THE FISHERIES OF THE UNITED STATES.

BY H. C. HOVEY.

There is a constantly increasing demand for the products of our lakes, rivers, and seas; but the supply is liable to serious fluctuations. Vast sums have been profitably expended in developing the agricultural and mining resources of civilized lands, while the most frequented waters are but partially rescued from their natural wildness. No wolves nor panthers frequent the woods of Long Island, but sharks and other marine monsters swim up to our very wharves. All is an unclaimed waste of waters beyond the narrow hem, three miles wide, bordering our coast. Until recently legislation has followed the old saying of Blackstone that "fish fall under the general law as to animals *feræ naturæ*."

Experiments in fish culture were made on a small scale in Europe during the last century; and there are traditions of similar attempts by the ancients. But the first large establishment was made in 1851, by the French Government at Hüningen, on the Rhine, covering 80 acres, whence millions of eggs and young fish have been distributed through the waters of Europe, and even of the United States.

The first fish farm in this country was located by Dr. Garlick, near Cleveland, Ohio, in 1853. Practical fish culture among us does not, however, date further back than fifteen years. But since then its importance has rapidly gained recognition. Our law makers begin to see that fisheries, instead of being a series of sports and ventures, are an arm of national industry; and science, which has befriended every other calling, no longer leaves fishermen to trust to luck, but is trying as far as possible to eliminate the elements of chance and danger from their proverbially hazardous vocation. The warfare long waged against the finny tribe, reckless as that by which game has been driven from forest and prairie, is coming to an end. Indeed it has helped to work its own cure by creating widespread alarm lest one of our most valuable sources of wealth should fail.

The Connecticut River, originally abounding in shad and salmon, ceased to be visited by the latter forty years ago, and became greatly limited in its supply of the former. So likewise with the rivers of Maine and other seaboard States. Dams were continually built across important streams without the fishways required by law, thus preventing anadromous species from obeying the instinct leading them to their proper spawning grounds. Thus also were many small varieties destroyed or driven away on which larger and valuable ones feed. Besides this, methods began to be adopted by eager fishermen that would take larger catches than could be made by hook and line or simple nets. Incursions of blue fish were also found to chase from our waters the codfish, and perhaps other kinds.

From a careful diagram of the mackerel catch of Massachusetts it appears to have grown steadily from 7,000 barrels in 1804, to 385,000 barrels in 1831. In the next ten years it declined to 50,000. The scale has since been fluctuating, being for this year about 150,000. This account is only of salt mackerel, and is not appreciably affected by the use of pounds, weirs, and traps, all caught thus not exceeding 5,000 barrels yearly, most of which are consumed fresh. The number of barrels used in this way, in 1876, was for the whole United States but 27,000. Evidently causes different from mere methods of capture must account for the partial disappearance of mackerel, and much is yet to be learned as to this valuable but singular fish, upon whose migratory movements so many depend for a living. In early spring they strike the coast of Virginia, moving northward in immense schools, visiting successively Cape May, Sandy Hook, Block Island, Cape Cod, and various points as far as Labrador. Captain N. E. Atwood is my authority on these points, who, in illustration of the vicissitudes of mackerel fishing, states that with help of a boy he has caught in one night off Cape Cod 2,050 fish, and the next night 3,520; but on another trip he fished all the way from the Grand Bank to the Azores and caught only one mackerel!

The trout farms of Seth Green and many others having proved the feasibility of fish raising, the process was extended to the salmon, shad, whitefish of the lakes, the bass, codfish, and other varieties. Curious results have rewarded attempts to cross the salmon with the trout, and the shad with the elegant striped bass. Interest has been awakened in pisciculture from Maine to California. So perfect have become the methods of hatching that in some of the largest trouteries it is claimed that the loss is only about two per cent. Streams barren of fish are beginning to be well stocked again. It is estimated that during the last eight years our rivers have been replenished artificially by 48,000,000 young fish; and this falls far short of the actual increase by this means Many private ponds and streams have also been stocked, until it is the boast of New York (and perhaps other States could say the same) that every stream within its limits has been more or less benefited by either private, State, or national culture of the fish best adapted to its waters.

In thirty-three States of the Union fish commissioners have been appointed, whose duties have varied according to the condition and needs of the region where they serve. Besides local clubs and societies, several strong associations have been formed, the most noteworthy perhaps being the "American Fish Culturists' Association" and the "Central Fish Culture Society." The latter is recently organized, and held a spirited meeting this fall in Chicago, attended by the leading pisciculturists of the West. These bodies have done much good in several different ways. They have stimulated scientific research, arrested some of the destructive methods of fishing by which the noble lakes and network of rivers were fast being depopulated, and called public attention to other abuses that still defy restraint. The obstacles put in the way of these reforms by selfish or ignorant persons have been so many, however, that the prevailing opinion seems now to favor the cultivation of fish so rapidly and on so large a scale as to counterbalance illegal arts and exhaustive methods. Still it is a trial to one who is at considerable expense to hatch out a few hundred thousand eggs and plant them in lakes and streams for public good, to learn, as one fish culturist did this year, that from a single market in his town fish in spawn had been sold for food that would, if left in their element, have laid 5,000,000 eggs free of cost to anybody! Certainly the legislatures of the several States owe it to the people that salutary fish laws should be passed; and then the people should see that they are enforced.

In the spring of 1871, by an act of Congress for the protection and propagation of food fishes, both along the sea coast and in inland waters, Hon. Spencer F. Baird, of the Smithsonian Institution, was appointed U. S. Fish Commissioner. He was to serve without salary, but to receive aid from the different departments of government, as might be required, in making his investigations. Eminent specialists at once volunteered their services. The various persons and agencies already at work were brought into co-operation. Correspondence with foreign commissions of a similar nature was begun. Leaving to the State commissions the propagation of fish local in their habits, such as the trout, black bass, perch, etc., the principal inland work of the U. S. Commission has been with varieties of the salmon, the shad, and to some extent the whitefish of the lakes. Inter-State relations have been harmonized as to operations on rivers, like the Connecticut, running through adjacent States. Facilities, and to some extent funds, have been furnished by the States and localities most benefited. But, like many another agency working *pro bono publico*, there has been an immense amount of gratuitous work done by the Fish Commission and its allies.

The most systematic and fruitful research has been on the sea coast from Saybrook, Conn., to the Bay of Fundy, including the Nova Scotian coasts. Each department has had a special agent in charge of it; *e. g.*, inquiries concerning the invertebrates have been conducted by Professor A. E. Verrill, of Yale College, and the vertebrates have been looked after by Professor G. B. Goode, who is also charged with preparing data for the forthcoming census of 1880. The U. S. steamer Speedwell has been used by the commission in deep sea dredging, which requires peculiar and strong appliances. Beside several smaller dredges, a huge trawl is used, the mouth of which is 17 feet across, with a net 50 feet long. This is dragged by steam power along the bottom of the sea, sometimes at a great depth, and then drawn up with its accumulation of marine treasures. During one haul, which the writer witnessed, over 5,000 specimens were taken of the astrophiton, or basket star fish, each of which has 82,000 arms!

Much that is new to science is thus obtained. Specimens, dried or preserved in alcohol, are kept of all objects of interest. The specimens of food fish are sent to Washington, and the rest to the Peabody Museum for classification and labeling Fifty sets are made of all objects of scientific interest. The first choice belongs to the National Museum at Washington, the second to the Peabody Museum at New Haven, the third to the Cambridge Museum at Boston. The remaining sets go to institutions of learning in this country and to foreign scientific bodies.

The menhaden fishery has received especial attention from Professor Goode, whose paper on that subject was one of the most valuable laid before the American Association for Advancement of Science at their last annual meeting. This fish has at least thirty different names, and the utmost confusion has existed as to its habits and uses. In New Jersey it is canned and sold as "sardines," while in Connecticut it is called "whitefish," and is used for manure. In Maine and elsewhere it is valued for its oil, which is yielded at the rate of four or five gallons per barrel of fish. Much of the olive oil is really from this source, as is also a large share of the linseed oil now in market. In order of commercial value the menhaden ranks fourth in importance The American cod fishery in 1876 was estimated at $4,826,000; the whale fishery, $2,850,000; the mackerel, $2,275,000; and in 1879 the menhaden, $1,658,000. The entire number of menhaden caught by man is nearly one billion annually, and at least as many more fall a prey to the rapacity of other fish.

More difficulties have been found in the way of hatching marine fish than fresh water varieties, yet a fair measure of success has rewarded persevering effort. The hatching house at Gloucester produced last year about 12,000,000 young codfish, with which the water teems this year.

Many new species of scientific interest have been discovered by the persons connected with the commission, among which are several valuable food fishes. The tile fish (*Lopholatilis chamæleonticeps*) is a new genus and species marked by a narrow crest. It weighs from ten to ninety pounds. Split and dried it resembles codfish, and has thus already gone into consumption. Another, new to our waters, is the pole flounder (*Glyptocephalus cynoglossus*), somewhat like the turbot in flavor, but having its eyes on the right side instead of the left, as the true turbot has them located. This fish is esteemed a luxury in the New York market, and readily sells for 50 cents a pound.

The commission has just fairly begun to investigate the oyster trade, which will be attended to by Mr. T. B. Ferguson, who has made the edible bivalves his especial study. One begins to realize the magnitude of this business on being told that in Maryland its commercial value actually vies with the iron trade.

Thus far the Fish Commission has depended chiefly on vessels that could be spared from the U. S. Navy for its use. But now a steamer of 400 tons, yet of light draught, and made after special designs, is being built at Wilmington, Del. It will be called the Fish-hawk, and is intended for stocking the Southern rivers with shad and salmon, and then, as the season grows warmer, sailing toward the Northern waters.

The appropriations thus far made by the United States have been meager compared with those made for a similar purpose by the Canadian Government. Hence came the Halifax award, by which we lost directly $5,500,000 and indirectly $2,500,000 more. It cost us $8,000,000 to go empty handed to meet Canadians who had a preponderance of information. It will not be so again, for the present investigation will arm us with facts whereby to cancel, as early perhaps as 1883, the unfair arrangement now existing.

Professor Baird justly claims that for solving all the problems before him a marine survey is called for, as exhaustive as the territorial surveys for which such liberal sums have been granted. The food fishes cannot be protected and propagated without an accurate knowledge of their feeding grounds, their associates, their enemies, and their diseases. Think of it, that it is not yet known where the mackerel, menhaden, and other "cold absentees" spend the winter months! A vast field remains to be explored. An effort is being made, by request of the Superintendent of the Census of 1880, to compile all accessible facts as to the United States fisheries. The commission now has in its possession 30,000 pages of manuscript, and the circulars sent out to all fishing towns and leading fishermen are daily bringing answers, increasing this mass of material. The plan of inquiry includes every conceivable line of research, and the final results must be of the utmost interest and practical value.

Waste.

There must be, of necessity, a percentage of loss in all the material transactions of every-day life, whether these be carried on in the workshop, the counting-room, the kitchen, or the laboratory; but this inevitable waste can be so far reduced by good management that it amounts to but little in the course of a year. Observation has convinced us that the loss in large workshops must be considerable, for in a great majority of cases we have seen materials lying about under foot—bolts, nuts, washers, kicking around in the mud out in the yard, new work exposed to injury from the elements, tools misplaced, essential articles, or tools necessary to the perfection of certain parts of the work, at great distances from each other, and an infinite number of abuses which, although small of themselves, when summed up, make a grand total loss at the end of the year. As the thirty-second part of an inch too little on one piece of a steam engine, a sixty-fourth on another, and as much on still another will result in great derangement of the functions of the machine, so infinitesimal waste, continually occurring, is the representative of hundreds of dollars for which there has been no return. No matter what the nature of the trade or manufacture, it is very certain that a material reduction of the expenses of every department can be made by careful attention to the minor matters, and these remarks are made with the hope that all interested will give them attention.

The Philosophy of Blowing Out a Candle.

If we blow a fire it burns more fiercely, but if we blow a candle it goes out. These two facts taken together are a familiar illustration of the influence of temperature upon chemical affinity. In both cases, that of the fire and that of the candle, the burning is the combining of carbon and hydrogen with oxygen. Now cold carbon or hydrogen may lie in contact with oxygen for any length of time without combining with either, but if the substances are made red hot they instantly enter into chemical combination. When a candle is burning, the heat generated by the combustion constantly raises new quantities of the material to the temperature at which combination with oxygen will take place, and thus the combustion is kept up. But if a current of air of a temperature far below the combustion point is thrown against the flame, the hot vapors are swept away, and others which are rising in their place are so cooled that combination with oxygen no longer continues; in other words, the candle ceases to burn.

On the other hand, when we blow a large fire, the mass of burning combustion is so great, that instead of the carbon and hydrogen being cooled, the oxygen is heated, and the combination is made more active; in other words, the fire burns more fiercely.

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