

**Article XXIV.—VOYAGE OF THE ‘ALBATROSS’ TO THE
GULF OF CALIFORNIA IN 1911.**

BY CHARLES HASKINS TOWNSEND.

By a special arrangement with the United States Bureau of Fisheries, the American Museum of Natural History, The New York Zoölogical Society, the New York Botanical Garden and the United States National Museum, coöperated in a two months' voyage of the ‘Albatross’ in the Lower California region early in the year 1911.

Mr. Arthur Curtiss James, a Trustee of the American Museum, contributed \$7,500 to the expedition. The Zoölogical Society and the Botanical Garden each contributed \$1,000. The National Museum contributed the services of a naturalist. The Bureau of Fisheries furnished the ‘Albatross,’ with her officers and crew.

The various collections were to become the property of the institutions participating: all the preserved zoölogical collections to the American Museum, with a series to the National Museum; all the living specimens to the Zoölogical Society and the botanical collections to the Botanical Garden.

The Bureau of Fisheries desired information respecting the fish and fisheries and the oceanographical features of Lower California and the Gulf region, referring especially to the desirability of further knowledge regarding the supply of edible fishes, oysters and turtles, with the view to inaugurating a fish trade with our southwestern states.

The ‘Albatross’ being available for two months only, the voyage was accordingly arranged to include brief visits to as many different parts of the coast and islands as practicable, leaving time for considerable deep sea work during the return trip. The following itinerary shows that anchorages were made at thirty different points where marine and shore explorations were made:

<i>Ports Visited</i>	<i>Arrival</i>	<i>Departure</i>
San Francisco.....		Feb. 23
San Diego.....	Feb. 25.....	Feb. 28
Guadalupe Island.....	Mar. 2.....	Mar. 4
San Diego.....	Mar. 6.....	Mar. 7
San Benito Ids.....	Mar. 9.....	Mar. 10
Cedros Island.....	Mar. 10.....	Mar. 12 (3 anchorages)
San Bartolome Bay.....	Mar. 13.....	Mar. 15
San Cristobal Bay.....	Mar. 15.....	Mar. 15

<i>Ports Visited</i>	<i>Arrival</i>	<i>Departure</i>
San Roque Id.	Mar. 15.	Mar. 15
Abrejos Anchorage.	Mar. 16.	Mar. 16
Santa Maria Bay.	Mar. 18.	Mar. 18
Magdalena Bay.	Mar. 18.	Mar. 19
Margarita Island.	Mar. 19.	Mar. 20
Marcy Channel.	Mar. 20.	Mar. 21
Cape San Lucas.	Mar. 23.	Mar. 25
San Jose del Cabo.	Mar. 25.	Mar. 26
La Paz (Pichiliuque Hbr.)	Mar. 27.	Mar. 30
San Josef Island.	Mar. 30.	Apr. 1
Agua Verde Bay.	Apr. 1.	Apr. 2
Carmen Island.	Apr. 2.	Apr. 3
Mulege.	Apr. 4.	Apr. 5
Concepcion Bay.	Apr. 5.	Apr. 8 (2 anchorages)
San Francisco Bay.	Apr. 9.	Apr. 10
Angel de la Guardia Id.	Apr. 10.	Apr. 11
Tiburon Id.	Apr. 11.	Apr. 13
San Esteban Id.	Apr. 13.	Apr. 14
Guaymas.	Apr. 15.	Apr. 15
Santa Catalina Id.	Apr. 16.	Apr. 16
Santa Cruz Id.	Apr. 16.	Apr. 16
La Paz (Pichiliuque Hbr.)	Apr. 17.	Apr. 19
Espirito Santo Id.	Apr. 19.	Apr. 19
Cerralbo Island.	Apr. 19.	Apr. 19
San Jose del Cabo.	Apr. 20.	Apr. 20
San Bartolome Bay.	Apr. 23.	Apr. 23
San Francisco.	Apr. 28.	

The zoölogical shore collections included 804 specimens of birds representing 143 different species; 259 specimens of mammals ¹ of 59 species, ten of which proved to be new to science; 446 specimens of reptiles, of 47 species eight of which are new. A number of living reptiles were brought to the New York Zoölogical Park. A small but important series of insects was obtained and a very large collection of invertebrates.

The botanist, with assistance from the crew, made large gatherings of plants, obtaining about 1800 specimens. The collection of cacti was the most important of its kind ever brought from Lower California, and more than a thousand living specimens were sent safely to the New York Botanical Garden. Many of the plants have been described as new to science and there are many still to be studied. A short account of the botanical work by Dr. J. N. Rose appeared in the 'Journal' of the New York Botanical

¹ See 'Mammals Collected in Lower California, with Descriptions of New Species,' by Charles Haskins Townsend. Bull. Amer. Mus. Nat. Hist., Vol. XXXI, Art. XIII, pp. 117-130, June 14, 1912.

Garden for December, 1911. Most of the century plants ¹ brought back by the expedition proved to be new species.

The time spent at the various anchorages was usually one or two days, affording the scientific staff opportunity for making a natural history reconnaissance of the coastal region of the peninsula at many widely separated localities.

While in the Gulf of California the ship was usually moved at night so that the days could be largely devoted to shore work. Moving rapidly from point to point as we did, the shore work could not be extended very far inland, nor could the work of collecting be made very thorough, but the naturalists made the best possible use of each day ashore.

The active interest of Captain Burrage and the officers of the 'Albatross' contributed greatly to the effectiveness of our work, while the expedition would not of course, have been undertaken without the coöperation of the Bureau of Fisheries.

Dr. Hugh M. Smith, U. S. Commissioner of Fisheries, authorized the publication of the results of the expedition by the institutions participating.

In the oceanographic work, dredge hauls were made with the large beam trawl at 27 stations in depths ranging from 284 fathoms to 1760 fathoms, mostly off the west coast of Lower California. Following is a list of the stations occupied, with their positions and depths;

<i>Dredging Stations</i>	<i>Lat. & Long.</i>	<i>Date</i>	<i>Fathoms</i>	<i>Bottom Temp.</i>	
5673	31 26' 00" N. 117 42' 00" W.	Mar. 1	1090	....
5674	31 28' 45" N. 117 09' 50" W.	Mar. 8	590	39.4	
5675	27 07' 05" N. 114 33' 10" W.	Mar. 15	284	44.6	
5676	25 31' 15" N. 113 29' 30" W.	Mar. 17	645	39.0	
5677	25 23' 45" N. 113 16' 00" W.	Mar. 17	735	38.6	
5678	24 35' 20" N. 111 59' 35" W.	Mar. 21	13½	....	(Magdalena Bay)
5679	23 47' 45" N. 111 23' 00" W.	Mar. 22	325	44.1	
5680	23 40' 30" N. 111 12' 45" W.	Mar. 22	389	43.6	
5681	23 33' 15" N. 111 02' 10" W.	Mar. 22	405	43.3	
5682	22 48' 20" N. 109 52' 40" W.	Mar. 24	491	40.8	
5683	22 46' 45" N. 109 50' 15" W.	Apr. 20	630	39.1	
5684	23 23' 30" N. 112 00' 30" W.	Apr. 21	1760	....
5685	25 42' 45" N. 113 38' 30" W.	Apr. 22	645	....
5686	26 14' 00" N. 114 00' 00" W.	Apr. 22	930	37.3	
5687	27 39' 15" N. 115 16' 00" W.	Apr. 23	480	41.1	
5688	27 38' 45" N. 115 17' 40" W.	Apr. 23	525	39.9	
5689	29 23' 00" N. 116 14' 00" W.	Apr. 24	879	....

¹ 'The Agaves of Lower California,' by William Trelease. Rept. Missouri Bot. Gard., 1911, pp. 37-65.

<i>Dredging Stations</i>	<i>Lat. & Long.</i>	<i>Date</i>	<i>Fathoms</i>	<i>Bottom Temp.</i>
5690	29 29' 00" N. 116 18' 00" W.	Apr. 24	1101	38.1
5691	31 08' 20" N. 118 29' 30" W.	Apr. 25	868	37.2
5692	31 23' 45" N. 118 31' 30" W.	Apr. 25	1076	37.1
5693	33 13' 30" N. 120 04' 30" W.	Apr. 26	451	....
5694	33 24' 36" N. 120 12' 30" W.	Apr. 26	640	....
5695	33 33' 00" N. 120 17' 30" W.	Apr. 26	534	38.9
5696	35 18' 30" N. 121 28' 00" W.	Apr. 27	440	39.9
5697	35 35' 00" N. 121 39' 00" W.	Apr. 27	485	39.8
5698	35 50' 00" N. 121 49' 30" W.	Apr. 27	475	39.9
5699	36 00' 30" N. 122 00' 00" W.	Apr. 27	659	37.9

The hydrographic observations connected with this work are presented in detail elsewhere in this report, and all sea and shore stations are indicated on the accompanying chart.

The dredgings were rich in new and interesting forms. Among the more striking results of this work for museum purposes, were fifty casts of deep sea fishes made on board from freshly dredged specimens, by Mr. J. C. Bell.

In these casts the following twenty-two genera are represented:

Venefica	Raia	Argyropelecus
Narcetes	Liparis	Leucicoris
Halosaurus	Nemichthys	Alepocephalus
Porogadus	Pleuronectes	Sebastolobus
Macrurus	Monomitopus	Melamphæus
Chaunax	Phycis	Scopelengys
Malthopsis	Merlucius	
Antimora	Lycodes	

The last (*Scopelengys*) was dredged from a depth of 1760 fathoms.

Of the deep sea collections, only the echinoderms¹ have as yet been studied. The latter consist of 1881 specimens, representing 107 species, seven of which were previously unknown; namely:

Zoroaster platyacanthus	Urechinus reticulatus
Pedicellaster hyperoncus	Lætmæneus scotoeides
Diopederma axiologum	Stichopus parvimensis
Ophiura oligopora	

The collection of fishes obtained by the Albatross was a large one. The deep sea species have not yet been studied. The collection of shore fishes²

¹ Echinoderms from Lower California, with Descriptions of new Species. By Hubert Lyman Clark. Bull. Am. Mus. Nat. Hist., Vol. XXXII, Art. viii, pp. 185-236. July 9, 1913.

² Shore Fishes Collected by the 'Albatross' Expedition in Lower California with Descriptions of New Species. By Raymond C. Osburn and John Treadwell Nichols. Bull. Am. Mus. Nat. Hist., Vol. XXXV, Art. xvi, pp. 139-181, May 26, 1916.

contains 185 species of which the following 15 have been described as new:

<i>Raja microtrachus</i>	<i>Amia guadalupensis</i>
<i>Urobatis concentricus</i>	<i>Girella simplicidens</i>
<i>Letharchus pacificus</i>	<i>Hermosilla robusta</i>
<i>Bascanichthys bascanoides</i>	<i>Callyodon compressus</i>
<i>Fundulus parvipinnis</i> , sub sp. <i>brevis</i>	<i>Callyodon microps</i>
<i>Tylosurus pterurus</i>	<i>Dactyloscopus cinctus</i>
<i>Siphostoma exile</i>	<i>Lucioblennius lucius</i>
<i>Atherinopsis sonoræ</i>	

Most of the collection was obtained along the shores and about the islands, the deeper parts of the Gulf being muddy and apparently poor in fish life as shown by previous dredgings by the 'Albatross.'

The peninsula of Lower California is nearly 800 miles in length, with an average width of 60 or 70 miles. It is a mountainous region, having a central elevation, near the northern end, of over 10,000 feet.

The climate is almost rainless and the country as a whole is of desert character. Less than a hundred springs and streams have been described and of the latter only five or six flow permanently to the coast. Populated localities are necessarily located with reference to the limited supplies of water.

Lower California is rich in mineral resources but these remain undeveloped except in a few localities where sufficient water is obtainable. Agriculture is practiced under the same limitations as mining. The fishery resources are important but have as yet been but little drawn upon.

Zoölogically and botanically the region is of great interest to naturalists. Climatically it belongs to the Sonoran province of the temperate realm, usually described as arid. The fauna of the extreme southern end has many tropical characteristics, while much of the fauna and flora of the northern end is related to southern California.

The climate of the eastern side of the peninsula is warmer than that of the western side. Observations made on board the Albatross during the cruise along the west coast of the Peninsula from March 1 to 25 and from April 20 to 29, give the mean temperature of the air as 61° Fahr. and of the water at the surface 60°. While cruising in the Gulf of California from March 26 to April 20, the mean temperature of the air was 71° and of the water 68°.

Narrative. The steamer 'Albatross' left San Francisco at 9.30 A. M., February 23, 1911, under the command of Commander G. H. Burrage, U. S. N., who had instructions from the Bureau of Fisheries to proceed to San Diego and report for work during the months of March and April in the Lower California Region.

The vessel arrived at San Diego at noon on the 25th of February, where our party joined her. These were C. H. Townsend, Director, Dr. J. N. Rose, Botanist, Dr. Paul Bartsch, Conchologist, H. E. Anthony, Collector, P. I. Osburn, Collector, and James Bell, Modeler. Messrs. L. M. Tongue

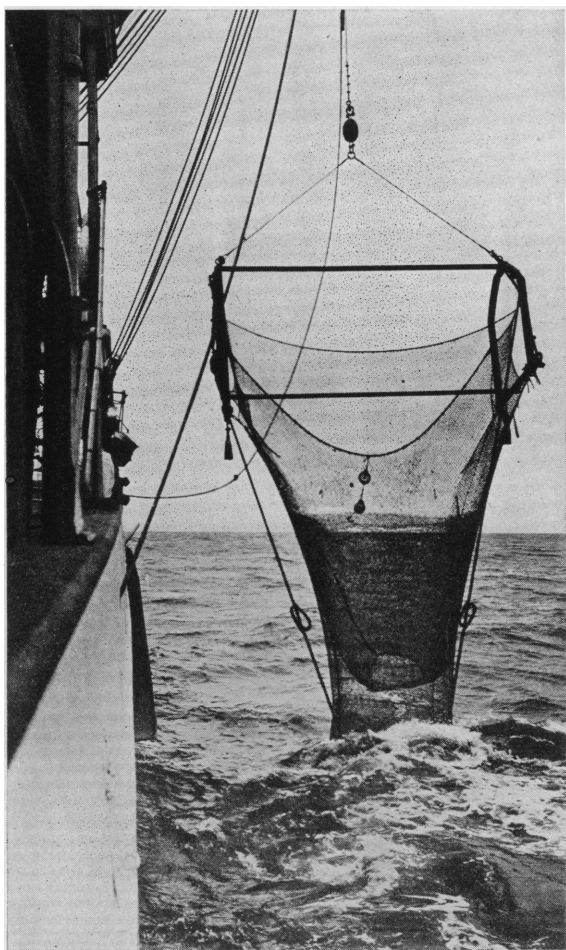


Fig. 1. The beam trawl of the 'Albatross' coming up with a load from deep water.

and W. L. Schmitt of the Fisheries Bureau were also with the expedition. After coaling and taking on supplies, the 'Albatross' sailed on the evening of the 28th, the course being laid for Guadalupe Island.

The following day a haul of the dredge was made in 1090 fathoms (Sta.

5673). The catch consisted of two fishes and numerous invertebrates, with about two barrels of stiff blue mud. The animal forms were roughly identified as follows: Fishes — 1 *Macrurus*, 1 *Raia*; Starfishes: *Eremicaster pacificus* and *Pectinaster agassizii*. Shells — *Trophon*, *Hemicardium*, 8 brachiopods, 8 *Dentalia*; Crustacea — 3 species of crimson prawns; miscellaneous — worms, ophiurans, holothurians, ascidians, silicious sponges, 1 very large pycnogonid, ophiurans and worms in tubes by hundreds. The blue mud obtained here proved to be interesting. Our modeler was in need of modeler's clay, of which we had but a small supply. With a little working by hand, the bluish, stiff mud from this and other dredging stations in this general region, could be made equal to the best modeler's clay. It was used constantly as a modeling clay on board the ship and was not distinguishable from the commercial article.

We arrived at Guadalupe Island on the morning of March 2, where the scientific staff was landed at the deserted camp near the northeast point. I started with the ship at once for the northwest side to examine the site of an old rookery of elephant seals which I had visited in 1892. At that time I was in charge of the schooner 'Santa Barbara,' making a reconnaissance of Guadalupe Island for the Department of State with a view to identifying the species of fur seal known to exist there. Two miles west of North Point I took a boat and began examining the coast, the 'Albatross' keeping off shore. I followed along the beach just outside of the breakers for a couple of hours to within two miles of Steamer Point, where I found about one hundred elephant seals hauled out on the sand beach below the cliffs and between two large rock slides. I killed one large male and one large female, which were skinned and taken on board at nightfall, along with six live yearlings. Early in the afternoon the ship left us some men, and returned to the east side to pick up the party landed there in the morning. On her return at dusk, she anchored about half a mile off the elephant seal beach in fifteen fathoms, where we spent the night.

The following day the sea was too rough for landing. We remained at anchor and spent the day in preparing the two large skins for museum purposes; our collectors working on the birds, plants, and other specimens obtained on the east side of the island the day before. Among the birds collected were the Guadalupe house finch, wren and snowbird. The goldfinch was observed. Nothing was seen of the Guadalupe flicker, which is believed to have been exterminated by former collectors. Several petrels were captured on board during the two nights we were anchored off elephant beach.

The beach occupied at present by the elephant seals is five or six hundred yards in length, and is not accessible from the island at any point. The

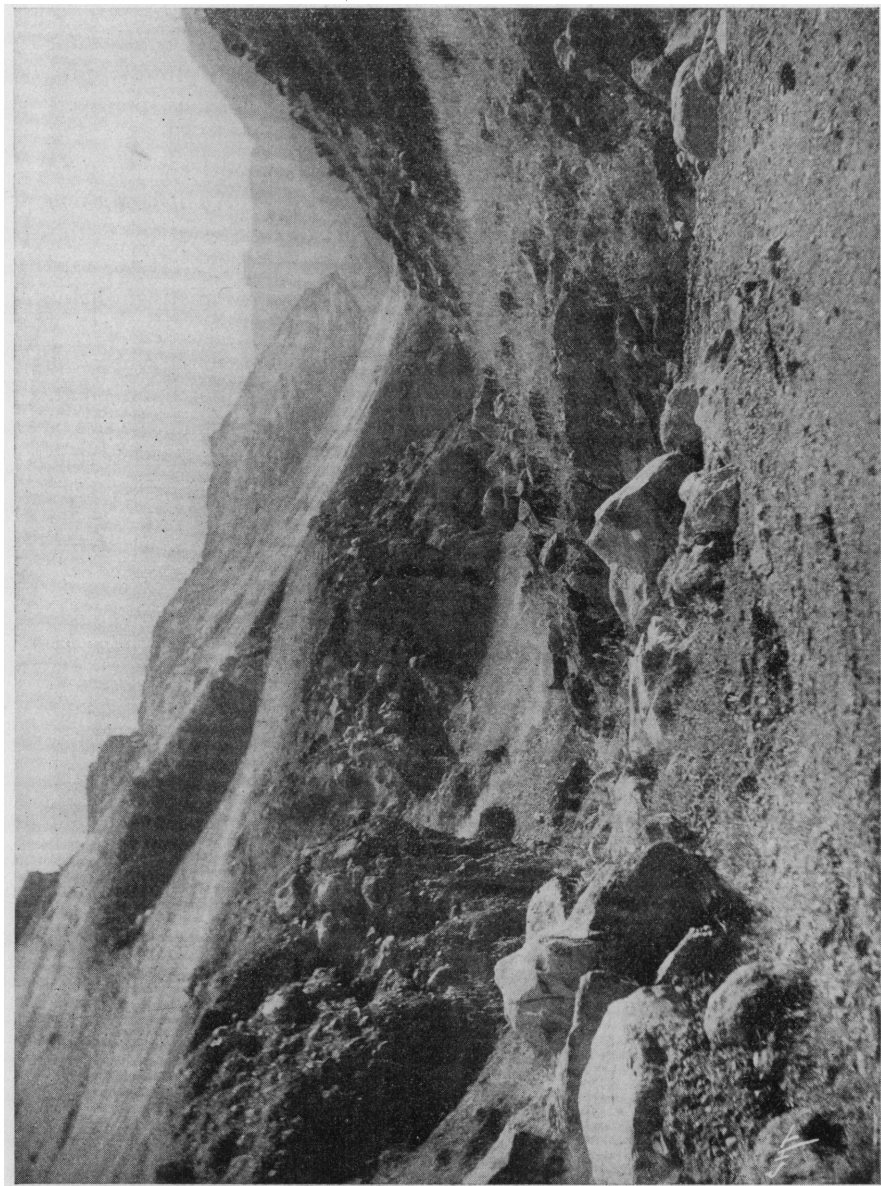


Fig. 2. Cañon at the northeast landing, Guadalupe Island, L. C.

morning of the 4th, I landed and shot two more of the large elephant seals. We spent the forenoon and half of the afternoon in skinning and skeletonizing these, several men working on the large heavy specimens. Each of the large males killed measured sixteen feet in length. Our operations caused very little disturbance of the rookeries; one large male remaining within thirty feet of where we were working. A few of the elephant seals left the beach, but the most of these soon returned and probably none of them would have moved if they had not been annoyed by the sailors walking among them.

The six yearlings taken the day before were captured by simply winding them up in nets to prevent them from biting, or escaping from the boats. I secured about fifty good negatives, showing the seals in various attitudes and the general character of the rookery. There was ample proof that this was the commencement of the breeding season; a dozen or more of the females being accompanied by very young pups. The latter were very dark colored and quite distinct in size from those of the apparently yearling class which we had captured alive. They were remarkably fat and almost incapable of movement on that account. Later in the afternoon before we sailed, I examined the shore line for a couple of miles south of Steamer Point, where I had observed fur seals in 1892, but found no signs of them. The Guadalupe fur seal (*Arctocephalus townsendi* Merriam) may be extinct. If there are any individuals left they probably occupy some of the numerous beach caves farther south, as it was the habit of the species to lie in such shelters.

Guadalupe Island is about 20 miles long and from 3 to 7 miles wide. It is 4500 feet high near the northern end and is of volcanic origin. The island is overrun with goats, which have contributed greatly to its barrenness. Although formerly used as a goat range, the animals being raised for their skins only, it has long been uninhabited. There are a few scattered cypresses, pines and cabbage palms about the higher elevations, and a few springs some of which fail in dry seasons.

Fishing at the elephant-beach anchorage was good, but the fishing ground about the island is limited, as it is surrounded by very deep water.

At nightfall the 'Albatross' sailed for San Diego in order that the young elephant seals and the large skins might be shipped eastward without delay. The entire following day was spent in cleaning and preparing the skins and skeletons of our four large specimens for shipment. We arrived at San Diego on the morning of the 6th. The young elephant seals were each crated separately and forwarded by express to the New York Aquarium, without food or water, as they would not eat and were in good condition. Later two of them were sent to the Zoological Park in Washington.¹

¹ The writer has published a special account of the elephant seal in 'Zoologica,' Scientific Contributions of the New York Zoological Society, I, No. 8, pp. 159-173, pl. 52-72, April, 1912. He has also published an article on the same subject in the 'Century Magazine' for June, 1912, pp. 205-211.

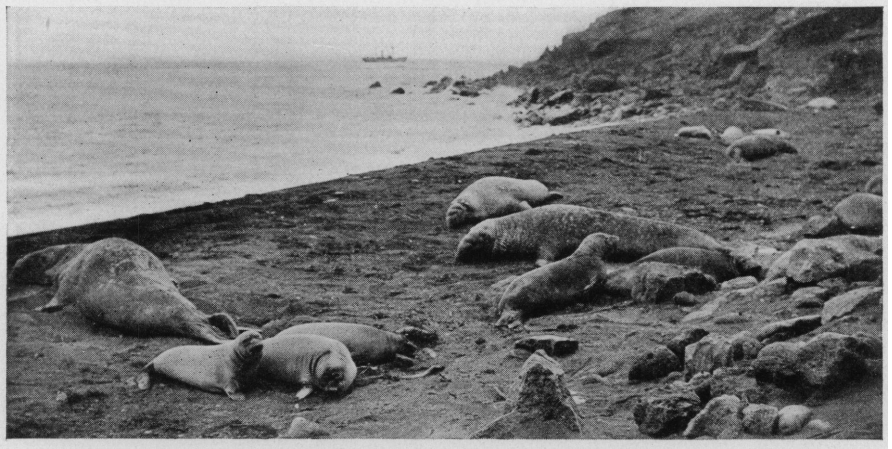


Fig. 3. Elephant Seals. Guadalupe Island.

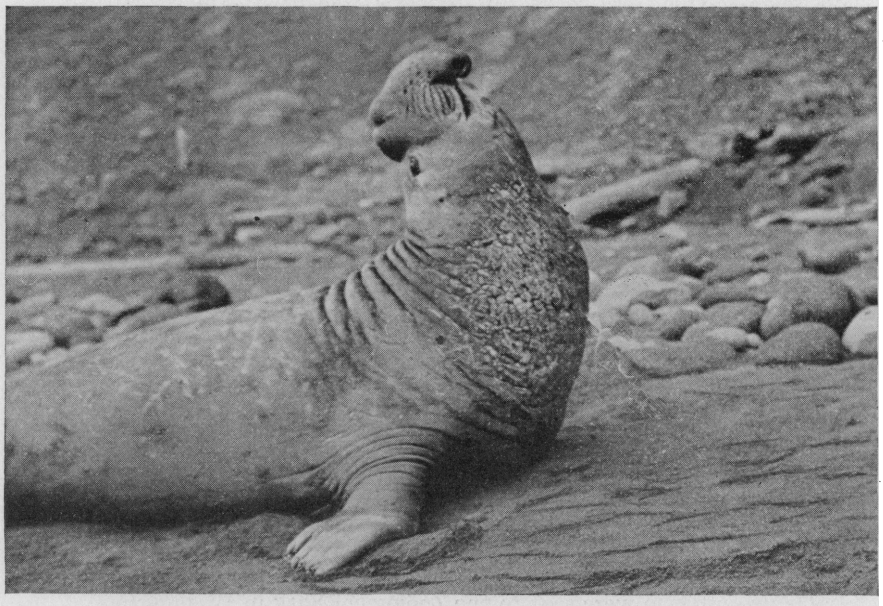


Fig. 4. Old male Elephant Seal. Guadalupe Island.

The 'Albatross' sailed southward in the evening. The following morning we dredged in 590 fathoms (Sta. 5674). The haul was a small but clean one, there being merely a handful of blue mud. The catch was as follows: Fishes — 1 *Stemonidium*, 1 *Cyclothone*, 2 *Melamphæ*s; Invertebrates — 1 crimson prawn; schizopod, 1 starfish, and a few salpæ. This was a clean haul with only a handful of blue mud. It is interesting to note that all the fishes came up *alive*, an unusual occurrence from such a depth.

We arrived at the San Benito Islands early on the morning of the 9th. I examined carefully the north and east shores of West Benito in search of the fur seal which formerly existed there. There was a rookery of about one thousand sea-lions (*Zalophus californianus*) on the west side, extending fully half a mile along the rocks. It was evidently not the breeding season of the California sea-lion, as no pups were seen. Many weathered heaps of abalone shells were observed along the north shore, where formerly Chinese were engaged in drying abalone meat. Nests of the osprey, composed of dried sea weed, were observed on low rock pinnacles, about half of them containing sets of three eggs. As only one young osprey was observed, the nesting season was evidently not far advanced.

In the afternoon I examined the eastern shore of East Benito, looking over several small sea-lion rookeries in my search for the fur seal. There appeared to be about seven hundred sea-lions on this island. The collectors worked on both islands obtaining lizards, plants, fishes and invertebrates. Among the birds obtained were San Benito sparrow, MacGregor's house finch, sparrow hawk, rock wren, burrowing owl, osprey, oystercatcher, gull, duck hawk, hummingbird, horned lark, cormorant and Cassin's auklet. The surface of parts of East Benito was so riddled with the burrows of auklets that it was difficult to walk without breaking into them. A new species of century plant found at the San Benitos has been named *Agave disjuncta*.

We sailed early on the morning of the 10th for South Bay, Cedros Island. This locality has a much scantier vegetation than other parts of the island. The weather was extremely rough for landing. The collectors obtained comparatively little; the land birds being represented by sparrow and hummingbird only. Osprey eggs were brought on board, and gulls, cormorants and terns were seen. A few of the land birds observed were horned lark, house finch, Say's flycatcher, raven and vulture. Black-chinned hummingbirds were numerous. The collection of plants was good, and one species of mouse (*Peromyscus eremicus cedroscensis*) was obtained.

On the 11th the 'Albatross' arrived at the watering place on the south-east side of Cedros where the collectors were all landed. Birds were not abundant but a few species of land birds were obtained. The collection of plants and lizards was more important. A few mice were taken and a single

frog was captured at the spring. Work with the seine was more profitable and a good variety of fishes was obtained. Smelts and anchovies of excellent quality were very abundant, a few sweeps of the seine yielding more than a barrel of them.

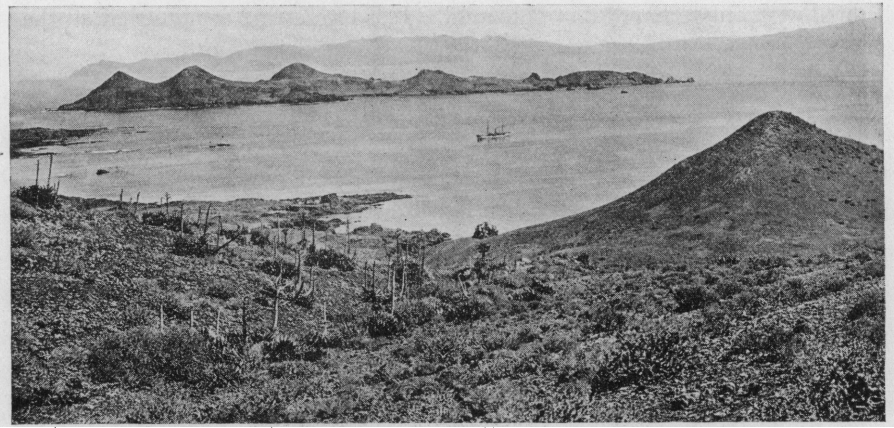


Fig. 5. The 'Albatross' anchored between east and west San Benito Islands. Century plants (*Agave*) in foreground.

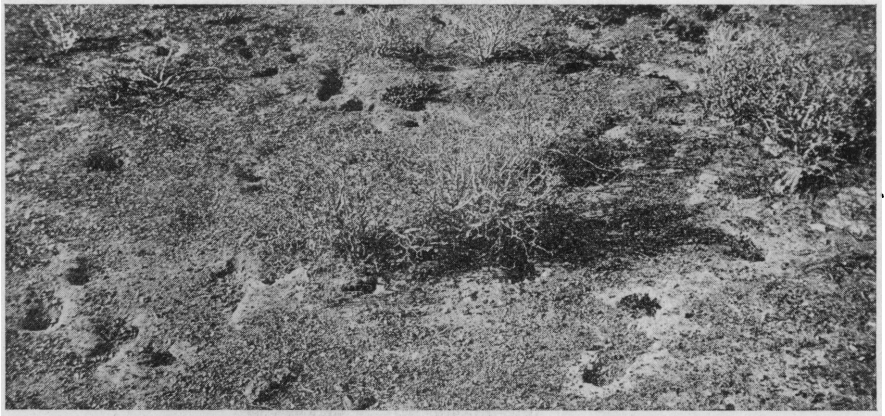


Fig. 6. Burrows of petrels. East San Benito Island.

The spring at this anchorage is the only place where fresh water can be obtained near the beach in this region of Lower California. The water is somewhat charged with sulphuretted hydrogen and has a very distinct odor.

On the morning of the 11th we arrived at the central part of the east side of Cedros and anchored opposite a beach at the foot of a wide, flat valley leading into the interior. The collectors followed up the valley, some of them climbing the high central ridge, covered with cedar trees, about four miles inland. About three miles inland the winding valley opened out into an amphitheatre, at the upper end of which is a spring of water where the main valley forks. This valley is the best route to the interior of the island. The spring water here also smelled and tasted of sulphur and left a whitish deposit on the ground. This is the only fresh water in this part of the island.

A good collection of birds, lizards and plants was obtained. The seining party got fishes similar to those obtained at the last anchorage. Photographs were taken of plants and scenery. I procured a fourteen-inch lizard



Fig. 7. The barren southern end of Cedros Island.

which had swallowed a ten-inch lizard. There were no snakes seen. Among the birds taken were finches, two species of hummingbird, burrowing owl, gnatcatcher, Audubon's warbler and wren. A few wild mice (*Peromyscus eremicus cedroscensis*) were taken in the traps.

A very interesting feature of the plant life of Cedros Island is the strange elephant tree (*Pachycormus discolor*) which takes a thick bush-like form. It sometimes reaches a height of twenty feet, with a spread of forty. The main stem may be more than a foot thick at the ground, and branches immediately into several arms, the branches are exceedingly thick and heavy and the bark, sometimes an inch in thickness, is a soft pulpy rind which may be cut readily with a penknife. The elephant tree is a monstrous growth in appearance and is commonly found on the lower hillsides and in the cañons. It is also found on the mainland. (See Fig. 10.)

The seining party obtained a good variety of fishes and the boat dredge



Fig. 8. Watering place, southeast side of Cedros Island.

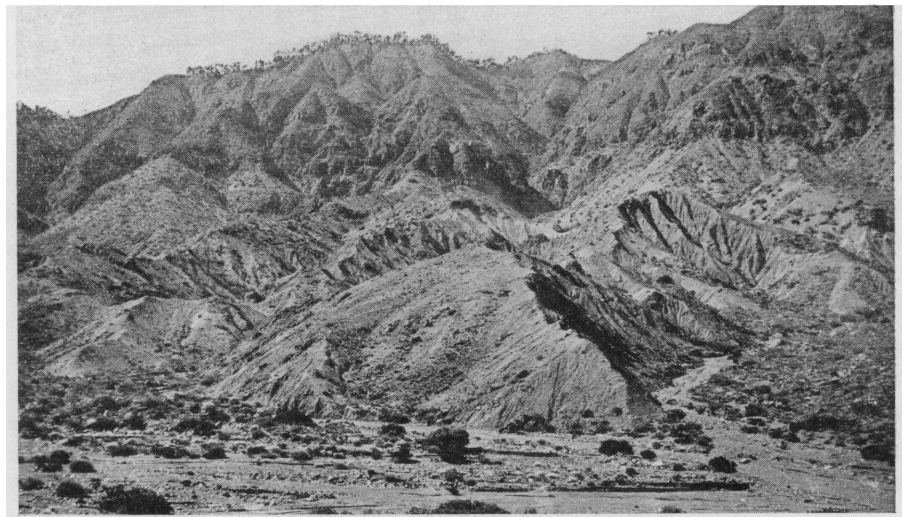


Fig. 9. Head of the central valley of Cedros Island, showing on high central ridge, the cedars from which the island derives its name.

was towed by the launch with fair success. Cedros, like nearly all of the islands off Lower California, is uninhabited.

Sailing in the evening we arrived at San Bartolomé Bay, on the Peninsula, on the morning of the 13th. Here we found two camps of fishermen engaged in catching spiny lobsters (*Panulirus*), for the San Diego and Los Angeles markets. They supplied us most liberally with green turtles and lobsters in exchange for a barrel of fresh water in order to save themselves a 35-mile voyage to Cedros Island, the nearest place for fresh water.

An account of this lobster fishery will be found under another heading. Green turtles are very abundant here, and "Turtle Bay" is one of the names used for this locality. This was our first working place on the Peninsula and the scientific staff made the most of our two days' stay. We obtained specimens of coyote (*Canis peninsulæ*), deer (*Odocoileus hemionus peninsulæ*), woodrats (*Neotoma intermedia gilva*) and mice (*Perognathus penicillatus arenarius*, *P. fallax*, and *Peromyscus maniculatus coolidgei*). The birds included both water and land forms but the latter, as on the islands we had visited, were not very abundant or of many varieties. Among the species obtained were the large-billed sparrow, sage thrush, horned lark, wren and golden-crowned sparrow. Water birds were quite abundant, there being large rookeries of pelicans and cormorants at the entrance of the bay. Porpoises are common in the bay and we obtained one skull of *Tursiops gilli* on the beach.

The entire coastal region of Lower California is desert-like in character, as also are the outlying islands. The vegetation is low and brushy. As rain seldom falls, nearly all the vegetation has a decidedly dry and scorched appearance. The boat dredge was used successfully and the seining party obtained fishes in abundance and variety. Two large California jewfish (*Stereolepis gigas*) were taken at the anchorage. They weighed 138 and 204 pounds respectively.

Leaving on the morning of the 15th, we proceeded twenty miles south to San Cristobal Bay, where in 1884 I had obtained specimens of elephant seal for the National Museum when I was in charge of the schooner 'Laura.' While the 'Albatross' lay off shore I examined the beach for several miles from the steam launch at close range, but there were no signs whatever of elephant seals. A large California jewfish was taken at the anchorage. We moved off shore in the afternoon and dredged in 284 fathoms (Sta. 5675), making a good haul of fishes and invertebrates which were listed as follows: Fishes — 18 sharks (1 species, the largest being 18 feet long), 59 macrurids of 3 species, 1 *Nemichthys*, and two other species; invertebrates — 2 quarts of small grayish echini, 2 dozen anemones, 25 holothurians, 3 species of starfishes (*Pseudarchaster pusillus*, *Ceramaster leptoceramus*, and *Zoroaster*

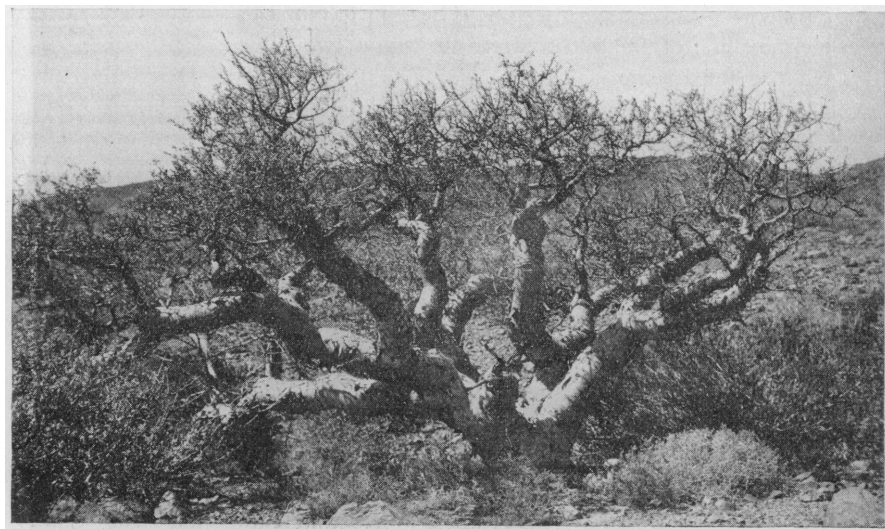


Fig. 10. Elephant Tree (*Pachycormus discolor*). San Bartolome Bay, Lower California.



Fig. 11. Seining party from the 'Albatross.' San Bartolome Bay, Lower California.

platyacanthus), 5 species of crustaceans, 25 ascidians, many *Nassa*, 4 *Amphitrite*, several Ophiurans, worms and numerous sea urchins (*Brissopsis pacifica*).

At five P. M. we landed on San Roque Island where collecting was carried on until dark. The island has rookeries of gulls, cormorants and pelicans. A few ospreys were seen about their nests. The soil of the island appears to contain considerable guano and the soft ground is riddled with the burrows of petrels and auklets. Steaming slowly during the night the 'Albatross' arrived at Abrejos Point, Ballenas Bay, on the morning of the 16th. The desert vegetation was sparse, dried up and much of it appeared dead although merely dormant. The locality was the most barren desert we had yet seen and there were no signs of fresh water. The seine hauls



Fig. 12. Pattern of lobster pot used at San Bartolome Bay.

yielded about half a barrel of large kingfish, as many young kingfish, a few flounders, smelts and anchovies. The beach was lined with rows of clam and other shells. Gulls and cormorants were abundant and a few sea lions were seen about the Point.

Sailing in the evening, we dredged the following morning in 645 fathoms (Sta. 5676), obtaining fishes and a good variety of invertebrates. The modeler made wax and plaster casts of all the species of fishes obtained. Contents of the dredge: Fishes — 5 *Malthopsis*, 1 *Venefica*, 1 *Halosaurus*, 1 *Porogadus*, 1 *Raia badia*, 3 *Macrurus*. Invertebrates — 26 hermit crabs, 12 holothurians, 14 red crustaceans, 2 *Polycheles*, 3 *Pennatula*, 3 medusæ, 1 squid, 1 salpa, 1 starfish (*Pseudarchaster pectinifer*), 4 worms, a few small mollusca.



Fig. 13. 'Abalone' (*Haliotis*) used as bait for lobster pots. Meat left attached to shell and suspended inside the pot. San Bartolome Bay.

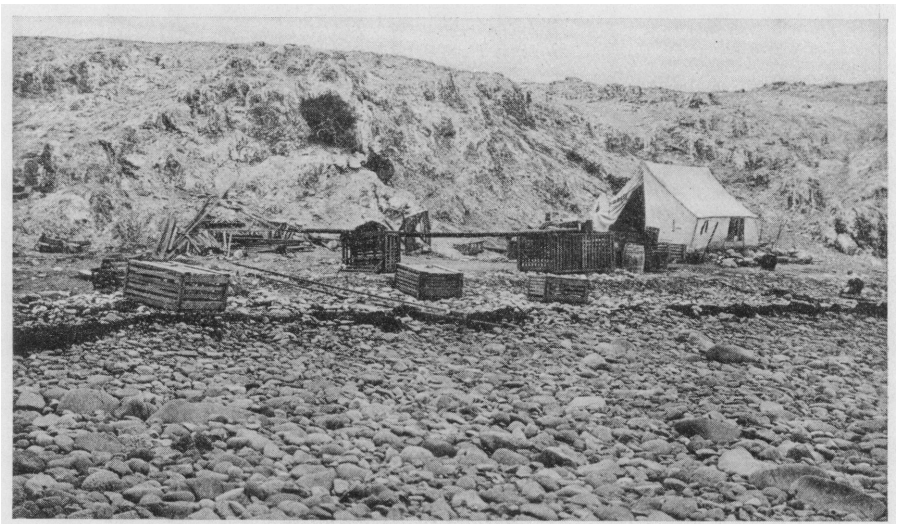


Fig. 14. Camp of lobster fishermen, San Bartolome Bay.

We dredged again at one o'clock in 735 fathoms (Sta. 5677). The catch was roughly identified as follows: Fishes — 1 *Venefica tentaculata*, 1 *Scopelogadus*, 1 *Melamphæus*, 2 other small species. Invertebrates — 2 large red *Lithodes* crabs, 1 *Polychæles*, 1 *Galacantha*, 1 *Glyphocrangon*, 2 crimson prawns, 17 small brown anemones, 1 large annelid, 2 red ophiurans, 1 *Venus*, 1 *Dentalium*, 3 purple holothurians, various small mollusca.

The large *Lithodes* crabs came up *alive*, an interesting fact considering the great depth.

Santa Maria Bay was reached on the morning of the 18th where we saw a remarkable flock of about a thousand cormorants flying in a compact mass near the anchorage. Porpoises were observed in the lagoon. Here the botanist found much that was interesting; among the plants was a new species of evening primrose which he has named after Captain Burrage, and a new century plant (*Agave connochaetodon*). Among the birds obtained were mangrove warbler, yellowthroat, lutescent warbler, large-billed sparrow, Xantus jay, hummingbird, sparrow hawk, raven, Audubon's warbler, bittern and green heron. The boat dredge and seine were in operation most of the day. Among the food fishes were weak-fish, king-fish, and smelts. Lizards and shore invertebrates were also collected.

We proceeded to Magdalena Bay in the evening, arriving at ten P. M. On the morning of the 19th after calling on the collector of the port, the ship was moved to Margarita Island at the southwest part of the Bay, anchoring on the northeast side above Marcy Channel. Traps were set overnight in which several woodrats (*Neotoma intermedia pretiosa*) and mice (*Peromyscus eremicus polypoli*) were taken. This locality contained many nests of the woodrat, most of which were quite bulky and covered with the dried dung of cattle and donkeys, dried cactus and small stones. An eagle's nest was found in a large elephant tree overhanging a ravine; the old birds were present but the nest contained no eggs. A good collection of plants, birds and lizards was made. While crossing the Bay a fine yellowtail (*Seriola dorsalis*), weighing fifteen and one half pounds was obtained by trolling.

On the morning of the 20th the ship was moved to Marcy Channel, between Margarita and Mangrove islands. The collecting on Mangrove Island was good and numerous birds were secured. The seine took half a barrel of mullet in the lagoon, and numerous kingfish, smelts and flounders on the beach outside. A black-tailed jack rabbit was obtained on Margarita Island. The vessel returned to the village anchorage on the morning of the 21st, dredging on the way near the harbor entrance in thirteen and one half fathoms. All the specimens taken were shoal water forms. Seining in the lagoon near this anchorage yielded an abundance of mullet and California weakfish (*Cynoscion*). At Magdalena Bay the collectors ob-

tained a good variety of desert birds, including plumbeous gnatcatcher, Baird's verdin, Grinnell's water thrush, black-chinned sparrow, finch, rock wren and caracara vulture. Other species of land and water forms were obtained. The vegetation about Magdalena Bay was especially dry and scorched; we were told that not a drop of rain had fallen in three years. Water holes are few and far apart in this region.

Proceeding to sea in the evening, the dredge was cast at nine the following morning in 325 fathoms (Sta. 5679) at eleven o'clock in 389 fathoms (Sta. 5680), and in the afternoon in 405 fathoms (Sta. 5681). The total catch from these three hauls was very small, being as follows: Fishes — 34 *Monomitopus*, 13 small sharks. Invertebrates — a few small crabs, prawns and shells.

Cape St. Lucas was reached on the morning of the 23d, where we remained two days. Here we found a change in the character of the desert and decidedly for the better. The bushes were higher, some of them in bloom. There were many small trees and an abundance of giant cactus. Birds were numerous and of many species and we collected for the first time forms peculiar to the Cape Region. A most important collection was made of small mammals, birds, lizards and plants. Among the mammals were: *Lepus californicus xanti*, *Perognathus spinatus peninsulae*, *P. siccus*, *Neotoma intermedia arenacea*, *Peromyscus eremicus eva* and *Ammospermophilus leucurus peninsulae*.

This is a most interesting region to the naturalist. Our lists of the various land forms expanded immediately into several times what we had previously secured. Considerable work was done with the seine and boat-dredge. At all anchorages up to the present time more or less collecting of small pelagic forms was done with the electric light on the surface of the water. On the 24th, while the collectors were ashore, the 'Albatross' went out and made a dredge haul just south of the Cape, in 491 fathoms (Sta. 5682). The contents of the dredge were as follows: Fishes — 29 *Macrurus*, 14 *Merlucius*, 1 *Alepocephalus*, 1 *Argyropelecus*. Invertebrates — 1 *Polychetes*, 30 *Glyphocrangon*, 5 *Heterocarpus*, 36 *Peneus*, 12 *Acanthophrya*, 6 schizopods, 20 *Munidopsis*, 2 quarts of small munida, 4 *Plumularia*, 6 anemones, 6 ophiurans, 2 starfishes (*Ceramaster patagonicus* and *Henricia clarki*), 2 echini (*Brissoopsis columbaris*) and 2 ascidians. The botanist obtained over 100 species of plants at Cape St. Lucas.

The ship returned to her anchorage at noon and on the 25th proceeded to San José del Cabo. Captain Burrage and I called on the officials, saddle horses having been sent to the beach and placed at our disposal. The town is situated near the mouth of San José River, and as irrigation is practised this part of the valley is under cultivation. The mammals, birds, plants

and reptiles obtained here included most of those found at Cape St. Lucas, but the variety was greater. An important collection was made of both land and sea forms; the botanist obtaining over forty species of plants. Several species of ducks were found along the shallow river.

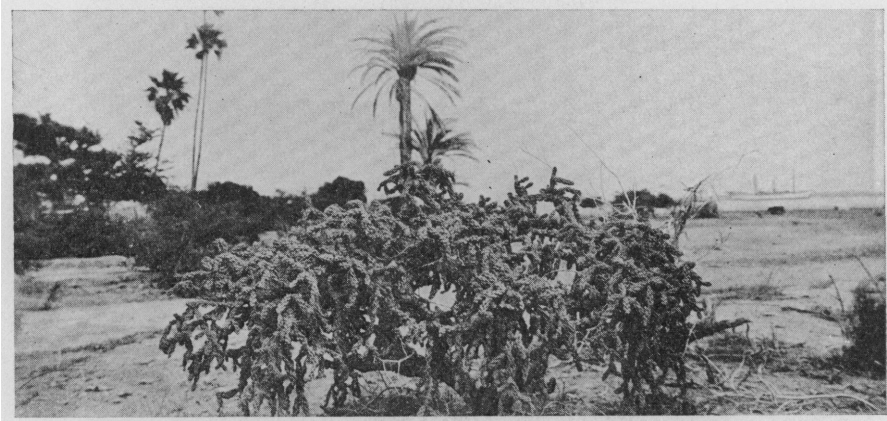


Fig. 15. "Cholla" cactus (*Opuntia*). Cape St. Lucas. One of the most troublesome of the cacti. The minute spines break off at the lightest touch and are difficult to extract from the skin.

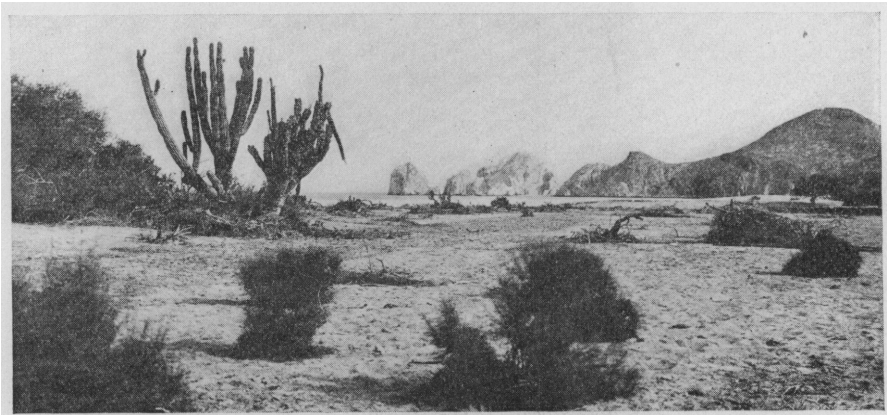


Fig. 16. Cape St. Lucas, Lower California. "Cardon" cactus (*Pachycereus*) at left.

Leaving on the evening of the 26th, the 'Albatross' arrived at La Paz (Pichilique Harbor) on the 27th. I accompanied the officers on a visit to the American Consul and local officials, the call being returned the following day. Here as at all our anchorages, our party made a good collection of

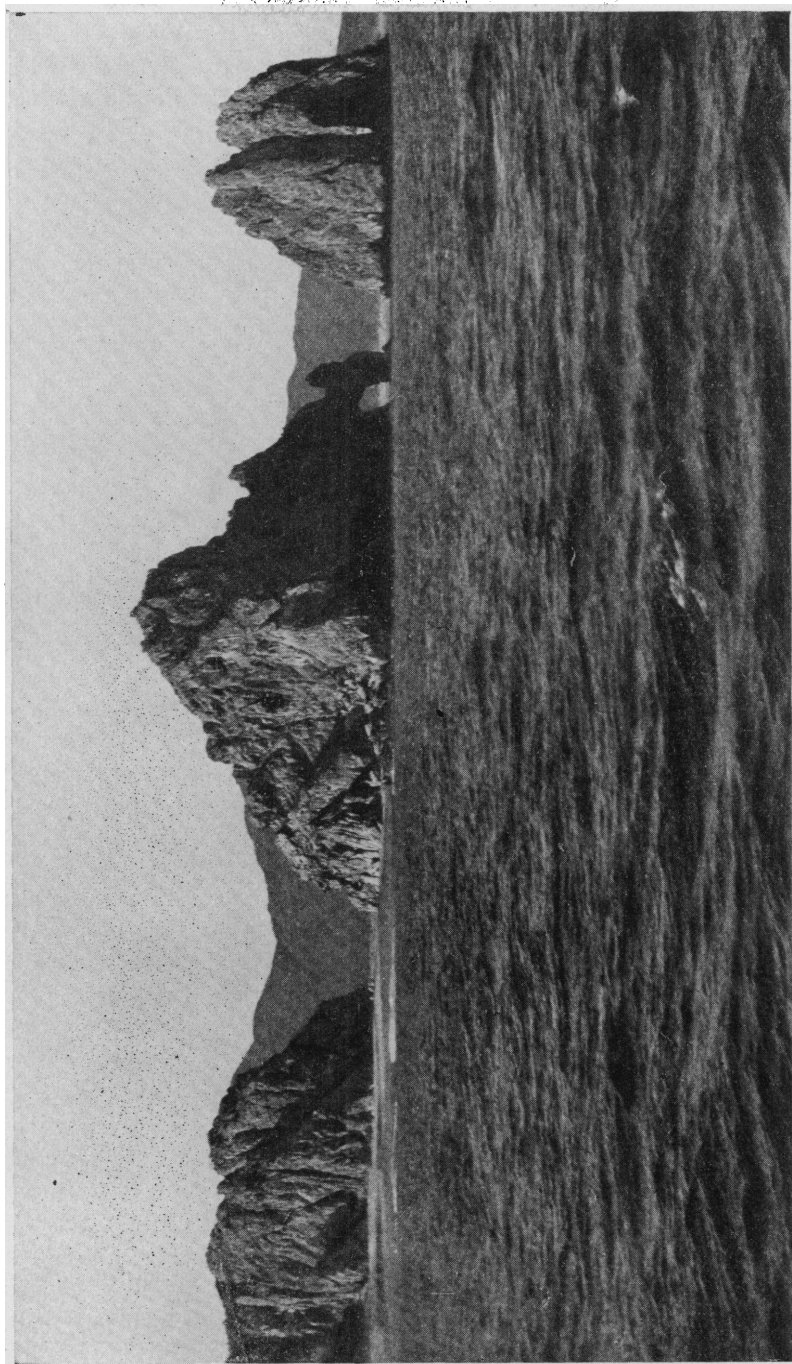


Fig. 17. Cape St. Lucas, Lower California. These outlying rocks are opposite the extreme southern end of the Peninsula.

natural history specimens, obtaining some forms not previously secured. The collection included mammals, birds, reptiles, fishes, invertebrates and plants. Among the mammals were *Lepus californicus xanti*, *Perognathus spinatus peninsulae*, *P. rhydinorhis*, and *Peromyscus eremicus eva*.

A supply of coal being taken on board, we sailed on the morning of the 30th, arriving at San Josef Island (Amortajada Bay), and this locality proved to be an interesting one. The variety of fishes obtained was large including numerous groupers and other food species. Various shore forms of vertebrates were collected in abundance including three species of small mammals peculiar to this island. The boat dredge was used to good advantage. The ship's dredge was not in use while we remained in the Gulf,

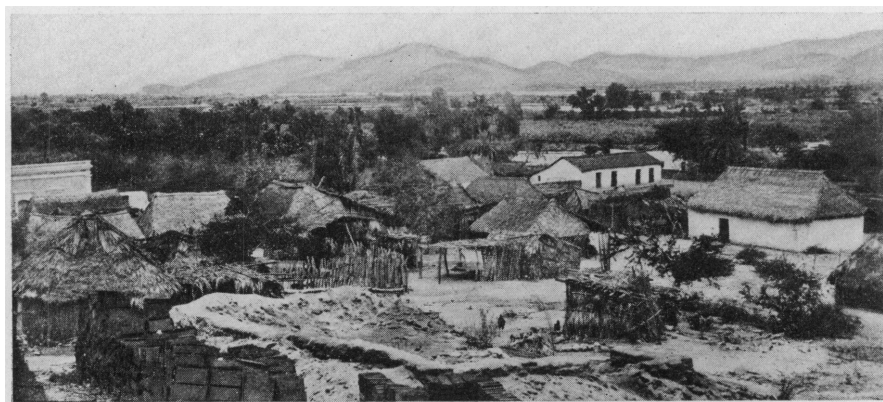


Fig. 18. Edge of the town of San Jose del Cabo, Lower California.

previous experience showing that such dredging was unsatisfactory. The bottom is generally covered with offensive mud and animal forms are neither numerous nor varied.

San Josef is $16\frac{1}{2}$ miles long and from 2 to 6 miles wide, with a height of 2,077 feet.

On the morning of April 1, we left for Agua Verde Bay where we arrived at 3 P. M. This is an attractive little harbor with a fine beach and there are a couple of small ranches in the neighborhood. As at the localities previously visited, the principal catches in the small traps were wood rats and wild mice. Among the fishes taken at Agua Verde were several specimens of the barracuda (*Sphyræna argentea*).

We found the natives preparing tan-bark for shipment to La Paz. This appears to be the basis of an industry carried on in Lower California where-

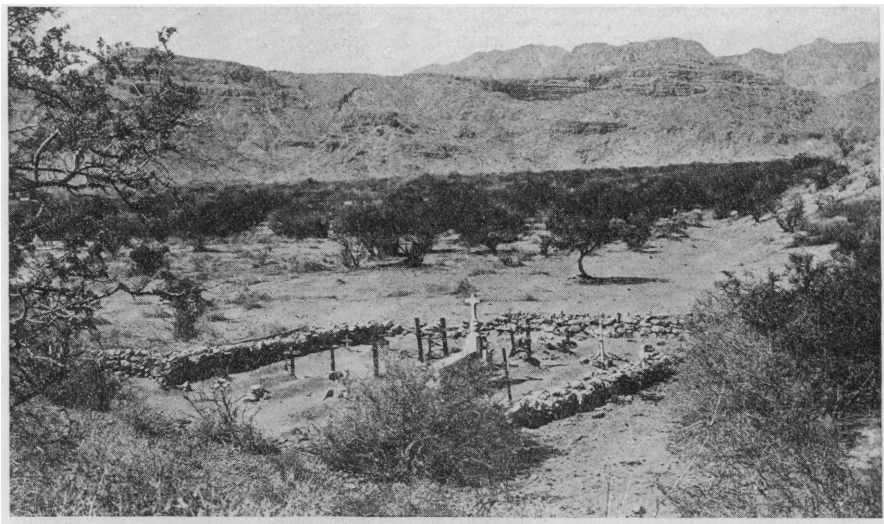


Fig. 19. View at Agua Verde Bay, Lower California.

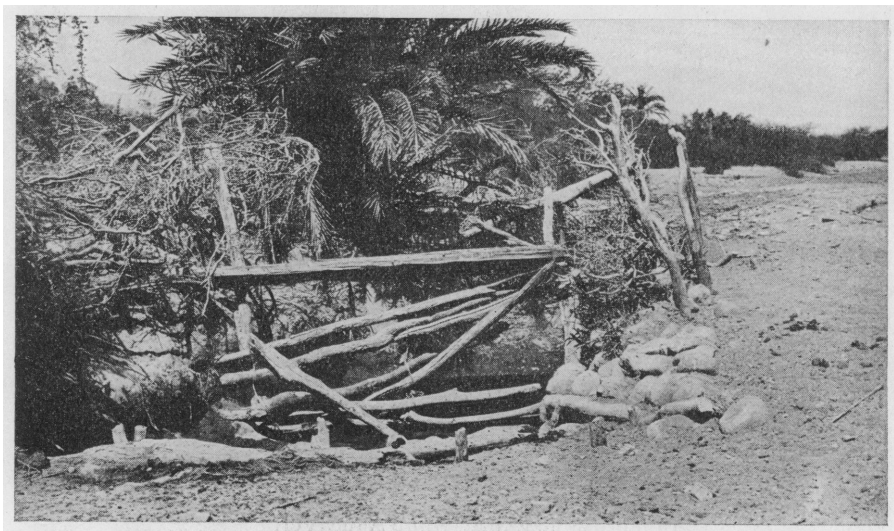


Fig. 20. A fenced-in water hole. Agua Verde Bay, Gulf of California.

ever the Palo Blanco tree is abundant. The bark is light and is packed in sacks. The botanist obtained eight species of cacti.

The duration of the cruise being limited to two months, our reconnais-

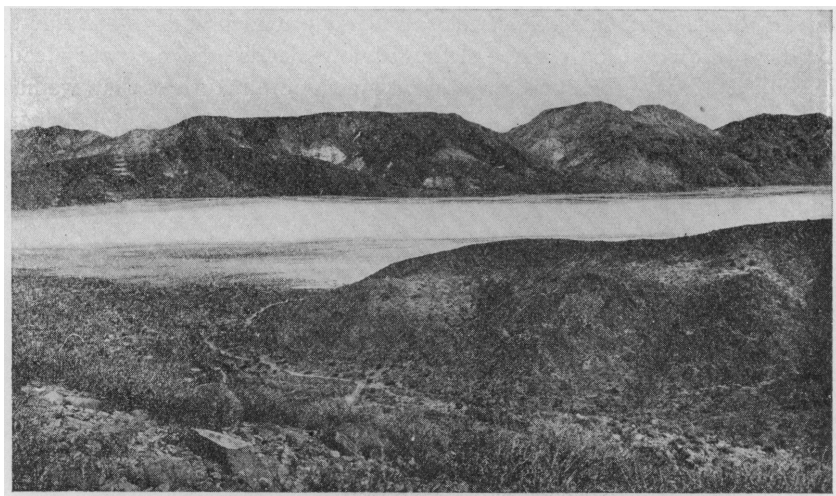


Fig. 21. Salt Lake at Carmen Island. View of the central portion.

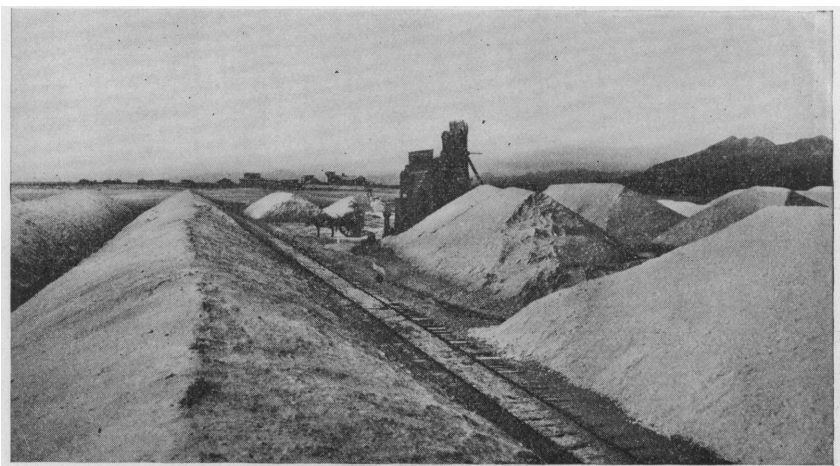


Fig. 22. Salt heaps at Carmen Island. Showing salt as dug from surface of lake.

sance of the coastal region of the Peninsula was necessarily carried on rapidly. We attempted, however, to make the most of our stops, and the collection of the fauna and flora grew steadily.

Leaving Agua Verde on April 2 at 11:30, we reached Carmen Island, celebrated for its salt deposits, at 3:30, anchoring off the salt works. Here, as at other islands visited, the party made the most of the time afforded. The fishing operations yielded many food and other fishes. For the benefit of the botanist, the manager of the salt works provided horses for a ride to Ballandra Bay on the west side of the Island. Passing down a valley leading to this bay we found the vegetation much more luxuriant than we had encountered elsewhere. Dr. Rose found a new century plant (*Agave carminis*) and collected ten species of cactuses, including the great barrel

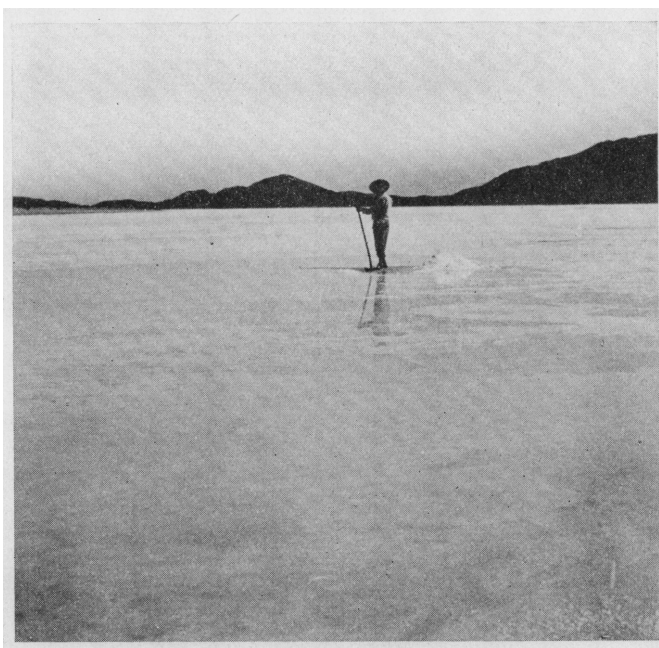


Fig. 23. Salt Lake at Carmen Island. Salt digger at work.

cactus (*Echinocactus diguetii*). The seining yielded an important collection of food fishes of several species, among them being "cabrilla piritita" (*Mycteroperca pardalis*) and "mojarra dorada" (*Gnathanodon speciosus*). Among the mammals obtained were two new species of mice (*Perognathus spinatus occultus*) and (*Peromyscus eremicus carmeni*). The salt deposit of Carmen Island is a notable one. It is in reality, a lake of snow-white salt nearly two miles long and a mile wide. The surface salt is dissolved during the annual rainy season and after re-crystallizing forms new supplies. The deposit appears to be inexhaustible and only about one-tenth of the lake

surface has ever been worked. There were about sixty tons of salt piled up ready for use. The crystallization is heaviest after the rains. Later on the salt is taken from the few moist localities where a little water remains. These can be emptied by the cart-load daily, about twenty-four hours being sufficient for a new supply to form in the same spots. As much as 35,000 tons have been shipped in one year, but much more could be supplied if demanded. Its purity is such that it requires no refinement. This salt deposit has been worked commercially for about fifty years and is at present in the hands of an English company. The salt lake has no connection with the sea. The deposit of salt is known to be at least 15 feet in depth.

Carmen Island is 17 miles long by $5\frac{1}{2}$ miles wide and has a height of 1500 feet.

Leaving Carmen Island on the evening of the 3d, we anchored at Mulege on the Peninsula, on the morning of the 4th. Some of the officials visited the ship in the morning, the Captain returning the call later in the forenoon. In the afternoon many of the citizens came to the ship and in the evening the officers were entertained ashore. The collectors were busy as usual, and obtained good results. Among the food fishes taken at Mulege was the large and important crevallé (*Caranx hippos*) which is found also on the Atlantic coast, numerous weakfish, kingfish and red snappers.

On the morning of the 5th, the ship proceeded to the head of Concepcion Bay, about thirty miles inland from Mulege, where our work was carried on with gratifying success. Mountain sheep occurring in this region, I made a hunt for them, but only one was seen and this one not secured. Four pairs of horns were obtained from Señor Castro, a ranchman in the neighborhood. The mountain sheep occurs on both sides of this bay but is more common among the higher ranges farther inland.

Dr. Bartsch made an important collection of marine invertebrates in this locality, both along the shore and by means of the boat dredge. Here, as at all localities visited on the Peninsula from Cape St. Lucas northward, we found quail and doves in abundance. The shore collections in general were important, but the character of the beaches did not permit of seining. A number of grunts, groupers and red snappers were taken by other means. We saw uncommonly large schools of porpoises moving about the Bay, one of them containing perhaps two hundred individuals. The ranchers here had a few cattle and donkeys, and occasionally collected iron-wood (*palo ferro*) for sale at Guaymas. The botanist secured among other things a new species of century plant (*Agave affinis*).

The ship was moved six miles northward to Ricason Island on the morning of the 7th, where we engaged in profitable work until the following day at 1:30, when we returned to Mulege. After a stop of three hours, we pro-

ceeded northward to San Francisquito Bay, arriving at 2 P. M. This proved to be one of the best localities visited during the cruise for marine invertebrates, and a great variety of such forms was obtained. A considerable number of fishes was secured. At nearly all localities we obtained an abundance of food fish for the crew.

On the morning of the 10th the 'Albatross' went to Angel Guardia Island, arriving at noon. This large island is said to be entirely lacking in fresh water and, like nearly all other islands in the Gulf, is uninhabited. The land forms were especially interesting; among the birds taken were burrowing owl and great-horned owl. We obtained eighteen specimens of the large black lizard (*Sauromalus hispidus*) and found rattlesnakes (*Crotalus atrox*) abundant. Four of the black lizards exceeded two feet in length. The beaches were unsuitable for successful work with the seine, but a number of fishes were obtained by other means, one of them being *Mycteroperca venadorum*, an important food fish which reaches a weight of 150 pounds. About 60 of these were taken, averaging 15 pounds each. Four large California jewfish were caught, the largest weighing 70 pounds. Among the mammals procured here were a new woodrat (*Neotoma insularis*), and a new mouse (*Peromyscus guardia*). Angel de la Guardia, near the western shore of the gulf, is 40 miles long by about 10 miles wide and has a height of about 4000 feet.

On the morning of the 11th, we proceeded to the south end of Tiburon Island, arriving at 3 P. M. The general appearance of this island is not different from that of other islands in the gulf, except in its greater height, all the islands being essentially desert-like in character and most of them entirely without fresh water. Tiburon is uninhabited by whites but there are Seri Indians on the north and east sides. We saw nothing of the latter and no signs of human occupation except a deserted camp of turtle hunters on the beach. Lieutenant Stanley killed a buck weighing 121 pounds, not including the viscera, while I killed a doe which was considerably smaller. The small traps yielded several kangaroo rats. The burrows of these animals were to be seen everywhere in the level places, and were mostly connected by well-beaten trails.

Five new species of mammals were obtained: a coyote (*Canis jamesi*),¹ a jack-rabbit (*Lepus alleni tiburonensis*), a wood-rat (*Neotoma albigula seri*), and two pocket mice (*Perognathus penicillatus seri* and *Perognathus baileyi insularis*). The mammals, birds, lizards and plants obtained here were all valuable, as very little is known of the fauna and flora of this island. One land tortoise was procured and the botanist found a new century plant (*Agave subsimplex*). Our explorations extended about five miles inland in several directions, but we found no evidences of fresh water. The seine,

¹ Named for Mr. Arthur Curtiss James of New York.

fishing lines, and boat dredge were all employed successfully. The food fishes taken included large jewfish, grouper and mullet.

Tiburon is the largest island in the Gulf. It is 30 miles long by about 15 in width and has a height of 4000 feet. It is separated from the Mexican mainland by a channel from one to three miles wide. The Seri Indian

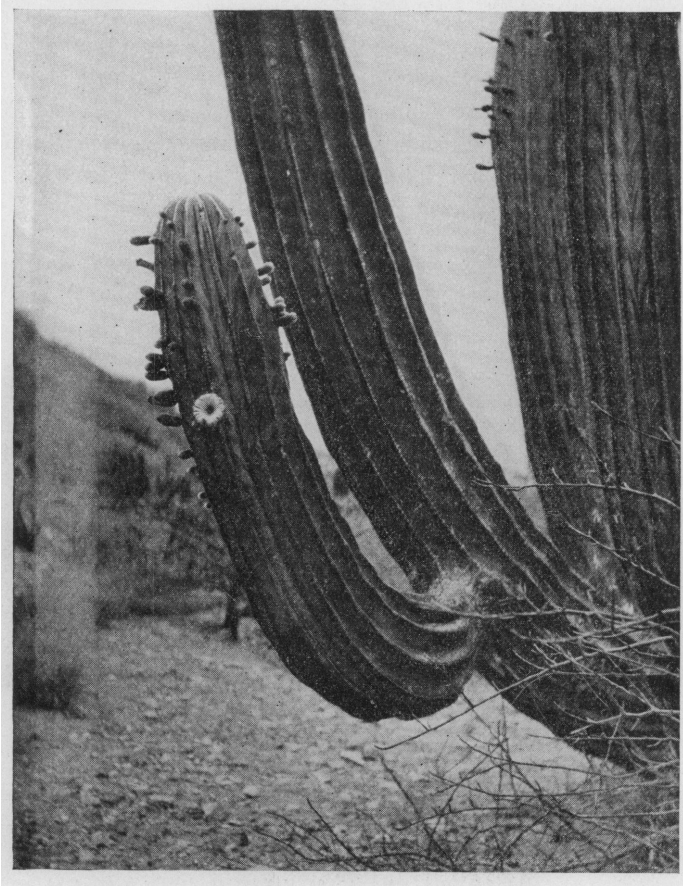


Fig. 24. Giant cactus (*Pachycereus*) in bloom. Santa Catalina Island, Gulf of California. April 16, 1911.

inhabitants are reported by the Mexican authorities to be dangerous to small parties.

The 'Albatross' left Tiburon Island at 11 o'clock on the morning of April 13, arriving at San Esteban Island at 1:30. Almost upon landing we

began to obtain specimens of two species of large lizards, one a *Sauromalus*, the other apparently *Ctenosaura hemilopha*. They occurred in shallow depressions under large stones and were usually detected by their tails, which were not always drawn in out of sight. They were captured easily by turning the stones, which were not generally too large for a couple of men to handle. Forty-seven specimens in all were captured alive, the largest being thirty inches long. The *Sauromalus* proved to be new to science. Two rattlesnakes (*Crotalus molossus*) were also secured and a few mice and birds, while the botanist obtained a new century plant (*Agave dentiens*). A new species of mouse obtained here has been named *Peromyscus stephani*. San Esteban is about 4 miles in diameter, exceedingly rough and mountainous, with a height of 1800 feet. It lies 8 miles S. W. of Tiburon, is without fresh water and is uninhabited.

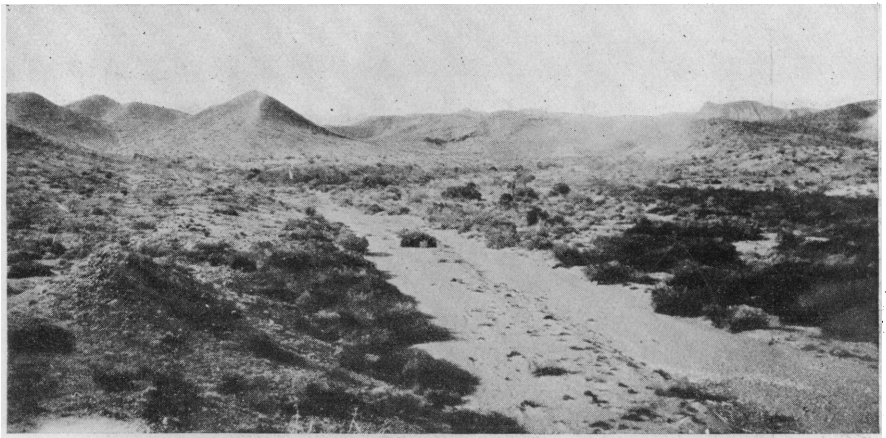


Fig. 25. Valley at south end of Tiburon Island, Gulf of California.

The flow of the tides is very strong in this part of the Gulf. During the night the ship dragged anchor somewhat on the ebb tide. When we left for Guaymas at 8:30, the anchor came up minus a fluke which had broken off. The tide was running fiercely, and with half a gale of wind also in our favor, we started for Guaymas under sail and steam. Passing San Pedro Martir Island at noon, where it was impossible to make a landing on account of the weather, we reached Guaymas after dark.

On the following morning the Captain and I called on the American Consul and some of the local officials. Dr. Bartsch left the ship at this point on his way to Panama, but finding no satisfactory transportation proceeded to Washington by rail. Two crates of live reptiles, large lizards

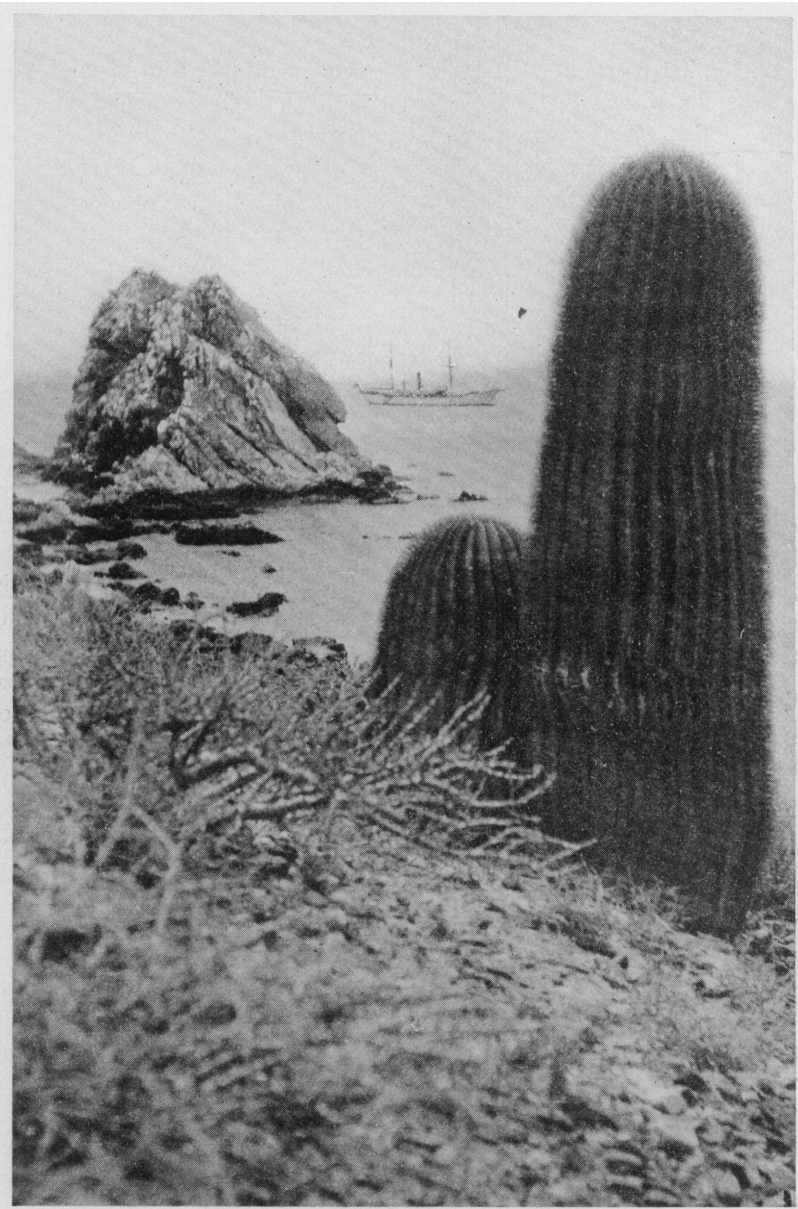


Fig. 26. The 'Albatross' at Santa Catalina Island, Gulf of California. "Viznaga" cactus (*Echinocactus diguetii*) 12 feet high.

and rattlesnakes were forwarded by express to the Zoölogical Park at New York.

We left Guaymas at 6 P. M., and reached Santa Catalina Island, near the west side of the Gulf, at 9 o'clock of the 16th. The botanist found this a rich locality, there being many large barrel cacti (*Echinocactus diguetii*) some of them 15 feet high. One of the largest measured seven feet in circumference. A number of skulls of porpoises (*Globiocephalus scammoni*) and one of *Tursiops nuuanu*, a new species, were obtained on the beach where fishermen had evidently been making porpoise oil. A good collection of fishes and lizards was obtained. The fishes included a sea bass (*Derma-
tolepis punctatus*) 30 inches long and some groupers.

We left at noon for Santa Cruz Island a little farther south, arriving at 3 o'clock. Here additional skulls of porpoises were obtained on the beach and a good collection was made of fishes and shore forms.

Leaving Santa Cruz at 5 P. M., we reached La Paz (Pichilique Bay), on the morning of the 17th where the usual work of the expedition was resumed. The following day the collecting party, including the botanist, was sent by launch to Espiritu Santo Island with a tent to remain over night and be picked up by the ship the next day on her way south. While the ship was coaling, we again called on the officials, procured our mail and made inquiries respecting the fisheries.

On the morning of the 19th, the 'Albatross' reached Espiritu Santo, arriving at 9 o'clock. The collectors came on board with one specimen of the interesting black jack rabbit (*Lepus insularis*) peculiar to this locality, an introduced specimen having been previously secured on Pichilique Island. They obtained also wood-rats, mice, lizards, birds and plants. Among the last was a new century plant (*Agave roseana*). We remained here until noon, visiting the pearl shell propagating station, under the guidance of the manager, Mr. Gaston Vives. Some excellent photographs of this important station were secured. An account of the pearl fishery will be found under another heading.

Leaving at noon, we reached Ceralbo Island on our way down the Gulf at 3 P. M. The most interesting find here was the large black and white lizard (*Ctenosaura hemilopha*) the species obtained on San Esteban Island farther up the Gulf. Seven specimens of this lizard were taken, four of which exceeded two feet in length. A few fishes were also secured.

Ceralbo is $15\frac{1}{2}$ miles long by about 4 miles wide, with a height of 2,477 feet. It lies east of La Paz Bay and is not more than five miles from the nearest point on the Peninsula.

Leaving Ceralbo at 6 P. M. we reached San José del Cabo on the morning of the 20th. Here Mr. Osburn left the ship with a collecting outfit with

instructions to hire pack animals and make a month's trip into the Sierra Laguna mountains for mammals, birds and reptiles. Governor Sanginez at La Paz had furnished him with a letter of introduction to the authorities at San José del Cabo for this purpose. He had instructions to proceed to San Diego by steamer a month later. The trip into the Sierra Lagunas yielded numerous species of mammals, birds and reptiles not obtained elsewhere by the 'Albatross' expedition.

Leaving San José del Cabo at 10 A. M., the work of dredging was taken up seriously. Off Cape St. Lucas, at 12:30, the dredge was lowered in 630 fathoms (Sta. 5683). The fishes obtained were *Macrurus*, *Melamphæus*, *Malthopsis*, *Serrivomer*, *Alepocephalus* and *Sebastolobus*. Among the crustaceans were *Gnathophausia*, *Glyphocrangon*, *Nephropsis*, *Galacantha*, *Polychæles*, *Munidopsis*, *Peneus*. Other invertebrates were sponges, holothurians, shells, worms and fragments of echini.

Proceeding northward, we dredged the following morning at 6:30 in 1760 fathoms, off Magdalena Bay (Sta. 5684). The haul was an interesting one and yielded about two quarts of black nodules resembling manganese, along with considerable animal life. It is interesting to note that the depth at this station was exactly two miles. The dredge contained the following: 1 fish (*Scopelogys*), 1 large creamy-white crustacean (*Munidopsis*), 1 very large pycnogonid, 9 sea urchins (*Cystechinus*), prawns, ophiurans, starfishes, shells, holothurians, pennatulids and worm tubes. Among the starfishes was *Eremicaster tenebrarius*, the only specimen taken during the voyage.

Continuing northward, we dredged the following morning at 8 o'clock in 645 fathoms (Sta. 5685). The catch, a most interesting one, included a specimen of *Harriotta*, the first capture of this deep-sea fish in the eastern Pacific ocean. The other fishes obtained were *Alepocephalus*, *Malthopsis*, *Melamphæus* and *Serrivomer*. The invertebrates included shells, holothurians, pycnogonids, echini and various crustacea. There were two very large bright red specimens of *Lithodes panamensis*, a starfish (*Leptychaster inermis*) and a sea urchin (*Schizaster latifrons*).

We dredged again at 3 P. M. in 930 fathoms (Sta. 5686). The only fish was an *Argyropelecus*. Among the invertebrates were starfishes (*Ctenodiscus crispatus*), ophiurans, holothurians, anemones, ascidians and crustaceans.

The following morning, April 23, at 5 o'clock, we anchored again in San Bartolome Bay. A seining party was sent to the head of the bay for a supply of fresh fish and about a barrel of edible fish, chiefly mullet, was obtained. Many spotted sharks and sting-rays were also taken and destroyed. From the lobster fishing camp we obtained several bags of fresh spiny lobsters in exchange for provisions and fresh water. The Bay was full of turtles, but the fishermen had none at hand.

The 'Albatross' proceeded to sea at 10 A. M. for San Francisco. At noon the dredge was lowered in 480 fathoms (Sta. 5687) west of Natividad Island. The fishes taken were *Melamphæus*, *Macrurus*, *Nemichthys* and *Scopelengys*. The invertebrates were ascidians, ophiurans, sponges, anemones, shrimps, annelids and a starfish (*Strongylocentrotus fragilis*).

We dredged again in 525 fathoms (Sta. 5688) at 2:30, west of Natividad Island, obtaining 20 fishes: *Alepocephalus*, *Macrurus* and *Melamphæus*. Invertebrates came up in abundance and variety. Among them the large red *Lithodes* crab and a starfish (*Nearchaster aciculatus*).

On the morning of the 24th the dredge was lowered in 879 fathoms (Sta. 5689) east of Guadalupe Island, bringing up *Macrurus* fishes and invertebrates of the groups already obtained, together with some sea urchins (*Urechinus reticulatus*).

The dredge was hauled again at 10 o'clock in 1101 fathoms (Sta. 5690), and brought up invertebrates only, consisting of crustaceans, shells, starfishes and holothurians. Of the starfishes there were four species: *Hymenaster quadrispinosus*, *Zoroaster ophiurus*, *Brisinga panamensis* and *Pectinaster agassizii*.

The whole catch was imbedded in about a barrel of stiff gray mud. This clay after a little working was found to be equal to modeler's clay in texture and was at once employed on board ship by our modeler for that purpose.

On the 25th, at 6 o'clock, dredging was resumed southwest of San Diego, California, in 868 fathoms (Sta. 5691). This haul was also embedded in gray mud like the modeler's clay referred to above. The contents of the dredge haul were interesting, there being among the fishes one *Cyema*, a genus not before known in the Pacific. The other fishes were *Argyropelecus* and *Melamphæus*. Among the invertebrates were a dozen fleshy starfishes (*Hymenaster perissonotus*), and some brachiopods.

At 11 o'clock on the 25th, we dredged in 1076 fathoms (Sta. 5693) west of San Nicolas Island. The haul was a large and important one, containing seven species of fishes, there being twenty large rose-red *Sebastes* and a large pink *Liparis*. Among the invertebrates was a fine *Anthomastus*, a large brachiopod and a starfish (*Psilaster pectinatus*).

The dredge was hauled again at 9 o'clock in 640 fathoms (Sta. 5694). It contained a good variety of fishes and invertebrates. There were five species of very large starfishes, and as many of small ones. Among those identified were *Thrissacanthus penicillatus*, *Hippasteria californica*, *Solaster borealis*, and *Heterozonias alternatus*.

The third haul for the day was made at 1 o'clock in 534 fathoms (Sta. 5695) and yielded a variety of fishes and invertebrates. Among the latter

were crinoids, octopus, *Lithodes* and starfish (*Solaster paxillatus*, *Lophaster furcilliger*, and *Pteraster jordanii*).

On the 27th, at 6 A. M., we dredged again in 440 fathoms (Sta. 5696) taking an abundance of fishes and invertebrates of many kinds, among them starfishes (*Peribolaster biserialis*) and sea urchins (*Schizaster townsendi*).

At 10 A. M. the dredge was lowered in 485 fathoms (Sta. 5697) bringing up two specimens of *Chauliodus* and four other species of fishes. The most interesting of the invertebrates was an octopus with webbed arms. Additional specimens were secured of *Schizaster townsendi*, a sea urchin described by Agassiz from several points between the Gulf of California and Panama out to depths of 995 fathoms.

At 2 o'clock we dredged in 475 fathoms (Sta. 5698) with satisfactory results. The fourth haul for the day, and the last dredge haul of the voyage, was made at 6 P. M. in 659 fathoms (Sta. 5699). The results were similar to those of the preceding haul.

The 'Albatross' arrived at San Francisco on the morning of April 28 and anchored off Sausalito. The ship's collection in general being a large one, several days were required for packing and a special car was secured for its transportation to the east.

Fisheries and Fishery Resources.

Pearl Fishery.— Important pearl fisheries have been conducted in the Gulf of California ever since its discovery by the Spaniards.

La Paz is the center of the pearl shell industry of Lower California, in which there are three companies engaged. The largest of these is the Mangara Exploration Company, Ltd., an English corporation which operates from the head of the Gulf of California southward to Guatemala. According to Mr. F. W. Moore, general manager, the Lower California yield of pearl shell amounts to about 60 tons a year from the Gulf alone, valued at \$100. to \$350. (gold) a ton, according to the grade. (The value in 1912 was much higher ranging from \$200 to \$500. gold). The shell is classified in three grades, the first being the most valuable. The product finds its principal market in England. The company operates with a capital of \$150,000. The principal part of the catch is made in Pacific waters, where operations are carried on from November to May. In the Gulf of California the work is done chiefly from July to October. The concession of the Mangara company extends until 1932.

The Mangara Company operates 4 schooners and 21 boats: there being diving outfits with each boat. The number of men employed by this

company is 150 and the annual yield of shell 175 to 200 tons. The schooners with their boats are divided into three fleets, the divers of each fleet using their schooner as the home base. Pearl fishing is carried on at depths varying from 20 to 120 feet.

A concession for pearl fishing around the islands of Espiritu Santo, San José and Cerralbo in the Gulf, and also in Charmela Bay, sixty miles north of Manzanillo in the Pacific, is held by Señor Miguel Cornego of La Paz. With him is associated Señor Gaston J. Vives, in the management of the "Compania Criadora de Concha y Perla de la Baja California," engaged in the propagation of the pearl oyster. The concession for oyster cultivation dates from 1903.

During the years 1910 and 1911 the total amount of shell exported from La Paz and derived from the waters adjacent to the Peninsula of Lower California was 331 tons. The industry has suffered considerably as a result of disturbed political conditions in Mexico.

The above figures relate to pearl shell only, and do not include the value of pearls, which is reported to amount to about \$100,000 annually.

Pearl Oyster Cultivation.—An important feature of the pearl fishery of La Paz is a station for the cultivation of the pearl oyster under the management of Señor Gaston Vives. This station is located at San Gabriel Cove, Espiritu Santo Island, in the Gulf of California, fifteen miles from La Paz and is the only establishment of the kind in the world.

The station has the appearance of being well adapted for the purpose for which it was constructed. A great deal of space is occupied by the equipment of the station and there is evidence that a considerable amount of money has been carefully invested in the enterprise. The sub-station of La Gallina on the opposite side of the cove, we had no opportunity to visit.

The methods of pearl oyster culture practised here include the collecting of young spat or seed in the open bay in artificial collectors, the transferring of this seed to an artificial canal to which the tide is admitted and where they are protected from their enemies by wire-screened gates, and finally, after a period of growth and protection, a transference back to the natural bottom in the open bay, in protected crates until mature growth is attained.

The lagoon at San Gabriel has been cut off from the bay by a heavy barrier of masonry, behind which has been constructed a long zig-zag canal of masonry for the protection of the immature crop of shells. This, the so-called hatchery, is the place of growth for young shells obtained from the spat collectors in the bay outside. The numerous cross sections of the canal afford ample space for the operations of oyster cultivation and have a uniform depth of seven or eight feet.

The entrance is well screened to exclude mollusk-eating fishes, star-

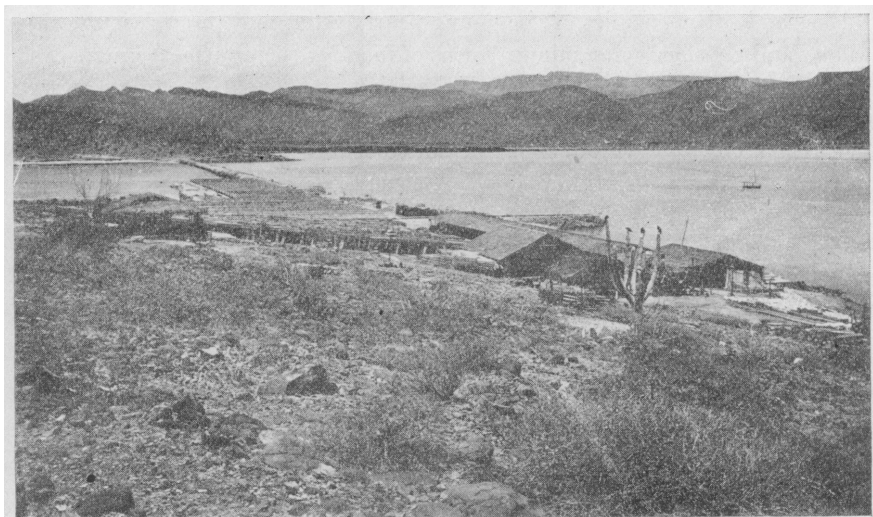


Fig. 27. General view of station for cultivation of the pearl oyster. Espiritu Santo Island, Gulf of California. (The negative was unfortunately reversed in the camera).

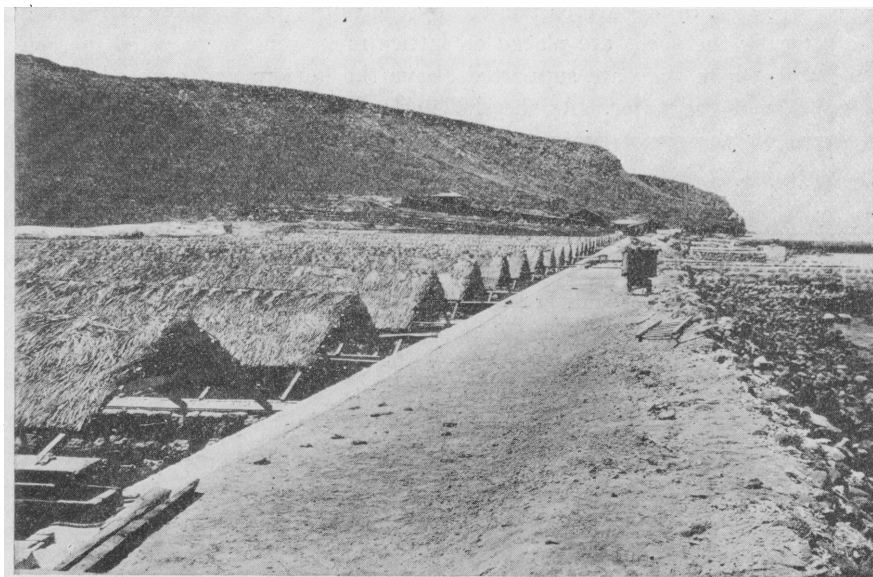
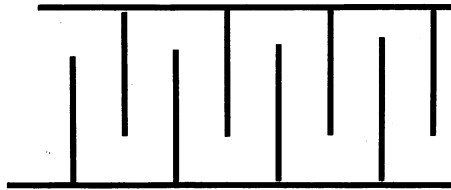


Fig. 28. Thatched roofs over the cross-sections of the canal; the open Bay on the right.

fishes and other enemies of the young pearl oyster, and through it the tide flows and ebbs, carrying minute forms of food for the growing young. The tide through it can also be controlled so that a sufficient covering of water for the young oysters can be maintained. The canal is provided with thatched covering throughout its entire length as a protection against undue heat when the tide is low. A general view of the station is shown in Fig. 27. The dividing barrier of masonry is seen extending to the opposite shore; nearer it is somewhat hidden by the thatch shelters of the cross sections of the canal. The general plan of the canal is indicated by the following diagram:



A closer view of the closely set roofed sections is presented in Fig. 28 taken from the protecting barrier of masonry, the open bay lying at the right. Beneath the sun shelters of each section the young shells are laid at low water, to be covered and fed by the tides. The shallow wire trays containing the shells are placed on lattice racks centrally located in each section, where they are supported above the bottom and exposed to the free flow of the water. As the shells grow larger their cultivation is continued on the rocky bottom of the canal. Some of the wire trays are shown in Fig. 29.

A view of one of the spat collectors is shown in Fig. 30. It is a heavy-framed, wire-covered crate, containing five shallow, latticed trays, closely set with short upright pieces of lath, to which the young free-swimming oysters attach when shell growth begins.

This collector has been brought to the beach from its original position in some part of the bay and hauled up the cemented grade by a chain and windlass. A nearer view of one of its trays is shown in Fig. 31, containing young shells from two to three months old.

Fig. 32 shows the trays of the crate removed, and employees ready to transfer young oysters to the shallow wire trays for placing in the canal. Each operator is provided with small wire trays.

The young shells at this stage are an inch or two in diameter, as indicated in Fig 29. They are more or less covered with marine growths of various kinds, which are for the most part removed.

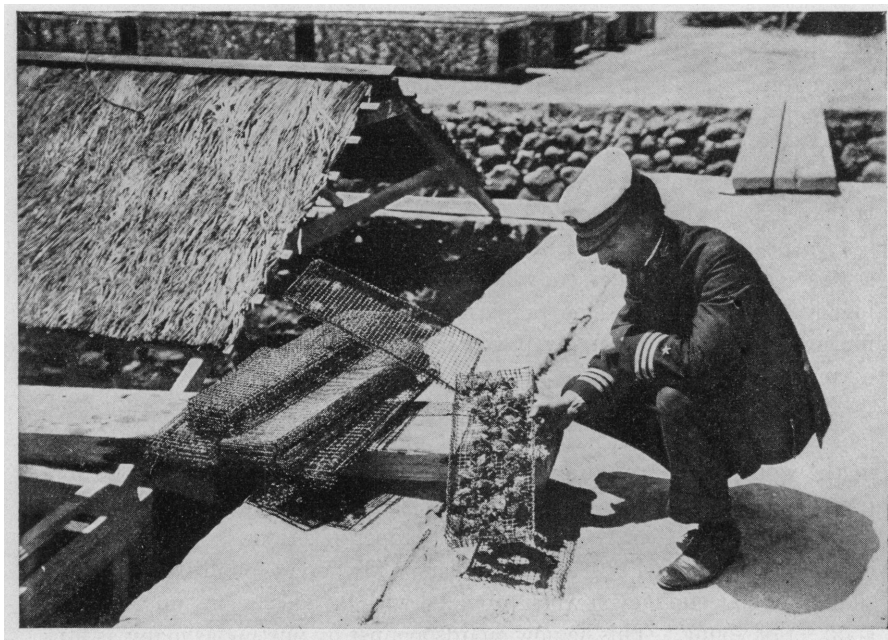


Fig. 29. Shallow wire trays on which young pearl oysters are laid for growth.



Fig. 30. A spat collector landed, with a full setting of young shells. One of the six trays is placed on top of the crate.

The station has several cemented grades where the heavy collectors are dragged up the sloping beach from the water (Fig. 33). Much of the manipulation is performed under the large thatched shelter shown at the right in the same photograph.

After a growth of eight or nine months in the protected canal, the pearl oysters are, as stated above, returned to the bay for final growth, or until they are about three years old.

All pearl oysters placed in the bay for growth are protected in wire-screened crates, and all crates whether containing spawn collectors or growing oysters, are lowered on prepared bottom which has been cleaned of marine growths, and roughly paved with rocks and stones by divers in diving armor.

The clean stony bottom on which the crates rest, serves also to catch more or less oyster spawn, but the bulk of the set of young shell is secured in the wooden trays of the wire-protected collecting crates. The bottom prepared by the divers is usually in coves, small bays or inlets.

Each collecting crate when put in proper position, is provided with numerous adult pearl oysters as breeders. Mr. Vives found by experience that some collectors, even when provided with breeders, came up without a good set of young. This he now guards against by putting as many as fifty adults in a crate as spawners, to insure the presence of both male and female oysters, the sexes being separate in the pearl oyster.

In Fig. 34 some of the matured shell is shown in boxes at the left, while a heap of shell being scraped and cleaned is shown at the right. Figs. 35, 36 and 37, show various forms of crates used in collecting and distributing growing shells and protecting them from their enemies.

There are several hundred spat collecting crates in use, some of them being sent out to favorable points many miles distant from the station at San Gabriel. All crates are protected by heavy, galvanized wire netting of about half-inch mesh. The spawning season of the pearl oyster in this region lasts from October until April or May. The intelligent efforts of Mr. Vives to secure an abundant set of spat in collectors located on the natural beds of the pearl oyster have undoubtedly been successful.

Two or three crops of matured shell had already been secured when the 'Albatross' called at San Gabriel in March, 1911, and subsequently an additional crop of shell was reported for that year.

Mr. Vives was apparently devoting all his energy to a successful solution of the problems of artificial cultivation and expressed the conviction that his work would prove successful.

There was abundant evidence that the methods of collecting spat were effective. There appeared to be also an abundance of apparatus for the different operations of pearl shell culture.

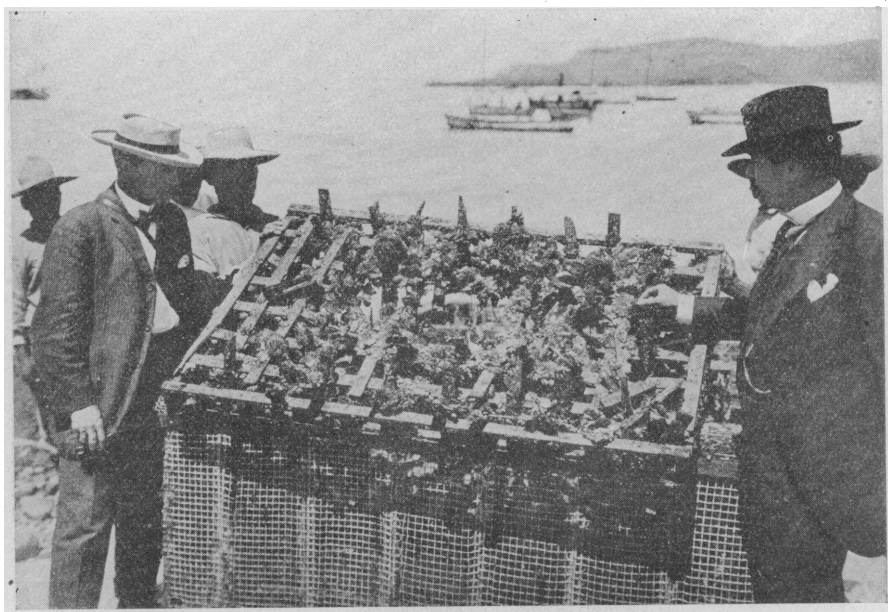


Fig. 31. Nearer view of the spat collector.

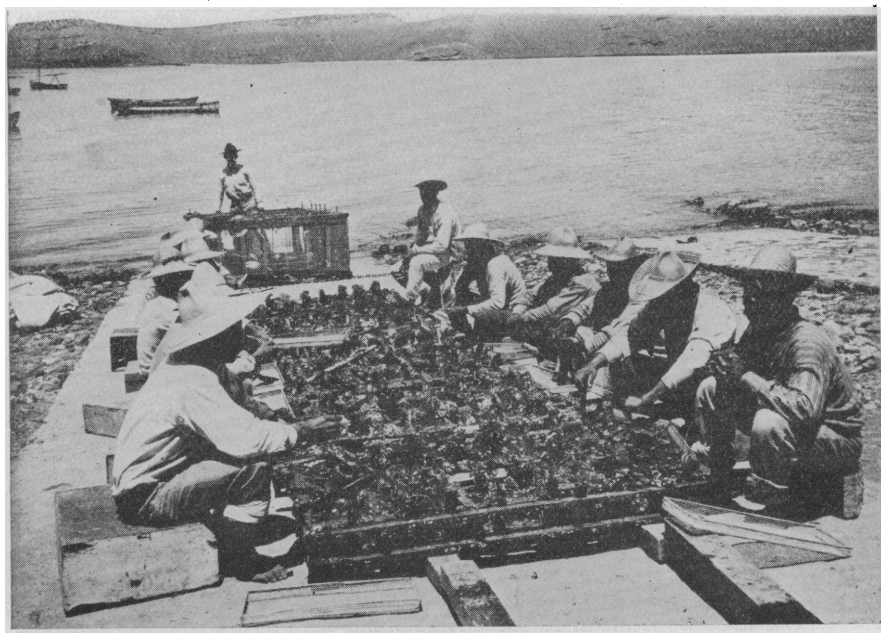


Fig. 32. Wooden trays of the spat collector removed and young oysters being placed on small wire trays for growth.

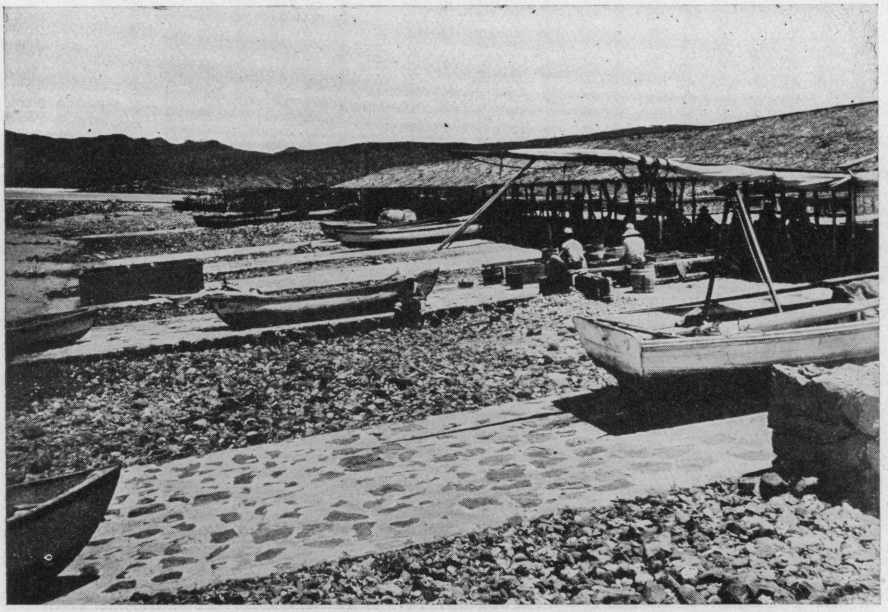


Fig. 33. Cemented grades on the beach to facilitate the handling of spat collectors and other oyster growing apparatus.



Fig. 34. Cleaning and packing shells of artificially-grown pearl oysters.

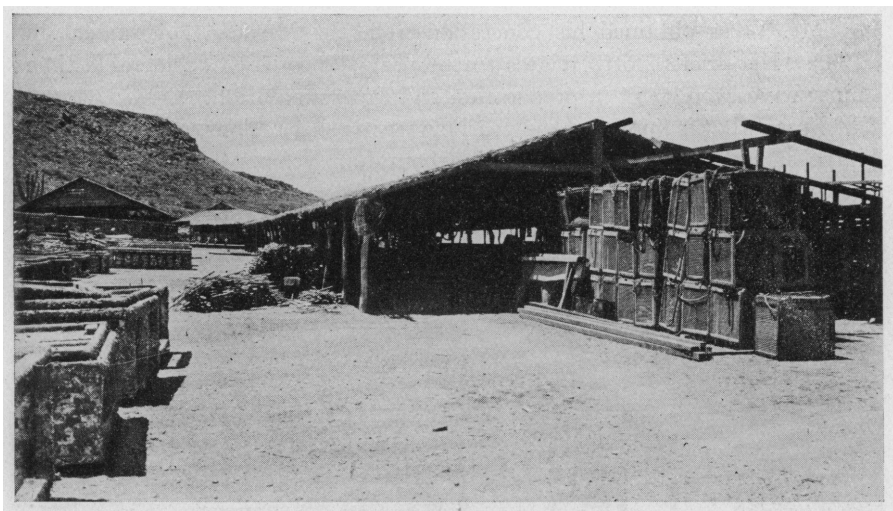


Fig. 35. Shelter and apparatus.

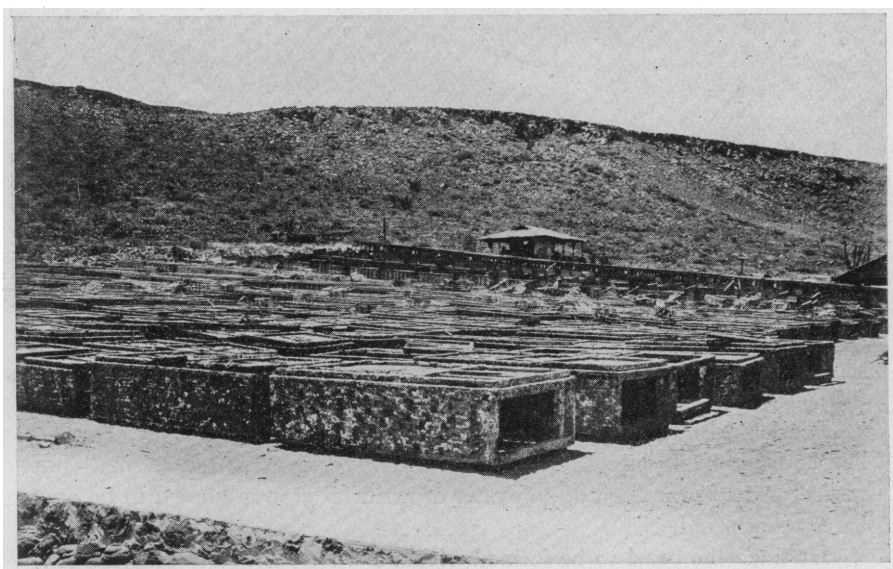


Fig. 36. Wooden apparatus for the protection and handling of pearl oysters laid out for growth.

Mr. Vives obtained his concession from the Mexican government in 1903. His brief report¹ relates to the years 1906-07. Considerable time must have been spent in preparation and experimentation.

From what is known of the pearl oyster in other regions, the shells grow large enough for industrial uses in about four years. They continue to grow after that period of course, but suffer deterioration from worms and boring sponges. What Mr. Vives had to say concerning the formation and growth of free pearls is interesting, and is presented here without comment as this has been a subject of much scientific and unscientific discussion.

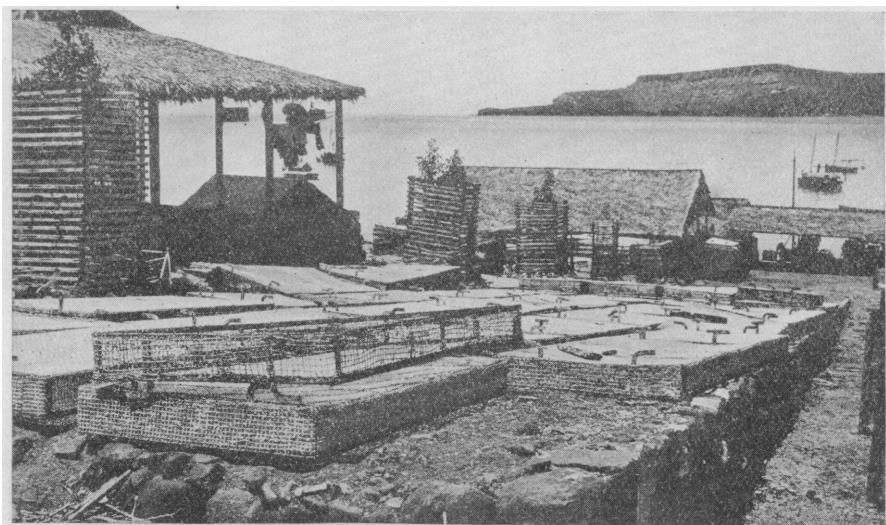


Fig. 37. Forms of wire apparatus for the protection and handling of pearl oysters laid out for growth.

New pearls are secreted by pearl oysters of all ages, but chiefly by the younger oysters. After the pearl oyster is three years old fewer pearls are formed.

Pearls are seldom found except during the period from August to December and rarely as late as December. Mr. Vives exhibited a small but perfect pearl in the flesh of an oyster of artificial growth known to be only three months old.

He finds the pearl to be formed within a watery blister (epithelial sac)

¹ *Compañía Criadora de Concha y Perla de la Baja California*, By Gaston J. Vives. Informe rendido por la Dirección General á la Secretaría de Estado y del Despacho de Fomento, Colonización é Industria, sobre los trabajos emprendidos durante los años de 1906 y 1907.

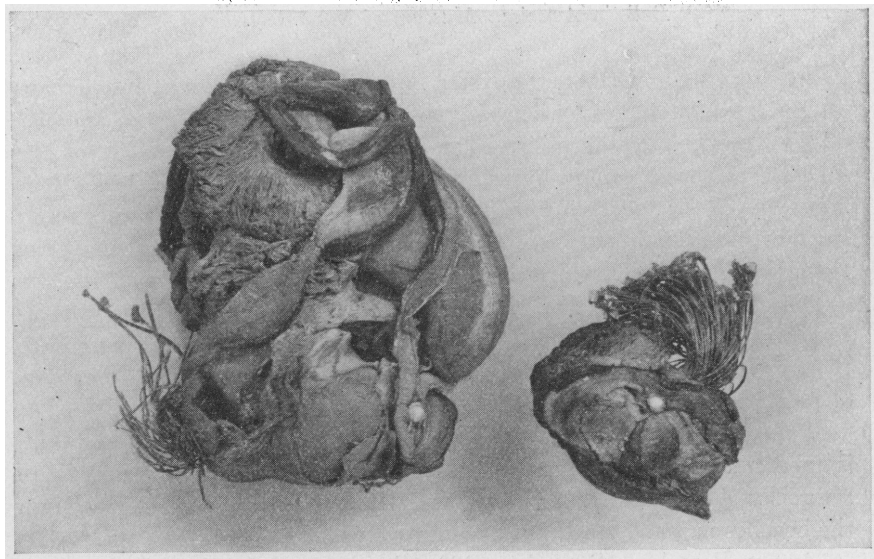


Fig. 38.

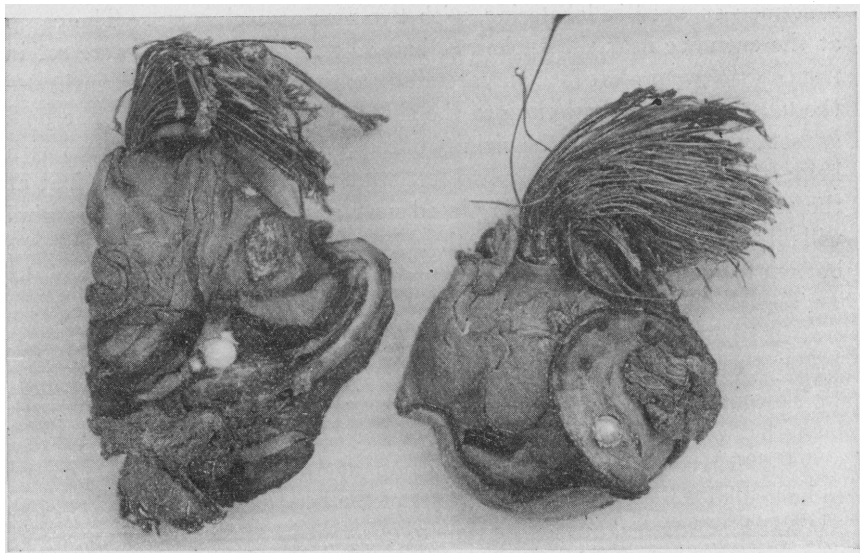


Fig 39.

Figs. 38 and 39. Photographs of pearl oysters (*Margaritifera* var. *mazatlantica*) showing newly formed pearls which have developed on various parts of the mantle.

In each specimen the thin sac has been cut open to expose the pearl sufficiently for good photographic results. The pearls are shown in about natural size, but the oysters have been shrunk in spirits. All of the pearls are located on some portion of the free mantle, generally on the branchial surface, some being on the inner surface. The pearls are apparently spherical and vary in size from about one to three grains.

Specimens presented to the American Museum of Natural History by Gaston J. Vives of La Paz.

located almost anywhere in the oyster, but chiefly in the mantle, and perhaps often thrown off and lost when the sac is ruptured. (See Figs. 38 and 39.)

The pearly growths of irregular form attached to the inside of the shell are of course caused by injuries of various kinds to the shell. It is now believed that pearls formed in the fleshy parts of the pearl oyster result chiefly from cestode parasites around which the oyster secretes a layer of epithelial tissue within which the pearl is eventually formed.

The inception at La Paz of an original method of pearl oyster cultivation is of more than passing interest, as the application of that method to the growing of pearl oysters in our own waters may be quite within the limits of possibility.

Spiny Lobster (*Panulirus interruptus*).—This large and valuable species is apparently common along the west coast of the Peninsula wherever there are rocky shores and reefs. Portions of their dried shells are common on the beaches in many localities, indicating a wide distribution.

At San Bartolome Bay, about 330 miles south of the United States and Mexican boundary lines, there were at the time of our visit four camps of fishermen engaged in lobstering, with two men at each camp. The camp at the entrance near the anchorage had 30 pots in use which were set in from one to twenty-five fathoms, according to the condition of the weather—the lobsters being found close to the shore in smooth weather. The pots are set outside the Bay in the vicinity of rocky ledges which are covered with kelp; they are four feet long, two feet wide at the bottom by one foot at the top, where the entrance is placed near one end. A pot of this kind will fill nearly full of lobsters. Both ends have narrow compartments at the bottom for ballast. (Fig. 12.)

The bait is principally abalones which are left attached to the shells, tied in small bunches with wire and suspended in the center of the pot. Fishes are also used to a small extent as bait. (Figs. 13, 14.)

The pots are made of lath, $1\frac{1}{2}$ inches wide and $\frac{1}{4}$ inch thick, the framework being heavier. Two men working together catch about a ton a week for which they receive 4c. a pound. The camps at San Bartolome were supposed to be visited weekly by a small steamer of the International Fisheries Company of Los Angeles, but at the time of our visit in March the steamer was three weeks overdue and most of the catch had spoiled. The fishermen were nearly out of fresh water and they would have been under the necessity of going to Cedros Island, about thirty-five miles distant, had we not furnished them with a supply from the ship. When we returned to San Bartolome late in April there was but one camp of these fishermen remaining, as the locality was desolate and totally without fresh water. The steamer was again long overdue and the fishermen short of water and provisions. The

industry did not appear to be a flourishing one although lobsters were abundant. The method of transportation makes it difficult to carry the catch through alive. The lobsters were transported in crates, a halfway stop being made at San Quentin to revive the lobsters by lowering the crates into the water over night. This species has always been taken in limited quantities in southern California, but the local supply is not large.

The lobster resources of Lower California could be utilized at less expense if regular steamer shipping facilities were available. The lonely, almost waterless shores of the Peninsula are seldom visited, and there is doubtless considerable difficulty in getting fishermen to remain for long periods in the isolated camps.

San Bartolome is apparently the only point in Lower California where a lobster fishery is carried on, and the work there appears to be intermittent.

Green Turtle (Chelonia virgata).— This species is found in abundance on both sides of the Peninsula. There is probably no better place for obtaining turtles than San Bartolome Bay. According to the fishermen located there, turtles are present during most of the year, being inside the bay chiefly during the winter months. They are reported to haul out on the beaches for egg laying in April and May. A few were being sent to market, but there appeared to be little demand for them.

When the 'Albatross' visited San Bartolome on April 11, 1889, a very remarkable catch of green turtle was made. The U. S. S. 'Ranger' was there at the same time and a seining party was made up consisting of members of the crew of that vessel and of the 'Albatross.' In a single haul of a seine 600 feet long we brought to shore 162 green turtles, many of them of large size. Probably half as many more escaped from the seine before it could be beached; there being a continual loss by turtles crawling over the cork lines during the entire time we were hauling it. The great bulk of this catch was, of course, liberated, although both vessels took on board all that could be used. There are doubtless other bays around the Peninsula which are frequented by turtles at the egg laying season and where large numbers might be obtained by seining.

Turtles are plentiful in the Gulf of California, and the 'Albatross' obtained specimens in the vicinity of Willard Bay, on the Peninsula near the head of the Gulf in 1889. During the present cruise, we found deserted turtle camps and an abundance of turtle shells at Tiburon and other islands in the Gulf. Turtles are said to abound near the mouth of the Rio Colorado where their eggs are deposited in the sands. The inhabitants of the Peninsula seem to have no difficulty in obtaining a supply of them. Turtles are sometimes shipped to San Francisco by steamer from Magdalena Bay.

Hawksbill or Tortoise-shell Turtle (Eretmochelys squamata).— The hawks-

bill is fairly common about the lower end of the Peninsula and the islands in the lower part of the Gulf. It is reported to be more abundant about the Tres Marias Islands below the mouth of the Gulf. The employees of the pearl shell companies at La Paz obtain quantities of tortoise shells, but

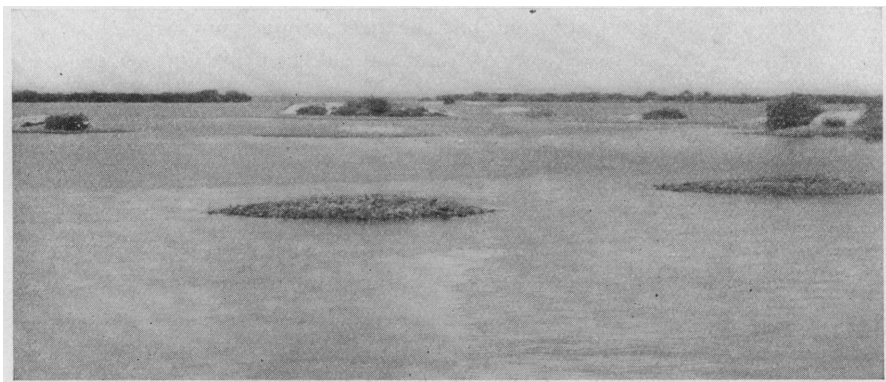


Fig. 40. Oyster reefs at low tide. Algodones Lagoon, above mouth of Yaqui River, Gulf of California.



Fig. 41. Seal Rock near San Josef Island, Gulf of California. Showing numerous shells of green turtle left on the beach by fishermen. San Josef Island in distance on the right.

some of these are received from localities along the mainland of Mexico. I obtained two very fine specimens at La Paz for museum purposes, which measured along the top shell 34 inches and 31 inches respectively. Some of the largest specimens obtained are roughly mounted and polished for exhibition purposes.

Oysters.—The oyster of the Gulf of California appears to be more abundant about the mouth of the Yaqui River, near Guaymas, than it is anywhere north of that point. The species is not apparently distinguishable from *Ostrea virginica* and has indeed been referred to *virginica* by some conchologists.

Algodones Lagoon, just north of the river delta, is a great reservoir of oysters of excellent quality. These oysters have always been used locally and are gathered chiefly by Yaqui Indians for sale at Guaymas. They are shipped to some extent to points in the interior. (Figs. 40, 42.)

Oysters are found at several points toward the head of the Gulf as at Georges Bay, on the east side and Angeles Bay and at Carmen Island on the west side.

Abalone.—Several species of the large and valuable "Abalone" (*Haliotis*) are found along the coast of Lower California and may be quite as abundant as they are along the shores of southern California.

The abalone is the basis of an important fishery in California where its meat is used for food and the ornamental shell used for jewelry and inlaying material. Most of the abalone meat is dried for export to China.

During a former visit to Lower California the writer found camps of Chinese fishermen located at San Bartolome Bay and at the San Benito Islands, engaged in gathering abalones. Great quantities of the meats were spread out on the ground and dried in the sun until they were quite hard. The shells were also saved.

During the voyage of the Albatross we met with no abalone fishermen, but they may have been located at points not visited by the expedition. There can be no doubt as to the abundance of abalones along the northern part of the Peninsula and the outlying islands.

The value of abalone shell varies according to the species, the green shells being worth from \$100 to \$150. a ton, while black shells of the best quality are two or three times as valuable.

Food Fishes.—Lower California has important fishery resources both on the Pacific and Gulf coasts, which are as yet undeveloped.

The population of the region is quite limited and while there is desultory fishing at all towns and villages, there are no fish markets worthy of the name. The methods of handling the catch are crude. Fresh fish must be sold promptly as ice is not available and there are no fishing boats fitted with wells in which fish can be transported alive. Much of the catch is roughly salted and is uninviting. The introduction of well-smacks, such as those used in Florida and some parts of the West Indies would work a transformation in this respect.

During the different voyages of the 'Albatross' to this region good food

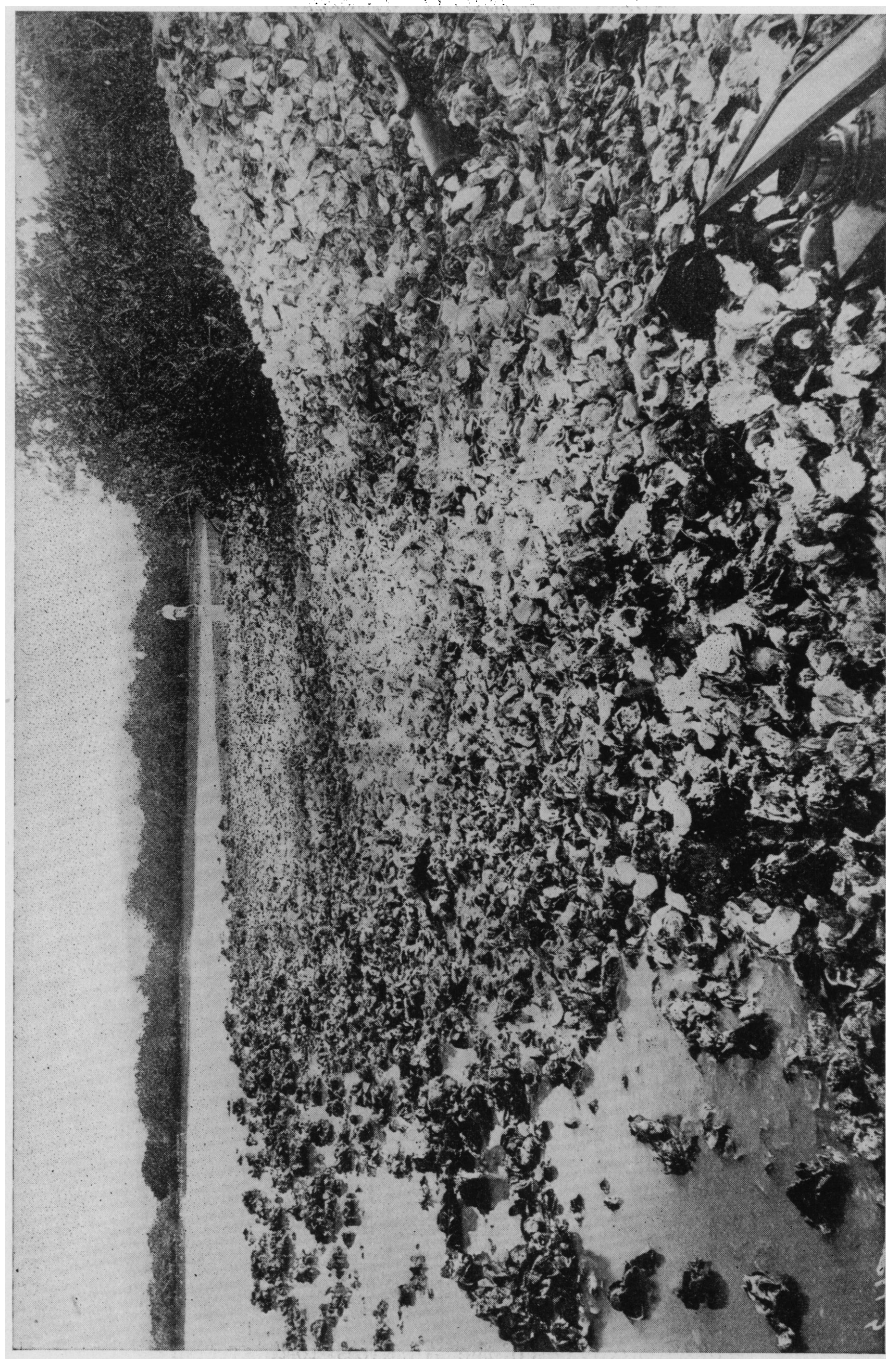


Fig. 42. Natural oyster beds at low tide. Algodones Lagoon, above mouth of Yaqui River, Gulf of California.



Fig. 43. California Sea Lion (*Zalophus*). San Luis Islands, near head of the Gulf of California.

fishes were found at most anchorages and were obtained with both seines and hand-lines.

Several species of food fishes of the Atlantic coast occur also in the Gulf of California. Among these may be mentioned the Spanish mackerel (*Scomberomorus maculatus*), Chub Mackerel (*Scomber colias*), Mullet (*Mugil cephalus* and *M. curema*), Jack (*Trachurops crumenophthalmus*), Crevallé (*Caranx hippos*), Horse-eye Jack (*C. latus*), Jurel (*Caranx caballus*) and Jewfish (*Promicrops guttatus*). The 'Albatross' met with most of these about the islands in the Gulf, but there are many native food fishes of impor-

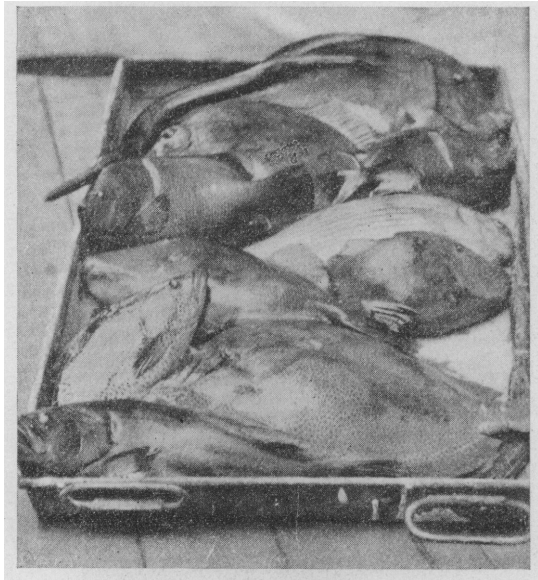


Fig. 44. Fishes from Santa Cruz Island, Gulf of California.

tance, some of which were first made known to ichthyology through the earlier investigations of the 'Albatross' in this region. The most important of these is *Cynoscion macdonaldi*, locally known as "Totuava" and "sea Bass," the largest of the weakfishes, reaching a weight of 175 pounds. It is an excellent food species, common along the eastern shore of the Gulf and southward as far at least as Guaymas where it occurs during the winter months. The 'Albatross' found it in abundance at the head of the Gulf in March, 1899. Specimens taken with heavy cod gear had to be pulled aboard with the aid of gaff-hooks, three of them weighing 79, 82 and 140 pounds respectively. This species enters the brackish waters of the mouth

of the Rio Colorado and is sometimes taken there by spearing. (See Fig. 45.)

Another weakfish of the finest quality is *Cynoscion parvipinnis*, common to both sides of the Peninsula. It is called "bluefish" in Southern California.

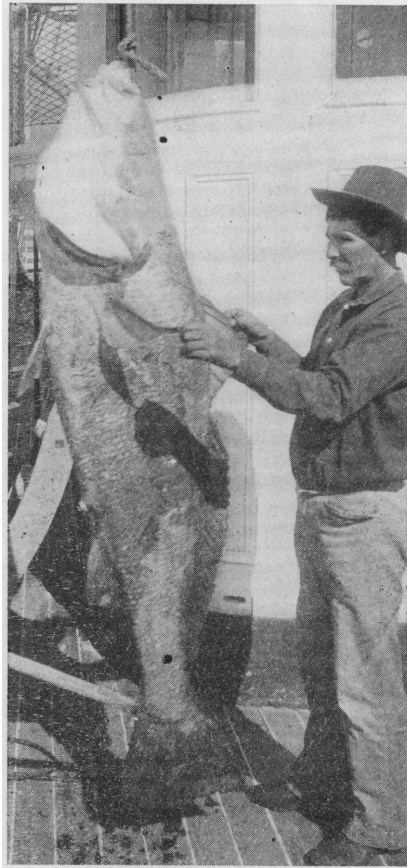


Fig. 45. Giant Weakfish (*Cynoscion macdonaldi*) weighing 140 pounds. This species was found in abundance near the head of the Gulf of California.

The large Pez de Gallo (*Nematistius pectoralis*) is abundant in the upper part of the Gulf, and reaches a length of four feet.

Among the more or less abundant food fishes of the Gulf are Barracuda (*Sphyræna argentea*), Spotted Cabrilla (*Serranus maculato-fasciatus*), Cabrilla de Astillera (*Mycteroperca jordani*), Pargo Amarillo (*Neomænis*

argentiventris), Flamenco (*N. guttatus*), Burro (*Pomadasis macracanthus*), Mojarra Garabata (*Calamus brachysomus*), Yellow-tail (*Seriola dorsalis*), Redfish (*Pimelometopon pulcher*), Mojarra Dorara (*Gnathanodon speciosus*), Garlopa (*Mycteroperca venadorum*), Grouper (*Dermatolepis punctatus*), Cabrilla Piritita (*Mycteroperca pardalis*), Codorniz (*Umbrina xanti*), Mojarra Blanca (*Xystema cinereum*).

Good food fishes are known to be abundant about Guaymas, but they are doubtless just as abundant at many other points on the Gulf.

Mullets of large size are very abundant at the mouth of the Rio Colorado, running up the river as far as there is brackish water.

In cruising about the Gulf the many large-sized fishes to be seen leaping indicate their abundance.

A few angler-yachtsmen from California have found their way into the upper part of the Gulf and enjoyed the best of sport with rod and reel. The fish reported by them as "tarpon" is without doubt the bone fish (*Elops saurus*), first cousin of the tarpon. It is a hard-fighting game fish, three feet in length and common at Guaymas. This species is also found on the Atlantic coast.

The Gulf of California is 700 miles long with an average width of about 100 miles. Its fishery resources are of great importance and undoubtedly worthy of development. The only existing means of communication with the United States is the Sonora Railway extending from Nogales, Arizona, to Guaymas, situated about midway on the Gulf. The head of the Gulf extends to within forty miles of the Arizona-Mexico boundary at two points, the mouth of the Rio Colorado and Adair Bay, situated fifty miles east of the mouth of that river.

If access to the northern part of the Gulf with its abundant supply of food fishes, oysters and turtles could be secured, it would be possible to inaugurate a fish trade under American auspices, between points on the Gulf and the large fishless section of the United States represented by New Mexico, Arizona, Nevada and southeastern California. An outlet to the extreme head of the Gulf of California, through a strip of American territory which might be acquired by purchase from Mexico, would be of great benefit to the people of both countries. It would lead not only to the development of latent fishery resources, but would open to traffic a great navigable waterway that has hitherto been tightly sealed.

Appendix A.

DREDGING AND HYDROGRAPHIC RECORDS OF THE U. S. FISHERIES STEAMSHIP 'ALBATROSS' DURING THE VOYAGE TO THE GULF OF CALIFORNIA IN 1911.

Explanation of Tables.

The last previous dredging station of the 'Albatross' was No. 5672, and the last hydrographic station was No. 4937, occupied during the Philippine Expedition, 1907-1910. (See Bureau of Fisheries Document No. 741.) Twenty-seven dredging and sixteen hydrographic stations were occupied during the Lower California Expedition, extending the series of dredging stations to No. 5699, and the hydrographic series to No. 4953. In the tables the series are distinguished by the prefixed letters D and H, respectively.

Only those stations where the ship's gear was used (*i. e.*, with the ship as an instrument) to collect natural history specimens have been designated in the records as dredging stations. No numbers have been given to the shore stations, nor to minor collections made with the ship at anchor. Numbers should be given in the dredging series to hauls of the large intermediate net when used in a tideway with the ship at anchor, but this net was not used during this cruise.

Since the shore work constitutes such an important part of the total, the data regarding shore stations is shown in chronological order with the dredging stations, the locality, apparatus, etc., appearing in the appropriate columns. To economize time most of the reef collections of fishes were made with dynamite. The method was to locate the desirable fishes in the coral growth or among the rocks by means of a view glass (a glass-bottomed box) used from a boat. A small charge of dynamite with electrical connections was carefully lowered and discharged. Such fishes as floated were at once collected with a dip net, and the place marked by a buoy. As soon as the bottom had cleared it was searched and the dead fish gathered by means of long-handled spears. Seining operations were carried on wherever suitable beaches could be found within reasonable distances from where the ship was anchored. A general location of the beaches is shown in the column headed "Remarks." The dynamiting operations were usually about the reefs and rocks in close proximity to where the ship was anchored, and it is impracticable to give the locations more definitely.

The various kinds of apparatus used at each station are recorded in the tables in chronological order, each on a separate line, opposite the station number, or, in case of unnumbered stations, opposite the locality, in the column "Apparatus."

The "Position" of a station is that point occupied by the vessel, as determined by the navigator at the time of beginning the first operation at that station. The position of the subsequent operations under the same station number corresponds in a general way to the line as indicated under "Drift." The distance covered by all the operations of a station is usually, however, not greater than the negligible error of observation, except in stations near shore determined by bearings. In conformity with previous practice, an additional position, by true bearing and distance, of some prominent shore feature is given for each station when practicable.

All bearings are true unless otherwise indicated.

In the column "Chart" is noted the number and edition of the chart used at each station.

The spelling of all geographic names in these tables is that found on the charts designated in the column "Chart."

"Time of day" in the case of soundings indicates the time the plummet struck bottom; in the case of dredgings, the time at which the apparatus began to tow on the bottom; in the case of intermediate nets, the time at which the nets started to tow at the depth indicated; in the case of surface hauls, the time at which they were lowered into the water and began to be towed or the current to pass through them.

"Depth" (in fathoms) is the depth obtained by the sounding when a sounding was made. In cases where no sounding was made the depth is estimated from the chart, unless the station immediately follows another, in which case the depth obtained at the preceding station is given. In seine hauls the depths given are approximate, and represent the greatest depth of water through which the seine was hauled.

"Temperatures." The air temperatures are taken from the ship's log for the hour nearest the hour entered in the time column; the same is true of the surface temperatures. The bottom temperature was taken at the time of sounding. All readings by Fahrenheit thermometers.

"Density." The water density is in all cases reduced to 15' C. The density of bottom water was ascertained from a sample taken by the Sigsbee water bottle.

In the double column "Trial" is indicated the depth at which apparatus was worked, as well as the duration of operation. In the case of bottom apparatus this latter is the time during which it is supposed to be dragging on the bottom, up to the beginning of reeling in; for intermediate nets the

time occupied in towing at the depth shown in the depth column is indicated by the first quantity, the time occupied in hoisting by the second; for surface nets the time indicated is the time actually towed at the surface.

In the double column "Drift" is shown approximately the general direction in which the gear was hauled, as well as the distance. The state of the currents and of the wind, with the exigencies incident to the steering of the ship, make this more or less inaccurate.

The apparatus used during this expedition consisted of the usual beam trawls for all work on the bottom. No intermediate work was carried on, and the surface nets were used very seldom.

Appendix B.

RECORD OF AIR AND WATER TEMPERATURES OF THE U. S. FISHERIES STEAMSHIP 'ALBATROSS,' MARCH 1 to APRIL 28, 1911.

Date 1911	Air: Dry Bulb	Water at Surface	Date 1911	Air: Dry Bulb	Water at Surface
From San Diego, Calif., to Guadalupe Island.			Mar. 4 12 m.	63	60
Mar. 1 4 a.	57	56	4 p.	60	60
8 a.	57	58	8 p.	58	60
12 m.	60	59	Mid.	57	58
4 p.	59	58	Mar. 5 4 a.	57	58
8 p.	57	57	8 a.	56	57
Mid.	57	58	12 m.	61	59
Mar. 2 4 a.	57	58	4 p.	61	58
Guadalupe Island.			8 p.	57	57
Mar. 2 8 a.	61	59	Mid.	56	57
12 m.	67	60	Mar. 6 4 a.	53	55
4 p.	67	60	San Diego, Calif.		
8 p.	64	60	Mar. 6 8 a.	50	57
Mid.	65	60	12 m.	68	58
Mar. 3 4 a.	54	60	4 p.	62	58
8 a.	64	60	8 p.	58	58
12 m.	66	61	Mid.	57	58
4 p.	64	60	San Diego, Calif.		
8 p.	60	60	Mar. 7 4 a.	55	57
Mid.	60	60	8 a.	57	58
Mar. 4 4 p.	59	60	12 m.	62	58
8 a.	60	60	4 p.	60	58
Making passage to San Diego, Calif.			8 p.	61	58
			Making passage to San Benito Ids.		
			Mar. 7 Mid.	60	57

Date 1911	Air: Dry Bulb	Water at Surface	Date 1911	Air: Dry Bulb	Water at Surface
Mar. 8 4 a.	59	57	Mar. 14 Mid.	63	59
8 a.	61	59	Mar. 15 4 a.	60	59
12 m.	62	60	San Bartolome to		
4 p.	63	59	Abreojos Anchor-		
8 p.	60	59	age.		
Mid.	61	59	Mar. 15 8 a.	65	59
Mar. 9 4 a.	61	60	12 m.	66	64
8 a.	62	60	4 p.	67	63
San Benito Islands			8 p.	64	61
Mar. 9 12 m.	78	61	Mid.	63	62
4 p.	75	61	Mar. 16 4 a.	65	62
8 p.	63	60	Abreojos An. to		
Mid.	61	60	Sta. Maria Bay		
Mar. 10 4 a.	61	60	Mar. 16 8 a.	67	61
San Benito Isl. to			12 m.	70	63
Cedros Isl.			4 p.	69	62
Mar. 10 8 a.	61	60	8 p.	63	62
12 m.	64	60	Mid.	63	61
4 p.	61	60	Mar. 17 4 a.	64	63
8 p.	58	59	8 a.	65	66
Mid.	57	59	12 m.	70	67
Mar. 11 4 a.	56	58	4 p.	75	66
8 a.	57	59	8 p.	66	66
12 m.	66	61	Mid.	65	65
4 p.	67	62	Mar. 18 4 a.	65	65
8 p.	58	62	Sta. Maria Bay to		
Mid.	56	60	Magdalena Bay.		
Mar. 12 4 a.	56	60	Mar. 18 8 a.	69	64
8 a.	65	59	12 m.	72	65
12 m.	85	62	4 p $\frac{1}{2}$	70	66
4 p.	79	63	8 p.	65	65
Cedros Isl. to Port			Mid.	62	64
San Bartolome			Mar. 19 4 a.	61	63
Mar. 12 8 p.	60	61	8 a.	67	64
Mid.	57	59	12 m.	73	67
Mar. 13 4 a.	58	60	Mar. 19 4 p.	67	67
8 a.	63	60	8 p.	65	66
12 m.	82	61	Mid.	62	65
4 p.	78	61	Mar. 20 4 a.	63	64
8 p.	63	60	8 a.	66	68
Mid.	59	59	12 m.	76	69
Mar. 14 4 a.	58	60	4 p.	70	69
8 a.	65	60	8 p.	65	67
12 m.	83	60	Mid.	65	65
4 p.	76	63	Mar. 21. 4 a.	65	66
8 p.	65	60	8 a.	65	68

Date 1911	Air: Dry Bulb	Water at Surface	Date 1911	Air: Dry Bulb	Water at Surface
Magdalena Bay to St. Lucas Bay.			Mar. 28 8 a.	72	70
Mar. 21 12 m.	71	66	12 m.	76	71
4 p.	70	65	4 p.	87	72
Mid.	65	65	8 p.	73	71
Mar. 22 4 a.	66	67	Mid.	70	69
8 a.	66	67	Mar. 29 4 a.	67	69
12 m.	71	68	8 a.	75	70
4 p.	70	68	12 m.	79	71
8 p.	68	68	4 p.	80	72
Mid.	68	68	8 p.	74	71
Mar. 23 4 a.	67	68	Mid.	71	70
8 a.	72	70	Mar. 30 4 a.	68	70
12 m.	73	70	8 a.	73	71
4 p.	74	70	Pichilique to Amortajada Bay		
8 p.	72	70	Mar. 30 12 m.	84	74
Mid.	70	70	4 p.	79	73
Mar. 24 4 a.	67	69	8 p.	74	71
8 a.	69	69	Mid.	74	70
12 m.	76	69	Mar. 31 4 a.	73	69
4 p.	71	69	8 a.	78	71
8 p.	68	68	12 m.	76	72
Mid.	66	67	4 p.	80	71
Mar. 25 4 a.	63	68	8 p.	73	71
St. Lucas Bay to San Jose del Cabo			Mid.	70	70
Mar. 25 8 a.	64	68	Apr. 1 4 a.	70	70
12 m.	72	70	Amortajada Bay to Agua Verde Bay		
4 p.	70	70	Apr. 1 8 a.	74	70
8 p.	68	69	12 m.	75	71
Mid.	65	69	4 p.	81	72
San Jose del Cabo to Pichilique			8 p.	77	71
Mar. 26 4 a.	64	68	Mid.	76	70
8 a.	66	68	Apr. 2 4 a.	70	69
12 m.	72	70	8 a.	70	68
4 p.	70	69	Agua Verde Bay to Salinas Bay		
8 p.	69	69	Apr. 2 12 m.	72	68
Mid.	67	70	4 p.	79	71
Mar. 27 4 a.	66	69	8 p.	66	70
8 a.	69	69	Mid.	64	68
12 m.	72	71	Apr. 3 4 a.	63	66
4 p.	77	72	Salinas Bay to Mulege Anchorage		
8 p.	71	72	Apr. 3 8 a.	68	68
Mid.	68	70	12 m.	71	69
Mar. 28 4 a.	66	69			

Date 1911	Air: Dry Bulb	Water at Surface	Date 1911	Air: Dry Bulb	Water at Surface
Apr. 3 4 p.	73	69	Apr. 10 4 a.	66	59
8 p.	67	67	San Francisquito to Angel de la Guardia Id.		
Mid.	65	67	Apr. 10 8 a.	69	61
Apr. 4 4 a.	65	67	12 m.	65	61
8 a.	70	66	4 p.	72	62
12 m.	70	68	8 p.	65	68
4 p.	72	68	Mid.	63	61
8 p.	67	68	Apr. 11 4 a.	61	60
Mid.	64	67	8 a.	65	60
Apr. 5 4 a.	63	67	Angel de la Guardia to Tiburon		
Mulege Anc. to Concepcion Bay			Apr. 11 12 m.	72	64
Apr. 5 8 a.	67	67	4 p.	73	63
12 m.	77	74	8 p.	65	62
4 p.	82	74	Mid.	62	63
8 p.	73	72	Apr. 12 4 a.	72	60
Mid.	71	72	8 a.	69	61
Apr. 6 4 a.	69	72	12 m.	75	64
8 a.	80	72	4 p.	79	62
12 m.	82	77	8 p.	69	63
4 p.	84	76	Mid.	63	62
8 p.	75	74	Apr. 13 4 a.	57	60
Mid.	73	73	8 a.	63	60
Concepcion Bay			Tiburon Id. to San Esteban Id.		
Apr. 7 4 a.	71	72	Apr. 13 12 m.	67	62
8 a.	76	72	4 p.	73	58
12 m.	76	73	8 p.	66	61
4 p.	75	73	Mid.	67	59
8 p.	73	73	Apr. 14 4 a.	68	57
Mid.	70	72	8 a.	70	58
Apr. 8 4 a.	68	72	San Esteban Id. to Guaymas		
8 a.	77	72	Apr. 14 12 m.	67	63
12 m.	74	73	4 p.	66	63
Concepcion Bay via Mulege anchorage to San Francisquito.			8 p.	67	62
Apr. 8 4 p.	73	70	Mid.	67	62
8 p.	70	70	Apr. 15 4 a.	70	64
Mid.	69	68	8 a.	73	64
Apr. 9 4 a.	68	67	12 m.	83	64
8 a.	69	64	4 p.	80	66
12 m.	70	62	Guaymas to Sta. Catalina Island.		
4 p.	70	61	Apr. 15 8 p.	68	63
8 p.	66	60			
Mid.	67	59			

Date 1911	Air: Dry Bulb	Water at Surface	Date 1911	Air: Dry Bulb	Water at Surface
Apr. 15 Mid.	69	68	Apr. 21 4 p.	66	68
Apr. 16 4 a.	69	68	8 p.	63	65
8 a.	72	68	Mid.	60	63
Sta. Catalina Id.			Apr. 22 4 a.	60	62
via. Sta. Cruz,			8 a.	60	61
Pichilique.			12 m.	61	62
Apr. 16 12 m.	77	69	4 p.	61	61
4 p.	73	71	8 p.	57	58
8 p.	73	72	Mid.	57	58
Mid.	75	72	Apr. 23 4 a.	55	54
Apr. 17 4 a.	73	72	8 a.	57	56
8 a.	75	73	Port San Barto-		
12 m.	83	74	lome to San Fran-		
4 p.	86	75	cisco.		
8 p.	75	73	Apr. 23 12 m.	61	60
Mid.	71	72	4 p.	61	60
Apr. 18 4 a.	70	73	8 p.	59	60
8 a.	73	75	Mid.	59	60
12 m.	83	75	Apr. 24 4 a.	58	59
4 p.	87	74	8 a.	58	58
8 p.	75	73	12 m.	60	58
Mid.	69	71	4 p.	59	60
Pichilique			8 p.	58	60
Apr. 19 4 a.	67	72	Mid.	58	59
Via Espiritu Santo			Apr. 25 4 a.	57	58
& Caralbo Islands.			8 a.	58	59
Apr. 19 8 a.	73	71	12 m.	58	59
12 m.	84	74	4 p.	58	59
4 p.	78	75	8 p.	56	58
8 p.	74	74	Apr. 26 4 a.	55	56
Mid.	73	74	8 a.	54	54
Apr. 20 4 a.	72	69	12 m.	61	56
San Jose del Cabo			4 p.	55	56
to Port San Barto-			8 p.	53	54
lome.			Mid.	51	54
Apr. 20 8 a.	74	74	Apr. 27 4 a.	51	54
12 m.	72	74	8 a.	53	53
4 p.	68	70	12 m.	56	53
8 p.	67	66	4 p.	52	53
Mid.	65	68	8 p.	51	52
Apr. 21 4 a.	62	64	Mid.	50	50
8 a.	67	67	Apr. 28 4 a.	49	52
12 m.	72	68	8 a.	50	51

*Appendix C.**Abbreviations and Symbols.*

- 12' Agz.....12-foot Agassiz beam trawl. This was the only kind of trawl used this cruise. The runners stand 4 ft. in height and the usual type of net carries a taut headline, making the full opening available. The "reversible" style of this net, for deep-sea work where the possibility of upsetting the frame is great, was not used.
- botm.....bottom.
- Bt. dredge....boat dredge; made of $\frac{1}{2}$ -inch webbing, with a bobbinet lining; protected by a canvas apron. Towed by steam launch when used.
- C. S.....Coast Survey.
- D.....dredging, or collecting, station.
- dip.....ordinary dip net on a 12-inch or 14-inch ring, with bamboo handle; used extensively in reef fishing with dynamite, and from the gang-way ladder with electric light.
- dyn.....dynamite.
- e. l.....electric light.
- H.....hydrographic station.
- H. O.....U. S. Hydrographic Office.
- hbr.....harbor.
- K. 1.....a small plankton or Kofoid net, made of No. 12 silk, on a 14-inch ring.
- K. 3.....same as above, but made of No. 2 silk.
- Lt.....light.
- Luc. sdr.....Lucas sounding machine.
- m. b.....mud bag. This is a bag made of canvas, and sewed to an iron frame. It is about 3 feet long and 18 inches wide. It is attached at the tail of the dredge net.
- wng. b.....wing bag. This is a circular bag, about 3 feet long, fastened to a 14-inch brass ring; usually placed at both ends of the trawl, but one was used several times this cruise at the tail of the dredge net, instead of the square mud bag.
- spec.....specimen.
- 3 $\frac{1}{2}$ ' Tnr.....3 $\frac{1}{2}$ ' Tanner beam trawl; was used from steam launch at various places when ship was at anchor.
- Tnr.-Blish sdr..Tanner-Blish sounding machine.
- therm.....Negretti-Zambra deep-sea thermometer, used with Tanner case.
- wat. bot.....water bottle. A water bottle was used at each sounding.
- Hand leadline..this is used from the bow of the ship when approaching an anchorage, or from a small boat to make soundings in proximity of the anchorage.
- †.....signifies nets towed astern, from taffrail, side by side.

"Character of bottom," determined by the specimens from the sounding cup, is expressed by abbreviations, the key to which is appended. It will be noted that these abbreviations are arbitrarily capitalized for nouns. When used as adjectives, however, the noun abbreviations are not capitalized.

bk.....black	Lav....Lava
bl.....blue	M.....Mud
br.....brown	mrgn...marginal
br-gn...brownish-green	Mss...Masses
brk.....broken	Oz.....Ooze
C.....Clay	P.....Pebbles
Clmps..Clumps	Ptr....Pteropod
Co.....Coral	R.....Rock
crs.....coarse	Rf.....Reef
dk.....dark	rky....rocky
fne.....fine	S.....Sand
For.....Foraminifera	sctrd...scattered
G.....Gravel	Sh....shells
Glob....Globigerina	sml....small
gn.....green	Sp.....Specks
gn-br...greenish-brown	St....Stones
gn-gy...greenish-gray	vol....volcanic
gy.....gray	W.....Seaweed
hrd.....hard	wh....white

Appendix C.

DREDGING AND HYDROGRAPHIC RECORDS OF THE U. S. FISHERIES STATION

Station No.	Position	Chart	Date	Time
	<i>Between San Diego, Cal. and Guadalupe Island, Mexico.</i>			
D. 5673	Near U. S. Mex. Boundary	H.O. 1006 (1887)	Mar. 1	6:23 A.M.
	3782' Cone- 32 18' 30"N. 116 46' 00"W. bore N.42 E.			8:23 A.M.
	4900' Cone- 31 36' 30"N., 116 14' 30"W. bore N.82 E.		Mar. 2	
	31 26' 00"N. 117 42' 00"W. <i>Guadalupe Island, East Coast, Northern End.</i>			9:00 A.M.
		see below		
H. 4938	Black Rock, N.89 W. Near North Pt., 1.5 mi. 29 10' 20"N., 118 15' 45" W.	H.O. 1681 (1897)	Mar. 2	6:55 A.M.
H. 4939	Near North Point, N.12 E. Block House S.78 W. 29 08' 50"N., 118 17' 50"W.	"	"	7:55 A.M.
H. 4940	Elephant Rock, S.23 W. Cone N side of Id. S.71 E. 29 09' 30" N., 118 23' 00" W.	"	"	9:10 A.M.
H. 4941	E. R., S.18 W., Cone N side of Id., N.75 E. 29 09' 00"N., 118 23' 20"W.	"	"	9:25 A.M.
H. 4942	E. R., S.1 W., Cone N side of Id., N.65 E. 29 08' 40"N., 118 24' 10"W.	"	"	9:50 A.M.
H. 4943	E. R., S.40 E., Cone N side of Id., N.60 E. 29 08' 00"N., 118 24' 30"W.	"	"	10:05 A.M.
H. 4944	E. R., N.46 E., Rock at Str. Pt., S.11 E. 29 06' 50"N., 118 25' 00"W.	"	"	10:25 A.M.
H. 4945	E. R., N.17 E., Rock at Str. Pt., S.7 E. 29 00' 20"N., 118 24' 30" W.	"	"	11:00 A.M.
H. 4946	Midway bet. pts. at E. R. & Str. Pts. 29 04' 50"N., 118 24' 00"W.	"	"	11:30 A.M.
	"	"	Mar. 3	to 2:00 P.M. 7:45 P.M.
H. 4947	Rock at Str. Pt. & right tangent Inner Id. in line S.21 E.; E. R., N.6 E.; 29 00' 30"N. 118 24' 30"W.	"	Mar. 4	4:08 P.M.
H. 4948	Rock at S. Pt. & E. R. in line N.2 W. Inner Id. rt. tan. S.22 E., 28 59' 30"N., 118 25' 50" W.	"	"	4:12 P.M.
H. 4949	S. Pt. & E. R. in line N.4 W. Inner Id. rt. tan. S.21 E.; 29 01' 15"N., 118 23' 00"W.	"	"	4:20 P.M.
H. 4950	Str. Pt. N.26 W. Inner Id. rt. tan. S.21 E. 29 01' 15"N., 118 22' 50"W.	"	"	4:43 P.M.

'ALBATROSS' DURING THE VOYAGE TO THE GULF OF CALIFORNIA IN 1911.

Character of Bottom	Temperature F.			Apparatus	Depth	Dur.	Direc.	Dis.	Remarks
	Air	Sur- face	Botm.						
M; few Glob.	56.	56	Luc. sdr.	botm.	:28	N.E.	0.2	Thermo did not capsize.
.....	58.	58	12' Agz;m.b.	One bridle-stop parted.
.....	dyn.	15 ft.	4:	4 shots.
bottom not reached	Tnr.-Blish sdr.	{ Hand line fishing from ship at vari- ous times with from 2 to 8 lines when at anchor.
.....	"	
.....	"	
l. S.	"	
.....	"	
s; St.	"	6 shots of 1 to 3 dyn. caps at gangway.
rs. S.	"	
"	Hand lead line	.....	.....	.....	.....
"	e.l. dip.	Surf.	3:	.....	.....
.....	Tnr.-Blish sdr.	.....	.....	.....	.....
bottom not reached	"	
gy S.	"	
"	"	

Appendix C—Continued.

Station No.	Position	Chart	Date	Time
	<i>Between Guadalupe Island, Mexico, & San Diego, Cal. Straight run.</i>			
	<i>Between San Diego, Cal., & San Benito Is., Mexico.</i>			
H. 4951	3782' Cone, N.22 E. Bluff Peak (1450') N. 78 E., 31° 28' 45'' N., 117° 09' 50'' W.	H.O. 1149 (1909)	Mar. 8	6:11 A.M.
D. 5674	"	"	"	6:11-7:50 A.M.
	<i>Middle San Benito Id. So. side (anch.)</i>	H.O. 1194 (1890)	Mar. 9	8:30 A.M.
	S. E. Pt., W. San Benito Id. S.62°W., NE. Pt. N.34°W.			9:00 A.M.
				7:30 P.M.
	<i>San Benito Islands to Cedros Is., off Lower Cal. Straight run.</i>			
	<i>Cedros Island South Bay (anch)</i>			
	Prominent Blk Rock N.58°W., Rock $\frac{1}{2}$ mi. E. of latter N.19°E.	H.O. 1192 (1890)	Mar. 10	9:00 A.M.
	So. part of E. side (anch) E. tan. Cedros Id. N.26°E., Morro Redondo Pt. S.5°W.	H.O. 1310 (1909)	Mar. 11	10:30 A.M. 2:00 P.M.
	Middle of E. side (anch) E. of 1808' Peak. Lat. 28° 13' 00'' N.	"	Mar. 12	8:30 P.M. 9:00 A.M. 9:30 A.M. 2:30 P.M.
	<i>Cedros Is. to Port San Bartolome, Lower Cal. Straight run.</i>			
	Port San Bartolome (anch) Coffin Rock S'n. tan. S.65°W. Entrance Rock, N.68°W.	H.O. 1204 (1890)	Mar. 13	9:00 A.M.
	"	"	Mar. 14	10:30 A.M. 8:30 A.M. 9:30 A.M. 8:00 P.M.
	<i>Port San Bartolome to San Cristobal Bay, Lower Cal. Straight run.</i>			
	San Cris. Bay (anch) Morro Hermoso Pt. N.59°W.; San Pablo Bluff, S.10°E.	H.O. 1310 (1909)	Mar. 15	10:00 A.M.
	<i>San Cristobal Bay to San Roque Island, Lower Cal.</i>			
D. 5675	Lower Cal., Mex., San Pablo Pt. N.33°E.; Asuncion Pt. N.87°E. (27° 07' 08'' N.114° 33' 10'' W.)	H.O. 1310 (1909)	"	2:11 P.M. 2:50 P.M.
	<i>San Roque Is. (anch) NE. end of Is., S.68°E., W. end of Is. S.10°W.</i>	H.O. 1268 (1891)	"	5:00 P.M.

Character of Bottom	Temperature F.			Apparatus	Depth	Dur.	Direc.	Dis.	Remarks
	Air	Surface	Botm.						
I; fine S:	60°	58°	39.4°	Luc. sdr.					Propeller on water-bottle jammed.
bb.									
"	60°	58°	39.4°	"					
	61°	59°	.....	12' Agz; m.b.	botm.	:25	N.49°W.	2.4	
				18 handlines	botm.	8:00			
R.				100' seine	5-15ft.	2:30			7 hauls on beach of W. San Benito Id.
				e.l; dip.		1:00			
				6 handlines	botm.	3:			Seining party failed to find suitable beach.
				100' seine	10 ft.	1:00			3 hauls on beach near anchorage.
				200' seine	20 ft.	3:00			"
				e.l. dip.	surf.	1:00			"
G.				100' seine	10'	2:00		2	"
				3½' Tn'e	botm.	2:30		5	"
				Bt. dredge	"	1:00		2	"
									30 min. each
3. G.				130' seine	5 ft.	4:00			9 hauls, SE. beach near anchorage.
				Bt. dredge	botm.	3:00			12 hauls, 5-30 mi. ea.
				130' seine	4'	7:00			14 " SE. beach
				Bt. dredge	botm.	3:30			7 " 10-30 mi. ea.
				e.l. dip.	surf.	1:00			Handlines used from time to time while at anchor.
				8 handlines	botm.	1:00			Anchored 1½ hrs. while party made observations along shore for elephant seals.
M. fine S.	67°	64°	44.6°	Luc. sdr.					
	67°	63°	.....	12' Agz; m.b.	botm.	0:20	S.50°W	0.7	
									anchored 2½ hrs. shore party only.

Appendix C — Continued.

Station No.	Position	Chart	Date	Time	I
	<i>San Roque Id. to Abrejos Anchorage, Ballenas Bay, Lower Cal. Straight run.</i>				
	Abrejos Anch. (anch) Abrejos Pt., S. 73°W. 312' Hill, N.08°W.	H.O. 1294 (1891)	Mar. 16	8:30 A.M.	
		.....	.....	1:30 P.M.	
		.....	.....	10:00 A.M.	
		.....	.....	9:00 A.M.	
	<i>Between Ballenas Bay & Santa Maria Bay, Lower Cal.</i>				
H. 4952	25° 31' 15''N., 113° 29' 30''W.	H.O. 1493 (1908)	Mar. 17	8:17 A.M.	
D. 5676	"	"	"	8:17-9:06 A.M.	
H. 4953	25° 23' 45''N., 113° 16' 00''W.	"	"	1:13 P.M.	
D. 5677	25° 23' 45''N., 113° 16' 00''W.	H.O. 1493 (1908)	Mar. 17	1:13 P.M.	
				2:05 P.M.	
				1:40 P.M.	
	Santa Maria Bay (anch) Hughes Pt. S.10°W. Mt. San Lazaro N.70°W.	H.O. 1636 (1898)	Mar. 18	7:30 A.M.	
			.....	10:00 A.M.	
	<i>Santa Maria Bay to Magdalena Bay, Lower Cal. Straight run.</i>				
	Magdalena Bay, off Mag. (anch) Mag. Light S.88°W., Cove Pt. S.52°E.	H.O. 1636 (1898)	Mar. 18	.....
	Off N. side Santa Margarita Is. (anch) L. tan. Deering Bluff N.60°E.; NW. tan. Id. N.88°W.	"	Mar. 19	1:00 P.M.	
	Marcy Channel (anch) Cisne Pt. S.70°W.; E. tan. Santa Margarita Id. S.46°E.	"	Mar. 20	9:30 A.M.	
				10:00 A.M.	
				2:00 P.M.	
D. 5678	Sail Rock, Entrada Pt.; S.53°W.; Redondo Pt. S.15°W. (24° 35' 20''N. 111° 59' 35''W.) Off Magdalena (anch) Mag. wharf S. 82°W. Cove Pt. S.57°E.	"	Mar. 21	9:58-10:03 A.M.	
		"	"	1:45 P.M.	
				2:00 P.M.	
	<i>Between Magdalena Bay & San Lucas Bay, Lower Cal.</i>				
D. 5679	23° 47' 45''N., 111° 23' 00''W.	H.O. 1664 (1899)	Mar. 22	6:41-7:21 A.M.	
D. 5680	23° 40' 30''N., 111° 12' 45''W.	"	"	10:09-11:24 A.M.	
D. 5681	23° 33' 15''N.; 111° 02' 10''W.	"	"	2:08-46 P.M.	

Character of Bottom	Temperature F.			Apparatus	Depth	Dur.	Direc.	Dis.	Remarks
	Air	Surface	Bottom						
				130' Seine	6'	3:00			3 hauls, beach near anchorage.
				200' seine	10'	2:30			"
				Bt. dredge	bottom.	3:00			7 hauls 15-20 mi. ea.
				8 handlines	"	3:00			
fne S; Glob.	65°	66°	39.0°	Luc. sdr.					
"	65°	66°	39.0°	"	bottom.	0:20	NWxW	0.2	
	70°	65°		12' Agz; m.b.					
"	70°	66°	38.6°	Luc. sdr.					
fne S. Glob.	70°	66°	38.6°	Lne sdr. 12' Agz;					
	70°	66°		m.b. K's I & 3†	bottom.	0:20	WNW	0.2	
	70°	66°			surf.	0:50	"		Towed astern during dredging operation.
				Bt. dredge	bottom.	5:00			13 hauls 10 min. each
				100' seine	8'	1:30			3 " on N. beach
									Stopped for inspection of port officials.
									Shore parties.
				200' seine	10'	2:00			3 hauls on beach of Mangrove Id.
				Bt. dredge	bottom.	:45			4 hauls 10 mi. ea.
				100' seine	5 ft.	2:30			Worked up lagoon of Mangrove Id.
brk.Sh. edge)	71°	66°		hand line					
	71°	66°		12' Agz;m.b.	bottom.	:20	N81°W.	0.6	
				Bt. dredge	bottom.	2:00			7 hauls 5-10 mi. ea.
				100' seine	6'	3:00			Worked up Howland lagoon
M.For.	65°	67°	44.1°	Luc. sdr. 12'	bottom.	0:16	N68°W.	0.2	Net badly torn.
"	65°	67°	.	Agz;m.b.2wng.b's					
	68°	68°	43.6°	Luc. sdr.					
	71°	68°	.	12' Agz:wng b	bottom.	:21	"	"	Wing bag at tail of net.
ecm. M;For edge)	70°	68°	43.3°	"	"	:20	2	"	"
	70°	68°	.						

Appendix C—Continued.

Station No.	Position	Chart	Date	Time
<i>San Lucas Bay & Vicinity</i>				
D. 5681	S. L. Bay (anch) Cape St. L. S.70°E.; Customs House N.77°W.	H.O. 1666 (1898)	Mar. 23	8:30 A.M. 2:00 P.M. 9:30 A.M. 8:00 P.M.
D. 5682	Off St. L. Bay; Cabo Falso N.61°W. Cape St. Lucas, N.11°W. (22° 48' 20"N., 109° 52' 40"W. St. L. Bay (anch) Cape St. L. S.3°W.; Customs House S.88°W.	" "	Mar. 24 "	7:32-8:18A.M. 1:30-7:45P.M.
<i>San Lucas Bay to San Jose del Cabo Bay, Lower Cal. Straight run.</i>				
	S. J. del C. Bay (anch) Semaphore S.83°W. Customs house, N.42°W.	H.O. 1667 (1898)	Mar. 25 Mar. 26	..... 9:30 A.M.
<i>Gulf of Cal. (Western side).</i>				
	Pichilingue Harbor (anch) SE. tan. San Juan Is. S.14°W.; SW. tan. N. side of False Bay, S.41°E.	H.O. 2087 (1902)	Mar. 27 Mar. 28 Mar. 29	7:00 P.M. " "
	Amortajada Bay, San Josef Id. (anch) S. tan. Cayo Id., S.81°W.; Coyote Id. S. 12°E.	H.O. 2181 (1904)	Mar. 30 Mar. 31	7:00 P.M. 8:30 A.M.
				9:00 A.M. 1:30 P.M.
	Agua Verde Bay (anch) San Pasqual Pt., N.10°W.; Opposite Pt. N.83°E.	H.O. 850 (1878)	Apr. 1 Apr. 2	1:30 P.M. 4:00 P.M. 7:30 P.M. 8:30 A.M. 8:45 A.M. 8:15 A.M.
	Salinas Bay, Carmen Id. (anch) Perice Pt., S.63°E.; White Pt. S.29°W.	H.O. 2181 (1904)	Apr. 2 Apr. 3	7:00 P.M. 8:00 A.M. 8:00 A.M.
	Mulege Anchorage, Mouth of Conception Bay (anch). Sombrerito Pt. S.44°W.; Gallite Pt. S.54°E.	H.O. 849 (1878)	Apr. 4	8:00 A.M. 1:00 P.M.

Character of Bottom	Temperature F.			Apparatus	Depth	Dur.	Direc.	Dis.	Remarks
	Air	Sur- face	Botm.						
.....	175' seine	10-20'	3:00	.....	.....	5 hauls, beach S. of village.
.....	200' "	20-30'	2:30	.....	.....	2 hauls, beach S. of village.
.....	Bt. dredge	botm.	3:00	.....	.....	13 hauls, 10-15 mi. ea.
.....	e.l. dip.	surf.	1:30	.....	.....
.....	69	69	40.8	Luc.sdr.					
.....	69	69	.....	12' Agz;wng. b.	botm.	2:20	S18°W.	0.6	Wing bag at tail of net.
.....	100' seine	10-15'	3:00	.....	.....	6 hauls beach S. of village.
.....	e.l.;dip.	surf.	2:15	.....	.....
.....	Shore parties.
.....	16' seine	3'	4:00	.....	.....	A number of hauls in streams & small lagoons.
.....	e.l. dip.	surf.	3:00	.....	.....
.....	"	"	2:00	.....	.....
.....	"	"	3:00	.....	.....
.....	e.l.,dip.	surf.	2:00	.....	.....
.....	175' seine	10-20'	3:00	.....	.....	5 hauls beach near mouth of San José River.
.....	Bt. dredge	botm.	1:30	.....	.....	4 hauls of 10 mi. ea.
.....	100' seine	5'	3:30	.....	.....	Working up S. José River.
.....	dyn.	15-25'	4:00	.....	.....	6 shots.
.....	175' seine	10-15'	1:30	.....	.....	3 hauls, main beach.
.....	e.l.; dip.	surf.	2:45	.....	.....	2 small ponds close to beach.
.....	16' seine	3'	1:00	.....	.....
.....	175' seine	10-15'	1:30	.....	.....	3 hauls, main beach.
.....	Bt. dredge	botm.	2:30	.....	.....	12 hauls 10 to 20 mi. ea.
.....	e.l.; dip.	surf.	2:00	.....	.....
.....	175' seine	10'	3:15	.....	.....	6 hauls NW. beach.
.....	dyn.	8-18'	3:15	.....	.....	6 shots.
.....	3½' Tne.	botm.	2:15	.....	.....	6 hauls 20 mi. ea.
.....	Bt. dredge	"	3:30	.....	.....	14 hauls varying time.
.....	dyn.	6-8'	1:00	.....	.....	2 shots, 1 shot lost.

Appendix C — Continued.

Station No.	Position	Chart	Date	Time
D. 5682				2:00 P.M.
	So. Part of Conception Bay (anch) Concep. Peak, S.22°E.; 500' Peak, S.27°W.	H.O. 849 (1878)	Apr. 5	2:00 P.M.
			Apr. 6	8:00 A.M. 2:00 P.M. 7:45 P.M.
	"	"	Apr. 7	9:00 A.M. "
	Ranada Pt. S.83°W.; R. tan. Ricason Id. S.39°E.			9:15 A.M.
			Apr. 8	8:30 A.M. "
	Mulege Anchorage (anch)	"	"	5:00 P.M.
	San Francisquito Bay (anch) NW. tan. N.11°E.; Eastern tangent N.80°E.	H.O. 630 (1878)	Apr. 9	3:30 P.M. 7:00 P.M.
	Angel de la Guardia Id. SE. Side (anch) E. tan. Pond Id. N.34°E.; E. tan. Isla Partida S.28°E.	H.O. 620 (1909)	Apr. 10	1:30 P.M. "
	Tiburon Is. So. side (anch); Red Bluff Pt. S.86°W. S. tan. Turner's Is. S.47°E.	"	Apr. 11	3:45 P.M. "
				8:30 P.M.
			Apr. 12	8:00 A.M. 8:30 A.M. 9:00 A.M.
	San Esteban Id. (anch) NE. tan. N.5°W.; 25' Rock, S.54°W.	"	Apr. 13	1:15 P.M. 1:30 P.M.
	San Pedro Martir Id.		Apr. 14	11:55 A.M.
	Guaymas, (anch)	H.O. 640 (1878)		
	Santa Catalina Id., (anch)	H.O. 850 (1878)	Apr. 15	7:00 A.M.
	Santa Cruz Id.	H.O. 621 (1909)	Apr. 16	9:15 A.M.
	Pichilique Harbor (anch) off Coaling Sta.	H.O. 2087 (1902)	Apr. 16	3:15 P.M.
	San Gabriel Bay, Espiritu Santo Id. (anch)	H.O. 2193 (1914)	Apr. 17	2:00 P.M.
			Apr. 19	9:00 A.M.

Location of Bottom	Temperature F.			Apparatus	Depth	Dur.	Direc.	Dis.	Remarks
	Air	Sur- face	Botm.						
				100' seine	5'	2:45			7 hauls, mouth of Mulege R.
				Bt. dredge	botm.	2:30			8 hauls 10-20 mi. ea. no seining beach.
				dyn.	3-15'	7:30			13 shots.
				Bt. dredge	botm.	4:00			5 hauls 20 m. to 1 hr.
				e.l., dip.	surf.	1:15			
				dyn.	15'	3:30			6 shots.
				Bt. dredge	botm.	2:30			7 hauls varying time
				175' seine	5-10'	3:00			3 hauls, beaches near anchorage.
				dyn.	15'	2:30			5 shots.
				175' seine	10'	"			3 hauls beaches near anchorage.
									Stopped for Bill of Health only.
				dyn.	8-15'	2:30			2 shots.
				e.l., dip.	surf.	"			
				Bt. dredge	botm.	4:00			8 hauls varying time.
				dyn.	20'	3:00			5 shots. No beach for seining.
				dyn.	6-25'	1:45			4 shots.
				175' seine	10-15'	"			4 hauls beach E. of Red Bluff Is.
				e.l., dip.	surf.	:05			Current too strong for use of light.
				Bt. dredge	botm.	3:00			6 hauls varying time.
				100' seine	8'	1:00			2 hauls same beach.
				dyn.	15'	2:15			6 shots.
				Bt. dredge	botm.	2:45			5 hauls, 20 mi. ea.
				dyn.	8-20'	2:30			5 shots.
									Choppy sea; too rough to land.
									For Bill of Health and mail.
				dyn.	10-15'	2:00			7 shots.
				dyn.	10'	1:30			4 shots.
				dyn.	8'	2:30			6 shots.
									Stopped 3 hrs. for inspection of pearl oyster industry.

Appendix C — Continued.

Station No.	Position	Chart	Date	Time
D. 5682	Ceralbo Is.	H.O. 621 (1909)	Apr. 19	4:00 P.M.
	San Jose del Cabo Bay (anch.)	H.O. 1667 (1898)	Apr. 20	6:00 A.M.
	<i>West Coast of Lower Cal. between Cape St. Lucas & Port San Bartolome.</i>			
D. 5683	Off Cape St. L.; Cabo Falso N.53°W.; Cabeza Belleno N.; (22° 46' 45"N., 109° 50' 15"W.)	H.O. 1664 (1899)	Apr. 20	12:48 P.M. 1:44 P.M.
D. 5684	So. of Magdalena Bay, (23° 23' 30"N., 112° 00' 30"W.)	"	Apr. 21	6:25 A.M.
				8:49 A.M.
D. 5685	So. of Abreojos Pt. (25° 42' 45"N., 113° 38' 30"W.)	H.O. 1493 (1908)	Apr. 22	8:14 A.M. 9:16 A.M.
D. 5686	SW. of Abreojos Pt. (26° 14' 00"N., 114° 00' 00"W.)	"	Apr. 22	3:16 P.M. 4:20 P.M.
	Port San Bartolome (anch) Entrance Rock, N.79°W.; S. tan. Coffin Id. S.52°W.	H.O. 1204 (1890)	Apr. 23	7:00 A.M.
	<i>Between Port San Bartolome, Lower Cal., Mex. & San Francisco, Cal., U. S. A.</i>			
D. 5687	So. of Cedros Id. W. tan. Natividad Id. N.10°E. Breaker Pt., Lower Cal. N.72°E. (27° 39' 15"N., 115° 16' 00"W.)	H.O. 1310 (1909)	Apr. 23	12:42 P.M. 1:29 P.M.
D. 5688	So. of C. Id. W. tan. Nat. Id. N. 15°E.; Breaker Pt., Lower Cal. N.72°E. (27° 38' 45"N., 115° 17' 40"W.)	"	Apr. 23	2:35 P.M. 3:22 P.M.
D. 5689	E. of Guadalupe Id. Hat Mt. N.59°E. St. Vincent Pk. N.47°E. (29° 23' 00"N., 116° 14' 00"W.)	H.O. 1193 (1909)	Apr. 24	6:20 A.M. 7:32 A.M.
D. 5690	East of Guadalupe Id. (29° 29' 00"N., 116° 18' 00"W.)	"	Apr. 24	10:18 A.M. 11:33 A.M.
D. 5691	Off Lower Cal. SW. of San Diego (31° 08' 20"N., 118° 29' 30"W.)	H.O. 1006 (1887)	Apr. 25	6:17 A.M. 7:30 A.M.
D. 5692	Off Lower Cal. SW. of San Diego. (31° 23' 45"N., 118° 31' 30"W.)	"	Apr. 25	11:32 A.M. 1:03 P.M.
D. 5693	W. of San Nicholas Id. Cal. (33° 13' 30"N., 120° 04' 30"W.)	C.S. 5002 (1904)	Apr. 26	6:11 A.M.
				6:57 A.M.
D. 5694	NW. of San Nicholas Id., Cal. (33° 24' 36" N., 120° 12' 30"W.)	"	Apr. 26	9:16 A.M.
				10:20 A.M.
D. 5695	"	"	Apr. 26	1:13 P.M. 2:14 P.M.
	(33° 33' 00"N., 120° 17' 30"W.)			

Station of Bottom	Temperature F.			Apparatus	Depth	Dur.	Direc.	Dis.	Remarks
	Air	Sur- face	Botm.						
.....	.....	.....	.....	dyn.	10-20'	1:30	.....	.....	6 shots.
.....	.....	.....	.....	.....	.....	.....	.....	.....	Short stop only.
n.M;G.	70°	73°	39.1°	Luc.sdr.	botm.	0:15	S26°W.	1.5	Frame badly bent.
.....	69°	73°	.....	12' Agz.					
.....	64°	67°	?	.....				
.....	66°	67°	.....	"	"	:30	NWxW	?	Wire parted while heaving in. Sounding instrument lost.
Co.	60°	61°	?	.....	.....	.....	.....	.....	Thermo defective.
.....	61°	61°	.....	"	"	"	WxS	?	.....
Glob.	60°	61°	37.3°	.....	.....	.....	.....	.....	.....
.....	61°	61°	.....	"	"	:20	"	?	.....
.....	.....	.....	.....	250' seine	20'	1:00	.....	.....	1 haul on SE. beach.
Glob.	61°	60°	41.1	Luc.sdr.	botm.	:30	S.72°W	1.5	.....
.....	62°	60°	.....	12' Agz.					
.....	61°	60°	39.9	"	"	"	S.85°W	2.0	
.....	61°	60°	.....	"	"	"	.....	.....	.....
fne S; Glob.	58°	58°	?	.....	.....	.....	.....	.....	Thermo defective.
.....	58°	58°	.....	"	"	"	N87°W.	?	.....
Glob.	60°	58°	38.1	.....	.....	:18	S82°W.	?	.....
.....	60°	58°	.....	"				
.....	57°	59°	37.2	"					
.....	58°	59°	.....	"	"	:20	"	?	.....
.....	58°	59°	37.1°	"	"	"	"	?	.....
.....	61°	60°	.....	"	"	"	"	?	.....
.....	54°	56°	?	.....	.....	.....	.....	.....	Wire parted while heaving in. Sounding instruments lost.
.....	53°	54°	.....	"	"	:30	N.86°W	?	.....
.....	60	57°	?	.....	.....	.....	.....	.....	Thermo did not capsiz.
.....	56°	57°	.....	"	"	"	S.63°W.	?	.....
Glob.	58°	57°	38.9	"	"	"	S.85°W.	?	.....
.....	57°	56°	.....	"	"	"	.....	.....	.....

Appendix C—Concluded.

Station No.	Position	Chart	Date	Time
D. 5696	W. of Pt. Buchon, Cal., Pine Mt. N.42°E. (35°18'30"N., 121° 28' 00"W.)	C.S. 5002 (1904)	Apr. 27	6:22 A.M. 7:07 A.M.
D. 5697	W. of Piedras Blancas, Cal., Silver Pk. N. 40°E. Pine Mt. N.75°E. (35° 35' 00"N. 121° 39' 00"W.)	"	Apr. 27	10:07 A.M. 10:48 A.M.
D. 5698	Off Pt. Sur, Cal. Pt. Sur. N.6°W. Juniperre Mt. N.47°E.; (35° 50' 00"N., 121° 49' 30"W.)	"	Apr. 27	2:07 P.M. 2:59 P.M.
D. 5699	Off Pt. Sur, Cal.; Pt. Sur Light N.12°E. (36° 00' 30"N., 122° 00' 00"W.)	"	Apr. 27	6:14 P.M. 7:06 P.M.

Appendix D.

Record of monthly mean temperatures at La Paz, Lower California during the year 1910 (Fahrenheit).

	7 A. M.	Noon	Rain.
January,	60°	66°	
February,	58	68	
March,	62	71	
April,	66	76	
May,	69	84	
June,	73	83	
July,	72	84	2 days
August,	80	87	2 "
September,	80	87	5 "
October,	75	82	2 "
November,	69	76	
December,	63	71	
Annual mean,	74	78	

From daily records made by Lucien N. Sullivan, U. S. Consul.

ter of Bottom	Temperature F.			Apparatus	Depth	Dur.	Direc.	Dis.	Remarks
	Air	Sur- face	Botm.						
ple	50°	54°	39.9	.....	.....	.....	.....	.....	Shot did not detach. Frame badly twisted.
.....	52°	54°	.....	12' Agz.	botm.	:14	N63°W	?	
gk.S.	55°	52°	39.8	.....	.....	.....	.....	.....
.....	56°	53°	.....	"	"	:31	N72°W	?	
ple	53°	53°	39.9	.....	.....	.....	.....	.....	Shot failed to de- tach.
.....	53°	53°	.....	"	"	:20	"	?	
.....	51°	52°	37.9	.....	.....	.....	.....	.....
.....	52°	52°	.....	"	"	:30	S.86W.	?	

Appendix E.

SCIENTIFIC RESULTS OF THE EXPEDITION TO THE GULF OF CALIFORNIA IN CHARGE OF C. H. TOWNSEND, BY THE U. S. FISHERIES STEAMSHIP "ALBATROSS" IN 1911. COMMANDER G. H. BURRAGE, U. S. N., COMMANDING.

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Zoological Papers Published.

- I. Voyage of the 'Albatross' to the Gulf of California in 1911. By Charles Haskins Townsend. Bull. Am. Mus. Nat. Hist., Vol. XXXV, Art. xxiv, pp. 399-476. July, 1916.
- II. The Northern Elephant Seal. By Charles Haskins Townsend. Zoologica. N. Y. Zoöl. Soc., Vol. I, No. 8, pp. 155-173, figs. 52-72. N. Y. April 15, 1912.
- III. Mammals Collected in Lower California, with Descriptions of New Species. By Charles Haskins Townsend. Bull. Am. Mus. Nat. Hist., Vol. XXXI, Art. xiii, pp. 117-130, 4 illust. June 14, 1912.
- IV. List of Insects Collected in Lower California. By John A. Grossbeck. Bull. Am. Mus. Nat. Hist., Vol. XXXI, Art. xxiv, pp. 323-326. Sept. 13, 1912.
- V. Echinoderms from Lower California with Descriptions of New Species. By Hubert Lyman Clark. Bull. Am. Mus. Nat. Hist., Vol. XXXII, Art. viii, pp. 185-236. July 9, 1913.
- VI. Shore Fishes from Lower California with Descriptions of New Species. By Raymond C. Osburn and John Treadwell Nichols. Bull. Am. Mus. Nat. Hist., Vol. XXXV, Art. xvi, pp. 139-181, figs. 1-15. May 26, 1916.

Zoölogical Papers in Preparation.

- VII. Birds Collected in Lower California. C. H. Townsend.
- VIII. Deep-sea Fishes from the Lower California Region. C. H. Townsend.
- IX. Reptiles from Lower California. M. C. Dickerson.
- X. Mollusca of the Lower California Region. Paul Bartsch.

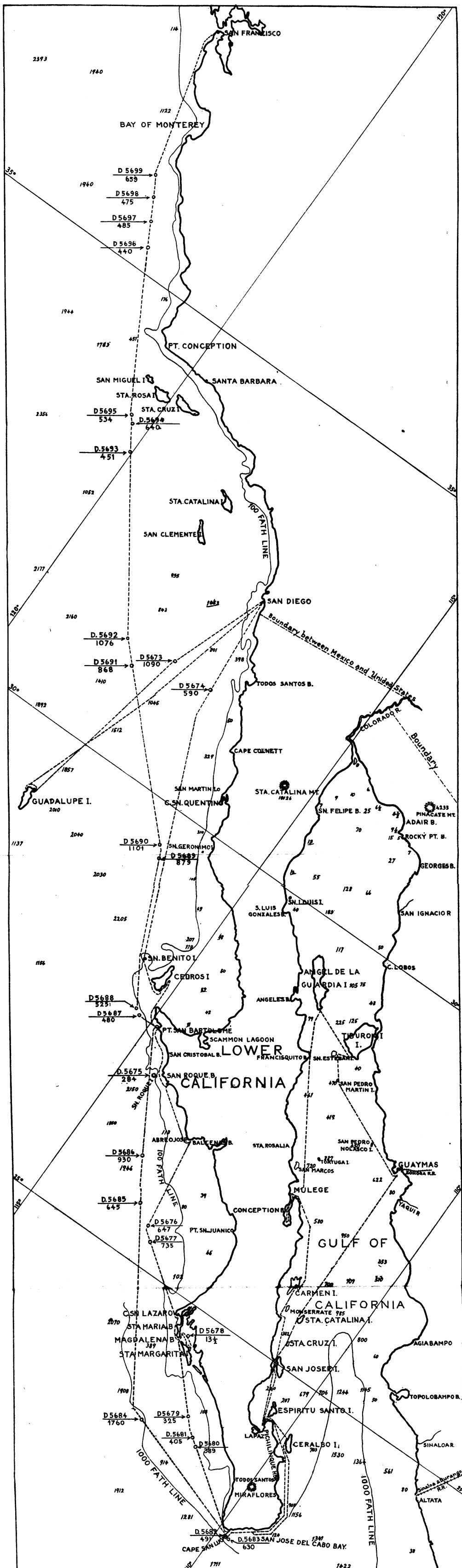
Invertebrates other than Echinoderms and Mollusks.
(Yet to be assigned for study.)

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- Botanical Exploration in Lower California, By J. N. Rose.
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- Monograph of the Huyeae, By Smith and Rose.
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- Mamillaria arida, Rose.
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Monograph of the Cacti, Britton and Rose.



MAP OF THE LOWER CALIFORNIA REGION
SHOWING ROUTE OF THE ALBATROSS EXPEDITION IN 1911
UNDER THE DIRECTION OF G.H. TOWNSEND

