

## XVII.—THE EXPERIMENT OF TRANSPORTING TURBOT AND SOLES FROM ENGLAND TO AMERICA.

BY FRED MATHER.

When I left New York, October 13, 1877, for Germany, with salmon-eggs, an account of which has been rendered, I also carried orders to return by way of England and make the experiment of transporting Turbot and Soles for stocking the waters of Massachusetts Bay. I was provided with a letter to Mr. Thomas J. Moore, curator of the Museum at Liverpool, who had kindly offered to assist in the enterprise, and furnish such facilities for keeping the fish until ready as the capacity of the salt-water aquaria of the Museum would permit. I had also a letter from Mr. J. G. Kidder, of Boston, to Messrs. W. Cunard & Co., London, reminding them of their generous offer made two years previously to Messrs. Baring Bros., of free transportation to an agent of the United States Fishery Commission, together with the tanks of fish. I had, through the liberality of Oelrichs & Co., New York, the same privilege, should I wish to return via Southampton and New York, but as the fish were destined for the vicinity of Boston, it was deemed advisable to return by the Cunard Line from Liverpool.

Arriving at Southampton on the evening of November 12, I spent four days attending to some personal matters, and started for Liverpool on the morning of the 17th, where I arrived at 2 p. m., and reported to Mr. Moore, who, having considered his own tanks inadequate both in size and circulation to support so many animals in addition to the regular occupants, had arranged with the Great Aquarium at Southport for the storing of the fish, and decided on this point as possibly the easiest to collect from at this season. The next day being Sunday, we postponed our trip to Southport, a fashionable watering-place, twenty miles north, until Monday.

*November 19.*—I went to the office of D. & C. McIver, agents, Cunard Line, Liverpool, and presented the letter from Mr. Kidder, and was referred to Mr. Cunard, London, who replied that he would be pleased to hear when the fish were ready. Mr. Moore and self left at noon for Southport, met Mr. John Long, curator of the aquarium, and saw the fine store-tanks in the "naturalists' room"; they are of slate, 8 by 12 feet, and 3 feet deep, with a plentiful flow of water and a subdued light; here new specimens are acclimated before placing in the show-tanks. Mr. Long thinks that we may get what we wish, and sent for a fisherman, Thomas Ball, to meet me in the morning.

November 20.—I met Ball. He catches shrimps for feeding the aquarium fish and for market; gets small soles in quantity from 3 to 4 inches long; seldom gets large, marketable fish, except in summer; he agrees to catch me 100 small soles for 30 shillings. Too stormy to fish to-day, so I try and get some information about these fish, of whose habits I know nothing.

I am told that it is of no use to try for large soles with the men who fish for market, as at this time of year they go far out and stay from three days to a week, using heavy trawls that require an hour or more to raise; hence they leave them down for nearly a whole tide, and when raised the fish are mostly dead. In the summer soles are found near the shore and in the mouths of rivers, but at the approach of cold weather, or during storms, they seek deeper waters. Fishermen say that the shifting sand near shore in stormy weather gets in their gills, which they do not like, although they often bury the greater part of their bodies in sand or shingle in quiet water. Ball fishes with what is called a "shank" net, something like a beam-trawl, but smaller, and dragged somewhat faster over the sand and weeds for shrimp. Still blowing too hard to fish. Heard of a "Lemon Sole" in market; went to see it, and found that it was not Günther's fish of that name, *Solea aurantiaca*, but a species of Flounder, *Pleuronectes microcephalus*, also called "Lemon dab" and "Smooth dab"; it is sold much cheaper than the sole, and in great quantity. Stormy weather continued with more or less violence until November 29.

November 29.—Ball fished; got eleven small soles, which he says are not the true variety, but a kind that grows no larger. Mr. Long disputes this, and I incline to accept his opinion, as based upon a scientific acquaintance with British fishes. To make sure, however, and provide against all chances of error, I procured Couch's illustrated work on "British fishes," and Günther's "Catalogue of fishes of the British Museum," and found by presence of pectoral fin on lower or white side, and other characters, that Mr. Long was correct, and that the specimens were neither the "Little Sole" or "Solonette," *Solea minuta*, Gthr., which is common in Cornwall and the west coast of England, and has its eyes near each other and jaws nearly equal with a projection of the lower instead of the upper jaw, as in *S. vulgaris*, and the nostrils very close in front of the right eye; nor the one known by the names of "Variegated Sole," "Thick back," "Bastard Sole," and "Red-backed Sole," *S. variegata*, Gthr., which seldom grows over 8 or 9 inches in length, and is not esteemed for the table; this species is characterized by having its lower eye smaller and in advance of the other. These and *S. aurantiaca*, referred to above, which has no pectoral fin on the blind side, being all that I had to beware of, made it certain that I would not mistake an allied form for the right one *S. vulgaris*; and although I proved the fisherman's notion false, it had the good effect of putting me on guard in collecting fish with which I was unfamiliar, and thus teaching me that there was danger

of getting a wrong and insignificant fish in waters where, finding but one species in market, I was previously unaware of their existence.

*November 30.*—Eleven of the soles procured yesterday were dead this morning; many of them show red blotches on the white side as if blood was congested there from injuries; put them in spirit for the Smithsonian Institution. High wind and rain; no fishing.

*December 1.*—At suggestion of Mr. C. L. Jackson, consulting naturalist of the aquarium, I hired a boat and two men, and we went out to fish one tide with a beam-trawl. Result: five small soles and a great quantity of flounders from 1 to 3 inches long. The fishermen now say it is too late in the season for soles, and regret that I did not arrive a fortnight earlier. This is the usual consolation for collectors everywhere.

*December 3.*—Fleetwood, still farther up the coast, is a famous place for soles. Went there; same story—"too late." Dropped a line to a fisherman at Bangor, Wales, to know if any were to be had below Liverpool.

*December 6.* Weather has been good and the men have fished, but caught no soles. A letter from Bangor gives no hope. The five caught on the 1st, and the two on hand, are dead, and it looks like a hopeless task to get enough for a trial; for if they will not live a week in the aquarium they certainly will not on the ship, and I had reluctantly made up my mind to return without them, when Mr. Long offered me his nearly full grown ones from the show-tanks where he had fed them to their present size from yearlings of 3 inches, and of which he had between twenty and thirty specimens.

*December 7.*—Wrote Mr. Cunard that the fish would be ready to go at his earliest convenience. The men caught twenty small soles to-day, but all died before getting them ashore; they say that soles will die in a can if there is a frost, no matter what the temperature of the water inside may be. This is surely untrue; possibly they may not stand a certain degree, but the men evidently do not know the dying point. Mr. Long states the extremes of temperature at Southport pier as 45° and 68°. Thought it well to know how they would stand water without circulation, and so I put a sole 6 inches long in a gallon of water at noon, and looked at it every half hour; at 9 p. m. it seemed as fresh as ever, and I thought if it would live nine hours in a gallon, it might live twelve as well, and changed the water, measuring it with a half-pint glass; woke up in the night and suddenly remembered that I had only put in twelve half-pints instead of sixteen; fish alive at 9 a. m., apparently ignorant of my blunder, and lived until 9 p. m., twenty-four hours, when I considered that it had undergone trial enough, and replaced it in the tank alive and well. In this experiment it is fair to state that, being placed in the bottom of an oval can 2 feet by 1 wide, with one end slightly raised, there was a comparatively great amount of surface exposed, and the oxygenation consequently better than is usual in a transportation can. There is a Cunard

ship advertised to leave for Boston every Thursday; am in hopes to go on the next one, which leaves on the 13th.

*December 8.*—Mr. Long has offered to lend me two heavy galvanized iron cans, each 4 feet 3 inches long by 2 feet 6 inches wide and 2 feet high; these are elliptical in shape, with a top piece 6 inches wide riveted on all around, with a flange an inch wide dropping from it, into which the cover fits. These cans may be returned by next steamer; or, if there is a prospect of returning for more fish in the spring or early summer, they may be stored until then.

*December 10.*—Men at 9 p. m. reported thirty-five small soles in the boat, but could not be reached until daylight; gave a man a shilling to bring them early in the morning.

*December 11.*—The fish reported yesterday were all dead this morning; it has been cold, but no frost; begin to think that these small soles do not stand the rough handling or bruising of the trawl; this is partly confirmed by Mr. Long, who says that half or more of those caught in summer die.

*December 13.*—Day for ship to sail, but no letter from Mr. Cunard.

*December 15.*—Wrote again, asking if it would be possible to leave in the next ship, leaving on the 20th.

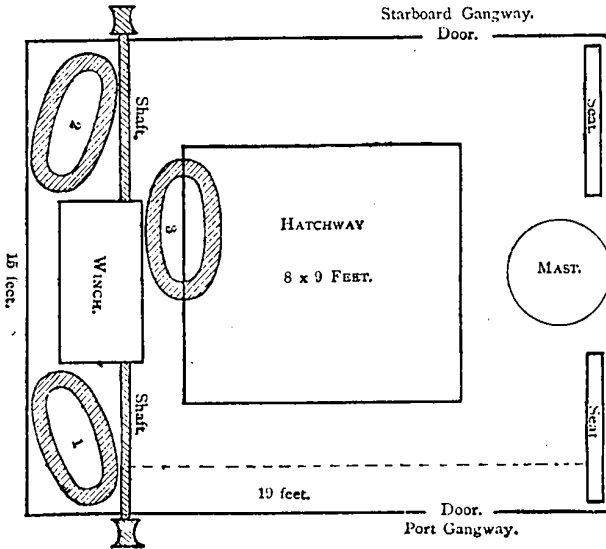
*December 18.*—Letters from Mr. Cunard and Messrs. McIver, both saying that there will be no ship of their line leaving for Boston before January 3.

Mr. Jackson suggested also taking a few turbot for trial, to learn how they would bear transportation, and thought that the sand which I had been advised to put in the cans might in a heavy sea have its lighter particles in such constant motion as to interfere with their gills, and that it would be better to substitute shingle. Mr. Long also approved of this, and it looked quite reasonable to me then, and so that was decided upon.

*January 2, 1878.*—Went to Liverpool and procured my ticket, and called on Mr. Moore. It was decided to get on board at the dock, which the ship left at 9 a. m., the passengers leaving the landing by a tender at 10. To do this the fish must leave Southport at 7, and stop at Bank-hall, a suburb of Liverpool, Mr. Moore very kindly promising to have a conveyance and two men in readiness at the station, where there was a flight of thirty-six steps to carry the cans up and required six men, but which saved about three miles cartage. Telegraphed Mr. Long that the fish should be caught to-night. On arrival at the aquarium, found the fish had been taken from the show-tanks and placed in the store-tanks.

*January 3.*—The fish were put up and the programme fully carried out. In one tank were six turbot, each 11 inches long by 8 broad, and three soles; the other contained twenty-three soles, the smallest 9 inches in length, and the largest 12½ by 6 broad, each can having a quantity of gravel in the bottom. In carrying up the steps the gravel all got in one end, and I feared for the fish. The ship was the *Siberia*, Captain McKay;

of the Parthia, temporarily in command, and we hauled into the river, took on passengers, and sailed at 11 a. m. The cans were in a place called by the sailors the "fiddler," nearly amidships on the main deck. The upper deck does not cover the whole width of the vessel at this point, hence doors open from the "fiddler" on an uncovered gangway, from which plenty of fresh air can be had. A hatchway occupied the middle of this room, and a steam-winch for hoisting freight, one end; the floor was covered with a wooden grating, so that any quantity of water could be spilled and run down and out of the scuppers. It was used by cabin passengers as a smoking-room. The accompanying diagram will show the arrangement and assist my explanations.



1. Can with 6 turbot and 3 soles.
  2. Can with 23 soles.
  3. Second position of No. 1.
- Dotted line, hidden steam-pipe.

The cans were securely fixed back of the winch-shaft in the places marked 1 and 2, No. 1 containing the turbot, two of which were dead at midnight.

*January 4.*—Two more turbot and one sole dead this morning. Water in No. 1 has got hot; on examination I find the steam-pipe that heats the cabins runs under the grating in the course marked by the dotted line, and of which I was not aware; the water being  $72^{\circ}$ , or  $22^{\circ}$  higher than at 8 a. m. Had it removed on the hatch and lashed to the winch in place marked 3. My arrangement was that I attended to them and aerated the water every three hours from 8 a. m. until midnight; the sailors washed decks at 4 a. m.; then the boatswain put the hose in the cans for a few minutes, and I was up between 7 and 8 again, so that they were never more than four hours without attention. There were now four of the six turbot dead, and one on its back; cooled the water gradually and changed it; turbot turned right side up.

January 5.—Turbot that was weak is dead.

January 6.—Found a sole out of the can on the grating—sailors let the water on too strong; the fish being alive was put back. Sailors promise more care; spoke to them about temperature, cautioning not to use hose if the water was cold, no danger, however, until near the banks of Newfoundland.

January 7.—All looking nicely; men washed another fish out at 6 p. m.; find it is another set of men in kindness giving the fish an extra change.

January 11.—This morning found the last turbot and fifteen soles dead; the water at midnight was 42°; this morning at 7.30 it is 46°. The men say that they were all right at 4 when they changed the water; it has been very cold during the night; perhaps the fish were killed by a sudden change of warm water at about 58°, but which had cooled down before my arising. Emptied one tank, put it over the steam-pipe, threw out the gravel which had bruised some of the fish, and put the remaining six soles into it.

January 12.—On the banks; very cold; three of the soles dead and one missing; the two remaining ones were brought through alive without change of water from this until the 16th.

January 16.—Cape Cod light visible; took the two soles out in a bucket to get the temperature down from 58° at 6 a. m.; at 7 they are at 44°. On consultation with the captain as to the best place for deposit, there not being enough to warrant employing a boat to go out from Boston, he recommended "Stelwagen bank," some two or three miles off Nahant, a sandy bank separated from a rocky shore by blue mud. At 8.30 we reached this place, and I lowered the bucket near the surface and emptied it by a cord attached to the bottom. This was in 18 fathoms of water, the surface temperature of which was 31°, while that in the bucket was 36°; had no means of getting the bottom temperature.

The temperatures during the trip were as follows, that of the air being in the room and bore very little relation to that outside:

| Date.  | Air in room. |    |         |          | Water in cans. |    |         |          | Remarks.  |
|--------|--------------|----|---------|----------|----------------|----|---------|----------|---|
|        | 6 a. m.      | M. | 6 p. m. | 12 p. m. | 6 a. m.        | M. | 6 p. m. | 12 p. m. |   |
| Jan. 3 | 49           | 54 | 52      | 50       | 50             | 50 | 50      | 52       | Water in No. 1 at 11 a. m., 72°, from steam pipe; four turbot dead.<br>One turbot dead; weather beautiful.<br>But little motion to ship.<br><br>Rolling heavily; can hear the gravel in cans.<br>Cold; snow; quieter.<br>Last turbot and fifteen soles dead.<br>Only two soles left; ship rolling.<br>No water added from yesterday during remainder of trip.<br>Calm and warm.<br>Colder and rough.<br>Planted two soles at 8.30 a. m. |
| 4      | 52           | 58 | 55      | 58       | 51             | 54 | 56      | 55       |   |
| 5      | 62           | 62 | 59      | 60       | 56             | 55 | 56      | 55       |   |
| 6      | 62           | 59 | 60      | 60       | 55             | 53 | 54      | 54       |   |
| 7      | 63           | 64 | 63      | 65       | 56             | 56 | 57      | 57       |   |
| 8      | 58           | 57 | 50      | 53       | 58             | 58 | 55      | 56       |   |
| 9      | 47           | 47 | 46      | 46       | 54             | 51 | 50      | 52       |   |
| 10     | 51           | 48 | 44      | 46       | 55             | 50 | 46      | 45       |   |
| 11     | 40           | 43 | 44      | 43       | 46             | 48 | 53      | 55       |   |
| 12     | 41           | 45 | 50      | 46       | 60             | 62 | 62      | 62       |   |
| 13     | 55           | 60 | 60      | 59       | 62             | 62 | 60      | 61       |   |
| 14     | 58           | 54 | 54      | 55       | 62             | 60 | 61      | 62       |   |
| 15     | 50           | 51 | 51      | 50       | 62             | 62 | 61      | 60       |   |
| 16     | 40           |    |         |          | 58             |    |         |          |   |

I have not the least doubt, from the appearance of the fish, but what all the deaths that occurred before the 15th were from bruises occasioned by the shingle, as, besides the congested appearance mentioned, one of the turbot had the lower opercle torn and the gill injured. I would not use any substance for them to bed in, notwithstanding they love to bury themselves. I think that there is little danger of a sole being injured by friction on the bottom, for they can stick fast there or on the sides at pleasure. I have even seen them in the aquarium holding to the glass. Do not remember seeing turbot do this, but think that possibly they can hold to the bottom as other flat fish do. I noticed that neither of these fish have ribs protecting the abdominal cavity, which is particularly exposed to injury. The majority of them dying on the morning of the 11th, between the change of water at 4, and my arrival at 8, at once shows something wrong in the water. The two soles that were in the can with the turbot were well on the fatal morning, and might not have had a change; the men were contradictory on this point; were put with the others that survived, making six, all of which died except two, but their identity was lost, and I cannot say if they were the survivors.

However, the fact of getting two across safely proves that soles, and perhaps turbot, can be brought over under more favorable circumstances, though I cannot conceive of a better ship than the *Siberia* for fish transportation, and Captain McKay considers the *Parthia* as good.

I regard the season as not only bad for transportation, but also for planting, as the fish being turned loose in midwinter had no chance to gradually work into warmer water, which is at greater distance from Boston than any part of England, and the sole swims slowly and apparently laboriously. I have only seen them in aquaria where they are usually on the bottom and occasionally start with a leech-like motion for a short distance and settle down again, not seeming to possess the power of elevating their heads and darting as the flounder does. On the arrival of the tugboat I received a letter of introduction to Mr. C. B. Simmons, collector of customs for the port of Boston, who had so kindly offered to Professor Baird the use of the revenue-cutter to deposit the fish, should they arrive; this I, of course, did not use. The letter of instructions, also received at the same time, directed the fish to be planted "at some point off Nahant," and it is worthy of note that this locality was selected some two hours before getting the letter. I would much prefer soles that had been fed in captivity a month, to any recently captured, if the attempt was again made.

