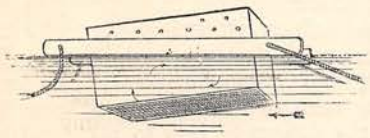
PROGRESS IN FISH-CULTURE.

ATKINS'S METHOD OF PENNING SALMON.

FEW persons not specially interested in fish-culture are aware of the rapid advance made in the last ten years. It seems but a short time ago when fish-culture was regarded merely as a curious discovery, or, at best, a plaything for people of means to amuse themselves with; and from the time of its discovery by the German, Jacoby in 1741, and the publication of the fact in France in 1770, and in England eight years later, down to the middle of the present century, little or nothing had been done in a practical way, although John Shaw, of England, began hatching a few salmon in 1837. Even the successful rearing of brook-trout in America by Dr. Theodatus Garlick and his partner, Professor Ackley, in 1853, was not at that time regarded as having any bearing on the question of the food supply of the people. And the publication of a treatise on the subject by the former, in the proceedings of the Cleveland Academy of Natural Science, in the following year, failed to awaken interest in it in this country outside of scientific circles. Two years after Drs. Ackley and Garlick began their work they published an account of it, and thereupon the Rev. Dr. Bachman made the claim that he had hatched trout in Charleston in 1804. The governments of Belgium, Holland, and Russia began, in a small way, to cultivate fish about the year 1853. Public attention in America was first called to the subject, as one which promised to be of future benefit, by an act of the Massachusetts Legislature in 1856, appointing three commissioners to report such facts concerning the artificial propagation of fish as might tend to show the practicability and expediency of introducing the same into the Commonwealth, under the protection of law. Three years later, Stephen H. Ainsworth began trout-breeding in the State of New York, at West Bloomfield, Monroe County, and achieved a limited success with a scant supply of water.

With the creation by Congress of a Commission of Fisheries for the United States, in 1871, and the appointment of Professor Spencer F. Baird as Commissioner, fish-culture began to extend its usefulness; and from a means of growing a few brook-trout for the angler, or of increasing in a small way the food fishes of a few rivers, it has become a system of propagating both sea and fresh-water fishes, of introducing the best native and foreign species, and also of investigating the food and habits of those fishes which are inhabitants of our coasts during a part of the year only, and whose migrations and life history can be worked out by trained scientific observers alone. From the beginning of the

work on this extended scale dates the great improvement in apparatus, which has made

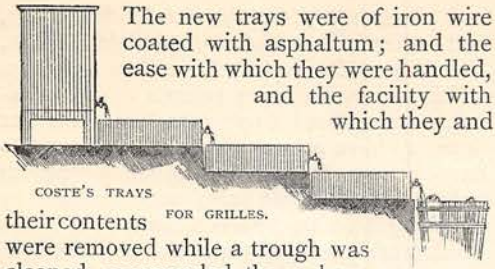


GREEN'S SHAD-BOX.

the past ten years a period of constant progress in methods and in knowledge, and which has stimulated the work, not only in America but throughout the civilized world, by the very complete manner in which the results have been accomplished and published. Previously, the introduction of salmon into Tasmania, from England, by Mr. Francis Francis, was the only attempt at sending the eggs of fishes long distances, while now each season sees millions of eggs of different species crossing the ocean.

The very important discovery was made by the Russian Vrasski that the best mode of fertilizing the eggs of the salmon family was by the dry method, or without the use of water at first; this was translated by Mr. G. S. Page some years after, and was found to have been also an original discovery of Mr. Atkins, of Maine, who had written of it previous to Mr. Page's translation. These, and the invention of Mr. Seth Green's floating shad-hatching box, were really all the important improvements or experiments made previous to the formation of the United States Fish Commission. Since that time the numerous labor-saving devices, the extensive operations undertaken, as well as the important discoveries made, have placed the United States far in advance in both the science and practice of fish-culture. There are but few States in the Union which have not their fishery commissioners, and the present methods enable one man to do the work that formerly required several persons. In the mode of obtaining salmon eggs, a great step in advance was made by Mr. Atkins, on the Penobscot, when, instead of depending on the accidental capture of salmon with ripe eggs, he found that he could keep the fish in pens, in fresh water, until their spawn ripened, and thus could obtain a hundredfold more than had been got before. At Bucksport, Maine, after the eggs are taken from the salmon, a metal tag with a number on it is attached to the posterior part of the first dorsal fin. A record is kept of the sex, length, and weight of each fish, and the date of its liberation, thereby showing what growth is made up to the time of its second capture. A reward is offered for the return of these tags accompanied by statements of the time and place of capture, the weight of the fish, and other information. A female salmon, liberated at Bucksport, November 10, 1875, which weighed sixteen pounds after spawning, was captured two years later, and was found to have grown a foot in length, and to have increased eight and a half pounds in weight. Mr. Buckland also marked salmon by punching holes in the second dorsal fin with a conductor's punch, but we have no records of their subsequent capture and rate of growth. Mr. Stone, also, corralled the salmon on the McCloud River, California, and thereby obtained enormous quantities of the eggs of the salmon of the Sacramento. Thus at Bucksport, Maine, and at Baird, Shasta County, California, the supply of salmon eggs on our eastern and western coasts was surprisingly increased. This increase naturally resulted in taxing the working force of these hatcheries beyond their capacity, which led to the discarding of the old system of hatching on gravel as too laborious, and as requiring too much work to keep the dead eggs from destroying the living ones. Then the Brackett trays came into use. Similar trays had been used before, but they were of glass grilles, easily broken, and expensive.

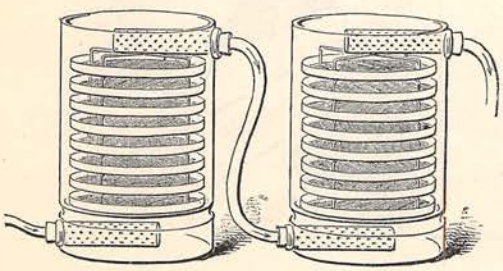
TAGGING SALMON.



COSTE'S TRAYS FOR GRILLES.

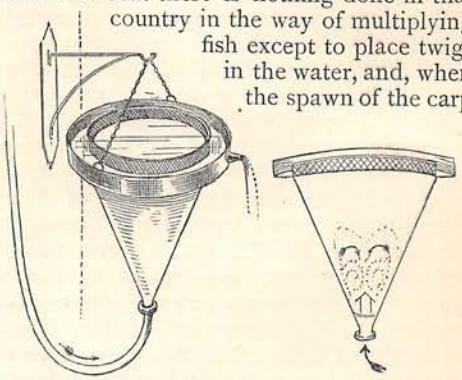
The new trays were of iron wire coated with asphaltum; and the ease with which they were handled, and the facility with which they and their contents were removed while a trough was cleaned, commended them above all other apparatus. For bringing forward eggs to the point where the eyes were visible, and the eggs ready for shipment, they were placed in the troughs, five or six trays on top of each other, and thus the capacity of the hatching-troughs was increased many times, and the labor much simplified. This has been the great object of American fish-culturists—to get the maximum of results with the minimum of labor, a most important thing in our country, and one which the fish-culturists of Europe, on account of the cheapness of labor there, do not strive for as we do.

Germany is far in advance of any other European country in the propagation of fishes, and is second only to the United States and Canada; but their apparatus is bulky, even when made after American models, and the fish-breeders of that country seem to care little about economizing either space or labor. France has done something, and so has England. The latter has been far behind without knowing it, and is now awakening to the fact. At a recent meeting to organize a national fish-cultural association, Lord Exeter plainly told the English fish-culturists that they were not up to the times; and this statement has been seconded by such able men as Mr. R. B. Marston and Mr. W. O. Chambers, who have been foremost in promoting the above-mentioned society. The late Mr. Frank Buckland was regarded as the fountain-head of all piscicultural knowledge in England, but he really made little progress in a matter affecting the people at large, and which had no public recognition. With the forming of the new association, and the clamor for governmental aid, it may safely be prophesied that England will soon take rank beside other nations in the art of cultivating the waters and of producing food from them. Hungary has an influential society for fish-culture. Sweden sustains a school wherein pupils are taught, and salmon culture is fostered by sending men to the different fisheries to instruct the fishermen how to take and hatch the eggs of their fish.



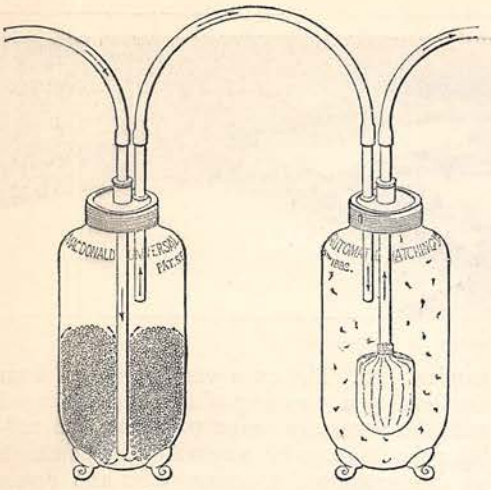
FERGUSON'S HATCHING-JARS.

The first hatching of fish in all countries, excepting China, was begun by propagating the brook trout, and in all cases the work was done on gravel until the invention of Coste's glass grilles and the improved system of wire trays, which rendered it possible to remove the eggs and clean the trough. China was said by missionaries and travelers, who knew nothing of fish-culture, to be far advanced in the art and to have practiced it for an indefinite number of years. Inquiry has shown that there is nothing done in that country in the way of multiplying fish except to place twigs in the water, and, when the spawn of the carp is found to be deposited upon them, to remove them to other waters and allow them to hatch. How long the Chinese have done this is not known, but they have never made any improvement upon it.



BELL AND MATHER SHAD-HATCHING CONE.

The difficulties that beset the fish-culturist in dealing with a fish whose breeding habits are unknown are many. His former experience is often of little value, because the eggs of different fishes usually require different treatment. The eggs of the salmon family, except those of the smelt, are comparatively large and considerably heavier than water; the eggs of the shad have little specific gravity and will sink in perfectly still water and die. The salmon eggs may lie in a trough and a strong current be passed over them, while under the same conditions the shad eggs would be washed down stream. The ova of the shad require a buoying current which forms an eddy, while the eggs of the smelt, herring, carp, and some other fishes are covered by a glutinous coating which adheres to twigs, stones, etc. Again, the eggs of the

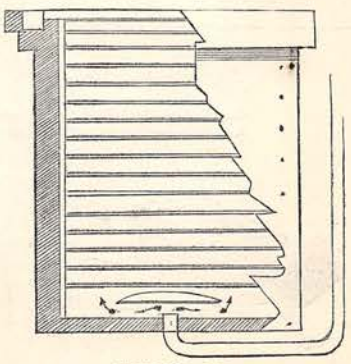


McDONALD JARS.

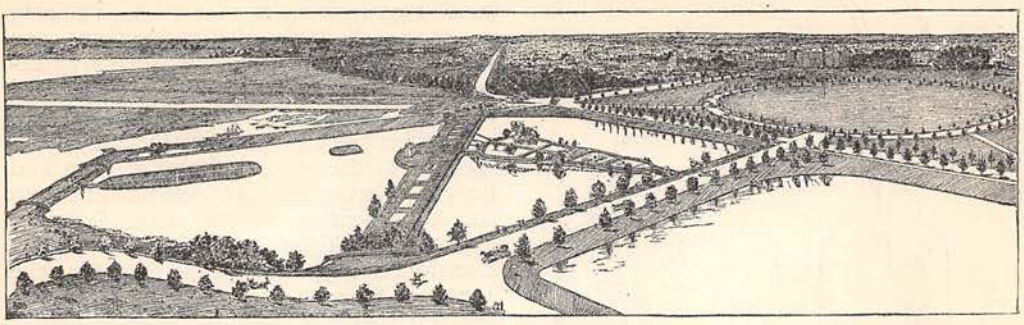
common yellow perch are in a ribbon-like mass which is hung over twigs but does not adhere to them, and the small egg of the cod-fish follows a slight current. These varying conditions have tasked the ingenuity of fish-culturists to devise means to develop the different eggs; and, with the exception of those of the cod, they have been successful with all. A perfect arrangement for the eggs of the cod has not yet been found, unless the new McDonald jar should prove to be the proper one. This apparatus, the latest fish-hatching device, will be referred to again. One of the first improvements on the old methods with which the public are familiar was the use of glass jars by Major T. B. Ferguson, then of the Maryland Commission, but now of the United States Fishery Commission; his jar allowed the different layers of eggs to be inspected without removal. The same gentleman also devised a system of plunging buckets, to be worked by machinery on an old scow, whereby shad eggs might be developed in waters where neither tide nor currents were available.

Another invention, in 1875, by the writer and his assistant, C. F. Bell, known as the Bell and Mather hatching cones, superseded the hatching of shad in floating boxes. The eggs were placed in a conical vessel, with the water entering from below and sustaining them in mass with a gentle motion. The Chase jar, for whitefish eggs, and its modification by Mr. Clark, in both of which the water is delivered at the bottom by a glass tube, followed, and in the hatching of whitefish eggs seemed perfection until McDonald improved upon it by sealing the jar and drawing out the dead eggs through a sliding tube let down through the stopper. This latest improvement is adapted to hatching the eggs of shad, whitefish, and perhaps cod; and these glass jars have, in most large hatcheries, superseded the earlier troughs and boxes of Williamson, Holton, Clark, Green, and others. Their simplicity, the perfect inspection of the eggs through the glass, and the great saving of labor, commend them to all. All these improvements are of American invention. To them we should add the McDonald fish-way, a device for permitting the ascent of fishes to upper waters, which permits of a steeper incline and more perfect checking of the down-flow than any other form of fish-ladder. These fish-ways are now in operation on the Rappahannock, Savannah, and Oswego rivers, and another will be built at the Great Falls of the Potomac. Thus we have a record showing that our specialists have been busy with their brains as well as with their hands.

From a meeting of a few trout-breeders in Albany, nearly twelve years ago, to arrange a tariff to regulate the sale of their products, has sprung the American Fish-cultural Association — a society which holds annual meetings and listens to papers from experts and scientists from all parts, and which numbers among its members the Crown Prince of Germany and many gentlemen from other lands. This association is only second in importance and influence to the powerful Deutsche Fischereiverein of Germany, which, under its President, the Hon. Herr von Behr, has organized societies for fish-culture in all parts of Germany, and has exchanged valuable species of food fishes with the United States. Within the past six years many kinds of adult fish and eggs have passed between this German society and the United States Commission of Fish and Fisheries. The Germans have thus received six species of American Salmonidæ, viz.: the eastern brook trout, the rainbow trout of California, the quinnat or California salmon,

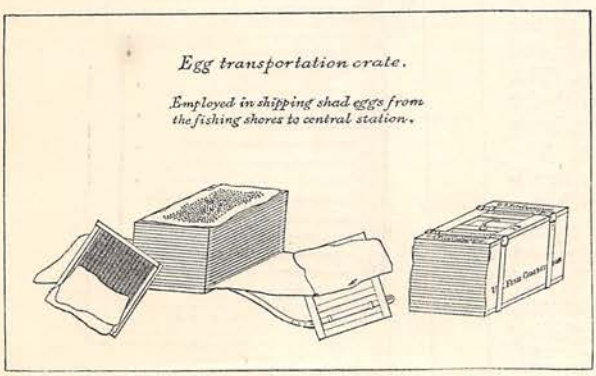


HOLTON'S BOX.



BIRD'S-EYE VIEW OF CARP-PONDS AT WASHINGTON.

the lake trout, the land-locked salmon of Maine, and the whitefish of the great lakes. They have also received our black bass. In return, Professor Baird has received the salbling, *Salmo salvelinus*, a large lake char which grows to a weight of fifteen to twenty pounds, and is as bright and beautiful as our brook trout; the common trout of Europe, *Salmo fario;* the gold-orfe or golden-ide, a fish bred for both ornament and the table; and the more useful carp, which has been bred in such numbers in the national carp ponds as to allow thousands of the young to be sent to the different States, and which will prove of incalculable value to those parts of the country which have no running streams, and consequently no good table fish. This exchange of the best things in each country has not been confined to Germany and America, although they have led in the matter of important exchanges of the greatest number of species and of specimens. Two years ago some South American gentlemen residing in Ecuador wished to introduce the German carp from America to the vicinity of Quito, and Professor Baird left the details of shipment to Mr. E. G. Blackford, of Fulton Market, who is also a member of the New York Fishery Commission. Cans were made to fit the backs of peons, or burden-bearers, who were to carry the fish over the mountains—a journey occupying a week or more under a tropical sun. The cans were protected from the heat by a covering of felt, and arranged with the necessary straps to enable the toiling peon to grope his way with his alpenstock up the wearisome mountain-paths and down the other side. The fish arrived safely, pauses having been frequently made to aërate the water by means of dippers; and they are reported as doing well in their new home. Last January, a lot of trout eggs and young carp, the former from the United States Fish Commission station at Northville, Michigan, in charge of Mr. Frank N. Clark, and the latter from Mr. Blackford's stock, were taken by Mr. Decerro to Bogotá, Colombia, also a mountainous journey, on the backs of men and mules; and, while the carp may thrive, it is doubtful if the trout will find there the necessary cool and congenial waters. In sending eggs to foreign countries, the writer has been intrusted with their repacking for the warm ocean voyage. A package has been devised wherein the eggs are surrounded by ice, which retards the development of the embryo and prevents premature hatching. Most of the eggs are received in living moss, which retains moisture and gives off oxygen. From this they are transferred to wooden frames with a bottom of canton flannel, and the frames are packed in a box of ice. The success of this mode has been such that the average loss in transportation has not been greater than if the eggs had remained in the hatching-troughs.

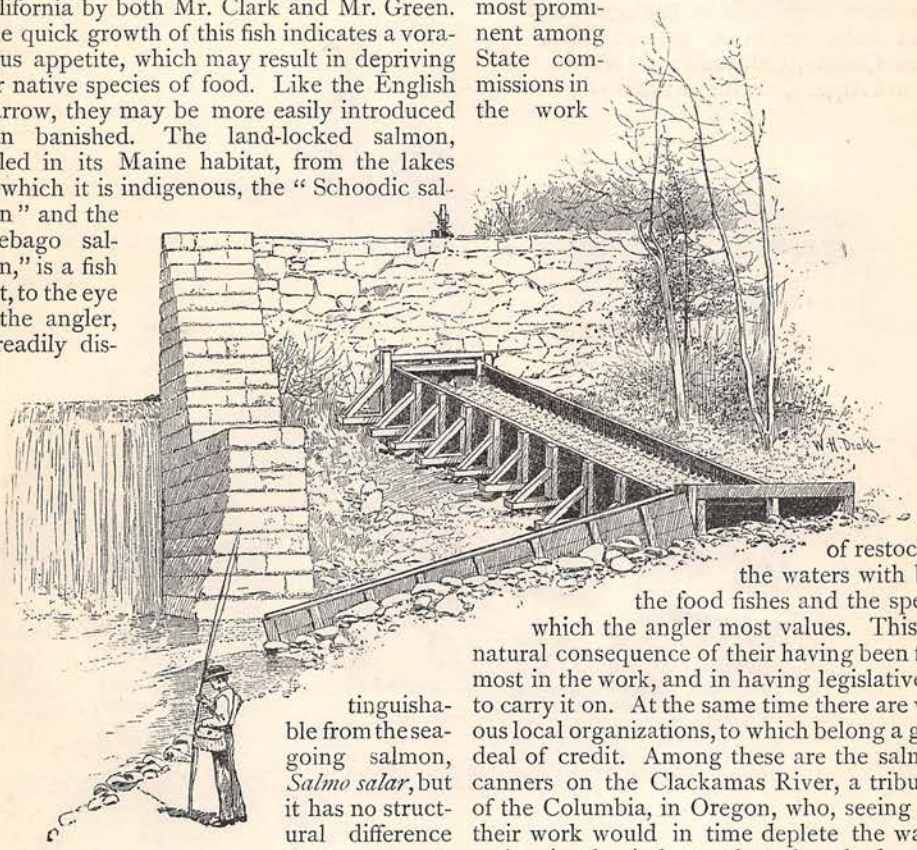


Egg transportation crate.

Employed in shipping shad eggs from the fishing shores to central station.

In the distribution of fishes within our own borders, the most notable events are: the introduction of shad into California, at different times, by Messrs. Green and Stone; the taking of eels, lobsters, and oysters to the same State by Mr. Stone; and the accidental stocking of the Elkhorn River, a tributary of the Missouri, with black bass and other fish, through the breaking of a bridge and the upsetting of a car in which Mr. Stone had an assortment of fishes destined for

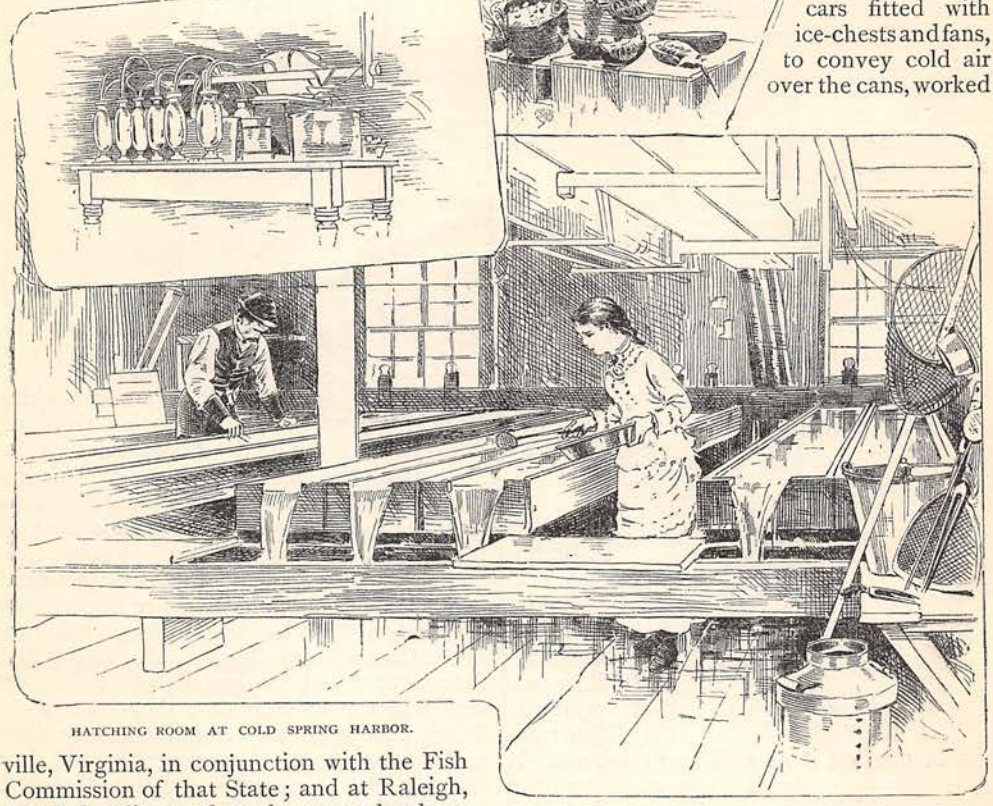
California. Eels have been planted by the Michigan Fish Commission in the great lakes above Niagara, with what result is not yet known; black bass have been introduced into eastern New York and the New England States, to which they are not native; and the rainbow trout has been brought east from California by both Mr. Clark and Mr. Green. The quick growth of this fish indicates a voracious appetite, which may result in depriving our native species of food. Like the English sparrow, they may be more easily introduced than banished. The land-locked salmon, called in its Maine habitat, from the lakes to which it is indigenous, the "Schoodic salmon" and the "Sebago salmon," is a fish that, to the eye of the angler, is readily distinguishable from the sea-going salmon, *Salmo salar*, but it has no structural difference that warrants the ichthyologist in classing it as a different species. It appears to be a salmon whose ancestors have been cut off from access to the sea and obliged to live and breed in fresh water. Their descendants have lost the migratory instinct, and, although the obstruction to their descent to salt water has been removed by some convulsion of nature, they are content to remain in the lakes throughout the year. This fish has been in great demand, and Mr. Atkins, of the United States Fish Commission, has paid great attention to it; he has gathered the eggs for several years in increasing numbers, and the fish has been introduced into many new waters. They love deep, cool lakes, and General R. U. Sherman, of the New York Fish Commission, has planted them in Woodhull Lake, Oneida County, New York, and other Adirondack lakes, and last year took specimens of five pounds weight. He regards this valuable fish as peculiarly fitted for those waters, and intends to stock many other lakes of that elevated region with it. The New York Fish Commission has been a most useful one, and, with the commissions of the New England States, the most prominent among State commissions in the work of restocking the waters with both the food fishes and the species which the angler most values. This is a natural consequence of their having been foremost in the work, and in having legislative aid to carry it on. At the same time there are various local organizations, to which belong a great deal of credit. Among these are the salmon-canners on the Clackamas River, a tributary of the Columbia, in Oregon, who, seeing that their work would in time deplete the waters and ruin the industry that they had established, concluded to build a hatchery there and keep up the supply; and to this end they sent for Mr. Stone, who established such a hatchery for them, which is now in running order, turning out as many fish as possible in the hope of keeping the stream up to its full salmon-bearing capacity,—a prevision so rare among fishermen as to be worthy of special note.



THE McDONALD FISH-WAY AT RAPPAHANNOCK, VA.

The United States Commission of Fish and Fisheries was created for the purpose of investigating the cause of the decrease of our marine food fishes, and afterward devoted much attention to fish-culture as a means of increasing the food resources of the country. It keeps up the annual scientific investigations on the coast, and has added much to our knowledge of the life history of fishes. Stations have been established for the season at Noank, Conn.; Eastport, Me.; Wood's

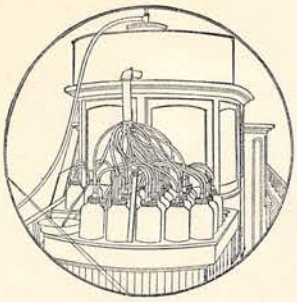
Holl, Gloucester, and Provincetown, Mass., and at Newport, R. I., where valuable collections of marine fauna have been made, the food, habits, and migrations of fishes studied, and testimony taken from the best informed fishermen. Besides these stations for scientific observation, hatcheries for different fishes have been built at Bucksport and Grand Lake Stream, Maine; at Baird, Shasta County, California; at Northville and Alpena, Michigan; at Wytheville, Virginia, in conjunction with the Fish Commission of that State; and at Raleigh, North Carolina, and much support has been given the station of the New York Commission at Cold Spring Harbor, Long Island. At first, a small tug-boat, the *Bluelight*, was borrowed from the Navy Department, and most efficient aid has been rendered by Captains Beardslee and Tanner, of the navy, who volunteered for this service. Following the *Bluelight*, the yacht *Lookout* was fitted up for river work. Two new steamers have since been built by the Government especially for the work of the Commission. The *Fish-Hawk* is a flat-bottomed vessel with twin screws, designed to go up the rivers, and fitted with the most approved apparatus for hatching shad wherever caught. Her pumps supply a copious flow of water to the Bell and Mather hatching cones on her upper deck, and a cam on a shaft works the Ferguson plunging buckets on her sides. The other steamer, the *Albatross*, is fitted with machinery for deep-sea soundings, taking temperatures, dredging, etc., and a naturalist's room with microscopes, ice-chests, and alcohol tanks for preserving specimens. The Commission has also two transportation cars fitted with ice-chests and fans, to convey cold air over the cans, worked by the axles when the car is in motion, bunks and kitchen for the men, and all that is necessary to transport live shad, carp, or other fish anywhere by rail, with only the labor of taking on water where the engines are supplied. These cars have taken fish from Washington to Texas and California, in the most perfect manner.



HATCHING ROOM AT COLD SPRING HARBOR.

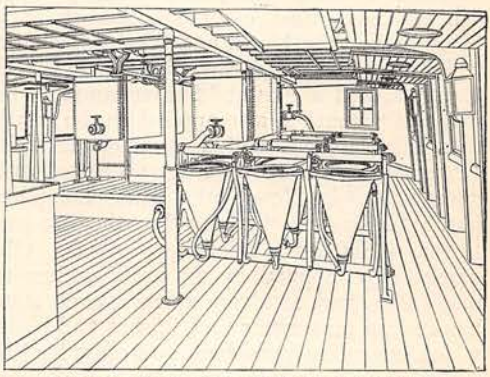
Within the past two years the propagation of oysters has received attention, and, while not yet a complete success, approaches have been made toward it that give promise of future benefit. Professors Brooks, Rice, and Ryder, and Lieutenant Winslow, U. S. N., have all made valuable experiments in this line, and we at least know more of the life

history of the toothsome mollusk than formerly. Abroad, oyster-culture is practiced to the extent of placing twigs, shells, and other objects, in the water, to arrest the free-swimming "spat" until it fastens itself and settles down to steady habits and the accumulation of a sufficient amount of succulent protoplasm to entitle it to the honor of being laid on the "half shell." In the Poquonnock River, near New London, Connecticut, the tops of trees are placed in the water at the proper season, and when loaded with oyster spat are hauled out by oxen, when the twigs with the juvenile "East Rivers" are scattered on the beds. It is the desire of the Commission to be able to express the eggs and milt from oysters, and fertilize the eggs and grow them, as is done with the fishes. Professor Ryder has also experimented with clams.



MCDONALD JARS ON THE "LOOK-OUT."

It is only within a few years that the propagation of the cod has been attempted. While the Commission was at Gloucester, Massachusetts, some three years ago, the eggs of the cod were taken and hatched. The young fish were turned out in the harbor, and now they are taken by boys from the docks. When it is remembered that the inshore cod are small and red in color, and the same fish from the different "banks" are gray and more slender, with shorter fins and clear-cut forms, it will readily be seen that it does not require an ichthyologist to determine whether a cod-fish comes from the banks or is a "rock cod," and no gray fish were ever taken in Gloucester harbor before. This fact has been so encouraging, that efforts toward a perfect hatching apparatus for the delicate eggs of the cod-fish have been made by several persons. Captain H. C. Chester, formerly of the *Polaris* expedition, but now with the United States Fish Commission, made a semi-rotary vessel which promised fairly; but last year Colonel McDonald devised the closed hatching-jar, already referred to, which has its inlet and outlet below the surface of the water, and this promises to do the work without danger that the almost floating eggs will escape with the outflow. The suggestion of Mr. E. G. Blackford, that millions of cod eggs could be obtained from the fish brought alive in the well-smacks to Fulton Market, has been acted upon, and eggs were gathered there last year and sent to the old Armory at Washington, which has been turned into a hatchery. It had been decided to turn the eggs loose in the waters about

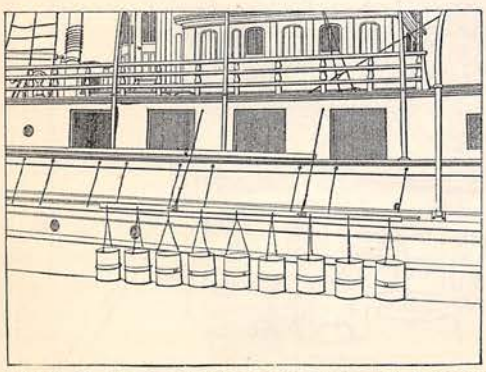


PART OF THE INTERIOR OF THE "FISH-HAWK."

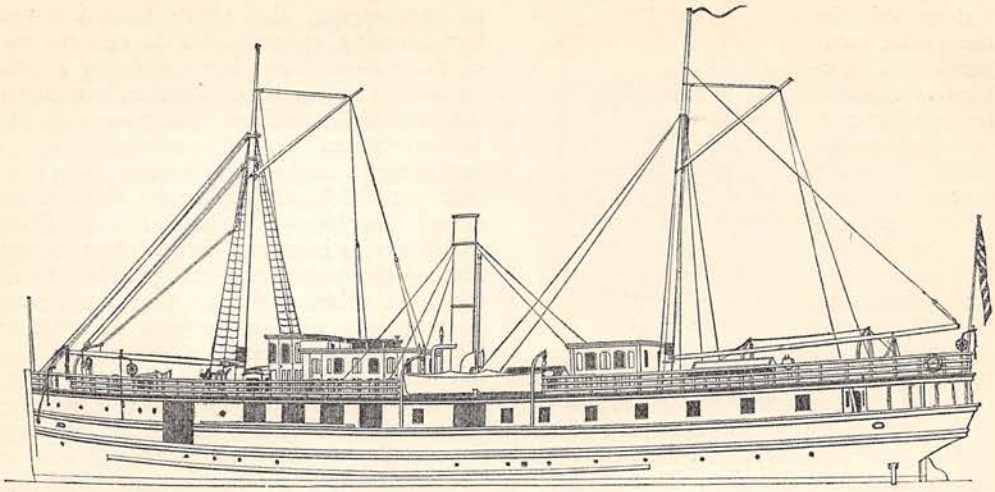
New York; but in December, 1882, just at the spawning season, the severe weather prevented the arrival of many ripe fish.

The introduction of the improved German carp, which has been of great value to warm inland waters where no good food fish was before found, has been a boon to those living far from the sea-coast. These fish have made most wonderful growth in many states, especially in the South, and their progeny have even been asked for by the Germans who sent the original stock.

One of the amusing phases of fish-culture is the numerous specimens of small, indigenous species which are sent to the National Museum on the supposition that they are the newly planted shad, trout, carp, or salmon. They are generally some small cyprinoids which never grow to large size, and consequently have hitherto escaped the observation of the sender. This, and the confusion of the names of fishes in different localities, tend to mislead those whose desire for knowledge

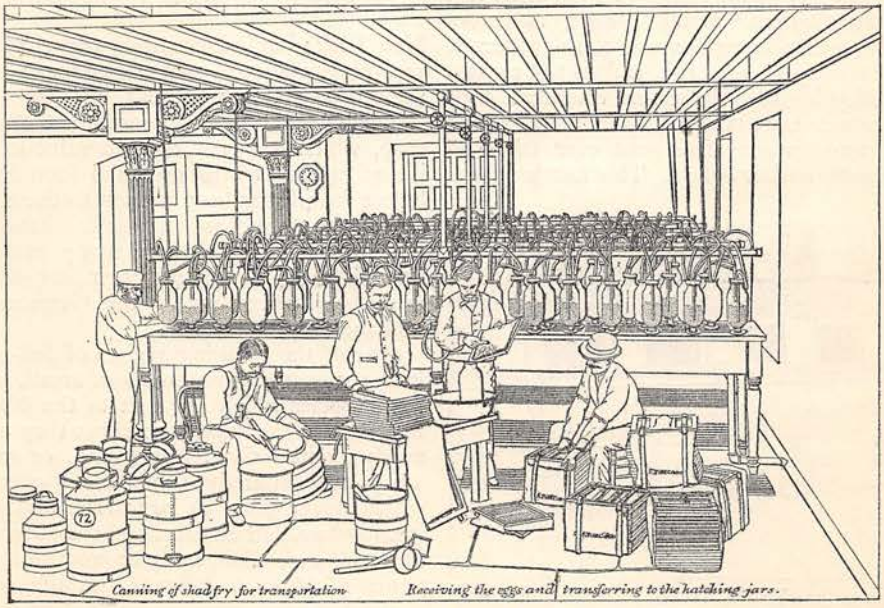


SECTION OF "FISH HAWK," SHOWING FERGUSON'S PLUNGING BUCKETS.



UNITED STATES FISH COMMISSION STEAMER "FISH-HAWK."

and new fishes is but just awakened. The fish which is most commonly known as a black bass in the North and West becomes a "chub" in Virginia, a "welshman" in North Carolina, and a "trout" farther south. The name of "trout" is also applied in the South to a salt-water fish called "squeteague" and other names in the New England States, and "weak-fish" in New York; while the pike-perch becomes a "salmon" in the Susquehanna, Ohio, and Mississippi rivers. Old names were applied by the early settlers to new fishes, and, as a consequence, each state has certain misnomers for its fishes and birds, which errors are persistent, and often lead to misunderstandings. Among the new fishes lately brought to yield their eggs to the fish-culturist, in addition to those mentioned, are the Spanish mackerel (which were discovered at the spawning season in Chesapeake Bay by Mr. R. E. Earll), the haddock, and moon-fish,—the last being a valuable food fish, but little known, and sometimes appearing on the bill of fare in New York as "angel-fish." A few turbot and soles have been brought over from England and released on our coasts, but not in numbers sufficient to hope for important results; but from the introduction into New Hampshire lakes of the German salbling, *Salmo salvelinus,* a large

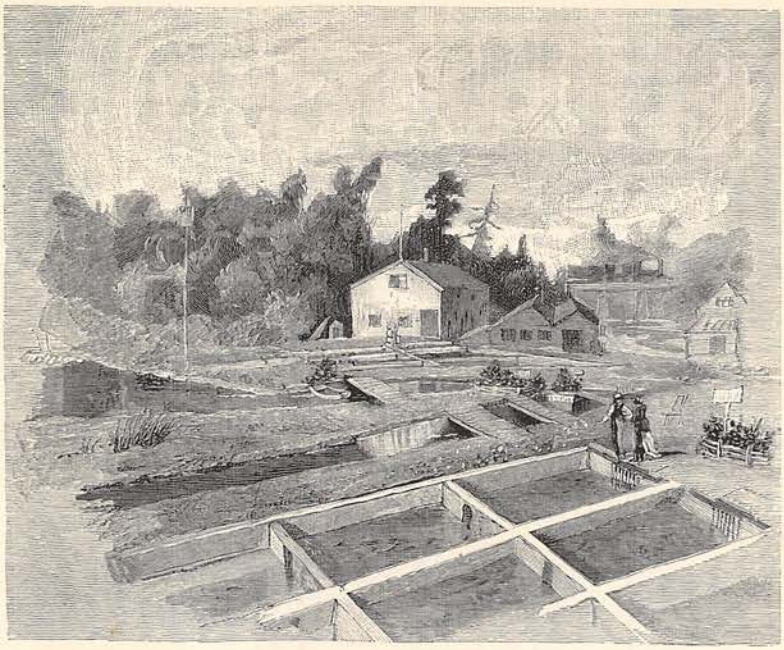


CENTRAL STATION UNITED STATES FISH COMMISSION.

lake char, or trout of high color and fine flesh, much may be expected.

The general awakening of the people of the United States to the benefits of fish-culture has been a source of gratification to the pioneers in the art, whose early enthusiasm was occasionally ridiculed, but many of whose prophecies have been fulfilled. The fishermen have been the last ones to see its benefits, for they seem to have a firm faith in the inexhaustibility of the waters, even though they acknowledge that the supply of fish has rapidly decreased in the past twenty years. A few of them have begun to look favorably upon pisciculture, and the first indication of it is a desire to have their waters stocked and for protection of the fish during the spawning seasons. The different townships on Cape Cod protect the alewife, or "river herring," and only allow each inhabitant to take two or three barrels of them from the artificial run-ways, constructed of three planks, which sometimes extend for five or six miles. Each one pays a certain sum for his fish, and the money is applied to the school fund. The remainder of the alewives are allowed to spawn, in order to keep up the stock. The number of private and public fish-cultural establishments in America is astonishing to one who has but recently looked into the subject. The number of them sixteen

HATCHERIES AND REARING PONDS AT COLD SPRING HARBOR, N. Y.



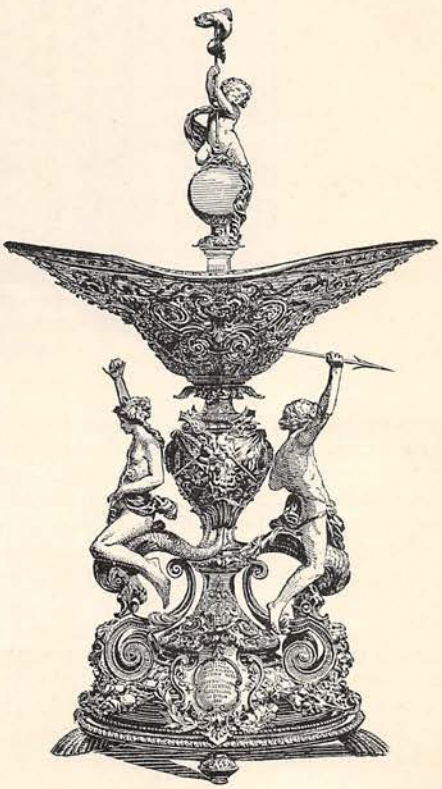
NEW YORK STATE HATCHERIES AT CALEDONIA.

years ago, when the writer first engaged in fish-culture as a private enterprise, could be almost numbered on the fingers of one's hand; while to-day it would take many pages of this magazine to record them. Of the different States and Territories, thirty-seven have appointed fishery commissioners, and the private hatcheries and ponds are almost innumerable. Among the latter may be mentioned the South Side Sportsmen's Club, of Long Island, which has over five miles of trout streams and more than a hundred acres in ponds. This club keeps a fish-culturist, who takes the eggs from the fish and hatches them; and while its members have all the fishing which they allow themselves, they sent a surplus of a ton of trout, alive and dead, to Fulton Market in 1882. The Blooming Grove Park Association, of Pennsylvania, is now building a hatchery to replenish their streams and lakes, which once abounded with trout. Among the notable private fish-cultural establishments are the trout ponds of Mr. James Annin, at Caledonia, New York; Mr. Livingston Stone, Charlestown, New Hampshire; Messrs. Eddy and Mosher, Randolph, New York; Mr. Geo. F. Parlow, New Bedford, Massachusetts; Mr. W. H. Furman, Smithtown, New York; and Mr. A. R. Fuller, of Malone, Franklin County, New York. Mr. Fuller is deserving of especial mention from the fact that his work has been directed toward stocking the waters of the Adirondack region in the vicinity of Meacham Lake, which are open to public fishing. He has stocked Clear Pond, where trout were before unknown, and are now found of five pounds weight, the largest brook trout found wild in the State of New York; and this has been done without public assistance, or even

SHAD-HATCHING STATION AT HAVRE DE GRACE.

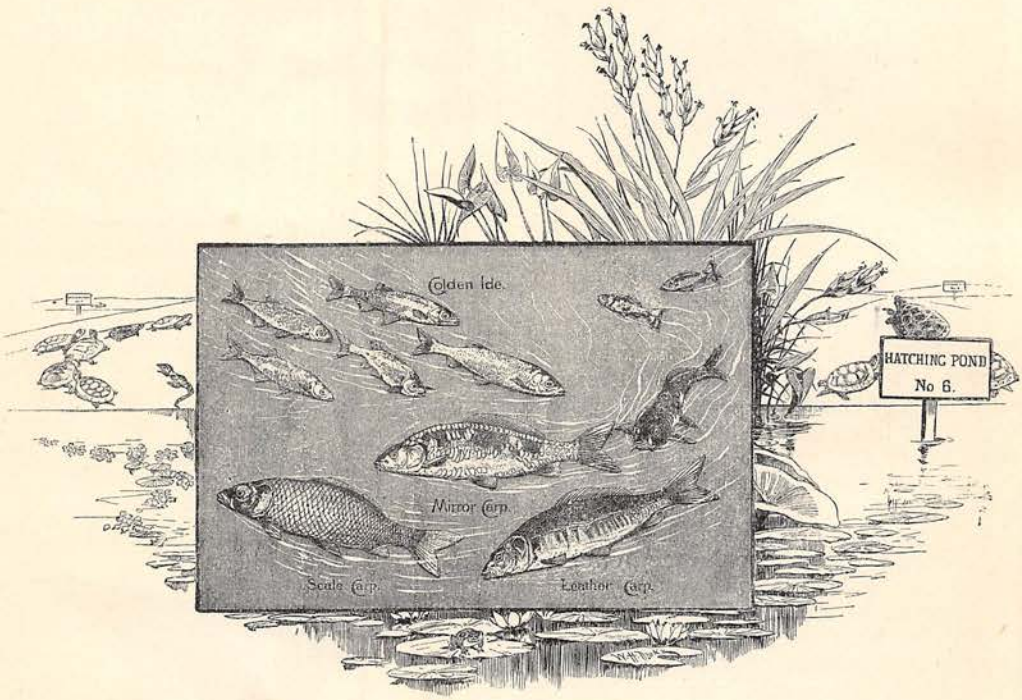
STRIPPING SHAD.

recognition. The New York Fish Commission, in addition to its well-known hatchery at Caledonia, has, since the appointment of Mr. Blackford as a member of its board, established a supplemental hatchery on Long Island, at Cold Spring Harbor, where salt water is pumped into an elevated reservoir and brought into the hatchery, and fresh and salt water fishes may be hatched side by side, and where it is easy to make preserves for either native or foreign marine fishes. To this station Professor Baird has sent many thousand eggs of both the Atlantic and land-locked salmon, for distribution in the Adirondack waters, he having previously used the private hatchery of Mr. Thomas Clapham, at Roslyn, Long Island, for the same purpose. The land-locked salmon of Maine is especially valuable for deep, cool lakes, and therefore the Adirondack waters are suited to them, as has been proved by the few specimens which were planted in the Bisby Lakes a few years ago. The new hatching station at Cold Spring Harbor has distributed many of these fish, and its proximity to salt water will give it great facilities for storing foreign marine fishes or hatching native ones. The work of taking, hatching, and distributing the eggs of the lake whitefish has been most successfully done in Michigan, both by the Fishery Commission of that State at its Detroit hatchery, and by the United States Commission at its stations at Northville and Alpena, under Mr. F. N. Clark, a fish-culturist of much experience and good judgment. This fish and the shad are the most important of the commercial fishes which are propagated; the former spawning in the fall, and the latter in early summer. Attempts have been made to introduce the shad into Europe, but have not been successful. Mather and Anderson took 100,000 fry as far



FIRST PRIZE AT BERLIN, AWARDED TO PROFESSOR SPENCER F. BAIRD.

as Southampton in 1874, and the next year Mr. M. A. Green and Mr. H. W. Welsher started with eggs, which died outside Sandy Hook. Both Rice and McDonald have since made experiments on the retardation of the development of the embryo which promise good results. The Germans, becoming impatient at the delay in sending them this fish, point to the fact that Meyer, of Kiel, retarded the eggs of the herring for nearly a month by means of ice; overlooking the fact that fishes like the winter spawners will bear to have their eggs retarded by cold, because they develop them on a falling temperature, while the eggs of fishes which spawn in spring, on a rising



CARP POND AT WASHINGTON.

thermometer, are killed by a lowering of the temperature. The fact is, that fishes of some kind are spawning during every month in the year, and their eggs require to be hatched, or kept, under natural conditions. This makes it possible to ship the eggs of the fall and winter spawning fishes any distance, if kept cold and not allowed to freeze; while the quick-hatching eggs of summer spawners will not bear to be retarded in their development by ice to any great extent, although the experiments of Rice and McDonald seem to point to a different conclusion. In the propagation of shad, the main difficulty in producing great numbers lay in the fact that the ripe fish could not be obtained in sufficient quantities. A great breeding ground was discovered in Chesapeake Bay, and at Havre de Grace a station was established which yielded great numbers of eggs. The process of stripping the shad is similar to that of other fishes, but the impregnation requires less time to become apparent than with species which spawn in colder waters.

Progress in fish-culture may be noted not alone in the multiplication of hatcheries, the creation of fish commissions, and the publication of journals like "Forest and Stream" and the reports of the fish commissioners. Public interest in it is shown by the recent exhibitions of fisheries and their products in Germany, England, and Scotland. One of the first and largest of these was the great International Fisheries Exhibition at Berlin, in 1880. At this exhibition, all the countries except France made more or less of a display of their fishery resources and products. The exhibition was a complete success, both from a utilitarian point of view and financially. It became the fashion; ladies flocked there to see not only the displays of pearls and amber, but the fountains and the decorations. On some days as many as twenty thousand persons visited it. The American exhibit was prepared, under direction of Professor Baird, by Professor G. Brown Goode, who accompanied it to Berlin and

remained in charge, with a staff of assistants. It included everything, from the knives used by fishermen to their clothing, boats, apparatus of all kinds, and even their food; models of fish-curing houses, the hooks of bone, wood, or iron of the inhabitants of Greenland and Alaska, as well as the appliances of the modern angler. Fish-culture in all its branches was illustrated, and a majority of the awards in this class came to America. At the distribution of awards by the Crown Prince of Germany, no surprise was shown when the grand prize of honor offered by the Emperor for the best collective exhibit was given to Professor Baird. A National Fisheries Exhibition was held the next year in England, at Norfolk, and another the year following at Edinburgh, Scotland. The great interest manifested in these displays led to a grand International Exhibition in London, which opened in May of last year, and which eclipsed all others in the size and character of the exhibits. The American exhibit by Professor Baird was again in charge of Professor Goode, and was more extensive than at Berlin, owing to greater facilities and the longer time allowed for preparation.

The day when fish-culture was regarded as an experiment passed several years ago, and it is now one of the recognized industries in Europe and America. ("Most *all* countries" are in great part outside of these.) Its results in restoring food fishes to depleted waters, and the introduction of new fishes, have popularized it, until the supply of young fish and eggs cannot keep pace with the demand. It has not cheapened fish food to any extent, owing to the growth of population, but it has increased the supply in American waters, which were becoming exhausted in both the older and some of the newer States, and promised to become entirely barren. It restored the salmon to the Connecticut River, where they were taken and sent to market for three years, until the rapacity of the fishermen exhausted the supply by cutting off the fish from their spawning grounds. It has placed shad in San Francisco markets, where they were before unknown, and has materially added to the supply of our lake and river fishes, and now promises to increase those of the sea-coast.

Fred Mather.

WRITTEN IN EMERSON'S POEMS.

FOR A CHILD.

MIDNIGHT or morning, eve or noon,
Torn March or clover-scented June,—
  Whene'er you stand before this gate,
'T will open—if but not too soon
  You knock, if only not too late.

Well shall it be if, boyhood gone,
A boy's delight you still may own
  To play the dawn-new game of life,—
If what is dreamed and what is known
  In your still startled heart have strife.

Ere you have banished Mystery,
Or throned Distrust, or less shall be
  Stirred by the deep and fervent line
Which is the poet's sign and fee:
  Be this your joy that now is mine.

When comes the hour, be full and bright
Your lamp, as the wiser virgins' light!
  Choose some familiar shrine-like nook,
And offer up in prayer the night
  Upon the altar of this book.

Always new earth, new heavens lie
The apocalyptic spirit nigh:
  If such be yours, oh, while you can,
Bid unregretted Youth good-bye,
  For morning shall proclaim you Man.

Robert Underwood Johnson.

exactly a mathematical average of the public sentiment of the country might fail to represent more than a minute percentage of absolute sentiment. An average does not necessarily represent anything. To all this it will be fair to answer that there are really two kinds of sentiment in our people — the local and the national. The effects of the distinction may be seen by supposing that the regulation of divorce were remitted to the towns. Removed from general inspection, exposed to the full power of a few influential and interested individuals, the towns would certainly make our divorce laws even a greater stench than they now are. Even State control, though it has avoided some of the evils of town control, has not avoided all of them. Local sentiment might tolerate loose divorce laws by a town, or even by a State; but a proposition for a loose *national* divorce system would call into action a national sentiment on the subject which has never yet been fairly voiced. It is not meant that the general sentiment would drown the local, but that the voters and their representatives, if called upon to approve a loose divorce Act of Congress, would look at it from quite a new point of view, and would have a hesitancy about exposing the nation to the condemnation of Christendom which they would never feel if only their town or State were in question. As this mode of public sentiment is an utterly unknown quantity, it must be a matter for individual judgment how far it would operate to restore the balance, so that a divorce law, too stringent to satisfy the local sentiment of the town of A or of the State of B, might be perfectly in accordance with the *national* character of both. To us it seems to be the factor needed; but at all events it is one which has not received adequate consideration, while little more than a statement of it is needed to show its importance in any attempt to forecast the results.

The objection just mentioned, if it should be pressed, as it certainly would be, would at once bring out to view one of the worst evils of our present system. The objection implies that a divorce law which would suit New York would not suit Louisiana or Oregon, or even New Jersey or Connecticut. The objection would have more weight if interstate migration were of as small proportions now as a century ago. In 1880, nearly ten millions of our population were living in States other than those of their birth. Suppose one-half of these were women, and the magnitude of the evil becomes apparent. No class is so much exposed to the purely legal evils of our divorce system as women; no class is so ignorant of them. The little that a woman knows of the marriage and divorce laws of her own State is the result of a long series of petty social observations. Leaving the State of her first residence, she loses all the little knowledge she had, and goes into her new location as ignorant as a child. When the ablest lawyer can hardly make anything intelligible out of the marriage laws of the State of New York, wherein shall the average woman dare to rely on her own knowledge? So far from its being true that the social repulsions of the States are an argument for State marriage and divorce laws, the mobility of our modern population exposes a very large class to constant and extreme danger from them. While the States make these laws, a woman must take her social life in her hands whenever she steps an inch out of the beaten path of ceremony; and even when she thinks she has kept the beaten path she is apt to find that she has merely been committing social suicide. The social repulsions of our men may demand State laws on these subjects; but are the interests of our women to count for nothing?

It is true that the transfer to Congress of legislative power on marriage and divorce is, in more senses than one, a leap into the unknown. But, when it offers so promising, so clear a road to the solution of the Mormon problem, when it offers assurance of security to a great and helpless class of our ever-moving population, when the indications from analogy are that the unknown will be advantageous to the social and political interests of the people and injurious to none, the subject is evidently one for the most thoughtful consideration, lest opportunity, once let slip, should pass from us forever.

OPEN LETTERS.

The Outlook of the Fisheries.

THE future of our fisheries is a subject which is now attracting a large share of public attention. An industry that in 1880 employed 131,426 men, an invested capital of $37,955,349, supported a population of more than half a million, and the annual product of which, at the prices paid to the fishermen, was $43,046,053, is certainly entitled to consideration as an important factor in our national growth and prosperity. Especially is this so when it is considered that the harvest thus reaped is taken from the sea — from fields that no man has sown — and the gathering of which trains a large body of hardy and enterprising men, who constitute a self-supporting militia of the sea, a force of inestimable value to any nation that aspires to naval or commercial greatness.

The question of the hour is, what ought to be done to foster and protect our fisheries, in order that they may be carried on with that reasonable assurance of success which alone will guarantee their continuance? Will success be best assured by some so-called reciprocal arrangement with the British provinces, similar to the Washington treaty recently expired? or will greater prosperity be attained under the treaty of 1818, which is now in force? The answer to this question has been most emphatically given by the entire fishing population of New England. The expiration of the fishery clauses of the Washington treaty was hailed with unfeigned satisfaction, and during the past winter they unanimously declared in memorials to Congress that the inshore British fishery was absolutely valueless to them. It was stated "that there was nothing in its use as a fishery that our fishermen desired the Government to procure for them at the price of any equivalent, whether in opening our

market to Canadian fish, or in money; that when the treaty of Washington had, at the cost of $5,500,000 and other considerations, opened those waters as a fishery to us, the shore people prevented our taking bait by mobs and violence to our vessels and seines; that Great Britain, unwilling to restrain them, paid damages for the Fortune Bay outrages; that we did not use the cod fishery in the limit; that the mackerel was insignificant, and that the use of these waters as a fishing adjunct to our undoubted rights of common fishery in the ocean had no practical value for fishing under our flag and was not asked for by our fishermen."

A brief review of the New England fisheries will enable us to weigh the value of this declaration, in the light of well ascertained facts, and to arrive at an understanding of whether the reciprocity treaties which have been made, ostensibly in behalf of the fishermen, have been of value to them or otherwise. By so doing we shall be better able to judge of the future of our fisheries and of what is best calculated to insure their prosperity and continuance as an American industry.

First, what are the advantages to be gained by American fishermen from enjoying the so-called privilege of fishing within the three-mile limit, on certain parts of the provincial coast, from which, by the treaty of 1818, they are debarred? It may be stated at the start, in positive terms, that the cod and halibut fisheries are prosecuted by American fishermen entirely in the open sea, outside of British jurisdiction. According to the United States Fish Commission, the area of the offshore banks thus unrestrictedly frequented by the American vessels, and exclusive of the Greenland and Iceland halibut grounds, is 73,123 square geographical miles. This includes the range of elevated ocean plateaus that extend from Cape Cod to the Flemish Cap, off Newfoundland, and which constitute the great fishing banks in the western Atlantic.

The mackerel fishery, then, is the only one which, even under the privileges of the Washington treaty, was prosecuted to any extent at all by American fishermen in inshore British waters. The value of the privilege of fishing for mackerel within the three-mile limit on the Canadian coast may be judged from the following:

According to a report on the fishing grounds of North America, prepared by the United States Fish Commission, the total area of the mackerel fishing grounds off the eastern coast of the United States is 56,000 square geographical miles. Here, in our own waters, the most extensive and valuable mackerel fishery of the world is carried on. In addition to this, our fishermen have the right to fish in the waters of the Gulf of St. Lawrence outside of the three-mile limit; and thus is opened to them an additional area of 15,200 square miles, making a total of more than 70,000 square miles over which they have an unquestioned right to prosecute their operations. Now, if we estimate the area of inshore waters frequented by our fishermen in pursuit of mackerel, we will able to get an idea of their relative importance, always supposing that the fishery can be prosecuted as well inshore as it can off, which is not the fact, as will be shown hereafter. The north shore of Prince Edward Island and Cape Breton are the localities in the inshore British waters which are now chiefly visited by American vessels in pursuit of mackerel. The total area of the inshore waters in these regions commonly resorted to by American fishermen does not much exceed 775 square miles (if we follow the coast line), or about one per cent. of the area of the mackerel fishing grounds to which they have an unquestioned right. Or, if we include the south shore of Nova Scotia and Cape Breton, the east side of Cape Breton, and what is known as the "West Shore"—from Point Escumenac to Point Miscou—in the Gulf of St. Lawrence, we shall have a total area of 2,064 square miles. But a simple statement of the area of these inshore waters over which alone England has any control can convey little idea of their value. The mackerel fishery is now exclusively prosecuted with the great purse seine instead of by hook and line, which were formerly used. Therefore, the larger portion of this inshore area of water being too shallow and the bottom too rough to permit of the successful manipulation of the fishing apparatus, it is comparatively seldom that any fish are caught near the land. On the southern coast of Nova Scotia few fish are taken by American vessels, and these only during their migratory period. Thus it will be seen that the available area inside the limit is exceedingly small.

Then, too, the change in the methods of fishing has, in recent years, led to the almost practical abandonment of the mackerel fishery in the Gulf of St. Lawrence. Occasionally a considerable fleet enters the Gulf; but, since the results have generally been unsatisfactory, there have been seasons when only a very few vessels went there. It is true, perhaps, that the mackerel being a remarkably erratic species, its movements cannot be predicted from year to year with any absolute certainty.

The results obtained in the past ten years, since the universal employment of the purse seine, may serve, however, as a fair basis in judging of the future. It is an historical fact, now well established by the most accurate and careful investigation and inquiry, that the catch of mackerel in the Gulf of St. Lawrence, not to speak of the inshore waters under British control, has been of comparative insignificance during the last decade. And even under the most favorable conditions, when the catch there has been exceptionally large, as in 1885, the total product of the Gulf mackerel fishery did not amount to more than eight per cent. of the entire catch of the New England fleet. Of this, less than one-fourth was taken inside of the three-mile limit.

The influence of the reciprocity treaty of 1854 was not immediately felt, and the fleet employed in the food fisheries of New England seems to have reached its maximum in 1862. At this date, according to the returns of the Bureau of Statistics, there were 133,601 tons employed in cod fishing, and 80,596 tons engaged in the mackerel fishery, a total of 214,197 tons. Since 1862 there has been more or less fluctuation in the tonnage employed in the fisheries; but, since the conclusion of the Washington treaty, the decline has been very marked, so much so that in 1883, according to the authority above mentioned, the tonnage employed in the cod and mackerel fishery was only 95,038 tons new measurement, which would be equivalent to about 140,000 tons old measurement, which shows an actual decrease, since 1862, in these branches of the fisheries, of 74,197 tons.

In 1879 an excellent opportunity was presented to me to note the practical operation of the fishery clauses of the Washington treaty. In the summer of that year I was at Pubnico, Nova Scotia, and was told by residents of that place that its fishing fleet, under the influence of the free markets of the United States, had grown from four small vessels to a fleet of about sixty fine schooners, during the previous six or seven years. In the latter part of the summer I entered upon the work of investigating the fisheries of New England for the tenth census. In many places on the coast it was found that the treaty had exerted a very baneful influence. Towns which had formerly sent to sea fleets of fishing vessels, varying from twenty-five to upward of one hundred sail, had then barely a remnant left, and in some cases not a single schooner. Some of these outfitting stations were veritable pictures of desolation — merely reminders of a lost industry. One in particular, called "Rigg's Cove," at Georgetown, Maine, impressed me the most forcibly. From here had sailed, a few years previously, fifty fine schooners. But what a change! At the time of our visit nothing remained to indicate its former business importance but neglected and tumble-down storehouses, and decaying wharves, against which lay a superannuated fish freighter, the tide flowing in and out of her open seams, and the broken cordage flapping monotonously against her bare spars, as if she had come here to die on the scene of her former usefulness.

It may not then be wondered at that, with such examples before them, American fishermen look with dread and distrust upon any proposition to renew similar relations with the British provinces. The evils they now have under the treaty of 1818, though they are many and onerous, are preferred instead.

Judging from the past, there can be no question that the result of another era of free fishing and "free fish" would be the practical annihilation of our ocean fisheries. And there can be little doubt that fair success can be obtained, and our fisheries restored to prosperity, if they are accorded a reasonable amount of protection, so that, at least, they may be placed on an even footing with foreign competitors, who are fostered by bounties, and have none of the onerous duties to pay which are exacted from our fishermen.

The future of our fisheries, then, depends almost wholly on the action of our Government. Let the rights of citizens of the United States in provincial waters be only clearly and authoritatively defined by the United States, and the fishermen will soon adapt themselves to the existing conditions. If they have commercial rights, as has been claimed by the highest authorities in the Senate, it is proper that they should know what those rights are, at the earliest practicable moment. They do not care to fish in British waters which are *only inside the three-mile limit*, and do not include off-shore fishing grounds, as has been erroneously supposed by many. This right would be valueless, as has been shown; and it is worthy of remark that not one of the Canadian cruisers has had cause for interfering with American vessels on this head during the present season.

The rights which are ours by the convention of 1818 have also to a large degree been rendered valueless in consequence of the interpretation given to the treaty by Canada. Such, for illustration, is the right of shelter. Let me ask who has the best right to an opinion in regard to the need of shelter for a vessel? Is it her master, who, by long years of training and experience, is competent to judge of the dangers which he must encounter in leaving a harbor, or is it a landsman, devoid of all experience of the sea, who, nevertheless, may be appointed as a custom officer, and, under the present arrangement, may have the power to order a vessel to sea under the penalty of seizure! On a coast where gales suddenly arise, accompanied by hard driving snows, rain and fog, frequently lasting for many days, where comes the right to order a vessel to sea under penalty of seizure if she lay in harbor beyond a prescribed limit? It is, perhaps, not too much to hope that questions of this kind, which have long been held in abeyance, may be soon settled, in accordance with the humane and enlightened spirit of the age.

Let our fishermen be once assured of protection in the enjoyments of their rights under the treaty of 1818, and there can be no reasonable doubt that, with the improved methods and appliances which have been recently adopted, together with the bravery and hardihood which have been their distinguishing characteristics, the industry in which they are engaged will recover its former prosperity. It will take time, to be sure, to shake off the effects which are a result of two reciprocity treaties. But this can be done if the conditions are favorable.

And will it not be a wiser policy to promote by all justifiable means an industry which adds to the country's wealth, and at the same time trains a large body of efficient seamen, who must ever stand as a bulwark against its invasion by sea? If this is granted, then experience has proved that there is only one way to reach the desired result. While "free fish" will surely sound the death knell of the American fisheries, the assurance of American markets for American products will as certainly promote them.

J. W. Collins.

Is it Sectional or National?

SENATOR JOHNSTON was right when he said Mr. Cable impeached a whole nation. If he meant, by his article on the "Silent South," an impeachment of the justice of whites toward blacks, that impeachment covers the Union from Florida to Oregon and from Maine to California. The same facts that are true from Richmond to Galveston hold also from Boston to San Francisco.

I base my assertion on a statement by states of the number of prisoners in penitentiaries, jails, calabooses, workhouses, military prisons, and the hands of lessees. Tables were compiled by Fred H. Wines, for ten years secretary of the Illinois Board of Commissioners of Public Charities, and are the most accurate of the kind ever gotten up by the government of the United States.

Figures deduced from these tables show that in the South * the percentage of the negro population who were in prison convicted or accused of crime was 3.67 times as large as the percentage of the white

* Under the title South we include the fifteen old slave states (with West Virginia), and the District of Columbia. The term North is used as including all the remaining states.