeries on the island, which together probably number at least 1,000 animals. No land shells were found, but in the detrital material brought back to the *Orca* 1 specimen of *Gastrocopta* was found. On the upper slopes there is a fine cactus forest of *Pachycereus pringlei*. A limited collection of insects was made which included a few large weevils. A strong wind developed and the landing parties were recalled by ship whistle at 1130. It was a rough sea to board the skiffs from the rocks and row back to the ship. We then set course for Bahía San Pedro, Sonora, where we arrived and dropped anchor at 1800. The night lights attracted many fishes heretofore not seen. Ball, Figg-Hoblyn, Firstman, Wall, and Arnaud went ashore for night collecting,

with only limited success.

April 4, 1953. Saturday. Bahía San Pedro, Sonora to Guaymas, Sonora.

The rocks at Bahía San Pedro are ancient volcanics with much alteration. A few representative samples were taken, including one which looked like a half obsidian. It was part of a two foot vein in red altered volcanics at the northeast end of the bay.

It was an overcast cold morning. Mr. Sefton took a fine series of chitons on the low tide. He also decapitated a porpoise which was found floating in the bay the previous night and which he had towed ashore. It had large teeth which were heavily worn. The last tide pool collecting was done by Briggs with the help of the herpetologists. Because of the weather, no reptiles were out except for a few lizards. A search was made for specimens of *Bulimulus* by Hanna, and a few were found among the boulders in the old stream bed of the large canyon which comes into the northeast corner of the bay.

At noon we left Bahía San Pedro for the port city of Guaymas. The trip down the coast was with a heavy following sea. We arrived after 1600.

April 5, 1953. Sunday. Guaymas, Sonora.

Four of the Stanford biologists, Briggs, Cliff, Firstman, and Leviton, together with Ball, left by bus for their home destinations. Figg-Hoblyn and Arnaud hiked into the hills northeast of Guaymas where they collected insects with good results. Specimens of a new genus and species of mite gall maker, *Paraphytoptella arnaudi* (Keifer, 1959: 17-18), were collected. These mites caused clusters of bead galls on the leaves of the white-flowered shrub *Cordia parvifolia*. A few land snails (*Bulimulus* species) and 2 pupillids were also collected. Hanna and Slevin invited Sefton, Figg-Hoblyn, and Arnaud out to dinner in Guaymas in the evening.

The collections made by the Stanford group of biologists were left aboard the *Orea*. They were to be transported on April 16 by the California Academy of Sciences vehicle which was to pick up Hanna and Slevin and their collections. This was the conclusion of the first part of the Sefton *Orea* Expedition.

Part II. April 6 - 17, 1953

April 6, 1953. Monday. Guaymas, Sonora.

The last two Stanford biologists, Figg-Hoblyn and Arnaud, left by bus in the morning for a short visit to Hermosillo, on their return trip to California. Arnaud carried the insect collection in a suitcase for safe transport. They also carried several live specimens of *Sauromalus varius* as part of their baggage. Dr. Rolf Bolin, ichthyologist from Stanford University's Hopkins Marine Station at Pacific Grove, arrived at Guaymas in the evening, as well as two fishermen from San Diego.

April 7, 1953. Tuesday. Guaymas, Sonora.

The *Orca* was in port. Hanna was recovering from a mild case of food poisoning presumably obtained at the dinner in Guaymas.

April 8, 1953. Wednesday. Guaymas, Sonora to Bahía de Santa Inez, Baja California Sur.

The *Orca* left Guaymas at 0600. There was a brisk north wind on the day's crossing of the Gulf. On the way deep plankton hauls were made. In the first, with a fine mesh, a half gallon of miscellaneous pteropods and crustaceans were collected. Arrived at Bahía de Santa Inez, Baja California Sur, at 1700. The fishermen caught 2 sharks and 2 bone fish before dark.

April 9, 1953. Thursday. Bahía de Santa Inez, Baja California Sur.

Bolin and Sefton collected fish on shore all day and took representatives of 27 species in tide pools. The sport-fishermen, George and Doc, went out to Isla Santa Inez trolling and came back with 34 groupers. The Captain and Chief also got 7. Slevin and Hanna worked ashore and obtained a good collection of shells-- living, Pleistocene, and Pliocene. The living or recent shells were piled in windrows on the beaches. The Pleistocene covers an elevated bench up to 50 feet which extends inland about 3/4 of a mile. In places it is 6 feet thick solid shells, calcareous algae, and coral. A great many species are present, apparently all living today. Although present, representatives of the heavy species of *Spondylus*, *Chama*, the round form of *Ostrea*, *Strombus*, and *Fasciolaria* were not collected. The Pliocene underlies this and forms the low hills behind the bay. It is brown limy sand with the shells nearly all dissolved away. The rock was so tough and hard that it was difficult to dig into, but collections were made of some pectens and echinoids which were well preserved.

April 10, 1953. Friday. Bahía de Santa Inez, Baja California Sur.

The biologists and Sefton worked ashore, collecting shore fishes, shells, etc., and taking photographs. Specimens representing 2 species of *Vermetus* were found. One, a very small form, grew in great head-like clusters at about mid-tide. The fishermen, George and Doc, and Jackson went fishing and returned with 30 fish, mostly groupers.

April 11, 1953. Saturday. Bahía de Santa Inez, Baja California Sur to Bahía Coyote, Bahía Concepción, Baja California Sur.

The *Orca* went out into deep water in the early morning to make deep plankton hauls for Bolin. The wind freshened farther from shore, so that but 1 haul was made with 4000 feet of line. The result was 4 small lantern fish. By the time the net was brought in, a strong north wind of about 30 to 40 miles was blowing and the sea was so rough that further work was impractical. Anchorage was sought therefore in the small well protected Bahía Coyote, and all went

ashore. Collections were made mostly around the mangrove lagoon on the west side. In the lagoon there was a heavy growth of coral and on the mangrove roots there were great clusters of oysters. The latter were also attached to the surrounding rocks. Kitchen middens were very extensive and very deep, especially next to the cliffs of volcanic agglomerate. This is mostly andesite blocks up to several feet in diameter, apparently the toe of a very massive flow. In one place a 6-inch seam of yellowish opal was observed.

April 12, 1953. Sunday. Bahía Coyote, Bahía Concepción, Baja California Sur.

Bolin, Slevin, and Hanna went to a small island (no name) near the anchorage this morning, but found no land shells. Two geckos and 2 lizards were obtained. They then proceeded to Isla Coyote farther out and found specimens of a *Bulimulus* species to be exceedingly abundant. Over 100 specimens were obtained, as well as some geckos and lizards. In the afternoon they returned to the mangrove lagoon and with a boat inside took many fine specimens of several species of fishes in the growths about the mangrove roots. The wind was strong all day but at night it was dead calm.

April 13, 1953. Monday. Bahía Coyote, Bahía Concepción, Baja California Sur.

Bolin, Slevin, and Hanna dredged in the morning, making hauls in Bahía Coyote and across Bahía Concepción at that point, using the launch. Depths ranged from 2 to 16 fathoms. In every case the bottom was the same broken and dead shells, sand and mud. It was detrital material washed out from near shore, indicating that the whole bay is a drowned valley. In the afternoon the *Orca* moved to the head of Concepción. There in the mangrove lagoon 10 species of fish were obtained. On shore in several places there were heaps of relatively fresh large *Strombus* shells which had been broken open by natives who use the animals for food.

April 14, 1953. Tuesday. Bahía Concepción, Baja California Sur to San Inez, Baja California Sur.

Left anchorage in morning and made the run to Bahía de Santa Inez in order to have a good start for Guaymas on the 15th. At Santa Inez Bay, Bolin and Hanna went ashore in the afternoon to check the Pliocene farther inland to try to get some good, well preserved fossils, but failed. The beds are consolidated to a hard, tough, impure lime with nearly all fossils dissolved out. Favorable preservation, it was thought, could be found in the area and would be very important. However, it would be necessary to have enough time so that a careful search could be made. What appeared to be fragments of *Pecten keepi* and other striking Pliocene forms were seen. Wind continued to blow about 20 miles per hour even in the evening. Packing was practically completed preparatory to going ashore on the morning of the 16th.

April 15, 1953. Wednesday. Bahía de Santa Inez, Baja Cal-

ifornia Sur to Guaymas, Sonora.

Departure was made at midnight to try to avoid the strong winds which spring up about 1100 each day. At daylight a fairly successful 100-fathom plankton haul was made. There were several lantern fishes and some other forms. The trip across the Gulf was rough. The nearly constant strong winds encountered in this part of the Gulf had been totally unexpected. Upon arrival at Guaymas, the remainder of the day was spent getting the collections and gear in order to be put ashore as soon as Mr. A. E. Gundred of the California Academy of Sciences arrived.

April 16, 1953. Thursday. Guaymas, Sonora.

The California Academy of Sciences and the Stanford University collections were loaded in the Academy's panel truck which was driven to Guaymas by Alvin Gundred following his arrival at 1430. This was a very heavy load, too heavy in fact, and the next day out of Hermosillo it was necessary to dump the formaldehyde out of all fish and reptile containers to lighten up. Bolin, Slevin, Gundred, and Hanna left Guaymas at 0600 on the 17th, and after tire trouble in Magdalena, arrived in Casa Grande, Arizona, at 2200. On the 18th the party returned to San Diego via Yuma and reached San Francisco on the morning of the 20th.

April 17, 1953. Friday. Guaymas, Sonora.

At this time the University of California, Los Angeles, group joined the *Orca* for work in the Gulf and returned to San Diego at the beginning of May. The work of this third part is not treated in this account.

SUMMARY

Significant collections were made by all scientific personnel. Some collections formed part of research studies which were published almost immediately, see Cliff (1954), while other portions of the collections have been utilized in revisions and monographs, often from larger geographical areas, as in the Diptera, see Melander (1961) and Wirth (1969). It will be many decades, however, before all specimens have been studied and described, particularly when considering the insects collected.

The collections are deposited in a number of scientific institutions, and these are as follows: fossils, mollusks, and other marine invertebrates collected by Dr. G Dallas Hanna are deposited in the collections of the Departments of Geology and Invertebrate Zoology of the California Academy of Sciences; the reptiles collected by Mr. Joseph R. Slevin are deposited with the Department of Herpetology, California Academy of Sciences; the fishes collected by John C. Briggs and scientific personnel are deposited with the Stanford Fish Collections at Stanford University; the reptiles collected by Frank S. Cliff, Alan E. Leviton, and John P. Figg-Hoblyn were deposited with Stanford University and have recently been transferred to the California Academy of Sciences; the spiders, scorpions, and allies collected by

Bruce L. Firstman were deposited with the American Museum of Natural History in 1962; the Coleoptera collected by John P. Figg-Hoblyn and the Diptera and other insects collected by Paul H. Arnaud, Jr., were primarily donated to the Department of Entomology, California Academy of Sciences, in 1954.

The collections made by Arnaud and presented to the Academy totaled 5,978 pinned specimens (of these, 2,580 were pinned while aboard the *Orea*). In addition, some series of ants and a few scorpions preserved in alcohol and donated to the California Academy of Sciences are not included in this total. Entomological specimens distributed elsewhere are as follows: collections of scale insects (Homoptera) presented to the late Prof. G. F. Ferris, Stanford University; gall forming mites (Eriophyidae) presented to Mr. H. H. Keifer, California Department of Agriculture, Sacramento; a duplicate series of bees of the genus *Perdita* presented to Mr. P. H. Timberlake of the University of California, Riverside; a large series of duplicate marine Dolichopodiidae of the subfamily Aphrosylinae from Isla San Geronimo presented to Mrs. Marian Adachi Cohen, of the University of Hawaii, Honolulu; duplicate marine shore flies of the family Canaceidae presented to Dr. Willis W. Wirth, of the United States National Museum; and a small collection of about 100 Tachinidae and a similar number of insects collected at Guaymas are retained in the Arnaud collection.

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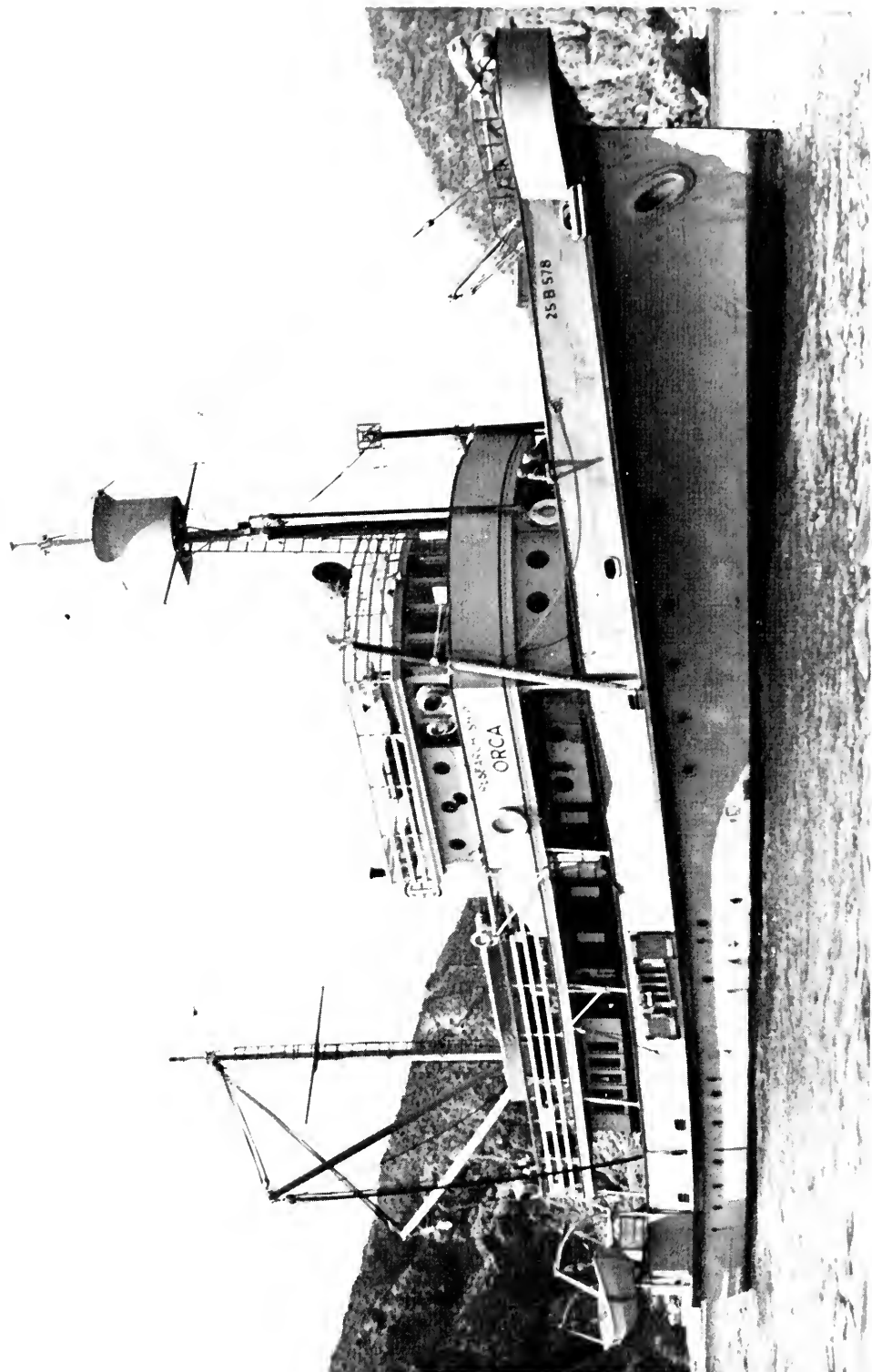


FIGURE 1. Research ship *Orca*. Photograph furnished by the late Mr. Sefton.

FIGURE 2. Route of the 1953 Sefton *Orca* Expedition, Parts I and II, to the Gulf of California. The localities are indicated by numbered circles and are as follows:

Part I. March 9 - April 5, 1953

1. San Diego, California (9 March)
2. Cabo Colnett, Baja California Norte (9 March)
3. Isla San Geronimo (10 March)
4. Bahía del Sur, Isla de Cedros (11 March)
5. Bahía San Bartolomé, Baja California Sur (12 March)
6. Punta Abreojos, Baja California Sur (13 March)
7. Bahía Santa María, Baja California Sur (14, 15 March)
8. Cabo San Lucas, Baja California Sur (16, 17 March)
9. Los Frailes, Baja California Sur (18, 19 March)
10. Punta Gordas, Isla Cerralvo (20, 21 March)
11. Isla Espíritu Santo, Isla Partida (22, 23 March)
12. Isla San Francisco (24 March)
13. Bahía Amortajada, Isla San José (24, 25 March)
14. Isla Santa Cruz (26 March)
15. Bahía Agua Verde, Baja California Sur (26 March)
16. Isla Santa Catalina (27 March)
17. Bahía de Ballandra, Isla de Carmen (27, 28 March)
18. Loreto, Baja California Sur (28, 29 March)
19. Isla Ildefonso (30 March)
20. Punta Pulpito, Baja California Sur (30, 31 March)
21. Isla San Marcos (31 March)
22. Isla de San Esteban (1, 2 April)
23. Isla San Pedro Martír (3 April)
24. Bahía San Pedro, Sonora (3, 4 April)

Part II. April 6-16, 1953

25. Guaymas, Sonora (4-7, 16 April)
26. Bahía de Santa Inez, Baja California Sur (8-10, 14 April)
27. Bahía Coyote, Baja California Sur (11-13 April)
28. Bahía Concepción, Baja California Sur (13 April)

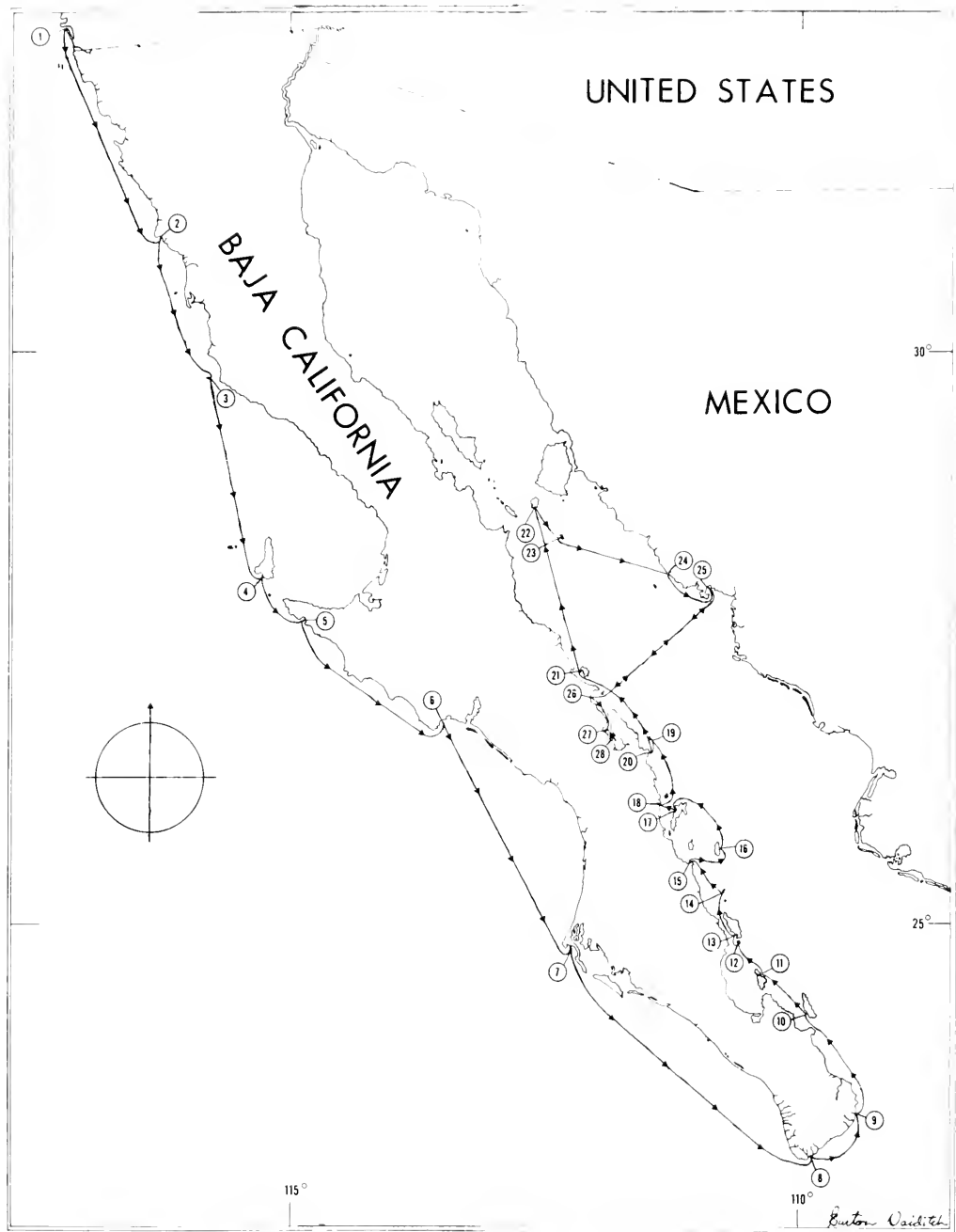




FIGURE 3. Mr. Slevin, on left and Dr. Hanna on right, aboard research ship *Urea*, off Pacific coast Baja California.

FIGURE 4. Left to right, Engineer McNeilage, Captain Ellis and crewman Wall, on bridge *Urea*.

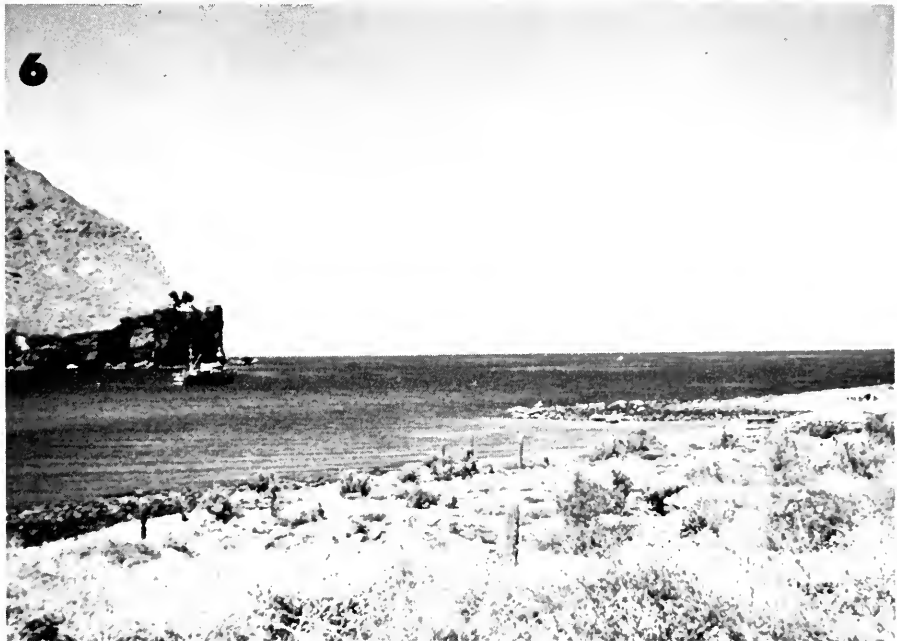
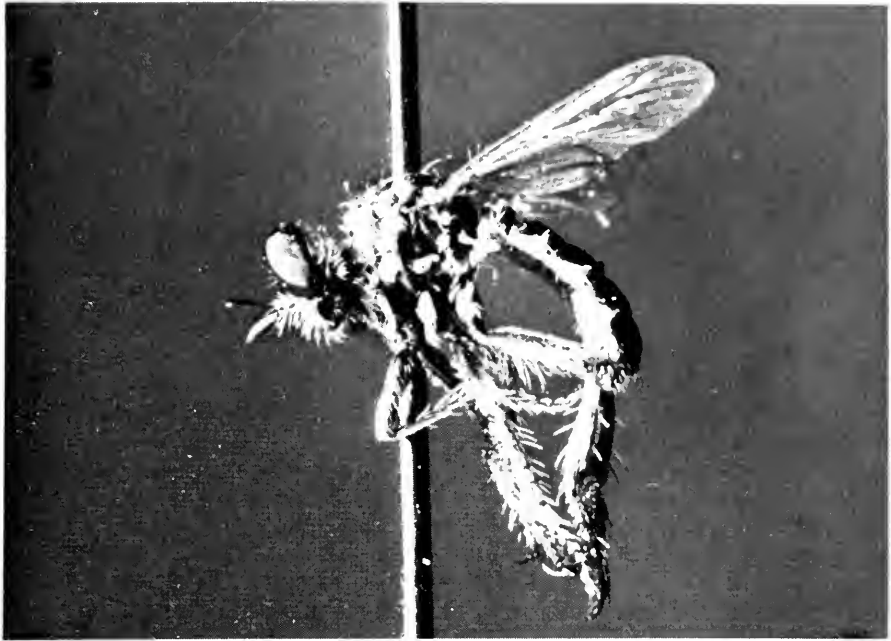


FIGURE 5. A robber fly, *Parataraticus arenicola* Martin, Los Frailes, Holotype male.

FIGURE 6. *Orca* at anchorage, looking east from Isla Espíritu Santo on right and Isla Partida on left.

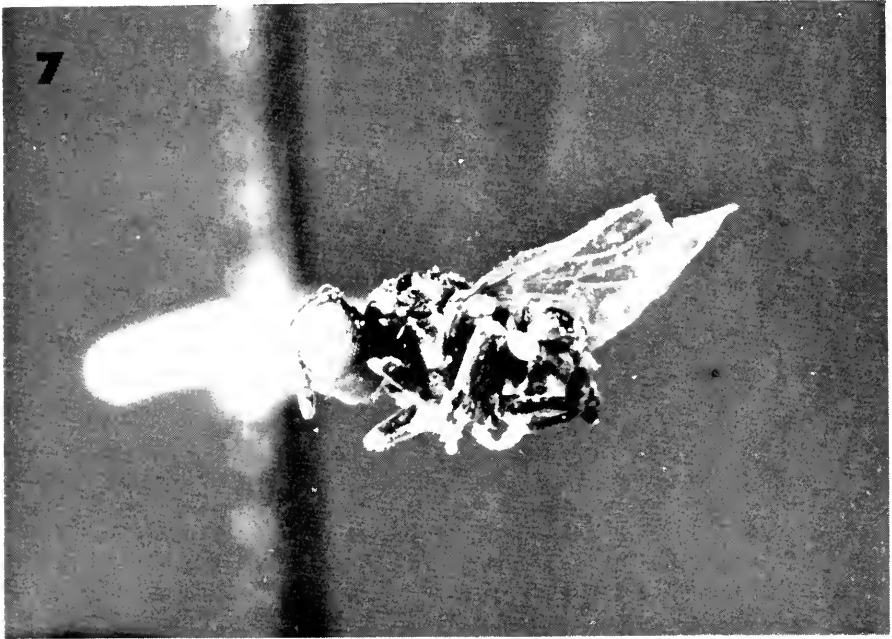


FIGURE 7. A scenopinid fly, *Scenopinus seftoni* Kelsey, Isla Espíritu Santo, Holotype male.

FIGURE 8. Rowing back from shore collecting, Isla San Francisco, left to right, Mr. Slevin, Ball, Figg-Hoblyn, Cliff, Leviton, and Briggs.

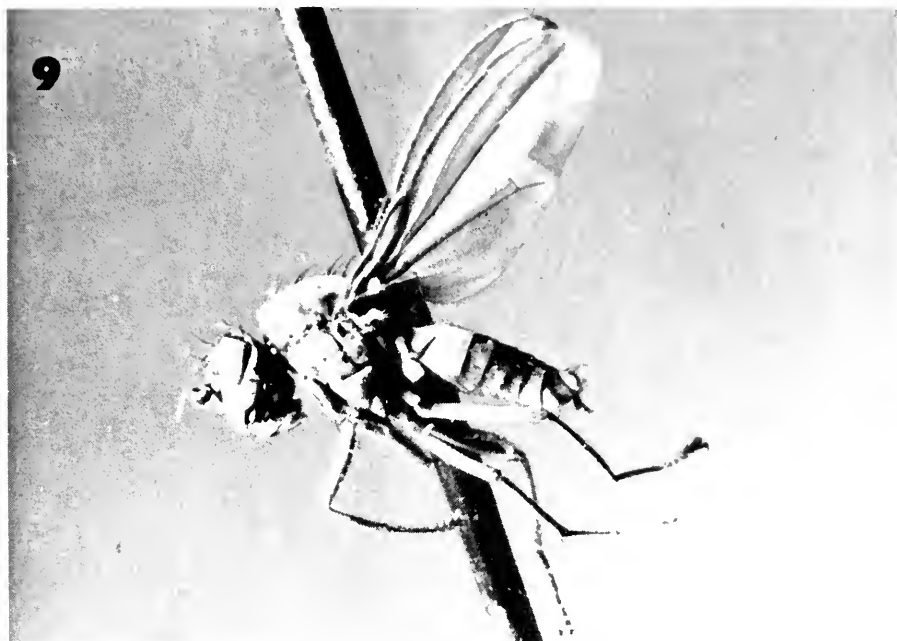


FIGURE 9. Marine shore fly, *Canaceoides setosus* Wirth, Isla Santa Catalina, Holotype female.

FIGURE 10. Interior of Isla de Carmen, facing west toward Puerto Ballandra.

**12**

FIGURE 11. Trail from La Salina to Puerto Ballandra, Isla de Carmen, with resident and burros.

FIGURE 12. Trail leading to La Salina at end of trail from Puerto Ballandra, Isla de Carmen.



FIGURE 13. Young Blue-footed Boobies (*Sula nebouxi*) in cliff, Isla Ildefonso.

FIGURE 14. Young Osprey (*Pandion haliaetus*) in nest, on Isla Ildefonso.



FIGURE 15. Punta Pulpito, Baja California Sur, with a mass of vein-like black crumbly obsidian (photograph taken by Dr. G Dallas Hanna).

FIGURE 16. Dr. Hanna on Isla San Esteban, main canyon, with large Cardón (*Pachycereus pringlei*) left foreground.

17



18



FIGURE 17. *Machaerocereus gummosus*, left foreground, and Cardón (*Pachycereus pringlei*), Isla San Esteban.

FIGURE 18. The "docile chuckwalla" (*Sauromalus varius*) held by Figg-Hoblyn, on left, and Arnaud, Isla San Esteban.

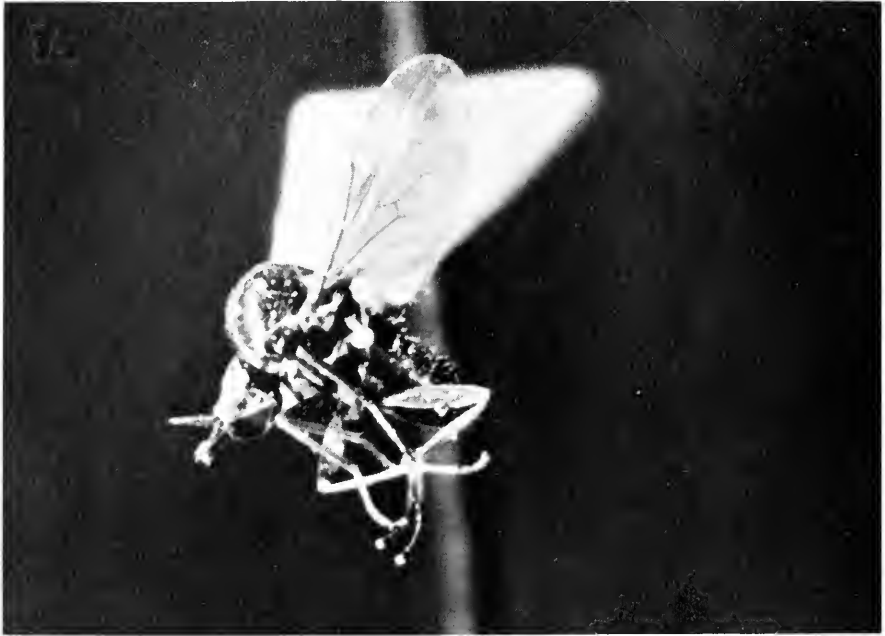
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FIGURE 19. Minute bee fly, *Mythicomyia fumipennis* Melander, Isla San Esteban, Holotype male.

FIGURE 20. Rowing skiff for return to *Orca*, a daily occurrence, with left to right, Dr. Hanna, Arnaud, Firstman and Ball (photograph by John P. Figg-Hoblyn).

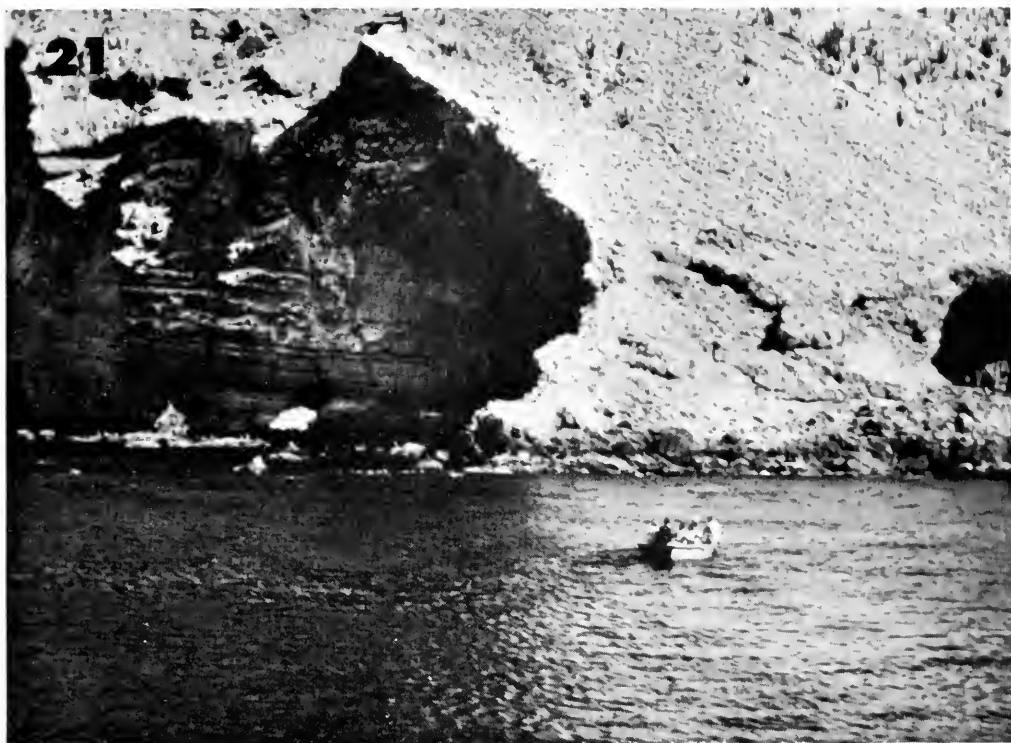


FIGURE 21. Isla San Pedro Martír, with landing party skiff rowing ashore. Cardón (*Pachycereus pringlei*) on upper slopes.

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