

II.—A REPORT OF THE WORK OF THE UNITED STATES FISH COMMISSION STEAMER FISH HAWK, FOR THE YEAR ENDING DECEMBER 31, 1881.

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At the close of my last report, December 31, 1880, the vessel was at the United States navy-yard, Norfolk, Va., where she remained until February 26. The work of painting and refitting was completed about the middle of January, and a series of experiments with the hatching machinery carried on during the months of January and February.

It was considered desirable to introduce air with the feed-water on its entrance to the hatching cones for the purpose of economizing water, and, in order to mix the two sufficiently to prevent violent ebullition by the rapid ascent and explosion of large air bubbles at the surface, we experimented with numerous forms of simple aerators, succeeding finally, as far as practicable, without first reducing the feed-water to a spray.

Fig. 1 is a vertical sectional view of the aerator (full size). *a a* is the outer case into which *b b* is screwed; *c*, the feed-pipe connection; *d*, the nozzle over which the upper end of the flexible feed-pipe is attached; *e e*, air-holes.

Fig. 2 is an end view, *b b* is the nozzle to which the feed-pipe is attached; *c*, feed-pipe connection; *e e e e e e e e*, air-holes.

The feed-water entering at *c* and the air at *e e* meet and find their way into the bases of the hatching cones partially mixed, that is, the feed-water is impregnated with numerous small air-bubbles.

Experiments were instituted also with a view of adapting the cones to cod-fish hatching.

Shad eggs, for which the hatching apparatus on board this vessel was designed, sink rapidly and require a constant upward current to prevent matting or settling at the bottom in a solid mass. Cod-fish eggs, on the contrary, float upon the surface of

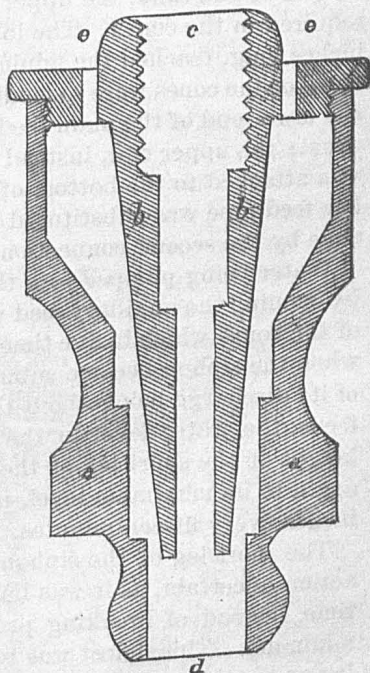


FIG. 1.

sea-water, continued submersion resulting in the destruction of the embryos from asphyxia.

It was necessary, therefore, to devise some means by which the requisite change of water could be effected without establishing a constant current in either direction. Since the specific gravity of cod eggs is very near that of sea water, they take the direction of its slightest movement. Admitting water at the bases of the cones as in shad hatching would soon result in packing them around the perforated plates. Were the order reversed, by introducing water at the top and discharging at the base the downward current would soon send them all to the bottom. To surmount these difficulties, if possible, the following series of experiments was inaugurated:

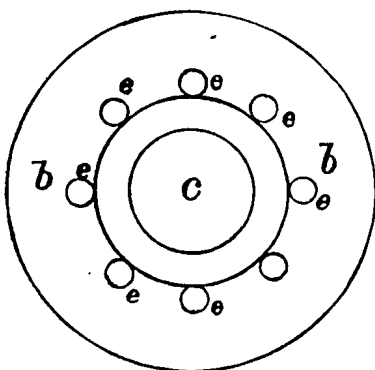


FIG. 2.

A cylindrical tank was hung on gimbals, occupying the place of one cone in a set of four. The long leg of a siphon was secured to the bottom of the tank, the upper end reaching the maximum water level required in the cones. The lower end of the short leg, which was five inches long, reached the minimum water level. The goose necks at the bases of the cones were so modified as to have two feed-pipe connections; the lower end of the main feed remained attached to the goose neck, as usual; the upper end, instead of connecting with the distributing pipe, was attached to the bottom of the siphon tank. The second or auxiliary feed-pipe was substituted for the main feed, being attached to the cone by the second connection above mentioned.

Water being pumped into the distributing tanks filled the pipes and, by opening the auxiliary feed valves, a current was admitted to the base of the cones which in due time filled them to the maximum level desired, when the siphon became submerged and commenced to act. The area of its discharge being about three times that of the combined auxiliary feeds, the water level in the cones steadily fell until it reached the height of the short leg of the siphon, when, its action ceasing, it rose again to its maximum level, producing a constant rise and fall of five inches every fifteen minutes.

The short leg of the siphon was at first cut square, but we found its action uncertain, as it was liable to suck air and water for an indefinite time, instead of breaking promptly when the water level reached its minimum. This defect was remedied by cutting the end of the short leg at an angle of about 60°.

We succeeded in establishing a steady and reliable ebb and flow in the cones by the use of this very simple and inexpensive device which, working automatically, required no extra attention. For the purpose of observation, we kept a set of cones in operation several days, closely

watching the circulation and found that the surface water remained practically unchanged, the circulation taking place in the lower portion of the cones.

To obviate this defect the auxiliary feed-pipes were removed from the base of the cones and laid in the space outside of the perforated plates in such a manner as to give the surface water a slightly circular motion, and a feed-pipe was attached to the siphon tank, thus giving a feed at both top and bottom.

We labored under the disadvantage of having no eggs with which to experiment, but we knew their specific gravity and utilized such substitutes as small pieces of beeswax about the size of cod eggs, bread dust, &c., which served at least to demonstrate what effect the various movements would exert on minute floating bodies.

The experiment of admitting feed water at both ends of the cones resulted in a complete change of water, but was not otherwise satisfactory, as the circular motion imparted by the surface feed caused a movement of the particles representing eggs towards the center, and, the bottom feed being converted into a discharge while the siphon was in operation, a miniature whirlpool developed sufficient strength to draw the eggs to the bottom and thence through the discharge pipe to the tank where they were taken up by the siphon and carried to the general discharge.

Numerous experiments were tried with varying success until, finally, the following arrangement was adopted as most nearly producing the required movement:

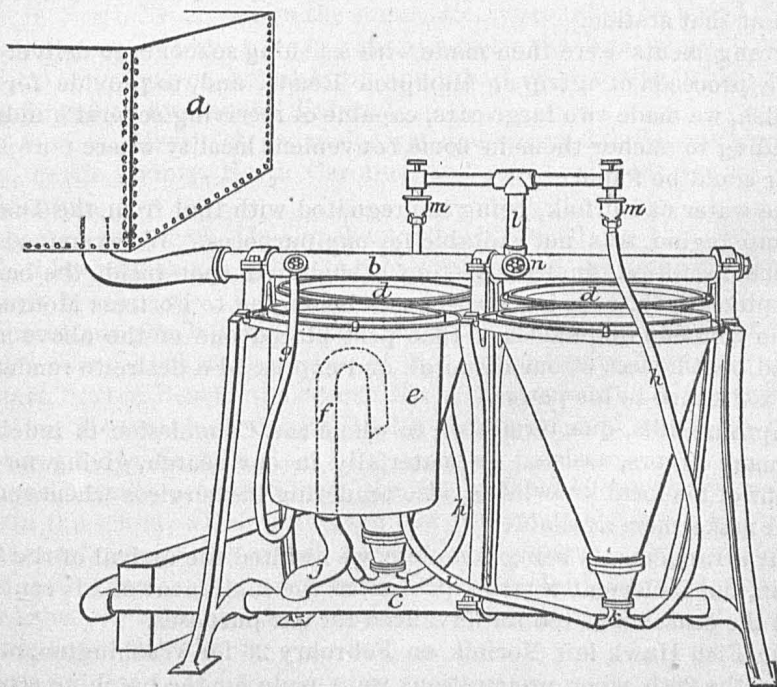


FIG. 3.

Fig. 3 represents the nest of three hatching cones and siphon tank; *a* is the distributing tank; *b*, the general feed pipe; *c*, the general discharge pipe; *d d d*, cones; *e*, siphon tank; *f*, siphon; *g*, feed pipe; *h h*, auxiliary feed-pipes; *i*, discharge pipe; *j*, siphon discharge; *k*, goose neck; *l*, auxiliary feed connection; *m m*, aerators; *n*, feed valve.

The feed-pipe *g* remained attached to the siphon tank *e*, to be used in case it was required. The auxiliary feed-pipes *h h* were again attached to the bases of the cones, and aerators, *m m*, attached to their upper ends. The water being at low level and the feed turned on, a series of air bubbles followed each other in rapid succession to the surface, causing a general movement of the water, and periodical change at the surface as well as in the lower part of the cones. There being no surface feed during the action of the siphon *f*, and the auxiliary feed *h h* taking the direction of the discharge *i*, the water then became placid, the particles representing eggs spread over the surface, where they remained until the siphon ceasing to operate; air-impregnated feed-water again entered the cones, renewing the upward current, causing a general movement in which the surface of the eggs would be cleansed, to a certain extent, of fungus growth and other minute foreign substances liable to adhere during the process of hatching.

While the above experiments were in progress preparations were made for the reception of a quantity of impregnated eggs to be sent from Wood's Holl with which to test our apparatus practically, but, owing to the unusual severity of the weather, they failed to procure them at that station.

Arrangements were then made with a fishing schooner to deliver the entire proceeds of a trip at Hampton Roads, and, to provide for the live fish, we made two large cars, capable of receiving several hundred, intending to anchor them in some convenient locality where pure salt-water could be found.

The water at Norfolk, being impregnated with that from the Dismal Swamp region, was not suitable for our purposes. We examined numerous localities, finally selecting a sheltered spot inside the bar of Hampton Creek, near the boat-houses belonging to Fortress Monroe.

The commanding officer of that post placed one of the above-mentioned boat-houses at our disposal, and expressed a desire to render us any assistance in his power.

Captain Gillis, quartermaster, to whom the Commission is indebted for many favors, assisted us materially in our search, giving us the benefit of his local knowledge, also tendering his services whenever we could make them available.

Our arrangements being complete, we awaited the arrival of the fisherman, but inclement weather prevented the fulfillment of his contract until the season was too far advanced for our purposes.

The Fish Hawk left Norfolk on February 26 for Washington, arriving on the 28th, when preparations were made for the hatching season.

As many of the crew as could be spared were set to work on the barges overhauling machinery, painting, &c.

Everything being in readiness, we left Washington on the 23d of March and arrived at Norfolk the following day, bound for Avoca, Albemarle Sound, where we were to commence the season's work of shad-hatching. A few tons of coal and other stores were taken in during the day. On the afternoon of the 25th we left the navy-yard, and steaming to the lock gates made fast for the night. The following morning the wind was strong from the northeast, giving more than an average depth of water in the canal. We passed the locks soon after daylight, and worked our way along about three miles, and finally grounded on a shoal spot and remained till high-tide; then made another mile. Starting again at high-tide in the morning, we reached North Landing and moored to the wharf for the night.

At daylight on the morning of the 28th we left the wharf and reached North West River, when the vessel grounded again. The light-house steamer Tulip came to our assistance, taking a tow-line ahead, and in this manner we finally reached the vicinity of Bell Island, where the vessel stuck fast and remained during the night. Her draught was 7 feet, and there being but 6 feet 6 inches in the channel, we found it necessary to lighten her. Work was commenced at daylight on the 29th, and everything movable placed in lighters, sent for the purpose by General O. E. Babcock, of the Light-House Department, and at 2.30 p. m., with the assistance of the Tulip, we passed the shoals and anchored in North River, where the stores, &c., were taken on board from the lighters, which were towed to that place by the light-house tender Bramble. We took on board a ton and a half of coal also, which was kindly furnished by General Babcock.

At 5.30 a. m., March 30, got under way and steamed to Salmon Creek, Avoca, Bertie County, North Carolina, and anchored near the steam-boat landing.

I called at once upon Dr. Capehart, who informed me that no ripe shad had been taken yet, owing to cold weather and low temperature of the water.

Preparations for hatching were soon completed, and spawn-takers attended every haul of the seine at the two fisheries owned by Dr. Capehart, Sutton Beach, and Scotch Hall. The schooner E. G. Pickup arrived on the morning of April 8 with 40 tons of coal which we had contracted for in Norfolk.

Westerly winds prevailed from the 1st to the 8th, causing very low water in the sound, which prevented our getting up the creek to Capehart's wharf, where the vessel was to be stationed. Fresh easterly winds sprung up on the morning of the latter date, however, and we crossed the bar without much trouble, mooring in a snug berth about 40 yards below the wharf.

As soon as the vessel was moored, the schooner was taken alongside and the coal transferred during the 9th.

The first shad eggs were taken on the 12th, 66,000 being procured from both fisheries. They were not in good condition, many being unripe and the milt hard; but they were put into the cones, more to test the apparatus than from any expectation of satisfactory results.

Eggs were taken on the 13th, 14th, and 15th; total number, including those of the 12th, 283,000. No ripe fish were found during the 16th, 17th, and 18th. A fair proportion of the eggs taken were impregnated, and the development, although slow, was apparently normal, except the eyes, which were very small, barely visible to the naked eye.

The embryos from eggs taken on the 12th died on the 19th, either before or immediately after leaving the shell. The temperature of the water ranged between 50° and 58°, much too low for successful hatching. Eggs were taken again on the 19th and every day after that until the 30th. Those taken from the 13th to the 15th died on the 22d and 23d under similar conditions to those of the 12th. The range of temperature was from 50° to 64°.

From the 23d to the 30th, the water varied from 57° to 71° in the hatching cones; and although the frequent changes operated against us, a fair proportion of eggs were hatched. Five hundred thousand herring eggs were taken on the 25th, of which about 200,000 hatched on the 30th and were deposited in the sound. Great quantities of the latter fish were taken at the fisheries, but no ripe females were found except those mentioned above.

Our work ceased at Avoca on the 30th of April, and preparations were made for immediate departure. The eggs on board were transferred to the North Carolina Commission, the young fish deposited in the sound, boats taken on board, and ship unmoored ready for an early start.

The results of the season's work at Avoca are briefly as follows:

Shad eggs taken	5, 727, 000
Herring eggs taken	500, 000
Total eggs taken	6, 227, 000
Shad hatched	1,328, 000
Herring hatched	200, 000
Total	1, 528, 000

Shad eggs transferred to North Carolina Commission, 3,029,500.

The shad eggs were procured from 196 females, 189 males being used for impregnation. The average number of eggs from each female was 30,300.

The arrangement of pipes and valves is such that water can be pumped back into the distributing tanks from the waste-pipe using it over and over as often as desired. In order to ascertain the practicability of

transporting eggs and young fish under the above conditions, we retained half a million eggs and commenced the experiment at 6 p. m., April 30. The temperature rose to 68° during the night and to 71° at 10 a. m., May 1, the water smelling badly and a large portion of the eggs dying. The cones were thoroughly cleaned, dead eggs removed, and the experiment continued.

At 5 p. m. but few survived, and 330,000 dead ones were thrown overboard. The remainder were found dead and thrown overboard at daylight the following morning.

At 5 a. m. on May 1 we got under way and steamed down Albemarle Sound, through Croatan Sound, Roanoke Marshes, and down Pamlico Sound, to Hatteras Inlet, where, at 7.20 p. m., we anchored for the night. At 4.45 a. m. on May 2 got under way, with a pilot on board, and proceeded to sea by way of Hatteras Inlet. The swell on the bar was so heavy that the pilot refused to take the vessel out, whereupon he was discharged and the ship proceeded to sea without one. At 8 a. m. passed Hatteras Light, Bodie's Island Light at meridian, and at 3.50 p. m. Currituck. At 8.10 p. m. passed Cape Henry, and at 11.35 Wolf Trap. At midnight a thick fog and mist prevailed. At 10.10 p. m. on May 3 we anchored in Annapolis Roads. At 4.45 a. m. on May 4 got under way, and at 10.10 a. m. arrived at Havre de Grace. At 11.40 made fast to the coal wharf, and the crew were employed during the remainder of the day in coaling ship. At 10 a. m. on the 5th instant, having finished coaling, we proceeded to our station off Bull Mountain, mouth of North East River, where we anchored in 15 feet of water.

The fisheries along the shore were visited, and preparations made for hatching work. During the evening 182,000 shad eggs were taken. On May 6 the wind was light and variable, and the weather rainy during the night, clearing after daylight. Four hundred and sixty-two thousand shad eggs were taken during the day. On May 7 every haul of the seines at the various fishing shores was attended and gill boats visited during the evening, but no eggs were taken. No ripe fish were found in the seines, and those taken by gillnets were penetrated and stripped by eels. On the 8th 506,000 eggs were taken, and on the 9th 1,660,000.

No payment had been made thus far for the privilege of taking eggs. On the 9th instant a fisherman called on behalf of the gillnets, and stated that, at an informal meeting, they had decided to furnish the Commission with eggs, whether paid for it or not, but, as they were put to some inconvenience and extra labor thereby, they requested him to see if I could not procure them the usual compensation of twenty-five cents for each spawning fish.

Tickets having been received from the Commission, they were issued from the 10th instant.

On the 10th the breeze was moderate to brisk from the southward and westward, making quite a heavy swell in the channel; 341,000 eggs were procured during the day. On the 11th 913,000 were taken, and

on the 12th 979,000; 664,000 young fish were deposited in the river near the ship on the latter date. On the 13th 265,000 eggs were taken and 1,660,000 young fish deposited in the North East River and at the mouth of the Susquehanna.

On the 14th 348,000 eggs were taken and 830,000 young fish deposited in the river near the ship. During the evening of the 15th there was a fresh breeze from the southward and westward. A large number of eggs were procured, but owing to the heavy swell many were spilled out of the pans and pails in the boats, leaving 357,000 as the result of the evening's work; 598,000 young fish were deposited near the ship. On the 16th 357,000 eggs were received and 979,000 young fish deposited near the vessel. On the 17th 424,000 eggs were taken, and on the 18th, 257,000. On the latter date 498,000 young fish were deposited. The weather was overcast and cloudy, raining during the afternoon and evening, the wind blowing fresh from northeast, changing to west during the evening. The water was rough, making it difficult to attend the gill-boats. At 3.30 p. m. the Herreshoff steam launch, No. 62, borrowed from the Navy, arrived from Brooklyn in charge of Mr. Robert West.

On the 19th the weather was overcast and rainy; moderate breeze from southeast; 423,000 eggs were received, and 1,660,000 young shad deposited near the ship. On the 20th the weather was overcast and rainy, partially clearing during the day; moderate breeze from east-southeast to northeast. Large numbers of fish were taken at the beaches, but most of them were unripe and were recognized as "the May run"; 781,000 eggs were taken during the day. On the 21st the weather was cloudy, latter part rainy, with thunder and lightning, light variable breezes; 1,792,000 eggs were taken during the day. The seines in this vicinity have all cut out except two.

The following seine fisheries are located in North East River, and have been visited by our spawn-takers during the season, viz:

Carpenter's Point, west side, P. K. Barnes.

Carrot Cove, east side, Russell & Sempers.

Bull Mountain, east side, J. C. Caruthers.

Gridiron Beach, east side, W. J. Wilson.

Gilder's Hole, east side, J. Fletcher Wilson.

Beaver Dam, James Roney.

The two last were not regularly visited.

On the 22d of May 291,000 eggs were taken. Large numbers of people visited the ship, many of whom had traveled long distances for the purpose. On the 23d 650,000 eggs were taken and 325,000 young fish deposited in the river near the ship. A considerable number of young fry, hatched on the 11th from eggs taken on the 7th, were retained in a cone for the purpose of ascertaining how long they could be kept alive after absorption of the yolk bag, which disappeared from the naked eye on the 15th instant. On the 16th the fish which had hitherto re-

mained on the surface went down from four to six inches or more, where they appeared to be feeding upon the minute particles collected on the surface of the cone. On the 23d they were still thriving, but few dead ones having been seen. It was an undoubted fact that they were feeding and developing normally. On the 24th 463,000 eggs were received and 313,000 young fish deposited in the river near the ship.

On the 25th 781,000 eggs were taken and 275,000 young fish deposited. The young shad before mentioned, fourteen days old, were doing well, no dead fish being noticed. The last seine in this region cut out on this date. On the 26th 1,062,000 eggs were taken and 406,000 young fish deposited. One of the young shad, fifteen days old, was examined under a microscope to-day. Minute crustacea were found in its stomach.

On the 27th 625,000 eggs were taken and 1,250,000 young fish deposited near the ship. A ripe rock, the first of the season, was taken to-day, but no milt could be procured to impregnate the eggs. On the 28th 675,000 shad eggs were taken and 500,000 young shad deposited. Mr. Capehart and his son, Dr. R. W. Capehart, owners of two great fisheries in Albemarle Sound, visited the ship and inspected the hatching operations.

On the 29th 369,000 shad eggs were received. The small number of eggs taken may be attributed to the lateness of the tide. Shad are taken in gill-nets at or near slack-water in this locality, and when this occurs at sundown or an hour or two later many fish are taken in the act of spawning. It should not be inferred from this that all spawning takes place at that time, but it is an undoubted fact that we take a large proportion of our eggs between the hours mentioned.

On the 30th 50,000 eggs were taken and 375,000 young fish deposited near the ship, and at 3 p. m., May 31, we got under way and delivered a shipment of 1,250,000 young fry at Havre de Grace. We then steamed down the channel and anchored near Locust Point, Spesutie Island. A furious squall of wind and rain with thunder and lightning swept down the river from 7 to 11 p. m., two inches of rain falling in the mean time.

The gill-boats along the west shore were visited and 106,000 eggs procured; 625,000 young fry were deposited in North East River. There was a slight freshet in the river on June 1st, which made the water very muddy; 187,000 eggs were taken and 500,000 young fish transferred to Battery Station for shipment; 38,000 eggs were taken on the 2d, 312,500 young fish transferred to Battery Station, and 625,500 deposited near the ship.

The young fish of May 11, twenty-two days old, remaining in the cone, were sent to Washington. They were well developed and in fine condition.

On the 3d of June 50,000 eggs were taken and 125,000 fry transferred to Battery Station.

The estimate of eggs taken during the season has been on the basis of 25,000 to the dipper of $7\frac{1}{4}$ gills. By actual count, four fluid ounces (one

gill) of impregnated shad eggs were found to contain 3,600, that is, 900 per fluid ounce or 26,100 per dipper. A deduction of 1,100 was made for water, &c. The above measurements were made with an ordinary apothecary's graduate, used in the medical department.

All necessary preparations having been made for leaving the Susquehanna, we transferred 300,000 shad eggs to Battery Station, and directed the Herreshoff launch, No. 62, to report to the officer in command for temporary duty.

At 9.25 a. m., June 5, we left the river for Baltimore, arriving at 2.55 p. m. On the following morning the vessel was hauled out on W. Skinner & Son's marine railway, her bottom examined, copper cleaned and repaired, propellers painted, and outboard connections examined. The work was completed during the day, and on the following morning the vessel was put into the water, and at 10.35 a. m. left for Washington, where we arrived at 1.40 p. m. on the 8th.

On the 10th coaled ship, and on the 13th received a special outfit designed for hatching Spanish mackerel. As this work was to be carried on in salt water, all metallic surfaces were nickel plated in order to reduce galvanic action to the minimum. At 4.15 a. m., June 14, we left the navy-yard and steamed down the Potomac, arriving off Saint Jerome's Creek at 3.30 p. m., where we were directed to examine the channel improvements and report what progress had been made. Having made the required examination, we steamed off-shore two or three miles and swung ship, with port helm, under steam, observing azimuths on each point for compass error. When the circle was completed with the port helm, we ran into Cornfield Harbor and anchored for the night.

Launch No. 62 arrived from Havre de Grace at 6 a. m. on the 15th and reported for duty. At 6.15 a. m. we got under way, swung ship with starboard helm and, as soon as the observations for compass error were finished, started for Cherrystone Inlet, the launch in company, arriving at 2.30 p. m.

The pound nets were visited the following morning, but no ripe fish were found, and the fishermen reported that they had seen none during the season.

We met with better success, however, on the 17th, when 700,000 Spanish mackerel eggs were taken and placed in hatching cones with siphon attachment. A small number were placed in a marbleized pan, the water being changed every three hours. About 30 per cent. of the eggs hatched in from thirty to forty hours after impregnation, the temperature of the water ranging from 76° to 80° F. The fry were not in good condition and were all dead within a few hours.

No eggs were procured on the 18th and 19th. On the 20th, however, we succeeded in getting 240,000, a portion of which were placed in an ordinary hatching cone and treated as shad eggs, the remainder being distributed among the various forms of cylinders. They commenced hatching twenty-four hours after impregnation, but the fry were not strong and many of them died.

We deposited 120,000 fry in Cherrystone Inlet on the 22d and on the 23d procured 300,000 eggs, which were placed in the various hatching apparatus on board. The temperature fell suddenly nearly ten degrees, which retarded the development, the first young fry appearing thirty-nine hours after impregnation. About 60 per cent. of the eggs hatched and the fry were in much better condition than any of the previous lots.

Three hundred thousand eggs were procured on the 25th and placed in cones and cylinders. About 75 per cent. hatched, but those in the cones soon died.

We were unable to account for the loss of fry hatched in cones and the survival of those in the cylinders, unless we attributed it to galvanic action. The cones above mentioned were copper, nickel plated, and after a few hours' service in salt water the entire submerged surface was covered with a dark deposit which we thought was sulphate of nickel, to which was attributed the great mortality among the fry hatched in the cones.

Among the cylinders used was one of block-tin, in which the largest proportion of eggs were hatched, and the fry seemed to be in better condition. In this vessel we had a light whitish deposit which we called sulphate of antimony, but it did not seem to have an injurious effect on the eggs or fry.

One hundred thousand young fish were deposited on the 26th, 50,000 on the 27th, and 100,000 transferred to the Lookout on the 28th for experimental purposes.

Mr. Marshall McDonald, of the United States Fish Commission, arrived on the latter date to continue the experimental work, the Fish Hawk being required for other service. Such articles as he required were landed, launch No. 62 turned over to him, and at meridian on the 29th we left for Washington. We had at this time about 5,000 young fish which I had placed in a glass aquarium soon after they were hatched, where they had remained ninety-six hours without change of water. Very few died in the meanwhile, and those that were alive were strong and vigorous. There were about ten thousand in a hatching cylinder, and they were placed in a glass jar for transportation. They were in good condition until about 3 p. m., when we encountered a furious squall in Chesapeake Bay, with very heavy thunder and incessant lightning. From that time they showed signs of distress, and before morning were nearly all dead.

We anchored for the night at Lower Cedar Point, and arrived at the Washington navy-yard at 9.50 a. m., June 30. Active preparations were made for the summer's cruise; hatching apparatus was landed and the dredging outfit taken on board.

The last of the young fish in the aquarium died on the 1st of July, having been one hundred and forty-four hours without change of water.

At 2.10 p. m., July 7, we left the navy-yard for Wood's Holl, Mass., passing Cape Henry at 8.40 a. m. on the following day. A fresh north-

erly wind was encountered, and on the 9th a moderate northeast gale with mist, rain, and thick fog at times, the weather clearing during the latter part. We passed Montauk at 1.15 a. m. and arrived at Wood's Holl at 8.10 p. m. on the 10th. On the morning of the 11th we went to Bristol, where we left the steam cutter for repairs, returning on the following day.

At 7.28 p. m., July 15, we left Wood's Holl, with the naturalists on board, for an off-shore trip. Speed was reduced between Gay Head and No Man's Land to allow surface towing.

At 4.10 a. m. on the 16th we cast the trawl in 44 fathoms, latitude $40^{\circ} 22'$ north, longitude $70^{\circ} 42'$ west. Ten casts were made during the day between the above position and latitude $39^{\circ} 55'$ north, longitude $70^{\circ} 47'$ west, in from 44 to 229 fathoms. There was some delay in preparing for the first cast, but with that exception everything worked smoothly and the results of the day's work were very satisfactory. We started for port at 6.30 p. m., arriving at 6.15 the following morning.

The naturalists were employed in the laboratory during the 18th and 19th preserving specimens, and on the 20th we made eight hauls of the dredge and trawl in the sound between Gay Head and Vineyard Haven.

The naturalists were engaged in the laboratory until the 23d and unfavorable weather detained us in port till the 29th, when we went to New Bedford for coal, returning the following day. We were again detained by unfavorable weather till 5.40 p. m. on the 3d of August, when we left for another off-shore trip. There was a thick fog during the night, but it cleared towards morning, and at 8.14 we cast the trawl in 782 fathoms, latitude $39^{\circ} 45'$ north, longitude $69^{\circ} 44' 45''$ west. The trawl came up foul and several fathoms of the dredge-rope were badly kinked. Seven hauls were made during the day in from 782 to 95 fathoms, between the above position and latitude $40^{\circ} 01'$ north, longitude $69^{\circ} 56'$ west. We started for port at 8.30 p. m., and arrived at 8.30 a. m. the following morning.

The naturalists were employed in the laboratory on the 6th and 7th. At 5 p. m. on the 8th we left for an off-shore trip. A dense fog prevailed during the night, with moderate breezes from northwest to southwest, the weather clearing towards morning.

At 6.15 a. m. we set the trawl-line for tile-fish in 138 fathoms, latitude $40^{\circ} 01'$ north, longitude $71^{\circ} 12' 30''$ west.

A ship's boat was reported adrift about 9.30 a. m., which proved to be the wreck of a mackerel seine boat having on one quarter the name G. M. Hopkins, and on the other, Hingham, Mass.

At 11.30 a. m. picked up our boat and found that they had taken 157 pounds of tile-fish, the largest specimen weighing 29 pounds; several whiting, and large numbers of hake, skate, &c., were taken. Six hauls of the trawl and dredge were made during the day in from 138 to 319 fathoms between the position given above and latitude $39^{\circ} 53' 30''$ north,

and longitude $71^{\circ} 13' 30''$ west. We started for port at 5.30 p. m., arriving at 6.10 a. m. the following morning. There was a fresh breeze during the night, with a moderate beam sea, which caused the vessel to roll heavily at times.

The naturalists were employed in the laboratory during the 11th and 12th. One cast of the trawl was taken in Buzzard's Bay on the 13th. We were detained in port by unfavorable weather until 4 p. m. on the 22d, when we left for an off-shore trip. At 4.15 a. m. the following morning, we set a trawl-line with 900 hooks in 100 fathoms, latitude $40^{\circ} 03'$ north, longitude $70^{\circ} 31'$ west, and took 540 pounds of tile-fish, the largest weighing 32 pounds. Large numbers of skate, hake, and whiting were taken also. Many interesting specimens were taken during the day by fine towing nets, so attached to each end of the trawl-beam as to act from the time it was lowered from the ship's side till it left the water. So far as I know, this ingenious contrivance was never used before and the results were most satisfactory.

Six casts of the trawl and dredge were made in from 71 to 724 fathoms between the position given above and latitude $39^{\circ} 52' 30''$ north, longitude $70^{\circ} 17' 30''$ west. It is doubtful whether the trawl reached the bottom in the latter depth, but several interesting specimens were found in the net, probably caught on the way down or up. We started for port at 6.50 p. m. and arrived at 7.25 the following morning.

The naturalists were engaged in the laboratory on the 25th, and on the 26th we made a re-examination of various localities in Buzzard's Bay.

We were detained in port by unfavorable weather until the 29th, when, the weather clearing, we left for the fishing banks off Chatham. Finding a thick fog hanging over the shoals, we anchored at Hyannis for the night. The weather clearing, we got under way at 4.25 a. m., and at 7.50 cast the trawl in 10 fathoms, Chatham Lights bearing northwest $\frac{1}{2}$ west, distant 5 miles. Twenty-one casts of the trawl and dredge were made during the day, and at 4.30 p. m. we started for port, arriving at 10.55 p. m.

On the following day, August 31, we went to New Bedford for coal, returning September 2. We were detained by gales and fog until the 7th. A peculiar atmospheric condition worthy of note was observed on the 6th instant. The weather was overcast, with a brisk breeze from southwest, moderating during the morning, when a thick fog set in, lasting until afternoon when it rose, and, combined with smoke, darkened the atmosphere to almost a twilight. The light was peculiarly yellow, and gave to the foliage an intensified color; ordinary oil lamps had the color and general appearance of electric lights. The sky remained overcast after dark, but became clearer and objects resumed their natural colors.

At 8.45 a. m., September 7, we left port, and at 12.50 p. m. cast the trawl in 26 fathoms, latitude 41° north, longitude $70^{\circ} 49'$ west. Nine

casts of the trawl and rake dredge were taken in from 26 to 39 fathoms between the above position and latitude $40^{\circ} 28'$ north, longitude $70^{\circ} 44'$ west. The last haul was made at 8.20 p. m., completing a line from No Man's Land to our off-shore working ground.

At 4.50 a. m. the following morning we cast the trawl in 368 fathoms, latitude $39^{\circ} 40'$ north, longitude $71^{\circ} 30'$ west. Eight hauls of the rake dredge and trawl were made between the above position and latitude $39^{\circ} 50' 30''$ north, longitude $71^{\circ} 23'$ west, in from 368 to 182 fathoms. We started for port at 3.30 p. m. and arrived at 3.30 a. m. on the 9th, where we were detained till the 13th by the report of a storm moving along the coast from the southward.

At 4.30 p. m., on the latter date, we left for an off-shore trip. At 7.32 the following morning the trawl was cast in 93 fathoms, latitude $40^{\circ} 00'$ north, longitude $69^{\circ} 19'$ west. Ten hauls were made between the above position and latitude $39^{\circ} 58'$ north, longitude $69^{\circ} 30'$ west, in from 93 to 458 fathoms.

We started for the port at 8.30 p. m., and at 7.20 a. m. the following day cast the trawl in 16 fathoms between No Man's Land and Gay Head. It fouled on a rock, the sudden strain unshipping the heel of the dredging boom; it was soon replaced, however, and the trawl recovered without further damage. At 10 a. m. we anchored in Wood's Holl harbor.

We were detained in port by unfavorable weather till 4 p. m. on the 20th, when we left for an off-shore trip. Passed No Man's Land at 6.45. Between 8 and 9 o'clock passed through large schools of fish, probably menhaden.

At 6 a. m., the following day, we set a trawl line in 113 fathoms, latitude $39^{\circ} 58'$ north, longitude $70^{\circ} 06'$ west. No tile-fish were taken, and but few of the baits were disturbed. This was the first time we had failed to take more or less of this fish when we made the attempt. Three casts of the dredge and trawl were taken, when the increasing wind and sea made it impracticable to carry on work, and at 11.30 a. m. we started for port, arriving at 11.50 p. m.

Two casts of the trawl were made in Vineyard Sound on the 22d.

The colors were set at half mast on the 26th, and the day observed in memory of the late President James A. Garfield. We were detained in port by unfavorable weather till 4.10 p. m. on the 30th, when we went to New Bedford for coal, returning at 5.50 p. m. on the 2d of October.

The specimens taken during the season, and material belonging to the United States Fish Commission, were taken on board during the 3d and preparations completed for leaving the station, the work of deep-sea exploration at this station being finished for the season.

At 2.05 p. m., October 4, we left Wood's Holl and steamed to New Bedford to take on board a whale-boat and equipments, which had been presented to the National Museum by J. H. Bartlett & Sons. The boat was received on the evening of the 5th, and at 5.50 the following morning we left for Bristol, R. I., arriving at 11.20, when the steam cutter

was sent on shore for slight repairs. At 5.30 a. m. the following day we left for New Haven, arriving at 5.10 p. m. The specimens consigned to Prof. A. E. Verrill were landed at daylight the following morning, and at 9.15 a. m. we left for Washington. At 3.45 p. m. made fast to Bayles' wharf, at Throgg's Neck, for the night, as the weather was somewhat threatening.

At 2 p. m., October 9, we cast off and proceeded to sea. At 7.17 the following morning we cast the trawl in 130 fathoms, latitude $38^{\circ} 39'$ north, longitude $73^{\circ} 11'$ West. Seven hauls were made during the day between the above position and latitude $38^{\circ} 28'$ north, longitude $73^{\circ} 22'$ west, in from 130 to 435 fathoms. At 5.30 p. m. started for the capes of the Chesapeake. The weather was pleasant during the day, with moderate winds, but at 8 p. m. a northerly gale rose suddenly, making it necessary to heave the vessel to until 5 o'clock the following morning, when wind and sea moderating we resumed our course, passing Cape Henry at 6 p. m., and arriving at the navy-yard, Washington, at 11.20 a. m., October 12. The specimens were landed and sent to the National Museum the following day.

The vessel having been placed at the disposal of the Hon. Robert T. Lincoln, Secretary of War, during the celebration at Yorktown, preparations were made for departure, and at 12.25 p. m. on the 17th we left for the latter place with the Secretary and party on board, arriving at 10.15 a. m. on the 18th.

The ceremonies attending the laying of the corner-stone of the monument ended on the afternoon of the 20th, and at 5.30 p. m. we left for Washington, arriving at 1 p. m. the following day, having visited Mount Vernon on the way.

We coaled ship during the 24th and 25th, returning to the navy-yard on the latter date, where we remained until the close of the year. The crew were employed during this time in giving the vessel a thorough overhauling preparatory to next season's work.

On the 29th of November we transferred our Herreshoff steam cutter and First-class Fireman William H. Lynch to the United States steamship Despatch for surveying duty in the West Indies, receiving from that vessel a cutter of the same description which was at the time unserviceable. The transfer was made at the request of the Navy Department.

Reports received from officers of the Despatch show that it performed excellent service, being at times the only steam cutter in working order. The boat received from that vessel was refitted by our crew, and at the close of this report was in good condition.

List of officers attached to the vessel during the year.—Lieut. Z. L. Tanner, U. S. N., commanding; mate, J. A. Smith, U. S. N.; mate, Samuel Gee, U. S. N., June 1 to December 30, inclusive; mate, C. H. Cleaveland, U. S. N., from December 31; passed-assistant paymaster, G. H. Read, U. S. N.; assistant engineer, W. B. Boggs, U. S. N.; apothecary, first-class, J. A. Kite, from March 21; paymaster's yeoman, first-class, H. E. Minkler; machinist, F. J. Barry; machinist, John Maxwell.

Record of shad-hatching on board United States Fish Commission steamer Fish Hawk, Lieut. Z. L. Tanner commanding, at Capehart's Wharf, in Salmon Creek, Avoca, N. C., from March 30 to May 2, 1881.

70

REPORT OF COMMISSIONER OF FISH AND FISHERIES.

[16]

Date.	Barometer.		Temp. air.		Water surface.		Bottom.		In codes.		State of water.	Winds.		Weather.	Ripe shad.		Eggs obtained.	Fish deposited.	Where deposited.	Remarks.
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.		Direction.	Force.		Males.	Females.				
1881.	0	0	0	0	0	0	0	0	0	0										
Mar. 30	29.45	29.32	59	39	54	49					Muddy	Sd. and Wd.	1-8	Cloudy						Anchored in mouth of Salmon Creek; muddy water sets in from the sound; generally clearer water higher up the creek.
31	29.70	29.40	52	36	50	48					do	W. SW.	3-6	do						
April 1	29.00	29.88	52	39	49	47					do	W. SW.-W. NW.	1-3	Showers						8th.—Moved to the bank 1 mile above the mouth, near Capehart's wharf; 10 to 13 feet of water; generally clear, colored with juniper.
2	30.10	29.80	57	34	50	46	49	46			do	Var.	1-3	Clear						
3	30.10	29.80	60	35	51	47	50	47			do	Var.	1-4	do						April 30.—Transferred the eggs on board to the North Carolina Commission.
4	29.88	29.65	59	35	53	48	51	48			do	SW.-NW.	1-3	Rain						
5	29.01	29.85	47	31	50	46	49	46			do	NW.	0-4	Fair						The herring eggs were taken on the 25th and hatched on the 30th and 31st. The only ripe herring found.
6	30.00	29.85	57	32	47	46	47	45			do	W. SW.-N. NW.	1-4	Clear						
7	30.20	30.00	64	35	51	46	49	45			do	NW.-SE.	1-4	Fair						Eggs lost on May 1 and 2 were kept on board for experiment, using water over, and over 66,000 eggs died.
8	30.04	29.65	55	43	51	48	50	48			do	SE.-N. NW.	1-4	Rain						
9	29.95	29.80	52	41	53	48	50	48			Clear	NW.	1-2	do						140,000 eggs died.
10	30.06	29.83	62	41	53	49	53	49			do	N. NW.-S. SW.	1-4	do						
11	30.24	30.05	74	42	59	51	52	51			do	Var.	1-2	Clear						83,000 eggs died.
12	30.10	30.95	79	50	57	51	56	51			do	Sd.	1-5	Cloudy	3	3	66,000			
13	30.03	29.74	73	64	56	53	53	51			do	Sd. and Wd.	1-5	Rain	2	2	66,000			41,500 eggs died.
14	29.74	29.48	50	44	52	50	55	53			Muddy	Wd.	3-7	do	4	4	117,000			
15	29.87	29.76	61	45	53	50	53	50			Clear	W. SW.	1-4	Clear	1	1	34,000			18,000 fish died.
16	30.03	29.80	58	47	54	52	54	52			do	W. SW.	1-4	Fair						
17	30.20	30.03	70	41	56	52	56	52			do	W. SW.	1-4	Clear						34,000 eggs died.
18	30.06	29.95	78	50	57	53	56	53			do	Var.	0-3	Cloudy						
19	30.20	30.00	68	52	58	54	57	54			do	N. NE.	1-3	Fair	9	8	132,000			16,000 eggs died.
20	30.11	30.03	74	50	60	55	55	55			do	N. NE.	1-4	Cloudy	3	3	107,000			
21	30.24	30.06	68	49	61	54	56	54			do	Nd. and Ed.	1-3	Fair	11	11	332,000			41,000 eggs died.
22	30.20	30.06	63	50	59	55	54	58	56		do	Var.	1-2	Rain	21	21	648,000			
23	30.40	30.15	86	48	65	57	55	61	57		do	NE.	0-1	Clear	18	18	489,000			34,000 eggs died.
24	30.40	30.15	83	50	63	61	57	55	62		do	SE.	0-3	do						
25	30.20	30.03	85	60	65	61	58	68	59		do	SW.	1-3	Fair	28	28	929,000			41,000 eggs died.
26	30.05	29.96	89	68	69	61	60	58	66		do	SW.	1-2	Cloudy	34	32	979,000			
27	30.02	29.95	76	63	68	61	60	58	65		do	Var.	0-4	Rain	32	30	931,000			41,000 eggs died.
28	30.20	30.00	84	60	73	62	57	58	63		do	Var.	1-2	Fair	11	10	298,000			
29	30.15	30.06	88	60	71	67	58	68	60		do	Var.	0-4	do	18	18	482,000	488,000	At Capehart's Sound	34,000 eggs died.

	30	30.35	30.15	80	61	70	62	59	57	71	60	do	NE.	1-4	Clear	5	5	168,000	850,000	do	8,000 eggs died.
May	1	30.45	30.30	65	59	66	62	59		71	64	Clear	NE-SE.	3-4	Clear				3,020,500	(*)	500,000 eggs died.
	2	30.36	30.10	79	64	61	49			72			Var.	2-4	Fair						379,000 eggs died.
																		195,189	5,727,000	4,357,500	1,369,500

* Eggs transferred to North Carolina Commission.

NOTE.—Herring eggs taken, 500,000; 200,000 deposited in Albemarle Sound; 300,000 eggs died. The average number of eggs per female shad at this station was 30,301.

Record of Spanish mackerel-hatching on board the United States Fish Commission steamer Fish Hawk, Lieut. Z. L. Tanner commanding, at Cherrystone, Northampton County, Virginia, from June 16 to June 29, 1881.

Date.	Barometer.		Temp. air.		Water surface.		Bottom.		In cones.		State of water.	Winds.		Weather.	Ripe shad.		Eggs obtained.	Fish hatched.	Fish deposited.	Remarks.
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.		Direction.	Force.		Males.	Females.				
1881.	0	0	0	0	0	0	0	0	0	0										
June 16	30.25	30.05	74	68	79	75	79	75	79	75	Clear	E.NE.-E.SE.	2-4	Clear						
17	30.05	29.90	83	70	78	74	78	74	79	78	do	SW.	6-7	Threatening			700,000			
18	30.05	29.92	84	75	78	74	79	75	80	76	do	NW.-SW.	6-3	do			0			
19	30.00	29.98	83	72	78	75	78	75	78	75	do	SW.	4	Fair				200,000		500,000 dead eggs thrown overboard.
20	30.03	29.84	85	75	80	75	80	76			do	NW.-SE.	2-4	do			240,000			200,000 fish died on 19th.
21	29.94	29.80	78	70	80	78	79	77	81	78	do	NW.	4	Fair q.r.				93,000		147,000 eggs died.
22	30.00	29.94	70	61	79	72	70	72	79	72	do	NE.	5	Rain					120,000	74,000 fish died and escaped.
23	30.12	29.98	71	61	73	69	73	69	73	70	do	Eastward.	4	Fair			300,000			
24	30.25	30.10	75	64	74	71	74	71	74	71	do	SW.-SE.	4-4	Clear; rain						
25	30.23	30.13	77	65	75	72	75	72	76	72	do	Var.	2-4	Fair			300,000	168,000		132,000 eggs spoiled.
26	30.17	30.11	77	67	78	73	77	73	77	73	do	SE.-SW.	2-4	do					100,000	
27	30.20	30.02	77	70	70	76	78	75	80	76	do	SW.-SE.	2-5	do			210,000	50,000		90,000 eggs spoiled.
28	30.01	29.92	81	75	84	77	83	77	83	78	do	SW.-SE.	2-5	do					100,000	Transferred to str. Lookout.
29	29.95	29.50	88	77	81	76	81	81	82	81	do	SW.	2-4	do						
																	1,540,000	671,000	370,000	

NOTE.—896,000 eggs failed to hatch. 274,000 fish died after hatching.

Record of shad-hatching on board the United States Fish Commission Steamer Fish Hawk, Lieut. Z. L. Tanner commanding, on the Susquehanna River, Maryland, from May 5 to June 5, 1881. Station at the junction of the Susquehanna and North East Rivers.

Date.	Barometer.		Temp. air.		Water surface.		Bottom.		In coves.		Winds.	Ripe shad.	Eggs obtained.	Fish deposited.	Where deposited.	Remarks.			
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.											
State of water.																			
Direction.										Force.		Males.		Females.					
1881	0	0	0	0	0	0	0	0	0	0									
May 5	30.40	30.18	62	49	60	58	60	58	60	58	Clear	Sd. and Ed.	1-4	Cloudy	6	6	182,000		Vessel was anchored or
6	30.15	30.05	73	50	59	59	59	59	59	59	do	Var.	1-3	Rain	17	17	462,000		the west side of the chan-
7	30.21	30.07	78	55	62	59	60	58	61	59	do	NE-SE.	1-3	Fair					nel off Bulls Mountain,
8	30.24	30.10	77	54	63	60	63	60	65	61	do	Sd. and Wd.	2-4	Clear	21	21	506,000		from the 5th to 31st, and
9	30.26	30.15	79	59	66	63	66	62	67	63	do	Sd. and Wd.	1-4	do	49	47	1,660,000		off Spessie Island from
10	30.25	30.16	80	66	70	65	69	65	71	66	do	Sd. and Wd.	1-4	do	11	11	341,000		the 31st till the 5th of
11	30.25	30.10	87	69	72	68	72	68	73	70	do	Sd. and Wd.	2-4	do	28	28	913,000		June.
12	30.20	30.06	91	73	76	71	74	71	77	73	do	Sd. and Wd.	1-3	do	30	30	979,000	664,000	The former station was
13	30.16	30.06	90	72	78	74	77	73	80	75	do	Var.	0-4	do	8	8	265,000	1,660,000	at the junction of the
14	30.10	29.90	75	66	77	74	76	74	77	75	do	Var.	2-4	do	9	9	318,000	830,000	Susquehanna and North
15	29.90	29.71	82	69	76	75	76	75	77	76	do	Var.	2-4	Cloudy	14	12	357,000	598,000	east Rivers.
16	29.84	29.68	70	64	73	74	73	74	76	74	do	Nd. and Wd.	2-4	do	10	11	357,000	979,000	The water was frequently
17	30.00	29.80	61	54	74	71	74	71	74	71	do	E-NE.	2-4	Rain	10	13	424,000		quite muddy farther up
18	30.02	29.84	58	52	70	67	70	68	71	68	do	NE-NW.	2-4	do	9	8	257,000	498,000	the Susquehanna when
19	29.94	29.84	60	57	68	65	68	65	67	65	do	SE.	1-4	do	12	14	423,000	166,000	it was clear at the ship.
20	30.05	29.92	81	57	66	63	65	63	66	64	do	Nd. and Ed.	1-4	do	20	25	781,000		From the 17th to the 20th,
21	30.16	30.02	82	58	69	64	65	64	67	65	do	Var.	0-2	Fair	53	54	1,792,000		inclusive, it was stormy
22	30.20	30.10	80	62	69	65	68	65	70	66	do	Var.	0-3	Rain	18	19	291,000		rainy weather.
23	30.30	30.15	77	59	69	67	69	68	71	68	do	NE.	1-3	Fair	17	23	650,000	325,000	do
24	30.34	30.21	70	61	70	68	69	68	71	69	do	Var.	0-3	do	14	15	463,000	313,000	do
25	30.25	30.18	80	61	73	69	72	69	75	70	do	Var.	1-3	Clear	28	31	781,000	275,000	do
26	30.31	30.16	80	59	73	70	72	70	75	70	do	Var.	1-3	Fair	40	43	1,082,000	496,000	do
27	30.17	30.02	84	63	75	71	74	71	78	72	do	SW.	0-3	Clear	22	22	655,000	1,230,000	do
28	30.04	29.98	87	66	77	74	76	74	78	75	do	SW.	2-4	do	22	25	675,000	500,000	do
29	30.06	29.95	88	59	77	74	76	75	78	75	do	SW.	1-4	do	10	10	369,000		do
30	30.03	29.95	89	71	78	75	78	74	80	76	do	SW.	2-3	do	2	2	50,000	{ 375,000 625,000 }	Susquehanna and North East
31	30.02	29.90	90	88	80	77	80	77	81	78	Muddy	Var.	2-5	Rain	6	6	106,000	1,230,000	Rivers.
																			Shipment.....

June 1	29.94	29.75	103	68	80	78	80	78	80	77	...do...	Var.	0-5	...do...	8	8	187,000	{ 50,000 312,000 }	Battery.....
2	29.90	29.78	68	60	80	73	80	73	79	78	...do...	NE.	4-5	...do...	2	2	38,000	625,500	Susquehanna and North East Rivers.
3	29.78	29.72	61	59	73	69	73	69	74	71	...do...	NE.	2-7	...do...	2	2	50,000	125,000	Battery.....
4	29.05	29.74	73	37	70	68	70	68	70	69	...do...	NE.-NW.	0-3	...do...	2	2	50,000	.....	.....
																	500 524	15,444,000	12,576,500

NOTE.--Shad eggs on hand morning of 5th, transferred to Battery, 300 000.

Dredging and trawling record of the United States Fish

Date.	Thermometer used.	Number of observations.	Locality.	Hour.	Tide.	Temperature of water.					
						Air.	Surface.	5 fathoms.	10 fathoms.	15 fathoms.	20 fathoms.
1881.						°	°	°	°	°	°
July 16	N. Z. 46402, surface; N. Z. 46403, deep.	917	Lat. 40° 22' N., long. 70° 42' W.	4. 10 a. m.		66	63	60	49	45	46
16	do	918	Lat. 40° 22' 24" N., long. 70° 12' W.	5. 33 a. m.		67	63	60	49	45	45
16	do	919	Lat. 40° 16' 18" N., long. 70° 41' W.	7. 00 a. m.		70	66	63	48		
16	do	920	Lat. 40° 13' N., long. 70° 41' 54" W.	8. 20 a. m.		72	66	63	45		
16	N. Z. 46402, surface; N. Z. 42603, deep.	921	Lat. 40° 07' 48" N., long. 70° 43' 54" W.	9. 40 a. m.		75	70	66			
16	do	922	Lat. 40° 03' 48" N., long. 70° 45' 54" W.	10. 57 a. m.		70	72	69	59	58	58
16	do	923	Lat. 40° 01' 24" N., long. 70° 40' W.	12. 27 p. m.		74	72	69	55	54	54
16	do	924	Lat. 39° 57' 30" N., long. 70° 40' W.	1. 52 p. m.		74	71	70	61	60	60
16	do	925	Lat. 39° 55' N., long. 70° 47' W.	3. 35 p. m.		74	71	70	58	48	48
16	do	926	Lat. 39° 56' N., long. 70° 40' W.	5. 24 p. m.		74	71	68		59	59
20	do	927	Gay Head light, W. by S. $\frac{1}{2}$ S., 2 $\frac{1}{2}$ miles.	10. 47 a. m.	Ebb	68	62	61			
20	do	928	Gay Head light, W. $\frac{1}{2}$ S., 2 $\frac{1}{2}$ miles.	11. 30 a. m.	Low water.	69	62	59			
20	do	929	Gay Head light, S. by W., $\frac{1}{2}$ miles.	12. 35 p. m.	Low water.	66	63				
20	do	930	Gay Head light, S. by W., $\frac{1}{2}$ miles mag.	1. 10 p. m.	Low water.	65	63	63			
20	do	931	Gay Head light, SW. by S. $\frac{1}{2}$ S., $\frac{1}{2}$ miles mag.	1. 42 p. m.	Flood.	65	63				
20	do	932	Nobaka light, NE. by E. $\frac{1}{2}$ E., 2 $\frac{1}{2}$ miles mag.	2. 43 p. m.	Flood.	67	66	63	65		
20	do	933	West Chop light, S. $\frac{1}{2}$ E., $\frac{1}{2}$ miles mag.	3. 30 p. m.	Flood.	68	65	64			
20	do	934	Nobaka light, W. $\frac{1}{2}$ S., $\frac{1}{2}$ miles mag.	4. 10 p. m.	Flood.	68	67	67			
Aug. 4	do	935	Lat. 39° 45' N., long. 69° 44' 45" W. by chr.	8. 14 a. m.	Flood.	72	70	69	66	48	48
4	do	936	Lat. 39° 46' 30" N., long. 69° 47' W.	10. 43 a. m.	Flood.	78	71	69	66	48	48
4	do	937	Lat. 39° 49' 25" N., long. 69° 40' W.	12. 45 p. m.	Flood.	75	72	67	62	42	42
4	do	938	Lat. 39° 51' N., long. 69° 49' 15" W.	2. 44 p. m.	Flood.	80	72	69	57	56	56
4	do	939	Lat. 39° 53' N., long. 69° 50' 30" W.	4. 25 p. m.	Flood.	78	73	70	67	57	57
4	do	940	Lat. 39° 54' N., long. 69° 51' 30" W.	5. 30 p. m.	Flood.	76	72	70	62	49	49
4	do	941	Lat. 40° 01' N., long. 69° 56' W.	7. 45 p. m.		74	71	70	53		
9	do	942	Lat. 40° 01' N., long. 71° 12' 30" W.	6. 15 a. m.		72	69	69	65	52	53
9	do	943	Lat. 40° N., long. 71° 14' 30" W.	7. 10 a. m.		76	70	69	65	52	53
9	do	944	Lat. 40° 01' N., long. 71° 14' 30" W.	8. 27 a. m.		78	70	68	66	50	53
9	do	945	Lat. 39° 58' N., long. 71° 13' W.	12. 05 p. m.		75	71	70	67	58	53
9	do	946	Lat. 39° 55' 30" N., long. 71° 14' W.	2. 00 p. m.		75	71	61	55	51	52
9	do	947	Lat. 39° 53' 30" N., long. 71° 12' 30" W.	4. 00 p. m.		75	70	69	55	50	50
13	do	948	Penikese Island E., 2 miles.	5. 20 p. m.		76	67				
23	do	949	Lat. 40° 03' N., long. 70° 31' W.	4. 20 a. m.		78	66	66	66	48	50
23	do	950	Lat. 40° 07' N., long. 70° 32' W.	5. 50 a. m.		69	65	64	63	47	
23	do	951	Lat. 39° 57' N., long. 70° 31' 30" W.	9. 40 a. m.		78	67	65	64	49	52

Commission steamer Fish Hawk, season of 1881.

and water.				Depth in fathoms.	Character of bottom.	Wind.	Drift.	Dredge or trawl.	Specific gravity.			
40 fathoms.	50 fathoms.	— fathoms.	Bottom.						Depth.	Temperature.	Specific gravity.	Corrected to standard of 60°.
°	°					Miles.	Miles.					
..	..	..	42	44	Gn. mud.....	SE. 1	NE. $\frac{1}{2}$	Trawl	..	..	..	..
..	..	..	42	46	Gn. mud.....	SE. 1	N. NE. 1	do	..	..	..	..
..	..	..	42 $\frac{1}{2}$	53	Gn. mud.....	S. 1	NE. 1	do	..	..	..	..
..	..	..	40	63	Gn. mud.....	S. 1	W. by S. 1	do	..	..	..	..
..	..	..	52	67	Gn. mud.....	S. SW. 1	W. 1	do	..	..	..	..
..	..	..	52	71	Sand and gn. mud.	SW. 2	N. by W. 1	do	..	..	..	..
..	..	..	52	78	Sand.....	SW. 2	W. NW. $\frac{1}{2}$	do	..	..	..	..
..	..	..	44 $\frac{1}{2}$	164	Sand.....	SW. 2	NW. 2	do	..	..	..	..
53	..	..	42	229	Sand and mud.	S. SW. 3	NW. by W. 1 $\frac{1}{2}$	do	..	..	..	..
58	..	..	44	190	Sand and mud.	S. SW. 3	NW. $\frac{1}{2}$ N. 2 $\frac{1}{2}$	do	..	..	..	..
..	..	..	50	11	Sand.....	S. SW. 2	W. NW. $\frac{1}{2}$	do	..	..	..	..
..	..	..	80	10	Sand.....	S. SW. 3	W. by N. $\frac{1}{2}$	do	..	..	..	..
..	..	..	62	10	Sand.....	S. SW. 3	SE. by S. $\frac{1}{2}$	Dredge	..	..	..	..
..	..	..	62	12	Sand and shells	SW. 3	S. $\frac{1}{2}$ E. $\frac{1}{2}$	do	..	..	..	..
..	..	..	62	16	Sand and shells	SW. 2	S. $\frac{1}{2}$ W. $\frac{1}{2}$	do	..	..	..	..
..	..	..	66	14	Rock.....	SW. 2	NW. by W. $\frac{1}{2}$	do	..	..	..	..
..	..	..	64	14	Stones.....	SW. 3	E. NE. 2 $\frac{1}{2}$	do	..	..	..	..
..	..	..	67	9	Sand and shells	SW. 2	N. NW. 1	Trawl	..	..	..	..
44	39 $\frac{1}{2}$	762	Yel. mud and sand.	N. NE. 4	NW. $\frac{1}{2}$ N. 2 $\frac{1}{2}$	do	..	..	..	..	..	..
44	39 $\frac{1}{2}$	716	Gn. mud.....	N. NE. 3	NW. $\frac{1}{2}$ W. 2	do	..	..	Surface 70 $\frac{1}{2}$	1.02420	1.02573	..
55	40 $\frac{1}{2}$	516	Gn. mud and sand.	N. NE. 2	N. 2 $\frac{1}{2}$	do	..	..	5 fms. 70	1.02420	1.02566	..
53	42	315	Gn. mud and sand.	Calm, 0	N. NW. 2	do	..	..	5 fms. 75	1.02370	1.02596	..
56	47	264	Gn. mud and sand.	SW. by W. 1	N. NW. 1 $\frac{1}{2}$	do	..	..	5 fms. 72	1.02380	1.02556	..
49 $\frac{1}{2}$	52	184	Sand.....	SW. by W. 1	N. NW. $\frac{1}{2}$ W. 2	do	..	..	5 fms. 73	1.02380	1.02572	..
..	52	70	Sand and mud.	NW. 3	W. NW. 1 $\frac{1}{2}$	Trawl	..	..	5 fms. 71 $\frac{1}{2}$	1.02400	1.02508	..
..	50	138	Sand and mud.	SW. 2	SW. by W. 2	Dredge	..	..	5 fms. 72 $\frac{1}{2}$	1.02380	1.02564	..
..	40	157	Mud, sand, and shells.	SW. 1	NW. by N. 2 $\frac{1}{2}$	do	..	..	5 fms. 71	1.02400	1.02560	..
..	51	128	Mud, sand, and shells.	SW. 1	NW. by N. 1 $\frac{1}{2}$	Trawl	..	..	5 fms. 70 $\frac{1}{2}$	1.02425	1.02577	..
..	44	207	Gn. mud and sand.	SW. 4	NW. by N. 2	do	..	..	5 fms. 09	1.02400	1.02528	..
..	47	247	Gn. mud and sand.	SW. 4	NW. by W. 1 $\frac{1}{2}$	do	..	..	5 fms. 08	1.02420	1.02533	..
..	44	310	Gn. mud and sand.	SW. 4	W. NW. 3	do	..	..	5 fms. 70	1.02380	1.02525	..
..	66	7	Bl. mud and shells.	SW. 4	W. SW. 1	do	..	..	5 fms. 09	1.02385	1.02513	..
..	52	100	Yel. mud.....	W. 3	N. NW. 2	Rake dr'ge	..	..	5 fms. 70	1.02380	1.02525	..
..	52	71	Sand, shells, and mud.	W. 4	N. NW. 1 $\frac{1}{2}$	Trawl	..	..	5 fms. 70	1.02385	1.02545	..
..	41	225	Mud.....	W. NW. 3	N. 1 $\frac{1}{2}$	do	..	..	5 fms. 70 $\frac{1}{2}$	1.02390	1.02542	..
..	..	..	..	..	..	..	..	..	5 fms. 71 $\frac{1}{2}$	1.02385	1.02553	..
..	..	..	..	..	..	..	..	..	5 fms. 68	1.02420	1.02533	..
..	..	..	..	..	..	..	..	..	5 fms. 70	1.02385	1.02530	..
..	..	..	..	..	..	..	..	..	5 fms. 65	1.02460	1.02529	..
..
..	..	..	..	..	..	..	..	..	Surface 65	1.02520	1.02589	..
..	..	..	..	..	..	..	..	..	5 fms. 65	1.02520	1.02589	..
..	..	..	..	..	..	..	..	..	Surface 60 $\frac{1}{2}$	1.02500	1.02600	..
..	..	..	..	..	..	..	..	..	5 fms. 65	1.02480	1.02654	..
..	..	..	..	..	..	..	..	..	Surface 67 $\frac{1}{2}$	1.02456	1.02691	..
..	..	..	..	..	..	..	..	..	5 fms. 67	1.02500	1.02598	..

Dredging and trawling record of the United States Fish

Date.	Thermometer used.	Number of obser- vations.	Locality.	Hour.	Tide	Temperature of air					
						Air.	Surface.	5 fathoms.	10 fathoms.	20 fathoms.	50 fathoms.
1881.											
Aug. 23	N. Z. 46402, sur- face; N. Z. 42663, deep.	952	Lat. 39° 55' N., long. 70° 28' W.	11. 28 a. m.	.....	82	68	66	63	49	53
23	do	953	Lat. 39° 59' 30" N., long. 70° 17' 30" W.	2. 30 p. m.	.....	77	68	64	62	53	54
23	do	954	Lat. 39° 53' N., long. 70° 18' 30" W.	4. 50 p. m.	.....	74½	68	65	63	50	53
26	N. Z. 46402, sur- face; N. Z. 46405, deep.	955	Buzzard's Bay, Nye's Neck, E. by S. ½ mile.	10. 50 a. m.	Ebb	67	67½				
26	do	956	Buzzard's Bay, Nye's Neck, S. SE. ½ E., ½ mile.	11. 26 a. m.	Ebb	71	69				
26	do	957	Buzzard's Bay, Nye's Neck, S. SE. ½ E., ½ mile.	11. 45 a. m.	Ebb	73	69½				
26	do	958	Buzzard's Bay, Nye's Neck, S. by E. ½ E., ½ mile.	12. 20 p. m.	Ebb	75	70				
26	do	959	Buzzard's Bay, Nye's Neck, S., ½ mile.	12. 40 p. m.	Ebb	72	69				
26	do	960	Buzzard's Bay, Nye's Neck, S. ½ E., ½ mile.	1. 10 p. m.	Ebb	72½	69½				
26	do	961	Buzzard's Bay, Nye's Neck, NE. ½ E., 2½ miles.	1. 52 p. m.	Low	71½	69				
26	do	962	Buzzard's Bay, Woe- fuka and island, NE. ½ E., 1½ miles.	3. 10 p. m.	Flood	71	68				
26	do	963	Buzzard's Bay, Woe- fuka and island, SE. ½ S., 1 mile.	3. 40 p. m.	Flood	70	68				
30	do	964	Chatham light, NW. ½ W., 5 miles.	7. 50 a. m.	Ebb	65	61	59			
30	do	965	Chatham light, NW. ½ W., 6 miles.	8. 15 a. m.	Ebb	65	61	59			
30	do	966	Chatham light, NW. by W. ½ W., 6½ miles.	8. 40 a. m.	Ebb	65	61		54		
30	do	967	Chatham light, NW. by W. ½ W., 6½ miles.	8. 50 a. m.	Ebb	66	61	61			
30	do	968	Chatham light, NW. by W. ½ W., 7½ miles.	9. 00 a. m.	Ebb	66	61½	61			
30	do	969	Chatham light, NW. by W. ½ W., 7 miles.	9. 10 a. m.	Ebb	66	61½				
30	do	970	W. NW. ½ W., 6 miles.	9. 43 a. m.	Ebb	67	61				
30	do	971	Chatham light, W. ½ N., 4½ miles.	10. 05 a. m.	Ebb	67	61½				
30	do	972	Chatham light, NW. by W. ½ W., 7½ miles.	10. 48 a. m.	Ebb	67	62				
30	do	973	Chatham light, W. NW. 6½ miles.	11. 10 a. m.	Ebb	67	62				
30	do	974	Chatham light, W. NW. ½ W., 6½ miles.	11. 30 a. m.	Low	67	62				
30	do	975	Chatham light, W. NW. ½ W., 6½ miles.	11. 45 a. m.	Low	68	63				
30	do	976	Chatham light, W. NW. ½ W., 6 miles.	12. 00 m.	Low	69	63				
30	do	977	Chatham light, W. NW. 6½ miles.	12. 20 p. m.	Low	70	64				
30	do	978	Chatham light, W. NW. 6 miles.	12. 30 p. m.	Low	70	64				
30	do	979	Chatham light, W. NW. ½ W., 6 miles.	12. 40 p. m.	Low	70	64				
30	do	980	Chatham light, NW. by W. ½ W., 5½ miles.	1. 00 p. m.	Low	70	62				
30	do	981	Chatham light, W. NW. 16 miles.	2. 10 p. m.	Flood	65	63½	63	56		
30	do	982	Lat. 41° 30' N., long. 69° 35' W.	2. 45 p. m.	Flood	65	63½	60	67	43½	
30	do	983	Lat. 41° 33' N., long. 69° 32' W.	3. 23 p. m.	.....	64½	64	62	54		
30	do	984	Lat. 41° 31' N., long. 69° 28' W.	4. 07 p. m.	Flood	64	63½	63	52		

Commission steamer *Fish Hawk*, season of 1881—Continued.

and water.				Depth in fathoms.	Character of bottom.	Wind.	Drift.	Dredge or trawl.	Specific gravity.			
— fathoms.	— fathoms.	— fathoms.	Bottom.						Depth.	Temperature.	Specific gravity.	Corrected to standard of 60°.
			o			<i>Miles.</i>	<i>Miles.</i>					
			40 396		Yel. mud and sand.	W. NW. 2.	NE. by N. 1½	Trawl	Surface 67½	1.02525	1.02631	
									5 fms. 67	1.02505	1.02603	
			39½ 724		Mud	W. NW. 2.	N. NW. 1½	do	Surface 69	1.0250	1.02628	
									5 fms. 67½	1.02505	1.02611	
			39½ 651		Sand and mud.	W. NW. 2.	N. NW. 2	do	Surface 68	1.02485	1.02598	
									5 fms. 67½	1.02485	1.02591	
			68 7		Sand.	SW. 3.	W. by S. ¼ S. ½	do	Surface 68½	1.02320	1.02441	
									5 fms. 69½	1.02385	1.02521	
			68 5½		Sand.	SW. 3.	W. by S. ¼	Trawl, with wings.	Surface 69	1.02280	1.02408	
									5 fms. 71	1.02270	1.02430	
			68 6		Sand and stone	SW. 4.	W. ¾ N. ¼	do	Surface 69½	1.02270	1.02406	
									5 fms. 70	1.02280	1.02425	
			68 5		Sand, stone, and shells.	SW. 5.	W. SW. ¼	do	Surface 70	1.02270	1.02415	
									5 fms. 69½	1.02285	1.02421	
			68 5		Sand, stone, and shells.	SW. 5.	W. ½	do	Surface			
									5 fms.			
			68 4½		Sand, stone, and shells.	SW. 5.	SW. by W. ½	do	Surface			
			68 8		Bn. mud	SW. 5.	W. by S. ¼	do	Surface 68½	1.02240	1.02411	
									5 fms.			
			66 8		Bn. mud and sand.	SW. 6.	W. NW. ½	do	Surface 68	1.02320	1.02433	
									5 fms. 68½	1.02360	1.02421	
			66 8½		Bn. mud	SW. 6.	W. SW. ¼	Dredge	Surface 68½	1.02320	1.02441	
									5 fms. 68	1.02321	1.02433	
			55 10		Sand and gravel.	S. 4.	S. SE. ¼	do	Surface 61	1.0240	1.02413	
									5 fms. 58	1.02465	1.02402	
			53 15		Sand and gravel.	S. 4.	SE. by E. ¼	do	Surface 61	1.0240	1.02413	
									5 fms. 59	1.02400	1.02448	
			52 16		S. and sn. st.	SW. 4.	SE. ½	Dredge	Surface 61	1.02420	1.02413	
									5 fms. 60	1.02440	1.02440	
			52 16		S. and g.	SW. 4.	SE. ½	do	Surface 61	1.02440	1.02453	
									5 fms. 61½	1.02400	1.02419	
			50½ 18		G.	SW. 4.	NW. by W. ½	do	Surface 61½	1.02420	1.02439	
									5 fms. 62	1.02370	1.02397	
			51 18		S. p. st.	SW. 4.	SE. ¼	do	Surface 61½	1.02420	1.02439	
									5 fms. 60	1.02440	1.02440	
			54 13		S. p. st.	SW. 4.	W. NW. ½	do	Surface 61½	1.02400	1.02419	
									5 fms. 59½	1.02420	1.02414	
			54 11		S. p. st.	SW. 4.	S. SE. ¼	do	Surface 62	1.02395	1.02422	
									5 fms. 61	1.02400	1.02418	
			52 16		Gr., s., and st.	SW. 5.	NE. ½	do	Surface 62½	1.02400	1.02434	
									5 fms. 62	1.02420	1.02447	
			51 17		Gr., s., and st.	SW. 5.	W. SW. ¼	do				
			51 16		Gr., s., and st.	SW. 5.	W. SW. ¼	do				
			52 16		Gr., s., and st.	SW. 5.	S. ½	do				
			52 16		Gr., s., and st.	SW. 5.	S. SW. ½	do				
			52 17		S. p. st.	SW. 5.	W. by N. ¼	do	Surface 63	1.02420	1.02458	
									5 fms. 62	1.02440	1.02467	
			52 17		S. p. st.	SW. 5.	W. by N. ¼	do				
			52 16		S.	SW. 5.	W. by N. ¼	do				
			53 14		S. p. st.	SW. 5.	SW. ½	do	Surface 62	1.02420	1.02447	
									5 fms. 61½	1.02450	1.02461	
			49 48		S. and grv.	SW. 5.	S. ¼ W. 1½	Trawl	Surface 63½	1.0243	1.02477	
									5 fms. 65	1.02420	1.02489	
			41½ 42		S. and grv.	SW. 7.	S. SW. 1½	do	Surface 63	1.02420	1.02458	
									5 fms. 63½	1.02420	1.02407	
			42 36		S.	SW. 7.	S. by E. ½	do	Surface 63½	1.02400	1.02447	
									5 fms. 63½	1.02410	1.02457	
			41½ 33		M. and s.	SW. 6.	S. ½ W. ½	do	Surface 63	1.02390	1.02431	
									5 fms. 63	1.02500	1.02541	

Dredging and trawling record of the United States Fish

Date.	Thermometer used.	Number of observations.	Locality.	Hour.	Tide.	Temperature of air					
						Air.	Surface.	5 fathoms.	10 fathoms.	20 fathoms.	30 fathoms.
1881. Sept. 7	N. Z. 46402, surface; N. Z. 46405, deep.	985	Lat. 41° 00' N., long. 70° 40' W.	12.55 p. m.		73	66	64	57½	60½	...
7	do	986	Lat. 40° 55' N., long. 70° 48' W.	2.00 p. m.		73	67	65	...	50	...
7	do	987	Lat. 40° 54' N., long. 70° 48' 30" W.	2.28 p. m.		73	67	65	59½	50	...
7	do	988	Lat. 40° 49' 30" N., long. 70° 47' W.	3.30 p. m.		73	67	64	58½	50	...
7	do	989	Lat. 40° 49' N., long. 70° 47' W.	4.00 p. m.		73	67	64	58½	50	...
7	do	990	Lat. 40° 44' N., long. 70° 47' W.	5.08 p. m.		71½	66	64	59½	50½	...
7	do	991	Lat. 40° 39' N., long. 70° 46' W.	6.05 p. m.		70	66	64	56½	49½	...
7	do	992	Lat. 40° 33' N., long. 70° 45' W.	7.30 p. m.		69	65	63	52	50	...
7	do	993	Lat. 40° 28' N., long. 70° 44' W.	8.20 p. m.		69	65	63	54	51	...
8	do	994	Lat. 39° 40' N., long. 71° 30' W.	4.50 a. m.		72	68	69	65½	49	46½
8	do	995	Lat. 39° 40' 30" N., long. 71° 31' W.	6.00 a. m.		72	68	69	65½	47	46½
8	do	996	Lat. 39° 41' 00" N., long. 71° 31' 37" W.	7.35 a. m.		75	67½	65	56½	45	44
8	do	997	Lat. 39° 42' N., long. 71° 32' W.	8.49 a. m.		75	67½	65	56½	45	44
8	do	998	Lat. 39° 43' N., long. 71° 32' W.	10.05 a. m.		74	68	63	51	44	43½
8	do	999	Lat. 39° 45' 13" N., long. 71° 30' W.	11.45 a. m.		73	68	63	51	45	43
8	do	1025	Lat. 39° 49' N., long. 71° 25' W.	1.05 p. m.		71	69	68	69½	54½	48
6	do	1026	Lat. 39° 50' 30" N., long. 71° 23' W.	2.40 p. m.		69	69	68	68	56	48
8	do	1027	Lat. 40° 00' 00" N., long. 69° 10' W.	7.32 a. m.		61	65	66	56	47	44
14	do	1028	Lat. 39° 57' N., long. 69° 17' W.	8.38 a. m.		66½	66	66	61	48	45
14	do	1029	Lat. 39° 57' 06" N., long. 69° 16' W.	12.00 m.		72	68	66	63	48	45
14	do	1030	Lat. 39° 53' 30" N., long. 69° 15' W.	1.30 p. m.		65	66	66	65	48	45
14	do	1031	Lat. 39° 57' 00" N., long. 69° 18' W.	2.45 p. m.		64	65	63½	58	47	45
14	do	1032	Lat. 39° 56' 00" N., long. 69° 22' W.	3.42 p. m.		65	65	63½	58	47	45
14	N. Z. 46405, surface; N. Z. 46402, deep.	1033	Lat. 39° 56' 00" N., long. 69° 24' W.	4.55 p. m.		66	63	63	57	47	47
14	do	1034	Lat. 39° 56' 00" N., long. 69° 26' W.	5.55 p. m.		66	62	60	57	47	47
14	do	1035	Lat. 39° 57' 00" N., long. 69° 28' W.	6.43 a. m.		65	62	60	57	47	47
14	do	1036	Lat. 39° 58' 00" N., long. 69° 30' W.	7.45 p. m.		62	61½	...	...	...	...
15	do	1037	Gay Head, N.E. ½ N. 4 miles.	7.20 a. m.		...	...	...	...	...	...

Commission steamer *Fish Hawk*, season of 1881—Continued.

and water.				Depth in fathoms.	Character of bottom.	Wind.	Drift.	Dredge or trawl.	Specific gravity.			
50 fathoms.	100 fathoms.	200 fathoms.	Bottom.						Depth.	Temperature.	Specific gravity.	Corrected to standard of 60°.
°	°	°	°			Miles.	Miles.					
			50	26	S	SW. 3	SW. 1½	Trawl	Surface	69	1.02340	1.02468
									5 fms.	66	1.02360	1.02441
									10 fms.	65	1.02380	1.02449
			40	28	S	SW. 3	S. ½ W. 1	do	Surface	67	1.02340	1.02438
									5 fms.	66	1.02350	1.02434
									10 fms.	64	1.02370	1.02424
			40	28	S	SW. 3	S. ½	R. D.	Surface	67	1.02340	1.02438
									5 fms.	66	1.02350	1.02434
									10 fms.	64	1.02370	1.02424
			40½	30	S	SW. 3	S. ½	do	Surface	67½	1.02370	1.02476
									5 fms.	67½	1.02380	1.02486
									10 fms.	64½	1.02420	1.02481
			40½	30	S	SW. 3	S. ½	Trawl	Surface	67½	1.02370	1.02476
									5 fms.	67½	1.02380	1.02486
									10 fms.	64½	1.02420	1.02481
			47	34	G. m. and s.	W. SW. 3	S. ½ W. ½	do	Surface	66	1.02400	1.02484
									5 fms.	65	1.02420	1.02489
									10 fms.	65	1.02420	1.02489
			47½	34	Gn. m. s.	W. SW. 3	S. ½ W. ½	Trawl	Surface	68	1.02400	1.02484
									5 fms.	65	1.02420	1.02485
									10 fms.	63	1.02420	1.02401
			48	30	M		S. ½	Trawl				
			40½	30	M	W. SW. 4	S. ½	do				
48½			40½	308	Bro. m.	N. NW. 3	W. NW. 2	do	Surface	68	1.02450	1.02543
									5 fms.	67½	1.02440	1.02546
									10 fms.	67½	1.02440	1.02546
48½	48½		40½	358	Yl. m. s.	N. NW. 3	W. NW. ½	do				
48			40	340	Yl. m. s.	N. NW. 3	NW. ½	Rake dr'ge				
48	41½		40	335	Yl. m. s.	N. NE. 3	N. by W. ½	Trawl				
46	40		40	302	Yl. m. s.	E. NE. 4	N. 1½	do	Surface	68	1.02450	1.02503
									5 fms.	68	1.02450	1.02543
									10 fms.	59	1.02500	1.02488
46			42	260	Gn. m. s.	E. NE. 4	N. NW. ½	Rake dr'ge	Surface	68	1.02440	1.02553
									5 fms.	67	1.02450	1.02548
									10 fms.	59	1.02460	1.02448
51			45	216	Gn. m.	NE. by E. 4	N. ½ E. 1	Trawl	Surface	68½	1.02480	1.02601
51			47½	182	Gn. m. s.	E. NE. 5	N. by E. 1½	do	5 fms.	68	1.02440	1.02553
46			48½	93	S	E. NE. 3	N. ½	do	Surface	68	1.02460	1.02513
									5 fms.	67½	1.02460	1.02566
									Surface	65	1.02480	1.02549
									5 fms.	65½	1.02500	1.02570
49½	46		41	410	M	NE. 3	N. NE. ½	do	10 fms.	64	1.02520	1.02574
									Surface	60	1.02480	1.02574
									5 fms.	60½	1.02490	1.02581
49½	46		40	458	Yl. m. s.	E. NE. 4	NE. by N. 1	do	10 fms.	65½	1.02480	1.02550
									Surface	66	1.0240	1.02574
									5 fms.	66½	1.02490	1.02581
									10 fms.	65½	1.02480	1.02556
49	46		41	337	Yl. m. s.	E. NE. 4	N. by W. 1½	Rake dr'ge	Surface	68	1.02400	1.02574
									5 fms.	68½	1.02490	1.02574
									10 fms.	65½	1.02480	1.02556
46			46	255	Yl. m. s.	N. NE. 4	NW. by N. 1½	Trawl	Surface	65	1.02470	1.02530
									5 fms.	63½	1.02480	1.02522
									10 fms.	63	1.02480	1.02521
46			46	208	Yl. m. s.	NE. 4	NW. ½	do	Surface	65	1.02470	1.02530
									5 fms.	63½	1.02480	1.02522
									10 fms.	63	1.02480	1.02521
				183	G. s.	NE. 3	N. NW. 2	do				
46			46½	146	S	NE. 3	N. NW. ½	do				
48			47	120	S	NE. 3	N. ½	do				
			51	94	S	NE. 4	N. NW. 1½	Rake dr'ge				
			47	16	S							

Commission steamer Fish Hawk, season of 1881—Continued.

and water.				Depth in fathoms.	Character of bottom.	Wind.	Drift.	Dredge or trawl.	Specific gravity.			
50 fathoms.	100 fathoms.	200 fathoms.	Bottom.						Depth.	Temperature.	Specific gravity.	Corrected to standard of 60°.
°	°	°	°			Miles.	Miles.					
47	146	S. sh	N. NE. 4	N. by E. 1	Trawl							
50	136	S. sh	NE. 6	N. by E. 2	do							
60	93	S. sh	N. NE. 6	N. by E. 2	Ex. dredge							
65	9	S. g	S. SW. 4	W. SW. 2	Trawl							
65	6	S. g	S. SW. 5	W. by N. 2	do							
49	130	Sand	N. NE. 4	NW. by N. 12	do				Surface	65	1.0256	1.02629
									5 fms.	64	1.0254	1.02601
									10 fms.	64	1.0252	1.02574
52	42	224	Gray mud	NW. 3	W. NW. 2	do			Surface	65	1.0252	1.02589
									5 fms.	65	1.0252	1.02589
51	40	312	Gray mud	N. NW. 3	W. 2 N. 2	do						
52	51	104	Sand	N. 4	W. NW. 2	do			Surface	65	1.0252	1.02589
									5 fms.	65	0254	1.02609
									10 fms.	64	0255	1.02604
51	49	156	Sand	N. 4	N. W. 12	do						
51	51	45	40	435	Mud	N. 4	W. 2	do	Surface	05	1.0250	1.02569
									5 fms.	65	1.0248	1.02556
									10 fms.	65	1.0248	1.02549
51	51	45	40	435	Mud	N. 4	N. NW. 2	do				

steamer Fish Hawk, Lieut. Z. L. Tanner, U. S. N., commanding.

pounds.]

Coming up.										Remarks.
000 to 800 fathoms.	800 to 700 fathoms.	700 to 600 fathoms.	600 to 500 fathoms.	500 to 400 fathoms.	400 to 300 fathoms.	300 to 200 fathoms.	200 to 100 fathoms.	100 fathoms to surface.	Total in time.	
m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.
							4 00		4 00	
								5 00	5 00	
							3 10	1 50	5 00	
							3 20	2 00	9 30	
							1 40	1 20	10 05	
							1 27	1 25	0 53	7 46
							1 50	1 25	4 35	8 55
							0 20	1 40	5 05	2 50
							0 20	2 00	5 05	2 50
							1 25	1 55	5 25	8 40
							1 30	1 45	4 55	5 00
								1 15	2 00	5 00
							0 45	1 45	0 35	4 25
							1 40	1 55	4 10	1 45
							0 25	1 55	2 00	2 25
							0 28	1 32		

Record of speed of trawling United States Fish Commission

Current number.	Going down.											Fathoms of line out.
	Surface to 100 fathoms.	100 to 200 fathoms.	200 to 300 fathoms.	300 to 400 fathoms.	400 to 500 fathoms.	500 to 600 fathoms.	600 to 700 fathoms.	700 to 800 fathoms.	800 to 900 fathoms.	Total time.	Depth in fathoms.	
	<i>m. s.</i>	<i>m. s.</i>	<i>m. s.</i>	<i>m. s.</i>	<i>m. s.</i>	<i>m. s.</i>	<i>m. s.</i>	<i>m. s.</i>	<i>m. s.</i>	<i>m. s.</i>		
949	3 00	3 00								0 00	100	200
950	2 20	3 10								5 40	71	200
951	3 00	3 00	5 00	4 30	2 33					17 00	225	420
952	2 15	2 25	2 05	2 30	11 05	4 50				24 10	390	600
953	3 50	3 40	3 10	2 45	2 35	2 38	3 57	5 35	5 20	33 30	724	885
954	2 32	2 52	2 11	1 55	1 50	1 24	4 20	5 43		23 00	651	800
994											368	615
995	3 05	2 35	2 10	2 15	2 05	2 15	0 03			14 28	858	615
996	4 00	4 00	4 00	3 35	3 25	4 05	0 25			23 30	346	625
997	3 15	3 05	2 45	2 40	3 30	3 05	3 05			21 25	335	700
998	2 45	3 00	2 30	3 45	4 00	5 25	0 30			21 55	302	610
999	8 05	3 25	4 45	2 45	4 40	1 20				25 00	266	550
1025	2 50	3 00	3 00	3 15	9 25					21 30	216	500
1026	3 30	2 45	3 15	2 30						12 00	182	400
1028	3 40	3 50	3 15	4 05	2 45	2 10	2 25			22 10	410	694
1029	3 50	3 55	2 35	2 10	3 10	2 55	2 30	1 10		22 15	458	750
1030	3 25	3 25	3 40	6 45	5 50	1 20				24 25	337	530
1031	3 45	1 45	2 10	3 25	2 40	0 25				14 20	255	520
1032	6 30	4 15	3 25	4 05						18 15	208	400
1033										21 45	183	404
1034	6 15	3 25	2 35							12 15	146	300
1035										13 45	120	340
1036										16 45	94	300
1038										15 00	146	325
1039										17 00	136	295
1040										21 00	93	340
1043	4 00	3 50	4 50							12 40	130	360
1044	4 05	4 10	4 00	4 30						16 45	224	409
1045	3 55	4 10	4 15	3 25	4 00	9 25	4 20			38 30	812	650
1046	3 10	6 00	12 05							21 15	104	230
1047	3 10	5 40	5 15	4 05						18 10	156	355
1048	3 20	4 45	4 25	4 00	3 15	3 10	2 45			25 40	435	700
1049	6 10	3 15	4 25	3 20	3 20	2 30	2 10	2 00	10 30	37 40	435	877

steamer Fish Hawk, Lieut. Z. L. Tanner, U. S. N., commanding.

Coming up.											Remarks.
Trawl down.	900 to 800 fathoms.	800 to 700 fathoms.	700 to 600 fathoms.	600 to 500 fathoms.	500 to 400 fathoms.	400 to 300 fathoms.	300 to 200 fathoms.	200 to 100 fathoms.	100 fathoms to surface.	Total time.	
m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	h. m. s.	m. s.	m. s.	m. s.	h. m. s.	
30 00	4 00	4 00	8 00	Rake dredge.
24 00	3 30	3 45	7 15	Trawl.
16 00	3 20	3 55	8 00	Do.
18 50	3 02	2 58	3 10	Do.
23 00	3 17	3 04	8 29	Do.
21 00	4 10	3 54	3 58	3 54	3 31	8 20	8 12	3 01	2 57	8 22	Do.
.....	8 22	8 47	8 27	2 24	8 12	8 01	2 57	3 40	3 15	26 34	Trawl and wings.
22 07	4 30	4 00	4 15	4 00	3 40	3 15	.....	Trawl.
9 30	5 00	3 52	8 48	2 50	3 35	3 25	23 30	Rake dredge.
15 20	4 45	3 15	8 15	3 00	2 45	6 10	23 10	Trawl.
12 45	4 16	8 45	3 55	8 50	6 15	3 40	8 50	29 30	Do.
7 00	5 00	3 50	6 15	4 25	3 55	3 10	25 35	Rake dredge.
7 15	1 35	4 30	3 25	3 15	2 50	2 55	18 30	Trawl.
7 00	4 25	3 45	3 45	4 05	4 10	20 10	Do.
15 20	4 30	4 05	4 25	4 00	17 00	D. trawl—Heavy load.
15 15	6 30	7 30	1 02 35	7 10	6 30	6 05	1 48 50	Trawl.
8 30	2 45	4 05	.....	8 20	3 20	3 30	8 20	3 20	3 25	27 15	Rake dredge.
13 30	1 25	3 40	8 20	8 10	3 10	3 15	18 00	Trawl.
.....	5 15	8 30	4 10	3 55	5 15	22 00	Do.
9 00	Do.
.....	5 05	3 55	3 45	12 45	Do.
.....	12 15	Do.
.....	9 55	Rake dredge.
.....	17 00	Trawl.
.....	11 00	Do.
.....	11 00	Excelsior dredge.
.....	2 15	3 00	3 10	8 25	Trawl.
7 20	8 25	2 15	3 50	2 40	12 10	Do.
7 35	8 55	3 45	3 50	3 05	24 35	Do.
20 20	2 35	8 50	8 35	.....	1 20	3 30	3 00	7 50	Do.
25 50	8 20	3 30	2 42	12 15	Do.
8 45	6 15	18 30	7 15	4 10	4 30	8 45	3 25	3 10	3 10	29 25	Do.
.....	5 30	4 00	8 45	8 30	4 45	4 30	4 00	49 45	Do.

Synopsis of the steam log for the year ending December 31, 1881.

Stroke of piston, in feet	24
Number of condensing cylinders	2
Diameter of condensing cylinders, in inches	22
Mean point of steam cut-off from commencement of stroke of piston, in inches	6.75
Mean number of holes of the throttle valve, open	3.39
Mean vacuum in condenser, in inches of mercury	24.02
Mean steam pressure in boilers while engines were in operation	26
Mean temperature of engine room	92.4
Mean temperature on deck	60.1
Mean temperature of injection water	64.9
Mean temperature of discharge water	95.8
Mean temperature of feed water	83.9
Total time fires were lighted, in hours and minutes	4,685 25
Total time fires were lighted for hatchings, in hours and minutes	1,433 00
Total time engines were in operation in hours and minutes	778 50
Total time engines were in operation for dredging, in hours and minutes	121 09
Total number of revolutions of starboard engine	3,126,099
Total number of revolutions of port engine	3,272,441
Mean number of revolutions per minute <i>en route</i>	81.7
Mean piston speed, in feet per minute	337.65
Total number of knots run	5,029.5
Mean number of knots per hour	6.46
Mean number of knots per hour <i>en route</i>	8.4
Total weight of coal consumed for engineer department	473,448
Total weight of coal consumed while engines were in operation	237,140
Total amount of coal consumed for galley	24,440
Total weight of refuse	83,448
Mean number of pounds of coal consumed per hour while engines were in operation	692
Total number of gallons of oil consumed	364.75
Total number pounds of tallow consumed	138
Total number of pounds of wiping stuff consumed	199
Mean draught forward, in feet and inches	7 feet 3½ inches.
Mean draught aft, in feet and inches	7 feet 7 inches.
Number of screws	2
Kind of screws	true.
Mean pitch of screws, in feet and inches	12 feet 3 inches.
Diameter of screws, in feet and inches	6 feet 8 inches.
Length of screws, in inches, parallel to axis	20 inches.
Number of blades	4
Maximum indicated horse power	222.92
Mean indicated horse power	172.85
Mean number of pounds of coal per horse power	3.9
Maximum number of pounds of coal per square foot of grate	15
Mean number of pounds of coal per square foot of grate	12.7
Maximum speed attained, under steam alone, in knots per hour	10.33
Number of hours maintained	5
Slip of screws at maximum speed, in per cent.	9.4
State of tide and sea	favorable and smooth.
Mean slip of screws, in per cent.	14.9

Table of distances made under steam by the United States Fish Commission Steamer Fish Hawk, for the year 1881.

Date.	Where bound.	Distance.
1881.		<i>Miles.</i>
Feb. 26	From Norfolk to Washington	109
27	.....Do	60
28	.....Do	31
Mar. 23	From Washington to Norfolk	200
24	.....Do	120
	.....Do	80
25	From Norfolk to Avoca, N. C.	200
26	.....Do	8
27	.....Do	4
28	.....Do	3
29	.....Do	10
30	.....Do	9
	.....Do	47
		90

Table of distances made under steam, &c.—Continued.

Date.	Where bound.	Distance.
Apr. 30	From Avoca to Havre de Grace.....	1
May 1	Do.....	92
2	Do.....	166
3	Do.....	93
4	Do.....	43
		895
5	From Havre de Grace to Northeast River.....	9
31	From Northeast River to Havre de Grace.....	13
June 5	From Havre de Grace to Baltimore.....	42
7	From Baltimore to Washington.....	198
8	Do.....	68
		176
14	From Washington to Cherrystone.....	107
15	Do.....	60
		167
29	From Cherrystone to Washington.....	93
30	Do.....	53
		146
July 7	From Washington to Wood's Holl.....	90
8	Do.....	177
9	Do.....	192
10	Do.....	68
11	Do.....	60
12	Do.....	50
		637
15	Dredging trip.....	86
16	Do.....	138
17	Do.....	56
20	Do.....	32
29	From Wood's Holl to New Bedford.....	14
30	From New Bedford to Wood's Holl.....	14
Aug. 3	Dredging trip.....	62
4	Do.....	124
5	Do.....	75
8	Do.....	62
9	Do.....	116
10	Do.....	50
13	Do.....	27
22	Do.....	66
23	Do.....	103
24	Do.....	62
25	Do.....	28
29	Do.....	22
30	Do.....	112
31	From Wood's Holl to New Bedford.....	14
Sept. 1	From New Bedford to Wood's Holl.....	14
2	From wharf at Wood's Holl to anchorage.....	1
3	From anchorage to wharf at Wood's Holl.....	1
7	Dredging trip.....	93
8	Do.....	119
9	Do.....	37
13	Do.....	67
14	Do.....	111
15	Do.....	78
17	From anchorage to wharf.....	1
20	Dredging trip.....	67
21	Do.....	141
22	Do.....	14
30	From Wood's Holl to New Bedford.....	14
Oct. 1	From New Bedford to Wood's Holl.....	14
4	From Wood's Holl to New Bedford.....	14
6	From New Bedford to Bristol, R. I.....	52
7	From Bristol, R. I., to New Haven.....	93
8	From New Haven to New York.....	42
9	From New York to Washington, D. C.....	96
10	From New York to Washington (dredging trip).....	100
11	From New York to Washington.....	168
12	Do.....	109
17	From Washington to Yorktown.....	88
18	Do.....	74
		162
20	From Yorktown to Washington.....	57
21	Do.....	89
		146
24	From Navy-yard, Washington, to Sixth street coal wharf.....	2
25	From Sixth street coal wharf to Navy-yard, Washington.....	2
	Total distance run.....	5, 029½