XV.—DESCRIPTION OF APPARATUS USED IN CAPTURING FISH ON THE SEA-COAST AND LAKES OF THE UNITED STATES.

MODES OF CAPTURE.

The methods by which fish are captured in the United States are very varied, and in some of their modifications may be considered as superior to those in use in other countries.

The usual apparatus may be divided into: lines armed with hooks, nets and weirs, although other methods are in less extensive use, of which it is scarcely necessary to make extended mention here, these consisting in the main of spears, harpoons, the bow and arrow, poisoning, and explosive compounds.

PROJECTILES, EXPLOSIVES, AND POISON.

The *spear* is used more especially by the Indians in different parts of the country for taking salmon, and is not so well adapted to other fish.

The *bow and arrow* are extensively employed among the Esquimaux and the Indians of the northwest coast of America.

For *poisoning* fish, berries of the *Cocculus indicus*, or some other stupefying drug, are intimately mixed with bait and thrown into the water. The fish eating this became narcotized and floated to the surface, where they are taken. This method is of course available only in still localities, like mill-ponds, &c.

The *explosives* used consist of cartridges or torpedoes of gunpowder, dynamite, nitro-glycerine, &c., and sometimes, when set off in the vicinity of a large school of fish, destroy great numbers.

The *harpoon* is largely employed in the capture of the sword-fish off the New England coast. This consists of a barb with jointed ears, and fastened to one end of a rope of several hundred feet in length, to the other end of which is attached an empty, well-bunged barrel, to serve as a buoy. The end of a long handle carries a pointed iron stem, over which the socket of the harpoon-head referred to, usually called the lily-iron, is slipped. The fisherman stations himself at the end of the bowsprit of a small sloop or schooner, supported by a sort of iron frame, and when a sword-fish is seen resting idly upon the water the boat is steered directly toward it so as, if possible, to bring the harpooner immeditely over the fish, when the weapon is driven down with great force into the back of the neck; and if the lily-iron is fastened in the flesh, it slips off from the stem of the handle, which is pulled out as the fish darts away, and the rope and buoy are thrown overboard. The fish, of course, swims off with great velocity, diving to the bottom; but after a time, fatigued by the drag of the buoy, comes again to the surface. One of the fishermen then follows in a small boat, and, taking hold of the rope, draws the fish close up to him and kills it by means of a lance.

A harpoon of a somewhat similar character is sometimes fired from a shoulder-gun, either with or without a torpedo (bomb-lance) attachment. This method is rarely used on our coast for the true fishes, so far as I know being confined to the capture of whale.

The explosion of torpedoes under the water has only lately come into vogue, and it is said has been employed with much success on our southern coast. This method is used by poachers in England and Scotland for taking salmon and trout surreptitiously, the torpedo being fired, when sunk to the bottom, by means of a portable battery or otherwise. It is said that many fish are killed in this way, and that it is extremely difficult, if not impossible, to detect the poacher. A similar practice is said to have been recently introduced into New Jersey among the trout-ponds.

The Indians of Maine and New Brunswick are accustomed to kill porpoises in the bays and off the coast, and about the islands of Campobello and Grand Manan, with muskets loaded with buckshot. In this pursuit two Indians go out together in a canoe, when the sea is calm, and hunt for the porpoises as for other wild game, and when one is seen anywhere in the distance, they row with all their skill and might directly toward the object, and, when sufficiently near, fire at the head of the porpoise as it comes above the surface. Being good marksmen, they almost invariably wound and stun the fish; but as it would quickly sink beyond reach if killed, a lance with a long handle is made use of to fasten to and hold the game, which is soon deposited in the bottom of the canoe. About the northern head of Grand Manan, and in other favorable localities, the canoes of the Indians may be seen scattered over the water by dozens, upon a favorable day, watching for porpoises, the summer season being spent in temporary encampments on the shore by Indians from various parts of the northeast coast of Maine and New Brunswick.

These different methods, however, are of little moment compared with the use of the hook and line, nets, and weirs.

LINES.

Line fishing varies in its character, from the coarse, heavy cord used in taking fish at great depths in the sea, to the delicate apparatus of the trout, salmon, and striped-bass fishermen, the first-mentioned being the most important in an economical point of view. It may consist either of the hand-line or the set-line. In the case of the *hand-line* we have a single line and one or two hooks baited and sunk to or near the bottom, or thrown to any desired distance by means of a weight, and managed from the shore, or from a boat anchored or moving slowly; or the line may be drawn rapidly over the surface of the water behind a sail-boat, as in the capture of blue-fish, Spanish mackerel, striped bass, black bass, &c., either with or without a bait, other than some shining substance to attract the attention of the fish in question. This is known as trawling or trolling.

The more effective line apparatus, however, consists in the use of what is called in the United States the "*trawl-line*" or "trot-line;" in England known as "long-line," "spillans," "spillar," or "bultow." This consists essentially of a long line from forty fathoms to several miles in length, which is anchored at each end to the bottom, the position of the ends being shown by buoys, and short lines of about three feet attached at intervals of about seven or eight feet, with a hook at the other end. In some cases the hooks on a single line number as many as five thousand, although on the coast of Maine and Massachusetts there are usually from

four hundred to eight hundred. Bait of the proper kinds is placed upon these, and the lines allowed to remain down through a part of a tide. If set at half-tide, they are sometimes overhauled at intervals of half an hour or an hour. When taken up for examination, the fisherman, commencing at one end close to the buoy, lifts the main line to the surface and carries it along over the boat upon one side, which is hauled along under the line toward the other end. The fish found upon the hooks are dropped into the boat by the man who pulls up the line, while a companion, as the line passes over the boat, puts new bait, if necessary, upon the hooks and drops them again into the water. In this way the trawl is traversed from one end to the other, and, under favorable circumstances, as soon as the operation has been performed it can be again repeated, the line being taken up in an opposite direction. The principal fish taken in this way on our coast are the cod, hake, haddock, and skate, the pollock swimming too near the surface to be attracted by the bait.

In England a single trawl-line is usually forty fathoms in length, with twenty-six hooks attached by snoods. As many of these lines are united as is thought expedient, and these are shot across the tide as the vessel sails along, so that the snoods may hang clear. There is usually an anchor at each end, at intervals of forty fathoms, to keep the line in position at the bottom, as well as the buoys already referred to.

The same process is used very largely on the Banks of Newfoundland for taking cod, first introduced, I believe, by the French, and afterward imitated by men of other nationalities..

Much complaint has been made by fishermen in Massachusetts Bay and elsewhere of this mode of fishing, chiefly, however, on account of the large catch; but there seems no good reason for believing that it can exercise an injurious influence upon the supply of fishes, as none appear to be taken by it during the spawning season.

NETS.

Next to the lines come the nets, moveble or fixed. The simplest form of these is the *seine*, which, as is well known, consists of a webbing of net-work, provided with corks or floats at the upper edge, and with leads of greater or less weight at the lower, and used to inclose a certain area of water, and by bringing the ends together either to a boat or on the shore, to secure the fish that may happen to be in the inclosure, unable or unwilling to escape. The seine varies in length from one sufficient to take a few minnows to the shad-seine of a mile in length, hauled in by a windlass worked by the power of horses or oxen, or by a steam-engine.

Another equally simple form of net is the *gill-net*, which is generally fastened at one or both ends, and so arranged, by varying the weight upon the lower edge, so that it shall float near the surface of the water, at any intermediate depth, or near the bottom. When a net of this character is allowed to float with the tide, it becomes a drift-net. Both forms are used very extensively on our coast, the drift-net perhaps more frequently for taking salmon, mackerel, and herring. Shad are also taken very largely in nets of this construction; blue-fish and Spanish mackerel are more frequently captured in the fixed apparatus.

The gill-net used on Lake Michigan, (Fig. 1,) according to Mr. Milner, to whom I am indebted for the figure and descriptive account, is made of imported linen gilling-twine or thread, from No. 35 to as fine as No. 60. Its width is from fifty to eighty-one inches when stretched taut, having from twelve to eighteen meshes in the width. Each net is usually from one hundred and eighty to two hundred and seventy feet long. A light line, from "20 to 40 thread seine-twine," is seized on along the outer edges of the net—the seaming.

Another slightly heavier line—the meter—from "40 to 120 thread seine-twine," is stretched along the seaming and secured with seizings at intervals of a yard. The meter and seaming on one side of a net are usually together, about equal to from "60 to 140 thread" line, according to the exposure to storms at different fishing-grounds, and the depth of the water in which the nets are set.

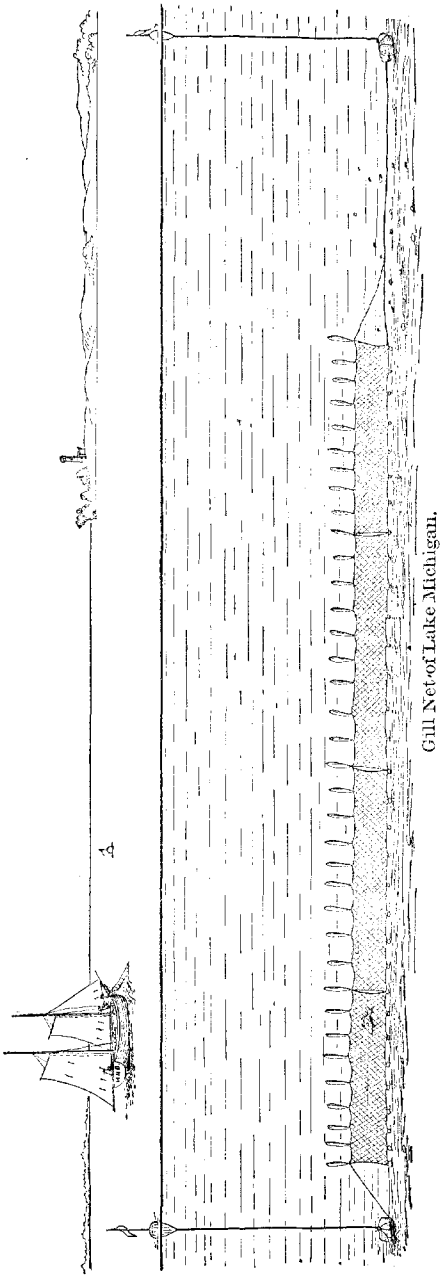


Fig. 1.

Gill Net of Lake Michigan.

Set at bottom of water, kept vertical by cedar floats,—only a few lengths of net represented.

The seaming is for the purpose of stretching the net, the meter for strength, and the attachment on one side of the stones, on the other the floats.

The floats are splinters of cedar, thirty inches long and about one and a fourth inches wide, and three-eighths of an inch thick. The stone is a small cobble-stone, weighing about one and a fourth pounds, notched on its edges to secure a string.

Both floats and stones are taken off, when the nets are drawn up from the lake. A few fishermen use gill-nets with permanent corks and leads, similar to those used on seines.

The mesh measured in its length, or when stretched so as to form two parallel lines, is barely from four and one-fourth to five inches. The commonest size, formerly, was four and one-half inches, but within a few years nets with four and one-fourth inches mesh have been on the increase. The gill-net captures a fish by entangling it in its meshes.

In setting the nets, the stones and floats are tied on in the shanty, and the nets, with the floats, are folded into bales on a tray, with the stones in another tray drawn up to the first. A "gang" of from eight to thirty-six nets are put in the boat, with three lines and two buoys. After reaching the fishing-ground, in from eighteen to seventy fathoms of water, a stone, weighing from fifty to seventy-five pounds, is tied on the ends of two lines, one a buoy line and the other a stretcher. The stone is lowered to the bottom, when a buoy is tied to the end of one line, and the end of a net to the stretcher. The boat is moved slowly ahead, while the gang of nets is paid out, one man throwing the stones and another the floats. The weights are so closely balanced to the buoyancy of the floats, that their points are seen standing above water in a long line astern, while they slowly sink. When they come to the last net, a line, with a stone attached, is tied on and lowered to the bottom, and to the upper end a buoy is fastened. These buoys have a flag-staff, with the flag six or seven feet above the surface. They guide the fishermen to the ends of the gang, and the two are often a mile apart.

Taking up the nets.—The nets are taken up by hauling in the line until the end of the net is reached, when they are drawn over a roller fixed in the bow of the boat—nets,

fish, floats, and stone, passing inboard over the roller. The stones and floats are removed and piled in racks and trays, the fish taken out and thrown into the box, and the nets doubled into bundles. Picking out sticks and leaves, rinsing the nets and drying them on stakes set in a long row for the purpose, complete the work up to tying on floats and stones again.

The cork and lead nets are dried on a large reel. At intervals of a few weeks the nets are boiled in soap-suds or lye, to rid them of fish-slime and confervæ, as otherwise the twine rots rapidly.

From two to four gangs are left in the lake at once, taking up each gang in from two to four days from the time it was set.

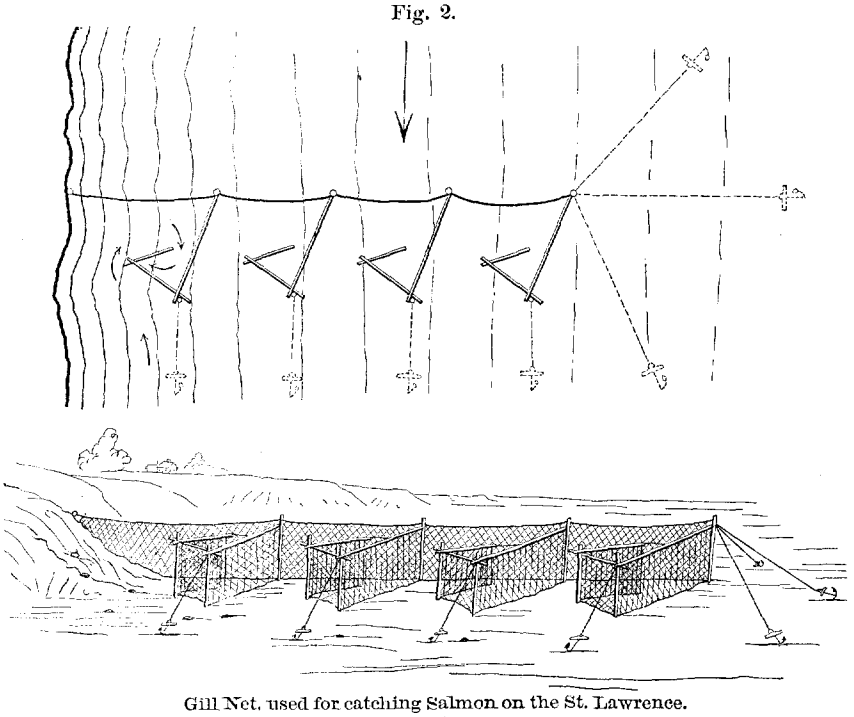
In the southern half of Lake Michigan the fishermen use a large boat, with five and six gangs to the boat, each gang having from twenty-five to thirty-six nets, and employing five men to the boat.

In the northern half of the lake light Mackinaw boats are used, two or three men to the boat, and from two to four gangs of nets, with eight to twenty nets to the gang.

When anchored, gill-nets are not unfrequently brought into a curve, one end being bent so as to form an acute and very narrow V; and the fish striking against the longer limb of the V and moving into the angle, gradually become entangled and are meshed. At other times both ends are brought around and fastened, so as to form a shape somewhat similar to that of the heart of a regular pound.

The fishery-acts of Canada, respecting the capture of salmon in their passage up the rivers at the spawning-season, provide that no net or other device shall be so used as to entirely obstruct the passage of fish, and that the main channel or course of any stream shall not be obstructed. While prohibiting the use of bag-nets, trap-nets, and fish-pounds, in the capture of salmon, it allows the use of a gill-net, (Figure 2,) known as the "stake-net," which is a net fence hung on stakes set

Fig. 2.



Gill Net, used for catching Salmon on the St. Lawrence.
DR. PIERRE FORTIN.

about seven yards apart, in a line at right angles with the shore. This portion of the net is termed the "bar-net." At from ten to fifteen yards

down the stream another row of stakes is set, each opposite a stake in the bar-net, and between these stakes a wing-net is stretched, having several yards of netting more than suffices for the distance. This end is carried round in the form of a triangle and held in position by poles lashed together at their ends. The free end of one pole is secured to the stake, and of the other to the seaming of the wing-net, and thus secured they float at the surface of the stream.

The triangular portion of the wing, or "hook" as it is called, is arranged so as to allow an opening between the end of the hook and the wing through which the salmon enter the triangle.

The netting is made of strong gilling-twine, the minimum mesh allowed being five inches.

The salmon swimming up the current come in contact with the bar-net, and turning to pass around it, find themselves opposed by the wing; they turn again up stream, and are pretty certain to enter the hook, the netting of which hangs slack. In their efforts to escape they become gilled.

Another kind of net, not unfrequently used in Europe, but less in this country, is what is called the "*trammel-net.*" This consists of three seines of similar outline, fastened together at their edges. The central net is very loose and full, and is of fine thread and small mesh. The two outer ones measure from three to six inches along the side of the mesh, and of coarser thread. The fish, in moving along on either side, especially if suddenly startled, pass readily through the first or coarser meshes and strike against the inner net, which is forced through on the opposite side, the fullness of the net readily permitting this protrusion. The fish is then held in a kind of pocket, and, in endeavoring to escape, is quite as likely to carry the bag the net has made across into another mesh, which, of course, holds it with perfect security. This net is much used in mill-ponds and other localities filled with brush or other obstructions preventing dragging-apparatus. Here, by muddying the vicinity of the net and then stirring around and making a great noise, the startled fish shoot in every direction, and frequently strike the net and are captured.

Next to the seine-nets of various forms, and far more productive than the gill-net, is the apparatus called "*trawl*" in England. This is simply a huge bag of netting, with an open mouth, drawn behind a vessel and dragging on the bottom of the sea, sweeping into itself the ground-fish, surface-shells, sea-weed, &c. Quite commonly this is about seventy feet long, with a semi-elliptical opening at the mouth of forty feet in breadth, diminishing gradually to the posterior end, where, however, there is a portion, of about ten feet in length, of a uniform diameter of four or five feet. The upper part of the mouth of the net is fastened to a beam of wood about forty feet long, supported at each end by two iron frames three feet high, and known as the trawl-heads or irons, the upper part of which has a socket into which the beam passes, and the lower side having a runner, turned up forward, on which the trawl rests. The trawl-net is fastened to the beam above, and to a leaded rope below, which extends from one runner to the other, exhibiting a considerable amount of slack. Ropes are fastened to each runner, which are brought together, after passing a certain distance, and to them the line itself is attached by which the apparatus is dragged along. Thus rigged, the apparatus is lowered over to the bottom, and is held behind a vessel of thirty-five to sixty tons, or even more, in moderate motion. The runners glide over the bottom, dragging the lead-line between them. The fish, as they are imbedded in the sand or concealed in the mud or weeds, if

not previously startled, are frightened from their hiding-places by the lead-line, and generally shoot upward to escape. They, however, meet the upper side of the net, and in the progress of the trawl are carried back toward the posterior extremity. Here pockets have been made, or *cul-de-sacs*, into which the fish make their way and find themselves unable to escape.

After a certain time the trawl is lifted and the fish removed, and the trawl thrown over again. As may be readily imagined, this trawl-net can be used only on smooth bottom, sandy bottom being preferred. If, however, the lead-line catch upon a rock or other obstacle, it is so arranged that it will break before the drag-rope parts, so that no damage will be done other than that of tearing the net, which, of course, is preferable to losing the entire apparatus.

Trawling is generally carried on in the direction of the tide, sometimes across, but never against it, as the trawl cannot be kept down against the tide. The rate of progress is usually from half a mile to two miles an hour, depending upon the kind of fish set for, the object being to keep the trawl steadily working on the ground.

It is not a little remarkable that this method of fishing should be entirely unknown in the United States, while in England nearly all the fishes of a certain class, such as the turbot, the sole, the plaice, &c., are captured by its means. I have used a net of this character of smaller size than that described, for several seasons, to great advantage in collecting specimens for investigation; but, with the exception of one constructed for my use and one used by Dr. Stimpson and Mr. Blatchford in Florida, I am unaware of others having been placed in American waters. It is possible that the unpopularity of the flat-fish in America may be the cause of this state of things, as the flounders and skates that are taken in so great quantity by this means are not marketable, or in very small numbers only.

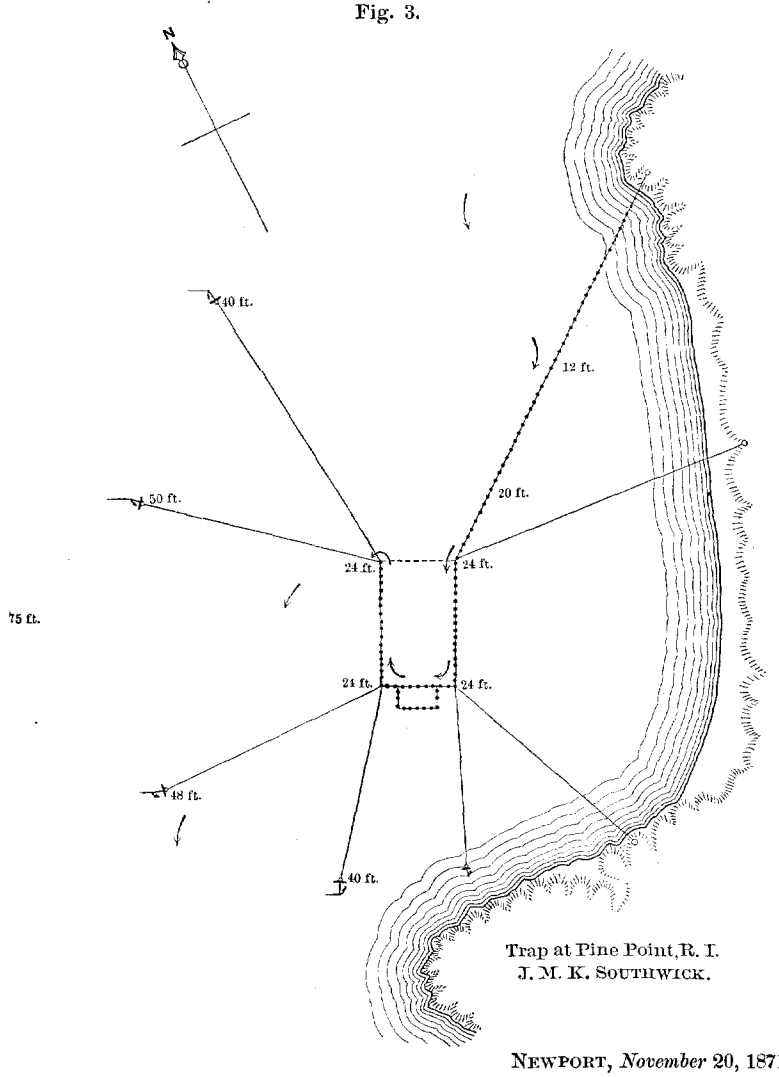
A net known as the "casting-net" is in extensive use in the West Indies, Florida, and elsewhere on the southern coast. This consists of a circle of netting, varying in diameter from four feet to fifteen or more, to the circumference of which are attached, at short intervals, leaden weights. There is a central opening in the net, usually constituted by a ferrule of bone or metal. One end of a long rope passes through this ferrule, and to it are attached numerous cords extending to the lead-rope. The net is used by gathering up the casting-rope in a coil on one arm, and taking the net itself on the other. By a dexterous fling of the arm containing the net, this is thrown in such a way as to spread out completely, and it is sometimes hurled to a distance of many feet, so as to fall perfectly flat on the surface of the water. The leads sink immediately, forming a circular inclosure, and imprisoning any fish that happen to be under it at the time. The rope is then hauled in from the other end, causing the entire circumference to pucker inwardly, and the leads and puckered portion come together in a compact mass, in which the fish are entangled. Much skill is of course required for success in the use of this net; but it is very efficient in taking such fish as the mullet, which, when captured with the common seine, will leap over the cork-line with the greatest ease and escape.

TRAPS, WEIRS, POUNDS, AND FYKES.

In the United States by far the greatest weight of summer market-fish, with the exception, perhaps, of the cod, shad, and menhaden, is taken in the more elaborate constructions, variously known as traps, pounds, heart

nets, weirs, &c. These may consist entirely of netting, of brush or of laths, or a combination of two or more of these materials, the construction, in form and material, varying in different parts of our sea-coast or of the great lakes. The apparatus constructed of nets is used principally on the south side of New England and on the lakes, and in its simplest form, is as described by Mr. Southwick on page 10, accompanied by a diagram. The trap-net proper (Fig. 3) is peculiar to the waters of Rhode Island, especially the Seaconnet River, and is illustrated in the accompanying figure, as well as by that on page 10. The following account of this trap, and the mode of using it, I owe to Mr. Southwick.

Fig. 3.



Trap at Pine Point, R. I.
J. M. K. SOUTHWICK.

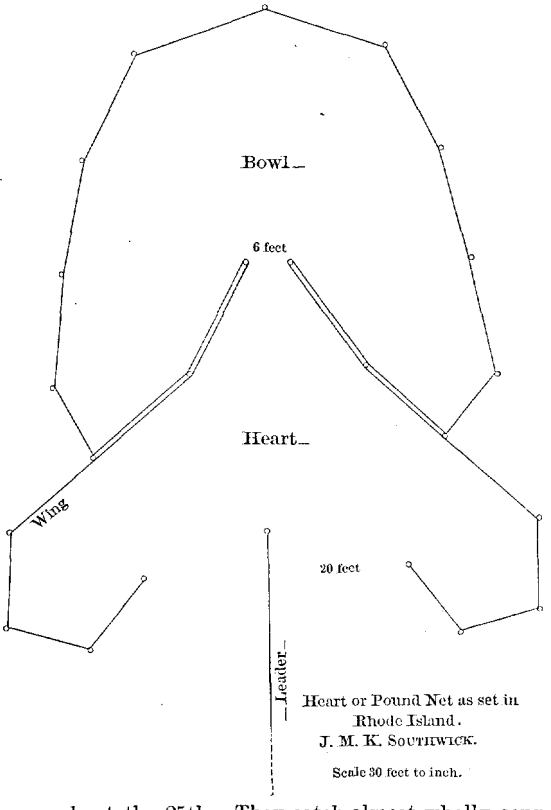
NEWPORT, *November* 20, 1871.

DEAR SIR: A trap, or "square trap" as sometimes called, is simply an oblong square box of netting, open at the inshore and above ends, to one edge of which is attached a leader running toward or on the shore, where it is fastened by an anchor or to some object. The lower edge of the leader is kept on the bottom by a chain or stones lashed

to it, and the upper edge of both leader and trap is floated by corks, and all kept in place by anchors attached by cables to the upper corners. There are no poles driven into the sea-bottom, as in the heart-seine. The netting, therefore, has a certain amount of swing with the tide.

The mouth of the trap (or upper end) is kept for the time on the bottom by leads strung on a line and seized to the line run through the meshes that passes across the bottom, up the end of the side opposite the leader, and thence away around the trap, to which is seized the cork-line. This line also runs across the top of the open end to prevent the trap from spreading. And here are two buoys of corks, with lines running to the bottom and attached to the lead-line, one of which is caught by each boat, and the bottom of the trap pulled up to the gunwale, when the setting is caught by the men and distributed among them, each holding as much as he can handle, and keeping a sharp lookout that no opening be left for the fish to pass by them. The netting is now overhauled, and passes under the boats and to the bottom while the fish are being bunted into the corner where the pound is attached. When they are crowded hard, and a good bunch of them, they will sink the corks, otherwise an oar is used to sink the corks, and they pass over into the pound or pocket. Any remaining seine is thrown from the boats, and by sinking the corks at the most convenient spot, with a scoop-net or oar, the boats go out of the trap, and are ready to try the same thing over again, and so on until the tide is too strong for them; when they go ashore to eat and sleep, or wait for another tide, that must be fished in the same way, come when it will, midnight or daylight. When fish are running, the traps are bunted five or six times each tide. It takes six good men to bunt, and another good man to cook for them. These traps are set the 1st of May and taken up about the 25th. They catch almost wholly scup and sea-bass, but comparatively few other fish.

Fig. 4.



Heart or Pound Net as set in Rhode Island.
J. M. K. SOUTHWICK.
Scale 30 feet to inch.

To give some idea of the proportion, I will give the following rough estimate of the catch to one trap: Scup, 1,500 barrels; sea-bass, 2,500 barrels; flat-fish, 1,000 barrels; tautog, 500 barrels; bass, 700 barrels; mackerel, 200 barrels; menhaden, sea-robins, bellows-fish, 200 barrels.

Nineteen-twentieths of the fish are caught during the great run in five or ten days, from the 10th to the 20th of May. We have known two-thirds of the season's catch to be taken in forty-eight hours.

These traps vary from twenty to thirty fathoms in length, from five to ten in depth, and ten to fifteen in width.

Yours, truly,

J. M. K. SOUTHWICK.

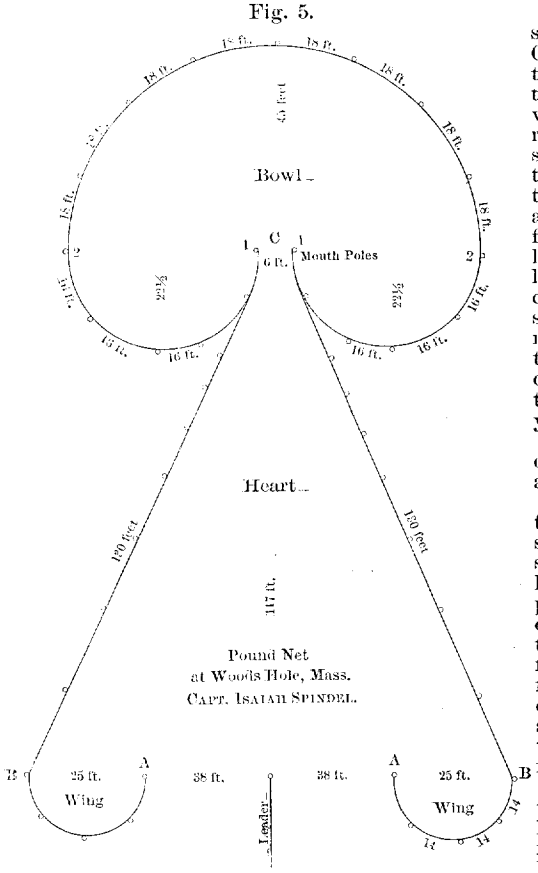
Professor BAIRD.

It will be seen that this net requires the constant supervision of the fishermen, as there is nothing to prevent the fish from swimming out after they have gone around the circuit of the inclosure. It is therefore necessary to be on the watch, so as to raise the forward part of the net

in time to prevent the escape of the fish. By this precaution the fish are gradually driven back and forced into the pocket, where they are kept until needed.

The *heart-net* or *pound* consists of three parts, the *leader*, *heart*, and *bowl*, and is variously constructed, according to the fancy of the fishermen or the special conditions of the locality. Fig. 4 shows in more detail the Rhode Island pound, figured and described by Mr. Southwick on page 10. In Fig. 5 will be seen a working plan of the very efficient pound commanded by Captain Spindel at Wood's Hole, the construction and management of which will be readily comprehended from the following directions supplied by him. This class of net does not require the constant watchfulness of the managers, as the fish, once in, usually remain until taken out. This is done once or even twice a day.

Fig. 5.



First set mouth-poles, 1 and 1, six feet apart; then from center, C, run a line forty-five feet long to 2 and set stake or pole, and the same to 3 and set pole, which will bring those four poles in range; then from center, C, sweep around the circle with this forty-five-feet line and set the poles about eighteen feet apart, until you come to 2; then from center of 1 and 2 fasten line twenty-two and a half feet long, and sweep the quarter circle, setting the poles about sixteen feet apart. A little judgment must be used in setting these poles, as it is not a true circle. Finish the other quarter circle in same way, and you will have the bowl poles set.

We set the bowl poles in circle, five feet larger than the bowl, and anchor each pole.

To set heart pieces, fasten line to mouth of bowl at C, and run straight line one hundred and seventeen feet and set a pole for leader; fasten line now to this pole, and measure off thirty-eight feet and set heart pole, A; then measure, say twenty-five feet, to B, and set pole; and from this pole set a straight line of poles, about twenty-five feet apart, to mouth-pole 1. Have the wing about twenty-seven feet deep, with three poles.

We have only one row of poles to bowl, and are set five feet larger than the bowl, so that the netting can be drawn out taut, both at the bottom and top, but not necessarily close to the poles. Each pole is guyed with anchor. Our leader is two hundred and sixty-five yards long, the poles being set about twenty feet apart.

ISAIAH SPINDEL.

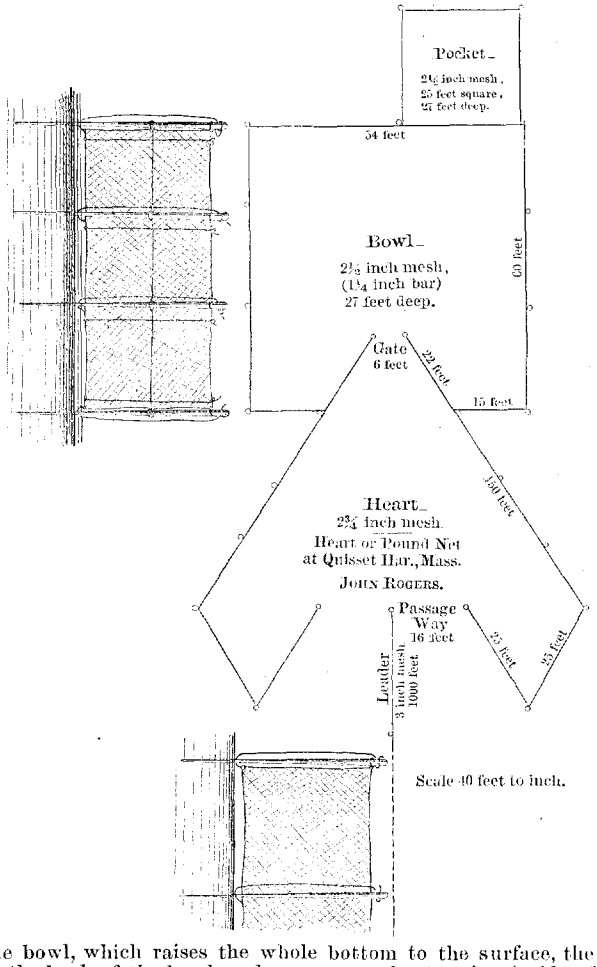
The next figure represents another form of this pound, as erected at Quissett Harbor by Captain Rogers, of Noank, Connecticut, and party, consisting of four brothers. This is somewhat smaller than the other, and is more easily taken off or put on the poles. We are indebted to the captain for the following account of his apparatus. We may premise,

however, that the length of the leader varies with the locality, the object generally being to carry the bowl into water of from three to five fathoms in depth. This, in some cases, will be accomplished with a leader of one hundred and fifty yards, while, again, five hundred will be needed.

NOANK, CONNECTICUT, *December* 4, 1871.

DEAR SIR: I do not know whether I can give you a satisfactory account of the construction of my pound, but I will, at any rate, try to do so. The leaders are fastened upon the poles, beginning at the off-shore pole, stretching the top rope from one pole to the other, drawing it tight, fastening or seizing to every pole. The bottom rope of the leader is hauled down by ropes that are rove through every pole, close to the bottom, keeping the leader down without the use of chains, and the same throughout the whole gear, as you see by the drawing.

Fig. 6.



A center line runs round the bowl, marked on the net half way from the top to bottom, and is fastened to rings which slip up and down the poles when we haul and set the pounds, which keeps the net close to the poles, giving room inside the bowl.

The door that opens from the "heart" into the pound is six feet wide, extending from the top rope of the bowl to the very bottom, like a gate-way.

The passage-way that runs from the leader into the heart, is sixteen feet wide on each side of the leader, extending from top to bottom.

The poles on the leader are driven at different distances, beginning at the off-shore end twenty-six feet, and varying up to forty feet apart. Poles on the heart and bowl are also driven at different distances apart, according to the shape of the net.

When we lift the pound we begin at the door, untying the ropes that hold the bowl to the bottom, pulling on the ropes that lift the bowl, following from one pole to the other round to the back, there being a haul-down rope and a lift-up rope to every pole that is attached to the bowl, which raises the whole bottom to the surface, the fish swimming ahead into the back of the bowl, and one or more boats going inside of the bowl and pursing up that part of the net, bring the fish into close compact.

Yours, truly,

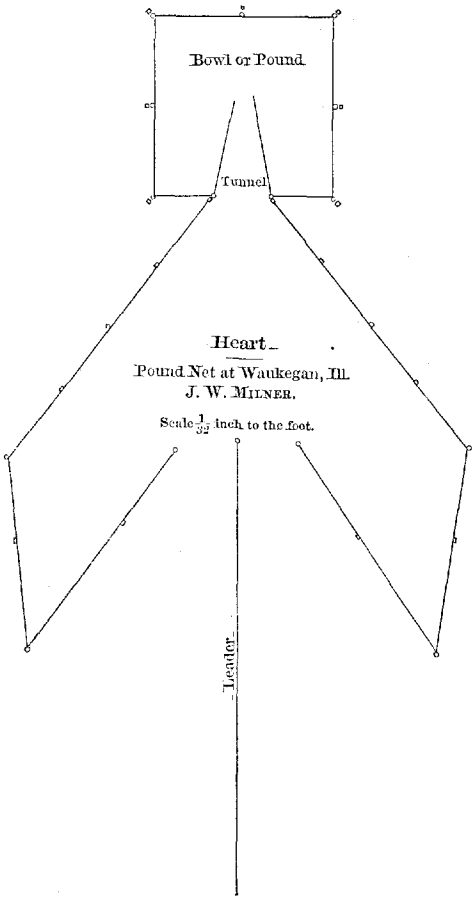
JOHN ROGERS.

Professor BAIRD.

A still more complicated arrangement of a heart-pound is that in use in Lake Michigan, and elsewhere in the great lakes, and preferred as by far the most efficient of all, as there is much less chance of the

escape of the fish when once in the bowl. For the description and illustrations of this (Figs. 7 to 12) I am indebted to Mr. James W. Milner.

Fig. 7.



The pound-nets are commonly made of 20-thread soft laid seine-twine, netted by hand or woven by machinery, and well saturated with tar. They have several parts, termed the "leader," the "heart," the "pot," "bowl," or "crib," and the "tunnel."

The Leader, (Fig. 7.)—The leader is merely a net fence that guides the fishes, in their attempt to get around it, into the heart.

Small piles, of six or seven inches diameter, are driven into the lake-bottom, until about two feet only stand above the surface. The piles

Fig. 8.

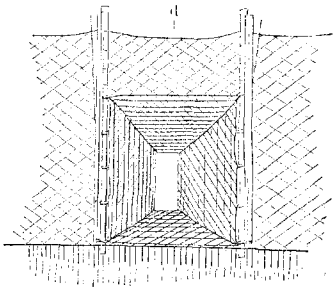
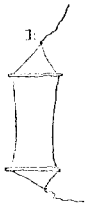


Fig. 9.

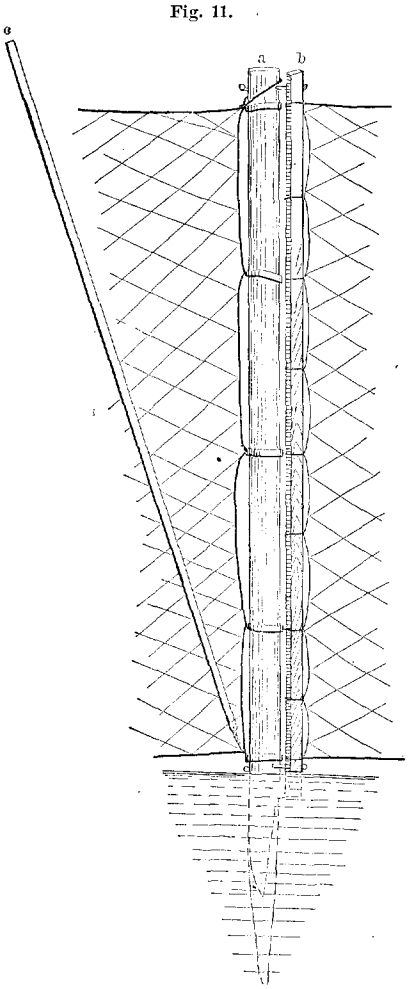


extend in a row, four rods apart, for a length of from sixty to two hundred rods, generally beginning near the shore, and extending directly out into the lake, but often started where there are favorable shoals, as far as four, and once even six miles from the shore. Upon these piles a net is stretched, extending from the top of the water to the bottom. The leader is made in pieces, ten rods in length. The top of the net is secured to the pile by a short rope, and weights are attached to the bottom, stones weighing from fifty to seventy-five pounds, every two rods. The mesh of the leader is $4\frac{1}{2}$ inches.

The Heart, (Figure 7.)—The shape of its outline gives this part of the net its name. Each side of the heart is a net, eight rods in length, set close to the lake-bottom, and reaching above the water two feet. The shore ends are secured to piles, driven each ten feet from the last pile of the leader, leaving an opening or entrance ten feet wide, on each side of the leader, through which the fish pass. The net is carried round inside of piles, arranged in the outline of the sides of a heart, until the outer ends approach each other to within ten feet, the width of the tunnel. These ends are tied fast to scantling, (*b*, fig. 11) and the scantlings are fastened snugly to the piles on each side of the tunnel-opening. The lower end of each scantling has attached an iron ring, which is put over the upper end of the pile and slid down to the bottom, while the upper end of the scantling is lashed to the head of the pile. There are three other piles on each side, besides those at the ends. The net is secured at the top by guys, three feet long, and the bottom is weighted with stones, the same as the leader, opposite and between the piles. The mesh of the heart is usually $3\frac{1}{2}$ to 4 inches, extension measure.

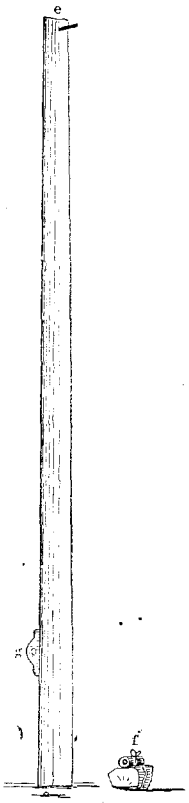
The Pot, Bowl, or Crib, (Fig. 7.)—The pot is in the shape of a room, having four walls and a floor. It is thirty feet square, and, in height, extends from the bottom to three feet above the surface. In the middle of the side next the heart is an opening ten feet wide and sixteen feet high, beginning at the bottom, in which is placed the tunnel. A pile is driven on the outside, at each corner, and one in the middle, on three sides, while on the heart side there are two, ten feet apart and ten feet from the corners. To all the piles, but the two mentioned, the net is made fast at the top by three-feet guys; at the bottom of each pile is sunk a stone of from seventy-five to eighty pounds' weight, and on the top of the stone is lashed a bull's-eye, (Fig. 10, *f*.) A rope tied to the bottom of the net, opposite the stone, is rove through the bull's-eye and passes upward to the top of the pile, where the end is made fast, leaving plenty of slack. When the net is set, the ropes are hauled taut and secured by half-hitches to a pin driven into the top of the pile, which serves also to coil up the slack. The mesh of the pot is from one and a half to three and one-quarter inches.

Fig. 11.



The Tunnel, (Figs. 7, 8.)—The tunnel is a netting, shaped something like a truncated cone. Its longer end is fitted and laced into the sides of the opening (*d*, fig. 8) in the heart side of the pot. The smaller end projects into the pot about sixteen feet and narrows to its outlet, an opening two and one-half feet by six, (*h*, fig. 9.) Short sticks are attached to the upper and lower sides of the outlet, having small bridles to which lines are made fast. The lower one is rove through a hole in a cleat (*g*, fig. 10) nailed to the side of the middle pile, opposite the tunnel outlet, and at five feet from the bottom, and from there passes upward to the top of the pile, where the end is made fast, leaving plenty of slack. The upper line passes directly to the top of the pile. When hauled taut they keep the tunnel standing open, for the free passage of the fish.

Fig. 10.



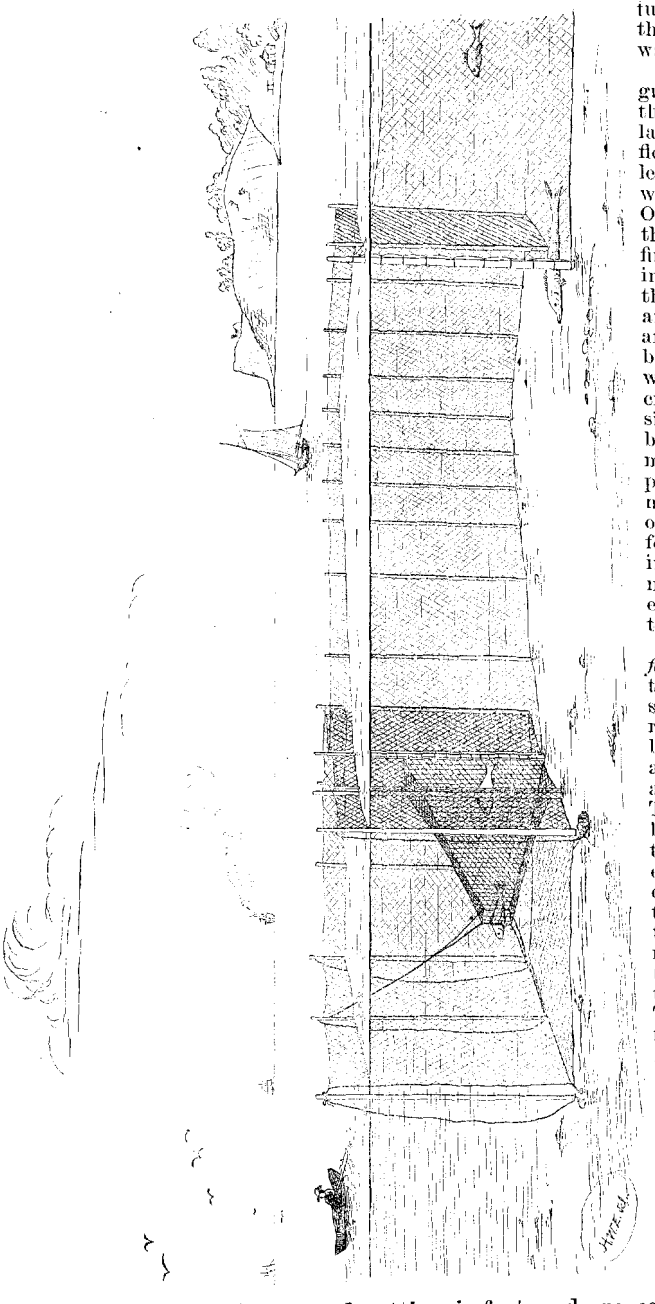
In the sides of the tunnel entrance are fastened hoops, five on each side. These hoops are put over the top of the adjacent piles, and allow the net to slide up and down readily, when the tunnel is closed for the purpose of taking out the fishes, and again when it is reset. To the bottom hoop is fastened a slender pole, called the shover, (*c*, fig. 11,) for use in closing and opening the tunnel entrance. The mesh of the tunnel is the same as that of the pot.

How the fishes get in.—The schools of fishes, in moving along near the shore, find the long leader obstructing their way, and although the meshes are large enough for them to pass through, so wary and cautious are their instincts that they will not come in contact with the net, but swim within a few inches of it, out from the shore, until they enter the heart.

At first sight the heart would appear of unnecessary dimensions, but it is contrived in accordance with a knowledge of the habits of the fish, which are not inclined to

turn at short angles, but prefer a course of straight lines or long curves. If the passage to the tunnel is narrow and contracted, a fish becoming alarmed is much more apt to turn short round and pass out at the opening it has just entered. In the large heart they are quite as apt to dart through the tunnel as to escape through the shoreward openings.

Fig. 12.



Like many other gregarious animals, the white-fish and lake herring will flock in behind a leader, just as sheep will through a gate. Once in the pot, they are not apt to find the small opening at the outlet of the tunnel, but swim around the sides, and, after a time, becoming familiar with the net, or crowded against the sides by the numbers within the pot, many attempt to pass through the meshes, the smaller ones escaping, and a few larger, becoming gilled, die. Still, no frantic effort at escape is made until the net is lifted.

Taking out the fishes.—In taking them out a boat is sent round, and the ropes staying the bottom of the pound, and the tunnel-guys, are all cast loose. The boat is now brought inside of the pot, the "shovers" are drawn up, closing the entrance to the tunnel, and the end of the tunnel is pulled up and thrown back over the side of the pot. The bottom of the net is raised by pulling up the tunnel side, until it is reached; it is then tripped along under the boat until the fishes are gathered into a corner, like shaking wheat into the middle of a sheet, when they are thrown into the boat with a scoop-net.

The stakes on which pound netting is fastened are usually driven into place by means of a pile-driver, and are never left down throughout the

winter on account of their almost certain destruction by storms and floating ice. They are piled up in the autumn and stored for use in the coming season. Sometimes they are set in large stones, about four feet square, and simply set on the bottom. This method is used on Prince Edward's Island, as in the pound of Mr. J. C. Hall of Charlottetown.

Not unfrequently the heart-pounds are so arranged that a second leader is started in a line with the first, running out from the outer side of the bowl to a given distance, and another heart and bowl attached, so as to cover a much larger portion of the channel-way. This is seen in the pound at Waquoit, Massachusetts, for a lucid description of which, with accompanying illustrations, I am indebted to the report of Theodore Lyman.

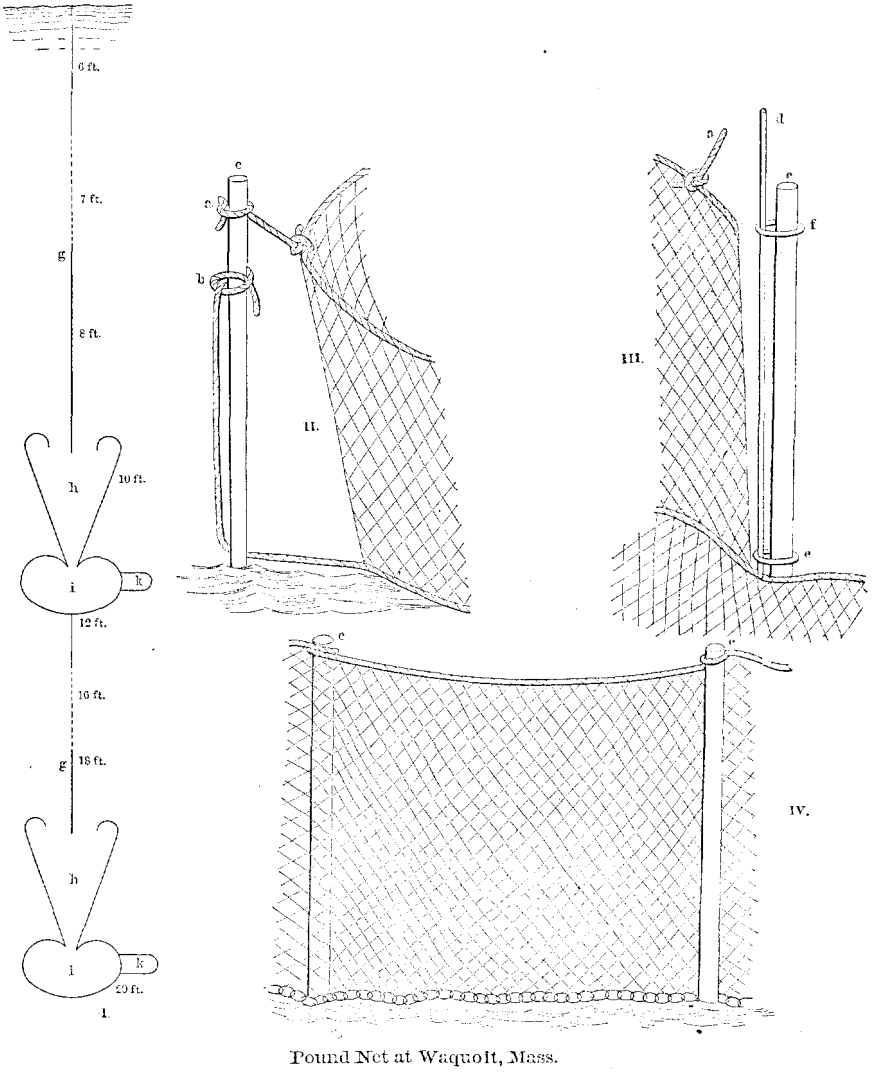
A pound or weir is an old and singular contrivance, whose success depends upon the fatal principle of fishes never to turn a sharp corner. A place is chosen where it is known that large schools are accustomed to coast along, parallel with the shore, and there a barrier is run out in a straight line. This barrier is called the "leader," and may be a stone wall, a fence of laths or of brush, or a net stretched on poles. At the end of this leader, and like a spear-head on its handle, is constructed a heart-shaped inclosure or "pound" (or "heart") having a narrow opening, on either side, next the point of the leader. On its off-shore end this heart again opens into a circular inclosure called the "bowl." A school coasting along shore is suddenly stopped by the leader, and immediately the fish turn toward deep water, and, swimming parallel with the barrier, pass into the heart, whence there is no escape save by a sharp backward turn, which, as before stated, is against their principle. Therefore they swim round and round and pass into the bowl, where they are left by the tide, or, if the bowl be in deep water, they are hauled up by a net-bottom.

The Waquoit weir is made like many of the same sort. About the middle of March, if the weather permits, the men begin to set the poles which are to support the "lint" as the netting is called. First a row of stout poles, or rather posts, running straight out, is firmly set by a floating pile-driver. The poles stand fifteen feet apart, and run directly seaward for seven hundred and fifty feet, to make the first "leader," (Fig. 13, I, *g*,) which here stops short at the mouth of the "heart," *h*, whose outline is marked out by the same kind of poles set nearer together, or about ten feet apart. The entrance to the heart is twenty-five feet wide on each side of the leader, or fifty wide in the whole; but it converges strongly toward its outer apex, so that the entrance to the "bowl" is only seven feet wide. This bowl, *i*, is marked out, like the heart, with poles set somewhat close together. Moreover, from its east side projects a sort of lobe, eighteen feet wide and thirty-six long, *k*, indicated by the five poles which are to support this "pocket" wherein fish may be kept alive. From the outer point of the bowl another row of leader-poles is driven, running seaward four hundred and fifty feet; and, at its extremity, posts are driven for the second heart, bowl and pocket, like the first. Then the lint is carried out in boats and hung on the leader-posts. It is composed of a pretty strong net, with a mesh of two and a half to three inches. Along its foot, where are placed the leads of a seine, there is made fast a chain; while along its upper edge runs an inch rope, (*i. e.*, an inch in circumference.) As the net is passed on alternate sides of the succeeding poles, a round turn is taken with the rope to hold it in place, while the chain, sinking to the bottom, maintains the lint in an upright position and closes the spaces between the poles, (13, IV.) The heart is hung with lint in the same way, but the bowl must be differently treated, for the bowl-net has a bottom as well as sides. It is in fact a great bag, forty feet long, eighty wide, and fifteen or twenty deep, and is hung in an oval of poles, fifty feet long and one hundred wide. For this purpose a one and a quarter inch rope runs, like a binding, entirely around the upper edge of the bowl-net, (Fig. II,) and opposite each pole there is made fast to this rope a head-line (13, II, *a*) whose other end is attached to the pole. These head-lines suspend the bowl-net, which cannot, however, be held down by chains or weights, because these would make it too heavy to handle when the weir is "hauled." Therefore there are bottom-lines (13. II, *b*) corresponding to the head-lines, except that they are attached to the lower edge of the bowl-net, whence they pass through a hole in the pole, are brought to the surface of the water, and are there made fast. When, now, the head-lines and bottom-lines are hauled taut and made fast, the bowl-net must be firmly set in position, namely, projecting about five feet above the water, and extending thence nearly or quite to the bottom. It remains only to show how the fish are admitted to the bowl and how the fatal door is closed on them. On either side of the entrance to the bowl stands a post, (13, III, *c*,) and, beside it, a long, slender pole (13, III, *d*) attached by rings (13, III, *f e*) to the post, but free to run up and down. The lower end of the pole is tied to the lower part of the bowl-net, and by

pushing the pole down till it touches bottom, the net is held firmly down; and a gap being left in the side of the net at this point, a free entrance is made for the fish. This entrance is closed by pulling up the sliding poles till they bring the net to the surface of the water.

The weir is "hauled" once a day, and always at slack water, because with a strong tide, running east or west, it is impossible to handle the bottom-lines. The men pull out in two parties; of which one, in a large scow, passes round the out-

Fig. 13.



Pound Net at Waquoit, Mass.

side of the bowl, casting off the bottom-lines; while the other, in a yawl-boat, pushes inside the bowls, pulls up the sliding poles, and closes the entrance. The slackening of the bottom-lines allows the bowl-net to hang free; and the crew inside begin to haul up the bottom of this net in such a way as to work the fish toward one corner, letting the net, as it comes to the surface, pass under their boat, which is thus slowly drawn across the bowl toward the corner where the capture is to take place, and where the scow is already waiting outside.

An arrangement, different in construction, but on the same general principle, largely in use from New York to New London, consists of what is called a fyke-net, as shown in the accompanying sketch, (Fig. 14 :)

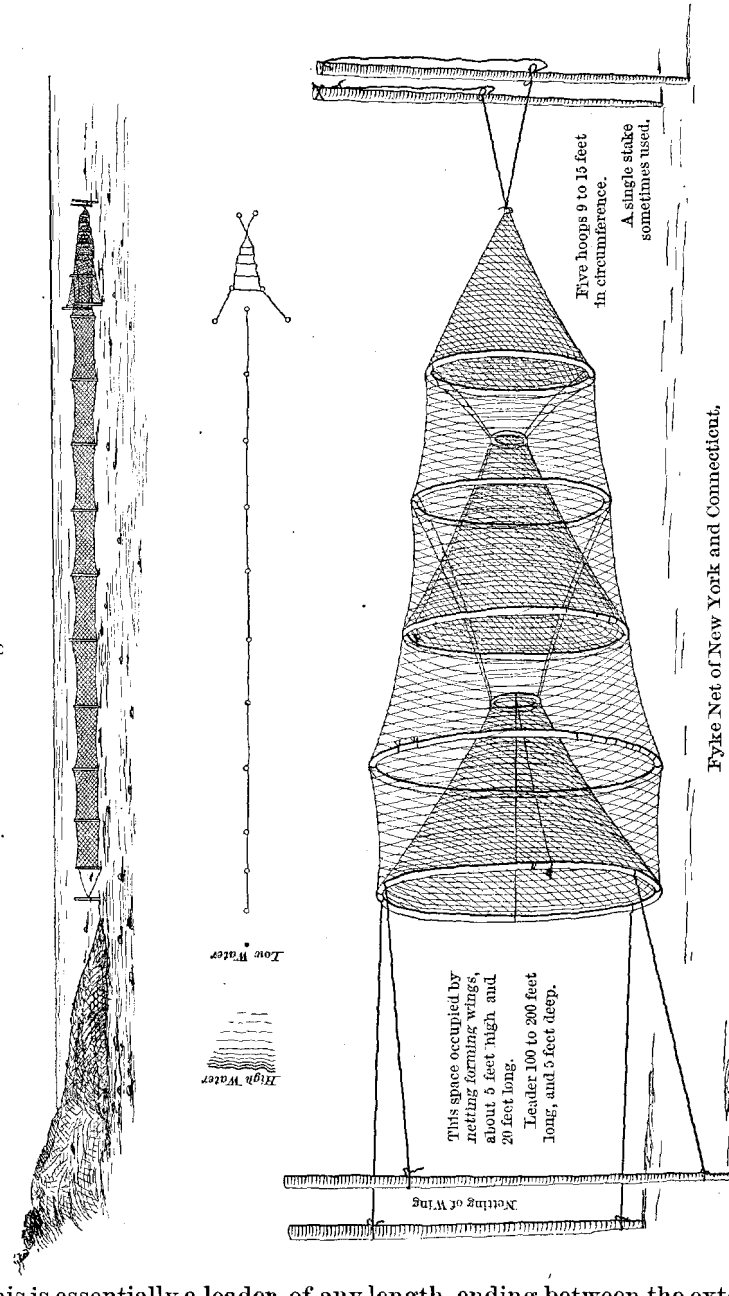


Fig. 14.

Fyke Net of New York and Connecticut, J. C. Brevoort.

This is essentially a leader, of any length, ending between the extended arms of a fyke-net, which is nothing more than the ordinary set-net

of the rivers. The fish, in their movements, strike against the leader, are led unconsciously to this net and trapped, from which they cannot escape.

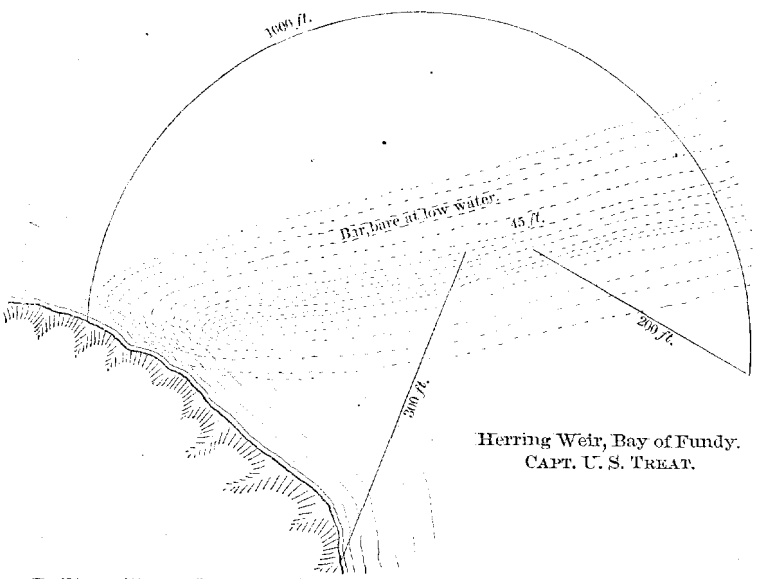
All these various forms of heart-pounds are so arranged as to take fish from either side, whether with the ebb or the flood, although it is perhaps more common for the fish to run along the shores in the ebb of the tide rather than the flood.

As we pass to the north of Cape Cod a different form of fixed apparatus comes into use, these generally the weir proper, which is commonly constructed of brush, and usually takes the fish at low tide, either leaving them inclosed in a small basin, from which they are seined, or causing them to be stranded on the bottom, where they are picked up.

The simplest form of a brush-weir consists of a mere fence of brush driven into the sand or mud, to prevent its floating away, and forming a curve concave to the ebb of the tide. As the water runs off, becoming more and more shallow, the fish which happen to be inside of the inclosure of this brush fence are detained, and left, when the water has run off, to be captured at leisure. For this arrangement no leader is required.

The ordinary construction of weirs for taking herring is seen in Fig. 15, illustrating one now in successful use by Captain U. S. Treat of Eastport.

Fig. 15.



Herring Weir, Bay of Fundy.
CAPT. U. S. TREAT.

Built of piling and brush up to low water mark, netting of cotton twine above. At low water the fish are seined and dipped into boats. At low water there is 18 ft. of water between the bar and the weir.

Into this the fish enter at high tide, through a narrow opening, and if the number of fish noticed as having come in is considerable, a gate of netting, suspended over the narrow entrance, is dropped, and the escape of the fish is cut off. As the tide falls the fish are gathered into the basin in the weir, from which they are drawn into a narrower space by means of the seine, and either hauled out to the shore or dipped out into boats by means of large dip-nets. As many as from one hundred and fifty to two hundred and fifty hogsheads of herring are frequently captured in this way in a single tide.

The fish usually enter in high water, either late in the evening or early in the morning, and when low water occurs between these periods few or no fish are taken.

At Eastport the weirs on the Campobello shore, as well as those at Grand Manan, take most fish when high water occurs in the evening, rendering it necessary to take out the herring about midnight, or a little later. At Captain Treat's weir and others adjacent to it, however, the best time for taking out the fish is usually from five or six o'clock in the morning until ten, a much more convenient arrangement.

Fig. 16.

South side lower St. Lawrence, Herring Weir. J. C. BREVOORT.

The variety of weirs in use in the vicinity of Eastport, and about Campobello and the island of Grand Manan, is very great, and the number in use, as well as the quantity of herring captured in them, is almost incredible.

This form of weir does not involve the use of a leader, and can be used to advantage only where the tide is very high and the shores especially adapted to them. Weirs with leaders are used more frequently where there is a long extent of shallow water, which is bare at low tide. A simple form of this leader is given in Fig. 16, kindly furnished by Mr. J. C. Brevoort, as used on the south side of the St. Lawrence River, from Quebec to near its mouth. Here the leader may be of indefinite length, (sometimes one thousand feet and over,) ending in either a bowl or a circle. The whole is constructed of stakes or osiers, or both. Sometimes a second leader, with its second bowl, is placed exterior to and in continuation of the first. This form of leader of a weir is the simplest of all, and the one more generally used in England, where our more complicated and more efficient arrangements appear not to be known.

This fact must be borne in mind in considering the decision of the British commission in reference to the amount of influence that such apparatus could exercise upon the fish supply, of which commission Professor Huxley was a member, to the effect that such apparatus exercised very little influence upon the persistence of the fish supply.

Weirs as used in Cape Cod are somewhat differently constructed, as they consist in large part of slats or boards. The figure and following description have been furnished by Captain Prince Crowell:

EAST DENNIS, MASSACHUSETTS, *December* 2, 1871.

DEAR SIR: The weirs on the north side of the cape are what are called dry weirs; they are set on the flats where the tide ebbs off and leaves them dry, at which time the fish are taken out. The flats extend from one-half to one mile from high-water mark; from six to eight feet water over them at high water.

The leaders and heart are constructed by nailing laths upon small poles worked into the sand, with a peg through the pole (when worked down) just under the surface of the sand, on which boards are placed, then stone ballast to keep them from working up, and the first and second pound-seines are usually used, the poles being fixed down the same as the heart and leader, although some are made of all laths. Some have only one pound instead of two. There are about fifteen of these weirs between Yarmouth and Provincetown. I know of no other kind. I inclose a little diagram, (Fig. 17,) without being drawn to any particular scale, and hope it will be intelligible.

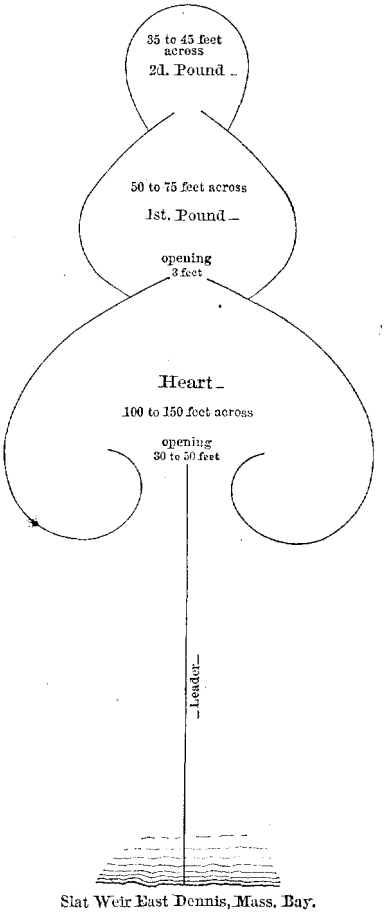
Yours, truly,

P. S. CROWELL.

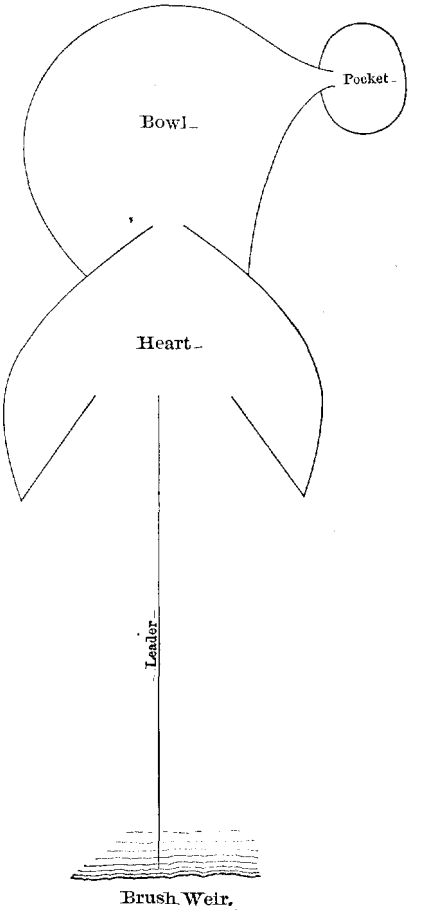
A modification of the heart-pound is largely used in the bays and mouths of the rivers of Maine and the provinces, for the capture of salmon, as illustrated in Fig. 18.

Here the leader is generally made of brush, up to the height of half-tide, and of netting the rest of the way. The heart is made of either brush or netting, and sometimes of slats. The bowl, instead of being placed at the outside of the heart, in a line with the leader, is placed either in the upper or lower side,

Fig. 17.



Slat Weir East Dennis, Mass. Bay.
CAPT. PRINCE CROWELL.



Brush Weir.
Deep Water Weir for taking Salmon, Shad &c: built into 18 to 20 feet of water. The pocket has a board floor, laid so that it is dry at low water for convenience of taking the fish.

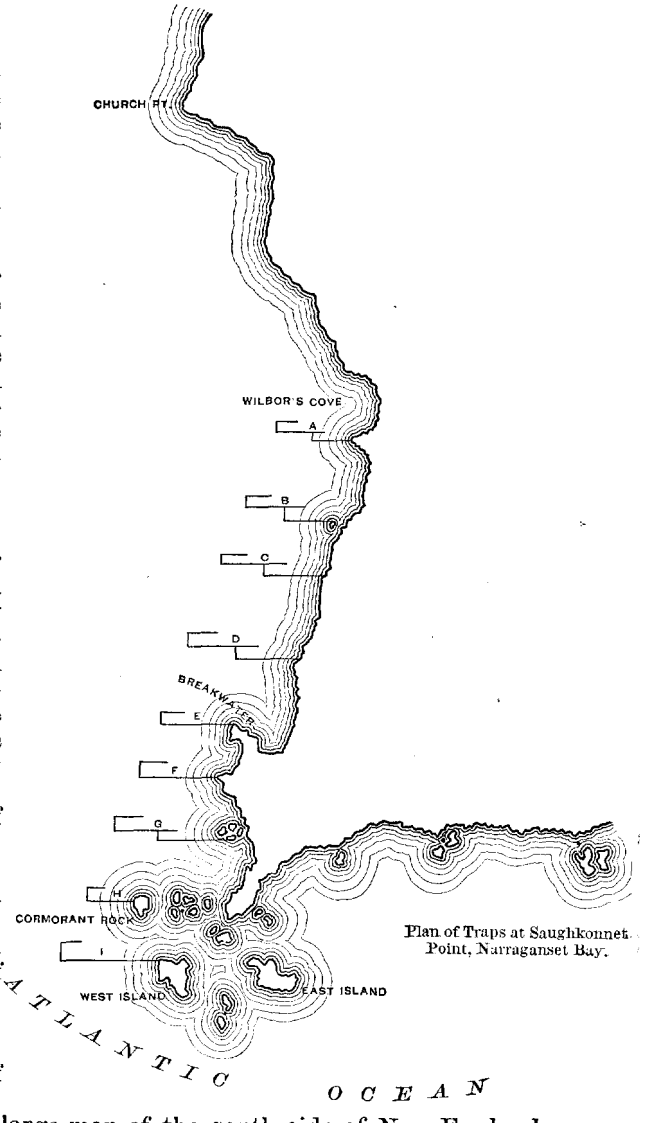
according to the nature of the coast, in some localities the efficiency being greater in the one case, while it is reversed in the other. The bowl may consist of netting or of slats, and the two forms are illustrated in the accompanying figures.

An ingenious apparatus, according to Perley, called the "spring-weir," is made use of in certain parts of the bay, where there is a very narrow entrance to a harbor, easily capable of being closed. This is so arranged as to drop flat to the bottom at low water, and allow the fish to pass over it with the incoming tide. At high water this is lifted up and worked from the shore by means of powerful capstans and ropes, forming an impassable barrier to the fish, which are retained as the tide passes out, and taken in large numbers, including shad, herring, salmon, &c.

LOCATION OF TRAPS, WEIRS, AND POUNDS, IN THE UNITED STATES.

I have thus indicated briefly the principal devices by which fishes are captured in the United States,[1] without attempting to represent all the individual modifications. The variety in the construction of traps, weirs, and pounds, is almost endless, depending very much upon the exposure, the nature of the bottom, the depth of water, the currents, the kind of fish to be taken, &c. I have given enough to illustrate the extent to which the simpler devices of the spear, the bow and arrow, and the hook, have been replaced by apparatus for a more wholesale destruction.

Fig. 19.



Plan of Traps at Saughkonnet Point, Narraganset Bay.

As already remarked, the seacoast weirs or pounds are used almost exclusively east of Connecticut, although fixed nets are in operation in or near the rivers of that State as well as of New York, principally for the capture of shad. The accompanying diagram (Fig. 19) is a plan of the traps at Seaconnet Point, on the eastern side of Narraganset Bay, as furnished by Mr. Southwick, and the details of which are given on page 260. In the large map of the south side of New England, accom-

[1] I am indebted to Dr. H. C. Yarrow for the account of an ingenious method employed in New York Harbor for trapping the *Morrhua pruinosa*, ("Tom-cod,") and which does not come under any of the classes of fishing referred to in the preceding pages.

A sufficient quantity of good rye or wheat straw is gathered into a sheaf and firmly

panying this report, the location of the principal traps and pounds in 1871 is indicated. The weirs of Cape Cod Bay are represented on a separate diagram, forming Plate XXXIX of the accompanying illustrations.

Finally, for the purpose of illustrating the subject of fish-pounds in the lakes, I give on the following page (Fig. 20) a diagram of the pound-nets erected and worked in 1871 in Lake Michigan, the nets being indicated by the short lines drawn perpendicular to the shore-line, in the water surface. A full account of the lake fisheries will be given in the report for 1872.

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tied in the middle; after being weighted with bricks or iron the ends of the sheaf are loosely tied; a rope is attached and the bundle lowered to the bottom of the water, where it is allowed to remain for a few days, until the fish become accustomed to its presence, after which it may be examined once or twice daily. In good localities the straw in the interstices will be literally crammed with fish. Whether they enter the straw for its warmth or for the friction received in their efforts I am unable to state.

The most suitable localities for setting the trap are near wharves or rafts of timber.