1.—REPORT UPON THE INVESTIGATIONS OF THE U. S. FISH COMMISSION STEAMER ALBATROSS FOR THE YEAR ENDING JUNE 30, 1892.

By Lieut. Commander Z. L. TANNER, U. S. N., commanding.

CRUISE TO BERING SEA WITH THE U. S. BERING SEA COMMISSIONERS.

San Francisco to Bering Sea.—The *Albatross* was in dry dock at the Union Iron Works, San Francisco, Cal., at the close of the fiscal year ending June 30, 1891, for the purpose of cleaning and painting her bottom. The vessel had been in the water but five months, yet her service in the tropical waters of the Gulf of Panama and the region of the Galapagos resulted in a luxuriant growth of barnacles and grass, to which was added a coating of slime, bryozoa, and mussels accumulated while lying at Mare Island. The estimated weight of the accumulation was 17 tons, and the reduction of speed caused by it, about 1½ knots an hour. The bottom was painted with a coat of red lead, followed by one of white zinc, at her previous docking, a preparation which gave satisfaction in the cold waters of Bering Sea, but proved ineffective in the tropics. Inferior zinc may have contributed largely to this result.

A communication was received from the U. S. Commissioner of Fish and Fisheries, inclosing an order from the Navy Department, reducing the crew from 67 to 53 men on July 1, and taking from us some of our most important ratings. This reduction was ordered on account of the lack of men for manning the new ships of the Navy recently completed. After leaving the dry dock the bunkers were filled with coal, and, with the exception of an incomplete list of officers, the vessel was ready for her usual Bering Sea cruise on July 7. We proceeded to the navy-yard at Mare Island on the afternoon of the same day.

Assistant Paymaster C. S. Williams was relieved on the 2d of July by Assistant Paymaster John S. Carpenter. Paymaster Williams was attached to the *Albatross* nearly four years, performing the duties of disbursing agent for the Fish Commission in addition to those regularly devolving upon him as paymaster; and I avail myself of this opportunity of saying that the Fish Commission is under many obligations to him for the prompt and efficient manner in which he performed this duty. Personally I am greatly indebted to him for the cheerful alacrity with which he responded to every call without reference to the character of service required. He received his detachment on July 9.

The following telegram was received from the Commissioner on July 9:

President directs *Albatross* to carry agents of the Government to Seal Islands, Bering Sea, and remain with them during their investigation to continue all summer. You will arrange to carry out President's instructions. Fish Commission work will be given up unless you find opportunity to do something. Agents will meet you in San Francisco. Full details later.

Ensign H. B. Wilson, U. S. Navy, reported for duty on the 10th.

Learning from the public press that Prof. T. C. Mendenhall, superintendent of the U. S. Coast and Geodetic Survey, had been appointed commissioner, I met him by arrangement on his arrival in San Francisco and made all necessary preparations for the voyage. His colleague, Dr. C. Hart Merriam, had not arrived, but was expected at any time, and then they would be ready to sail.

Little remained to be done except to take on a further supply of fuel, mess stores, etc., and, returning to San Francisco on the 14th, final preparations were completed the next day, when the following telegram was received from the Commissioner:

T. C. Mendenhall and C. Hart Merriam have been designated as agents to visit Bering Sea. In accordance with President's directions you will receive them on board and carry out the instructions they may give you. All possible facilities for the conduct of their inquiries will be furnished by you.

The commissioners came on board at 5 p. m., July 16, when we immediately got under way and proceeded to sea en route to the Seal Islands, via Unalaska. It was desirable to reach our destination as soon as practicable, yet I deemed it advisable to start at moderate speed, with fires under one boiler only, as nearly all of the engineer's force were new to the ship, and strangers to each other. A heavy head sea was encountered during the first night and next day, but on the 18th the weather moderated, and everything was working so smoothly that fires were started under the second boiler, and the speed increased to 10½ and 11 knots per hour.

The weather was generally cloudy, with frequent mists and showers of rain, and light to moderate winds from northwest to southwest. Few birds were seen during the trip, mostly petrels and the brown albatross. A question arose as to whether the same birds followed the vessel day after day, and, to decide the point, one of the latter was taken and labeled; when released he deviated neither to the right nor left, but disappeared as quickly as his rapid flight would allow, and was never seen again. Whales were of almost daily occurrence, and porpoises were seen occasionally. No seals were observed, however, outside of Bering Sea.

The water was literally covered for hours at a time during the trip with velellas, medusæ, and floating barnacles, the latter in clusters from 1 to 6 inches in diameter, each individual being joined by its stem to a fleshy mass common to the colony. Many of these masses were opened and found to contain the skeleton of a velella. A piece of kelp

was seen on the 23d, 500 miles from the nearest of the Aleutian Islands, and the next day puffins, gulls, etc., began to appear. Occasional vessels were seen as we approached the land.

The volcano of Akutan was sighted early on the morning of the 25th, and at 3:45 p. m. the same day we dropped anchor in Iliuliuk, Unalaska, having made the trip from San Francisco in a little less than nine days. The steamer *Danube* having on board Sir George Baden-Powell and Dr. George M. Dawson, the British commissioners to Bering Sea, was found in port; she had arrived the same day.

The harbor presented a most animated appearance for a place so remote from the ordinary routes of commerce and travel. In addition to the vessel mentioned there were lying in the harbor H. B. M. S. *Nymphe*, *Pheasant*, and transport *Costa Rica;* the U. S. S. *Alert*, *Thetis*, revenue steamer *Rush*, and transport *Al Ki*. There were also the barks *Carrolton* and *Ferris S. Thompson* with coal; the Alaska Commercial Company's steamer *Dora* and schooner *Matthew Turner;* and the prize *La Nimfa*. The steamers *Lakme* and *Farallon* were lying in Dutch Harbor, about a mile distant.

Pribilof Islands.—The *Danube*, with the British commissioners on board, left for the Seal Islands at 10 a. m. on the 26th, and, after coaling, the *Albatross* followed at 6 a. m. on the 27th. We exchanged signals with the U. S. S. *Mohican* about noon, and heard a steamer's fog whistle about midnight, but did not see her. Seals were frequently encountered after crossing the 100-fathom line into shoaler water. They were seen singly as a rule, and there were seldom more than two or three in sight at a time.

Steaming through the night at low speed, in a thick fog, we made St. George Island at 8 a. m. the following morning, and anchored off the village two hours later.

The commissioners landed at 10 a. m. and returned at meridian, bringing with them Mr. J. Stanley-Brown, special Treasury agent, and Capt. A. W. Lavender, Treasury agent for St. George Island, for passage to St. Paul. Getting under way as soon as they arrived, we ran over to the latter island, and reached Village Cove at 5:45 p. m. during a dense fog. The *Danube*, with the British commissioner on board, was lying at anchor in the bay, having arrived about noon.

Mr. Tingle, agent of the North American Commercial Company, and Mr. Murray, U. S. Treasury agent, came on board and called on the U. S. commissioners. The time required in going to and from the ship, even under favorable conditions, and the uncertainty of communication at all times, induced the commissioners to take up their quarters ashore during their stay at the island, and they were landed the following day, July 29. There is no protected harbor on either island and anchorages are sought to leeward of projecting points, or under the lee of the island itself, to be changed with the shifting winds of that ever-varying climate. A well-found steamer may remain safely

at anchor long after communication with the shore has become impracticable; in fact, she might lay out many of the short summer gales, even with the wind blowing on-shore.

We were greatly entertained during the first night of our visit at St. Paul by the graceful antics of the seals which were constantly playing about the ship. They were greatly interested in the electric lights, and their efforts to obtain a nearer view of them through the side ports were persistent and very amusing. Numbers of them remained about the ship day and night watching every movement on deck or aloft, their particular delight, however, being the ship's boats, which they would escort to and from the vessel, playing about in the most graceful manner just clear of the oars.

I visited Lukannon rookery on the afternoon of the 29th in company with J. Stanley-Brown and the U. S. commissioners, and had an excellent opportunity of observing it carefully. The first impression of the novice is unbounded amazement at the seemingly endless numbers of seals (*Callorhinus ursinus*) covering the ground adjacent to the beach, yet further observation revealed the fact that only a small proportion of the original rookery was occupied. The grassy margins define unmistakably the extent of the rookery at successive periods.

I made no survey of the rookery, made no measurements whatever; yet, standing on Lukannon Hill, overlooking nearly every foot of its adjacent breeding and hauling grounds, a fairly good estimate could be made of the comparative area of the original rookery and the space occupied at present. The family relations were beginning to break up, the pups being several weeks old and many of the cows absent from the rookery seeking food; but the old bulls still occupied their harems with such of their females and young as they could keep about them.

The interval of time which has elapsed since the first indicated contraction of area was estimated at from seven to ten years; my own opinion, based upon the appearance of the grass which covered the surface, inclines to the shorter period.

The Treasury agent informed me on the evening of the 29th that a sealer had been at work off Northeast Point rookery for three days, his rifles being distinctly heard in the fog, and, in the absence of naval vessels or revenue cutters, he appealed to the *Albatross* to assist him to capture or warn the poacher off. We offered all practicable aid, as a matter of course, and, with the agent and a boat's crew from the village on board, we examined the region north and east of the island next day, but saw nothing of the vessel. We learned subsequently, however, that she was captured by the revenue cutter *Corwin* on the 28th of July and taken to Unalaska. Early in the morning of August 3 the United States and British commissioners, officers of the *Danube* and *Albatross*, and others, met on the village killing-ground to witness the killing of 120 young male seals, a part of the quota of 7,500 allowed for the subsistence of the natives.

The seal-killing over, we returned on board and got under way immediately for a dredging trip. Five hauls of the beam trawl were made off the south and west sides of the island, in depths ranging from 20 to 51 fathoms, bottom of fine gray or black sand and shells; a few pebbles were found at some stations, and a trace of black mud at others.

The general character of life was much the same in all of the hauls, and while but few individuals of each kind were taken, the variety of species was comparatively large. An exception should be made, however, in the case of starfishes and ophiurans, the former being quite plentiful, and the latter coming up by the bushel in most of the hauls.

The catch for the day may be summarized as follows: Small pollock (one specimen); young cod, tomcod, young sculpins, eels, *Lycodes* and *Agonidæ* (a few specimens each); flounders (*Limanda aspera*, few, and *Lepidopsetta bilineata*, one); crabs, hermit crabs, shrimps, prawns, and pycnogonids; annelids; mollusks of several species, including naked mollusks and a large *Trophon*; ascidians and bryozoans; holothurians, sea-urchins, starfishes, and ophiurans; medusæ, hydroids, and sponges.

Nothing was taken with the hand lines, though they were tried at several stations. The natives report that cod and halibut frequent the waters about the island during the winter and early spring, but the former become scarce soon after the seals arrive and only a few of the latter remain during the summer. Neither of these species is ever taken in large numbers. It is a well-known fact that feeding seals go farther and farther from the islands in search of food as the season advances, until in the latter part of July they reach the vicinity of the 100-fathom line south and west of the Pribilofs, from 50 to 100 miles and more from their rookeries.

After finishing the biological explorations for the day, several hydrographic soundings were made off the western extremity of the island, and an excellent anchorage for the night was found in 8 fathoms to the westward of Cross Hill, near Northeast Point. The revenue cutter *Rush* passed the night there also. A number of sea-lion skins were procured the next day for specimens, and in the afternoon we returned to our former anchorage at Village Cove.

On the morning of August 5 the U. S. commissioners, Prof. T. C. Mendenhall and Dr. C. Hart Merriam, came on board, accompanied by the British commissioners, Sir George Baden-Powell and Dr. George M. Dawson, with a stenographer and interpreter, to visit the Northeast Point rookery. They were landed on the east side of the point near Cross Hill, where they were joined by Mr. G. R. Tingle, general agent for the North American Commercial Company, Mr. J. C. Redpath, and Mr. Fowler, employés of the company, who acted as guides. Mr. Fowler was in charge of the rookery.

This rookery is the largest in the world, and the view from the summit of Hutchinson's Hill is simply astounding. Yet the evidences of diminution in numbers are unmistakable.

Returning to Village Cove, the *Albatross* remained at anchor until our final departure from the islands.

A hunting and fishing party was sent out on the 6th and returned with 3 halibut and 5 small codfish, the results of a hard day's work. One of the best native fishermen was employed as pilot, and having the steam cutter at their disposal they were able to change their ground as often as desirable; hence all conditions were favorable, and the catch was considered satisfactory for the time of year. The hunters secured a variety of birds from Otter Island, from which excellent specimens were prepared. They were all well-known species, however.

The *Danube*, with the British commissioners on board, left for Nunivak, St. Matthews Island, etc., during the morning.

British and United States men-of-war and revenue cutters were constantly coming and going, and there was seldom a day that one or more failed either to call or pass within signal distance.

At 9:45 a. m. August 9 the *Albatross* got under way, and with the U. S. commissioners and Mr. J. Stanley-Brown on board, steamed to St. George Island, arriving at 2:30 p. m. The gentlemen above mentioned and a number of officers landed and made a cursory examination of the rookery near the village, returning at 5:20 p. m. Mr. Stanley-Brown remained on the island. I had a casual glance only at one rookery at St. George, but here, as on St. Paul, there were unmistakable evidences of great reduction in numbers, a large portion of the original hauling-grounds being overgrown with grass.

The commissioners landed again at 8:30 the following morning, and returned at 10 a. m., when we took our final departure from the seal islands.

It was foggy during the day, with short intervals of clear weather. An occasional seal was seen until we reached the vicinity of the 100-fathom line, but none beyond that point.

Bogoslof Island.—We were under low speed during the night, and at 7 o'clock next morning hove-to off the volcano of Bogoslof and landed the commissioners. A party of officers and men visited the island also. We noted many changes since our visit the previous year. New Bogoslof was still active, smoke and steam escaping through numberless crevices throughout the whole mass from the water's edge to the summit. It was at least 100 feet lower and was otherwise changed in outline. What had been the rocky pinnacle was now lying in huge masses strewn down the steep incline, even to the surface of the sea, silent witnesses of great convulsions that had occurred during the previous winter.

The old and new volcanoes are about a mile apart, and were a year ago connected by a narrow isthmus but little above the level of the sea, composed of fine volcanic cinders. Now, however, there is an open passage through it several hundred feet in width near the new cone, the remainder of the spit extending from old Bogoslof having been

moved bodily to the westward with a broad sweep. A bar or middle ground was found a few hundred yards to the eastward of a line drawn between the cones. Wishing to anchor while the party was on shore, a boat was sent ahead sounding into the bight midway between the old and new peaks. Good anchorage being reported, with nothing less than 20 fathoms until near the spit, we started ahead slowly, the first sounding 20 fathoms and the next 9 feet, the vessel having moved less than twice her length. Of course the bow was aground, but we backed off without damage or delay. The boat had crossed the bank before commencing to sound. The beaches, the bank above mentioned, and the isthmus formerly connecting the two cones are composed of fine cinders, ashes, etc., lighter than sand or gravel, and are in consequence washed back and forth with every heavy gale.

Myriads of guillemots covered the rugged cliffs of the active volcano, as well as the extinct cone, and huge flocks were constantly coming and going in their usual active, bustling manner, their curiosity being evinced frequently by hundreds or thousands deviating from their course and circling around the vessel several times as closely as they considered prudent, observing us with apparent interest.

A sea-lion rookery referred to in former reports, near the base of old Bogoslof, was occupied as usual. This colony is notable for the unusual size of some of the old bulls. They seemed quite tame, permitting several of the shore party to approach close to them before showing signs of fear. Their location being remote from the usual routes in Bering Sea, they are seldom disturbed, and the few that have been killed were taken by officers of the Alaska Commercial Company, who never wantonly destroy or disturb these, to them, useful animals.

Bogoslof Island to Puget Sound.—The party returned from shore a few minutes after noon, when we started for Unalaska. The afternoon was clear, and the snow-capped peak of Makushin volcano was visible even from Bogoslof, and as we approached the rugged shores of Unalaska the peak of Akutan became visible while Bogoslof was still in sight, thus affording the unusual view of three active volcanoes at the same time.

We hove-to off Cape Cheerful and put the cod lines over, but the trial was unsuccessful. Probably it was too late. Our experience in Bering Sea has been that codfish usually cease to bite about sunset. A few scattering specimens were taken at all hours of the night when the vessel was at anchor on fishing-grounds, but never in paying numbers. After a delay of 10 minutes we steamed ahead and arrived at Iliuliuk at 8:10 p. m.

The revenue-cutters *Rush* and *Corwin* came in and anchored a few minutes later.

We went to the coal wharf the following morning, and at 12:05 p. m. August 13 finished coaling. The U. S. S. *Alert* arrived during the morning. Mail was received from the vessels in the harbor as well as

from shore, and at 12:25 p. m. the lines were cast off from the wharf and we proceeded to sea. Fires were lighted under one boiler only, which gave the vessel a speed of 9 knots per hour. Entering the Pacific through Unalga Pass, a course was laid for the north end of Vancouver Island. The sea being smooth and the weather unusually clear, our last view of the Aleutian Chain had little in it to remind us of our high latitude except the snow-capped peaks of Akutan and Shishaldin.

Fires were started in the second boiler on the 14th, and the revolutions gradually increased until at noon of the 16th we were making ordinary full speed. Cape St. James was sighted at 11:55 a. m. on the 19th; passed the Triangles the same evening and entered Goletas Channel at 2:50 a. m. on the 20th. We experienced light to moderate winds from NE. to NW., with pleasant weather as a rule, although it was occasionally overcast and squally. Whales were seen nearly every day, and the usual birds of those latitudes accompanied the ship from land to land.

Steaming through Goletas Channel, we soon entered the broad estuary of Queen Charlotte Sound, passed through Broughton Straits, and at 8:20 a. m. came to in Alert Bay, British Columbia. The commissioners visited the cannery and Indian village, and the naturalists busied themselves making collections of native hunting and fishing implements for the Columbian Exhibition.

Continuing our course after a delay of an hour and a half, we threaded the narrow channels of Johnstone Straits and Seymour Narrows to the Gulf of Georgia, finally anchoring in Departure Bay at 1:22 a. m., August 21. Going to the wharf at 9 a. m., 91 tons of coal were taken on board, and at 5:15 p. m. we steamed away again to the southward. Entering Active Pass at 9:12, its narrow sinuous channel was followed without difficulty or delay, notwithstanding the night was dark and the atmosphere thick with smoke. Our course led us through Swanson Channel, the Straits of Haro, and across the Straits of Fuca to Port Townsend, where we arrived at 2:40 a. m. the following morning.

We carry no pilot, and in navigating the tortuous inland passages of this region it is our usual practice to run during daylight only. The departure from this custom during the trip was occasioned by the anxiety of the commissioners to reach their destination as soon as practicable. The detention at Port Townsend was for the purpose of procuring mail which had accumulated during the trip; having received it, we left at 10:35 a. m. for Tacoma, arriving at 4:40 p. m., when the commissioners, Prof. Mendenhall and Dr. Merriam, took their final departure.

Mr. Ivan Petroff, special census agent for Alaska, was found in Iliuliuk on our return from the Seal Islands, August 11, anxiously awaiting transportation to the southward, his work in northern regions having been completed. As the *Albatross* was the first departure, he requested passage, which was of course granted, and he immediately

took up his quarters on board. He brought with him a one-man kayak made by the natives of Nunivak, which he donated to the Fish Commission exhibit at the World's Columbian Exposition.

The following is a brief summary of the movements of the *Albatross* while employed in transporting the United States commissioners to the Seal Islands, Bering Sea, and return:

July 16. Left San Francisco for Unalaska.
July 25. Arrive at Unalaska.
July 27. Left Unalaska for Seal Islands.
July 28. Arrived at St. Paul Island via St. George.
Aug. 9. Left St. Paul and arrived at St. George Island.
Aug. 10. Left St. George Island,
Aug. 11. Arrived at Unalaska via Bogoslof Volcano.
Aug. 13. Left Unalaska.
Aug. 20. Arrived at Alert Bay, British Columbia.
Aug. 21. Arrived at Departure Bay, British Columbia; took coal.
Aug. 22. Arrived at Tacoma, Wash., via Port Townsend.

No. of days on the voyage, 37; total distance made under steam (in knots), 4,686.

The cruise was made without accident resulting in delay, damage or loss of any kind.

INVESTIGATIONS ON THE COAST OF WASHINGTON.

Orders were received at Port Townsend on August 25 to explore the waters of the Straits of Fuca, and later to extend the work to Hood Canal.

A number of articles collected in Bering Sea for the Columbian Exposition were shipped to Washington on the morning of the 27th, and at 11:40 a. m. we got under way and steamed into the straits.

Commencing off New Dungeness, the beam-trawl was cast at 97 fathoms, and a line consisting of 4 stations occupied from that point to the vicinity of Race Rocks, the depths ranging from 80 to 100 fathoms. The bottom was mostly muddy, with a few pebbles; rocky bottom was found at one station in 100 fathoms. The results of the hauls may be stated in a general way as follows: Among the fishes were a few flounders (*Microstomus pacificus*), 4 species of small fishes, ratfish (*Chimæra collici*), alligator-fish, *Liparis*, etc. The list of invertebrates included 6 species of prawns, shrimps, crabs, sea-urchins, naked mollusks, worms and tubes, pectens, and several species of small shells. Two species of brachiopods were found in great numbers, and were a marked feature of the hauls. Hydroids, cup corals, pycnogonids, starfishes, ascidians, and sponges were found in each haul.

The surface net found the waters almost barren of life, a few small crustaceans being all that were found during daylight. After dark medusæ came to the surface, and a half bushel or more were taken at each haul.

Anchorage for the night was found at 11:50 p. m. in Neah Bay. Work was resumed on the morning of the 28th, by setting two cod and two halibut trawl lines in from 80 to 100 fathoms, off Neah Bay. Hand

lines were put over, but the current was too strong to admit of their being used successfully. The trawls was out but a few minutes when the buoys disappeared, one by one, beneath the surface, and we never saw them again.

Our investigations for the remainder of the day were confined to the beam trawl, while a new set of lines was being prepared. Six stations were occupied in from 98 to 151 fathoms, between Neah Bay and Cape Flattery, on rocky bottom. The results were satisfactory, but the wear and tear on trawl nets was unprecedented. The weather was excellent for that stormy region and the sea unusually smooth, yet strong and erratic currents swept the ship about in the most extraordinary manner, largely increasing the losses incident to rocky bottoms. A marked change in the character of the fauna was observed, deep-sea types occupying a more prominent position. The following forms were noted among the fishes: A single specimen of the true cod (*Gadus morrhua*) was found in one of the hauls, the first taken by the *Albatross* south of Alaska. The flounders were represented by *Microstomus pacificus*, *Glyptocephalus zachirus*, and *Atheresthes stomias*. The former were abundant and averaged 3 pounds in weight. It is an excellent fish, and is sometimes called the deep-sea sole, as is also the *Glyptocephalus*. A few of the following were scattered through the hauls: ratfish (*Chimæra*), dogfish, skate, *Sebastodes*, *Sebastolobus*, *Myctophum*, and *Liparis*.

The invertebrates were represented by prawns, shrimps, crabs, hermit-crabs, pycnogonids, brachiopods, and other shells, sea-urchins, starfishes, sponges, worms, and a single small squid.

Anchorage for the night was found in Neah Bay.

We were under way again at daylight on the 29th (August), and, steaming to a promising locality in the straits, one cod and one halibut trawl line were set in 140 fathoms, gravel bottom. Heavy grapnels were used for mooring each end of the lines, and double buoys were attached to the buoy ropes. Mr. A. B. Alexander, fishery expert, was so confident that his gear was sufficiently strong for the purpose, that the ship took up other work pending the hauling of the trawls; but it was not long before one of the buoys disappeared. The other end was secured by a boat and 100 hooks recovered, from which were taken 3 black-cod. The largest weighed 28 pounds and was 51 inches long.

Another trawl line was set at 12:30 p. m. in 125 fathoms, rocky bottom, boats being used as buoys, and we succeeded in recovering the gear, taking 14 black-cod averaging 12½ pounds in weight, sufficient evidence, our expert thought, of the presence of this excellent fish in the waters of the straits.

Two hauls of the trawl were made during the day, adding a few antedons and astrophytons to our list of specimens. It was foggy most of the day, sometimes very thick, otherwise the weather was favorable. At 10:45 p. m. we came to for the night in Royal Roads, off Esquimalt, B. C.

Our supply of trawl anchors, buoys, etc., having been expended, a sufficient number were procured in Victoria and we returned to Neah Bay on the morning of the 31st, prepared to make another attempt at trawl-line fishing in the Straits of Fuca.

Work was resumed at daylight September 1, and four sets of the trawl line were made between Neah Bay and the Vancouver shore. A few black-cod, red rockfish, and dogfish were taken. In one set the currents were so strong that nearly all the hooks were stripped of bait.

Four hauls of the beam trawl were made and the list of specimens enlarged by a fine cultus-cod weighing 29 pounds, several crinoids, isopods, and ophiurans.

We passed the night in Neah Bay, commencing work again at daylight on the 2d. Four sets of the trawl line and four hauls of the beam trawl were made between Neah Bay and Pillar Point, where we anchored for the night. The depths ranged from 53 to 123 fathoms, with sandy bottom at three stations, and rocky at the fourth, yet there was nothing taken on the trawl lines except a few dogfish. We did better with the beam trawl, however, and added to our list a young halibut (*Hippoglossoides*), several specimens of *Parophrys vetulus* and *Citharichthys sordidus*, a dozen young cod, and many crinoids.

Three sets of the trawl line and one haul of the beam trawl were made on September 3 in from 64 to 95 fathoms, sand or rocky bottom, between Pillar Point and Port Angeles. A few dogfish were the only results from the trawl lines, and there was nothing new among the specimens taken with the beam trawl.

Anchoring in Port Angeles at 4:20 p. m., a haul of the seine was made in which were taken flounders, perch, butter-fish, rock-crabs, sculpins, etc. Another haul of the seine was made early next morning, in which were taken flounders, herring, butter-fish, sculpins, and a single salmon trout.

Getting under way at 9:20 a. m., a series of hand-line stations were occupied running diagonally across the straits to the vicinity of Victoria, in which nothing at all was taken. These trials were made to demonstrate the practicability of that method of fishing in the upper part of the straits, but the currents were so strong that it was quite impossible to keep the lines on or near the bottom except close to land. Four hauls were made with the beam trawl, three of them quite successful, although nothing new was found.

We have demonstrated the existence of several species of sea fishes in the open waters of the Straits of Fuca, and have also shown the impracticability of taking them in paying quantities by the usual methods. Should the black-cod ever take the place it deserves in the market, means will doubtless be devised for its capture, even in the straits. In the vicinity of Cape Flattery the currents reach the bottom with strong scouring effect, and the state of tides on the surface is no indication of their condition at the bottom. A heavy confused swell

will also be encountered, even in the calmest weather. Of course, this soon becomes modified after passing up the straits.

After finishing work for the day we steamed into Esquimalt, anchoring at 5:10 p. m. Official visits were exchanged with Admiral Hotham, R. N., the captain of H. B. M. flagship *Warspite*, and the dock-yard officials. The U. S. Coast Survey steamer *McArthur* was at anchor in the harbor, and H. B. M. S. *Garnet* arrived on the 6th; official visits were exchanged.

SURVEY FOR A CABLE ROUTE BETWEEN CALIFORNIA AND THE HAWAIIAN ISLANDS.

Preparations for the survey.—On the evening of September 5, I was informed by telegraph that the Navy Department desired to have the *Albatross* make the survey for a cable route between San Francisco and Honolulu, for which a special provision had been made by Congress, and that it was important to begin the same as soon as possible. Reply was made that the ship was in condition to make the survey and could commence the work two weeks after arriving at San Francisco. On September 9 we went to Departure Bay for the purpose of coaling, where, the following day, we received orders to proceed at once to San Francisco.

Having finished coaling at 3 p. m., we left immediately for Port Townsend, and thence to San Francisco, arriving at the navy-yard, Mare Island, on the morning of the 15th, and reporting by telegraph. There were no instructions waiting us, and nothing further was heard concerning the survey until the 19th, when the following letter was received from Commodore F. M. Ramsay, Chief of the Bureau of Navigation, Navy Department, dated Washington, D. C., September 12, 1891:

The Department has been informed that the *Albatross* will be placed under its orders for the purpose of sounding out a route for the proposed telegraph cable between San Francisco and Honolulu. The Bureau desires to know what you will need for the work and about what time the vessel will be ready. Arrangements have been already made to supply you with wire, but there may be some delay in its being delivered.

The following reply was made by telegraph on September 19:

Letter of 12th received; will need wire, sinkers, cylinders, spare reel, additional coal-bunker, docking and painting bottom. Time, 15 working days, following our usual methods. Letter by mail.

The following telegram from the Acting Commissioner of Fisheries, dated September 18, was received on the 19th:

In compliance with request of Secretary of Navy the *Albatross* is hereby placed under his directions for making an ocean survey for telegraphic cable between San Francisco and Honolulu. You will report to the Navy Department the receipt of these instructions.

The following message was accordingly sent to the Secretary of the Navy on the same day:

Have received telegram from United States Commissioner of Fish and Fisheries placing *Albatross* under your directions for surveying telegraphic route from San Francisco to Honolulu. Will wait your orders. Letter by mail.

Letters were written the same day to the Secretary of the Navy, Commissioner of Fish and Fisheries, and the Chief of the Bureau of Navigation, the latter as follows:

Your communication of September 12, with reference to the *Albatross* having been placed under the Department's orders for the purpose of sounding out a route for the proposed telegraphic cable between San Francisco and Honolulu, is received. I wired you this morning in relation to the matter as follows:

"Letter of 12th received. Will need wire, sinkers, cylinders, spare-reel, additional coal-bunker, docking, and painting bottom. Time, 15 working days, following our usual methods. Letter by mail."

The sinkers, sounding-cylinders, spare reel, etc., can be procured from the yard. The additional bunker will increase our coal capacity about 40 tons. The docking and painting can probably be done at the yard; if not, I can do it at San Francisco without delay, although the expense will be greater. Our sounding-machine is now placed forward, and the wire is held vertically after sounding, until it is all reeled up, as in our work other operations prevent steaming ahead while the wire is coming in. We purpose to put the machine on the stern in such a position that we can start ahead as soon as the sinker reaches the bottom, thus gaining a mile or more on every sounding.

The estimate of 15 days to prepare the ship for the work is, as stated in the message, on the supposition that we will follow our usual methods, which enable us to procure everything required promptly without the routine of requisitions. I can give no estimate of the time which would be required to do the work under the ordinary navy-yard methods.

It would facilitate preparations very much if I had a general idea of the proposed scheme of the work.

A word of explanation may not be out of place regarding the references in the foregoing letter to "our usual methods" and "the ordinary navy-yard methods." In refitting, small articles will be required from time to time as the work progresses, and it has been our custom to procure them at once by open purchase without the delay incident to the making of requisitions, sending out proposals, and getting competitive bids. On the other hand, the navy-yard methods are controlled by the necessity of following the indicated routine, with the frequent and uncertain delays attending it; hence the difficulty of estimating the time required to complete a job with any degree of accuracy.

On September 21, Rear-Admiral John Irwin, commandant of the navy-yard, received the following telegram, a copy of which he forwarded to me.

Fit out *Albatross* for sounding between San Francisco and Honolulu.

F. M. RAMSAY,
Acting Secretary Navy.

I received instructions at the same time to make requisitions on the navy-yard for everything needed for the survey. The work of preparation was pushed forward as fast as possible. The vessel was docked the following day, September 22, and her bottom cleaned and painted, work on needed changes and repairs proceeding at the same time. Everything required for the survey, except wire, was furnished from the navy-yard or purchased at San Francisco.

On September 24 I wired the hydrographer asking the scheme of survey, intervals, and route, and the same day received the following reply:

Shortest practicable route probably just north of *Tuscarora's* route. Intervals of 10 and 2 miles; temperatures to be taken; letter explanations has been written.

Having received no definite instructions regarding the survey, the following letter was written to the chief of the Bureau of Navigation for the double purpose of giving the Department the benefit of such local knowledge as I had on the subject, and to avoid delay.

I have the honor to inform you that the *Albatross* will be ready to commence work on the cable survey in a few days. It may perhaps be advisable for me to acquaint you of the knowledge I already possess in this line. With reference to a practicable landing for the cable on the coast of California: A glance at Coast Survey chart 675 will show 100 fathoms within 1½ miles of Salinas Landing, Monterey Bay, and over 50 fathoms half a mile from land. From this point seaward extends a constantly widening gully in a southwesterly direction, in which the depths increase rapidly with a bottom of soft mud. I have, in connection with our regular work, run a line of soundings from the shore to 900 fathoms without change in the character of the bottom. There is no other place on this coast in the vicinity of San Francisco that a cable could be landed without passing over a greater or less extent of ground where vessels may anchor; neither is there any other place where so soft a bottom can be found. If the slope from the 900 to the 2,000 fathom curve proves as free from obstructions as I have reason to expect, Monterey Bay will be the best possible place to land the cable, as there would be less than a mile of the shore-end liable to damage from vessels' anchors, and thence to deep water it would rest securely in a soft bed of mud. In our operations along the California coast, we have frequently found the slope from the shore platform to the ocean-bed dotted with outcroppings of rock sharp enough to endanger the safety of any submarine cable. This was noticeably so to the southward of the Farallones, where the lead usually indicated sand bottom; but in hauling the trawl, the net often came in contact with these sharp projections.

In commencing the survey on the California coast we will be liable to meet with delay from coast fogs, boisterous weather, etc.; therefore, I think it will be advisable to complete that portion of the line, watching for a favorable opportunity if necessary, carrying it as far offshore as convenient, then return to San Francisco and fill up with coal. We can then take up the line and carry it to the islands if we meet with no expected delays; I count on the usual gales incident to the season.

The route I recommend, providing it starts from Monterey Bay, is practically a great circle to the east end of Oahu, passing about 40 miles to the northward of the *Tuscarora's* submarine mountain, and between the soundings of 2792 and 2711 shown on H. O. chart 527.

I suppose you will send us large scale projections on which to plot our soundings. It will be a great convenience, particularly if we find it necessary to run traverses in searching for a practicable route. We have received no instructions yet, but suppose they are en route. A telegram from the acting hydrographer gave us some information as to intervals of soundings. We have everything necessary for the commencement of the work within reach and expect to leave San Francisco to locate the shore-end on the 5th or 6th of October. If anything is lacking at that time we can pick it up on our return for coal.

The following instructions for the cable survey were received October 1, 1891:

BUREAU OF NAVIGATION, NAVY DEPARTMENT,
Washington, September 22, 1891.

SIR: When fully prepared for work, you will proceed with the vessel under your command to take deep-sea soundings between San Francisco, Cal., and Honolulu, Hawaiian Islands, with a view to determining a suitable route for a submarine cable between these ports. Soundings taken at alternate intervals of 10 and 2 miles will be sufficient to demonstrate any irregularity of bottom. It may not be necessary, however, to confine yourself to these distances; I merely give them as being such as will insure with certainty the proper development. Should any unusual rise in the bottom occur, it will, of course, need close examination to determine a feasible route.

You will please keep a complete record of all resulting data for transmission to the Department at the completion of the work, and will record upon appropriate forms the latitude, longitude, depth, nature of bottom, with frequent surface and bottom temperatures, and occasional serial temperatures.

The books and papers for the records will be furnished you from the Hydrographic Office, with a sheet showing the soundings taken by the *Tuscarora* in 1875, from which it appears that the desirable route is likely to be just to the northward of this line.

By direction of the Secretary of the Navy.

Very respectfully,

F. M. RAMSAY,
Chief of Bureau.

Lieut. Commander Z. L. TANNER, U. S. N.,
Commanding U. S. F. C. S. Albatross.

The vessel was ready October 3, with the exception of a supply of wire, books, etc., which were to be furnished by the Hydrographic Office. We waited for them until the 5th, then went to San Francisco and coaled. The following telegram was received on the 6th from the Chief of the Bureau of Navigation:

Method of survey proposed letter September 27 approved.

Monterey Bay to the Hawaiian Islands.—Messrs. C. H. Townsend, naturalist, and A. B. Alexander, fishery expert, were assigned to temporary duty on shore. We finished coaling on the 8th, having taken on board 171¾ tons. Proceeding to sea at daylight the following morning, we arrived off Santa Cruz at 2:50 p. m., and swung ship under steam, observing azimuths on every point to determine the errors of compass, finally anchoring off the town for the night. A dense fog obscured the sun during the forenoon of the 10th, but passed off at 2 p. m., when we swung ship for heeling error, first with a starboard list of 6° to 7½°, then with a like inclination to port, bearings being taken on the cardinal points. The results were widely different from previous observations, but they seemed reliable. The maximum heeling error did not exceed one-quarter of a point.

The first sounding of the survey was made at 9:45 a. m. on the 11th of October in 52 fathoms, 2½ cables W. ½ N. (mag.) from the head of Salinas Pier, a wooden pile structure about 150 yards in length; thence to the beach a line of soundings was run by boat. Taking a southwesterly course, following the submarine gully before mentioned, the

depth increased to 165 fathoms at 3 miles, and 618 fathoms at 11 miles, soundings having been taken at 1 mile intervals. Extending the line 17 miles with increasing intervals of 2, 3, and 4 miles, the depths increased to 868 fathoms, the character of bottom remaining the same, thus insuring a secure bed of soft mud in which a cable would soon sink beyond all its enemies.

From the above position, 28 miles from the initial station, an approximate great-circle course was taken, depths increasing uniformly to the normal ocean bed in 2,500 fathoms, and reaching a depth of 2,895 fathoms in latitude 33° 12′ north, bottom of brown ooze. Mud took the place of ooze at the last station, and an interval of 8 miles showed 225 fathoms less water, with small fragments of lava intermixed with the mud. The bottom soils from every station were submitted to microscopic examination, and the first warning of marked elevations of the ocean bed were almost invariably discovered by this means.

Uniform or slightly increasing depths continued for 50 miles followed by a gradual ascent, until in latitude 32° 44′ north we found ourselves on the summit of an elevation having 2,014 fathoms of water. The angles were so small and regular that the shoaling could not be considered as an obstruction, but an abrupt descent of 392 fathoms in the next 2 miles might be considered in that light. Traces of lava soon disappeared, but mud extended 12 miles from the summit, and was then replaced by brown ooze, which, with normal depths, extended to latitude 31° 43′ north. Here the line was dropped and we returned to Monterey Bay for the purpose of further developing the submarine canyon extending seaward from Salinas Landing, which, for convenience, will hereafter be referred to as the "cable trough." It was thought that more uniform depths might possibly be found by bearing slightly to the westward of the first line, but there was little choice between them. Having completed the examination, we returned to San Francisco, reaching port October 24.

The meteorological conditions, while unfavorable for the prosecution of the survey, were not unusual for the season of the year. Fogs prevailed some portion of each day in the vicinity of the land; strong coast winds with hazy, cloudy weather, extended 100 miles or more offshore; cloudy weather was the rule, and a southeast gale with heavy seas and drenching rain was encountered during the last two days the vessel was engaged on the line.

The preliminary trip developed a few weak points which were remedied in a couple of days, and the remainder of the outfit, completed during our absence, was taken on board. The 2,000 pounds of sounding wire contracted for by the Navy Department for the survey had not arrived. We waited for it until October 31; then with 160 pounds procured from the storehouse, 100 pounds from the *Thetis*, and a similar amount belonging to this vessel we left the navy-yard, took on board 190

tons of coal at San Francisco, and sailed November 4, for the further prosecution of the survey. Arrangements were made with the commandant of the navy-yard, Mare Island, to forward 400 pounds of wire to Honolulu as soon as practicable. Mr. C. H. Townsend, resident naturalist, returned on board, from special duty ashore.

The preliminary line passed about 40 miles north of the Belknap Rise, a huge submarine mountain, 14,000 feet above the ocean bed, yet no sign of it appeared either in depth, contour, or character of bottom.

The experience of the *Albatross*, following that of the *Tuscarora*, warned us of our approach to a region abounding in elevations and depressions of frequent occurrence, making it advisable to examine a wider area. With this object in view, and to avoid the elevation encountered on the preliminary trip, a parallel line was run from latitude 33° 7′ north, from 6 to 8 miles to the southward of it for about 200 miles. The elevation was avoided, and normal conditions continued to 31° 54′ north, where a depression was encountered having a maximum depth of 3,186 fathoms, and extending about 70 miles in a southwesterly direction. From 2,500 to 2,700 fathoms continued thence to 29° 11′ north, where another elevation occurred having a depth of 2,085 fathoms. The bottom specimen at this station contained a few grains of sand, minute quartz crystals, which were apparent only under the microscope. The normal depth was soon reached, and for 700 miles the average was about 2,900 fathoms, the maximum exceeding 3,000 fathoms. The bottom was, with few exceptions, composed of brown ooze, but traces of lava were found at three stations and sand at two.

In latitude 23° 14′ 30″ north, 200 miles from the east end of Oahu Island, was found the most important elevation in the line; from a base of 300 miles in diameter the depths gradually decreased from 2,839 to 1,256 fathoms. Approaching the island, a depression was crossed 60 miles from land, having a depth of 2,878 fathoms, mud bottom, all traces of foraminiferous ooze having disappeared at a distance of 100 miles from the nearest point of Oahu.

The shore platform was reached in 570 fathoms 20 miles from land, after a steep ascent from the normal ocean bed. From 300 to 400 fathoms, with smooth sand bottom, was carried through the Kaiwi Channel between Molokai and Oahu, but from the shore line to about 200 fathoms frequent coral lumps were found scattered over the sandy bottom.

Survey about the Hawaiian Islands.—We reached Honolulu at 12:30 p. m. November 21, and moored head and stern in the usual manner. The U. S. S. *Pensacola* was lying in port on our arrival. Slight repairs to machinery and sounding apparatus were made and reports of progress prepared. On December 1 a package of wire, 253 pounds gross weight, was received by steamer from San Francisco. It was the first of the new wire to reach us, and was received with no little pleasure, as it insured us an ample supply for the completion of the work. The hydrographic office blanks, before referred to, for plotting the data of the survey, were also received by the same steamer.

The order for a cable survey contemplated a single line, but our experience convinced me of the advisability of further development of the route, and on November 24 I wrote the hydrographer as follows:

Have finished the great-circle route, with the exception of the shore landing on Oahu. While it may be considered practicable, I do not feel that any single line will be wholly satisfactory, and will, therefore, as soon as possible, extend the second route on a rhumb line, which will be about as far to the southward of the *Tuscarora's* line as the great circle is to the northward of it. I don't know that it will be any better than the one we have already examined, but it will give us two surveys and a reconnoissance on practically parallel lines.

At 10:50 a. m., December 2, we left port to locate a cable landing on the east or south side of Oahu. Four of the most promising points were examined, as follows: Hanauma Bay, Mauna Loa Bay, Kapua Entrance, and Waikiki Bay. The latter lies about 3 miles from Honolulu, and all things considered seems the best, though Kapua Entrance or Mauna Loa Bay affords practicable landings.

A second line was run from Kaiwi Channel to an intersection with the great circle in latitude 21° 47′ north, practically completing that line, and defining another contour line from the shore platform to the ocean bed, about 10 miles south and west of the first one.

The currents in the vicinity of the islands are strong and erratic, frequently attaining a velocity of 4 to 6 miles per hour on the eastern shores of Oahu, and often reaching the bottom with scouring effect. In Kaiwi Channel there is sufficient drift to prevent the deposit of mud, yet not enough to hinder the growth of various delicate forms, which we found in large numbers.

A critical examination of the bottom was made in Kaiwi Channel and near the points selected for cable landings with beam trawl and tangles, to determine more definitely the character of bottom and its fauna, having special reference to the existence of coral lumps and such forms as might be destructive to a submarine cable. The general results of these few hauls may be briefly stated as follows:

Dredging station 3467: 6 specimens of *Macruri*, 2 chimæras, 2 starfishes, 3 shells, 1 sea-urchin, 1 brisinga, 2 ascidians, 1 *Pentacheles*, 2 alcyonarians, 1 gorgonian.

Dredging station 3468: 2 small fishes, 5 sea-urchins, a few crabs, little coral, 3 ophiurans, much bryozoa.

Dredging station 3469: 1 starfish, 2 shells, much coral, little bryozoa, little algæ.

Dredging station 3470: many small fishes, 1 large fish, few starfish, 1 octopus, many prawns, 1 squid.

Dredging station 3471: many small fishes, 12 prawns, 1 holothurian, 1 pennatula.

Dredging station 3472: 6 *Macruri*, many specimens of *Myctophum*, 2 flounders, 6 eels, 12 starfish, few shells, few crabs, 6 prawns, 1 holothurian, few sponges.

Dredging station 3473: 4 *Macruri*, 2 *Sternoptyx*, 1 starfish, 3 shells, 1 crab, 4 prawns 1 naked mollusk, 1 pennatula.

Dredging station 3474: 35 *Macruri*, 2 specimens of *Myctophum*, 2 of *Sternoptyx*, 2 eels, many starfish, few shells, 5 sea-urchins, 4 crabs, few ophiurans, few prawns, few sponges, few naked mollusks, 1 pennatula.

Dredging station 3475: 24 *Macruri*, many starfish, few shells, 3 sea-urchins, few prawns, few sponges, few naked mollusks, few pennatulas, 1 squid, 3 crinoids, few sea-anemones.

Dredging station 3476: many *Macruri*, many specimens of *Sebastes*, 1 *Monocanthus*, few starfish, few crabs, few *Pentacheles*, 1 octopus, few prawns, 1 holothurian, few sponges, 1 pennatula, few squid, 1 crinoid.

We were strongly tempted to extend our biological work to the almost unknown waters of Hawaii, where every haul brought many interesting forms entirely unknown to our naturalists, but the element of time was of such importance in the cable survey that we did not feel justified in doing anything that would interfere in the slightest degree with its progress. Enough was learned, however, to show us that the prolific waters of the Hawaiian Archipelago present an exceedingly interesting and almost virgin field for the scientific explorer.

The investigations above detailed occupied us until December 6, when we returned to Honolulu, took on board 172¾ tons of coal, and made final preparations for running a second line of soundings to the California coast.

We received many courtesies as well as material aid from the officers of the Hawaiian Coast Survey and others, which greatly facilitated our work.

Hawaiian Islands to Monterey Bay.—We took our final departure from the beautiful harbor and hospitable people of Honolulu at 4:50 p. m., December 11, and steaming around Diamond Head anchored for the night in Mauna Loa Bay. Getting under way early the following morning, the rhumb line was commenced in latitude 21° 18′ north, longitude 157° 33′ west, and extended N. 63° E. true for the California coast.

The outer verge of the shore platform was found in 603 fathoms, 20 miles from land, and a sharp descent of 29 per cent from this point developed the same bold contour that was found on previous lines. The bottom retained its character of mud and sand also, without the least indication of the rocky projections so apt to occur under like conditions. Increasing depths were revealed with each succeeding cast, and 75 miles from Oahu we entered a depression 30 miles in extent, having a maximum depth of 3,027 fathoms. Thence for 160 miles the mean was not far from 2,600 fathoms, increasing to a maximum of 3,038 fathoms in 135 miles, which proved to be the deepest cast on the rhumb line. A mean of 2,900 fathoms was then carried for 345 miles to an elevation having 2,346 fathoms, and 2,700 fathoms for 120 miles to a rise over which were 2,375 fathoms.

The great central plateau averaged about 2,600 fathoms, with elevations having 1,924, 1,858, and 2,175 fathoms, the latter lying S. 46° E. true, 28 miles from the crest of the great Belknap Rise, a remarkable submarine mountain, which has an elevation of about 14,000 feet above the ocean bed, and reaches within 388 fathoms of the surface. There is a strong probability that the last-mentioned sounding was on a

remote spur of this elevation, although the soundings do not positively indicate it.

The northern limit of the central plateau, following the rhumb line, lies about 450 miles from the California coast, and is succeeded by a depression 24 miles in width, having a maximum depth of 2,773 fathoms. Normal depths were soon reached again, and continued with remarkable uniformity for about 260 miles, when the water gradually shoaled toward the coast, 170 miles distant. The two lines intersected 35 miles from Salinas Landing; then followed the same route through the cable trough.

Head winds and continuous bad weather exhausted our coal, and made it necessary to drop the line in 31° 45′ north, on December 27, and go to San Francisco for a supply. We arrived on the 31st, but the next day being a holiday, and Sunday following, we were unable to commence coaling until January 3, 1892. The bunkers were full on the evening of the 6th, however, when we left the coal wharf, proceeded directly to sea, and, steaming to the spot where the line was dropped, took it up on the 10th and carried it to its intersection with the great circle in latitude 36° 40′ north. The last sounding was made in 1,053 fathoms at 8 p. m., January 15, 1892, and, the line being completed, we started for port, reaching Mare Island at 10:15 a. m., January 16.

Winds and weather.—During the preliminary trip, and while engaged upon the great-circle line, the meteorological conditions were about normal for the season of the year. Fogs and boisterous winds were experienced near the land, and after leaving the coast cloudy weather prevailed. A southeast gale was encountered between parallels 32° and 30° north, and thence to the vicinity of the islands we carried moderate to brisk trades. Heavy westerly swells were encountered at times, resulting from remote winds which did not reach us.

Good weather was the rule while we were employed in the examination of the shores of Oahu for a cable landing, although fresh winds and heavy ground swells were encountered in Kaiwi channel.

On the homeward trip bad weather was encountered from the start; a heavy norther with furious squalls and high-breaking seas struck us as soon as we left the protection of the land, but this we took philosophically, as it insured fairly clear weather, enabling us to locate the line at the slope from the shore platform to the ocean bed by cross bearings and astronomical observations. The storm continued from the 12th to the 14th, the trades springing up from ENE. on the 15th, light at first, but increasing rapidly to a strong wind with heavy squalls, rain and rising swell until, on the 20th, they attained the force of a moderate gale with heavy head sea. It began to subside on the 23d, and on the 25th we had light northeast trades, clear weather, and smooth sea, the first really pleasant day since our departure from the islands.

Wind and sea were nearly ahead for ten days, making it necessary to turn the vessel stern to it at every station, holding her in position

from an hour to an hour and a half while taking the sounding, then repeating the critical operation of turning her again to her course. The work was successfully prosecuted at no small risk to life and limb, and at the expense of great and unusual strain and wear and tear on hull and machinery.

We were obliged to drop the line at noon of the 27th and go to San Francisco for coal, encountering a heavy southwest gale en route. The following extract from a San Francisco paper, describing the trip of the U. S. S. *Charleston* from Honolulu to San Diego during the last half of December, shows the weather experienced by that vessel:

SAN DIEGO, *January* 1.—At 9 o'clock this morning the cruiser *Charleston* rounded Point Loma and steamed into the bay. * * * Her sides were rusty and dirt-begrimed, and she looks as if she had experienced a hard trip and rough usage. * * * During the past week the vessel passed through one of the most terrific storms ever experienced by anybody on board, it being so bad for the 24 hours ending Thursday morning, that everything had to be strapped down, and it was impossible for a person to maintain footing anywhere on the decks.

Returning to complete the line we found light winds, pleasant weather, and smooth seas, except a few hours of boisterous coast wind on the 15th of January.

Wear and tear.—Deep-sea sounding and dredging are much more destructive to machinery, boilers especially, than ordinary full-speed steaming. The run between stations must be made as quickly as practicable, and then the engines are slowed, stopped, and backed; if steaming head to the sea, the vessel must be turned stern to it by going ahead on one engine and backing the other, and to hold her in position first one engine and then the other is slowly backed. If running before wind and sea, it is not necessary to turn around, the engines being simply stopped and reversed until the vessel is brought to a standstill. In calm weather, smooth sea, and no current, soundings are sometimes made without moving the engines after getting into position, but as wind and sea increase the necessity for working them is enhanced until, in a gale, one or both are constantly moving, either in the same or opposite directions. Signal follows signal in rapid succession in order to maintain the position of the vessel over the sinker, for it is an invariable rule on board the *Albatross* that none but vertical soundings will be accepted.

The destructive effects of this peculiar service on the boilers is not apparent at first sight; but, remembering that constant and marked changes of temperature are taking place in them from the frequent opening and closing of the furnace doors, the introduction of cold fuel, and from other measures resorted to in order to control the pressure of steam without destroying the fires, it will be seen that rapid deterioration must ensue even were these the only hurtful agencies at work. If we add to this the frequent loss of fresh water by the unavoidable overflow of the hotwell while sounding or dredging, with the attendant evils arising from the introduction of an equal amount of salt feed,

the extraordinary service required of the *Albatross* boilers will be appreciated.

Preparations for a third line of soundings—The following letter from the chief of the Bureau of Navigation, dated November 30, was received January 17:

In returning from Honolulu to San Francisco, after completing the soundings at close intervals along the direct line between Salinas landing and Honolulu, please take soundings at intervals of about 60 miles upon a line situated about as far to one side of the line just completed as the soundings taken in 1874 by the officers of the U. S. S. *Tuscarora* are to the other side.

This was the first intimation I received that a second line was contemplated by the Bureau of Navigation; it was expected that the order would reach us at Honolulu, but it probably arrived there after our departure. I replied to the Bureau's letter as follows:

Your letter of November 30, 1891, with reference to second line of soundings between Honolulu and California, was received this morning. In reply, I beg leave to say that the second line has been completed with average intervals of about 10 miles, and is, I think, much the better of the two. We arrived at the navy-yard yesterday and are now waiting orders. The report of survey will be forwarded as soon as possible.

It will be seen that we had anticipated the wishes of the Bureau. As before stated, I recognized the necessity for a second line before the first was completed, and, while engaged on the latter, it occurred to me that still another one, farther to the southward, might be required. In anticipation of such an event, I wrote to the hydrographer, on December 25, 1891, that the wear and tear had been very great, and in case a third line was to be run we would require about two weeks at the navy-yard to make the necessary repairs.

All the available force was put to work on the report of cable survey, which was completed and forwarded February 1. This report included sounding and meteorological records, charts, plans, photographs, etc.

Telegraphic orders were received from the Bureau of Navigation, through the commandant of the navy-yard, February 10, directing me to run a line of soundings from Point Concepcion to Hilo. I informed the commandant that it would take three weeks' time and the expenditure of $2,000 to make temporary repairs necessary for the completion of the work.

The repairs could have been made while we were preparing the report had the necessary instructions been received. There was some question as to the practicability of paying for the repairs from the appropriation for cable surveys; and it was not until February 15 that instructions were received to go ahead with the work, keeping an account of items chargeable to the U. S. Commission of Fish and Fisheries and the Navy Department, respectively.

The vessel went into dry dock the following day, and upon examination a rope was found wound around the starboard propeller shaft in

such a manner as to give us the impression that the stern bushing was gone. A sixteenth of an inch of lignum-vitæ still remained in the bearing, however, and as it would require several days to renew it, we decided to risk the trip with the old bushing. Repairs were made to one of the sea connections, the ship's bottom was scrubbed, paint mended where it was broken, and on the 24th we left the dock.

The work progressed favorably and the expense came well within the estimates. We coaled ship from the 4th to the 8th of March, and tried the engines at the dock on the 10th, everything working satisfactorily. The vessel was then ready for sea, and would have sailed on the 11th to complete the cable survey had we not been detained by orders from Washington.

FUR-SEAL INVESTIGATIONS.

San Francisco to Cook Inlet, Alaska, etc.—A letter was received on the 7th from the Commissioner, intimating that the *Albatross* might be diverted from the survey, and outlining a proposed cruise in connection with investigations regarding seal life. The commandant of the navy-yard received a telegram from the Secretary of the Navy on the 8th to delay the sailing of the *Albatross* until further instructions. A telegram from the Commissioner on March 11 directed me to hold the vessel in readiness for sailing in accordance with the plans outlined in his letter of March 2, above referred to as having been received on the 7th. The Secretary of the Navy wired on the 12th that the services of the *Albatross* were no longer required in connection with the cable survey, directing stores to be turned over to the commandant of the navy-yard and the crew reduced to the complement allowed June 30, 1891.

A telegram was received from the Commissioner March 15, as follows:

President orders *Albatross* placed in Revenue Marine Division under orders from the Secretary of the Treasury, as explained in letter of March 13. Expect you will be ordered to sail at once for Port Townsend. Alexander should be on board, photographic outfit should be complete, and a good supply of alcohol on hand. Expenses from date will be paid by Treasury Department.

A message was also received from the Assistant Secretary of the Treasury, saying that "sailing and definite instructions will be telegraphed to-morrow." March 16 I received a dispatch from the Secretary of the Treasury containing sailing orders and specific instructions for the cruise until the arrival of the vessel in Port Townsend. Several letters and messages were sent and received relative to the reduction of the crew and the absolute necessity of having the full number on board. The Commissioner wired on the 18th that "extra crew would be retained, but not as part of naval complement." The 14 men in question were accordingly transferred to the civilian roll.

We left the navy-yard at 1 p. m. March 19, and anchored off Saucelito, for the double purpose of avoiding a NW. gale and readjusting machinery. A disagreeable thump was developed in the starboard

engine during the cable survey, which still continued in spite of our efforts to locate it, and was so marked during the run down the bay that we thought it advisable to make another effort to reduce it before proceeding to sea.

We were under way at daylight on the morning of the 20th, and steamed out through the Golden Gate en route to Port Townsend, where we arrived at 8:45 p. m. on the 24th, after a boisterous trip, which culminated in a moderate SW. gale off Cape Flattery with furious hail and snow squalls. Our instructions contemplated a careful observance of seal life as far as practicable without undue delay, and several traverses were run off and on the Oregon and Washington coasts with that object in view. Few seals were seen, however, owing largely to stormy weather.

We were instructed to procure two seal-hunters, an interpreter for the Chinook jargon, two otter boats, two Parker shotguns, etc., all of which were promptly secured in Port Townsend and Seattle.

Prof. B. W. Evermann reported for duty on the 27th, and Mr. A. B. Alexander, fishery expert, was ordered to temporary duty on board the United States revenue steamer *Corwin*. The coal bunkers were replenished at Seattle on the 29th, the vessel returning to Port Townsend the following day, when Mr. Joseph Murray, special U. S. Treasury agent, reported on board for duty connected with the investigation of seal life.

The *Albatross* left Port Townsend at 8:50 a. m., March 31, en route for Cook Inlet. There were on board, in addition to the regular complement of officers and crew, the following experts, viz: Joseph Murray, special U. S. Treasury agent; Prof. B. W. Evermann, naturalist; J. E. Lennan, hunter and Alaska pilot, and N. Hodgson, hunter and interpreter for Chinook jargon.

The weather, which was threatening at the time of our departure, culminated at 4 p. m. in a fresh gale from NE. to SE., with heavy cross seas after leaving the protection of the straits. It moderated about noon on the following day, but the swell continued to roll in from seaward. The course from Cape Flattery was intended to carry the vessel over the usual sealing-grounds off Vancouver Island in order to intercept the herd, observe the number of vessels, and general operations of the sealing fleet. Four schooners were observed during the day, all hove to on account of bad weather, and a solitary seal was seen about 1 p. m. off Cape Cook. A vigilant lookout was kept at all times during the cruise at the masthead during sealing weather.

Sealing weather, as understood in this report, included the interval from daylight until dark, whenever the weather and state of the sea would admit the lowering of boats and carrying on of the practical work of hunting.

Passing 30 miles from Cape St. James, a direct course was laid for the Barren Islands. The first seal, a single individual, was seen in latitude 55° 25′ north, and several were observed the following day

(April 5) in latitude 56° 01′ north, on the outer margin of Portlock Bank. A heavy northwesterly gale kept them moving constantly; they were seen by twos and threes during the afternoon, and while it was impossible to distinguish sex, there was no doubt whatever as to the absence of old bulls.

The Barren Islands and high lands of the Kenai Peninsula were sighted at 3:15 p. m., and as we did not wish to approach the coast until daylight next morning, the engines were slowed and finally stopped while an abortive attempt was made at cod-fishing in 28 fathoms—latitude 58° 22′ north, longitude 150° 09′ west. The depth was much less than had previously been found in that locality, and as we had ample time on our hands a line of soundings was extended across the bank during the night, the depths gradually increasing to 118 fathoms.

The officers and men on deck were startled about 10:30 p. m. by the passage of a brilliant meteor, which was followed a little later by a remarkable display of aurora borealis.

Steaming ahead at early daylight against a fresh breeze, we reached the landlocked harbor of Port Graham at 11:26 a. m. The entrance is narrow, tortuous, and to a stranger dangerous; but once inside ample room and perfect protection will be found. Fort Alexander, as the Aleut village here is called, lies on an exposed point near the southern approach to the harbor, and contains a population of 120 souls, all Aleuts except Mr. Cohen, agent of the Alaska Commercial Company. The whole face of the country was covered with snow, which buried the log cabins of the natives nearly to the eaves. The past winter was the most severe that has been known for many years, and there were few evidences of approaching spring at the time of our arrival. The usual winter's hunting was almost entirely prevented by inclement weather, and the people were very poor in consequence.

Mr. Cohen came on board soon after the anchor was down, and being informed of our mission, rendered valuable aid in getting the native hunters together and acting as interpreter. His experience of twenty-two years in the Territory, engaged in the fur trade, gave special value to his statements. His intimate acquaintance with the people and their language made free communication comparatively simple.

Affidavits relating to seal life were procured from Mr. Cohen and all of the native hunters, and at 2:45 p.m. on the 9th (April) the *Albatross* left the commodious harbor of Port Graham and anchored two hours later in Chesloknu or Soldovoi Bay. The village locally known as Soldovoi lies on the northern shore of the harbor, the log cabins in which the natives live being scattered irregularly from the beach over low wooded mounds, and fairly protected from prevailing winds. It has a population of 103 Aleuts and Kenai Indians and 4 white men. The North American Commercial Company has a station here in charge of Mr. John W. Smith, who has been twenty-four years in the Territory,

most of the time connected with the fur trade. He reported an exceedingly hard winter and late spring, and the natives having been unable to follow their usual avocation of hunting the sea otter, were in consequence very poor.

The bay is only partially protected from westerly winds, the entrance is narrow and intricate, and the space available for vessels of 12 feet draft is limited. There is, however, an inner harbor, or basin, east of the village where small vessels find perfect protection, and a shingle beach affords an excellent place for hauling out to clean or repair. Three small schooners, the *Hope*, *Matinee*, and *Anna Matilda*, wintered there; the last two belong to the Cutting Packing Company, of San Francisco, and act as tenders to their cannery, located farther up Cook Inlet.

Our investigations were completed on the 10th, but we were detained by a snow storm until the following morning, when, the weather having cleared, we steamed well out into the inlet and swung ship under steam, observing azimuths on every point, for the purpose of ascertaining compass errors; then stood into Coal Bay and anchored at 10 a. m.

This bay is formed by a projecting point which juts out 5 or 6 miles, at right angles to the main land, forming an excellent natural breakwater; its extremity of gravel and shingle is called Coal Point. Representatives of the Alaska Coal and Commercial Company and the Cooper Coal and Commercial Company were found comfortably housed in wooden structures on the point, watching the interests of their respective corporations. There were 11 men at this place, all white. Some work had been done toward the development of the Alaska Coal Company's property, but not sufficient to demonstrate its value. They seemed to be holding possession pending the securing of titles to their claims.

The coal measures are located near the extremity of a peninsula extending from the mainland and separating Cook Inlet from Kachemak Bay. It is a tableland of moderate height and thickly wooded. As nearly as I could ascertain, the product may be classed among the brown coals, resembling those of the Puget Sound region.

Our investigations were prosecuted as usual, and some additional information obtained. The question as to whether fur seals were ever known to haul out in or near Cook Inlet was among the many interesting subjects presented for solution. Inquiries were made among men who have passed their lives in hunting over the region under discussion, and the fact that none of them ever saw a seal hauled out would seem to settle the question conclusively. The fur seals pass along the shores, and sometimes enter Cook Inlet in small numbers when they are on their way to Bering Sea. They sometimes loiter about a few days, and then an occasional one is killed, providing there are no sea otter about; but should the presence of the latter be suspected the seals will remain undisturbed by the otter hunters.

It was our original intention to visit the Kenai settlement, but upon inquiry it was learned that the river was still encumbered with ice, making communication difficult, if not impracticable, and also that the natives were not always to be found there so early in the season.

We were under way again at 2:15 p. m. (April 10), and steaming into Cook Inlet, several miles off Soldovoi, spent nearly an hour with trial lines on a bank tradition has stocked with endless numbers of codfish and halibut. The bottom indications were favorable, but we caught no fish, and failed to discover the slightest indication of their presence, but they may resort to deeper water during the winter season. The locality is worthy of examination, however, for should fish be found in paying quantities the advantages of secure harbors and native settlements, wood, water, and coal would make these banks a favorite resort for fishermen. The fine beach at Soldovoi for hauling out would be available for fishing schooners, and even with the limited resources of the place would prove invaluable in case of emergency. The wind increased rapidly during the afternoon, and when we resumed our course, at 4 p. m., it was blowing a moderate gale from WSW., veering to WNW. later, and increasing in force, giving us an uncomfortable night in the rough confused seas and strong currents in the region of the Barren Islands.

The anchor was dropped in the outer harbor of St. Paul at 7 next morning; we went to the wharf four hours later, and 102 tons of coal were taken on board during that and the following days.

St. Paul, Kadiak Island, has a population of 380, of whom 65 are whites; the inhabitants of Wood Island number 193, including 3 whites. We were informed that the winter here also had been unusually severe and the approach of spring was reported three weeks late. Mr. White, agent of the Alaska Commercial Company, rendered us great assistance in the prosecution of our investigations and in forwarding our work generally.

The following schooners were in port fitting out for sea-otter hunting: *Pearl*, *Lydia*, *St. Paul*, *Nor'west*, *Albert Walter*, *Mary*, and *Three Brothers*. The *Undaunted*, *Alexandria*, and *Rose* had already sailed.

We left St. Paul at 1:15 p. m. April 14 for Port Etches, Prince William Sound; the weather had been threatening all day, and the wind increased in force until at 8 p. m. it was blowing a fresh gale from NW. with a rough sea nearly abeam, which caused the vessel to labor heavily until we reached the Kenai Peninsula, which afforded partial protection. It moderated on the morning of the 15th, and we steamed along the base of the snow-clad heights of the peninsula in comparatively smooth water, anchoring in Port Etches at 11 p. m.

One fur-seal was seen during the trip from Kadiak to Port Etches, in latitude 59° 07′ north and longitude 148° 03′ west.

The Aleut village of Nutchek lies on a spit near the northern shore of the entrance to Port Etches. It is a postal station and has a native population of 180. The only white man in the settlement, Mr. Frank

C. Korth, agent of the Alaska Commercial Company, came on board soon after our arrival and was of great service to us in prosecuting our investigations, particularly in getting the native hunters together and acting as interpreter. An unusually severe winter and late spring was reported at this place also, which still confined the hunters to winter quarters. The capture of the sea otter affords the principal employment of the natives, although bears and other land animals are taken, but the value of their furs is insignificant in comparison with that of the former. There were one or more native boats codfishing in the upper bay whenever the weather permitted, and no doubt they have the means of taking herring, but we saw none caught by them, although they were plentiful in the bay and large numbers were taken in our collecting seine. Codfish were taken with hook and line from the rail, and, while rather small, they were found to be of good quality.

An easterly gale and heavy snowstorm sprung up on the afternoon of the 16th and continued with slight interruption until the following evening, detaining us in port meanwhile. It cleared during the night, however, and at 3:15 a. m. on the 18th we got under way and steamed to the eastward. Cape Hinchinbrook was abeam an hour later, 2 miles distant, and at noon Castle Rock, a conspicuous and unmistakable landmark, lying off Cape St. Elias, bore NE. ¾ E., magnetic, 20 miles distant. The weather was unusually clear and, tradition having given the region a bad name, more than usual precautions were taken not only for the safe navigation of the vessel, but to confirm the existence or nonexistence of reported dangers.

H. O. chart 527 shows a rock  in latitude 59° 31′ north, longitude 144° 43′ west; but a sounding in 377 fathoms, gravel and mud bottom, proves the nonexistence of the danger in that position. The following soundings, leading up to it, increase regularly in depth and seem to confirm its absence on that line or near it, for our masthead lookout would have seen discolored water at least 5 miles on either hand. In latitude 59° 34′ 45″ north, longitude 144° 58′ west, the lead indicated 81 fathoms, green mud; and in 59° 33′ north, 144° 52′ west, 97 fathoms with the same character of bottom. The rock is probably nearer Cape St. Elias, a dangerous locality, where obstructions of that description are to be expected. Three fur seals were seen between noon and 4 p. m., and six during the next two hours.

Our vicinity to one of the assigned positions of Pamplona Rocks toward evening was sufficient inducement for renewed vigilance, for we had already demonstrated their nonexistence in the offshore position given them on the charts, and where, in 1888, the *Albatross* ran a line of soundings in from 1,600 to 1,800 fathoms. At 8:30 p. m. a sounding was made in 156 fathoms, pebbles, latitude 59° 35′ north and longitude 143° 21′ west.

The presence of a few scattering seals so early in the season led us to suspect that the vanguard of the herd might be encountered not

far away, and, fearing we might pass them in the night, the vessel was hove-to until 3 o'clock the following morning, when, the day breaking bright and clear, we started ahead with a man at the masthead looking out for seal life; also for indications of rocks or discolored water.

Steaming over one of the positions in which the Pamplona Rocks have been plotted on the charts, latitude 59° 35′ north, longitude 143° 04′ west, a sounding was made in 225 fathoms, blue mud and pebbles, in latitude 59° 36′ north, longitude 142° 57′ west; and another in 281 fathoms, same bottom, latitude 59° 37′ north, longitude 142° 45′ west. The course, which had been NE. by E. magnetic, was changed to ESE. $\frac{1}{8}$ E., and having steamed 26 miles, a sounding was taken in 504 fathoms, green mud; then running NE. $\frac{5}{8}$ E. for 12 miles, 114 fathoms, pebbles, was found in 59° 21′ north and 141° 51′ west. Changing the course to ESE. $\frac{5}{8}$ E., magnetic, an interval of 11 miles gave us 116 fathoms, gravel, in latitude 59° 14′ north and longitude 141° 35′ west. Steaming 27 miles ESE. $\frac{7}{8}$ E. magnetic, the last sounding of the series was made at 3:46 p. m. in 471 fathoms, green mud, in latitude 58° 56′ north, longitude 140° 56′ west.

The course was retained until 11:20 p. m., when a rising gale and rough sea forced us to heave to, head to wind. Mount St. Elias was visible until 6 p. m., but increasing clouds and mists obscured it from that time.

The various courses during the day practically paralleled those of 1888, when the *Albatross* made her first search for the rocks, and, both days being clear during the time of search, the masthead lookout would have noted anything *above* water at least 10 miles on either hand; hence, we may conclude that these vigias do not exist within the belt 40 miles in width and 100 in length, over which our reconnoissance extends. No sign of seal life was observed during the day, although a careful lookout was kept.

The gale continued until the morning of the 21st, when a small schooner and one seal were seen. Whales, wild geese, puffins, etc., were frequently observed. The engines were slowed to steerage way during the night, to avoid passing the sealing fleet or herd in the darkness.

Having passed the region of Sitka about 100 miles from land, we drew in to about 35 miles off Forrester Island, where a few scattering seals and a single schooner were seen. The usual April sealing-ground was said to be from the Columbia River to Dixon Entrance, and we were momentarily expecting to see indications of the herd and the sealing fleet, but not a sign of either was observed north of Cape Cook.

The date of arrival in Port Townsend was prescribed in orders from the Secretary of the Treasury, and, having a couple of days to spare, the time was utilized in cruising off Vancouver Island; but few seals were seen, however, and none taken. Several schooners were sighted. The *Mascot*, of Victoria, had her boats out. She had seen no seals nor sailing vessels since leaving port, and did not know whether the herd were north or south, but "would like to know just where they were."

We called at Neah Bay on the afternoon of the 27th to ascertain whether the ground had been covered during our absence, and incidentally to learn the whereabouts of the sailing fleet. We were informed that a Treasury agent had visited the reservation and had procured such information as was desired; he left only an hour or two before our arrival. Five sealing schooners were at anchor in the bay, four of them belonging to the Indians of the reservation. Capt. Quinn, of the *Teaser*, reported rather poor success on account of unfavorable weather; he did not know where the fleet were, but thought most of them were between the Columbia River and Cape Flattery. Subsequent information showed that the majority of the vessels were off Sitka at the time, and that we had passed them during the thick, blowing weather.

Leaving Neah Bay at 8 p. m., we reached Port Townsend early the following morning, four weeks from the time of our departure, and on the date specified in our orders for the trip to terminate.

The boilers were giving us trouble from leaky tubes, and it was necessary to change from one to the other whenever an opportunity occurred, in order to stop leaks and free them from accumulations of salt. The foremast developed a weakness at the hounds during the northern trip, and close examination resulted in the discovery that under a thin surface shell the wood was so much decayed that it was unfit for service. A new spar was immediately ordered. Telegraphic information was received from the Secretary of the Treasury that the Department had a contract with the Black Diamond Coal Mining Company, of Seattle, to furnish fuel for the revenue marine vessels, and that we would hereafter procure coal from them. It is not an economical or safe fuel for the boilers of the *Albatross*, although it gives good results in boilers specially constructed for its use.

Leaving Port Townsend early on the morning of the 4th of May, we moored alongside the bunkers at Seattle four hours later, and during that and the following day took on board 174 tons of coal, returning to Port Townsend on the 6th. The next day, May 7, was observed as a holiday in commemoration of the one hundredth anniversary of the discovery of Puget Sound by Vancouver. The event was celebrated in a notable manner on shore, and the men-of-war in the harbor participated by dressing ship and firing national salutes at 8 a. m., meridian, and sunset. The merchant shipping observed the day by dressing ship and joined, or rather led, in a general illumination in the evening. The *Albatross* participated as far as practicable. The new foremast was hoisted on board and stepped during the day.

Port Townsend to Unalaska.—We left Port Townsend for Unalaska at 8:55 a. m., May 10, via the inner channels of Vancouver Island, this route being taken in order that the light spars might be sent aloft, rigging set up, and the sails bent before reaching the open waters of the

Pacific. The weather was rainy, misty, and foggy at times, but we experienced little difficulty in running from point to point. We passed Seymour Narrows at 4:15 a. m. on the 11th, and reached Alert Bay at 2:05 p. m. the same day, where a stop of an hour was made to allow the engineers to effect some slight but necessary adjustments of valve gear, advantage being taken of the delay to send mail on shore.

Resuming our course, we stood through Johnstone Straits and Goletas Channel, finally taking our departure from Mexicana Point at 9:15 p. m. We had succeeded by energetic work in getting the spars all aloft, rigging set up, and the principal sails bent before we left the protection of the land, and other preparations were completed before we passed Cape St. James the following morning.

Our orders directed us to cross on the parallel of 52° north, and this was done, as nearly as wind and weather permitted, without undue delay. A southeast gale was encountered on the 13th and 14th, with rough sea and thick, misty weather, followed on the 16th and 17th by a gale from the southward and westward; thence to port light to moderate winds prevailed.

An accident occurred on the 15th from the use of Seattle coal, in which the vessel narrowly escaped a serious disaster. This coal contains a large percentage of gas, and burns quickly, with a long flame and intense heat, both commendable qualities with specially constructed boilers having large combustion chambers. The boilers of the *Albatross*, however, are designed for the use of anthracite and the slower burning of the bituminous coals, and consequently combustion takes place largely in the steam drum and smokestack when burning the highly inflammable varieties from the Puget Sound region, a red-hot funnel being of too frequent occurrence to attract special comment. On the occasion in question, without warning, the simultaneous ignition of soot in boiler tubes, steam drum, and smokestack superheated the steam to such an extent that solder on an extension joint of the main steam pipe began to melt, and the lower seams of the steam drum commenced to leak; the engine packing was burned out and the wooden casing protecting a small steam pipe which passes through a coal bunker was ignited, smouldering until the following day, when it was discovered and extinguished after the removal of many tons of coal. Leaks in the boilers increased to an alarming extent after the occurrence above related.

We reached the Fox Islands Passes on the evening of the 18th, lay to until daylight, and reached Unalaska at 11 o'clock next morning.

A constant and vigilant lookout was kept for seals during the trip, but none were seen. They follow a fairly well-defined route which, during the northern migration, is confined to the general direction of the shore line and does not depart very far from it. One sealing vessel was seen off the coast of Vancouver Island, within sight of land.

Application was made to the North American Commercial Company for coal immediately after our arrival, the Government having con-

tracted with that corporation to supply fuel to its vessels during the season. The agent informed me that they were not prepared to deliver coal at that time. We then went to the wharf of the Alaska Commercial Company and took on board a supply, finishing on the evening of the 21st. The *Albatross* was the first Government vessel to reach Bering Sea, the U. S. S. *Yorktown* arriving a day later.

Aleutian Islands.—We left Unalaska at 3:25 a. m., May 22, to visit the inhabited islands of the Aleutian chain west of Umnak, and, skirting the northern shores of Unalaska, Umnak, and the islands of Four Mountains, we passed within 4 miles of Seguam, and thence direct to Nazan Bay, Atka Island, arriving at 7 p. m. May 24. The passes between Umnak and Seguam are resorted to by large numbers of seals in their migrations to and from Bering Sea, but we saw no sign of them between Unalaska and Atka.

We were fortunate in reaching Nazan Bay while the hunters were still at home. The settlement is admirably situated in a sheltered nook on the western shores of the bay, and has a population of 120 natives and 1 white man, Mr. Henry Dirks, who has been resident agent of the Alaska Commercial Company for seventeen years.

The natives are hunters, and follow the sea otter among the Andreanof and Kryci or Rat islands, which extend from the islands of Four Mountains to the Near Islands. Hunting parties are transported to their various stations by a vessel of the Alaska Commercial Company in the spring, and returned again to their winter homes after the season's hunting is over. Blue foxes are found on some of the islands within their field of operations, and are taken in greater or less numbers. A small revenue is also derived from the manufacture of basket work, which is of a superior quality.

The Atka mackerel, *Pleurogrammus monopterygius*, an excellent fish, is taken to a limited extent and forms an important item in the native food supply. The fish appears on the shores of the Aleutians from Atka westward, in the spring, in large schools, which hover closely about the kelp beds, particularly favoring the passes or exposed points where swift currents prevail. This habit prevents the use of purse seines in their capture, but they can be taken rapidly by hand, using any of the simple methods known to fishermen. The favorite device at Atka is a lath, or strip of board about 2½ inches wide, in which are driven a number of sharp-pointed nails at an angle pointing upwards. Reaching the fishing ground, the boat is usually secured to a piece of kelp and the apparatus above described is used as a gig, bringing up from one to half a dozen fish at a time. As soon as the barbed device enters the water it is surrounded by fish drawn toward it, apparently by curiosity; the water is clear and the school not more than 6 feet below the surface; hence every movement can be seen by the fisherman, who watches for a favorable moment to impale his unsuspecting prey.

The agent and several of the older and most intelligent hunters tes-

tified regarding the movements of fur seals, and were unanimous in the opinion that the herds do not use the passes between Amukta and Great Kyska islands in their migrations to and from Bering Sea. Only scattering seals have been seen by them in the Andreanof and Kryci islands, and they were mostly gray pups, which appear from September to November, usually after northerly gales; they are never seen during winter. They are captured whenever opportunity offers, and the flesh used for food, it being considered a great delicacy. The skins are either used for domestic purposes or sold to the company. A dozen seals a year would probably be a fair average for the Atka hunters.

We were ready to sail on the morning of the 25th, but a northwesterly gale was blowing with sufficient force to prevent our progress along the Bering Sea side of the islands, except at a large expenditure of fuel, which we could not afford; neither could we wait for it to subside, for the limit of the cruise was fixed at a date which admitted no delay. Our only resource was to enter the Pacific via Amlia Pass, a narrow passage between the island of that name and Atka; it had never been used by anything larger than a fishing schooner, and was practically unknown, but Mr. Dirks had frequently fished in the vicinity and believed it was free from hidden dangers.

Waiting until 9:55 a. m. for a favorable condition of tide, we left the snug anchorage of Nazan Bay and steamed through the pass without trouble or delay. There was an extensive ledge on the Atka side, but it showed above water. We favored the Amlia shore until up with the reef; then taking a midchannel course SSE., magnetic, we steamed through the pass, which was from 1 to 1½ miles in width, against an 8-knot current with heavy rips, swirls, eddies, etc. The hand leads failed to reach bottom, and there was no kelp in midchannel; hence it may be assumed that the pass is navigable for a full-powered steamer—a sailing vessel would only attempt it under favorable conditions.

Having cleared the pass, we ran offshore about 2 miles, then hauled up parallel with the general trend of the islands, and under storm-sail and steam made excellent progress in comparatively smooth water. The wind moderated during the following day, and thence to port the weather was all that could be desired. The 180th meridian was crossed at 11 a. m., and the date changed from Thursday, May 26, to Friday, May 27, to correspond with the date in east longitude.

The scene was enlivened while coasting along the Aleutian chain by the constant movements of birds, such as wild geese, little auks, guillemots, petrels, puffins, the albatross—both white and gray—gulls, etc.; porpoises were seen frequently, sometimes in large schools. Tide rips and the constant occurrence of kelp lent a certain air of danger until the latter was approached and recognized as growing or floating, the former being considered as a warning, while the latter drifts aimlessly over the whole region, and frequently makes long sea-voyages when taken up by one of the great ocean currents.

The highlands of Attu were sighted at 8:20 a. m. May 28, Agattu and the Semichi Islands appearing above the horizon about the same time. Arriving off Chichagof Harbor, Attu Island, we got the flagstaff on with Range Point, as directed for entering, but soon discovered a kelp patch off Middle Rocks lying directly ahead; we left it on the starboard hand, and, as it was not shown on the chart and no mention of it made in the sailing directions, we were led to distrust the accuracy of the survey, so, following our usual practice in unsurveyed regions, a boat was sent ahead to sound, the vessel following slowly at a convenient distance. We entered without difficulty and anchored at 5:13 p. m. in 7¼ fathoms, about the center of the harbor. The bay is rather small, but is landlocked and has good holding ground of stiff mud.

The U. S. S. *Mohican* visited the harbor during the summer of 1892, and, anchoring in the kelp patch above described as lying in the fairway, soon swung upon a rock having 15 feet over it, with 3½ fathoms around it. The accident occurred from their failure to observe a well-established rule in navigating the waters of the North Pacific and Bering Sea, i. e., "Keep out of the kelp."

The village of Attu lies on a level tract of limited extent at the head of the bay, and has a population of between 80 and 90, all Aleuts. Filaret Prokopief, native storekeeper for the Alaska Commercial Company, said the winter had been very severe, and there had been much suffering in consequence. No sea-otter and very few foxes had been taken. The stock of provisions in his charge was practically exhausted in January, and the people had lived on smoked goose and fish. Dried salmon-berry leaves were used as a substitute for tea, and dried kelp took the place of tobacco. A civilized community can have no conception of the value these two articles, tea and tobacco, possess in the estimation of the Aleut. The tea-kettle, or samovar, is constantly simmering wherever a spark of fire can be kept, and a pot of the beverage is in order at any hour—2 or 3 gallons a day is not an excessive estimate for a man where the necessary ingredients can be procured. Tobacco is not counted a luxury, but occupies a prominent place among the necessities of life. The average Aleut will barter his most cherished possessions for it when a liberal offer of money is refused.

The condition of the people, especially the women and children, was so deplorable for lack of proper food that I ordered sufficient rations issued to relieve their necessities until the arrival of the supply vessel, sent to them at least once a year. The general condition of the natives of Attu contrasted strongly with those of Atka, where the superior intelligence of the white man was so apparent.

The men of Attu are hunters, their game consisting of sea-otters and blue foxes, their hunting-grounds embracing their own island of Attu, Agattu, and the Semichi group. This was formerly a rich station, but the sea-otter has been steadily decreasing in numbers until the hunter is hardly able to keep soul and body together. Agattu and the Semi-

chis are favorite nesting-grounds for wild geese, and the natives of Attu secure large numbers of them annually, smoking them for winter use. The down is an article of trade.

Halibut are taken in small quantities in the spring, and cod are found at all seasons along the northern shores of Attu, in from 30 to 60 fathoms. The Atka mackerel is abundant from April to September, and is an important article of food, either fresh, dried, or salted. They school in and near the kelp beds, as at Atka, but run deeper and are taken with gigs. The *Annie*, a small schooner, took 40 barrels of this excellent fish in the summer of 1891, salting them as mackerel are salted on the Atlantic coast, and sailed in August for San Francisco.

The women are expert workers in grass, and the Attu baskets, etc., bring a good price. It would be a source of considerable revenue if they could be induced to manufacture it in sufficient quantities.

Good water is to be had at all seasons of the year, and Attu has become a favorite watering station for the western sealing fleet. In August, 1891, the schooners *City of San Diego*, *Allie I. Alger*, and *Katy Ann* put in here for water on their return from a raid on the rookeries of the Commander Islands. The former reported a partial success, but the others were driven off.

The native hunters were interrogated concerning the movements of fur seals, and were practically unanimous on the following points, viz:

Fur seals are seldom seen about Attu, Agattu, and the Semichi islands, and they have never been known to haul out except when wounded. Two or three instances are remembered of wounded seals having been shot while hauled out to rest. Twenty-five or thirty years ago the older hunters recollected seeing them in small squads about the kelp beds during the month of June, feeding on Atka mackerel. They never saw any seals east of the Semichis, nor had they ever seen any about during the winter season.

It will be remembered that the Atka hunters did not believe that the Pribilof herd used the passes west of Amukta Island; the Attu men never saw fur seals east of the Semichi Group; and the *Albatross* experience in traversing the whole length of the Aleutian Archipelago, from Unalaska to Attu, without seeing even a single individual, seems to confirm the native belief that the Commander Islands herd does not enter or leave the sea east of Attu and the Pribilof herd does not enter or leave west of the Four Mountain Pass.

Commander Islands.—The *Albatross* left Chichagof Harbor at 6:55 p. m., May 29, for the Commander Islands. No soundings had ever been made between the Aleutians and the latter group, and it was a mooted question whether they properly belonged to the Aleutian system or to Kamchatka. To settle this interesting point, we ran a line of soundings from Attu to Copper Island, the maximum depth of 1,996 fathoms being found about 30 miles from the latter, which lies on the eastern verge of the 100-fathom curve off the Kamchatka coast.

A southeast gale sprang up on May 30 with a rough sea and thick weather. The south end of Copper Island was made at 11:25 p. m., about 2 miles distant, a narrow strip of beach being seen under the fog. The high land of Bering Island was first seen at 5:30 a. m. on the 31st; then it shut in for a couple of hours, when Cape Manati, the southern extremity of the island, bore NNE. ½ E., magnetic, 9 miles distant. The snow-covered mountains presented a wintry aspect as we steamed along the west coast of the island. The weather gradually cleared, however, and at 1:15 p. m., when we arrived off the settlement and anchorage of Nikolski, it was blowing fresh from the NW., making it a lee shore, on which the surf was breaking so heavily that we hauled off to wait for more favorable weather.

We had only a general chart of the islands, which was on a scale too small to give detailed information. The positions of settlements were not even indicated, and the only information concerning the anchorage was obtained from a native of Unalaska who had previously visited the islands in the capacity of interpreter, having had nothing whatever to do with the navigation of the vessel; hence his knowledge was limited to a general idea of the surroundings above water.

A number of soundings were made and codfish were taken while lying-to. Later we swung ship for compass errors. The results were not accurate, but they answered our purposes, and it was the only opportunity we had for compass observations in that region.

Wind and sea moderated towards evening, and a few minutes before 8 p. m. we steamed slowly in, and an hour later came-to off the settlement in 7 fathoms, Mr. Waldemar Paetz, agent of the Russian Sealskin Company, having pointed out the best berth. He came on board after we anchored and expressed a desire to assist us in every way possible.

I called on the governor, Col. N. A. Grebnitzky, the following morning and informed him of our mission. He had been advised of our coming from St. Petersburg, and signified his readiness to do anything in his power to assist us.

A naturalist, hunter, and photographer were dispatched to the North Rookery at once, by dog teams, to examine the locality and procure specimens of the different categories of seals. In the meantime, the most experienced and intelligent of the native population were interrogated regarding the various phases of seal life on and about the Commander Islands. The governor kindly gave us valuable information, besides assisting in getting the natives together, numbers of them being on duty at the rookeries.

They were unanimously of the opinion that the Pribilof and Bering Islands herds do not mingle; that the latter spend the winters along the Kurile Islands; that their numbers are fast decreasing on the rookeries, and they attributed it to the indiscriminate slaughter of all ages and sexes by pelagic sealers. There were a few seals on the rookeries, mostly old bulls; a few specimens were procured, but not as many as we had hoped to get.

There are two rookeries on Bering Island; the North Rookery, already mentioned, near the northern extremity of the island and distant about 8 miles from Nikolski, and Poludenni, a small and unimportant rookery lying 17 miles south of the settlement.

An excellent skeleton of a sea-cow, *Rhytina stelleri*, was purchased from a native at Nikolski; it was the third, and he claimed the best, he had found.

A reconnoisance of Nikolski Bay was made during our stay, which, although incomplete, will prove of great assistance to a stranger in making the anchorage. The position of the Salt House on Vkhodni Point, by observations with artificial horizon, June 1, 1892, was found to be latitude 55° 10′ 30″ north, and longitude 166° 00′ 58.5″ east; variation, 3° 37′ east. The region is a dangerous one, and should be navigated with the greatest caution.

The governor visited the ship on the morning of June 3, and at 5:25 p. m. the same day we left for Copper Island, having on board a native pilot sent to us by the governor.

Arriving off the village of Preobrajenski at 9:15 the following morning, we were boarded by the agent of the Russian Seal-Skin Company, Mr. E. G. Kluge, who came out in a whaleboat with a crew of boys and the patriarch of the village as coxswain, the hunters all being absent, some guarding the rookeries and others on the sea-otter grounds. The village lies on the south shore of a small bay, 10 miles from the north end of the island, which is accessible to small craft only. A vessel may anchor outside in fine weather, but she would be exposed to all winds from the northwest to east and southeast.

It was our intention to interrogate the hunters of this island regarding seal life, but finding it impracticable, owing to their absence, we took the agent's boat in tow, and with himself and party on board started for the Polatka Rookery, which is the largest and most important on Copper Island. It lies on the west side, about 10 miles from its southern extremity and 40 miles from the settlement. Arriving at 2:30 p. m., a party consisting of the agent and his crew, the naturalists, hunters, and photographer visited the rookery, where they procured a couple of young males, made a general inspection of the locality, and took several photographs illustrating the character of the ground and numbers of seals. With the exception of the two bachelor seals before mentioned, there were none but old bulls hauled out, and they were distributed over the ground holding their claims.

The rookery extends several miles along a narrow rugged beach, backed by precipitous mountain slopes, mostly inaccessible. The four principal rookeries lie along this stretch of beach, and are practically continuous, all but one having driveways across the island, from 1 to 3 miles, surmounting elevations of 400 to 800 feet—much more trying than the Pribilof drives.

Returning to the village, the agents left the ship and we started

immediately for Unalaska. We regretted not seeing the settlement of this, the wealthiest community in all the Bering Sea islands, but the lack of coal and the prescribed limit of the cruise admonished us of the necessity of promptly starting homeward.

The following notes concerning the Commander Islands may not be out of place, as, outside of parties interested in the sealing industry, they are almost unknown.

The group consists of two principal islands, Bering and Copper, with numerous outlying rocks and islets. Bering Island, the largest and most important, is about 50 miles in length, northwest and southeast, and 17 miles in breadth near its northern end, narrowing to a point at its southeastern extremity. A range of mountains extends through the center, reaching a height of 2,000 feet or more in the southern part, while they are much lower toward the northern extreme.

Copper Island is about 30 miles in length northwest and southeast, from 2 to 5 miles in width, and has a central mountain range upwards of 2,000 feet in height. The group belong to the Kamchatka system, Copper Island resting just within the 100-fathom curve from the Asiatic coast.

Neither island has a secure harbor for vessels of any size, Preobrajenski furnishing protection to small craft only. The "port," as Nikolski Bay is called, is open to westerly winds, subject to heavy ground swells, and is altogether an undesirable anchorage under the best conditions, and dangerous unless a vessel is prepared to go to sea at any moment.

The climate is not very severe, although the group lies in 55° north latitude, the benign influence of the Japan stream being evidenced by the absence of intensely cold weather. Heavy snows are not infrequent, and during the winter months northwest winds frequently bring in great fields of ice from the Asiatic shore. Driftwood from Kamchatka and Japan is depended upon for domestic purposes, and timber is reported to have drifted ashore which grows only on the American continent. Nutritious grasses grow over a large portion of Bering Island, and the natives cultivate some of the more hardy vegetables. Copper Island, on the contrary, has little level or arable land.

The population of Bering Island on July 1, 1892, was 354, 336 natives and 18 whites, the latter being members of the families of the governor and agent of the lessees.

Copper Island has a population of 300 natives and 2 whites, the agent of the lessees and the assistant to the governor.

The entire population of Bering Island is concentrated at Nikolski, and of Copper at Preobrajenski. They all came originally from the Aleutian Islands. They are housed in comfortable wooden cottages as a general rule, although a few still live in primitive "barabaras." The Greek church is the most prominent feature of the village.

Nikolski is admirably situated on a narrow strip of level land on the south and east shores of the bay of that name. Bluffs about 100 feet

in height rise immediately back of the settlement, from which extend rolling table-lands affording excellent pasture. A small stream passes through the center of the village and empties into the bay; just beyond the settlement, in a northeasterly direction, a fine stream about 400 feet in width falls into the head of the bay. This stream forms the outlet to a series of lakes and marshes which occupy the interior of the northern portion of the island, and affords a bountiful supply of salmon, flounders, herring, trout, and other varieties of edible fish, which are taken by means of a seine in the open season, and speared through holes in the ice during winter. We witnessed the hauling of a seine and shared in the results, receiving a quantity of excellent salmon, sufficient for a meal for the whole ship's company.

The available men took the seine on their shoulders and carried it to the stream; a footbridge a few hundred yards above its mouth enabled them to carry it across, and after adjusting it properly the ropes were manned and the seine dragged down stream slowly against a young flood tide until, by the weight of the net, it was ascertained that a sufficient number had been taken, when the men on the north bank, who wore waterproof boots, waded the stream, carried the lines across, and landed the catch on the bank nearest the settlement, where the women were gathered to receive it.

The government of the group is vested in a governor appointed by the authorities in St. Petersburg, Col. N. A. Grebnitzky being the present incumbent; he has an assistant on Copper Island. The agents of the lessees are intermediaries between governor and natives; the priest of the Russian church also wields great power. A native chief and second chief are elected by the vote of the able-bodied men of the island, subject to the governor and agent, the former having the power to displace them at any time. They serve during good behavior.

The chief must superintend personally all work undertaken by the natives of whatever description, and is held in a measure responsible for its execution. There are certain privileges and slight pecuniary compensation attaching to the position. If two or more expeditions are to start at the same time, he puts the second chief in charge of one, and accompanies the most important himself. He has authority to appoint as many deputies as the occasion demands, and all natives are required to obey him explicitly.

Every member of the community without reference to age or sex has certain duties to perform, according to individual capacity. During the sealing season, all the able-bodied men and larger boys are employed on the rookeries; in the winter time they hunt the blue fox. The pay of the natives for all work is turned into a common fund; the lessees pay 1½ rubles for every fur-seal skin taken, 14 rubles for each first-class blue-fox skin, and 7 rubles for second-class fox skins. The fund is divided per capita, a certain amount being withheld for the support of the church and for the additional compensation of the

chief. The head of each family is the person to whom the money is given in charge, the amount he receives being according to the number of persons in his household. These need not be actual relatives, but may be invalids, aged, or otherwise nonsupporting persons under his protection. All community work is performed without pay. The young man is naturally anxious to handle the family fund; hence he marries early in order to take his place as head of a family as soon as possible.

A small guard is maintained for watching over the rookeries. The privates are selected from the native youths between the ages of 15 and 21; they serve three years without further compensation than their share of the family fund. The noncommissioned officers are Russians. While the guards are stationed at the rookeries, they occupy barabaras usually situated on the bluffs overlooking the beaches, and are not allowed to approach a rookery except to repel poachers. It is their first duty to give the alarm, in case boats are seen approaching, and warn them off; if the warning is not heeded, they are to drive the seals into the water, and if the poachers still persist in landing or do not depart they are to fire upon them, using sufficient force to drive them away.

Strict rules for the preservation of the seal herd are rigidly enforced on the rookeries; they are voluminous and cover every possible contingency. The following are a few that differ from those in vogue on the Pribilofs:

None but natives are allowed to work on the rookeries.

A fine of 100 golden rubles is imposed by the Government upon any one who kills a female fur-seal, and 10 rubles for killing a pup, and such additional fine shall be paid as shall be imposed by the natives themselves.

No person, native or otherwise, is allowed to wear boots with nails in them on the rookeries; rubber boots or tarbosas must be used.

Chewing or smoking tobacco, expectorating, or attending to the requirements of nature are strictly prohibited on the rookeries.

Knives may be carried, but a stick with a metal ferule is not permitted.

No small boys or females are allowed on the rookeries, and dogs must be left half a mile from the rookeries during the breeding season.

Transportation on the islands is by means of dog sleds, nearly every adult native having at least one team. The dogs are kept staked out or penned up on the bluff back of the village, each team forming a separate colony, and when all are howling and barking the noise is deafening. In summer, when there is little or no snow on the ground, a team usually consists of 12 to 14 dogs harnessed two and two, with a leader; in winter, 8 to 10, harnessed in pairs with a leader, complete a team. When the ground is covered with snow the latter team will easily travel 25 miles a day, drawing a sled with 3 men and a reasonable amount of baggage, while in summer it is considered good work for the larger team to travel 15 miles with 2 men and baggage. The dogs are fed on seal meat, fish, fresh or dried, sea birds, etc. The teams are allowed considerable liberty during the winter season, and roam about the settlement at will, but in summer they are more strictly confined.

In 1881 the Alaska Commercial Company, then lessees of these islands, imported 15 reindeer from Siberia and turned them loose on Bering Island; there were 5 bulls and 10 cows. They soon became acclimated, increasing to about 300 by the spring of 1892, and it is expected that the average ratio of increase will bring their numbers to 1,000 in about five years. The herd has been carefully protected by the governor, and it is his intention eventually to make it a regular source of food supply.

The natives have small herds of Siberian cattle which find subsistence on the island the year round; the milch cows are stabled during the winter, as it not only increases the milk supply but insures their being within reach at milking time. This hardy breed of cattle is small, short-horned, covered with a thick coat of long hair, and has proven self-supporting on the Commander Islands. The officers and crew of the *Albatross* can attest to the excellence of their flesh as an article of food.

It seems to me that these sturdy cattle might be advantageously introduced into the Aleutian Archipelago. The climate is not unlike that of Bering Island; there is ample food for them on most of the islands; no wild animals larger than a fox would interfere with them, and in fact there is no apparent reason why they should not thrive and increase rapidly, eventually furnishing the natives a much-needed food supply. The extinction of fur-bearing animals which have heretofore afforded them means of purchasing provisions is already making it exceedingly difficult for the hunters to procure the necessaries of life for their families; a few years more and another source of supply must be made available to them or they will disappear from the face of the earth. It would involve but little expense for the Government to place a couple of bulls and from four to eight cows on the principal islands of the archipelago, whether inhabited or not; if near a settlement the chief could be given charge of them and on uninhabited islands they could take care of themselves.

Mention has been made of the regulations concerning seal life on the Commander Islands, and the following translation of the sea-otter laws may be of interest, in view of the fact that under them this valuable fur-bearing animal has not only retained its numbers, but is reported to be actually increasing:

Translation of the sea-otter laws in vogue on the Commander Islands, June, 1892.

The date on which sea-otter hunting commences each year is February 1; the season lasts until June 1, by the Russian mode of computing time. It is unlawful to kill or hunt the sea-otter at any time other than that specified above.

In the vicinity of and on the sea-otter rookeries spears and nets only shall be used in taking sea otter.

Notice: Any person is permitted to use rifle or shotgun in pursuit of the sea-otter when 5 or more Russian versts (2½ English miles) removed from the rookeries; but any person or persons using firearms when hunting sea-otter at a distance less than 5 versts from a rookery is liable to imprisonment and the confiscation of his personal and real property by the Imperial Government.

Females and yearling pups, when caught in the nets, may not be killed, but shall be set free again.

All persons are forbidden to go on or near a sea-otter rookery during the breeding season; neither shall any person or persons make camp on or near a rookery during this period, nor build a fire, nor be the cause of any kind of smoke.

Children are not permitted on or near the sea-otter rookeries.

The numbers allowed to be taken each season are also prescribed.

Commander Islands to Unalaska and Port Townsend.—The trip to Unalaska was uneventful. Strong easterly winds prevailed until June 7, and slow progress was made against the head seas. The boilers were giving us trouble also, leaks and consequent salting being so great that we were obliged to use both, even with a reduced consumption of 12 tons of coal per day. Light variable winds and smooth seas enabled us to make better time from the 180th meridian to port, where we arrived at 1:30 p. m. June 9, one day ahead of the date prescribed as the limit of the cruise.

The U. S. S. *Yorktown* was lying in port and Commander R. D. Evans, senior naval officer in Bering Sea, informed me that he would probably send the *Albatross* to Puget Sound with dispatches, etc., and on the 12th the following order was received:

U. S. S. YORKTOWN (3D RATE),
Dutch Harbor, Unalaska, June 11, 1892.

Lieut. Commander Z. L. TANNER, U. S. Navy,
Commanding U. S. Fish Commission Steamer Albatross:

SIR: When you are ready for sea, proceed with dispatch to Port Townsend, Wash., giving passage to Maj. Williams and such other persons as he may direct, and transportation to such articles as he may wish to take. On arrival at Port Townsend wire the Department and send the inclosed cipher message to the Secretary of the Navy. Forward all specimens immediately, by express, to Dr. Merriam, Agricultural Department, Washington, D. C. You will then return, with dispatch, to Unalaska, and continue your work in Bering Sea as directed.

Very respectfully,

R. D. EVANS,
Commander, U. S. Navy, Commanding U. S. Naval Force in Bering Sea.

Mr. A. B. Alexander, fishery expert, reported on our arrival, having been on temporary duty on board the revenue steamer *Corwin*. The bunkers were replenished from the 11th to the 14th, work meanwhile being pushed day and night on the boilers. Capt. J. E. Lennan, one of our hunters, and an experienced Alaska pilot, was, at the request of Commander Evans, temporarily transferred to the *Yorktown* pending the trip of this vessel to Puget Sound.

In obedience to the order of the senior naval officer, the seal specimens from the Pribilof Islands, destined for Washington, were received from the *Rush*. An invalid, Alonzo Jones, seaman, was transferred from the *Yorktown* with instructions to forward him to the U. S. Naval Hospital at Mare Island. The following-named persons were received for passage to Port Townsend: U. S. Treasury Agent W. H. Williams and wife; U. S. Treasury Agent H. S. Nettleton, wife, and child; U. S.

Treasury Agent Milton Barnes; Government School-teacher J. A. Tuck.

Mail was received from vessels in the harbor and from shore, and at 9:30 p. m. June 14 we proceeded to sea, entering the Pacific through Unalga Pass. Nothing of moment occurred until next morning, when large numbers of seals were seen between Unimak Pass and the Sannaks. It is worthy of remark that, with the exception above mentioned, not a seal was seen in the water during the voyage of the *Albatross* from Puget Sound to Unalaska, the Aleutian Archipelago, the Commander Islands, and thence to Unalaska and back to Puget Sound, though a vigilant lookout was kept whenever the vessel was underway.

After passing the Shumagin group, a great-circle course was taken for Cape Flattery. A southeaster was encountered on the 15th and 16th, followed by a heavy southwest gale on the 18th and 19th; thence to port, moderate to brisk breezes from the northward and westward.

We arrived at Port Townsend at 5 p. m. June 23, having sustained no material damage during the rough trip except the disabling of the foreyard, which was immediately replaced by a new one.

The seal specimens from the Pribilof and Commander islands were landed at once and forwarded by express as directed; affidavits and other papers were dispatched by registered mail.

The boilers gave us much trouble during the trip, leaking so badly that salt deposits in the back connections completely cut off the draft from some of the furnaces; the engineer's force worked night and day after our arrival to get them in condition for further service. We went to Departure Bay on the 26th, filled up with coal, and returned on the 29th, when stores and mail were taken on board for the vessels in Bering Sea. All preparations were completed on the evening of June 30, and a little after midnight the *Albatross* sailed again for Unalaska.

Scientific results.—The scientific investigations during the northern cruise were confined largely to collecting information pertaining to the natural history of the fur seal, and the gathering of such other facts as might have a bearing upon the question at issue between the Government of the United States and that of Great Britain concerning that animal. The detailed report of these investigations will be made at the proper time by Prof. Evermann and Mr. Townsend.

Very little time or attention could be given to other lines of natural-history work; yet, by taking advantage of the occasional days when the regular work could not be carried on, the naturalists on board were able to make considerable collections of fishes, birds, and marine invertebrates. Important collections of fishes were made at Port Graham, Kadiak, Port Etches, Unalaska, Atka, Attu, Bering Island, and Puget Sound. Numerous specimens of birds were secured at each of these places, including a particularly interesting series of ptarmigan from Kadiak and the Aleutian Archipelago. Large and valuable collections of plants were made, especially from about Unalaska.

At Bering Island we received, through the kindness of Governor Grebnitzky, a tank of fishes and invertebrates, a large box of bird skins, and a series of skulls of the fur seal, all presented by him to the U. S. Fish Commission. The most important specimen obtained, however, was the skeleton of Steller's sea cow (*Rhytina stelleri*), purchased from a native of Bering Island. This skeleton was found in May, 1891, imbedded in the sand on the west side of Bering Island, and is believed to be, with one exception, the best-preserved and most perfect skeleton of this animal known.

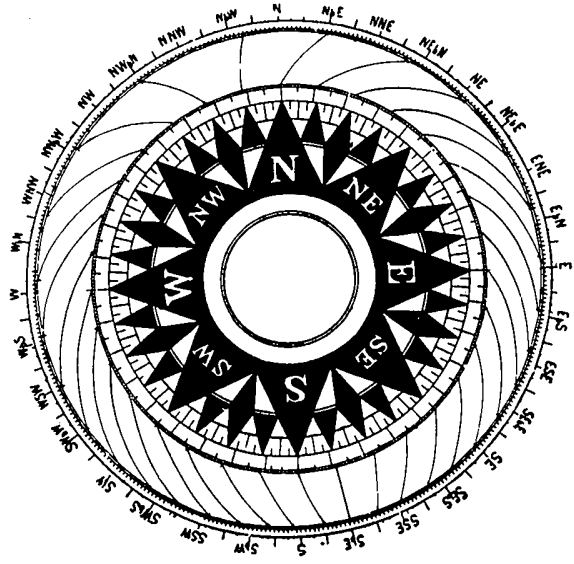
Mention has already been made of the various species of fish taken from the rail with hook and line.

SUMMARY OF THE YEAR'S WORK.

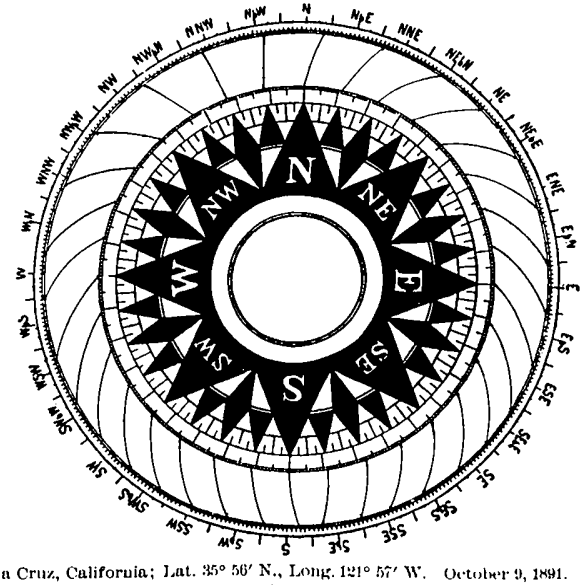
The cruising ground of the *Albatross* during the year has been between the parallels of 21° and 60° north and the meridians of 122° west and 166° east. The following table gives the number of days under way, distances run, and object of each trip:

Date.	Distance.	Object.
1891.	*Knots.*	
July 8	26	San Francisco to Mare Island.
July 14	26	Mare Island to San Francisco.
July 16 to 25	2,145	San Francisco to Unalaska.
July 27 to 28	255	Unalaska to St. Paul via St. George Island.
July 30	68	Cruise off St. Paul Island for sealing vessels.
Aug. 3 and 4	52	Sounding and dredging.
Aug. 5	66	Taking commissioners around St. Paul Island.
Aug. 9 to 11	273	From St. Paul to Unalaska via St. George and Bogoslof.
Aug. 13 to 21	1,728	From Unalaska to Departure Bay, B. C.
Aug. 22 to 26	204	Departure Bay to Tacoma, Seattle, and Port Townser
Aug. 27 to Sept. 10	455	Sounding, dredging, and fishing in Straits of Fuca.
Sept. 11 to 15	927	Departure Bay to Mare Island via Port Townsend.
Oct. 5	26	Mare Island to San Francisco.
Oct. 9 to 24	1,925	Preliminary trip: Cable Survey.
Oct. 25	26	San Francisco to Mare Island.
Nov. 1	30	Mare Island to San Francisco.
Nov. 4 to 22	2,186	Cable Survey: San Francisco to Honolulu, H. I.
Dec. 2 to 6	215	Cable Survey: Locating shore-end, Oahu.
Dec. 11 to 31	2,276	Cable Survey: Honolulu to San Francisco.
1892.		
Jan. 6 to 16	1,481	Cable Survey: Completion of rhumb line.
Mar. 19 to 25	938	Seal Investigation: Mare Island to Port Townsend.
Mar. 28 to 30	96	Port Townsend to Seattle and return.
Mar. 31 to Apr. 8	1,317	Seal Investigation: Port Townsend to Port Graham, Cook Inlet.
Apr. 9	17	Seal Investigation: Port Graham to Chesloknu Bay.
Apr. 11	26	Seal Investigation: Chesloknu Bay to Coal Bay.
Apr. 12	138	Seal Investigation: Coal Bay to Kadiak.
Apr. 14 to 15	257	Seal Investigation: Kadiak to Port Etches.
Apr. 18 to 28	1,435	Seal Investigation: Port Etches to Port Townsend.
May 4	42	Port Townsend to Seattle.
May 6	41	Seattle to Port Townsend.
May 10 to 19	1,924	Seal Investigation: Port Townsend to Unalaska.
May 22 and 23	342	Seal Investigation: Unalaska to Nazan Bay, Atka Island.
May 25 to 28	544	Seal Investigation: Nazan Bay to Chichagof Harbor, Attu Island.
May 29 to 31	336	Seal Investigation: Chichagof Harbor to Nikolski, Commander Islands.
June 3 and 4	119	Seal Investigation: Nikolski, Bering Island, to Preobrajenski, Copper Island.
June 4	81	Seal Investigation: To rookeries and return.
June 4 to 9	943	Seal Investigation: Copper Island to Unalaska.
June 14 to 23	1,808	Seal Investigation: Unalaska to Port Townsend.
June 26 and 27	107	Port Townsend to Departure Bay, B. C.
June 28 and 29	90	Departure Bay to Port Townsend.

At sea: 206 days; 24,991 knots steamed.



Kachemak Bay, Cook Inlet, Alaska; Lat. 58° 30′ N., Long. 151° 45′ W. April 11, 1892. Variation, 25° East; annual decrease 7′ (approx.).



Off Santa Cruz, California; Lat. 35° 56′ N., Long. 121° 57′ W. October 9, 1891. Variation, 16° 15′ East; annual change inappreciable.

DEVIATION CARD, U. S. FISH COMMISSION STEAMER ALBATROSS.

PERSONNEL.

There have been ten changes among the officers during the year, as follows:

July 2, 1891. Assistant Paymaster John S. Carpenter reported for duty.
July 9, 1891. Assistant Paymaster C. S. Williams was detached.
July 10, 1891. Ensign H. B. Wilson reported for duty.
Oct. 1, 1891. Ensign J. E. Shindel reported for duty.
Oct. 7, 1891. Lieut. (junior grade) J. H. Holcombe was detached.
Oct. 25, 1891. Ensign W. B. Fletcher reported for duty.
Oct. 26, 1891. Passed-Assistant Surgeon F. W. F. Wieber reported for duty.
Oct. 27, 1891. Passed-Assistant Surgeon Nelson H. Drake was detached.
Oct. 31, 1891. Ensign William G. Miller reported for duty.
Nov. 3, 1891. Ensign J. E. Shindel was detached.

Following is a list of the officers attached to the *Albatross* June 30, 1892: Lieut. Commander Z. L. Tanner, U. S. Navy, commanding; Lieut. C. G. Calkins, U. S. Navy, executive and navigating officer; Ensign H. B. Wilson, U. S. Navy; Ensign W. B. Fletcher, U. S. Navy; Ensign E. A. Anderson, U. S. Navy; Ensign W. G. Miller, U. S. Navy; Passed Assistant Surgeon F. W. F. Wieber, U. S. Navy; Passed Assistant Paymaster J. S. Carpenter, U. S. Navy; Assistant Engineer A. M. Hunt, U. S. Navy.

The civilian staff was as follows: Prof. B. W. Evermann, assistant in charge of scientific department during the sealing investigation; Charles H. Townsend, resident naturalist; A. B. Alexander, fishery expert; N. B. Miller, assistant in scientific department; Harry Clifford Fassett, clerk to commanding officer.

The crew list of June 30, 1891, limiting the number to 53 men, has been in force during the year except when the vessel was engaged on the cable survey under the Navy Department, the original number, 68, having been allowed during the progress of that work. With this exception, civilians have been taken on temporarily to fill the vacancies; and while we have maintained the efficiency of the vessel in a general way, the practice of making up a mixed crew of enlisted men and civilian employés has been found very unsatisfactory, and it is to be hoped that arrangements may soon be made for a suitable number of men for the performance of the special work assigned the vessel.

The Commission is indebted to Rear-Admiral John Irwin, commandant, and the officers of the navy-yard at Mare Island, California, for their uniform courtesy to the officers of the *Albatross* personally, and for the facilities of the yard, which have been freely granted to us at all times for making repairs and refitting the vessel.

We are also indebted to Pay Inspector George A. Lyon, U. S. Navy, in charge of the navy pay-office at San Francisco, for taking charge of and forwarding our mails, a kindness which can only be fully appreciated by those who spend half the year in Bering Sea.

The Alaska Commercial Company have, as usual, rendered us material aid in our northern work.

We are under obligations to the North American Commercial Company for the transportation of Prof. B. W. Evermann and Mr. N. B. Miller, the photographer, from Unalaska to the Seal Islands and return, also for subsisting them on the islands and facilitating their investigations generally.

MEDICAL REPORT.

[By T. A. Berryhill, passed assistant surgeon, U. S. Navy.]

I have to report that during the fiscal year ending June 30, 1892, the ship being at sea 44 per cent of the time, there were admitted to the sick-list of this vessel 46 patients, of whom 42 were discharged to duty and 4 transferred to hospital. There were 243 working days lost by these patients, which is about 3½ per cent of the whole number of working days of the entire ship's company. The number of days' work lost on account of injuries was 93, leaving 137 days' work lost on account of diseases due to contagion and infection, and conditions of ship life. The remaining 13 days were lost by a patient sent for transfer to hospital.

At one time there threatened to be an epidemic of "grippe," 5 cases being admitted to the sick-list and many others being under treatment who continued at work, but it was averted or limited, probably by the sanitary precautions recommended by the medical officer and carried out by the commander.

The general health of the officers and crew during the year may be considered as having been excellent. During the cruises of the vessel on the cable survey to Honolulu nothing of medical interest was noted.

During the cruises to Alaska and Bering Sea medical attention and medicines were furnished the natives and the white settlers at Port Graham, Soldovoi, Coal Harbor, Kadiak, Port Etches, Atka, Attu, Unalaska, and Bering Island. At each place medicines were left for the treatment of cases seen by the medical officer, and in some cases medicines were left, with directions for using, to treat cases that might occur.

In none of these places could medical advice be obtained except from men-of-war or the revenue cutters. At Bering Island medical attention was given the Russian governor, there being no doctor there except when a Russian war vessel is in port. At Unalaska advice and medicines were given to the sailors on the whaling and merchant vessels whenever requested.

While in Bering Sea it was interesting to note the immunity the ship's company enjoyed from colds and catarrhal affections, not one case of respiratory disease occurring.

The system of ventilation on board has previously been described. By its use the ship can be kept dry and the air in the living quarters kept pure. The use of steam heat has been of great advantage from a

sanitary standpoint, as it, together with the ventilation, prevents the "sweating," which is so objectionable in most iron ships, and keeps the berth-deck dry.

The water, which is distilled by the Baird apparatus, is all that can be desired.

REPORT ON BOTTOM SPECIMENS.

[By N. B. Miller, Assistant in Scientific Department.]

Having made a microscopical examination of each specimen brought up from the bottom by the sounding cup during the cable survey between Monterey Bay and Honolulu, I have to report that I found the specimens from the bay to consist of fine sand and mud, mixed with vegetable matter washed from the shore into the water. When station 31, latitude 36° 39′ 30″ N., longitude 122° 41′ W., in 1,424 fathoms, was reached, the sand disappeared and nothing but sticky brown mud was brought up. This continued until station 36, latitude 36° 28′ N., longitude 123° 44′ W., 2,061 fathoms, when the first ooze was encountered; it was gray in color and contained a few foraminifera. These conditions remained the same until, at station 40, latitude 36° 09′ N., longitude 124° 55′ 30″ W., in 2,434 fathoms, the ooze became mixed in color—brown and gray—containing few shells. From station 44, latitude 35° 47′ 30″ N., longitude 126° 05′ W., to station 72, latitude 33° 12′ N. and longitude 133° 34′ 30″ W., the depths from 2,566 to 2,895 fathoms, the ooze was of a dark-brown color and contained very few shells. At these great depths, the foraminifera had probably sunk deeper into the soft ooze than the specimen cup penetrated.

At station 73, latitude 33° 08′ N. and longitude 133° 46′ W., depth 2,678 fathoms, brown mud was again found; and at station 74, latitude 33° 04′ 30″ N., longitude 133° 56′ 30″ W., in 2,670 fathoms, the specimen cup brought up brown mud containing small pieces of lava. Brown mud and lava continued until station 81, latitude 32° 44′ 30″ N., longitude 134° 58′ W., depth 2,014 fathoms, when the cup brought up nothing but lava, there being no sign of mud having been in the cup; the largest piece of lava weighed a half ounce. The shot must have struck a large piece and shattered it, the specimen cup becoming detached before the mud was reached. From here to station 246, latitude 23° 11′ N., longitude 154° 34′ W., 1,783 fathoms, the character of the bottom remained the same, brown ooze containing few foraminifera. At this station the color changed to light gray, the ooze containing more foraminifera than had been found in any specimen previously examined. At the next station, 247, in latitude 23° 05′ N. and longitude 154° 45′ 30″ W., 2,411 fathoms, the color of specimen was brown and continued so up to station 256, latitude 22° 18′ N., longitude 155° 58′ 30″ W., 2,542 fathoms, when brown mud was again found; as we approached the island of Oahu, it became mixed with sand and sponge spicules.

At station 266, in 268 fathoms, the island of Oahu being then in sight, the specimen cup brought up about a pint of clean foraminifera, no mud or sand being present. The shells were globigerina and orbulina. From this station to the harbor of Honolulu the specimens examined consisted of fine sand, broken shells, small pieces of coral, and sponge spicules.

Returning over a line south of the other, the results were about the same.

We found no evidence of the red clay supposed to form the bottom of the ocean in the vicinity of the Hawaiian Islands.

REPORT ON THE MACHINERY.

[By A. M. Hunt, Assistant Engineer, U. S. N.]

(Abstract.)

Main engines.—During the year, the engines have been in operation 2,831 hours while the ship was on her course in free route. The time occupied in sounding and dredging at sea, when the engines were worked to signals, was 600 hours. The engines have been stopped for sounding and dredging, from full speed ahead, 640 times during the year, in addition to the number of stops incidental to her regular cruising. The ship has steamed 24,991 knots by log, an average of 8.85 knots per hour. The engines have made 10,592,556 revolutions, an average of 62.5 per minute. The maximum speed recorded during the year is 11.45 knots, and the highest average for six hours is 11.15 knots.

The run from San Francisco to Unalaska, in July, 1891, was made at high speed, and the wear on the crank-pin brasses was very excessive and abnormal. Babbitting the brasses, and changing the oiling gear, has reduced this wear to a minimum.

Such repairs have been made from time to time as to enable the ship to continue her work, but the engines are now in need of a thorough overhauling. The propeller shafts have worn down very much in the outboard bracket-bearings. The shafts are out of line and the starboard one shows signs of being sprung. Many parts are so worn as to require renewal, and much of the piping will have to be renewed. These repairs are fast becoming imperative.

Boilers.—Fires have been lit under the forward boiler, 5,128 hours; under the after one, 4,223 hours; under the donkey boiler, 471 hours. They have given a great deal of trouble during the year. The cast-iron check-valve chambers gave out in the second quarter, and have all been replaced by composition ones. Two hundred and forty-five new tubes were put in the boilers in June, 1891. Quite a number of these have pitted through, probably owing to imperfections in tubes. During the last two quarters, much trouble has been experienced from the tubes leaking at the back ends. This has become so aggravated during the last quarter that the tubes and connections become choked

up with salt, very much diminishing the efficiency of the boilers. Rerolling the tubes has only a temporary effect in stopping these leaks. I have fitted wrought-iron ferules in a number of the leaking tubes, but have not found much good resulting from their use. The tube sheets have cracked in about half a dozen places, across the bridges between adjacent tube holes. I can assign no reason for these cracks occurring.

In May, 1892, by orders of the Treasury Department, we took on board about 170 tons of Seattle (black diamond) coal. The boilers of this vessel are entirely unsuited to burning this coal, and its use was attended by a serious injury to the boilers and machinery. The coal is really a lignite, and, in burning, it evolves large quantities of gas. This gas (if the fires are forced at all) can not burn in the small combustion chambers of our boilers. As a consequence, it passes unconsumed through the tubes, but, heated above the igniting point, and coming in contact with air in the uptakes and stack, bursts into a fierce flame. This happened repeatedly while using the black diamond coal, and has never occurred with any other coal that has been used during the year I have served on this vessel. The drum, which is an annular cylinder, forming the lower section of stack, became very much overheated, and all the joints in it were started leaking. The steam in the drum became very much superheated and passing to the engines burnt out the packing all around. The steam had such a high temperature that it melted the solder off an expansion joint in the main steam pipe. The coverings of many small steam pipes were charred and burnt off. The wooden casing around the auxiliary steam pipe in the port coal-bunker caught fire and ignited the surrounding coal. Since the use of this coal the leaking at the tube ends has been much worse.

The boilers are in much worse condition than is generally the case with boilers that have had a similar length of service. This is due to the abnormal conditions to which they are subjected. One year of such service as that just closed, during which the engines were stopped from full speed ahead 640 times in addition to the number of stops incidental to cruising, is fully equal to two if not three years of ordinary service in destructive effect.

TABLES.

Record of hydrographic soundings by the U. S. Fish Commission steamer Albatross from July 1, 1891, to June 30, 1892.

Serial No.	Date.	Time of day.	Position.		Depth.	Character of bottom.	Temperatures.			Sounding machine.	Weight of sinker used.
			Lat. N.	Long. W.			Air.	Water at			
							Dry bulb	Surface.	Bottom.		
	1891.		° ′ ″	° ′ ″	*Fms.*		° F.	° F.	° F.		*Lbs.*
2639	Aug. 3	11:40 a. m.	57 07 00	107 27 00	31	bk. P. Sh	49	46	.....	Tanner	26
2640	...do...	5:56 p. m.	57 15 00	170 40 00	42	Rky	47	46	.....	...do...	26
2641	Aug. 11	6:15 p. m.	53 59 00	166 38 30	24	bk. G. brk. Sh	50	48	.....	...do...	26
2642	Aug. 28	7:25 a. m.	48 24 30	124 37 30	78	P	63	52	.....	...do...	26
2643	...do...	8:22 a. m.	48 26 00	124 37 20	144	br. M	63	52	.....	...do...	26
2644	...do...	9:13 a. m.	48 28 05	124 36 55	137	gy. S. G	63	52	.....	...do...	26
2645	Aug. 29	5:53 a. m.	48 24 25	124 37 45	59	G. S	59	54	.....	...do...	26
2646	...do...	6:39 a. m.	48 27 10	124 39 50	140	G	61	56	.....	...do...	26
2647	Sept. 1	6:20 a. m.	48 25 30	124 42 15	74	R	57	52	.....	...do...	26
2648	Sept. 2	12:18 p. m.	48 23 55	124 13 30	93	S. P	60	55	.....	...do...	26
2649	...do...	12:30 p. m.	48 24 50	124 11 40	73	gy. S	60	55	.....	...do...	26
2650	...do...	1:35 p. m.	48 25 30	124 08 00	44	gy. S	61	56	.....	...do...	26
2651	Sept. 3	6:25 a. m.	48 13 30	123 58 00	64	Sp	58	53	.....	...do...	26
2652	...do...	9:18 a. m.	48 18 00	123 49 40	95	rky	59	53	.....	...do...	26
2653	Sept. 4	12:10 p. m.	48 19 00	123 18 20	55	gy. S. G. Sh	62	58	.....	...do...	26
2654	...do...	1:03 p. m.	48 18 00	123 14 00	19	rky	62	58	.....	...do...	26
2655	Oct. 11	9:48 a. m.	36 48 10	121 47 50	52	fne. bk. S	50	55	49	Sigsbee	35
2656	...do...	10:03 a. m.	36 48 14	121 47 38	24½	gn. M	50	55	.....	Hand	14
2657	...do...	10:05 a. m.	36 48 15	121 47 34	20½	gn. M	50	55	.....	...do...	14
2658	...do...	10:07 a. m.	36 48 16	121 47 30	15½	gn. M	50	55	.....	...do...	14
2659	...do...	10:09 a. m.	36 48 17	121 47 28	12	gn. M	50	55	.....	...do...	14
2660	...do...	10:11 a. m.	36 48 18	121 47 26	10	gn. M	50	55	.....	...do...	14
2661	...do...	10:13 a. m.	36 48 14	121 47 26	9½	gn. M	50	55	.....	...do...	14
2662	...do...	10:15 a. m.	36 48 10	121 47 25	4½	gn. M	50	55	.....	...do...	14
2663	...do...	10:18 a. m.	36 48 06	121 47 27	7½	gn. M	50	55	.....	...do...	14
2664	...do...	10:20 a. m.	36 48 03	121 47 28	9	gn. M	50	55	.....	...do...	14
2665	...do...	10:21 a. m.	36 48 04	121 47 30	15	gn. M	50	55	.....	...do...	14
2666	...do...	10:23 a. m.	36 48 05	121 47 34	18½	gn. M	50	55	.....	...do...	14
2667	...do...	10:25 a. m.	36 48 06	121 47 38	23½	gn. M	50	55	.....	...do...	14
2668	...do...	10:40 a. m.	36 48 10	121 47 50	54	bk. M	52	55	.....	Sigsbee	35
2669	...do...	10:54 a. m.	36 47 53	121 49 00	75	gn. M	53	56	.....	...do...	35
2670	...do...	11:09 a. m.	36 47 34	121 50 20	124	gn. M	53	57	47·5	...do...	35
2671	...do...	11:22 a. m.	36 47 16	121 51 20	165	gn. M	53	56	.....	...do...	35
2672	...do...	11:36 a. m.	36 47 04	121 52 45	213	gn. M	53	56	46·1	...do...	35
2673	...do...	11:51 a. m.	36 46 50	121 53 50	266	br. M	53	56	.....	...do...	60
2674	...do...	12:07 p. m.	36 46 40	121 55 10	352	br. M. S	54	53	52·5	...do...	60
2675	...do...	12:24 p. m.	36 46 25	121 56 50	388	br. M. S	54	53	.....	...do...	60
2676	...do...	12:45 p. m.	36 46 15	121 57 30	442	fne. gy. S	54	53	39·5	...do...	60
2677	...do...	1:13 p. m.	36 45 45	122 00 00	377	gy. S	55	56	.....	...do...	60
2678	...do...	1:40 p. m.	36 45 25	122 02 30	618	br. M. S	55	55	39	...do...	60
2679	...do...	2:14 p. m.	36 45 00	122 05 30	548	br. M. S	55	55	40	...do...	60
2680	...do...	2:58 p. m.	36 44 40	122 09 30	868	br. M. S	55	55	37	...do...	60
2681	...do...	3:46 p. m.	36 44 00	122 13 00	486	gy. S	55	55	.....	...do...	60
2682	...do...	4:32 p. m.	36 43 00	122 17 00	663	br. M. S	55	55	38	...do...	60
2683	...do...	5:29 p. m.	36 42 30	122 22 00	770	br. M. S	54	55	.....	...do...	60
2684	...do...	6:39 p. m.	36 41 30	122 28 00	1,122	br. M. S	54	54	35·5	...do...	60
2685	...do...	8:42 p. m.	36 39 30	122 41 00	1,424	br. M	55	55	35·1	...do...	60
2686	...do...	10:46 p. m.	36 37 00	122 54 00	1,597	br. M	55	55	35	...do...	60
2687	Oct. 12	12:50 a. m.	36 35 00	123 06 00	1,661	br. M	55	55	35	...do...	60
2688	...do...	4:21 a. m.	36 32 30	123 19 00	1,907	br. M. S	56	54	35	...do...	60
2689	...do...	6:34 a. m.	36 30 30	123 32 00	1,983	(Lost Cup)	55	55	35	...do...	60
2690	...do...	8:45 a. m.	36 28 00	123 44 00	2,061	gy. Oz	55	54	35	...do...	60
2691	...do...	11:32 a. m.	36 25 30	124 02 50	2,112	gy. Oz	57	56	34·8	...do...	60
2692	...do...	2:16 p. m.	36 20 00	124 20 30	2,333	gy. Oz	55	55	35	...do...	60
2693	...do...	5:09 p. m.	36 14 30	124 37 30	2,330	gy. Oz	59	56	35	...do...	60
2694	...do...	8:55 p. m.	36 09 00	124 55 30	2,434	br. and gy. Oz	58	59	35	...do...	60
2695	...do...	11:47 p. m.	36 03 00	125 13 00	2,430	br. Oz	58	57	35	...do...	60
2696	Oct. 13	2:42 a. m.	35 58 00	125 31 00	2,547	br. and gy. Oz	58	57	35	...do...	60
2697	...do...	5:43 a. m.	35 52 30	125 48 00	2,576	br. and gy. Oz	58	57	35	...do...	60
2698	...do...	8:55 a. m.	35 47 30	126 05 00	2,566	br. Oz	62	62	35	...do...	60
2699	...do...	11:26 a. m.	35 41 50	126 22 20	2,574	br. Oz	61	62	34·9	...do...	60
2700	...do...	2:15 p. m.	35 37 00	126 41 00	2,569	br. Oz	62	62	34·9	...do...	60
2701	...do...	5:03 p. m.	35 33 00	126 59 30	2,654	br. Oz	62	62	35	...do...	60
2702	...do...	7:57 p. m.	35 28 30	127 17 00	2,577	br. Oz	61	62	35	...do...	60
2703	...do...	10:50 p. m.	35 24 00	127 36 00	2,533	bn. Oz	61	62	.....	...do...	60
2704	Oct. 14	1:38 a. m.	35 20 00	127 54 00	2,600	bn. Oz	63	64	35·0	...do...	60
2705	...do...	4:52 a. m.	35 15 30	128 12 00	2,701	bn. Oz	63	64	.....	...do...	60
2706	...do...	8:14 a. m.	35 11 30	128 29 00	2,666	bn. Oz	65	65	35·0	...do...	60
2707	...do...	11:10 a. m.	35 07 00	128 48 30	2,720	bn. Oz	65	65	35·0	...do...	60
2708	...do...	3:33 p. m.	35 03 30	129 05 00	2,645	bn. Oz	67	66	35·0	...do...	60
2709	...do...	6:18 p. m.	34 56 30	129 20 00	2,689	bn. Oz	66	65	35·0	...do...	60
2710	...do...	9:00 p. m.	34 49 00	129 37 00	2,707	(Lost Cup)	65	65	.....	...do...	60

Record of hydrographic soundings from July 1, 1891, to June 30, 1892—Continued.

Serial No.	Date.	Time of day.	Position. Lat. N.	Position. Long. W.	Depth.	Character of bottom.	Temperatures. Air. Dry bulb	Temperatures. Water at Surface.	Temperatures. Water at Bottom.	Sounding machine.	Weight of sinker used.
	1891.		° ′ ″	° ′ ″	*Fms.*		° F.	° F.	° F.		*Lbs.*
2711	Oct. 14	11:75 p. m.	34 42 00	129 52 30	2,701	br. Oz	64	65	.....	Sigsbee.	60
2712	Oct. 15	2:10 a. m.	34 35 00	130 08 00	2,751	br. Oz	64	64	35·1	...do	60
2713	...do ...	5:11 a. m.	34 28 00	130 24 00	2,768	br. Oz	63	64	.....	...do	60
2714	...do ...	7:52 a. m.	34 21 00	130 40 00	2,789	br. Oz	66	65	.....	...do	60
2715	...do ...	10:41 a. m.	34 14 00	130 56 00	2,869	br. Oz	67	65	35·4	...do	60
2716	...do ...	1:34 p. m.	34 07 30	131 12 00	2,895	br. Oz	66	65	.....	...do	60
2717	...do ...	4:31 p. m.	34 01 00	131 28 00	2,791	br. Oz	66	65	.....	...do	60
2718	...do ...	7:12 p. m.	33 54 30	131 45 00	2,772	br. Oz	66	65	35·4	...do	60
2719	...do ...	10:04 p. m.	33 48 30	132 01 00	2,806	br. Oz	66	66	.....	...do	60
2720	Oct. 16	12:58 a. m.	33 41 30	134 17 00	2,793	br. Oz	66	66	.....	...do	60
2721	...do ...	3:57 a. m.	33 35 00	132 33 30	2,833	br. Oz	65	66	35·3	...do	60
2722	...do ...	6:45 a. m.	33 28 30	132 50 00	2,700	br. Oz	65	67	.....	...do	60
2723	...do ...	8:50 a. m.	33 24 00	133 01 00	2,731	br. Oz	67	67	35·5	...do	60
2724	...do ...	10:51 a. m.	33 20 00	133 12 00	2,661	br. Oz	68	67	.....	...do	60
2725	...do ...	12:42 p. m.	33 15 30	133 24 00	2,662	br. Oz	68	67	.....	...do	60
2726	...do ...	2:42 p. m.	33 12 00	133 34 30	2,685	br. M	68	67	35·5	...do	60
2727	...do ...	4:56 p. m.	33 08 00	133 46 00	2,678	br. M	67	66	.....	...do	60
2728	...do ...	6:55 p. m.	33 04 30	133 56 30	2,670	br. M. Lava	67	67	.....	...do	60
2729	...do ...	8:50 p. m.	33 01 00	134 08 00	2,641	br. M. bk. Sp.	67	67	35·1	...do	60
2730	...do ...	11:04 p. m.	32 57 30	134 18 30	2,667	br. M	67	66	.....	...do	60
2731	Oct. 17	1:07 a. m.	32 54 00	134 30 00	2,796	br. M	67	68	.....	...do	60
2732	...do ...	3:19 a. m.	32 50 00	134 40 30	2,834	br. M	67	68	35·2	...do	60
2733	...do ...	5:45 a. m.	32 46 30	134 52 00	2,461	br. M	67	68	.....	...do	60
2734	...do ...	7:00 a. m.	32 46 00	134 54 00	2,322	br. M. Lava	69	68	35·3	...do	60
2735	...do ...	8:23 a. m.	32 44 40	134 58 00	2,014	Lava	69	68	.....	...do	60
2736	...do ...	9:16 a. m.	32 44 00	135 00 00	2,406	br. M. Lava	69	68	.....	...do	60
2737	...do ...	10:34 a. m.	32 42 00	135 05 00	2,529	br. M	69	68	35·3	...do	60
2738	...do ...	11:30 a. m.	32 41 30	135 07 20	2,463	br. M	69	68	.....	...do	60
2739	...do ...	1:00 p. m.	32 39 30	135 12 00	2,463	br. M	70	69	.....	...do	60
2740	...do ...	3:07 p. m.	32 35 30	135 22 00	2,375	br. Oz	70	69	35·2	...do	60
2741	...do ...	5:14 p. m.	32 31 00	135 33 00	2,739	br. Oz	69	69	35	...do	60
2742	...do ...	7:34 p. m.	32 27 00	135 43 30	2,506	br. Oz	69	69	.....	...do	60
2743	...do ...	9:35 p. m.	32 22 30	135 54 00	2,442	br. Oz	69	68	.....	...do	60
2744	...do ...	11:48 p. m.	32 18 00	136 04 30	2,276	br. Oz	69	69	34·9	...do	60
2745	Oct. 18	2:04 a. m.	32 14 00	136 15 00	2,557	br. Oz	68	69	.....	...do	60
2746	...do ...	4:27 a. m.	32 10 00	136 26 00	2,492	(Lost cup.)	69	69	.....	...do	60
2747	...do ...	6:58 a. m.	32 05 30	136 36 30	2,421	br. Oz	69	69	35	...do	60
2748	...do ...	9:41 a. m.	32 01 30	136 47 30	2,417	br. Oz	69	69	.....	...do	60
2749	...do ...	12:25 p. m.	31 57 00	136 58 30	2,601	br. Oz	62	69	.....	...do	60
2750	...do ...	4:10 p. m.	31 52 30	137 09 00	2,547	br. Oz	61	68	34·9	...do	60
2751	...do ...	6:31 p. m.	31 48 00	137 19 30	2,654	br. Oz	63	69	.....	...do	60
2752	...do ...	8:50 p. m.	31 43 00	137 30 30	2,670	br. Oz	65	69	.....	...do	60
2753	Oct. 23	11:51 a. m.	36 47 45	121 50 54	130	gn. M	68	60	.....	...do	35
2754	...do ...	12:04 p. m.	36 47 40	121 52 10	173	gn. M	68	60	.....	...do	35
2755	...do ...	12:18 p. m.	36 47 32	121 53 20	223	gn. M	68	60	.....	...do	35
2756	...do ...	12:33 p. m.	36 47 25	121 54 35	202	gn. M. S	68	60	.....	...do	35
2757					Void.						
2758	...do ...	12:46 p. m.	36 47 20	121 55 45	277	gn. M	68	60	.....	...do	35
2759	...do ...	1:02 p. m.	36 47 10	121 57 05	302	gn. M	63	60	.....	...do	35
2760	...do ...	1:20 p. m.	36 47 10	121 58 15	255	gn. M	64	60	.....	...do	35
2761	...do ...	1:36 p. m.	36 47 10	121 59 30	418	gn. M	63	60	.....	...do	35
2762	...do ...	1:53 p. m.	36 47 10	122 00 50	502	gn. M	63	60	.....	...do	35
2763	...do ...	2:14 p. m.	36 47 10	122 02 05	495	gn. M	60	59	39·4	...do	60
2764	...do ...	2:31 p. m.	36 47 10	122 03 20	122	gy. S	60	59	.....	...do	60
2765	...do ...	2:45 p. m.	36 47 10	122 04 35	441	gn. M. S	60	59	.....	...do	60
2766	...do ...	3:00 p. m.	36 47 10	122 05 50	196	gn. M. S	60	58	.....	...do	60
2767	...do ...	3:22 p. m.	36 47 10	122 07 05	202	gn. M. S	60	58	44·8	...do	60
2768	...do ...	3:37 p. m.	36 47 10	122 08 20	373	gn. M. S	60	58	.....	...do	60
2769	...do ...	3:56 p. m.	36 47 10	122 09 35	440	gn. M	59	58	.....	...do	60
2770	...do ...	4:19 p. m.	36 47 10	122 10 50	271	fne. gy. S	59	58	.....	...do	60
2771	...do ...	4:38 p. m.	36 47 10	122 12 05	291	gn. M. S	59	57	42	...do	60
2772	...do ...	4:56 p. m.	36 47 10	122 13 20	343	gn. M. S	59	58	.....	...do	60
2773	...do ...	5:13 p. m.	36 47 10	122 14 35	395	gn. M. S	59	57	.....	...do	60
2774	...do ...	5:31 p. m.	36 47 10	122 15 50	469	gn. M. S	59	56	.....	...do	60
2775	...do ...	5:52 p. m.	36 47 10	122 17 05	607	gn. M. S	58	56	37·7	...do	60
2776	...do ...	6:13 p. m.	36 46 10	122 18 20	621	gn. M. S	58	57	.....	...do	60
2777	...do ...	6:40 p. m.	36 47 10	122 19 35	979	gn. M. S	58	56	.....	...do	60
2778	Nov. 7	11:25 p. m.	33 07 00	133 46 15	2,239	bn. M. Lava	66	68	.....	...do	60
2779	Nov. 8	1:41 a. m.	33 02 30	133 57 00	2,520	bn. M	66	67	35·1	...do	60
2780	...do ...	3:52 a. m.	32 58 30	134 08 30	2,648	bn. Oz	64	67	.....	...do	60
2781	...do ...	6:15 a. m.	32 54 00	134 18 30	2,512	bn. Oz	64	67	.....	...do	60
2782	...do ...	8:35 a. m.	32 49 30	134 29 30	2,721	bn. Oz	66	68	35·1	...do	60
2783	...do ...	10:49 a. m.	32 45 00	134 40 00	2,425	br. Oz. bk. Sp	66	68	.....	...do	60
2784	...do ...	11:49 a. m.	32 43 40	134 42 30	2,442	br. M. Lava	68	68	35·1	...do	60
2785	...do ...	2:50 p. m.	32 41 00	134 49 30	2,415	br. M. Lava	68	68	.....	...do	60
2786	...do ...	4:02 p. m.	32 40 00	134 51 30	2,482	br. M	69	68	35·1	...do	60

Record of hydrographic soundings from July 1, 1891, to June 30, 1892—Continued.

Serial No.	Date.	Time of day.	Position.		Depth.	Character of bottom.	Temperatures.			Sounding machine.	Weight of sinker used.
			Lat. N.	Long. W.			Air.	Water at			
							Dry bulb	Surface.	Bottom.		
	1891.		° ′ ″	° ′ ″	*Fms.*		° F.	° F.	° F.		*Lbs.*
2787	Nov. 8	5:45 p. m.	32 37 30	134 57 00	2,564	br. Oz	69	68	.....	Sigsbee	60
2788	...do...	7:25 p. m.	32 35 00	135 03 00	2,470	br. Oz	69	68	.....	...do...	60
2789	...do...	9:11 p. m.	32 33 00	135 09 00	2,378	br. M. Lava Sp.	66	68	35·0	...do...	60
2790	...do...	10:50 p. m.	32 30 30	135 15 00	2,441	br. M	64	67	.....	...do...	60
2791	Nov. 9	1:56 a. m.	32 26 00	135 26 30	2,474	br. M	64	67	.....	...do...	60
2792	...do...	4:12 a. m.	32 21 30	135 38 00	2,600	br. M	64	67	.....	...do...	60
2793	...do...	6:24 a. m.	32 17 00	135 49 00	2,413	br. M	65	67	35·1	...do...	60
2794	...do...	8:31 a. m.	32 12 30	136 00 30	2,619	br. Oz	67	68	.....	...do...	60
2795	...do...	10:51 a. m.	32 08 00	136 11 30	2,606	br. Oz	68	68	.....	...do...	60
2796	...do...	1:01 p. m.	32 04 00	136 22 30	2,484	(Lost cup.)	64	67	.....	...do...	60
2797	...do...	3:29 p. m.	31 59 30	136 33 00	2,879	br. Oz	64	67	35·1	...do...	60
2798	...do...	6:01 p. m.	31 54 30	136 44 00	3,186	(Lost cup.)	65	67	.....	...do...	60
2799	...do...	8:43 p. m.	31 50 00	136 54 30	2,504	br. Oz	65	67	.....	...do...	60
2800	...do...	11:12 p. m.	31 45 30	137 05 00	2,591	br. Oz	68	68	35·1	...do...	60
2801	Nov. 10	1:41 a. m.	31 41 00	137 15 30	2,650	br. Oz	68	69	.....	...do...	60
2802	...do...	4:01 a. m.	31 36 00	137 26 00	2,629	br. Oz	67	69	.....	...do...	60
2803	...do...	6:32 a. m.	31 31 30	137 36 30	2,614	br. Oz	67	69	.....	...do...	60
2804	...do...	8:47 a. m.	31 27 00	137 47 00	2,719	br. Oz	67	68	35·1	...do...	60
2805	...do...	11:04 a. m.	31 23 00	137 58 00	2,700	br. Oz	66	67	.....	...do...	60
2806	...do...	1:10 p. m.	31 18 30	138 08 30	2,702	br. Oz	70	69	.....	...do...	60
2807	...do...	3:16 p. m.	31 14 30	138 19 00	2,587	br. Oz	70	69	.....	...do...	60
2808	...do...	5:37 p. m.	31 10 00	138 29 30	2,546	br. Oz	70	70	35·1	...do...	60
2809	...do...	7:42 p. m.	31 05 00	138 40 00	2,500	br. Oz	68	70	.....	...do...	60
2810	...do...	9:56 p. m.	31 01 30	138 50 00	2,412	br. Oz	68	69	.....	...do...	60
2811	...do...	11:59 p. m.	30 57 30	139 00 30	2,072	br. Oz. S	68	69	35·1	...do...	60
2812	Nov. 11	1:01 a. m.	30 56 30	139 02 30	2,199	br. Oz	69	69	.....	...do...	60
2813	...do...	2:51 a. m.	30 52 00	139 12 30	2,749	br. Oz	68	69	.....	...do...	60
2814	...do...	5:04 a. m.	30 48 00	139 23 00	2,567	br. Oz	68	69	35·1	...do...	60
2815	...do...	7:10 a. m.	30 44 00	139 34 00	2,752	br. Oz	68	69	.....	...do...	60
2816	...do...	9:16 a. m.	30 40 00	139 44 30	2,646	br. Oz. Lava	69	69	.....	...do...	60
2817	...do...	11:13 a. m.	30 36 00	139 55 00	2,723	br. Oz. S	70	69	.....	...do...	60
2818	...do...	1:10 p. m.	30 31 30	140 05 30	2,637	br. Oz	71	69	.....	...do...	60
2819	...do...	4:11 p. m.	30 27 00	140 16 00	2,591	br. Oz	72	70	35·2	...do...	60
2820	...do...	6:15 p. m.	30 23 00	140 26 30	2,650	br. Oz	69	69	.....	...do...	60
2821	...do...	8:33 p. m.	30 18 00	140 38 30	2,655	br. Oz	69	69	.....	...do...	60
2822	...do...	10:50 p. m.	30 13 00	140 50 30	2,671	br. Oz	68	69	35	...do...	60
2823	Nov. 12	1:03 a. m.	30 08 00	141 03 00	2,691	br. Oz	67	69	.....	...do...	60
2824	...do...	3:17 a. m.	30 03 00	141 15 00	2,747	br. Oz	68	69	.....	...do...	60
2825	...do...	5:37 a. m.	29 58 30	141 27 30	2,720	br. Oz	68	67	35·2	...do...	60
2826	...do...	7:58 a. m.	29 53 30	141 40 00	2,723	br. Oz	69	70	.....	...do...	60
2827	...do...	10:09 a. m.	29 48 30	141 52 00	2,738	br. Oz	69	70	35·2	...do...	60
2828	...do...	12:20 p. m.	29 43 00	142 04 30	2,741	br. Oz	72	70	.....	...do...	60
2829	...do...	2:43 p. m.	29 38 00	142 17 00	2,791	br. Oz	72	70	.....	...do...	60
2830	...do...	5:34 p. m.	29 31 30	142 32 00	2,820	br. Oz	71	70	35·4	...do...	60
2831	...do...	8:24 p. m.	29 25 00	142 47 00	2,785	br. Oz	71	70	.....	...do...	60
2832	...do...	11:01 p. m.	29 18 00	143 02 00	2,827	br. Oz	70	70	.....	...do...	60
2833	Nov. 13	1:34 a. m.	29 11 30	143 17 30	2,085	br. Oz	71	72	.....	...do...	60
2834	...do...	2:31 a. m.	29 10 30	143 20 00	2,280	br. Oz	71	72	35·1	...do...	60
2835	...do...	4:15 a. m.	29 13 00	143 15 00	2,379	br. Oz	70	70	.....	...do...	60
2836	...do...	5:39 a. m.	29 15 00	143 09 30	2,727	br. Oz. Lava	70	70	.....	...do...	60
2837	...do...	8:34 a. m.	29 08 30	143 25 00	2,733	br. Oz	70	70	35·3	...do...	60
2838	...do...	11:08 a. m.	29 03 30	143 36 00	2,744	br. Oz	73	72	.....	...do...	60
2839	...do...	1:16 p. m.	28 58 00	143 48 00	2,698	br. Oz	72	72	.....	...do...	60
2840	...do...	3:34 p. m.	28 52 00	144 00 00	2,784	br. Oz	72	72	35·3	...do...	60
2841	...do...	5:57 p. m.	28 46 00	144 12 00	2,510	br. Oz	72	71	.....	...do...	60
2842	...do...	6:59 p. m.	28 45 00	144 14 00	2,530	br. Oz	72	71	.....	...do...	60
2843	...do...	9:20 p. m.	28 39 30	144 25 30	2,719	br. Oz	71	71	35·2	...do...	60
2844	...do...	11:56 p. m.	28 33 30	144 37 00	2,821	br. Oz	70	71	.....	...do...	60
2845	Nov. 14	2:25 a. m.	28 27 30	144 48 30	2,570	br. Oz. Lava	69	71	35·1	...do...	60
2846	...do...	3:31 a. m.	28 26 30	143 50 30	2,770	br. Oz	69	71	.....	...do...	60
2847	...do...	9:42 a. m.	28 20 00	145 03 30	2,801	br. Oz	72	72	.....	...do...	60
2848	...do...	12:00 m.	28 12 20	145 13 00	2,728	br. Oz	72	72	.....	...do...	60
2849	...do...	2:13 p. m.	28 06 30	145 24 00	2,707	br. Oz	74	72	.....	...do...	60
2850	...do...	5:15 p. m.	28 00 30	145 35 00	2,635	br. Oz	73	73	.....	...do...	60
2851	...do...	7:29 p. m.	27 54 00	145 45 30	2,782	br. Oz	72	72	35·2	...do...	60
2852	...do...	9:43 p. m.	27 48 00	145 56 30	2,848	br. Oz	72	72	.....	...do...	60
2853	Nov. 15	12:01 a. m.	27 42 00	146 07 30	2,860	br. Oz	72	73	.....	...do...	60
2854	...do...	2:19 a. m.	27 36 00	146 19 00	2,910	br. Oz	72	73	35·4	...do...	60
2855	...do...	5:07 a. m.	27 30 00	146 30 00	2,914	br. Oz	72	73	.....	...do...	60
2856	...do...	7:42 a. m.	27 24 00	146 41 00	2,837	br. Oz	72	73	.....	...do...	60
2857	...do...	9:55 a. m.	27 18 00	146 51 30	2,629	br. Oz	73	73	35·2	...do...	60
2858	...do...	11:59 a. m.	27 12 00	147 02 40	2,795	br. Oz	75	74	.....	...do...	60
2859	...do...	2:13 p. m.	27 06 00	147 14 00	2,929	br. Oz	75	74	.....	...do...	60
2860	...do...	4:40 p. m.	27 00 00	147 25 30	2,815	br. Oz	75	74	35·3	...do...	60
2861	...do...	6:54 p. m.	26 54 00	147 36 30	2,898	br. Oz	72	74	.....	...do...	60
2862	...do...	9:07 p. m.	26 48 00	147 47 30	2,896	br. Oz	72	74	.....	...do...	60

Record of hydrographic soundings from July 1, 1891, to June 30, 1892—Continued.

Serial No.	Date.	Time of day.	Position. Lat. N.	Position. Long. W.	Depth.	Character of bottom.	Temperature. Air. Dry bulb	Temperature. Water at Surface.	Temperature. Water at Bottom.	Sounding machine.	Weight of sinker used.
	1891.		° ′ ″	° ′ ″	*Fms.*		°F.	°F.	°F.		*Lbs.*
2863	Nov. 15	11:31 p. m.	26 42 00	147 59 00	2,925	br. Oz	71	74	35·3	Sigsbee	60
2864	Nov. 16	1:58 a. m.	26 35 30	148 10 00	2,894	br. Oz	71	74	.....	...do	60
2865	...do	4:22 a. m.	26 29 00	148 21 30	2,942	br. Oz	71	74	.....	...do	60
2866	...do	6:47 a. m.	26 23 00	148 33 00	2,985	br. Oz	72	74	35·3	...do	60
2867	...do	9:22 a. m.	26 17 00	148 44 00	3,003	br. Oz	73	75	.....	...do	60
2868	...do	11:53 a. m.	26 10 15	148 55 00	2,864	br. Oz	73	75	.....	...do	60
2869	...do	2:20 a. m.	26 04 30	149 06 30	2,992	br. Oz	75	75	35·3	...do	60
2870	...do	4:48 a. m.	25 58 00	149 18 30	3,039	br. Oz	74	75	.....	...do	60
2871	...do	7:17 a. m.	25 52 00	149 30 00	3,008	br. Oz	74	75	.....	...do	60
2872	...do	9:42 a. m.	25 46 00	149 41 30	2,982	br. Oz	74	75	35·3	...do	60
2873	Nov. 17	12:07 a. m.	25 39 30	149 53 00	3,037	br. Oz	74	74	.....	...do	60
2874	...do	2:30 a. m.	25 33 00	150 05 00	2,993	br. Oz	73	74	.....	...do	60
2875	...do	4:57 a. m.	25 26 30	150 16 30	3,027	br. Oz	73	74	35·4	...do	60
2876	...do	7:32 a. m.	25 20 00	150 28 00	3,073	(Lost cups)	73	74	.....	...do	60
2877	...do	9:59 a. m.	25 14 00	150 39 00	2,952	br. Oz	73	74	.....	...do	60
2878	...do	1:18 p. m.	25 08 00	150 50 00	2,910	br. Oz	75	75	35·3	...do	60
2879	...do	3:48 p. m.	25 02 00	151 01 00	2,978	br. Oz	75	75	.....	...do	60
2880	...do	6:16 p. m.	24 56 00	151 13 00	2,910	br. Oz	75	75	.....	...do	60
2881	...do	8:45 p. m.	24 50 00	151 24 30	2,985	br. Oz	74	75	35·4	...do	60
2882	...do	11:30 p. m.	24 43 30	151 36 00	2,936	br. Oz	74	75	.....	...do	60
2883	Nov. 18	2:08 a. m.	24 37 00	151 47 30	3,023	br. Oz. Lava	75	75	.....	...do	60
2884	...do	4:34 a. m.	24 31 00	151 59 30	2,967	br. Oz	75	76	35·3	...do	60
2885	...do	7:07 a. m.	24 24 30	152 11 30	2,959	br. Oz	76	76	.....	...do	60
2886	...do	9:32 a. m.	24 18 00	152 22 30	2,950	(No specimen; defective cup.)	76	76	.....	...do	60
2887	...do	11:49 a. m.	24 11 30	152 34 00	2,953	br. Oz	76	76	35·4	...do	60
2888	Void.										
2889	...do	2:14 p. m.	24 06 00	152 46 00	2,907	br. Oz. S	76	76	.....	...do	60
2890	...do	4:32 p. m.	24 00 30	152 57 00	2,864	br. Oz. S	76	76	.....	...do	60
2891	...do	6:53 p. m.	23 55 00	153 08 30	2,811	br. Oz	76	76	35·4	...do	60
2892	...do	9:16 p. m.	23 49 00	153 20 00	2,801	(No specimen; defective cup.)	75	74	.....	...do	60
2893	...do	11:42 p. m.	23 43 00	153 31 30	2,748	br. Oz	75	74	.....	...do	60
2894	Nov. 19	2:02 a. m.	23 37 30	153 43 00	2,627	(No specimen; defective cup.)	75	75	35·3	...do	60
2895	...do	4:20 a. m.	23 32 00	153 54 00	2,610	br. Oz	75	76	.....	...do	60
2896	...do	6:36 a. m.	23 26 00	154 06 00	2,600	br. Oz	76	76	35·3	...do	60
2897	...do	8:52 a. m.	23 20 00	154 17 30	2,453	br. Oz	76	76	.....	...do	60
2898	...do	10:55 a. m.	23 14 30	154 28 30	1,265	br. Oz	76	76	.....	...do	60
2899	...do	11:25 a. m.	23 13 30	154 30 00	1,531	br. Oz	76	76	35·4	...do	60
2900	...do	12:44 p. m.	23 15 30	154 27 00	1,663	br. Oz	77	76	.....	...do	60
2901	...do	1:50 p. m.	23 17 30	154 23 30	2,502	br. Oz	78	77	.....	...do	60
2902	...do	4:20 p. m.	23 11 00	154 34 00	1,783	gy. Oz	78	77	35·5	...do	60
2903	...do	5:53 p. m.	23 05 00	154 42 30	2,411	(No specimen; defective cup.)	78	77	.....	...do	60
2904	...do	7:46 p. m.	23 00 30	154 51 00	2,404	br. Oz	77	77	.....	...do	60
2905	...do	9:49 p. m.	22 55 30	154 59 00	2,368	br. Oz. Lava	77	77	35·3	...do	60
2906	Nov. 20	12:02 a. m.	22 49 30	155 09 00	2,420	br. Oz	76	76	.....	...do	60
2907	...do	2:17 a. m.	22 43 30	155 18 30	2,272	br. Oz	75	76	.....	...do	60
2908	...do	3:15 a. m.	22 42 30	155 20 30	2,341	br. Oz	75	76	35·5	...do	60
2909	...do	5:25 a. m.	22 36 30	155 30 30	2,408	br. Oz	75	76	.....	...do	60
2910	...do	7:34 a. m.	22 30 00	155 40 00	2,426	br. Oz	75	76	.....	...do	60
2911	...do	9:44 a. m.	22 24 30	155 49 00	2,408	br. Oz	75	76	32·4	...do	60
2912	...do	11:44 a. m.	22 18 00	155 58 30	2,542	br. M	77	77	.....	...do	60
2913	...do	2:45 p. m.	22 11 00	156 09 00	2,640	br. M	77	77	35·4	...do	60
2914	...do	5:02 p. m.	22 03 30	156 19 00	2,766	br. M	78	77	.....	...do	60
2915	...do	7:26 p. m.	21 55 30	156 29 30	2,868	br. M	78	77	.....	...do	60
2916	...do	9:49 p. m.	21 47 30	156 39 00	2,878	br. M	77	77	35·3	...do	60
2917	Nov. 21	12:15 a. m.	21 39 00	156 48 30	2,615	br. M. fne. S	76	77	.....	...do	60
2918	...do	1:20 a. m.	21 37 30	156 50 00	2,576	br. M. fne. S	76	77	.....	...do	60
2919	...do	3:41 a. m.	21 29 30	156 59 30	2,056	br. M. fne. S	75	77	35·5	...do	60
2920	...do	5:50 a. m.	21 21 00	157 09 00	570	br. M. fne. S	76	77	.....	...do	60
2921	...do	6:46 a. m.	21 19 00	157 13 30	347	br. M. fne. S	76	77	.....	...do	60
2922	...do	7:32 a. m.	21 18 30	157 19 00	268	gy. S	76	77	44·8	...do	60
2923	...do	8:19 a. m.	21 18 00	157 24 30	392	gy. S	77	78	.....	...do	60
2924	...do	9:04 a. m.	21 16 48	157 30 00	301	gy. S. Co	77	78	.....	...do	28
2925	...do	9:47 a. m.	21 15 24	157 35 05	105	gy. S. Co	77	78	.....	...do	28
2926	...do	10:28 a. m.	21 13 38	157 39 32	804	fne. wh. S	78	78	43·8	...do	28
2927	...do	11:11 a. m.	21 12 50	157 44 32	293	M	78	78	.....	...do	28
2928	...do	11:32 a. m.	21 13 00	157 50 20	295	fne. wh. S	78	78	.....	...do	28
2929	Dec. 2	12:10 p. m.	21 15 13	157 50 58	10	(No specimen).	79	78	.....	Hand	14
2930	...do	2:47 p. m.	21 15 30	157 40 56	22	wh. S. Co	76	75	.....	Sigsbee	38
2931	...do	2:58 p. m.	21 15 20	157 40 28	47	S. brk. Sh	76	75	.....	...do	38
2932	...do	3:09 p. m.	21 14 59	157 40 10	189	fne. wh. S	76	75	.....	...do	38
2933	...do	3:21 p. m.	21 14 38	157 39 53	276	wh. S	76	75	.....	...do	38
2934	...do	3:32 p. m.	21 14 16	157 39 40	285	fne. wh. S	76	75	.....	...do	38

Record of hydrographic soundings from July 1, 1891, to June 30, 1892—Continued.

Serial No.	Date.	Time of day.	Position.		Depth.	Character of bottom.	Temperatures.			Sounding machine.	Weight of sinker used.
			Lat. N.	Long. W.			Air.	Water at			
							Dry bulb	Surface.	Bottom.		
	1891.		° ′ ″	° ′ ″	*Fms.*		° F.	° F.	° F.		*Lbs.*
2935	Dec. 2	3:42 p. m.	21 14 02	157 39 28	303	S. Co	76	75	.....	Sigsbee.	38
2936	...do ...	4:06 p. m.	21 13 55	157 41 23	255	fne. wh. S. Lava	76	75	.....	...do	38
2937	...do ...	4:21 p. m.	21 14 06	157 42 32	47	wh. S. Co	76	75	.....	...do	38
2938	...do ...	4:34 p. m.	21 14 30	157 43 24	142	fne. wh. S	76	75	.....	...do	38
2939	...do ...	4:47 p. m.	21 14 56	157 44 05	21	wh. S. Sh. Co ..	76	75	.....	...do	38
2940	...do ...	4:58 p. m.	21 15 32	157 44 32	10	wh. S.	76	75	.....	Hand ...	14
2941	...do ...	5:00 p. m.	21 15 49	157 44 27	7	wh. S.	76	75	.....	...do	14
2942	Dec. 3	9:40 a. m.	21 15 54	157 44 22	7½	wh. S.	74	77	.....	...do	14
2943	...do ...	9:38 a. m.	21 15 57	157 44 20	7½	wh. S.	74	77	.....	...do	14
2944	...do ...	9:36 a. m.	21 16 01	157 44 17	6½	wh. S.	74	77	.....	...do	14
2945	...do ...	9:34 a. m.	21 16 05	157 44 14	6	wh. S.	74	77	.....	...do	14
2946	...do ...	9:32 a. m.	21 16 08	157 44 10	4½	wh. S.	74	77	.....	...do	14
2947	...do ...	9:30 a. m.	21 16 11	157 44 06	4	wh. S.	74	77	.....	...do	14
2948	...do ...	9:28 a. m.	21 16 14	157 44 01	5	wh. S.	74	77	.....	...do	14
2949	...do ...	9:22 a. m.	21 16 18	157 43 56	2½	wh. S.	74	77	.....	...do	14
2950	...do ...	10:18 a. m.	21 15 40	157 43 47	7½	wh. S. Sh. Co ..	75	77	.....	...do	14
2951	...do ...	10:52 a. m.	21 15 48	157 43 49	7½	wh. S.	76	77	.....	...do	14
2952	...do ...	10:50 a. m.	21 15 56	157 43 50	6	wh. S.	76	77	.....	...do	14
2953	...do ...	10:48 a. m.	21 16 04	157 43 51	5½	wh. S.	76	77	.....	...do	14
2954	...do ...	10:46 a. m.	21 16 12	157 43 52	3½	wh. S.	76	77	.....	...do	14
2955	...do ...	10:44 a. m.	21 16 19	157 43 55	2½	wh. S.	76	77	.....	...do	14
2956	...do ...	1:19 p. m.	21 15 08	157 43 46	13	wh. S. Co	75	76	.....	...do	14
2957	...do ...	1:27 p. m.	21 14 37	157 43 45	53	wh. S. Co	75	76	.....	Sigsbee.	26
2958	...do ...	1:38 p. m.	21 14 06	157 43 43	222	fne. wh. S	75	76	.....	...do	26
2959	...do ...	1:50 p. m.	21 13 30	157 43 40	275	fne. wh. S.....	75	76	45·3	...do	38
2960	...do ...	4:28 p. m.	21 15 49	157 41 23	10½	rky	76	76	.....	Hand...	14
2961	...do ...	4:30 p. m.	21 15 52	157 41 28	7½	bk. S	76	76	.....	...do	14
2962	...do ...	4:32 p. m.	21 15 54	157 41 32	6	bk. S	76	76	.....	...do	14
2963	...do ...	4:33 p. m.	21 15 57	157 41 37	3½	rky.....	76	76	.....	...do	14
2964	...do ...	4:36 p. m.	21 15 58	157 41 40	2½	wh. S. P	76	76	.....	...do	14
2965	...do ...	5:38 p. m.	21 15 40	157 43 47	7	wh. S. Co	76	76	.....	...do	14
2966	...do ...	4:34 a. m.	21 15 08	157 51 01	12½	wh. S. Co	76	75	.....	...do	14
2967	...do ...	4:43 a. m.	21 15 13	157 50 58	10½	wh. S.	76	75	.....	...do	14
2968	...do ...	4:51 a. m.	21 15 17	157 50 46	8½	wh. S.	76	75	.....	...do	14
2969	...do ...	4:57 a. m.	21 15 18	157 50 30	7	wh. S.	76	75	.....	...do	14
2970	...do ...	5:02 a. m.	21 15 21	157 50 31	2½	wh. S.	76	75	.....	...do	14
2971	...do ...	5:08 a. m.	21 15 24	157 50 27	2	wh. S. Co	76	75	.....	...do	14
2972	...do ...	5:11 a. m.	21 15 27	157 50 22	2	wh. S. Co	76	75	.....	...do	14
2973	...do ...	3:09 p. m.	21 15 22	157 51 48	7½	Co.....	75	76	.....	...do	14
2974	...do ...	3:14 p. m.	21 15 23	157 50 43	5	wh. S.	75	76	.....	...do	14
2975	...do ...	3:20 p. m.	21 15 24	157 50 39	3	wh. S.	75	76	.....	...do	14
2976	...do ...	3:27 p. m.	21 15 25	157 50 32	2	wh. S.	75	76	.....	...do	14
2977	...do ...	9:03 a. m.	21 16 09	157 50 38	0½	wh. S.	75	75	.....	...do	14
2978	...do ...	9:07 a. m.	21 15 59	157 50 42	2½	wh. S.	75	75	.....	...do	14
2979	...do ...	9:09 a. m.	21 15 52	157 50 44	3½	wh. S.	75	75	.....	...do	14
2980	...do ...	9:11 a. m.	21 15 46	157 50 46	5	wh. S.	75	75	.....	...do	14
2981	...do ...	9:13 a. m.	21 15 40	157 50 49	4½	wh. S.	75	75	.....	...do	14
2982	...do ...	9:15 a. m.	21 15 35	157 50 51	5½	wh. S.	75	75	.....	...do	14
2983	...do ...	9:18 a. m.	21 15 30	157 50 54	7½	Co.....	76	76	.....	...do	14
2984	...do ...	11:01 a. m.	21 14 53	157 51 10	50	wh. S. bk. Sp ..	77	76	.....	Sigsbee.	38
2985	...do ...	11:10 a. m.	21 14 27	157 51 22	206	fne. wh. S.....	77	76	.....	...do	38
2986	...do ...	11:21 a. m.	21 13 57	157 51 29	271	fne. wh. S	77	76	.....	...do	38
2987	...do ...	11:52 a. m.	21 13 17	157 48 29	224	fne. wh. S	77	76	48·1	...do	38
2988	...do ...	12:08 p. m.	21 13 32	157 48 52	133	wh. S. Sh. Co ..	77	76	.....	...do	38
2989	...do ...	12:16 p. m.	21 13 48	157 49 29	164	wh. S. Co	77	76	.....	...do	38
2990	...do ...	12:26 p. m.	21 14 00	157 49 58	201	fne. wh. S.....	77	76	50·4	...do	38
2991	Dec. 4	12:39 p. m.	21 14 26	157 50 49	252	fne. wh. S	77	76	.....	...do	38
2992	...do ...	12:51 p. m.	21 14 40	157 51 17	153	fne. wh. S	77	76	.....	...do	38
2993	Dec. 5	7:51 a. m.	21 14 30	157 34 30	153	fne. wh. S. Co..	76	76	.....	...do	38
2994	...do ...	8:05 a. m.	21 15 00	157 33 00	305	fne. wh. S	76	76	44·3	...do	38
2995	...do ...	8:50 a. m.	21 18 00	157 29 00	308	fne. wh. S	76	76	.....	...do	38
2996	...do ...	9:36 a. m.	21 20 30	157 25 00	407	fne. gy. S.....	76	76	.....	...do	38
2997	...do ...	10:23 a. m.	21 23 30	157 21 00	372	gy. S. Co	77	76	50·7	...do	38
2998	...do ...	11:26 a. m.	21 26 00	157 17 00	508	fne. gy. S.....	77	76	.....	...do	38
2999	...do ...	11:54 a. m.	21 27 00	157 15 00	549	fne. gy. S.....	77	76	.....	...do	38
3000	...do ...	1:09 p. m.	21 29 30	157 12 00	1,557	gy. M. fne. S...	77	76	.....	...do	60
3001	...do ...	2:24 p. m.	21 32 30	157 08 00	1,792	gy. M. fne. S...	76	74	35·1	...do	60
3002	...do ...	3:41 p. m.	21 35 00	157 04 00	2,156	br. M. fne. S...	75	75	.....	...do	60
3003	...do ...	5:34 p. m.	21 40 30	156 56 00	1,951	br. M. Lava ...	75	75	.....	...do	60
3004	...do ...	6:32 p. m.	21 41 20	156 54 00	2,325	fne. S. Lava ...	75	75	35·1	...do	60
3005	...do ...	8:50 p. m.	21 47 00	156 46 00	2,612	br. M. S	75	75	.....	...do	60
3006	Dec. 12	8:25 a. m.	21 18 00	157 23 00	329	wh. and gy. S .	68	74	42·5	...do	60
3007	...do ...	9:17 a. m.	21 20 00	157 19 00	323	fne. gy. S.....	68	74	.....	...do	60
3008	...do ...	10:09 a. m.	21 23 00	157 14 30	547	gy. M. fne. S...	72	74	.....	...do	60
3009	...do ...	10:46 a. m.	21 24 00	157 12 00	603	gy. M. fne. S...	72	74	.....	...do	60
3010	...do ...	11:24 a. m.	21 25 00	157 10 00	1,116	gy. M. fne. S. .	72	74	36·1	...do	60
3011	...do ...	12:24 p. m.	21 26 17	157 08 30	1,781	(No specimen)	72	74	.....	...do	60

Record of hydrographic soundings from July 1, 1891, to June 30, 1892—Continued.

Serial No.	Date.	Time of day.	Position.		Depth.	Character of bottom.	Temperatures.			Sounding machine.	Weight of sinker used.
			Lat. N.	Long. W.			Air.	Water at			
							Dry bulb	Surface.	Bottom.		
	1891.		° ′ ″	°. ′ ″	*Fms.*		°F.	°F.	°F.		*Lbs.*
3012	Dec. 12	1:44 p. m.	21 28 30	157 04 00	2,067	br. M. fne. S	70	73	.....	Sigsbee	60
3013	...do	4:11 p. m.	41 32 30	156 54 00	1,807	br. M. S	70	73	35·3	...do	60
3014	...do	6:22 p. m.	21 36 30	156 44 00	2,767	br. M. fne. S	71	74	.....	...do	60
3015	...do	9:12 p. m.	21 41 00	156 32 30	2,966	br. M. fne. S	68	73	.....	...do	60
3016	...do	11:59 p. m.	21 46 00	156 21 00	3,017	br. M. fne. S	69	73	35·3	...do	60
3017	Dec. 13	3:11 a. m.	21 51 00	156 09 00	3,027	(No specimen)	70	73	.....	...do	60
3018	...do	6:03 a. m.	21 56 00	155 57 30	2,915	br. Oz	69	74	.....	...do	60
3019	...do	8:53 a. m.	22 00 30	155 46 00	2,782	br. Oz	73	75	35·2	...do	60
3020	...do	11:36 a. m.	22 05 30	155 34 30	2,654	br. Oz	74	74	.....	...do	60
3021	...do	2:20 p. m.	22 10 00	155 23 30	2,545	br. Oz	74	75	.....	...do	60
3022	...do	4:52 p. m.	22 15 00	155 12 30	2,475	br. Oz	72	75	35·2	...do	60
3023	...do	7:29 p. m.	22 20 00	155 01 00	2,463	br. Oz	72	75	.....	...do	60
3024	...do	10:07 p. m.	22 25 00	154 49 30	2,477	br. Oz	71	74	.....	...do	60
3025	Dec. 14	12:43 a. m.	22 30 00	154 38 30	2,485	br. Oz	71	75	35·3	...do	60
3026	...do	3:27 a. m.	22 35 00	154 27 00	2,453	br. Oz	69	74	.....	...do	60
3027	...do	6:07 a. m.	22 40 00	154 16 00	2,500	br. Oz	69	74	.....	...do	60
3028	...do	8:42 a. m.	22 45 00	154 04 30	2,587	br. Oz	73	74	35·7	...do	60
3029	...do	11:15 a. m.	22 50 00	153 53 00	2,555	br. Oz	74	74	.....	...do	60
3030	...do	1:48 p. m	22 55 30	153 42 00	2,602	br. Oz	74	74	.....	...do	60
3031	...do	4:20 p. m.	23 01 00	153 31 00	2,649	br. Oz	73	74	35·2	...do	60
3032	...do	6:49 p. m.	23 06 00	153 20 30	2,696	br. Oz	72	74	.....	...do	60
3033	...do	9:19 p. m.	23 11 00	153 09 30	2,822	br. Oz	72	74	.....	...do	60
3034	...do	11:58 p. m.	23 16 00	152 59 00	2,827	br. Oz	72	74	35·2	...do	60
3035	Dec. 15	2:50 a. m.	23 21 30	152 48 00	2,910	br. Oz	70	73	.....	...do	60
3036	...do	5:51 a. m.	23 27 00	152 37 00	2,894	br. Oz. S	70	73	.....	...do	60
3037	...do	8:41 a. m.	23 32 30	152 26 00	2,027	br. Oz. S	70	74	35.2	...do	60
3038	...do	11:32 a. m.	23 38 00	152 15 00	3,006	br. Oz	71	74	.....	...do	60
3039	...do	2:28 p. m.	23 43 30	152 05 00	2,970	br. Oz	69	74	.....	...do	60
3040	...do	5:13 p. m.	23 49 00	151 55 00	2,985	br. Oz	70	74	41·1	...do	60
3041	...do	8:45 p. m.	23 56 00	151 42 00	3,030	br. Oz	69	74	38·9	...do	60
3042	Dec. 16	12:18 a. m.	24 03 00	151 29 30	3,016	(No specimen)	69	73	.....	...do	60
3043	...do	3:42 a. m.	24 10 00	151 17 00	3,038	br. Oz	70	73	.....	...do	60
3044	...do	7:00 a. m.	24 17 00	151 04 00	2,979	br. Oz	70	73	.....	...do	60
3045	...do	10:27 a. m.	24 24 00	150 51 30	2,907	br. Oz	71	73	35·3	...do	60
3046	...do	1:40 p. m.	24 31 00	150 37 00	2,747	br. Oz	74	74	.....	...do	60
3047	...do	4:43 p. m.	24 37 00	150 23 00	2,916	br. Oz	72	73	.....	...do	60
3048	...do	7:50 p. m.	24 43 00	150 09 00	2,980	br. Oz	71	72	37·6	...do	60
3049	...do	11:00 p. m.	24 49 00	149 55 00	2,912	br. Oz	72	73	.....	...do	60
3050	Dec. 17	2:14 a. m.	24 55 00	149 41 00	2,984	br. Oz	70	73	.....	...do	60
3051	...do	5:27 a. m.	25 01 00	149 27 00	3,034	br. Oz	71	73	35·4	...do	60
3052	...do	8:36 a. m.	25 07 30	149 13 00	2,957	br. Oz	71	73	.....	...do	60
3053	...do	11:37 a. m.	25 13 30	148 59 00	2,930	br. Oz	72	73	.....	...do	60
3054	...do	2:35 p. m.	25 20 00	148 44 30	2,938	(No specimen)	71	73	.....	...do	60
3055	...do	5:34 p. m.	25 26 30	148 30 00	2,881	br. Oz	69	73	35	...do	60
3056	...do	8:36 p. m.	25 33 00	148 16 00	2,642	(No specimen)	69	73	.....	...do	60
3057	...do	11:42 p. m.	25 39 30	148 01 30	2,903	br. Oz	69	73	.....	...do	60
3058	Dec. 18	2:51 a. m.	25 46 00	147 47 00	2,893	br. Oz	69	72	35·1	...do	60
3059	...do	5:56 a. m.	25 53 00	147 32 30	2,923	br. Oz	69	72	.....	...do	60
3060	...do	8:57 a. m.	26 00 00	147 18 00	2,787	(No specimen)	72	72	.....	...do	60
3061	...do	12:12 p. m.	26 06 36	147 03 16	2,884	br. Oz	72	72	35·2	...do	60
3062	...do	3:16 p. m.	26 13 00	146 49 00	2,848	br. Oz	74	73	.....	...do	60
3063	...do	6:25 p. m.	26 19 30	146 34 30	2,777	br. Oz	71	72	.....	...do	60
3064	...do	9:33 p. m.	26 26 00	146 20 00	2,829	br. Oz	69	72	35·1	...do	60
3065	Dec. 19	12:54 a. m.	26 32 30	146 05 30	2,779	br. Oz	68	71	.....	...do	60
3066	...do	4:12 a. m.	26 39 00	145 51 00	2,854	br. Oz	68	72	.....	...do	60
3067	...do	7:35 a. m.	26 45 00	145 36 30	2,346	br. Oz	68	72	35·1	...do	60
3068	...do	9:05 a. m.	26 44 00	145 38 30	2,082	br. Oz	69	72	.....	...do	60
3069	...do	11:01 a. m.	26 46 00	145 33 30	2,077	br. Oz	70	72	.....	...do	60
3070	...do	1:57 p. m.	26 50 30	145 24 00	2,825	br. Oz	69	72	.....	...do	60
3071	...do	5:38 p. m.	26 57 00	145 09 30	2,739	br. Oz	69	72	35·1	...do	60
3072	...do	9:54 p. m.	27 03 30	144 54 30	2,714	br. Oz	68	71	.....	...do	60
3073	Dec. 20	3:20 a. m.	27 10 00	144 39 30	2,697	br. Oz	66	71	.....	...do	60
3074	...do	8:27 a. m.	27 16 30	144 24 30	2,750	br. Oz	68	70	35·2	...do	60
3075	...do	1:29 p. m.	27 23 00	144 10 00	2,506	br. Oz	68	70	.....	...do	60
3076	...do	6:30 p. m.	27 33 00	143 55 30	2,716	br. Oz	67	70	.....	...do	60
3077	...do	11:50 p. m.	27 42 30	143 41 30	2,375	br. Oz	67	70	35	...do	60
3078	Dec. 21	5:20 a. m.	27 52 00	143 27 00	2,827	br. Oz	67	70	.....	...do	60
3079	...do	10:46 a. m.	28 02 00	143 12 30	2,736	br. Oz	69	70	.....	...do	60
3080	...do	3:52 p. m.	28 08 00	142 57 00	2,731	br. Oz	69	71	.....	...do	60
3081	...do	8:55 p. m.	28 14 00	142 40 00	2,590	br. Oz	65	69	35·1	...do	60
3082	Dec. 22	1:30 a. m.	28 20 00	142 22 30	2,684	br. Oz	67	69	.....	...do	60
3083	...do	6:48 a. m.	28 26 00	142 05 00	2,711	br. Oz	67	69	.....	...do	60
3084	...do	11:12 a. m.	28 31 30	141 47 30	2,668	br. Oz. Lava	69	69	35·1	...do	60
3085	...do	3:21 p. m.	28 37 30	141 33 00	2,678	br. Oz. Lava	69	69	.....	...do	60
3086	...do	8:00 p. m.	28 43 00	141 19 00	2,700	br. Oz	68	69	.....	...do	60
3087	Dec. 23	12:55 a. m.	28 48 30	141 04 30	2,702	br. Oz	68	69	35·1	...do	60
3088	...do	4:40 a. m.	28 54 30	140 49 30	2,735	(No specimen)	66	69	.....	...do	60

Record of hydrographic soundings from July 1, 1891, to June 30, 1892—Continued.

Serial No.	Date.	Time of day.	Position.		Depth.	Character of bottom.	Temperatures.			Sounding machine.	Weight of sinker used.
			Lat. N.	Long. W.			Air.	Water at			
							Dry bulb	Surface.	Bottom.		
	1891.		° ′ ″	° ′ ″	*Fms.*		°F.	°F.	°F.		*Lbs.*
3089	Dec. 23	8:31 a. m.	29 00 30	140 35 00	2,664	br. Oz	66	68	.....	Sigsbee	60
3090	...do ...	12:28 p. m.	29 96 24	140 28 48	2,741	br. Oz	68	69	35·1	...do	60
3091	...do ...	4:11 p. m.	29 12 00	140 06 30	2,729	br. Oz	65	68	.....	...do	60
3092	...do ...	8:49 p. m.	29 17 30	139 52 00	2,687	br. Oz	65	68	.....	...do	60
3093	Dec. 24	12:36 a. m.	29 23 00	139 38 00	2,631	br. Oz	64	68	35·1	...do	60
3094	...do ...	3:53 a. m.	29 28 30	139 23 30	2,608	br. Oz	64	68	.....	...do	60
3095	...do ...	6:55 a. m.	29 34 00	139 09 00	2,668	br. Oz	63	68	.....	...do	60
3096	...do ...	10:04 a. m.	29 40 00	138 55 00	2,620	br. Oz	64	67	35·1	...do	60
3097	...do ...	1:15 p. m.	29 46 00	138 40 00	2,572	br. Oz	66	68	.....	...do	60
3098	...do ...	4:08 p. m.	29 52 30	138 24 00	2,653	br. Oz	63	67	.....	...do	60
3099	...do ...	6:59 p. m.	29 59 00	138 08 00	2,556	br. Oz. Lava	63	67	35·1	...do	60
3100	...do ...	9:41 p. m.	30 05 30	137 52 00	2,404	br. Oz. Lava	62	67	.....	...do	60
3101	Dec. 25	12:28 a. m.	30 12 00	137 36 30	2,672	br. Oz. Lava	63	66	.....	...do	60
3102	...do ...	3:11 a. m.	30 18 30	137 21 00	2,626	br. Oz	61	65	35·1	...do	60
3103	...do ...	5:41 a. m.	30 23 30	137 09 00	2,201	br. Oz. Lava	61	66	.....	...do	60
3104	...do ...	6:33 a. m.	30 24 00	137 07 00	1,924	(No specimen)	62	66	35	...do	60
3105	...do ...	8:03 a. m.	30 25 00	137 05 00	2,023	gy. Oz. fne. S	62	66	.....	...do	60
3106	...do ...	8:59 a. m.	30 26 00	137 03 00	2,248	(No specimen)	63	66	.....	...do	60
3107	...do ...	10:10 a. m.	30 27 00	137 00 30	2,604	br. Oz. S. Lava	63	66	35·2	...do	60
3108	...do ...	11:39 a. m.	30 30 01	137 05 06	2,521	br. Oz	64	67	.....	...do	60
3109	...do ...	1:07 p. m.	30 29 30	137 10 30	2,422	br. Oz	64	67	33·2	...do	60
3110	...do ...	2:44 p. m.	30 25 00	137 15 00	1,779	gy. Oz. fne. S	64	67	.....	...do	60
3111	...do ...	4:00 p. m.	30 19 30	137 15 00	2,208	br. Oz. Lava	64	67	.....	...do	60
3112	...do ...	5:24 p. m.	30 15 00	137 10 30	2,309	(No specimen)	65	66	35·1	...do	60
3113	...do ...	6:53 p. m.	30 15 30	137 04 30	2,551	br. Oz	63	66	.....	...do	60
3114	...do ...	8:26 p. m.	30 19 30	137 00 30	2,573	br. Oz. Lava	62	66	.....	...do	60
3115	...do ...	10:32 p. m.	30 28 00	136 53 00	2,291	br. Oz. Lava	62	66	35	...do	60
3116	...do ...	11:23 p. m.	30 29 00	136 51 00	1,932	br. Oz	62	66	.....	...do	60
3117	Dec. 26	12:09 a. m.	30 30 00	136 49 00	1,858	br. Oz	62	66	.....	...do	60
3118	...do ...	1:01 a. m.	30 31 00	136 47 00	2,131	br. Oz	62	66	.....	...do	60
3119	...do ...	2:10 a. m.	30 33 00	136 42 30	2,220	br. Oz	62	66	.....	...do	60
3120	...do ...	4:06 a. m.	30 38 00	136 33 00	2,612	br. Oz	62	66	42·3	...do	60
3121	...do ...	6:10 a. m.	30 43 00	136 23 00	2,502	br. Oz	62	66	.....	...do	60
3122	...do ...	8:49 a. m.	30 49 30	136 08 30	2,411	(No specimen)	63	66	.....	...do	60
3123	...do ...	9:46 a. m.	30 50 30	136 06 30	2,473	br. Oz	59	66	.....	...do	60
3124	...do ...	11:58 a. m.	30 54 45	135 56 35	2,505	br. Oz	62	65	.....	...do	60
3125	...do ...	2:00 p. m.	30 59 00	135 47 00	2,581	br. Oz	66	66	35·2	...do	60
3126	...do ...	3:58 p. m.	31 04 00	135 37 00	2,565	br. Oz	66	66	.....	...do	60
3127	...do ...	6:05 p. m.	31 08 00	135 26 30	2,480	(No specimen)	63	66	.....	...do	60
3128	...do ...	8:03 p. m.	31 12 00	135 17 00	2,413	br. Oz. Lava	63	65	35	...do	60
3129	...do ...	10:03 p. m.	31 16 00	135 07 00	2,572	br. Oz	64	65	.....	...do	60
3130	Dec. 27	12:03 a. m.	31 20 00	134 57 00	2,574	br. Oz	64	65	35·2	...do	60
3131	...do ...	2:07 a. m.	31 24 00	134 47 00	2,602	br. Oz	64	65	35·2	...do	60
3132	...do ...	4:13 a. m.	31 28 00	134 36 30	2,482	br. Oz. Lava	64	65	.....	...do	60
3133	...do ...	6:14 a. m.	31 32 30	134 26 30	2,611	br. Oz	63	65	.....	...do	60
3134	...do ...	8:15 a. m.	31 37 00	134 16 00	2,566	br. Oz	65	65	35	...do	60
3135	...do ...	10:21 a. m.	31 41 00	134 06 00	2,508	br. Oz	68	66	.....	...do	60
3136	...do ...	12:26 a. m.	31 45 14	133 56 00	2,589	br. Oz	69	66	.....	...do	60
	1892.										
3137	Jan. 10	12:39 p. m.	31 49 23	133 45 32	2,550	br. Oz	61	63	35·1	...do	60
3138	...do ...	2:42 p. m.	31 53 30	133 36 00	2,516	br. Oz	61	63	.....	...do	60
3139	...do ...	4:33 p. m.	31 57 30	133 26 00	2,619	br. Oz	61	63	.....	...do	60
3140	...do ...	6:32 p. m.	32 01 30	133 16 00	2,611	br. Oz	60	62	35·2	...do	60
3141	...do ...	8:36 p. m.	32 06 00	133 06 00	2,619	br. Oz	59	63	.....	...do	60
3142	...do ...	10:49 p. m.	32 10 00	132 56 00	2,686	br. Oz	60	63	.....	...do	60
3143	Jan. 11	12:55 a. m.	32 14 00	132 46 00	2,637	br. Oz	59	62	35·2	...do	60
3144	...do ...	2:54 a. m.	32 18 00	132 36 00	2,527	br. Oz	58	62	.....	...do	60
3145	...do ...	4:50 a. m.	32 22 00	132 26 00	2,656	br. Oz	59	62	.....	...do	60
3146	...do ...	6:45 a. m.	32 26 00	132 16 00	2,341	br. Oz	59	62	35·1	...do	60
3147	...do ...	7:40 a. m.	32 27 00	132 14 00	2,223	br. Oz	59	62	.....	...do	60
3148	...do ...	8:42 a. m.	32 28 00	132 12 00	2,560	br. Oz	59	63	.....	...do	60
3149	...do ...	10:07 a. m.	32 29 30	132 06 30	2,175	br. Oz. Lava	59	62	35·1	...do	60
3150	...do ...	11:13 a. m.	32 30 00	132 04 30	2,548	br. Oz. bk. Sp	59	62	.....	...do	60
3151	...do ...	12:43 p. m.	32 32 30	131 59 30	2,525	br. Oz	60	62	.....	...do	60
3152	...do ...	2:42 p. m.	32 36 00	131 49 30	2,583	br. Oz	59	62	35·3	...do	60
3153	...do ...	4:38 p. m.	32 39 00	131 40 00	2,525	br. Oz	59	62	.....	...do	60
3154	...do ...	6:35 p. m.	32 43 30	131 30 00	2,379	br. Oz	58	62	.....	...do	60
3155	...do ...	8:30 p. m.	32 47 00	131 20 00	2,519	br. Oz	58	61	35·3	...do	60
3156	...do ...	10:39 p. m.	32 51 00	131 10 00	2,535	br. Oz	58	61	.....	...do	60
3157	Jan. 12	12:36 a. m.	32 55 00	131 00 00	2,572	br. Oz. Lava	58	61	.....	...do	60
3158	...do ...	2:32 a. m.	32 58 30	130 50 00	2,361	br. Oz. Lava	58	61	35·2	...do	60
3159	...do ...	3:37 a. m.	32 50 80	130 48 00	2,531	br. Oz	58	61	.....	...do	60
3160	...do ...	5:32 a. m.	33 03 30	130 38 00	2,483	br. Oz	58	60	.....	...do	60
3161	...do ...	7:30 a. m.	33 07 00	130 28 00	2,541	br. Oz	58	60	35·1	...do	60
3162	...do ...	9:27 a. m.	33 10 30	130 18 00	2,542	(No specimen)	59	62	.....	...do	60
3163	...do ...	11:23 a. m.	33 14 00	130 08 30	2,551	br. Oz	60	62	.....	...do	60
3164	...do ...	1:29 p. m.	33 18 00	129 58 00	2,584	br. Oz. Lava	59	61	35·1	...do	60
3165	...do ...	4:35 p. m.	33 23 00	129 45 00	2,773	br. Oz	58	61	35 1	...do	60

Record of hydrographic soundings from July 1, 1891, to June 30, 1892—Continued.

Serial No.	Date.	Time of day.	Position.		Depth.	Character of bottom.	Temperatures.			Sounding machine.	Weight of sinker used.
			Lat. N.	Long. W.			Air.	Water at			
							Dry bulb	Surface.	Bottom.		
	1892.		° ′ ″	° ′ ″	*Fms.*		° F.	° F.	° F.		*Lbs.*
3166	Jan. 12	7:14 p. m.	33 28 00	129 32 00	2,701	br. Oz	58	61	.....	Sigsbee.	60
3167	...do...	9:25 p. m.	33 33 00	129 18 30	2,572	br. Oz	58	61	.....	...do....	60
3168	...do...	11:31 p. m.	33 38 00	129 05 30	2,572	br. Oz	58	61	35·2	...do....	60
3169	Jan. 13	1:42 a. m.	33 43 00	128 52 00	2,612	br. Oz	58	60	.....	...do....	60
3170	...do...	3:47 a. m.	33 48 00	128 39 30	2,619	(No specimen).	57	61	.....	...do....	60
3171	...do...	5:54 a. m.	33 53 00	128 26 00	2,637	br. Oz	56	59	35·1	...do....	60
3172	...do...	7:59 a. m.	33 58 00	128 13 00	2,508	br. Oz	56	58	.....	...do....	60
3173	...do...	10:08 a. m.	34 03 00	128 00 00	2,632	br. Oz	58	58	.....	...do....	60
3174	...do...	12:26 p. m.	34 08 10	127 46 41	2,665	br. Oz	60	59	35·1	...do....	60
3175	...do...	2:33 p. m.	34 14 30	127 34 30	2,588	br Oz	64	60	.....	...do....	60
3176	...do...	4:38 p. m.	34 20 30	127 22 30	2,657	br. Oz	58	59	.....	...do....	60
3177	...do...	6:47 p. m.	34 26 30	127 10 30	2,680	br. Oz	58	58	35·1	...do....	60
3178	...do...	8:55 p. m.	34 32 30	126 58 00	2,649	br. Oz	57	58	.....	...do....	60
3179	...do...	11:07 p. m.	34 38 30	126 46 00	2,637	br. Oz	59	58	.....	...do....	60
3180	Jan. 14	1:20 a. m.	34 44 30	126 34 00	2,626	br. Oz	57	58	35·1	...do....	60
3181	...do...	3:27 a. m.	34 50 30	126 22 00	2,606	br. Oz	56	57	.....	...do....	60
3182	...do...	5:32 a. m.	34 56 00	126 09 30	2,586	br. Oz	57	57	.....	...do....	60
3183	...do...	7:37 a. m.	35 02 00	125 57 30	2,585	br. and gy. Oz	57	58	35·1	...do....	60
3184	...do...	9:40 a. m.	35 08 00	125 45 30	2,572	br. Oz	58	57	.....	...do....	60
3185	...do...	11:46 a. m.	35 14 07	125 33 18	2,560	br. and gy. Oz	59	57	.....	...do....	60
3186	...do...	1:58 p. m.	35 19 30	125 21 30	2,529	gy. and yl. Oz	62	58	35	...do....	60
3187	...do...	5:17 p. m.	35 25 30	125 09 30	2,496	br. and gy. Oz	56	57	34·9	...do....	60
3188	...do...	7:19 p. m.	35 31 00	124 57 30	2,445	br. and gy. Oz	57	56	.....	...do....	60
3189	...do...	9:27 p. m.	35 36 30	124 45 30	2,413	br. and gy. Oz	56	56	.....	...do....	60
3190	...do...	11:31 p. m.	35 42 00	124 33 30	2,312	br. and gy. Oz	53	59	34·9	...do....	60
3191	Jan. 15	1:35 a. m.	35 47 30	124 21 30	2,223	br. and gy. Oz	54	54	.....	...do....	60
3192	...do...	3:28 a. m.	35 53 00	124 09 30	2,149	br. and gy. Oz	54	54	.....	...do....	60
3193	...do...	5:25 a. m.	35 58 30	123 57 30	2,169	gy. Oz	54	54	34·9	...do....	60
3194	...do...	7:23 a. m.	36 04 00	123 46 00	2,107	gy. Oz	54	55	.....	...do....	60
3195	...do...	9:18 a. m.	36 09 30	123 34 00	1,974	gy. Oz	54	54	.....	...do....	60
3196	...do...	11:06 a. m.	36 15 00	123 22 00	1,895	gy. Oz	54	52	35	...do....	60
3197	...do...	1:09 p. m.	36 21 00	123 10 00	1,797	gy. Oz	59	52	.....	...do....	60
3198	...do...	2:39 p. m.	36 25 00	123 00 00	1,725	gy. Oz	59	52	.....	...do....	60
3199	...do...	4:12 p. m.	36 29 30	122 50 30	1,660	gy. Oz	53	52	35	...do....	60
3200	...do...	5:42 p. m.	36 34 00	122 41 00	1,513	gn. M	53	52	.....	...do....	60
3201	...do...	7:15 p. m.	36 38 00	122 31 00	1,417	gn. M	51	52	.....	...do....	60
3202	...do...	8:14 p. m.	36 40 00	122 26 00	1,053	gn. M. fne. S	52	52	36·1	...do....	60
3203	Apr. 7	4:31 p. m.	58 22 00	150 09 00	20	brk. Sh	34	38	.....	Tanner.	26
3204	...do...	5:51 p. m.	58 25 00	150 18 00	30	Sh	34	38	.....	...do....	26
3205	...do...	6:43 p. m.	58 28 00	150 26 00	38	Sh	33	37	.....	...do....	26
3206	...do...	7:30 p. m.	58 31 00	150 34 00	47	crs. S. Sh	33	37	.....	...do....	26
3207	...do...	8:40 p. m.	58 34 00	150 42 00	49	bk. S. brk. Sh	33	38	.....	...do....	26
3208	...do...	9:42 p. m.	58 37 00	150 50 00	85	gy. S. bk. Sp	33	38	.....	...do....	26
3209	...do...	11:59 p. m.	58 39 00	150 58 00	103	M. bk. S	33	38	.....	...do....	26
3210	Apr. 8	1:05 a. m.	58 40 00	151 01 00	107	M. S	33	38	.....	...do....	26
3211	...do...	2:03 a. m.	58 43 00	151 09 00	118	bl. M. bk. Sp	33	38	.....	...do....	26
3212	...do...	3:03 a. m.	58 46 00	151 17 00	102	bl. M. bk. Sp	33	38	.....	...do....	26
3213	...do...	4:00 a. m.	58 49 00	151 25 00	93	bl. M. bk. Sp	33	38	.....	...do....	26
3214	Apr. 11	4:25 p. m.	59 32 00	151 55 00	20	gy. S	37	36	.....	...do....	26
3215	Apr. 18	8:45 a. m.	59 56 00	145 56 00	55	S. M	40	41	.....	Tanner.	26
3215a	...do...	2:19 p. m.	59 34 45	144 58 00	81	gn. M	43	42	.....	...do....	26
3216	...do...	2:56 p. m.	59 33 00	144 52 00	97	P. M	43	43	.....	...do....	26
3217	...do...	3:32 p. m.	59 31 00	144 43 00	377	G. M	43	43	.....	...do....	38
3218	...do...	8:35 p. m.	59 35 00	143 21 00	156	P	38	40	.....	...do....	26
3219	Apr. 19	3:03 a. m.	59 35 00	143 18 00	140	M. P	38	41	.....	...do....	38
3220	...do...	4:56 a. m.	59 36 00	142 57 00	225	bl. M	38	41	.....	...do....	38
3221	...do...	5:40 a. m.	59 37 00	142 45 00	281	bl. M. G	39	41	.....	...do....	38
3222	...do...	8:55 a. m.	59 19 00	142 10 00	504	gn. M	40	42	37·4	Sigsbee.	60
3223	...do...	10:28 a. m.	59 21 00	141 50 00	114	P	40	42	.....	...do....	60
3224	...do...	11:56 a. m.	59 14 00	141 35 00	110	S. G	41	42	.....	...do....	38
3225	...do...	3:46 p. m.	58 56 00	140 56 00	471	gn. M	41	42	37·9	...do....	38
3226	Apr. 24	6:45 p. m.	60 25 00	129 15 00	1,141	gn. M	46	46	35·3	...do....	60
3227	Apr. 25	7:31 p. m.	49 42 00	127 53 00	848	gn. M	49	48	37·5	...do....	38
3228	Apr. 26	8:05 p. m.	48 35 00	126 42 00	746	gn. M	48	48	37	...do....	38
3229	Apr. 27	1:01 p. m.	48 29 30	124 56 30	51	P. rky	52	51	.....	Tanner.	26
3230	...do...	1:24 p. m.	48 23 00	124 55 00	53	P. rky	52	51	.....	...do....	26
				East.							
3231	May 29	10:40 p. m.	53 13 00	172 38 00	1,447	yl. M. fne. S	41	40	.....	Sigsbee.	60
3232	May 30	5:43 a. m.	53 38 00	171 28 00	1,818	(No specimen).	38	39	.....	...do....	60
3233	...do...	11:35 a. m.	54 02 00	170 17 00	1,853	fne. bk. S	42	40	.....	...do....	60
3234	...do...	6:12 p. m.	54 30 00	169 03 00	1,990	yl. M. S	40	40	35·6	...do....	60
3235	May 31	12:03 p. m.	54 30 00	168 07 00	47	fne. gy. S	40	40	.....	...do....	60
3236	...do...	1:34 p. m.	55 09 00	165 51 00	25	rky	40	40	.....	Tanner.	26
3237	...do...	3:10 p. m.	55 10 00	165 47 00	33	rky. M	39	40	.....	...do....	26
3238	...do...	4:33 p. m.	55 08 00	165 48 00	36	gy. S	39	39	.....	...do....	26
3239	...do...	5:34 p. m.	55 10 30	165 45 00	32	gy. S	39	39	.....	...do....	26

Record of dredging and trawling stations of U. S. Fish Commission steamer Albatross from July 1, 1891, to June 30, 1892.

Serial No.	Date.	Time.	Position.		Temperatures.			Depth.	Character of bottom.	Wind.		Drift.		Instrument used.
			Latitude N.	Longitude W.	Air.	Surface.	Bottom.			Direction.	Force.	Direction.	Distance.	
	1891.		° ′ ″	° ′ ″	°F.	°F.	°F.	*Fms.*					*Miles.*	
3438	Aug. 3	11:04 a.m.	57 06 30	170 22 30	49	45	.....	20	fne. gy. S. Sh.....	East.....	1	SW. by W.....	·5	S.B.T.
3439	...do....	12:29 p.m.	57 06 00	170 35 00	50	44	44	41	fne. bk. S.....	East.....	1	SW. by W.....	·8	S.B.T.
3440	...do....	1:39 p.m.	57 05 00	170 41 00	49	46	.....	48	bk. M. Sh.....	SE.....	1	SW. by W.....	1	S.B.T.
3441	...do....	3:12 p.m.	57 01 20	170 52 30	49	48	39	51	bk. M. Sh.....	SE.....	1·2	SW.....	1	S.B.T.
3442	...do....	4:43 p.m.	57 10 00	170 47 15	50	50	40	47	bl. M. Sh.....	ESE.....	2	NW. ½ W.....	·7	S.B.T.
3443	Aug. 27	2:09 p.m.	48 13 30	123 11 20	65	57	46	97	gn. M. P.....	SW.....	1	SW. by W.....	1	L.B.T.
3444	...do....	3:54 p.m.	48 16 30	123 29 40	66	56	45	80	gn. M. P.....	Calm.....	0	SW. by W.....	·7	L.B.T.
3445	...do....	5:34 p.m.	48 16 [illegible]	123 45 05	66	65	44	100	Rky.....	Calm.....	0	W. ½ S.....	2	L.B.T.
3446	...do....	7:29 p.m.	48 18 30	123 58 20	68	53	44·5	100	bn. M.....	SW. by S.	1	SW.....	1·5	L.B.T.
3447	Aug. 28	10:35 a.m.	48 30 15	124 36 20	61	54	44	116	gy. S.....	ENE.....	1	NNW.....	1·5	L.B.T.
3448	...do....	3:13 p.m.	48 31 40	124 39 00	59	55	44	98	gy. S.....	SW.....	3	SSW.....	1	L.B.T.
3449	...do....	4:14 p.m.	48 29 40	124 40 10	60	55	.....	135	gy. S. G.....	SW.....	2	E. by S.....	1	L.B.T.
3450	...do....	5:15 p.m.	48 26 50	124 39 35	54	53	44	151	G.....	SW.....	2	ENE. ½ E.....	·7	L.B.T.
3451	...do....	6:29 p.m.	48 25 10	124 37 50	53	53	45	100	G. St.....	SW.....	2	ESE. ½ E.....	·6	L.B.T.
3452	Aug. 29	11:41 a.m.	48 24 40	124 29 10	57	53	44·5	125	Rky. bk. G.....	NW.....	1	E. by S.....	1	L.B.T.
3453	...do....	4:46 p.m.	48 20 00	124 13 40	61	57	44·4	120	gy. S. bk. Sp.....	WNW.....	2	ENE.....	1·6	L.B.T.
3454	Sept. 1	9:30 a.m.	48 27 50	124 42 40	58	54	44·2	152	gy. S. Rky.....	NNE.....	1	NW. by N.....	·3	L.B.T.
3455	...do....	10:38 a.m.	48 28 40	124 43 50	59	54	44·3	152	gy. S. Rky.....	ENE.....	2	N. by W.....	·5	L.B.T.
3456	...do....	12:09 m.	48 31 15	124 43 15	59	55	44·2	136	gy. S.....	ENE.....	2	NNW.....	1	L.B.T.
3457	...do....	3:30 p.m.	48 28 20	124 52 05	63	54	44·2	142	gy. S.....	NNE.....	2	S. by W.....	·7	L.B.T.
3458	Sept. 2	7:30 a.m.	48 21 50	124 24 00	57	51	.....	115	dk. S. St.....	NE.....	3	West.....	·3	L.B.T.
3459	...do....	9:30 a.m.	48 24 20	124 24 40	59	53	44·5	123	gr. S. P.....	NE.....	2	N. by E.....	·5	L.B.T.
3460	...do....	12:00 m.	48 25 05	124 10 00	59	53	46·8	53	gy. S.....	East.....	4	NE. by E.....	2	L.B.T.
3461	...do....	3:30 p.m.	48 17 20	124 07 25	60	54	44·4	114	gy. S. G. Rks.....	Calm.....	0	East.....	1·5	L.B.T.
3462	Sept. 3	12:38 p.m.	48 15 00	123 35 50	59	53	44·8	92	dk. S. Rky.....	West.....	1	NE.....	·5	L.B.T.
3463	Sept. 4	9:50 a.m.	48 09 30	123 23 30	56	52	47·8	45	gy. S.....	South.....	1	NW.....	·5	L.B.T.
3464	...do....	11:00 a.m.	48 14 00	123 20 40	61	55	47·8	40	gy. S. P.....	SW.....	1	NW.....	·3	L.B.T.
3465	...do....	1:56 p.m.	48 21 00	123 14 00	59	55	49·9	48	Rky.....	Calm.....	0	NNE.....	·3	L.B.T.
3466	...do....	3:55 p.m.	48 18 30	123 22 00	58	53	48·5	56	gy. S. Sh. Rky.....	SSW.....	2	South.....	·5	L.B.T.
3467	Dec. 3	1:58 p.m.	21 13 00	157 43 37	75	76	.....	310	fne. wh. S. bk. Sp....	NNW.....	1	E. by S.....	2	S.B.T.
3468	...do....	4:22 p.m.	21 15 36	157 41 10	75	76	.....	17	S. Co.....	NE.....	2	NE. ½ E.....	·7	Tangles.
3469	...do....	5:15 p.m.	21 14 51	157 43 30	76	76	.....	14	S. Co.....	ENE.....	2·3	NE. ½ E.....	·4	Tangles.
3470	Dec. 4	1:50 p.m.	21 08 30	157 49 00	77	76	43·3	343	Wh. S.....	East.....	3	NE.....	·8	L.B.T.
3471	...do....	3:29 p.m.	21 10 30	157 48 30	77	76	.....	337	fne. Wh. S.....	ENE.....	3	NW. by N.....	2	L.B.T.
3472	...do....	4:59 p.m.	21 12 00	157 49 00	77	78	.....	295	fne. Wh. S.....	ENE.....	2·3	NNW. by W....	1·5	L.B.T.
3473	Dec. 6	6:04 a.m.	21 15 00	157 30 00	75	76	43·8	313	fne. gy. S.....	NE.....	4	S. by E. ½ E....	·5	L.B.T.
3474	...do....	8:18 a.m.	21 12 00	157 38 30	70	77	.....	375	fne. Wh. S.....	NE.....	4	S. by W.....	2	L.B.T.
3475	...do....	10:35 a.m.	21 08 00	157 43 00	77	76	.....	351	fne. Wh. S.....	NE.....	4	W. by N.....	1·8	L.B.T.
3476	...do....	1:04 p.m.	21 09 00	157 53 00	77	76	.....	298	fne. Wh. S.....	North....	2·3	W. ½ N.....	1·8	L.B.T.

Record of tow-net stations of the U. S. Fish Commission steamer Albatross from July 1, 1891, to June 30, 1892.

[Serial numbers indicate cable survey numbers of stations, where Tanner submarine and surface tow nets were used.]

Serial No.	Date.	Time.	Position.		Temperatures.			Depth at which used.	Condition of sea.	Wind.		Drift.		Appearance of sky.	Remarks.
			Latitude N.	Longitude W.	Air.	Surface.	Bottom.			Direction.	Force.	Direction.	Distance.		
	1891.		° ′ ″	° ′ ″	°F.	°F.	°F.						*Miles.*		
45	Oct. 13	11:26 a.m.	35 41 50	126 22 20	61	62	34·9	Surface.	Moderate.	WNW ...	2	SW. ½ S.....	5	Cloudy ...	Surface tow net.
54	Oct. 14	3:33 p.m.	35 03 30	129 05 00	67	66	35	...do	Smooth...	West.....	1	SW. ½ S.....	5	Clear.....	Do.
64	Oct. 15	7:12 p.m.	33 54 30	131 45 00	66	65	35	...do	...do	West.....	3	SW. ½ S.....	5	...do	Do.
69	Oct. 16	8:50 a.m.	33 24 00	133 01 00	67	67	35·5	...do	...do	Calm	0	SW. ½ S.....	5	Showery..	Do.
74	...do	6:55 p.m.	30 04 30	133 56 30	67	67	.....	...do	...do	SSE	2	SW. by S ...	5	Clear.....	Do.
129	Nov. 8	11.49 a.m.	32 43 40	124 42 30	68	68	35·1	...do	...do	ENE	2	SSW. ½ W ..	5	...do	Do.
130	...do	2:30 p.m.	32 41 00	124 49 30	68	68	.....	...do	...do	ENE	2	SSW. ½ W ..	5	...do	Do.
133	...do	7:25 p.m.	32 35 00	125 03 00	69	68	.....	...do	...do	East.....	2	SSW. ½ W ..	5	...do	Do.
144	Nov. 9	8:43 p.m.	31 50 00	126 54 30	65	67	.....	.. do	...do	East.....	2	SW. by S . .	5	Cloudy ...	Do.
149	Nov. 10	8:47 a.m.	31 27 00	127 47 00	67	68	35·1	...do	...do	ESE.....	2	SW. by S ...	5	...do	Do.
150	...do	11:04 a.m.	31 23 00	127 58 00	66	67	.....	...do	...do	ESE.....	1	SW. by S ...	5	Clear.....	Do.
152	...do	3:16 p.m.	31 14 30	128 19 00	70	69	.....	330 fath	...do	East.....	2	SW. by S ...	5	...do	Tanner submarine net.
153	...do	6:03 p.m.	31 10 00	128 29 30	70	70	35	Surface	...do	East.....	2	SW. by S ..	5	...do	Surface tow net.
154	...do	7:42 p.m.	31 05 00	128 40 00	68	70	.....	...do	...do	East.....	2	SW. by S ...	5	...do	Do.
163	Nov. 11	1:10 p.m.	30 31 30	140 05 30	71	69	.....	330 fath	...do	East.....	2	SW. by S ...	5	...do	Tanner submarine net.
165	...do	6:00 p.m.	30 23 00	140 26 30	69	69	.....	Surface	...do	East.....	2	SW. by S ...	5	...do	Surface tow net.
174	Nov. 12	2:43 p.m.	29 38 00	142 17 00	72	70	.....	330 fath	...do	SE	1	SW. by S ...	5	...do	Tanner submarine net.
185	Nov. 13	3:34 p.m.	28 52 00	144 00 00	72	72	35·3	Surface	...do	SE.....	2	SSW. ½ W ..	5	Cloudy ...	Surface tow net.
192	Nov. 14	9:42 a.m.	28 20 00	145 03 30	72	72	.....	...do	...do	SE.....	2	SSW. ½ W ..	5	Clear.....	Do.
195	...do	6:00 p.m.	28 00 30	145 35 00	73	73	.....	...do	...do	SE.....	1	SSW. ½ W ..	5	...do	Do.
196	...do	7:29 p.m.	27 54 00	145 45 30	72	72	35·2	...do	...do	ESE.....	1	SSW. ½ W ..	5	...do	Do.
204	Nov. 15	2:13 p.m.	27 06 00	147 14 00	75	74	.....	100 fath	...do	ESE.....	1	SSW. ½ W ..	5	Cloudy ...	Tanner submarine net.
257	Nov. 20	2:45 p.m.	22 11 00	156 09 00	77	77	35·4	Surface	...do	NNW	2	SSW. ½ W ..	5	Clear.....	Surface tow net.
259	...do	7:26 p.m.	21 55 30	156 29 30	78	77	.....	...do	...do	West.....	1	SSW. ½ W ..	5	...do	Do.
286	Dec. 2	5:00 p.m.	21 15 49	157 44 27	76	75	.....	...do	...do	NE.....	1·2	WNW	5	...do	Do.
452	Dec. 24	4:00 p.m.	29 52 30	138 24 00	63	67	.....	...do	...do	ENE	3	NE. by E. ½ E	5	Cloudy ...	Do.
	1892.														
540	Jan. 14	1:58 p.m.	35 19 30	125 21 30	62	58	35·1	300 fath.	...do	North	2	NE. ½ E.....	5	Clear.....	Tanner subm. net.
541	...do	5:17 p.m.	35 25 30	125 09 30	59	57	.....	Surface and 300 fath.	...do	NNE	1	NE. ½ E.....	5	...do	Tanner submarine net and surface tow net.
542	...do	7:19 p.m.	35 31 00	124 57 30	57	56	.....	Surface.	...do	NNE	2	NE. ½ E.....	5	Moonlight.	Surface tow net.
543	...do	9:28 p.m.	35 36 30	124 45 30	56	56	.....	...do	...do	NNN	2	NE. ½ E.....	5	...do	Do.

Record of ocean temperatures and specific gravities by the U. S. Fish Commission steamer Albatross, July 1, 1891, to June 30, 1892.

[Each specimen was taken at about 1 foot below the surface. For observations which have been reduced to 60° F., indicating densities referred to pure water at 60° F., the constant 0·82 has been subtracted from the result in order to convert the latter into absolute densities at 15° C.]

Date.	Time of day.	Station.	Lat. N.	Long. W.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temp. of specimen at time specific gravity was taken.	Specific gravity observed.	Specific gravity reduced to 15° C., with pure water at 4° C. as standard
1891.			° ′ ″	° ′ ″	*Fms.*	°	°	°		
July 16	8 p. m.	Point Reyes, Cal			Surface	57	55	64	1·0234	1·023128
16	12 p. m.		38 07 00	123 55 00	...do	53	53	64	1·0240	1·023728
17	6 a. m.		38 15 00	124 35 00	...do	50	53	64	1·0250	1·024728
17	12 m		38 36 30	125 00 00	...do	56	57	64	1·0250	1·024728
17	6 p. m.		39 01 00	126 03 00	...do	58	59	64	1·0248	1·024528
17	12 p. m.		39 25 30	126 59 00	...do	59	60	64	1·0246	1·024328
18	6 a. m.		39 50 00	128 04 00	...do	60	61	64	1·0246	1·024328
18	12 m		40 15 00	129 00 00	...do	62	62	64	1·0246	1·024328
18	6 p. m.		40 46 30	130 10 00	...do	61	62	64	1·0246	1·024328
18	12 p. m.		41 28 00	131 30 00	...do	61	62	64	1·0246	1·024328
19	6 a. m.		41 59 00	132 50 00	...do	61	62	64	1·0245	1·024228
19	12 m		42 21 00	133 40 00	...do	63	63	64	1·0245	1·024228
19	6 p. m.		42 55 00	134 47 00	...do	60	60	64	1·0246	1·024328
19	12 p. m.		43 28 00	135 52 00	...do	58	59	64	1·0248	1·024528
20	6 a. m.		44 01 00	137 03 00	...do	57	61	64	1·0246	1·024328
20	12 m		44 36 00	138 08 30	...do	58	60	64	1·0246	1·024328
20	6 p. m.		45 08 00	139 20 00	...do	59	56	64	1·0246	1·024328
20	12 p. m.		45 40 00	140 28 00	...do	54	54	64	1·0250	1·024328
21	6 a. m.		46 12 00	141 49 00	...do	55	54	64	1·0246	1·024328
21	12 m		46 43 00	142 55 00	...do	55	55	64	1·0245	1·024228
21	6 p. m.		47 14 00	144 09 00	...do	54	55	64	1·0244	1·024128
21	12 p. m.		47 45 00	145 26 00	...do	53	57	64	1·0244	1·024128
22	6 a. m.		48 16 00	146 34 00	...do	52	51	64	1·0243	1·024028
22	12 m		48 47 00	147 51 00	...do	53	57	64	1·0242	1·023928
22	6 p. m.		49 13 00	149 12 00	...do	53	52	64	1·0243	1·024048
22	12 p. m.		49 38 00	150 30 00	...do	51	51	64	1·0243	1·024048
23	6 a. m.		50 05 00	151 57 00	...do	51	51	64	1·0243	1·024018
23	12 p. m.		50 30 00	153 17 00	...do	50	50	64	1·0242	1·023928
23	6 p. m.		51 00 00	154 46 00	...do	51	50	64	1·0242	1·023928
23	12 p. m.		51 31 00	156 12 00	...do	50	50	69	1·0238	1·024267
24	6 a. m.		52 01 00	157 42 00	...do	50	51	69	1·0238	1·024267
24	12 m		52 30 00	159 13 00	...do	51	54	69	1·0236	1·024067
24	6 p. m.		52 52 00	160 51 00	...do	51	51	69	1·0236	1·024067
24	12 p. m.		53 14 00	162 30 00	...do	50	50	69	1·0236	1·024067
25	6 a. m.		53 36 00	164 07 00	...do	49	49	69	1·0236	1·024067
25	12 m		53 58 00	165 48 00	...do	46	52	69	1·0236	1·024067
26	12 m	Unalaska, Alaska			...do	53	55	69	1·0232	1·023667
27	12 m		54 31 00	167 09 00	...do	50	50	69	1·0236	1·024067
27	6 p. m.		55 32 00	167 46 00	...do	50	51	69	1·0236	1·024067
27	12 p. m.		56 34 00	168 23 00	...do	49	50	69	1·0238	1·024267
28	6 a. m.		57 33 00	169 01 00	...do	48	49	69	1·0234	1·023867
28	12 m	St. George Island			...do	48	48	69	1·0234	1·023867
Aug. 1	12 m	St. Paul Island			...do	45	47	69	1·0232	1·023667
9	12 m		56 53 40	170 01 30	...do	46	48	69	1·0234	1·023867
10	12 m		56 26 00	169 22 00	...do	47	51	69	1·0234	1·023867
11	1 p. m.	Bogoslof Volcano			...do	48	56	69	1·0234	1·023867
13	6 p. m.	Off Unimak Pass			...do	48	53	69	1·0232	1·023667
13	12 p. m.		54 03 00	163 40 00	...do	50	50	69	1·0232	1·023667
14	6 a. m.		53 45 00	162 20 00	...do	50	52	69	1·0232	1·023667
14	12 m		53 27 00	161 09 00	...do	54	56	69	1·0234	1·023867
14	6 p. m.		53 12 00	159 43 00	...do	54	55	69	1·0234	1·023867
14	12 p. m.		53 05 00	158 17 00	...do	52	54	69	1·0234	1·023867
15	6 a. m.		52 56 00	156 51 00	...do	53	54	69	1·0234	1·023867
15	12 m		52 49 00	155 24 00	...do	53	59	69	1·0236	1·024067
15	6 p. m.		52 44 00	153 59 00	...do	54	56	69	1·0236	1·024067
15	12 p. m.		52 38 00	152 34 00	...do	55	57	66	1·0244	1·024420
16	6 a. m.		52 35 00	151 10 00	...do	55	56	66	1·0244	1·024420
16	12 m		52 27 00	149 45 00	...do	52	57	66	1·0242	1·024220
16	6 p. m.		52 21 00	148 13 00	...do	55	57	66	1·0242	1·024220
16	12 p. m.		52 16 00	146 41 00	...do	56	57	66	1·0242	1·024220
17	6 a. m.		52 09 00	145 09 00	...do	56	57	66	1·0242	1·024220
17	12 m		52 04 00	143 38 00	...do	58	50	66	1·0240	1·024020
17	6 p. m.		51 56 00	142 08 00	...do	57	59	66	1·0240	1·024020

Record of ocean temperatures and specific gravities by the U. S. Fish Commission steamer Albatross, July 1, 1891, to June 30, 1892—Continued.

Date.	Time of day.	Station.	Lat. N.	Long. W.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temp. of specimen at time specific gravity was taken.	Specific gravity observed.	Specific gravity reduced to 15° C., with pure water at 4° C. as standard.
1891.			° ′ ″	° ′ ″	*Fms.*	°	°	°		
Aug. 17	12 p. m.		51 49 00	140 38 00	Surface.	56	58	66	1·0240	1·024020
18	6 a. m.		51 41 00	139 10 00	...do....	57	56	66	1·0240	1·024020
18	12 m.		51 33 00	137 37 00	...do....	59	61	66	1·0240	1·024020
18	6 p. m.		51 29 00	136 05 00	...do....	59	60	66	1·0242	1·024220
18	12 p. m.		51 26 00	134 33 00	...do....	57	59	66	1·0242	1·024220
19	6 a. m.		51 22 00	133 01 00	...do....	59	58	66	1·0240	1·024020
19	12 m.		51 17 00	131 30 00	...do....	60	64	66	1·0236	1·023020
19	6 p. m.		51 05 00	130 11 00	...do....	60	60	66	1·0230	1·023020
19	12 p. m.		50 52 00	128 52 00	...do....	58	59	66	1·0226	1·022620
20	6 a. m.		50 43 00	127 33 00	...do....	55	57	66	1·0216	1·021620
20	12 m.		50 29 45	126 28 45	...do....	61	58	66	1·0224	1·022420
24	12 m.	Tacoma, Wash.			...do....	62	67	66	1·0154	1·015420
25	8 a. m.	Seattle, Wash.			...do....	58	63	66	1·0196	1·021620
28	8 a. m.	Neah Bay, Washington			...do....	53	60	66	1·0234	1·023420
29	12 m.		48 24 40	124 20 10	...do....	54	59	66	1·0228	1·022820
Sept. 1	5 p. m.	Cape Flattery			...do....	54	59	66	1·0230	1·023020
2	8 p. m.	Pillar Point			...do....	50	58	66	1·0232	1·023220
4	9 a. m.	Port Angeles			...do....	53	60	66	1·0232	1·023220
6	12 m.	Esquimalt Harbor			...do....	57	60	66	1·0230	1·023020
9	2 p. m.	Active Pass			...do....	54	56	66	1·0188	1·018820
9	8 p. m.	Departure Bay			...do....	55	57	66	1·0198	1·019820
11	8 a. m.	Port Townsend			...do....	54	55	69	1·0224	1·022807
11	12 p. m.		47 32 00	125 05 00	...do....	57	57	69	1·0228	1·023207
12	6 a. m.		46 41 00	125 11 00	...do....	59	58	69	1·0232	1·023667
12	12 m.		45 45 00	125 00 00	...do....	61	61	69	1·0232	1·023667
12	6 p. m.		44 52 00	125 03 00	...do....	62	60	69	1·0230	1·023467
12	12 p. m.		43 46 00	124 57 00	...do....	56	57	69	1·0232	1·023667
13	6 a. m.		42 58 00	124 52 00	...do....	56	57	69	1·0234	1·023867
13	12 m.		42 11 00	124 43 00	...do....	55	57	69	1·0236	1·024067
13	6 p. m.		41 17 00	124 24 00	...do....	58	61	69	1·0236	1·024067
13	12 p. m.		40 23 00	124 05 00	...do....	59	59	69	1·0240	1·024467
14	6 a. m.		39 29 00	123 46 00	...do....	55	56	69	1·0240	1·024467
14	12 m.		38 25 00	123 26 00	...do....	54	56	69	1·0242	1·024667
14	7 p. m.	San Francisco Bar			...do....	55	58	69	1·0240	1·024467
Oct. 11	10 a. m.	Salinas Landing			...do....	55	52	70	1·0242	1·024830
11	12 m.		36 46 50	121 53 00	...do....	56	54	70	1·0244	1·025030
11	6 p. m.		36 42 30	122 22 00	...do....	55	54	70	1·0244	1·025030
11	12 p. m.		36 35 00	123 06 00	...do....	55	55	70	1·0244	1·025030
12	6 a. m.		36 30 30	123 32 00	...do....	54	55	70	1·0242	1·024830
12	12 m.		36 25 30	124 02 30	...do....	56	58	70	1·0240	1·024630
12	6 p. m.		36 14 30	124 37 30	...do....	50	59	70	1·0240	1·024630
12	12 p. m.		36 03 00	125 13 00	...do....	57	57	70	1·0240	1·024630
13	6 a. m.		35 52 30	125 48 00	...do....	59	59	70	1·0240	1·024630
13	12 m.		35 41 50	126 22 00	...do....	62	61	70	1·0240	1·024630
13	6 p. m.		35 33 00	126 59 30	...do....	63	62	70	1·0240	1·024630
13	12 p. m.		35 25 00	127 36 00	...do....	62	61	70	1·0240	1·024630
14	6 a. m.		35 15 30	128 12 00	...do....	64	63	70	1·0242	1·024830
14	12 m.		35 06 45	128 48 45	...do....	65	65	70	1·0242	1·024830
14	6 p. m.		34 56 30	129 20 00	...do....	65	66	70	1·0242	1·024830
14	12 p. m.		34 42 00	129 52 30	...do....	65	64	70	1·0242	1·024830
15	6 a. m.		34 28 00	130 24 00	...do....	65	65	70	1·0240	1·024630
15	12 m.		34 12 50	130 59 00	...do....	66	66	70	1·0240	1·024630
15	6 p. m.		33 54 30	131 45 00	...do....	66	67	70	1·0240	1·024630
15	12 p. m.		33 41 30	132 17 00	...do....	66	66	70	1·0242	1·024830
16	6 a. m.		33 28 30	132 50 00	...do....	67	65	70	1·0242	1·024830
16	12 m.		34 18 00	133 15 35	...do....	67	67	70	1·0244	1·025030
16	6 p. m.		33 04 30	133 56 30	...do....	69	67	70	1·0244	1·025030
16	12 p. m.		32 57 30	134 18 30	...do....	68	67	70	1·0244	1·025030
17	6 a. m.		32 46 30	134 51 30	...do....	68	68	70	1·0244	1·025030
17	12 m.		32 41 30	135 06 50	...do....	68	69	70	1·0244	1·025030
17	6 p. m.		32 31 00	135 33 00	...do....	68	69	70	1·0244	1·025030
17	12 p. m.		32 18 00	136 04 30	...do....	69	69	70	1·0246	1·025230
18	6 a. m.		32 10 00	136 26 00	...do....	69	69	70	1·0248	1·025430
18	12 m.		31 58 00	136 56 00	...do....	69	65	70	1·0248	1·025430
18	6 p. m.		31 52 30	137 09 00	...do....	69	65	70	1·0248	1·025430
18	10 p. m.		31 43 00	137 30 30	...do....	68	64	70	1·0248	1·025430
Nov. 8	12 m.		32 43 40	134 42 50	...do....	68	68	70	1·0240	1·025622

Record of ocean temperatures and specific gravities by the U. S. Fish Commission steamer Albatross, July 1, 1891, to June 30, 1892—Continued.

Date.	Time of day.	Station.	Lat. N.	Long. W.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temp. of specimen at time specific gravity was taken.	Specific gravity observed.	Specific gravity reduced to 15° C., with pure water at 4° C. as standard.
1891.			° ′ ″	° ′ ″	*Fms.*	°	°	°		
Nov. 8	6 p. m		32 37 30	134 57 00	Surface.	68	69	76	1·0240	1·025622
8	12 p. m		32 30 30	135 15 00	...do	67	64	76	1·0240	1·025622
9	6 a. m		32 17 00	135 49 00	...do	67	65	76	1·0240	1·025622
9	12 p. m		32 07 30	136 13 20	...do	68	68	76	1·0240	1·025622
9	6 p. m		31 54 30	136 44 00	...do	69	67	76	1·0242	1·025822
9	12 p. m		31 45 30	137 05 00	...do	67	66	76	1·0242	1·025822
10	6 a. m		31 31 30	137 36 30	...do	68	67	76	1·0242	1·025822
10	12 m		31 22 20	137 59 30	...do	68	68	76	1·0242	1·025822
10	6 p. m		31 10 00	138 29 30	...do	70	68	76	1·0244	1·026022
10	12 p. m		30 57 30	139 00 30	...do	69	68	76	1·0244	1·026022
11	6 a. m		30 48 00	139 23 00	...do	69	67	76	1·0244	1·026022
11	12 m		30 35 30	139 36 45	...do	69	70	76	1·0244	1·026022
11	6 p. m		30 23 00	140 26 30	...do	69	69	76	1·0244	1·026022
11	12 p. m		30 13 00	140 50 30	...do	69	67	76	1·0244	1·026022
12	6 a. m		29 58 30	141 27 30	...do	68	68	76	1·0244	1·026022
12	12 m		29 44 30	142 02 00	...do	70	72	76	1·0244	1·026022
12	6 p. m		29 31 30	142 32 00	...do	70	70	76	1·0244	1·026022
13	6 a. m		29 15 00	143 09 30	...do	70	70	76	1·0246	1·026222
13	12 m		29 03 00	143 37 50	...do	72	73	76	1·0246	1·026222
13	6 p. m		28 46 00	144 12 00	...do	71	72	76	1·0246	1·026222
13	12 p. m		28 33 30	144 37 00	...do	71	70	76	1·0246	1·026222
14	6 a. m		28 20 00	145 03 00	...do	71	69	76	1·0246	1·026222
14	12 m		28 12 20	145 13 07	...do	72	72	76	1·0246	1·026222
14	6 p. m		28 00 30	145 35 00	...do	73	73	76	1·0246	1·026222
14	12 p. m		27 42 00	146 07 30	...do	72	72	76	1·0244	1·026022
15	6 a. m		27 30 00	146 30 00	...do	73	72	76	1·0244	1·026022
15	12 m		27 12 00	127 03 42	...do	74	75	76	1·0240	1·025622
15	6 p. m		27 00 00	147 25 30	...do	74	72	76	1·0242	1·025822
15	12 p. m		26 42 00	147 59 00	...do	74	71	76	1·0242	1·025822
16	6 a. m		26 29 00	148 21 30	...do	74	72	76	1·0242	1·035822
16	12 m		26 10 15	148 56 10	...do	75	73	76	1·0242	1·025822
16	6 p. m		25 58 00	149 18 30	...do	75	74	80	1·0242	1·026540
16	12 p. m		25 39 30	149 53 00	...do	74	74	80	1·0242	1·026540
17	6 a. m		25 26 30	150 16 30	...do	74	73	80	1·0240	1·026340
17	12 m		25 10 08	150 46 36	...do	75	75	80	1·0240	1·026340
17	6 p. m		24 56 00	151 13 00	...do	75	75	80	1·0240	1·026340
17	12 p. m		24 43 30	151 36 00	...do	75	74	80	1·0240	1·026340
18	6 a. m		24 31 00	151 57 30	...do	76	76	80	1·0240	1·026340
18	12 m		24 11 20	152 35 05	...do	76	76	80	1·0240	1·026340
18	7 p. m		23 55 00	153 08 30	...do	76	76	80	1·0240	1·026340
18	12 p. m		23 43 00	153 31 30	...do	73	75	80	1·0238	1·026140
19	7 a. m		23 26 00	154 06 00	...do	76	75	80	1·0238	1·026140
19	12 m		23 13 22	154 31 33	...do	76	76	80	1·0240	1·026340
19	6 p. m		23 05 00	154 42 30	...do	77	77	80	1·0238	1·026140
19	12 p. m		22 49 30	155 09 00	...do	76	76	80	1·0238	1·026140
20	6 a. m		22 36 30	155 30 30	...do	75	75	80	1·0238	1·026140
20	12 m		22 18 07	155 59 50	...do	77	77	80	1·0236	1·025940
20	6 p. m		22 03 30	156 19 00	...do	77	78	80	1·0236	1·025940
20	12 p. m		21 39 00	156 48 30	...do	77	76	80	1·0238	1·026140
21	6 a. m		21 21 00	157 09 00	...do	77	76	80	1·0236	1·025940
21	1 p. m	Honolulu, H. I			...do	78	78	80	1·0236	1·025940
Dec. 3	12 m	Monoloa Bay, H. I			...do	76	76	71	1·0250	1·025786
4	8 a. m	Wiekiki, H. I			...do	76	76	71	1·0250	1·025786
12	12 m		21 26 17	157 08 30	...do	74	71	71	1·0250	1·025786
12	6 p. m		21 36 30	156 44 00	...do	74	70	71	1·0252	1·025986
12	12 p. m		21 46 00	156 21 00	...do	73	70	71	1·0252	1·025986
13	6 a. m		21 56 00	155 57 30	...do	74	69	71	1·0250	1·025786
13	12 m		22 05 36	155 33 38	...do	74	71	71	1·0252	1·025986
13	7 p. m		22 20 00	155 01 00	...do	74	70	71	1·0252	1·025986
13	12 p. m		22 30 00	154 38 30	...do	75	71	71	1·0252	1·025986
14	6 a. m		22 40 00	154 16 00	...do	74	70	71	1·0252	1·025986
14	12 m		22 51 31	144 49 53	...do	74	73	71	1·0252	1·025986
14	6 p. m		23 06 00	153 20 30	...do	74	72	71	1·0252	1·025986
14	12 p. m		13 16 00	152 59 00	...do	74	72	71	1·0252	1·025986
15	6 a. m		23 27 00	152 37 00	...do	73	70	71	1·0254	1·026186
15	12 m		23 38 00	152 14 44	...do	74	72	71	1·0254	1·026186
15	6 p. m		23 49 00	151 55 00	...do	74	70	71	1·0252	1·025986

Record of ocean temperatures and specific gravities by the U. S. Fish Commission steamer Albatross, July 1, 1891, to June 30, 1892—Continued.

Date.	Time of day.	Station.	Lat. N.	Long. W.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temp. of specimen at time specific gravity was taken.	Specific gravity observed.	Specific gravity reduced to 15° C. with pure water at 4° C. as standard.
1891.			° ′ ″	° ′ ″	*Fms.*	°	°	°		
15	12 p. m		24 03 00	151 29 30	Surface	73	68	71	1·0252	1·025986
16	6 a. m		24 17 00	151 04 00	...do	73	70	71	1·0250	1·025786
16	12 m		24 27 56	150 44 17	...do	74	74	71	1·0250	1·025786
16	7 p. m		24 43 00	150 09 00	...do	72	71	71	1·0252	1·025986
17	1 a. m		24 55 00	149 41 00	...do	73	72	71	1·0252	1·025986
17	6 a. m		25 01 00	149 27 00	...do	73	71	71	1·0252	1·025986
17	12 m		25 13 44	148 58 03	...do	73	72	71	1·0252	1·025956
17	6 p. m		25 26 30	148 30 00	...do	73	69	71	1·0250	1·025786
17	12 p. m		25 39 30	148 01 30	...do	73	69	71	1·0250	1·025786
18	6 a. m		25 53 00	147 32 30	...do	72	70	71	1·0250	1·025786
18	12 m		26 06 30	147 03 00	...do	72	72	71	1·0250	1·525786
18	6 p. m		26 19 30	146 34 30	...do	72	71	71	1·0250	1·025786
18	12 p. m		26 32 30	146 05 30	...do	71	68	71	1·0252	1·025986
19	7. a. m		26 45 00	145 36 30	...do	72	68	71	1·0252	1·025986
19	12 m		26 47 20	145 30 00	...do	72	71	71	1·0252	1·025986
19	6 p. m		26 57 00	145 09 30	...do	72	69	71	1·0252	1·025986
19	12 p. m		27 06 30	145 17 30	...do	71	68	71	1·0252	1·025086
20	7 a. m		27 16 30	145 24 30	...do	70	68	71	1·0252	1·025986
20	12 m		27 20 30	144 12 54	...do	70	68	71	1·0252	1·025086
20	6 p. m		27 33 00	143 55 30	...do	70	67	71	1·0250	1·025786
20	12 p. m		27 42 30	143 41 30	...do	70	66	71	1·0250	1·025786
21	6 a. m		27 52 00	143 27 00	...do	70	67	71	1·0250	1·025786
21	12 m		28 03 42	143 10 05	...do	70	70	71	1·0250	1·025786
21	8 p. m		28 14 00	142 40 00	...do	69	65	71	1·0250	1·025786
22	1 a. m		28 20 00	142 22 30	...do	69	67	71	1·0252	1·025986
22	6 a. m		28 26 00	142 05 00	...do	69	67	71	1·0254	1·026186
22	12 m		28 31 55	141 45 01	...do	69	69	71	1·0254	1·026186
22	7 p. m		28 43 00	141 19 00	...do	69	68	71	1·0254	1·026186
22	12 p. m		28 48 30	141 04 30	...do	69	68	71	1·0254	1·026186
23	8 a. m		29 00 30	140 35 00	...do	68	66	71	1·0254	1·026186
23	12 m		29 06 21	140 20 21	...do	69	68	71	1·0254	1·026186
23	8 p. m		29 17 30	139 52 00	...do	68	65	71	1·0254	1·026186
24	1 a. m		29 23 00	139 38 00	...do	68	65	71	1·0254	1·026186
24	7 a. m		29 34 00	139 09 00	...do	68	63	71	1·0254	1·026186
24	12 m		29 44 08	138 45 07	...do	67	64	71	1·0256	1·026406
24	7 p. m		29 59 00	138 08 00	...do	67	63	67	1·0260	1·026167
24	12 p. m		30 12 00	137 36 30	...do	66	63	67	1·0260	1·026167
25	6 a. m		30 23 30	137 09 00	...do	66	61	67	1·0260	1·026167
25	12 m		30 30 00	137 04 30	...do	65	64	67	1·0260	1·026167
25	6 p. m		30 15 00	137 10 30	...do	66	63	67	1·0260	1·026167
25	12 p. m		30 30 00	136 49 00	...do	66	62	67	1·0260	1·026167
26	6 a. m		30 43 00	136 23 00	...do	66	62	67	1·0258	1·025967
26	12 m		30 54 45	135 56 35	...do	55	62	67	1·0258	1·025067
26	6 p. m		31 08 00	135 26 30	...do	66	63	67	1·0258	1·025967
26	12 p. m		31 20 00	134 57 00	...do	65	64	67	1·0258	1·025967
27	6 a. m		31 32 30	134 26 30	...do	65	63	67	1·0256	1·025767
27	12 m		31 45 14	133 56 00	...do	66	69	67	1·0256	1·025767
1892										
Jan. 10	12 m		31 49 23	133 45 32	...do	63	61	67	1·0252	1·025307
10	6 p. m		32 01 30	133 16 00	...do	62	60	67	1·0252	1·025307
10	12 p. m		32 14 00	132 46 00	...do	62	59	67	1·0250	1·025167
11	6 a. m		32 26 00	132 16 00	...do	62	59	67	1·0250	1·025167
11	12 m		32 31 24	132 01 43	...do	62	60	67	1·0250	1·025167
11	6 p. m		32 43 30	131 30 00	...do	62	58	67	1·0250	1·025167
11	12 p. m		32 55 00	131 00 00	...do	61	58	67	1·0246	1·024767
12	6 a. m		33 03 30	130 38 00	...do	60	58	67	1·0246	1·024767
12	12 m		33 14 46	130 07 06	...do	62	60	67	1·0246	1·024767
12	7 p. m		33 28 00	129 32 00	...do	61	58	67	1·0246	1·024767
12	12 p. m		33 38 00	129 05 30	...do	61	58	67	1·0246	1·024767
13	6 a. m		33 53 00	128 26 00	...do	59	56	67	1·0244	1·024507
13	12 m		34 08 10	127 46 21	...do	59	60	67	1·0244	1·024507
13	6 p. m		34 26 30	127 10 30	...do	58	58	67	1·0242	1·024367
13	12 p. m		34 44 30	126 34 00	...do	58	57	67	1·0242	1·024367
14	6 a. m		34 56 00	126 09 30	...do	58	57	67	1·0240	1·024167
14	12 m		35 14 07	125 33 18	...do	57	60	67	1·0240	1·024167
14	7 p. m		35 31 00	124 57 30	...do	56	57	63	1·0246	1·024191
14	12 p. m		35 42 00	124 33 30	...do	59	53	63	1·0246	1·024191

Record of ocean temperatures and specific gravities by the U. S. Fish Commission steamer Albatross, July 1, 1891 to June 30, 1892—Continued.

Date.	Time of day.	Station.	Lat. N.	Long. W.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temp. of specimen at time specific gravity was taken.	Specific gravity observed.	Specific gravity reduced to 15° C., with pure water at 4° C. as standard.
1892.			° ′ ″	° ′ ″	*Fms.*	°	°	°		
Jan. 15	6 a. m		35 58 30	123 57 30	Surface.	54	54	63	1·0246	1·024191
15	12 m		36 17 42	123 17 30	...do	52	54	63	1·0246	1·024191
15	6 p. m		36 34 00	122 41 00	...do	52	53	63	1·0246	1·024191
Mar. 31	6 p. m	Cape Flattery			...do	45	44	64	1·0236	1·023328
Apr. 1	12 m		49 30 00	128 10 00	...do	47	43	64	1·0236	1·023328
2	12 m		51 59 00	132 07 30	...do	45	43	64	1·0238	1·013528
3	12 m		53 48 00	136 13 00	...do	43	41	64	1·0244	1·024128
4	12 m		55 17 00	141 00 00	...do	40	36	64	1·0244	1·024128
5	12 m		55 44 00	142 24 00	...do	39	35	64	1·0244	1·024128
6	12 m		57 00 00	144 42 00	...do	38	36	64	1·0244	1·024128
7	12 m		58 01 00	149 16 00	...do	39	37	64	1·0236	1·023328
8	4 p. m	Port Graham, Cook Inlet			...do	36	34	64	1·0234	1·023128
10	9 a. m	Soldovoi, Cook Inlet			...do	36	33	64	1·0236	1·023328
11	12 m	Coal Point, Cook Inlet			...do	37	37	64	1·0234	1·023128
14	2 p. m	St. Paul, Kadiak			...do	38	39	64	1·0240	1·023728
15	12 m		59 23 00	148 37 00	...do	41	43	64	1·0240	1·023728
16	12 m	Port Etches, Prince Wm. Sound			...do	39	41	64	1·0234	1·023128
18	12 m	Off Cape St. Elias			...do	40	40	64	1·0238	1·023528
19	12 m		59 14 00	141 35 00	...do	41	41	64	1·0238	1·023528
20	12 m		57 57 00	139 43 00	...do	40	40	64	1·0240	1·023728
21	12 m		56 15 00	137 47 00	...do	42	38	64	1·0240	1·023728
22	12 m		54 34 00	134 14 30	...do	44	41	64	1·0240	1·023728
23	12 m		52 07 30	133 59 30	...do	45	43	64	1·0240	1·023728
24	12 m		50 45 00	130 33 00	...do	46	48	64	1·0240	1·023728
25	12 m		49 58 00	128 42 00	...do	49	52	64	1·0238	1·023528
26	12 m		49 17 00	127 16 30	...do	49	50	64	1·0236	1·023328
May 11	3 p. m	Alert Bay, British Columbia			...do	48	58	61	1·0232	1·022510
12	12 m		51 32 00	130 48 00	...do	47	47	60	1·0242	1·023380
13	12 m		51 51 42	136 03 37	...do	49	48	60	1·0246	1·023780
14	12 m		51 46 00	142 23 30	...do	44	46	60	1·0250	1·024180
15	12 m		51 08 00	148 07 30	...do	42	41	60	1·0250	1·024180
16	12 m		51 24 00	152 36 30	...do	41	40	60	1·0250	1·024180
17	12 m		51 57 00	157 04 42	...do	42	42	60	1·0248	1·023980
18	12 m		52 59 00	162 34 30	...do	42	41	60	1·0244	1·023580
22	12 m		53 48 30	167 59 00	...do	42	45	60	1·0250	1·024180
23	12 m		52 24 30	172 45 00	...do	41	39	60	1·0252	1·024380
24	12 m	Atka Island			...do	41	41	60	1·0248	1·023980
25	12 m		52 02 38	174 11 00 *East.*	...do	41	41	60	1·0248	1·023980
27	12 m		51 09 00	179 40 00	...do	40	38	60	1·0248	1·023980
28	12 m		52 29 30	174 07 00	...do	41	41	60	1·0250	1·024180
29	12 m	Attu Island			...do	42	45	60	1·0246	1·023780
30	12 m		54 02 00	170 17 00	...do	40	42	60	1·0250	1·024180
June 2	12 m	Nikolski, Bering Island			...do	42	45	60	1·0244	1·023580
4	12 m	Off Copper Island			...do	38	38	60	1·0252	1·024380
5	12 m		55 03 30	170 15 00	...do	40	38	60	1·0250	1·024180
6	12 m		54 48 00	173 24 00	...do	40	41	60	1·0250	1·024180
7	12 m		54 38 00	177 06 20 *West.*	...do	40	40	62	1·0246	1·024050
7	12 m		54 45 00	178 03 38	...do	40	40	62	1·0246	1·024050
8	12 m		54 36 42	172 16 40	...do	42	42	62	1·0246	1·024050
15	12 m		53 52 00	163 26 00	...do	45	46	67	1·0242	1·024367
16	12 m		54 21 00	158 23 00	...do	47	45	67	1·0242	1·024367
17	12 m		54 37 00	154 00 00	...do	47	46	67	1·0242	1·024367
18	12 m		53 36 30	149 46 30	...do	46	46	67	1·0242	1·024367
19	12 m		53 37 00	143 30 00	...do	47	45	67	1·0240	1·024167
20	12 m		52 38 00	137 32 00	...do	50	50	67	1·0240	1·024167
21	12 m		51 21 00	132 26 30	...do	52	53	67	1·0238	1·023967
22	12 m		49 41 30	127 27 30	...do	54	55	67	1·0236	1·023767

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