REPORT ON THE WORK OF THE STEAMER ALBATROSS.

[Abstract.]

By Lieut. Commander J. F. Moser, U. S. N.

During the first part of the fiscal year, until December 15, the *Albatross* was employed in fur-seal investigations, under direction of the Treasury Department. After an extensive cruise in the North Pacific Ocean, Bering Sea, visiting the different seal islands, she returned via Japan and Honolulu. The vessel was relieved from duty under the Treasury Department December 15, and the latter part of the year was engaged in fishery investigations off the coast of southern and central California until May, when preparations were made for an examination of the streams of southeast Alaska, to determine their fishery resources.

During the year there were 153 days spent at sea underway and in open anchorages, and 13,925 miles were steamed by log. The want of reliable charts for navigation on the Asiatic coast was felt, and, incidentally to the regular work of the vessel, many hydrographic omissions and errors were noted and corrected. Attention is called, in the report of the vessel work, to the many doubtful islands, reefs, and shoals on or near the regular tracks of vessels between Yokohama, Honolulu, and San Francisco. Hydrographic notes and observations, particularly of the Robben and Kuril islands, were compiled which, accompanied by photographs and sketches, have been transmitted to the office of the U. S. Coast and Geodetic Survey.

The itinerary of the vessel was as follows:

Dutch Harbor, Unalaska.....July 2–6	Honolulu Harbor, Oahu Island, Hawaii, Nov. 7–30
Pribilof Islands.....July 8–19	Sausalito Harbor, California.....Dec. 11–30
Dutch Harbor, Unalaska.....July 20–23	San Diego Bay, California.....Jan. 1–Apr. 5
Commander Islands.....July 30–Aug. 9	Santa Catalina Island, California.....Apr. 6–10
Petropaulski Harbor, Kamchatka.....Aug. 11–19	Monterey Bay, California.....Apr. 11–24
Kuril Islands.....Aug. 22–26	Sausalito Anchorage.....Apr. 25–May 8
Robben Island, Okhotsk Sea.....Aug. 28–Sept. 1	Ports on Puget Sound, Washington....May 14–30
Shana Anchorage, Kuril Islands.....Sept. 4–6	Ports and anchorages in British Columbia and southeast Alaska.....June 1–30
Hakodate Harbor, Yezo Island, Japan, Sept. 10–19	
Yokohama Harbor, Japan.....Sept. 22–Oct. 22	

The commission appointed by the President in June, 1896, to investigate the condition of the fur-seal herds of the Pribilof, Commander, and Kuril islands consisted of Dr. David Starr Jordan, of Leland Stanford Junior University; Mr. Leonhard Stejneger and Mr. F. A. Lucas, of the United States National Museum; Lieut. Commander Jeff. F. Moser, U. S. N., commander of the steamer *Albatross;* Mr. C. H. Town-

send, naturalist; Col. Joseph Murray, special agent of the Treasury, and Mr. G. A. Clark, secretary. The report covering their work will be made by that commission. All the commissioners visited the Pribilof Islands, and Dr. Stejneger and Lieut. Commander Moser were instructed to visit the Asiatic side, the former being detailed to make the report.

Submitted herewith are extracts and tables from the report of Lieut. Commander Moser covering the subsequent work of the vessel:

PACIFIC COAST FISHERIES.

In summing up the work of this vessel for the six months ending June 30, 1897, that part relating to the salmon and halibut fisheries of Alaska, which commenced June 6, forming part of the work for the summer and fall, will not be referred to, but left for the full report for the six months ending December 31, 1897. The fisheries in the vicinity of Santa Catalina Island and the salmon trials with deep-sea gill nets will here be chiefly considered.

Under instructions of March 24, the *Albatross* was directed to examine the shelf surrounding the island of Santa Catalina with reference to its fishing resources. This island lies 18 miles south of Point Fermin (San Pedro) and is separated from the mainland by the San Pedro Channel. Its extreme length is 18½ miles in a general east-and-west direction, extreme breadth 7 miles, average width 4 miles, and length of shore line about 45 miles. It is mountainous, with precipitous slopes, the highest peak reaching an altitude of 2,109 feet. About 6 miles from the extreme western end a break occurs in the mountain system connecting the two parts by a very narrow isthmus about one-half mile long, which gives it the appearance of two islands when approaching from the northward. There are several coves in which large vessels may find a lee, but no harbors for an all-around protection. The precipitous character of the shore line is sufficient indication that the shore shelf is narrow. The 50-fathom curve is nowhere more than 2½ miles from shore, and generally within a mile, while the greatest distance of the 100-fathom curve, so far as the hydrography has been developed, is less than 4 miles.

The character of the bottom generally is mud, with areas of mud and sand, or mud and shells, or all combined. At a few points outside of the immediate shore line and off the eastern and southeastern parts of the island small areas of rocky bottom are found.

The visit of the *Albatross* during the first part of April was at a period when the migratory fishes had not yet appeared, or at least the advance guard of a few species had only commenced to run. I can therefore only speak of what might be termed the winter or early spring fishing. From the morning of our arrival at Isthmus Cove, April 6, to the morning of departure, April 10, the drag seines, gill nets, trawl lines, hand lines, and beam trawl were constantly used whenever practicable, in depths varying between a few fathoms to 130 fathoms. The principal stations were made at Isthmus Cove and vicinity, in Catalina

Harbor—in the vicinity of Dakin Cove (Avalon) to 86 fathoms, off the southeast end to 50 fathoms, and off the south end to 132 fathoms. The results are appended in detail by stations. The largest catches were made with the drag seine, large numbers of smelt and small herring being taken; with other gear the results were disappointing.

At Avalon, one morning, some 25 or 30 wall-eyed mackerel (*Scomber colias*) and about a dozen rockfish (*Sebastodes*) were taken with the triple mesh gill-net; a few yellow-tails had also recently been taken. Hand-line fishing off the eastern end of the island did not meet with much success, but south of the island, off what is known locally as Silver Cañon, where the chart has character of bottom marked "rocky," we took by hand lines, in depths ranging from 90 to 132 fathoms, a large number of rockfish (*Sebastodes*), the largest weighing 8 pounds.

The fishing here is entirely in spots: As the vessel drifted over a favorable locality, probably a small, exposed rock area, as many as five rockfish would be taken on one line. A few minutes afterwards the place would be passed, and then a long wait until we drifted over another spot. All the places were visited that are known locally as good fishing-grounds around the island, but so far as could be ascertained there are no large fishing-banks on the shore shelf of this island. On the south and southeast sides are a few small, rocky patches in deep water, 80 to 130 fathoms, where if one knows the exact ranges—a ship's length makes a difference—a person desiring to handle 100 or more fathoms of line can obtain several varieties of fish in large numbers. The visitor to the winter resort at Avalon can go to these spots and get a "good day's fishing," and the small village at that point can also be supplied, but the grounds could not be relied upon for large markets.

Migratory fishes come to these shores during the spring and summer in large numbers for spawning, and the summer visitor finds many different species in abundance. During our visit, smelt, small herring, and anchovies were plentiful, the seine bringing in large numbers; and the local authorities stated that a little later all the fishes so well known in these waters would be abundant, such as mackerel (*Scomber colias*), yellow-tail (*Seriola dorsalis*), bonito (*Sarda chilensis*), albacore (*Germo alalunga*), barracuda (*Sphyræna argentea*), etc.

The fisheries around Santa Catalina Island are not vigorously prosecuted; there are a few fishermen at Avalon who supply the local demands, and a few more at Isthmus Cove who ship occasionally to San Pedro. These latter were engaged in setting pots for the spiny lobster during our visit, and making some preparations for summer fishing. The demand for fresh fish by neighboring cities on the mainland is easily met by local fishermen, and as the demands become greater this island may supply a larger amount during the summer season. When the sardine cannery at San Pedro is running, large hauls are made on this side of the channel, and no doubt fish of different species can be taken here in sufficient numbers for canning or salting, but the supply near the large cities is ample to meet their wants.

The fishing methods in this vicinity have been fully described in previous publications of the Fish Commission, and therefore need not be referred to again.

The *Albatross* arrived at Santa Cruz, Monterey Bay, at midnight of April 11, and commenced a series of investigations off Monterey Bay and the Golden Gate with a view of determining the grounds resorted to by salmon while at sea, and all the attending conditions. The stations were selected with special reference to the character of the bottom, and as net setting in such great depths was experimental, the work was commenced under 100 fathoms depth. Seven stations were made, and while the catch at each station, together with the beam-trawl hauls, is appended in detail, it may not be uninteresting to add a few remarks relating to our trials.

The stations were first selected on the chart, but before setting the nets the depth was ascertained by sounding, and, if satisfactory, one or more hauls of the beam trawl were made to test the bottom life. The first station was selected near the 100-fathom curve on the south side of the submarine gorge which penetrates the central portion of Monterey Bay, in latitude 36° 45′ 30″ N., longitude 121° 53′ 30″ W., at the sounding marked 127 fathoms, fine, dark sand. The lead at this point indicated soft mud. The vessel was then moved over short distances, but each sounding indicated muddy bottom. Trials with the beam trawl showed that proper bottom had been found, and two cod gill-nets were set in 68 fathoms, latitude 36° 45′ 15″ N., longitude 121° 53′ W., C. S. chart No. 5500. On account of a dense fog these nets were not hauled for three days, when the catch was found to be a few rockfish and dogfish. The nets were badly torn by sharks. In all our search for proper bottom conditions, the indications of mud as shown by the lead were not conclusive, for at all such stations in this vicinity and to the northward the beam trawl gave evidence of rocky bottom, either by bringing up pieces of rock or marine forms only found on rocky bottom, besides the net being torn by dragging over rocks. The shore shelf, say to 500 fathoms, appears to be bowlderous or stony, generally covered or partly covered with or imbedded in mud.

Station No. 2 was in 39 fathoms, latitude 36° 39′ 30″ N., longitude 121° 53′ W., near sounding 38 fathoms, hard gray sand. Two surface salmon nets were set at this station and remained 18 hours without result. At a third station, in 5 fathoms, gray sand and rock, inside of Point Pinos and parallel to the beach of Pacific Grove, where 2 salmon nets were down 12 hours, only a couple of rock bass were taken.

Station No. 4 was in 278 fathoms, mud and sand bottom, in latitude 36° 47′ N., longitude 122° 10′ W. The beam trawl indicated very prolific life, bringing up several bushels of sea-urchins, large numbers of flounders, slime-eels, spider-crabs, starfishes, and other forms. There were many humpback whales seen in the vicinity. These nets fished 16 hours, and when hauled brought in a number of black-cod and a few dogfish, rockfish, and spider-crabs; nets very badly torn by sharks.

Station No. 5 was in 581 fathoms, mud and sand, in latitude 36° 43′ N., longitude 122° 12′ W. The beam trawl at this position brought up about a dozen large macrura, the same number of rockfish and small flounders, spider-crabs, and many other forms. Easter Sunday intervened, and as a long search had to be made to recover the station the nets were in position 48 hours, and when hauled contained a number of macrura and black-cod; nets badly torn, presumably by sharks. This station is probably the deepest gill-net station that has ever been made, and it is doubtful if macrura have ever before been gilled.

Station No. 6 was made in 56 fathoms, sand and mud, in latitude 37° 00′ 30″ N., longitude 122° 20′ 30″ W. The beam trawl indicated live bottom, but the nets, after fishing 40 hours, were empty when hauled. The conditions at this time were very unsatisfactory; heavy wind and sea prevailed, so that the gear could hardly be handled, but the nets were well set, for they were clear when hauled.

Station No. 7 was in 68 fathoms, in latitude 37° 37′ 30″ N., longitude 123° 02′ W. The beam trawl indicated rocky bottom, the trawl net being badly cut. The gill nets fished 18 hours, and brought in large numbers of rockfish, several black-cod, ratfish, dogfish, skates, etc.

These stations were all made between April 13 and 24. En route to Alaska gill nets were set 4 miles SW. from the Tatoosh Island light (entrance to Straits of Fuca) in 77 fathoms, live bottom, as indicated by the beam trawl, and were fished for about 20 hours; they brought in 1 black-cod, 1 flounder, numerous dogfish, and (rolled up in a few fragments of what had been a net) a ground shark 10¾ feet long.

It was intended to continue this work a few days off Cape Flattery, but the weather was so unfavorable that all further trials were abandoned, and the vessel entered the sound to complete her preparations for work in Alaska.

Deep-sea gill nets, I think, can be used to 1,000 fathoms if the *proper gear and proper weather conditions are obtained.* The nets furnished the *Albatross* were not specially rigged and consisted of three salmon gill nets and three cod gill nets, all 30 yards long of 16–6 flax, and hung to 6-thread tarred manila. The salmon nets were: One 53 meshes, 6-inch; 45 meshes, 7-inch; and 40 meshes 8-inch; floats, 1 fathom apart. The cod nets were 1 each: 24 meshes, 6-inch; 21 meshes, 7-inch; 18 meshes, 8-inch; floats, 2 fathoms apart. The floats used were glass, and alternate ones on the salmon nets removed. The lower corner of the nets were anchored with 10-pound Chester folding anchors. The buoy line was 6 and 9 thread stuff and usually from a third to a half the depth of water was added to stray line. The hauling was done from boats by a small hand winch. This could have been done from the vessel by steam winch, but there was danger of carrying away the light gear, not only by the heavy strain of the winch, but by the jump of the vessel in a seaway. For hauling by steam specially heavy gear will be necessary.

The buoys were ordinary trawl-line buoys, the number increasing with the depth of the set. At 581 fathoms four buoys were used on

each line, and the line further relieved by a glass float at each 100 fathoms. The glass floats are excellent if properly made; those supplied seemed to be thin and not well sealed—about half becoming "drunken" under the pressure, and therefore useless.

The positions were obtained by sextant angles on shore objects and compass bearings, yet in several instances some difficulty was experienced in recovering the buoys. Large buoys can not be used without increasing the gear very much in weight, and it is probable if the size were very much increased the jump of the buoy in a seaway would move the moorings. A very small metal nun-buoy painted red and white, fitted with a socket for the staff of a small white flag, would be most suitable. It is true that a vessel could lie near the nets, but some method would have to be adopted to light the buoys for night work. This course would, however, be frequently defeated by the weather.

The weather on the Pacific Coast is not favorable for these investigations. The prevailing northwest winds, while not blowing a steady gale, at times approach it and send in a sea too heavy for work of this nature. When the winds slacken the fogs relieve them. Moderate and smooth seas are necessary to work the nets and use the beam trawl successfully, and clear weather to locate the positions.

The greatest enemies to the nets were found to be sharks, for which the gilled fish no doubt formed a tempting bait. A bite of the net was usually taken with the fish. In some instances the nets came up almost in ribbons, and one set was always under repairs. From 15 to 20 nets are needed in these investigations. When detained at an anchorage on account of unfavorable conditions outside, the drag seine was used, surface gill nets and hook trawls set, and boats employed in trolling and hand-line fishing.

Many fish taken by hook trawl and gill nets were found completely hollowed out, nothing remaining but the head, vertebra, and skin. This is the work of the slime eel, which, introducing itself inside the fish, sucks out the fleshy portion. A few specimens taken in the beam trawl have been preserved.

The fishermen of Santa Cruz and Monterey state that they took salmon in the bay every month during the winter of 1896–97; that the salmon follow the bait, anchovies, and sardines, and can be taken when the bait is inshore; that no salmon are taken in gill nets, but that during the summer when the run is large they take several tons a day, and all by trolling. During our visit no salmon were taken.

Referring to the investigations by deep-sea gill nets it will be seen that at every station occupied there was good live bottom, and at every set, except No. 6, fish were taken, showing that the nets were doing their work; but in no instance were any anadromous fishes captured. Judging from the forms of the bottom fish taken in the nets, the hauls of the beam trawl, the general nature of the bottom, and considering the subject of structure and pressure, it is my opinion that anadromous fishes will not be found in ocean depths.

TABLES.

1.—*Record of ocean temperatures and specific gravities (surface).*

Date.	Time of day.	Station.		Temperature by attached thermometer.	Temperature of air.	Temp. of specimen at time sp. grav. was taken.	Specific gravity.	Specific gravity reduced to 15° C.
		Lat. N.	Long. W.					
1896.		° ′ ″	° ′ ″	°	°	°		
July 1	6 a. m.	53 45 00	156 40 00	47	47	59	1.0250	1.024060
1	12 m	53 47 00	158 09 00	46	48	59	1.0252	1.024260
1	6 p. m.	53 40 00	159 22 00	46	49	59	1.0250	1.024060
1	12 p. m.	53 37 00	160 41 00	46	47	59	1.0250	1.024060
2	6 a. m.	53 35 00	162 12 00	46	47	59	1.0250	1.024060
2	12 m	53 30 00	164 07 00	45	43	59	1.0246	1.023660
2	6 p. m.	53 46 00	165 28 00	44	43	59	1.0246	1.023660
3	6 a. m.	Dutch Harbor		46	41	59	1.0234	1.022460
8	12 m	56 26 30	169 34 00	40	43	59	1.0240	1.023660
24	12 m	54 24 15	169 08 30	45	46	64	1.0244	1.024128
24	6 p. m.	54 31 00	170 08 00	44	45	64	1.0244	1.024128
24	12 p. m.	54 40 00	171 30 00	45	44	64	1.0246	1.024328
25	6 a. m.	54 45 00	172 48 00	45	45	64	1.0246	1.024328
25	12 m	54 46 20	174 17 00	45	47	64	1.0244	1.024128
25	6 p. m.	54 58 00	175 24 00	45	46	64	1.0244	1.024128
25	12 p. m.	54 59 00	176 38 00	46	48	64	1.0242	1.023928
27	12 m	55 03 35	179 07 18 East.	47	48	64	1.0242	1.023928
27	6 p. m.	55 05 00	170 55 00	46	49	64	1.0242	1.023928
27	12 p. m.	55 07 00	178 53 00	46	46	64	1.0244	1.024128
28	6 a. m.	55 07 00	177 30 00	46	48	64	1.0244	1.024128
28	12 m	55 05 00	176 09 00	46	48	64	1.0244	1.024128
28	6 p. m.	55 05 00	175 28 00	46	48	64	1.0244	1.024128
28	12 p. m.	55 03 00	175 15 00	46	47	64	1.0244	1.024128
29	6 a. m.	55 03 00	174 08 00	45	46	64	1.0246	1.024328
29	12 m	55 02 20	173 15 00	46	48	64	1.0246	1.024328
29	6 p. m.	54 58 00	172 21 00	46	48	64	1.0246	1.024328
29	12 p. m.	54 55 00	171 12 00	46	47	64	1.0246	1.024328
30	6 a. m.	54 51 00	170 08 00	46	46	64	1.0246	1.024328
31	3 p. m.	Bering Island		51	47	64	1.0244	1.024128
Aug. 2	10 a. m.	Copper Island		47	46	64	1.0246	1.024328
9	12 m	55 22 15	165 44 45	48	49	64	1.0246	1.024328
10	12 m	54 42 30	162 55 00	51	58	64	1.0244	1.024128
10	12 p. m.	53 45 00	161 15 00	51	55	64	1.0236	1.023328
11	6 a. m.	53 17 00	160 35 00	50	53	64	1.0236	1.023328
11	12 m	52 59 00	159 54 50	52	58	64	1.0224	1.022128
16	12 m	Petropaulski		50	55	64	1.0184	1.018128
19	4 p. m.	Aratcha Bay		48	60	64	1.0208	1.020528
19	12 p. m.	52 04 00	158 49 00	49	54	64	1.0240	1.023728
20	6 a. m.	51 36 00	158 30 00	46	50	64	1.0240	1.023728
20	12 m	51 15 30	157 53 30	51	54	64	1.0236	1.023328
20	6 p. m.	50 49 00	157 22 00	52	55	64	1.0238	1.023528
20	12 p. m.	50 23 00	156 53 00	48	48	67	1.0240	1.024167
21	6 a. m.	49 48 00	156 13 30	49	50	67	1.0238	1.023967
21	12 m	49 30 00	155 21 00	45	48	67	1.0240	1.024167
21	6 p. m.	49 12 00	154 56 00	42	45	67	1.0242	1.024367
21	12 p. m.	48 43 00	154 36 00	40	44	67	1.0242	1.024367
22	6 a. m.	48 39 00	154 20 00	38	41	67	1.0242	1.024367
22	12 m	48 34 11	153 52 00	42	44	67	1.0242	1.024367
22	6 p. m	48 29 00	153 37 00	38	48	67	1.0242	1.024367
22	12 p. m	48 22 00	153 20 00	43	45	67	1.0240	1.024167
23	3 p. m	Matua Island		49	50	67	1.0240	1.024167
24	12 m	Sundnoi Rocks		38	45	67	1.0242	1.024367
25	12 m	Ushishir Island		39	49	67	1.0242	1.024367
26	12 m	47 32 30	152 14 45	40	45	67	1.0242	1.024367
26	6 p. m	47 38 00	151 30 00	53	52	67	1.0240	1.024167
26	12 p. m	47 42 00	150 44 00	46	42	67	1.0238	1.023967
27	6 a. m	47 48 00	149 30 00	47	45	67	1.0238	1.023967
27	12 m	47 54 22	149 03 00	56	54	67	1.0236	1.023767
27	6 p. m	48 03 00	148 09 00	53	53	67	1.0233	1.023467
27	12 p. m	48 09 00	147 11 00	56	56	67	1.0230	1.023167
28	6 a. m	48 18 00	146 21 00	57	57	67	1.0230	1.023167
28	12 m	48 26 30	145 28 00	54	57	67	1.0220	1.022167
28	7 p. m	Robben Island		58	56	67	1.0222	1.022367
30	12 m	48 35 00	144 11 30	53	57	74	1.0222	1.023466
Sept. 2	12 m	48 46 07	144 00 17	56	56	74	1.0222	1.023466
2	6 p. m	48 29 00	144 41 00	47	54	74	1.0222	1.023466
2	12 p. m	47 56 00	145 13 00	55	54	74	1.0226	1.023866
3	6 a. m	47 28 00	145 48 00	56	53	74	1.0226	1.023866
3	12 m	46 56 27	146 22 32	57	58	74	1.0230	1.024266
3	6 p. m	46 38 00	146 45 00	56	66	74	1.0230	1.024266
3	12 p. m	46 18 00	147 05 00	55	53	74	1.0232	1.024466
4	6 a. m	45 54 00	147 17 00	53	53	74	1.0230	1.024266
4	12 m	45 31 30	147 32 30	55	58	74	1.0234	1.024666
6	12 m	45 16 30	147 44 00	58	64	74	1.0234	1.024666
6	6 p. m	45 17 00	146 51 00	58	61	74	1.0230	1.024266
6	12 p. m	45 20 00	145 58 00	58	62	74	1.0232	1.024466
7	6 a. m	45 24 00	145 03 00	57	60	74	1.0232	1.024466

1.—*Record of ocean temperatures and specific gravities (surface)*—Continued.

Date.	Time of day.	Station.		Temperature by attached thermometer.	Temperature of air.	Temp. of specimen at time sp. grav. was taken.	Specific gravity.	Specific gravity reduced to 15° C.
		Lat. N.	Long. E.					
1896.		° ′ ″	° ′ ″	°	°	°		
Sept. 7	12 m	45 25 30	144 04 30	56	62	74	1.0230	1.024266
7	6 p. m.	45 31 00	143 17 00	56	59	74	1.0228	1.024066
7	12 p. m.	45 35 00	142 32 00	58	58	74	1.0224	1.023666
8	6 a. m.	45 39 00	141 46 00	53	57	74	1.0228	1.024066
8	12 m.	45 28 46	141 21 00	66	64	74	1.0230	1.024266
8	6 p. m.	44 47 00	141 10 00	67	68	74	1.0234	1.024666
8	12 p. m.	44 19 00	140 42 00	68	68	74	1.0234	1.024666
9	6 a. m.	43 36 00	140 16 00	68	66	74	1.0234	1.024666
9	12 m	42 53 35	139 54 00	68	68	74	1.0236	1.024866
9	6 p. m.	42 22 00	139 37 00	68	69	74	1.0236	1.024866
9	12 p. m.	41 25 00	139 42 00	69	69	74	1.0236	1.024866
10	6 a. m.	41 21 00	140 12 00	70	68	74	1.0232	1.024466
10	12 m	Hakodate, Japan		68	68	74	1.0230	1.024266
20	12 m	39 44 30	142 17 00	67	70	70	1.0240	1.024630
20	6 p. m.	38 49 42	141 56 20	68	68	70	1.0238	1.024430
20	12 p. m.	37 51 00	141 36 10	69	69	70	1.0236	1.024230
21	6 a. m.	36 53 40	141 19 00	68	68	70	1.0238	1.024430
21	12 m	36 01 00	140 55 40	72	69	70	1.0238	1.024430
21	6 p. m.	35 24 30	140 42 30	77	72	70	1.0240	1.024630
21	12 p. m.	34 51 00	139 57 30	76	73	70	1.0242	1.024830
22	6 a. m.	Gulf of Tokio		70	66	70	1.0202	1.020830
Oct. 22	6 p. m.	34 50 00	140 35 00	73	68	70	1.0242	1.024830
22	12 p. m.	34 51 00	141 30 00	75	66	70	1.0246	1.025230
23	6 a. m.	34 50 00	142 29 00	73	66	70	1.0246	1.025230
23	12 m	34 57 00	143 25 30	75	67	70	1.0246	1.025230
23	6 p. m.	34 44 00	144 25 00	75	67	70	1.0246	1.025230
23	12 p. m.	34 35 00	145 50 00	74	65	70	1.0248	1.025430
24	6 a. m.	34 24 00	146 51 00	74	65	70	1.0248	1.025430
24	12 m	34 15 30	147 47 00	75	68	70	1.0248	1.025430
24	6 p. m.	34 09 00	148 56 00	75	68	70	1.0248	1.025430
24	12 p. m.	34 07 00	150 05 00	74	67	70	1.0248	1.025430
25	6 a. m.	34 05 00	151 10 00	73	66	70	1.0246	1.025230
25	12 m	34 04 19	152 04 00	74	72	70	1.0246	1.025230
25	6 p. m.	34 02 00	153 25 00	74	70	70	1.0246	1.025230
25	12 p. m.	34 02 00	154 40 00	73	69	70	1.0246	1.025230
26	6 a. m.	34 04 00	155 38 00	73	68	70	1.0248	1.025430
26	12 m	34 04 11	156 21 30	72	72	70	1.0246	1.025230
26	6 p. m.	34 10 00	157 42 00	76	74	70	1.0248	1.025430
26	12 p. m.	34 10 00	158 45 00	73	71	70	1.0248	1.025430
27	6 a. m.	34 20 00	159 50 00	72	72	70	1.0250	1.025630
27	12 m	34 25 30	160 54 46	72	72	70	1.0250	1.025630
27	6 p. m.	34 25 00	161 45 00	71	74	70	1.0250	1.025630
27	12 p. m.	34 26 00	162 46 00	70	73	70	1.0250	1.025630
28	6 a. m.	34 25 30	163 50 00	71	74	70	1.0248	1.025430
28	12 m	34 26 18	165 01 25	71	74	70	1.0248	1.025430
28	6 p. m.	34 24 00	166 10 00	71	74	70	1.0248	1.025430
28	12 p. m.	34 24 30	167 25 00	72	75	70	1.0248	1.025430
29	6 a. m.	34 24 00	168 35 00	72	74	70	1.0246	1.025230
29	12 m	34 23 46	169 32 23	69	73	70	1.0248	1.025430
29	6 p. m.	34 24 00	170 50 00	72	73	70	1.0248	1.025430
29	12 p. m.	34 23 30	172 00 00	72	73	70	1.0248	1.025430
30	6 a. m.	34 22 00	173 20 00	73	74	70	1.0250	1.025630
30	12 m	34 21 45	174 18 15	72	75	70	1.0252	1.025830
30	6 p. m.	34 16 00	175 45 00	70	74	70	1.0252	1.025830
30	12 p. m.	34 10 00	176 55 00	69	73	70	1.0252	1.025830
31	6 a. m.	34 02 00	178 00 00	69	72	70	1.0252	1.025830
31	12 m	33 56 00	178 55 00	67	70	70	1.0252	1.025830
31	6 p. m.	33 40 00	179 58 00	67	65	82	1.0236	1.026200
			West.					
31	12 p. m.	33 28 00	179 06 00	67	66	82	1.0236	1.026200
Nov. 1	6 a. m.	33 18 00	178 23 00	65	66	82	1.0240	1.026700
1	12 m	32 28 00	174 21 15	66	67	82	1.0242	1.026900
1	6 p. m.	32 00 00	173 31 00	69	65	82	1.0242	1.026900
1	12 p. m.	31 27 00	172 40 00	70	66	82	1.0242	1.026900
2	6 a. m.	30 50 00	175 31 00	72	67	82	1.0242	1.026900
2	12 m	30 13 00	170 56 45	72	71	82	1.0242	1.026900
2	6 p. m.	29 40 00	170 10 00	72	69	82	1.0242	1.026900
2	12 p. m.	29 07 00	169 23 00	72	69	82	1.0242	1.026900
3	6 a. m.	28 35 00	168 37 00	73	68	82	1.0244	1.027100
3	12 m	28 00 47	167 41 14	75	72	82	1.0244	1.027100
3	6 p. m.	27 40 00	166 57 00	75	74	82	1.0244	1.027100
3	12 p. m.	27 21 00	166 02 00	74	72	82	1.0244	1.027100
4	6 a. m.	26 55 00	165 19 00	75	72	82	1.0242	1.026900
4	12 m	26 29 00	164 19 00	76	75	82	1.0242	1.026900
4	6 p. m.	26 13 00	163 38 00	76	76	82	1.0242	1.026900
4	12 p. m.	25 47 00	162 53 00	76	76	82	1.0242	1.026900
5	6 a. m.	25 24 00	161 56 00	77	78	82	1.0240	1.026700
5	12 m	24 54 00	160 50 00	77	80	82	1.0240	1.026700
5	6 p. m.	24 21 00	160 22 00	78	80	82	1.0242	1.026900

1.—*Record of ocean temperatures and specific gravities (surface)*—Continued.

Date.	Time of day.	Station. Lat. N.	Station. Long. W.	Temperature by attached thermometer.	Temperature of air.	Temp. of specimen at time sp. grav. was taken.	Specific gravity.	Specific gravity reduced to 15° C.
1896.		° ′ ″	° ′ ″	°	°	°		
Nov. 5	12 p. m.	23 52 00	159 41 00	77	80	82	1.0242	1.026900
6	6 a. m.	23 27 00	159 27 00	77	79	82	1.0242	1.026900
6	12 m	23 02 30	159 01 30	77	80	82	1.0240	1.026700
6	6 p. m.	22 31 00	158 47 00	77	80	82	1.0238	1.026500
6	12 p. m.	22 03 00	158 32 00	77	80	82	1.0238	1.026500
7	6 a. m.	21 31 00	158 18 00	77	80	82	1.0238	1.026500
7	12 m	Honolulu, H. I.		78	81	82	1.0232	1.025900
30	12 m	21 21 00	157 28 00	76	78	67	1.0256	1.025767
Dec. 1	12 m	22 58 00	154 27 30	77	78	67	1.0258	1.025967
2	12 m	24 33 10	151 19 15	75	78	67	1.0258	1.025967
3	12 m	26 15 00	148 20 00	74	76	67	1.0258	1.025967
4	12 m	27 47 00	145 37 00	73	73	67	1.0258	1.025967
5	12 m	29 17 20	143 03 25	68	70	67	1.0258	1.025967
6	12 m	30 26 00	140 09 00	69	70	67	1.0256	1.025767
7	12 m	31 36 30	137 02 00	66	68	67	1.0256	1.025767
8	12 m	32 53 00	133 32 00	65	69	67	1.0252	1.025367
9	12 m	34 01 25	130 00 12	66	71	67	1.0248	1.024987
10	12 m	35 55 45	126 17 30	60	63	67	1.0248	1.024987

2.—*Record of accepted sounding stations of the United States Fish Commission steamer Albatross for the fiscal year ending June 30, 1897.*

EASTERN PORTION OF BERING SEA SOUTH OF PRIBILOF ISLANDS.

Date.	Serial number.	Time of day.	Position. Lat. N.	Position. Long. W.	Depth.	Character of bottom.	Temperatures. Air.	Temperatures. Surface.	Temperatures. Bottom.
1896.			° ′ ″	° ′ ″	*Fms.*				
July 7	Dr. 3634	4.14 p. m.	54 51 00	167 27 00	664	bk. vol. S	43	43	36.3
7	Hy. 3655	8.18 p. m.	54 51 00	167 46 00	671	gn. M. bk. vol. S	43	43	36.4
[1]FROM BERING ISLAND TO KAMCHATKA COAST.									
				East.					
Aug. 9	[2]Hy. 3660	3.05 p. m.	55 11 30	165 39 00	41	fne. gy. S. bk. Sh.	52	48	.....
9	Hy. 3661	5.21 p. m.	55 08 30	165 26 00	2,250	fne. gy. S. bk. P. C	49	49	35.0
9	Hy. 3662	11.16 p. m.	54 49 42	164 36 00	2,665	M. fne. dk. S. P	52	49	35.0
10	Hy 3663	5.24 a. m.	54 51 00	163 46 00	3,117	bn. M. fne. dk. S	54	49	35.2
10	[3]Hy. 3664	11.01 a. m.	54 42 30	162 55 00	2,077	bn. M. dk. S. P	57	50	35.0
10	[4]Hy. 3665	4.20 p. m.	54 35 00	162 11 30	473	bn. M. dk. S. P	53	44	38.0
10	[5]Hy. 3666	5.49 p. m.	54 32 30	161 58 30	586	bn. M. fne. S. P	53	44	37.4
10	[6]Hy. 3667	7.07 p. m.	54 29 00	161 50 00	453	bn. M. dk. S. P	54	45	37.0
[7]SOUTHEAST COAST OF KAMCHATKA.									
Aug. 20	Hy. 3638	10.04 a. m.	51 17 00	158 10 00	127	gn. M. Co. dk. S. P	53	49	32.7
20	Dr. 3643	10.43 a. m.	51 16 00	158 03 00	100	bk. S. P	53	49	31.7
20	Dr. 3644	1.09 p. m.	51 09 00	157 48 00	96	bk. S	60	51	33.1
[8]ALONG KURIL CHAIN.									
Aug. 21	Hy. 3669	8.42 p. m.	48 43 00	154 31 00	425	crs. dk. S	44	41	36.7
22	Hy. 3670	3.32 a. m.	48 33 00	154 53 00	114	hrd	42	37	35.7
22	Hy. 3671	5.01 a. m.	48 32 00	154 55 00	106	brk. Sh	41	37	.....
22	Hy. 3672	11.19 a. m.	48 36 00	153 59 00	304	crs. G	45	42	36.7
22	Hy. 3673	7.54 p. m.	48 26 00	153 33 00	1,102	crs. dk. S. P	47	45	34.7
23	Hy. 3674	10.26 a. m.	48 19 00	153 23 00	1,001	bk. S. P	48	44	35.7
23	Hy. 3675	2.24 p. m.	48 13 00	153 20 00	624	bk. S	48	49	36.3
24	[9]Hy. 3676	10.58 a. m.	47 35 00	152 48 30	96	rky	45	38	35.7

[1]Except station Hy. 3660, geographical positions on this line are independent of shore features.
[2]Accepting position of Ari Kamen, Bering Island, as plotted on Stejneger's map, it bore NE. by E. ½ E. (mag.), distant 3 miles from Hy. 3660.
[3]Serial temperatures to 1,000 fathoms.
[4]97° 33′ Ext. Rt. Pt. to Cape Kosloff. 95° 08′ first Pt. left of Ext. Rt. Pt. to Kosloff. 77° 02′ Ext. Rt. Pt. to Mt. Kronotski.
[5]102° 43′ Ext. Rt. Pt. to Kosloff. 91° 03′ Ext. Rt. Pt. to Kronotski. 5° 07′ Kosloff to Detached Rock. Ext. Right Point, N. 16° E., mag. Mt. Kronotski, N. 74° W., mag. Cape Kosloff, N. 86° 15′ W., mag.
[6]73° 56′ Ext. Rt. Pt. to Kosloff. 1° 12′ Kosloff to detached rock. Cape Kosloff, N. 46° 30′ W., mag.
[7]Geographical positions, approximate, without relation to shore features.
[8]Geographical positions approximate, without relation to shore features, except station Hy. 3676.
[9]Position referred to obs. spot at Old Village, Lower Ushishir Island, as in lat. 47° 30′ 56.8″ N., long. 152° 47′ 55″ E., determined by this vessel.

2.—Record of accepted sounding stations of the United States Fish Commission steamer Albatross for the fiscal year ending June 30, 1897—Continued.

[1] SEA OF OKHOTSK FROM LOWER USHISHIR ISLAND TO ROBBEN ISLAND.

Date.	Serial number.	Time of day.	Position. Lat. N.	Position. Long. W.	Depth.	Character of bottom.	Temperatures. Air.	Temperatures. Surface.	Temperatures. Bottom.
1896.			° ′ ″	° ′ ″	*Fms.*				
Aug. 26	[2] Hy. 3679	7.27 a. m.	47 31 30	152 45 48	37	P	45	39	38.7
26	[3] Hy. 3680	8.14 a. m.	47 31 30	152 39 00	685	P	45	40	35.7
26	[4] Hy. 3681	9.27 a. m.	47 31 42	152 32 00	1,164	fne. gy. S	44	39	35.2
26	[5] Hy. 3682	11.07 a. m.	47 32 00	152 21 00	1,500	bn. M. fne. gy. S	44	39	34.7
26	[6] Hy. 3683	1.22 p. m.	47 33 00	152 07 00	1,712	fne. gy. S	47	39	35.2
26	Hy. 3684	4.25 p. m.	47 36 00	151 46 00	1,830	bn. M. dk. S	53	53	.....
26	Hy. 3685	9.32 p. m.	47 40 30	151 05 00	1,836	bn. M. fne. S	49	50	35.7
27	Hy. 3686	2.32 a. m.	47 45 00	150 23 30	1,836	bn. M. fne. S	43	47	35.9
27	Hy. 3687	7.46 a. m.	47 50 00	149 42 00	1,843	bn. & yl. M. fne. S	48	50	36.0
27	Hy. 3688	1.02 p. m.	47 55 30	148 56 00	1,562	bn. M. fne. S	55	55	35.8
27	Hy. 3689	5.41 p. m.	48 01 30	148 16 30	1,426	bn. M. fne. S	55	55	36.0
27	Hy. 3690	10.35 p. m.	48 08 00	147 34 00	964	lt. bn. M. qtz. S	56	56	36.0
28	Hy. 3691	3.27 a. m.	48 15 00	146 51 00	796	lt. bn. M. qtz. S	57	59	36.0
28	Hy. 3692	8.02 a. m.	48 21 00	146 08 00	698	bn. M. fne. S	58	56	36.2
28	Hy. 3693	12.47 p. m.	48 27 45	145 20 30	155	bn. M. crs. vol. S	58	56	33.0
28	Hy. 3694	3.46 p. m.	48 31 48	144 54 51	27	fne. G. R. Sh	57	48	35.0
28	Hy. 3695	5.30 p. m.	48 29 00	144 42 30	16	rky	58	51	.....

[7] SEA OF OKHOTSK FROM ROBBEN ISLAND TO ITURUP ISLAND.

Sept. 2	Hy. 3696	5.44 p. m.	48 22 00	144 41 00	20	fne. S. P	55	47	40.0
2	Hy. 3697	9.04 p. m.	48 05 00	145 01 00	71	bl. M	54	55	31.0
3	Hy. 3698	1.40 a. m.	47 43 00	145 28 00	631	gn. M. S	54	54	37.0
3	Hy. 3699	6.12 a. m.	47 20 30	145 54 00	1,584	gn. M. fne. S	53	56	35.9
3	Hy. 3700	11.08 a. m.	46 58 00	146 20 00	1,818	gn. M fne. S	57	58	35.9
3	Hy. 3701	4.18 p. m.	46 35 00	146 49 00	1,820	lt. bn. M. S	62	55	36.0
3	Hy. 3702	9.13 p. m.	46 15 00	147 07 00	1,817	bn. M. fne. S	55	55	35.8
4	Hy. 3703	2.18 a. m.	45 48 00	147 22 00	1,825	gn. M. fne. S	53	54	36.0
4	Hy. 3704	4.28 a. m.	45 40 00	147 28 00	1,761	gn. M. fne. S	53	53	35.9
4	Hy. 3705	6.25 a. m.	45 31 30	147 32 30	1,078	bn. M. fne. S	53	54	36.0
4	Hy. 3706	8.20 a. m.	45 23 00	147 39 30	1,107	bn. M. fne. S	54	54	36.0
4	Hy. 3707	9.25 a. m.	45 18 00	147 42 00	668	bn. M. crs. S	54	54	36.5

[7] SEA OF OKHOTSK FROM ITURUP ISLAND TOWARD LA PEROUSE STRAITS.

Sept. 6	Dr. 3652	10.00 a. m.	45 15 30	147 53 00	14	yl. C	64	56	.....
6	Dr. 3653	10.30 a. m.	45 14 00	147 52 30	18	dk. gy. S	64	57	56.5
6	Hy. 3708	10.53 a. m.	45 16 00	147 52 00	27	dk. gy. S	64	58	50.0
6	Hy. 3709	11.48 a. m.	45 16 30	147 45 00	312	gn. M. fne. S	64	58	35.7
6	Hy. 3710	1.29 p. m.	45 18 00	147 31 00	810	gn. M. S	60	55	36.0
6	Hy. 3711	4.06 p. m.	45 19 00	147 09 00	1,641	gn. M. fne. S	60	54	36.0
6	Hy. 3712	9.06 p. m.	45 21 00	146 27 00	1,744	gn. M. fne. S	60	58	35.8
7	Hy. 3713	1.53 a. m.	45 23 00	145 46 00	1,700	gn. M. S	61	58	36.0
7	Hy. 3714	6.30 a. m.	45 25 00	145 02 00	1,649	gn. M. S	60	57	35.9
7	Hy. 3715	10.43 a. m.	45 27 00	144 21 00	408	gn. M. crs. S. P	62	54	36.5
7	Hy. 3716	2.38 p. m.	45 31 00	143 38 00	122	gy. S	62	56	33.0
7	Hy. 3717	5.22 p. m.	45 34 00	143 12 00	68	gn. M	61	57	34.0
7	Hy. 3718	6.50 p. m.	45 36 30	142 58 00	62	gn. M	60	59	32.0

[1] Geographical positions on this line referred to obs. spot at Old Village, Lower Ushishir Island, as in lat. 47° 30′ 56.8″ N., long. 152° 47′ 55″ E. Robben Island is assumed to be in lat. 48° 31′ 30″ N., long. 144° 48′ 38″ E.

[2] Babuskin Rock, south (true) ½ mile.

[3] SW. end Lower Ushishir, S. 68° E., true; S. end Ketoy, S. 48° W., true.

[4] SW. end Lower Ushishir, S. 80° E., true; S. end Ketoy, S. 28° W., true.

[5] SW. end Lower Ushishir, S. 92° E., true; S. end Ketoy, S. 14° E., true.

[6] Right end Ketoy, S. 44° E., true; North Ushishir Peak, S. 86° E., true.

The five preceding bearings are all independent of geographical positions of the stations and have not been adjusted.

[7] Positions on this line are geographical without relation to shore features. Position given on B. A. chart No. 2405 of Shana Village, Iturup Island, is accepted. Lat. 45° 15′ N., long. 147° 56′ E.

3.—*Record of stations of the steamer Albatross where long-beam trawl was used.*

Serial No.	Date.	Time of day.	Position.		Temperatures.			Depth.	Character of bottom.	Wind.		Time used (minutes).
			Lat. N.	Long. W.	Air.	Surface.	Bottom.			Direction.	Force.	
			° ′ ″	° ′ ″				Fms.				
			Santa Catalina Island, California.									
	1897.											
3662	Apr. 8	11.09 a. m.	1¼″ off Avalon, Dakins Cove.		69	58	51.7	47	Fne. gy. s...	Variable.	0—1	11
3663	Apr. 8	11.39 a. m.	Near preceding station.		69	58	52.5	47	.....do	...do	0—1	10
3664	Apr. 8	1.39 p. m.	2′ off Avalon, Dakins Cove.		70	58	49.7	80	.....do	...do	0—1	13
3665	Apr. 9	1.07 p. m.	33 17 00	118 24 00	76	61	.....	59	.....do	...do	0—1	9
			Monterey Bay and vicinity.									
3666	Apr. 13	11.02 a. m.	36 45 00	121 53 00	64	55	.....	68	M. s. bldr ...	West ...	1—2	8
3667	Apr. 13	12.04 p. m.	36 45 00	121 52 00	64	55	47.7	90	.....do	...do	2	12
3668	Apr. 13	2.44 p. m.	36 40 00	121 53 00	57	56	48.7	39	S. mica	W. by S.	1—2	11
3669	Apr. 16	4.48 p. m.	36 47 00	122 11 00	55	57	42.7	278	Gn. m. fne. s	SSW ...	0—1	15
3670	Apr. 17	11.44 a. m.	36 43 00	122 12 00	58	54	37.8	581	Gn. m. s.....	Calm ...		0
3671	Apr. 21	10.52 a. m.	37 00 00	122 20 00	53	50	.....	56	.....do	NW. by W	5—6	15
3672	Apr. 24	10.47 a. m.	37 37 00	123 02 00	56	49	49.0	68	S. co. r	NW	2	21
			Flattery Bank.									
3673	May 14	9.50 a. m.	48 21 45	124 50 30	54	47	45.0	77	Gn. m. s.....	West. ..	1—2	....

Results of Beam-trawl Hauls.

No. 3662.—Many flounders of 2 species, 1 quite large, many small; many small sculpins; several large holothurians; many sea-urchins, 2 species; 2 soft crabs with mossy backs; 1 naked mollusk; 1 shell with small ascidians attached; few small shells of two species; few large hermit-crabs; few brachiopods with cup-corals attached; few hard red starfish; 3 very small starfish; 2 fragments of sponge; 4 small shrimps.

No. 3663.—Several large flounders, 2 species, many young and small; several young sculpins; 1 small octopus; 1 small fish; 3 small shrimps; 1 large red holothurian; 2 hard red starfish; 1 large gray starfish; 1 very small starfish; 1 very small ophiuran; many sea-urchins of 2 species; 2 pennatula, 1 very small; 1 large worm in tube; 1 large and 3 small shells.

No. 3664.—2 large flounders of different species, few small; 1 red sculpin; several small sculpins; 2 alligator-fish; few young rockfish; 1 small blenny; many sea-urchins, 2 species; few small shrimps; 1 small hermit crab; 1 tiny spider-crab; 1 cushion starfish; several hard starfish with short arms; 1 large soft starfish; 1 large shell; few small shells; 1 holothurian; 1 naked mollusk; 1 worm; skate egg-cases, bryozoa, hydroids, etc.

No. 3665.—36 small flounders, 2 or 3 species; several flounder fry; 1 sculpin; small sculpins of several species; 1 adult and 2 small alligator-fish; few young rockfish; 1 small skate; 1 small octopus; sea-urchins, 2 species; several red holothurians; 1 hard-skinned holothurian covered with warts; 1 small ophiuran; several small starfish, 2 or 3 species; few small shrimps; 1 large worm in tube; 2 naked mollusks; 1 small sea spider.

No. 3666.—1 cultus-cod, female, 39½ inches, 21½ pounds, stomach empty; 1 cultus-cod, female, 30½ inches, 12 pounds, residue of fish well digested in stomach; 4 chimæra; 3 red rockfish; 1 skate; 3 small flounders; several young rockfish; 2 small octopus; 1 bushel large white anemones; 1 prawn; few small shrimps of 2 species; 1 each of 2 species of holothurians; 1 small crab; 1 hermit-crab; several small shells of several species; 1 small crustacean; 3 starfish of different species; many small and a few large worms and tubes; several cup-corals. A bowlder the size of a hogshead, covered with anemones and cup-corals, was also brought up.

No. 3667.—8 small rockfish, of 3 species; 1 cellpout; 1 small flounder; 1 small octopus; 1 holothurian; 2 sea-urchins.

No. 3668.—1 large and few small long-finned sole; 1 small fish; few shrimps; 3 small shells of 2 species; 1 parasitic crustacean; 1 ophiuran.

No. 3669.—1 rockfish (S. ruber); 1 large skate with rockfish in stomach; 1 small skate; 15 large flounders, of 3 species; several slime eels; 1 small pelagic fish, with very long teeth; 2 small fishes; several large and few small spider-crabs; 1 small anemone; few small medusæ; several hermit-crabs; 1 barrel sea-urchins, apparently of same species; several small hard starfish; several small brittle starfish with many arms; several shrimps; 1 fragment sponge; several shells.

No. 3670.—8 macruri, 4 male and 4 female, 1 with apparently ripe ova; 3 large flounders; many red small rockfish (probably Sebastes); several young rockfish; 1 small dusky fish, and 1 very small brilliant-scaled fish, both evidently pelagic; 6 large spider-crabs, with long thin red legs; many small ditto; 1 large crimson prawn; few small shrimps; 2 sea lice; few very small sea-urchins; 3 small starfish with many arms; 2 small starfish of different species; 2 ophiurans, 1 very small; many small shells of several species; many shells (Gasteropoda) mostly with small, red anemones attached, and a few with hermit-crabs; many small, red anemones; few small Pennatula; 2 naked mollusks; worms of several species; 4 sea mice; 1 small squid; 1 small medusa; 1 skate egg-case with anemone attached.

No. 3671.—Several large and few small flounders of 2 or 3 species; ova of larger flounders nearly ripe, showing pink through skin; few small rockfish; 3 alligator-fish; 2 young squid; 1 shrimp; few sea-urchins; several starfish; several ophiurans; several shells, 3 or 4 species; few worms and sea mice; 3 naked mollusks.

No. 3672.—4 large flounders, 2 each of 2 species; 1 small rockfish; 1 large skate; 1 alligator-fish, ova well developed; 1 small shrimp; 1 small starfish; few ophiurans; many crinoids; 2 small shells, 1 with hermit-crab; 1 sea-urchin; 1 large green worm; 2 small crabs; 1 large anemone; 1 small fragment coral.

No. 3673.—1 large barndoor skate, 8 pounds; 1 large flounder with young shrimps in stomach; 4 chimæra; 2 small alligator-fish; 2 flounder fry; 1 young squid; several shells, few with hermit-crabs; several shrimps and prawns; several ophiurans; few fragments sponge; 1 large starfish.

4.—Record of gill-net stations of the U. S. Fish Commission steamer Albatross.

Serial number.	Date.	Time.	Position.		Temperature.			Depth in fathoms.	Character of bottom.	Wind.		Nets set.		
			Lat. N.	Long. W.	Air.	Surface.	Bottom.			Direction.	Force.	Hours.	Number.	Kind.
			° ′ ″	° ′ ″										
			Santa Catalina Island, California.											
	1897. Apr. 7	7 p.m.....	1′ 3″ SE. of Avalon, Dakins Cove.		64	58	....	6–10	rky.	Variable	1*x*	11	2	Menhaden.
	8	.....do	.....do.....		60	58	....	6–10	rky.	....do ...	1-2*x*	?	2	Do.
			Monterey Bay and vicinity.											
1	Apr. 13	10 a.m....	36 45 15	121 53 00	64	55	47.7	68	m.S.bldr.	....do ...	0-1	70	2	Cod.
2	13	2.30 p.m ..	36 39 30	121 53 00	57	56	48.7	39	gy.S.mica.	W. & S .	1-2*x*	19	2	Salmon.
3	14	5 p.m.....	Off Pacific Grove, Point Pinos.		60	57	....	5	gy.S.rky.	WNW ..	3-2*x*	13	2	Do.
4	16	4 p.m.....	36 47 00	122 10 00	55	57	42.7	278	gy. m. fne. S.	SSW....	1	17	1 2	Salmon. Cod.
5	17	11 a.m....	36 43 00	122 12 00	57	55	37.8	581	gy. m. S.	Variable	0-1	51	1 1	Salmon. Cod.
6	21	9.30 a.m ..	37 00 30	122 20 30	53	50	....	56	gy. m. S.	WNW ..	5	48	1 1	Salmon. Cod.
7	24	10.30 a.m .	37 37 30	123 02 00	56	49	49.0	68	S. Co. R.	NW	2	20	1 2	Salmon. Cod.
			Flattery Bank.											
8	May 14.	8.30 a.m ..	48 21 30	124 50 15	53	48	45.0	80	gn. m. S.	W. & N.	2	22	1 2	Salmon. Cod.

Sets marked *x* made at surface; remainder on bottom.

Results of gill-net trials.

April 7.—1 anchovy.

April 8.—Barren.

No. 1.—One net badly torn. 8 rockfish (S. paucispinis), 3 badly eaten by sea lice—skin only remaining; average length of 5 not destroyed, 26½ inches; average weight, 8 lbs.; 4 females, all with empty stomachs; 1 male with fish bones. 1 rockfish (S. melanops), 20 inches long, also badly eaten. 1 cultus-cod (badly eaten), 38 inches long. 3 ground sharks (2 badly eaten), 1 with beaks of large octopus in stomach. 3 dogfish.

No. 2.—Barren.

No. 3.—2 rock-bass.

No. 4.—One cod and one salmon net badly torn; 7 black-cod; 3 males and 4 females; average length, 28 inches; average weight, 8¾ pounds; 3 stomachs empty; others with fish bones, young shrimps, and medusa. 3 red rockfish; bodies of 2 badly eaten; the other, 19 inches, 3 pounds; male, stomach empty. 1 large flounder; 2 dogfish; 6 crabs; branch of cherry tree with anemone attached (preserved section with anemone).

No. 5.—Cod net badly torn; 3 black-cod, all females; average length, 30⅜ inches; average weight, 11½ pounds; 2 stomachs empty; 1 with small piece fish bone; ova partially developed; 9 Macruri; 8 males, 1 female; average length, 24½ inches; average weight, 2¼ pounds.

No. 6.—Barren. Set from ship.

No. 7.—1 rockfish (S. entomelas); female; 18 inches; 3 pounds; stomach empty. 8 rockfish (S. paucispinis); 1 badly eaten by sea lice and slime eels; eel found in skin; of other 7, 3 were females and 4 males; average length, 27 inches; average weight, 6½ pounds; *stomachs all empty*; 2 black-cod; 1 chimæra; 1 barndoor skate; 5 small dogfish.

No. 8.—Nets badly torn; 1 ground shark 10¾ feet long; several dogfish; 1 flounder; 1 black-cod.

5.—Record of dip-net trials with electric light.

Date.	Time.	Position.	Length of trial.	State of sea.	Temperature.	
					Air, D. B.	Sea surface.
1897.		*Santa Catalina Island, Cal.*				
Apr. 6	8 p.m.....	Anchorage, Isthmus Cove....	1 hour	Smooth ...	60	56
9	.....do	.....do	.....do	.....do	70	58
		Monterey Bay and vicinity, Cal.				
Apr. 12	7.30 p.m..	Anchorage, Santa Cruz	1½ hours	Smooth ...	59	54
23	8 p.m.....	Anchorage, Halfmoon Bay....	1 hour	Light.....	55	49

Result of dip-net trials with electric light at surface.

April 6.—Quantity of minute crustacea, medusæ, and marine refuse. One worm.

April 9.—Several annelids. Quantity of minute crustacea and marine refuse.

April 13.—1 small fish.

April 23.—Many young fishes, thought to be anchovies and sand launces; 4 very tiny fishes; 3 young shrimps; many minute crustacea; large crustacean like a centipede; several minute worms.

6.—*Record of trawl-line stations of the U. S. Fish Commission steamer Albatross.*

Date.	Time.	Position.		Temperature.		Depth.	Character of bottom.	Wind.		Trawls set.		
		Lat. N.	Long. W.	Air.	Surface.			Direction.	Force.	Hours.	No.	Kind.
		Santa Catalina Island, Cal.										
1897.						*Fms.*						
Apr. 6	10 a. m..	Isthmus Cove		60	56	8–12	S. Sh. R.	NE	1–2	20	1	Cod.
6	1 p. m...	Catalina Harbor..		62	57	7–10	S. Sh. R.	....do ...	0–1	17	1	Do.
7	10.30 a.m	East Point ent. Dakins Cove.		63	57	10–15	S. Sh. R.	Calm. ..	0	8	1	Haddock
7	4 p. m...	SE. end Santa Catalina Island.		66	59	15–20	gy. S. R.	Variable	0–1	17	1	Do.
8	9. 30 a.m.	.....do		66	58	15–20	gy. S. R.	Calm ...	0	6	1	Do.
8	3.30 p.m.	.....do		72	59	15–20	gy. S. R.	Variable	0–1	15	1	Do.
9	5 p. m...	Bird Rock, Isthmus Cove.		80	59	35–40	S. Sh. R.	SSW ...	1	13	1	Do.
		Monterey Bay and vicinity.										
Apr. 12	5 p. m...	2′ south, Santa Cruz Light.		64	55	8–25	S. rky.	SW	2–3	13	1	Do.
17	5.30 p. m.	Off Point Almiza.		59	55	8	S. Sh. R.	WSW ..	2	14	1	Do.

Results of trawl-line trials.

April 6, 10 a. m.—1 large stingray; 2 tiger sharks; 3 rockfish.
April 6, 1 p. m.—Barren. Hooks fouled in kelp.
April 7, 10.30 a. m.—2 ground sharks; 2 dogfish; 7 chimæra; 14 red rockfish of several species; 2 small sheep or fat-heads.
April 7, 4 p. m.—8 dogfish; 1 sculpin. (Fish badly eaten by sea lice; small vial of them preserved.)
April 8, 9.30 a. m.—Barren.
April 8, 3.30 p. m.—2 dogfish; 3 red rockfish (badly eaten).
April 9, 5 p. m.—8 sharks; 6 dogfish; 1 chimæra; 2 yellow-tails (badly eaten); 1 sculpin; 8 rockfish; piece branchy vegetable coral.
April 12.—Gear lost. Ground line chafed off.
April 17.—1 rockfish; 3 large, soft starfish, with many arms; 4 small, hard starfish, short arms.

7.—*Record of seine hauls.*

Date.	Time.	Position.	No. of hauls.	Character of beach.	Temperature.	
					Air D. B.	Sea surface.
1897.		*Santa Catalina Island, Cal.*				
Apr. 6	9.30–11.30 a. m.	Isthmus Cove.....	3	Sand.....	61	57
6	2–4 p. m.....	Catalina Harbor.....	3	Sand and shingle..	61	57
7	10–11.30 a. m ..	1′ SE. Avalon, Dakins Cove ..	4	Shingle.....	64	58
8	3.30–5.30 p. m..	¾′ SE. Avalon, Dakins Cove ..	Several.	.....do	71	60
		Monterey Bay and vicinity, Cal.				
Apr. 12	2–3 p. m.....	Beach near steamship wharf, Santa Cruz Harbor.	4	Sand.....	64	56
15	8–10 a. m.....	Point Almeja	2	.....do	56	56
		Neah Bay, Washington.				
May 14	2.30–5 p. m	Beach between Indian Agency and Indian Village.	6	.....do	55	49

Results of seine hauls.

April 6, both stations.—Many smelt; 6 small kelp fish; 2 small flounders; 2 whitefish; small fry like smelt; many small crabs; several shells; quantity sea lice; 1 shrimp (from Isthmus Cove).
April 7.—Many herring; few smelt.
April 8.—3 barrels of herring; many smelt. (Salted down 4 tubs of herring for bait.)
April 12.—4 flounders of two species; several flounder fry; many anchovy fry; many young smelt; 1 young striped bass; 6 young cultus-cod; 1 pipefish; several sticklebacks; several sardines; 2 small fish like billfish; many perch (feeding on small fry); 1 large and 8 small crabs; few shrimps; few shells of four species; 1 small starfish; several sand crabs; 2 small crustacea.
April 15.—100 smelt; 1 small striped bass; 1 small crab.
May 14.—Many large black flounders. The 8 largest averaged 13½ inches and 1½ pounds; all females, only one showing development of ova; 4 with empty stomachs, while other 4 contained fish bones and shrimps partly digested. Few small black flounders. Many starry flounders. The 4 largest averaged 13 inches and ¾ pound; 3 females (ova developed), and 1 male; stomachs all empty. Many flounder fry. Many perch, the majority with young. Many sand launces, and several young. 3 small sculpins. Several young fishes, probably cultus-cod. Few shrimps; several small crabs.

8.—*Record of hand-line stations of the U. S. Fish Commission steamer Albatross.*

Serial number.	Date.	Time.	Position.		Temperature.			Depth in fathoms.	Character of bottom.	Wind.		Lines.		
			Lat. N.	Long. W.	Air.	Surface.	Bottom.			Direction.	Force.	Time used (minutes).	No.	Bait used.
			° ′ ″	° ′ ″										
			Santa Catalina Island, California.											
	1897.													
	Apr. 6	7 p.m.	Entrance to Isthmus Cove.		60	56	.....	12-15	gy. s. sh. rky	S. by N.	1	15-2a	2	Meat.
	7	12.30 p.m.	1¼′ E. by N. of Avalon, Dakins Cove.		66	59	.....	48	fne. gy. s	ENE	0-1	17	14	Salt fish.
Hyd. 3719	7	1.5 p.m.	do		66	59	.....	48	do	Calm	0	14	15	Do.
Hyd. 3720	7	1.30 p.m.	1¼′ E. by N. of Avalon, Dakins Cove.		66	59	.....	47	do	do	0	19	14	Do.
	7	3 p.m.	Off east end Santa Catalina Island.		66	59	.....	52	do	Variable	0-1	18	16	Do.
	7	3.40 p.m.	South of east end Santa Catalina Island.		66	59	.....	44	do	do	0-1	13	14	Do.
	7	4.15 p.m.	do		66	59	.....	38	fne. gy. s. bk. sh	do	0-1	19	14	Do.
	8	9.05 a.m.	Off east end Santa Catalina Island.		66	58	51.7	50	fne. gy. s	Calm	0	29	10	Do.
	8	10.10 a.m.	do		66	58	52.0	50	do	do	0	12	11	Do.
	8	3.30 p.m.	Rocks, east entrance Dakins Cove.		72	59	.....	?	rky	Variable	0-1	90	?	Fresh fish.
Hyd. 3721	9	9.50 a.m.	33 17 20	118 24 40	69	60	.....	77-132	do	Calm	0	60	5	Do.
Hyd. 3721a	9	11.40 a.m.	Near preceding position.		72	60	.....	77-132	do	Variable	0-1	60	5	Do.
			Monterey Bay and vicinity, California.											
	Apr. 12	p.m.	Anchorage, Santa Cruz.		62	55	.....	6	gy. s. m	SW	2	?	?	Meat.
Hyd. 3722	13	12.45 p.m.	36 44 30	121 52 00	57	55	49.0	45	do	SW. by W.	1-2	27	10	Fresh fish.
	13	4 p.m.	Anchorage, Monterey Harbor.		64	58	.....	6	s. m	W. by S.	0-2	120	?	Meat.
	14	8 a.m.	do		58	55	.....	6	do	Calm	0	60	?	Do.
	17	7 p.m.	do		58	56	.....	7	do	Variable	0-1	120	?	Do.
	18	7 p.m.	do		61	54	.....	7	do	SSW	2	120	?	Do.
Hyd. 3723	22	8.35 a.m.	36 56 30	122 09 00	52	51	.....	26	gy. s	NW	4-6	30	13	Salt fish.
Hyd. 3724	24	1.05 p.m.	37 37 30	123 02 00	60	51	49	68	gy. s. co. r	do	2	17	12	Do.
Hyd. 3725	24	1.30 p.m.	37 41 00	123 03 00	60	51	49	45	rky	do	2	25	12	Fresh fish.
Hyd. 3726	24	2.10 p.m.	37 41 00	123 04 00	60	51	49	50	do	WNW	2	30	12	Do.
Hyd. 3727	24	4.25 p.m.	37 41 00	123 00 00	60	51	49	30-40	do	do	2	106	12	Do.

April 6, 7 p. m.—2 sculpius; 1 large red rockfish. Irregular fishing from boat.
April 7, 12.30 p. m.—Nothing.
April 7, 1.05 p. m., Hyd. 3719.—1 dogfish.
April 7, 1.30 p. m., Hyd. 3720.—2 dogfish.
April 7, 3 p. m.—1 dogfish.
April 7, 3.40 p. m.—1 dogfish.
April 7, 4.05 p. m.—1 dogfish.
April 8, 9.05 a. m.—Nothing.
April 8, 10.30 a. m.—Nothing.
April 8, 3.30 p. m.—1 red rockfish; 1 sculpin; 1 ground shark.
April 9, 9.50 a. m., Hyd. 3721.—13 red rockfish of 3 species; 1 rockfish brought to surface and lost.
April 9, 11.40 a. m., Hyd. 3721a.—16 rockfish (S. pinniger); 9 males, 7 females: average length, 21½ inches; average weight, 6¾ pounds; stomachs all empty save one. 9 rockfish (S. elongatus); 1 male, 8 females; average length, 22¼ inches; average weight, 3¾ pounds: stomachs all empty.
April 12.—1 slime eel.
April 13, 12.45 p. m., Hyd. 3722.—Nothing.
April 13, 4 p. m.—4 large flounders of two or three species. At same time observed vast quantities of small medusæ in the water adjacent to the anchorage in Monterey Harbor; subsequently very few were seen at the same place.
April 14.—1 large soft starfish with 20 arms; 2 small shells in its stomach.
April 17.—1 small octopus.
April 18.—1 small octopus.

April 22, 1.05 p. m., Hyd. 3724.—2 rockfish of different species. One 20 inches long 3¾ pounds, female, empty stomach; the other 22 inches long, 4¼ pounds, male, empty stomach.
April 24, 1.30 p. m., Hyd. 3725.—1 rockfish (S. flavidus); 17 inches, 2¾ pounds, female. empty stomach. 1 rockfish (S. ministus); 19 inches, 4 pounds, female, empty stomach.
April 24, 2.10 p. m., Hyd. 3726.—1 rockfish (S. vexillaris); 19⅛ inches, 5¼ pounds, female with well-developed ova, empty stomach. 2 rockfish (S. flavidus); 1 female, 17 inches, 3 pounds, empty stomach; 1 male, 18 inches, 3 pounds, empty stomach. 1 rockfish (S. chlorostictus); 15 inches, 2¼ pounds, empty stomach, female with ova well developed. 1 small dogfish. 1 crinoid.
April 24, 4.25 p. m., Hyd. 3727.—4 rockfish (S. pinniger); average length, 14 inches; average weight, 1¾ pounds; all females with empty stomachs. 1 rockfish with bright yellow body and black tipped fins; 14 inches, 1½ pounds, female, empty stomach. 2 rockfish like S. maliger; one 15 inches, 2½ pounds, female, empty stomach; the other 17 inches, 3 pounds, male, empty stomach. 7 rockfish like S. vexillaris: 5 males and 2 females; stomachs all empty save one, which contained portions of octopus or squid well digested; average length, 19 inches; average weight, 5 pounds. 1 rockfish (S. paucispinis); 20 inches, 3 pounds, female, empty stomach. 1 large flounder: 16 inches, 2 pounds, female, stomach empty. 1 halibut; 44 inches. 45 pounds, male, stomach full of small octopus or squid well digested. 1 cultus-cod; 23 inches, 4½ pounds, male, empty stomach. 1 large barndoor skate. 1 large white anemone.

9.—*Record of dredging and trawling stations of the United States Fish Commission steamer Albatross.*

Serial No.	Date.	Time.	Position.		Temperatures.			Depth.	Character of bottom.	Wind.		Instrument used.	Remarks.
			Lat. N.	Long. W.	Air.	Surface.	Bottom.			Direction.	Force.		
	1896.		° ′ ″	° ′ ″				*Fathoms.*					
3634	July 7	4.08 p.m.	54 51 00	167 27 00	43	43	36.3	664	W. vol. S	W. by S	2-3	L. B. T. / Surface	Bering Sea.
3635	July 10	1.27 p.m.	Zapadnie Bay.	St. George Island.	44	43	.....	24	bk. S. sky	NNE	4-5	L. B. T.	Do.
3636	July 18	8.42 a.m.	57 05 40	170 25 00	41	38	42.2	18	rky	ENE	3-4	do	Do.
3637	July 18	9.35 a.m.	57 06 30	170 28 00	41	38	39.0	32	crs. G	NE. by E	4-5	do	Do.
3638	July 18	10.26 a.m.	57 07 30	170 28 15	41	38	38.7	33	G	do	4-5	do	Do.
3639	July 18	11.53 a.m.	57 05 45	170 30 00	41	38	38.8	27	fne. gy. S	do	5-6	do	Do.
3640	July 18	1.38 p.m.	57 06 00	170 32 00	40	38	39.0	26	do	NE	5-6	do	Do.
				East.									
3641	Aug. 19	2.37 p.m.	52 58 00	158 36 00	59	45	47.7	16	bk. M	SE. by E	4	do	Avatcha Bay, Kamchatka.
3642	Aug. 19	2.56 p.m.	52 57 45	158 36 30	60	47	.....	16	do	do	4	do	Do.
3643	Aug. 20	10.49 a.m.	51 16 00	158 03 00	53	49	31.7	100	bk. S. P	S. by E	4	do	SE. coast of Kamchatka.
3644	Aug. 20	1.18 p.m.	51 09 00	157 48 00	60	51	33.1	96	bk. S	do	2	do	Do.
3645	Aug. 31	8.34 a.m.	To westward of Robben Island, Sea of Okhotsk, from 2 to 10 miles distant.		54	47	.....	10	S	SE. by S	1	do	Off Robben Island.
3646	Aug. 31	9.04 a.m.			54	47	.....	18	fne. gy. S	SE	1	do	Do.
3647	Aug. 31	9.32 a.m.			54	47	.....	20	do	do	0-1	do	Do.
3648	Aug. 31	10.05 a.m.			56	47	.....	20	do	do	0-1	do	Do.
3649	Aug. 31	10.41 a.m.	Having no chart, near or location can not be given.		57	50	.....	25	fine. dk. S	do	0-1	do	Do.
3650	Aug. 31	11.31 a.m.			57	50	.....	28	bu. M. S	ESE	1	do	Do.
3651	Aug. 31	1.26 p.m.			53	47	.....	20	fne. gy. S	SE. by E	1	do	Do.
3652	Sept. 6	10.00 a.m.	45 15 30	147 53 00	64	56	.....	14	vl. C	Variable	0-1	do	Off Shana, Iturup Island.
3653	Sept. 6	10.31 a.m.	45 14 00	147 52 30	64	57	56.5	18	dk. gy. S	do	0-1	do	Do.
3654	Sept. 19	9.01 a.m.	In Hakodate Bay		66	67	.....	10½	gn. M. S	SW. by S	0-1	do	Hakodate Bay, Japan.
3655	Sept. 19	9.26 a.m.	do		66	67	.....	12	do	do	0-1	do	Do.
3656	Sept. 19	9.50 a.m.	do		66	67	.....	11½	do	do	0-1	do	Do.
3657	Sept. 19	10.19 a.m.	do		67	67	.....	13½	fne. gy. S	do	0-1	do	Do.
3658	Sept. 19	10.40 a.m.	do		67	67	.....	22	do	South	1-2	do	Do.
3659	Sept. 19	11.05 a.m.	do		68	65	.....	15½	do	do	1-2	do	Do.
3660	Sept. 19	11.27 a.m.	do		68	65	.....	14½	do	SSW	2-3	do	Do.
3661	Oct. 13	10.41 a.m.	Off Uki Shima, Nippon Island.		60	72	48.0	169	M. P	NNE	5-6	do	Gulf of Tokyo, Japan.

Dredging, fishing, and collecting station, 1896.

Sta. 3634, July 7.—1 Antimora; 1 Careproctus; many Macruri, 5 species; 3 Maynea; numerous holothurians; 1 dozen sea-urchins; few red prawns; 5 quarts red crabs; 6 shells.

Sta. 3635, July 10.—2 Hemilepidotus; 1 Lepidopsetta; 2 small Hemilepidotus; sponges; small crustacea; sea-urchins; shells and worms abundant.

Sta. 3636, July 18.—2 bushels sand-dollars; few shells and small flounders.

Sta. 3637, July 18.—1 Artediellus pacificus; few sculpin; Triglops beani; few broken shells, starfish, and shrimp.

Sta. 3638, July 18.—1 Careproctus.

Sta. 3639 and 3640, July 18.—Net empty.

Preobrajenski, Copper Island, July 30.—37 codfish, average weight 8¼ pounds, length 25 inches.

Nikolski, Bering Island, July 31.—40 Pleuronectes stellatus; numerous young salmon; 6 Dolly Varden trout; 50 sand launces; few small flounders; 1 sculpin; 2 Hexagrammos asper; 12 cod; 10 halibut.

South Rookery, Bering Island, August 1.—91 cod, average weight 8½ pounds, length 27 inches; 2 orange rockfish.

Karabelni, Copper Island, August 5.—26 cod, average weight 4½ pounds, length 21 inches.

Karabelni, August 5.—63 cod, average weight 6 pounds, length 28 inches.

Priobrajenski, Copper Island, August 7.—5 Pleuronectes stellatus; 3 Lepidopsetta; many young cod and salmon; 1 dog salmon; 15 sticklebacks from fresh-water lake.

North Rookery, Bering Island, August 7.—5 Hemilepodotus, 2 species; 1 orange rockfish; 13 cod.

Petropaulski Harbor, August 13.—50 humpback salmon; 30 sculpin, 4 species; 200 smelt; 150 herring; 100 blennies, 4 species; 200 tomcod; abundance of young salmon and cod; 1 young wolf-fish; 50 small flounders, 3 species; 8 Hexagrammos asper; few sticklebacks; 9 large crabs.

Rakoaya Bay, August 13.—2 small flounders; 1 sculpin; 1 eelpout; 10 crabs; few anemones; abundance of prawns.

Sta. 3641, August 19.—1 small flounder; 1 quart shells; ½ bushel worm-tubes (Dentalia); 12 hermit-crabs; 6 shrimp.

Sta. 3642, August 19.—7 flounders; 1 Murænoides; 12 Lycodes; 1 tomcod; 2 bushels worm-tubes; 6 large worms; 3 large crabs; 2 hermit-crabs; 1 ascidian; 2 quarts small clams; 5 quarts of bottom specimens of numerous small shells saved.

Sta. 3643, August 20.—2 small flounders; 4 Agonidæ, 2 species; 1 large red-spotted Liparis; 2 quarts small crabs; 2 quarts hermit-crabs; 12 anemones; few shrimp; small shells, and sponge.

Sta. 3644, August 20.—6 flounders; 4 Podothecus; one-half bushel shells, 6 species; 4 quarts hermit-crabs; 12 anemones, 3 species; 2 quarts small crabs; 2 naked mollusks; 3 starfish.

Sta. 3645, August 21.—2 small sculpin; few shrimp, hermit-crabs, sponge and shells.

Sta. 3646, August 21.—One large sculpin; 6 small sculpin; 2 Agonidæ; 6 Limanda; few shrimp, crabs and sponge; 6 starfish.

Sta. 3647, August 21.—1 large Lepidopsetta; 6 small flounders; 2 small sculpin; few shrimp and sponge; 6 starfish, 2 species.

Sta. 3648, August 21.—1 large sculpin; 1 small sculpin; 6 young cod; few shrimp and ascidians; 4 starfish.

Sta. 3649, August 21.—1 large hermit-crab; 4 small crabs; few shrimp; ascidians; hydroids; sponge; 2 small shells.

Sta. 3650, August 21.—3 small flounders; 3 young Agonidæ; few shrimp; hydroids; ascidians; small shells, 3 species; 1 large anemone; 1 starfish; 2 ophiurans.

Sta. 3651, August 21.—2 Limanda, 1 tomcod; few young cod; 1 sea-urchin; 10 small crabs. Eleven hand lines were put over at this station; caught 2 Limanda.

Robben Island, August 21.—8 large and 12 small Hexagrammos asper; 1 Pleuronectes stellatus. The Russians had a few Atka mackerel, which they had caught before we landed.

Shana, Iturup Island, September 4.—7 whitefish; 2 large sculpin; 12 large flounders; 20 small flounders, 2 species; 25 large blennies, several species; 12 small blennies; 6 sticklebacks; 1 large Hexagrammos; 20 small; half bushel smelt, 1 species; 1 dozen Agonidæ; few pipefish; 1 large wolf-fish.

Sta. 3652, September 6.—2 large sculpin; 1 very small sculpin; 6 young cod; 1 small eel; 2 small flounders; few isopods; sand-dollars and shrimp.

Sta. 3653, September 6.—6 Agonidæ; 5 small sculpin; 6 small flounders; 1 small Liparis; half pint shrimp, 3 species; half bushel sand-dollars.

Sta. 3654, September 19.—2 gobies; 1 holothurian.

Sta. 3655, September 19.—1 Lepidopsetta; 1 holothurian; few dead clam shells.

Sta. 3656, September 19.—3 flounders; 1 Sebastodes; 1 Agonidæ; 6 blennies; 1 Scopelus; few starfish; crustaceans, half pint shells; few holothurians; ascidians and worms; 6 small squid; 50 small crabs, 6 species.

Sta. 3657, September 19.—1 flounder; 1 Sebastodes; 1 Tetraodon; 2 small squid; few shells, worms, ascidians, ophiurans, and starfish.

Sta. 3658, September 19.—Few shells; 1 holothurian; 2 ascidians; 1 small squid.

Sta. 3659, September 19.—4 flounders; 1 Sebastodes; 1 Tetraodon; 1 small squid; few worms; 2 large holothurians; few ascidians and shells.

Sta. 3660, September 19.—1 shell.

Hakodate Harbor, September 19.—100 small flounders, 3 species; 10 halfbeaks; 12 garfish; 100 small Tetraodon; 8 small mullet; 50 young Percalabrax; 10 Liparis; 1 Seriola; 1 large and 4 small Hemilepodotus; 1 Sebastodes; 2 blennies; few shrimp; 4 crabs. Besides these there were collected from the markets 26 different species of fish.

10.—*Record of animal life, drift, etc., observed at sea.*

ON PASSAGE FROM SEATTLE, WASHINGTON, TO DUTCH HARBOR, UNALASKA.

Date.	Meridian positions.		Mean temperature.		Fur seals.	Whales.	Auks.	Albatrosses.	Cormorants.	Guillemots.	Gulls.	Petrels.	Puffins.	Kelp.	Remarks.
	Lat. N.	Long. W.	Air, D. B.	Sea, surf.											
1896.	° ′ ″	° ′ ″													
July 1	53 47 00	158 09 00	48	46+	.....	Seven	.....	Several	.....	Few	.....	Many	Several	Little	Several logs.
2	53 30 00	164 17 00	44	44+	.....	Few	Several	Few	Several	Many	Many	Many	Many	Much	

FROM UNALASKA TO PRIBILOF ISLANDS VIA BOGOSLOF VOLCANO.

July 6	Dutch Harbor, Unalaska.		50	46+	.....	.....	.....	.....	.....	.....	Few	Few	Few	Much	
7	54 21 30	167 46 00	44	44	.....	Many	Many	Few	.....	Many	Many	Many	Many	Much	Off Bogoslof Volcano.
8	56 26 30	169 34 00	43	41+	Few	.....	Many	Few	Several	Many	Many	Many	Many	Much	Few ferns.

AT THE PRIBILOF ISLANDS.

July 9 to July 18.	.....	.....	.....	.....	Many	.....	Many	Many	Many	Many	Many	Many	Many	Much	Many seals in water near rookeries and few between St. Paul and St. George Islands.

FROM ST. PAUL, PRIBOLOF ISLANDS, TO DUTCH HARBOR, UNALASKA.

July 19	56 19 00	169 46 00	43	41+	Few	.....	.....	Few	.....	Many	Many	Many	Many	Much	
20	54 23 30	167 03 00	49+	45+	.....	.....	.....	.....	.....	Many	Several	Many	Many	Much	

FROM UNALASKA, ALASKA, TO COMMANDER ISLANDS, SIBERIAN COAST OF BERING SEA.

July 23	Dutch Harbor		51+	44+	.....	3 orca	Few	.....	.....	.....	Several	.....	Few	Much	Several blackfish.
24	54 24 15	169 08 30	45+	45	Two	Several	.....	.....	.....	Many	Several	Many	Several	Much	
25	54 46 30	174 14 00	46	45	.....	.....	.....	.....	.....	Many	.....	Many	Several	Much	Large log. Crossed 180th mer.
26	55 03 35	179 07 18	48	46+	.....	One orca	.....	.....	.....	.....	.....	Several	Several	Some	Several blackfish.

		East.																	
28	55 05 00	176 09 30	47	46					One		Few		Several	Several	Much				
29	55 02 20	No obs. long.	47	45+									Many	Several	Much				
30	54 45 45	168 53 30	46+	45+	Two		Many	Several	Few		Many	Many	Many	Many	Some	Call at Copper Island.			
31	55 11 30	165 44 30	49+	47+	Two	Three	Many	Several	Two		Many	Many	Many	Many	Much				

AT THE COMMANDER ISLANDS.

Aug. 1 to Aug. 8 inclusive.					Few		Many	Few	Many		Many	Many	Many	Many	Much	Small amount of driftwood. Few ducks, geese, snipe, sandpipers, and land birds.			

FROM BERING ISLAND, COMMANDER GROUP, TO PETROPAULSKI HARBOR, KAMCHATKA PENINSULA.

Aug. 9	55 22 15	165 44 45	51	48					One		Many	Several	Many	Many	Much				
10	54 42 30	162 55 00	55+	47+		Two orca		Many					Many						
11	52 59 00	159 54 50	59	53		Three		Several			Many	Many	Many	Many	Some	One curlew.			

FROM PETROPAULSKI, KAMCHATKA, PENINSULA, TO LOWER USHISHIR ISLAND, KURIL CHAIN.

Date.	Meridian positions.		Mean temperature.		Fur seals.	Whales.	Porpoises.	Auks.	Albatrosses.	Curlew.	Guillemots.	Gulls.	Petrels.	Puffins.	Kelp.	Remarks.
	Lat. N.	Long. E.	Air, D. B.	Sea, surf.												
1896.	° ′ ″	° ′ ″	°	°												
Aug. 19	Tareneki Harbor, Kamchatka.		56+	48					One		Many.	Many	Few	Many		
20	51 15 30	157 53 30	54	48					Few	One			Several.	Many		
21	49 30 00	155 21 00	48	43+	Six	4 orca			One				Several.	Several		
22	48 34 11	153 52 45	45+	41				Many		Few	Many.			Many		Many blackfish; many sea lions.
23	48 24 00	153 30 00	48	45+			Several	Few	Several	Few	Many.	Several.	Many	Many	Much	Few cormorants; many sea lions; little drift-wood.
24	47 35 00	152 48 30	45+	44+				Few					Several.		Much	

10.—*Record of animal life, drift, etc., observed at sea*—Continued.

FROM LOWER USHISHIR ISLAND, KURIL CHAIN, TO ROBBEN ISLAND, GULF OF PATIENCE.

Date.	Meridian positions.		Mean temperature.		Fur seals.	Whales.	Porpoises.	Auks.	Albatrosses.	Curlew.	Guillemots.	Gulls.	Petrels.	Puffins.	Kelp.	Remarks.
	Lat. N.	Long. E.	Air, D. B.	Sea surf.												
1896.	° ′ ″	° ′ ″	°	°												
Aug. 26	47 32 30	152 14 45	47+	46	.....	.....	Many...	Many.	.....	.....	Many.	Many...	Many...	Many...	Much...	Few terns; few land birds.
27	47 54 22	149 03 00	49+	51+	.....	One.	.....	.....	Several	.....	Many.	.....	Many...	Many...	Much...	
28	48 26 30	145 28 00	57	53+	.....	One.	.....	.....	Several	.....	.....	.....	Many...	.....	Much...	Little driftwood; many land birds.

FROM ROBBEN ISLAND, GULF OF PATIENCE, TO SHANA BAY, ITURUP ISLAND, KURIL CHAIN.

Sept. 1	Off Robben Island.		49+	51	.....	.....	.....	.....	.....	.....	.....	Several.	Many...	Several.	Much...	
2	48 46 07	144 00 17	54	51+	.....	Two.	.....	.....	Several.	.....	.....	.....	Several.	.....	.....	Few turnstones.
3	46 56 27	146 22 02	54+	55+	.....	Many...	.....	.....	Several.	.....	Few.	.....	Many...	Many...	.....	Few phalaropes; hawk.
4	45 31 30	147 32 30	52+	54+	.....	.....	Many.	.....	.....	.....	.....	Few.	Several.	.....	Some.	

FROM SHANA BAY, ITURUP ISLAND, KURIL CHAIN, TO HAKODATE HARBOR, YEZO ISLAND, JAPAN, VIA LA PEROUSE STRAIT.

Date.	Meridian positions.		Mean temperature.		Whales.	Porpoises.	Albatrosses.	Curlew.	Ducks.	Guillemots.	Gulls.	Petrels.	Puffins.	Flying fish.	Kelp.	Remarks.
	Lat. N.	Long. E.	Air, D. B.	Sea, surf.												
1896.	° ′ ″	° ′ ″	°	°												
Sept. 6	45 16 30	147 44 00	61+	55	Many...	Many...	Several	.....	.....	Few..	Many...	Many...	Many.	.....	Much.	
7	45 25 30	144 04 30	60	55+	Many....	Many...	Few....	Two..	Many.	.....	.....	Many...	.....	.....	Much.	Several sharks and blackfish; few land birds.
8	45 28 46	141 21 00	62	60+	.....	.....	Few....	.....	.....	.....	.....	.....	.....	.....	Some.	Many salmon jumping; few land birds.
9	42 53 38	139 54 00	69+	67–	.....	.....	.....	.....	Many.	.....	.....	Many...	.....	.....	.....	

FROM HAKODATE, YEZO ISLAND, TO YOKOHAMA HARBOR, NIPPON ISLAND, JAPAN.

Date.	Meridian positions.		Mean temperature.		Porpoises.	Albatrosses.	Gulls.	Petrels.	Flying fish.	Kelp.	Remarks.
	Lat. N.	Long. E.	Air, D. B.	Sea, surf.							
1896.	° ′ ″	° ′ ″	°	°							
Sept. 19	Hakodate Bay, Japan.		63	67	.....	.....	.....	.....	.....	Some ...	Few land birds; many ducks.
20	39 44 30	142 17 00	69	68	.....	Several	.....	Few	.....	Little...	
21	38 01 00	140 55 40	70+	72+	.....	Several	.....	.....	Several.	Some ...	Few snipe; few guillemots; much driftwood.

FROM YOKOHAMA, JAPAN, TO HONOLULU, HAWAIIAN ISLANDS.

Oct. 22	Off Honmoku, Gulf of Tokyo.		66	69+	.....	.....	Few	Few	.....	Much...	
23	34 57 00	143 25 30	68+	74+	Several.	Several.	.....	One.....	Several.	.....	
24	34 15 30	147 47 00	67	74	Many...	Many...	.....	One.....	One.....	.....	2 whales.
25	34 04 19	152 04 00	69	73+	Many...	Many...	.....	One.....	.....	.....	1 shark.
26	34 04 11	156 31 30	70+	73	.....	Many...	One.....	Several.	Many...	.....	
27	34 25 30	160 54 46	74	71+	Few	Many...	.....	Few ...	Many...	.....	Carcass of shark.
28	34 26 18	165 01 25	74+	71	Many...	Many...	.....	Few	.....	.....	
29	34 23 46	169 32 23	74	71	.....	Many...	.....	Few	.....	.....	1 whale.
30	34 21 45	174 18 15	75+	71	Many...	Many...	.....	Several.	Few	.....	Little Vellela; 1 tropic bird.
31	33 56 30	178 55 00 *West.*	69+	69	Many...	Many...	.....	Few	Few	.....	
31	33 09 00	177 31 00	68+	68+	.....	Many...	.....	Several.	.....	.....	Few tropic birds.
Nov. 1	32 28 00	174 21 15	66	68	.....	Many...	.....	Few	.....	.....	Large flocks sea birds in a. m. Large flocks small birds in p. m.
2	30 13 00	170 56 45	69+	70+	.....	Many...	.....	Few	Many...	.....	Many small birds.
3	28 00 47	167 41 14	74	74	.....	Many...	.....	Few	Many...	.....	One tropic bird.
4	26 29 00	164 19 00	78+	76	.....	Several.	.....	Few	Many...	.....	
5	24 54 00	160 50 00	78+	77	.....	Several.	One.....	Several.	Many...	.....	Three man-of-war birds.
6	23 02 30	159 01 30	76+	77	.....	.....	.....	Few	Many...	.....	
7	Entrance to Honolulu Harbor.		81	79	.....	.....	Few	Few	Many...	.....	

10.—*Record of animal life, drift, etc., observed at sea*—Continued.

FROM HONOLULU, HAWAIIAN ISLANDS, TO SAN FRANCISCO, CALIFORNIA.

Date.	Meridian positions.		Mean temperature.		Porpoises.	Albatrosses.	Cormorants.	Gulls.	Petrels.	Flying fish.	Kelp.	Remarks.
	Lat. N.	Long. E.	Air, D. B.	Sea, surf.								
1896.	° ′ ″	° ′ ″	°	°								
Nov. 30	21 21 00	157 28 00	80+	76	Several.	Several.	.....	.....	.....	Many.	.....	
Dec. 1	22 56 00	154 27 30	77	76	Several.	Several.	.....	.....	.....	Many.	.....	
2	24 33 10	151 19 15	75+	75	.....	Many	.....	.....	.....	Many	.....	
3	26 15 00	148 20 00	74+	73+	.....	Many	.....	.....	Few	Many	.....	One tropic bird.
4	27 47 00	145 37 00	72	72	.....	Many	.....	.....	Few	Many	.....	
5	29 17 20	143 03 25	70	69	.....	Several	.....	.....	Few	.....	.....	Considerable Velella.
6	30 26 00	140 09 00	68+	68	.....	Many	.....	.....	Few	.....	.....	
7	31 36 30	137 02 00	67+	66+	.....	Many	.....	.....	.....	.....	.....	Do.
8	32 53 00	133 32 00	66+	65	.....	Many	.....	.....	Few	.....	.....	Do.
9	34 01 25	130 00 12	67+	64	Few	Several	.....	.....	.....	.....	.....	
10	35 55 45	126 17 30	60+	57	.....	Several	.....	Many	Few	.....	Some	One diver, several guillemots, one shark, one whale, much driftwood.
11	Off Sausalito, California.		57	53	.....	.....	.....	.....	.....	.....	.....	

FROM SAUSALITO, SAN FRANCISCO BAY, TO SAN DIEGO BAY, CALIFORNIA.

Dec. 30	37 18 45	122 32 00	58	54	.....	Several.	Several.	Many	Many	.....	Some	Few guillemots.
31	35 03 00	121 11 00	62+	57	.....	Few	Several.	Many	Many	.....	Some	
1897.												
Jan. 1	33 02 00	117 45 00	61	58+	.....	.....	Many	Many	Several	.....	Much	Anchor in San Diego Bay.

OBSERVATIONS ON THE MULLET AND OYSTERS OF HAWAII.

The principal food of the native Hawaiians, like the Japanese, is fish, the waters around the islands containing many varieties, some in great numbers. The market in Honolulu is a large, substantial structure, paved, open on the sides, clean, and well kept. The sale of fish is under Government supervision, an inspector having charge of all fish delivered, which if not sold after they have been taken from the water a certain length of time are converted into fertilizer.

The Chinese largely conduct this industry, not only in the open waters, but in the private ponds, and their methods are similar to those in their native country. A few natives also are employed in fishing.

The mullet is the principal marketable fish, and those supplied are largely taken along the reefs; but another source of this species is from the ponds, and this affords the main supply during inclement weather.

The fish-ponds are nearly as old as the peopling of the islands, for even the traditions give no time when they were first built; but it is supposed by the best authorities that they date back at least 500 or 600 years, and before the advent of civilization were the source of meat supply in addition to the sea fishes, as these islands when discovered contained no mammals. Fish and poi (fermented paste from the root of the taro) were the diet of the ancient Hawaiians, and are very dear to the modern natives, as fish and rice are to the Japanese. These fish-ponds were very numerous on all the islands, but through disuse and neglect many have become silted up and are now marshes, while the walls have been destroyed in others by the progress of civilization and the ravages of nature and are now dry land. Still quite a number are in excellent condition and are used for raising mullet from the small fry. There are about a dozen of these ponds in the vicinity of Honolulu, ranging in size from 15 or 20 acres to 150 acres.

The site selected for the pond usually is in shallow water, where the configuration of the land is such as to reduce as much as possible the length of the wall to be built, and in localities visited by the spawning mullet. The Loko Hanaloa, on the Pearl Lochs, covers at least 150 acres, but the wall necessary to inclose this area is less than one-fourth of a mile in length. The walls are constructed of volcanic or coral rock and originally without gratings. Interstices in the wall formed by the loose rock allowed the tidal flow. Prior to the advent of the missionaries, when the government of the island was in the hands of the native chiefs and subchiefs, every native was obliged to contribute his labor for several days, at certain definite periods, to his chief, and tradition states that in building the walls lines of men were formed from the sea to the hillsides and the rock passed from hand to hand.

There is no artificial hatching of food-fishes on any of the Hawaiian Islands, nor has there ever been any, so far as could be learned, but the fry are driven or transported to these artificial ponds and there raised. When the mullet come into the shoaler waters to spawn, the young fry seek, instinctively, the protection of the shallowest water. In former

times the natives from their lookouts would discover the location of the schools of fry, and then in their canoes, or by wading, would drive the fry toward the pond walls, where they would escape through the interstices into the ponds. In this manner the ponds were stocked. It is probable that many again found their way to the sea, but a large part, no doubt, learned the protection the walls afforded against predatory fishes, and remained to grow up and fatten. At the present time the walls are filled up solid, but openings or gratings, protected by grated gates to prevent the entrance of the larger fishes, are left at intervals for the ingress and egress of the tide waters. In stocking the ponds the fry are caught in small nets of mosquito netting or other open woven fabric, placed in pails and tubs, and quickly transported to the ponds; some few are driven through the gratings with the entering tide. The mullet are the only fish intentionally introduced, but naturally by the methods employed a few other species enter, which generally are destructive to the young mullet, and are removed whenever it is possible to do so.

Pond mullet are considered the finest, and when sea mullet bring 10 cents a pound those from the ponds find ready purchasers at 13 cents. The pond mullet is the fish usually eaten raw by the natives; from 6,000 to 10,000 of them are marketed in Honolulu each week, besides those taken at sea.

OYSTERS.

That the oyster was a native of these waters and occurred in great numbers is evidenced by the numerous oyster-banks found in different localities now raised above the sea level and having an earthy covering. When visiting the fish-ponds on the Pearl Lochs, I examined the ancient oyster-banks on the eastern side of the middle loch, on the neck which joins Waipu with the mainland. The shore line here consists of a vertical bluff from 10 to 15 feet high, with a stratum of oyster shells 6 to 8 feet thick. This stratum is exposed on the loch face for at least half a mile, and it can be traced for a long distance across the peninsula. From specimens procured it seems that they closely resemble our own oyster of the Atlantic coast. These are not shell heaps, like those on our Southern coast and in other localities, but are entire, *in situ*, as both valves are usually in place and can be readily removed. They do not seem to occur in masses or clusters, but are large single oysters, in size resembling the better varieties of the marketable Chesapeake Bay oysters. It is possible that these oyster-banks were formed layer by layer, the upper ones smothering the lower, until through some natural cause the beds were covered with mud and afterwards lifted above the sea level. On this little peninsula, in two different places, I examined the remains of large numbers of the pearl oysters, which seem to have occurred in pockets among the other oysters. It is said that at present a few pearl oysters are found off Beckoning Point.

Upon invitation of Hon. John F. Colburn I visited his fish and oyster pond on Pearl Lochs. In reply to an inquiry requesting information

relating to his efforts in oyster-culture in Hawaii, Mr. Colburn wrote as follows:

In the month of October, 1893, I imported from Mr. M. B. Moraghan, of San Francisco, three cases of oysters for the purpose of planting. Two of the cases contained about 1,000 eastern transplanted, and one case contained about 3,000 of the native California. They were brought down on the steamship *Australia*, in the ice-house, and arrived in apparently good order. I at once had them removed to my pond at Manana Ewa, and planted in a depth ranging from 1 foot to 2 feet of water.

Some three months after I made a thorough search of different places where I had planted oysters, and found that the native California were all dead, and of the eastern transplanted about 50 per cent were still living, though considerably sunk into the soft mud at the bottom of the pond. I had these taken up and put down again, and some three months afterward I examined them again and found they had started to grow; the new shell forming was easily noticeable. I continued my practice of taking them up at different intervals of time until the early part of 1895, when I was so elated with the prospect of my success that I made arrangements with Mr. Moraghan to send me down more eastern transplanted, with two objects in view: (1) To have fresh eastern oysters to supply the oyster-eaters of our city, and (2) to have them answer for the purpose of seed for propagating.

I imported 38,614 from San Francisco by the steamship *Australia*, having them come in five different trips of the vessel. About two-thirds were brought down on the open deck in boxes, and were wet down every morning when decks were being washed down. The balance came in the ice-house. With the former way my loss was more in number, but the latter way was the most expensive. On deck I could get the oysters landed for about $10 a ton measurement, but through the ice-house the charges were 5 cents a pound for freight.

As fast as the oysters would arrive I would have them sent down to my pond and laid out. In a month or so afterwards they would get very thin and be unfit for the market. However, I allowed them to recuperate by getting acclimated to the conditions of my pond as well as to the food.

In the latter part of 1895 I discovered young oysters clinging to stones and dead oyster shells. I have watched them very carefully and at different intervals of this year I have found more young ones. Of course the young are not as many as I would like to see, still I trust that in time I will be able to boast of a bed of Hawaiian oysters reared from the seed of the American eastern oyster. From those I have imported I am in a position to furnish to those desiring oysters a mess of them fresh from the water. The last lot have been now about eighteen months in my pond and are in fine and fat condition, having grown twice their original size.

Fresh sea water empties into my fish-pond through gates and a large spring of fresh water also runs into it, thereby making the water a little brackish.

It will be seen that oyster-culture in Hawaii is of very modern date and in an experimental stage. There is scarcely any doubt that the waters are suitable for oyster-culture; the ancient beds and the experience of Mr. Colburn attest it, but further investigation is necessary to discover the proper conditions for a commercial enterprise.

I went over the oyster-beds with Mr. Colburn and we took from the water both transplanted oysters and those that had been propagated in the pond. When taken from the water they have a brownish appearance, which upon inspection proves to be a mossy growth on the shell. They are large, well rounded, and when opened beautiful in appearance and of good flavor. They are planted in a fish-pond which is stocked with mullet. The bottom is soft, and I believe covered with grass. The gratings for tidal access are very small.