XIX.—GILL-NETS IN THE COD FISHERY: A DESCRIPTION OF NORWEGIAN COD-NETS, ETC., AND A HISTORY OF THEIR USE IN THE UNITED STATES.*

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CONSTRUCTION AND RIG OF THE NETS.

1.—Norwegian methods.

The nets used in the Norwegian cod fisheries are usually made of hemp twine, of two, three, or four threads, but occasionally of flax or cotton. The three-laid hemp twine, which is the most common size, weighs a pound to 400 or 420 fathoms. It is made chiefly on spinning-wheels by the fishermen's families, and the nets are constructed almost exclusively by the fishermen and their wives and children. Some of the hemp twine, however, is furnished by the factories of Norway and Great Britain, which also supply all of the cotton and linen twine.

The size of the mesh varies somewhat, according to the locality where the nets are to be used, as it is necessary to make the mesh correspond to the size of the fish that frequent different parts of the coast or make their appearance at different seasons. The smallest mesh is about $5\frac{3}{4}$ inches ($2\frac{7}{10}$ inches square) and the largest 8 inches (4 inches square). Those exhibited at Berlin were 7 and 8 inch mesh.

The length of the nets varies from 10 to 20 fathoms, the average length of those used at the Loffoden Islands being $15\frac{1}{4}$ fathoms when hung, and they are from twenty-five to sixty meshes deep. Nets about thirty meshes deep are generally used, while those of sixty meshes are employed only where there is little or no current. The nets are hung both to single and double lines, and these vary somewhat in size. Those exhibited were hung to double lines, each being $\frac{7}{10}$ of an inch in circumference, while Mr. F. M. Wallem says that 2-inch rope when single, and 1-inch rope when double, is the size commonly used at the Loffoden Islands. Some of the nets are hung to lines only at the top and bottom, having none across the end, while others have them on the ends as elsewhere. This last method is said to have been recently introduced, and is considered an improvement when the line is a little short, so that the

* Revised and republished from volume 1, Bulletin of the United States Fish Commission, 1881, pp. 1–17, with an account of the results subsequently obtained in the United States.

net will be a trifle slack or baggy. About one-third of the net is taken up in hanging; that is, if a net is 30 fathoms long stretched out before it is hung, it will be about 20 fathoms long afterwards. They are hung with twine about the same size as that of which they are made. The end of the twine is first made fast to the hanging line, then hitched to the upper part of one of the meshes, the distance between the line and mesh being equal to one side of the mesh; then back to the line again, around which a clove-hitch is taken, thus forming one-half of a mesh, as shown in Plate I. This method of hanging is thought by the Norwegian fishermen to be superior to any other for large-mesh nets. The twine or net webbing is generally prepared for use in Norway by tanning, and will last, when so prepared, from one to five seasons.

The nets are supported upright in the water by floats of wood, cork, or hollow glass. At the Loffoden Islands, where nets are more extensively used than elsewhere, the glass floats are preferred, it being said that they replace to great advantage the old wooden ones, which failed to prevent the nets from settling on the bottom. The fishermen from Söndmör, however, who fish on banks where there is a strong current, prefer wooden to glass floats, since it is said the latter are so much more liable to be carried away by the tide, causing the loss of many nets; while the principal objection to wooden floats is that they are so easily water-logged. But the latter is thought to be the less evil of the two by the Söndmör fishermen, since the floats can at the worst only sink to the bottom with the nets, whence they may easily be recovered. From this experience of the Norwegian fishermen, it may be inferred that while glass floats are preferable for general use, they are not so suitable as either wood or cork buoys where there is a strong tide. The glass floats are about 5 inches in diameter, with a covering of tarred marline or spun-yarn hitched over them, to which is attached an eye. In this eye is bent the small rope that holds them to the net. When so prepared for use these floats are quite strong, and break far less frequently than might be supposed. They withstand the pressure of water when submerged better than anything that has been tried, but are sometimes filled with water—"drunken," it is called—when set in depths of 75 fathoms or more. Plate II is intended to show the glass float and the way in which it is attached to the net. The small ropes with which these are held vary in length from 1½ to 6 feet.

Oblong-shaped stones, from 3 to 5 inches in length, are used for sinkers. By experience the fishermen learn how large these should be to sink the nets to the desired depth. From ten to twelve are fastened to the bottom of the net at equal distances apart, being held in a double string, as shown in Plate III.

Large stones are used instead of anchors to hold the nets to the bottom. These weigh from 72 to 144 pounds, the heavier one heading the current, and the smaller being on the other end of the gang, containing twenty to thirty-five nets. Besides these "mooring rocks," there are

others of smaller size that are held to the nets by a foot-line, one end of which is fastened to the stone which lies on the bottom, and the other to the rope that connects the lower corners of the nets together. The larger stones are generally slung with rope, but sometimes there is a band of iron around them with an eye or ring, to which the foot-line can be fastened. Iron anchors are not used, as the nets are liable to be torn on them should they settle on the bottom. Plates VI and VII show how the mooring rocks and the other stones are attached to the nets.

Buoys of different kinds are used by the Norwegian fishermen, but, according to Mr. Wallem, at the Loffoden Islands glass buoys, having a capacity of from three to five gallons, are the most common. These are generally egg-shaped and are covered in the same manner as the glass floats. Sometimes a buoy is made by fastening several of the latter around a staff, as shown in Plate X. The glass buoys of both kinds are employed in the trawl as well as the net fishery; they will rise to the surface again after having been under water for several days, an advantage not possessed by other kinds, and it seems that buoys of this description might be profitably used by our bank-fishermen, who frequently lose large quantities of gear on account of the wooden-keg buoys bursting and filling with water when they are submerged to any considerable depth. Hard-wood iron-bound kegs are used by some of the Norwegian net fishermen. From two to four glass floats, such as are on the nets, are fastened to the bight of the buoy-line, at different distances from the buoy, for the purpose of keeping the slack or scope from going on the bottom when there is no current. Where there is a strong tide, and a probability of the large buoy being drawn under the surface of the water, a number of the glass balls are attached to it with a line, these serving as "watch buoys" for the other. Plate V shows how the glass floats are fastened to the buoy-line and buoy.

2.—Newfoundland methods.

The nets employed in the Newfoundland cod fisheries are usually made of hemp twine one size smaller than salmon twine, which is also occasionally used. The size of the mesh is generally about 6 inches (3 inches square), a large mesh not being required for the small fish that generally frequent that coast. The nets vary in length from 50 to 80 fathoms, and in depth from 3 to 4 fathoms. They are hung to the lines in the same way that the Norwegian nets are, the foot-line being 1¼ inch rope, while small-sized double lines, of opposite lays, are the hangings for the top and ends. Rope is used on the lower part of the net, because, when set close to the bottom, small line would probably be bit off by ground-sharks, thereby causing the loss of a portion of the net.

To preserve the nets the Newfoundland fishermen make a mixture of tan and tar, which is thought better than either used separately. The tan is commonly made from spruce buds, fir bark, and birch bark (hem-

lock bark is not used), which are boiled together until it is sufficiently strong, when the bark is removed, and tar added in the proportion of five gallons of tar to two hundred gallons of tan, the whole being stirred well together. Some care is necessary in applying this, or else it will not be evenly distributed on the net. The custom of mixing tan and tar has doubtless been introduced from England, as it is known that the Cornish fishermen do this, pouring out their tanning liquor into large vats with coal-tar, and this mixture is found to preserve the nets much longer than simple tanning. The Newfoundland nets, when prepared in this manner, generally last about 4 seasons.

The floats are made of the best bottle-cork, when obtainable. Before being used they are dipped in hot pitch or tar, after which it is said they will stand for 4 weeks at the bottom in 50 fathoms before getting water-soaked. The fishermen have two sets of floats—one, when soaked, being replaced by the other.

The sinkers most generally in use by the Newfoundland fishermen are made by tying small rocks in a bag of old netting or cloth; but lead sinkers, similar to those on seines, are occasionally attached to the nets. The sinkers weigh from 1 to 2 pounds, are about 13 feet apart, and are fastened close to the bottom of the net.

Anchors, rocks, and stone killicks are used for moorings to the nets. The former weigh from 20 to 25 pounds each, while the killicks and rocks vary from 25 to 60 pounds, the heavier heading the current, and the lighter being on the opposite end of the net or gang.

The buoys are generally made of dry fir poles, 6 to 8 inches in diameter, which are usually from 3 to 4 feet long, and sharpened at one end, through which is a hole for the strap which the buoy-line bends to. Kegs are also used for buoys.

3.—American methods.

The nets that were first tried in Ipswich Bay were made of twine about the same size as that used in Norway; indeed, part of them were Norwegian nets which had been lent to Capt. George H. Martin by the United States Fish Commission. These were found, as in the previous trials made by the Commission, entirely too weak for the purpose, and were soon badly torn, not, however, before it had been proved that suitable nets could be very successfully used. The nets which have since been constructed for this fishery are made of Scotch flax twine, twelve-thread, of the size represented in Plate IV. The twine is very strong, and is found to be well adapted for the capture of large cod. The nets are mostly 9-inch mesh ($4\frac{1}{2}$ inches square), that size having been found well adapted for taking the large cod that visit our coast in winter.

The size of the nets depends somewhat on the locality where they are used, and also on the movements or habits of the fish. In some places where the cod keep close to the bottom, long shallow nets are probably the most suitable, while at other points, as at the Lofoden

Islands, where fish are often found in the greatest numbers some distance from the bottom, deeper nets are required.

The nets made for Captain Martin in the winter of 1880–'81 were 50 fathoms long and 3 fathoms deep, but as nearly all the fish were caught near the bottom, other persons have since had longer nets of less depth; some of those made for the shore fleet have been 100 fathoms long and 2 deep, but the standard size seems to be about 50 fathoms in length and 2½ to 3 fathoms in depth.* The American nets are hung to small double lines of opposite lays, and they are tanned before being used. It may be well to mention here the Dutch method of tanning cotton herring-nets, which is thought better than any other by those foreign fishermen, and may, perhaps, be applied with equal advantage to other fishermen, and may, perhaps, be applied with equal advantage to other nets, when made of that material. The tan is made by boiling catechu in water in the proportion of one pound of the former to two and a half gallons of the latter. When it is sufficiently strong the nets are soaked in it for twenty-four hours, after which they are dried. They are tanned and dried three times, and then soaked in linseed oil. A pound of oil is provided for each pound of net, and they are allowed to remain in it as long as any will be absorbed. They are then well drained and spread out on the ground to dry, after which the process is completed by tanning them once more.

Glass floats, similar to those of Norway, have been used on the American nets.† These cost about 30 cents each, when covered, and twenty-five of them are attached to a 50-fathom net. Bricks are used for sinkers, one of which is fastened to the foot of the net directly beneath each of the floats, they being held in the same manner that the stone sinkers are, as shown in Plate III. Attempts have been made to use metal sinkers and also metal floats, but these have proved unsatisfactory, and no improvement has yet been made on the brick sinkers first adopted. The cost of nets 50 fathoms long, with floats attached, is about $18.

Fourteen-pound trawl-anchors have been found quite suitable for Ipswich Bay, one being attached to each end of a gang of three nets, but it is probable that heavier ones will be required where there is deeper water and more current.

The buoys are common quarter-barrels, rigged in the same manner as for trawling.

THE FISHERIES.

1.—The Norwegian fisheries.

The method of taking cod with gill-nets is said to have been introduced into Norway about 1685, and nets are now extensively employed at the principal fishing stations along the coast of that country, but more than anywhere else in the great winter cod fisheries that are car-

* These nets have been made principally by the American Net and Twine Company, and by H. & G. W. Lord, Boston, Mass.

† These are made at the glass factories in Boston.

ried on at the Loffoden Islands. These islands are situated on the west coast of Norway, north of the arctic circle, and the banks in their vicinity are the favorite resort of immense schools of cod that gather there to spawn. Toward the latter part of December the first schools appear upon the grounds along the outer side of the Loffoden group, and soon the "coming-in" fish are taken on those banks lying inside, in the West Fiord. The arrival of these fish, which are the forerunners of the countless millions that invariably follow, is hailed with great delight by the fishermen, many of whom resort hither from other parts of the country to engage in these fisheries, so many often being congregated here in the winter that at some points they are crowded.

The bank which is the principal resort of the fishermen from Nordland extends along the coast of Loffoden from the Roost Island to the Strait of Rafte. This is from three to twelve miles from the land, and has a depth varying from 40 to 80 fathoms.

The fishing is at its height in February and March, while the fish are spawning. At this period, especially during the latter month, the cod are said to be very restless and disinclined to take the hook, and are usually caught in nets, the catch being increased and a better quality of fish obtained by using them. The experience of the Norwegian fishermen shows that the fatter the fish the less it is inclined to take the bait; therefore the most skilful fishermen are provided with nets as well as trawls.

The fishing is carried on in open boats. The net boats, which, as a rule, are larger than those used for trawling, are from 35 to 40 feet long, 9 or 10 feet wide, and 3 feet deep. These are provided with a single mast, on which is set a large quadrangular sail, and each boat has also ten or twelve oars, by means of which the crew can row rapidly even against the wind. The crew of a boat fitted for the net fishery varies from six to eight men, and the number of nets from sixty to a hundred. These are not all in use at the same time, but the greater part are kept in reserve to supply the place of such as may need repairs or drying or which may be lost. From twenty to thirty-five nets are fastened together and set in a gang by each boat on a specified part of the fishing ground. Where so many are fishing at one place they are obliged to adopt some rule for setting the gear to prevent its fouling, since that would result in loss to all and soon render a valuable fishery practically worthless. A certain part of the fishing ground is therefore assigned for the nets and another part for the trawls, as it is evident they should not be set together. The nets are prepared for setting by fastening them together at the top and bottom, attaching the sinkers, and bending on the large anchor-stones in the manner already alluded to, which is shown in Plates V, VI, and VII. The nets are so arranged that they will set close to the bottom or at some distance above it, according to the position of the fish.

The cod in the vicinity of the Loffoden Islands are said to be somewhat erratic in their movements, and it frequently happens that they are found in the greatest numbers at some distance from the bottom. The fishermen place their nets at a depth where they think the fish are most plentiful, and several expedients are made use of in order to find this out, such as trying with a hand-line, and setting a gang of nets with one end at the bottom and the other some distance from it, as represented in Plate VI.

Nets are occasionally set floating, but this method is practiced but little except at the stations east of Sorvaagen. One experienced in fishing soon learns at what depth the largest number of fish can be taken, and places his apparatus accordingly.

The fishermen all start in the afternoon at a given signal to set their gear, both nets and trawls being thrown out simultaneously to prevent them from becoming tangled, though this is sometimes unavoidable on account of the strong winds and tides. The nets are shot across or with the current. As soon as they are out the boats return to the shore.*

At the Loffoden Islands the fishermen start out together in the morning to haul their nets. In the darkness of the long nights they enter their boats; for the brief daytime, often shortened by gloomy skies, would be far too short for the work which has to be accomplished. They regard neither cold nor storm so long as the waves are not too high, so as to make fishing impossible. Hauling the heavily weighted nets, sometimes from a depth of 80 to 100 fathoms, is a task requiring the united strength of the boat's crew. The nets are hauled into the boats and taken on shore, where they are cleaned and put in readiness to be set again. But it must be remembered that in this region stormy weather often continues for weeks at a time during the winter months, making it impossible for the fishermen to go out to the banks, and as a rule fishing cannot be carried on more than two days in the week.

The daily fishing varies from a few scattering cod to several hundreds. A catch of four to five hundred to a boat is considered very satisfactory, although six hundred are often taken when everything is favorable, even when they will not bite and hand lines or trawl lines cannot be used. If more than six or eight hundred are caught, the fishermen are obliged to leave a part of the nets out until afternoon, as the boats can rarely carry any more, especially in rough weather.

The total catch of cod at the Loffoden Islands in 1878, according to the report of the superintendent, was 24,660,000 in number. Of these, upward of 14,000,000 fish were caught with nets, 9,250,000 with lines,

*At Söndmör, where the banks lie some distance from the coast, the fishermen sometimes stay out overnight during the month of April, when the nights have already become clear. Usually, however, these men haul their nets and return them again to the water, while they start for the shore to dispose of their catch.

and 1,250,000 with deep bait.* The men and boats engaged were divided as follows:

Method of fishing.	Fishermen.	Crews.	Boats.
Net fishing	13,168	2,154	*2,430
Line fishing	7,258	1,689	1,977
Deep-bait fishing	2,297	844	†844
Hired men	3,311	.....	.....
Total	23,034	4,687	5,251

* 269 of these also occasionally used lines. † 701 of these used no lines, and 143 used lines.

There was an *increase* from the year before of 2,542 in the number of net fishermen, an *increase* of 417 in the number of deep-bait fishermen, and a *decrease* of 1,504 in the number of line fishermen.

Highest total sum earned by net fisherman	$214 40
Lowest total sum earned by net fisherman	48 24
Highest total sum earned by line fisherman	120 60
Lowest total sum earned by line fisherman	32 16
Highest total sum earned by deep-bait fisherman	85 76
Lowest total sum earned by deep-bait fisherman	42 88

The superiority of the nets over lines and trawls, as shown by the respective earnings of the fishermen, has, as might be expected, led to an additional increase in that branch of the fishery, and in 1879 it is stated that 2,532 boats, with crews numbering 14,322 men, fitted out for the net fishery. The larger amount earned by the net fishermen is due to the better quality of fish taken by them more than to the increased catch, though this is also generally obtained. It has been found that the largest and fattest cod do not bite at the hook, but must be sought after with gill-nets, and it therefore follows that netted fish furnish a very superior article of merchandise.† It sometimes requires but 210 cod caught in a net against 360 taken on a hook to furnish the same amount of liver (about 26½ gallons), and the livers of the netted fish yield much more oil to the gallon than those of the trawl or line fish. In conclusion, it may be added that pollock are taken in gill-nets as well as cod. During the winter season large schools of these fish visit the coast between the sixtieth and sixty-second parallels of latitude, and in the summer and fall are found on the coasts of Nordland and Finmark, where enormous quantities of them are taken by nets, trawls, and hand-lines.

2.—The Newfoundland fisheries.

Gill-nets have long been used in the Newfoundland cod fisheries, especially on the east and south coasts of the island, but the exact date

* Trawls are probably meant by lines, and hand-lines by deep bait.

† The same fact has been demonstrated by the use of nets on the American coast. Both cod and pollock, of large size and extra quality, are frequently taken in abundance by nets when few or none can be caught on hooks and lines.

of their introduction is unknown. It is asserted, however, that this method of fishing has been pursued since early in the present century, and is still carried on to some extent.

The coast of Newfoundland is indented with many large bays, which are favorite feeding-grounds for the cod. In the early summer they make their appearance in pursuit of the capelin that gather in immense numbers along the shores to spawn, and generally remain from three to five weeks. During this time the cod usually keep near the surface of the water and the nets are set floating, but later they are set at the bottom, for when the capelin leave the shores the cod move into deeper water. Plates VIII and IX show the methods of setting at the surface and bottom. The nets are set singly or in gangs of three to seven. Two anchors are generally attached to a gang of floating nets, as represented in the plate; but where there is a current, one is sometimes found sufficient. They are usually set in the afternoon and hauled in the morning. Owing to the comparative lightness of the anchors, fewer men are required to haul these than in Norway, as a single fisherman will sometimes take in one or more nets, though in most cases two or three go in a boat. The net fishing is far less productive than that of Norway, but sometimes a large catch is made. Capt. Solomon Jacobs, a native of Newfoundland, states that on one occasion he took 2,000 cod from four nets, but says that this catch is rarely equaled. These fish are what are known in the American markets as medium cod.

3.—The American fisheries.

The common dory has been used for fishing the nets, each vessel having from seven to nine of them, according to the number of the crew. The men go singly, one in each dory, and, while out, either setting or underrunning, the vessel is kept under way, the captain and cook managing her and picking up the crew when the work is completed. Each one of a schooner's crew, except the captain and cook, is provided with a gang of three nets or more, which are fastened together at top and bottom when set, these forming a wall at the bottom of the sea 150 to 300 fathoms long and 3 fathoms deep, being held in position by an anchor at either end. The anchor-lines are usually 50 fathoms in length, and one end of each is bent to the upper corner of the nets, as represented in Plate XI. Under favorable circumstances one man can set a gang of nets, by letting the boat drift with the wind or tide and throwing them over as it moves along, but, as a rule, two men can accomplish this much better. The method of underrunning is illustrated in Plate XII.

4.—History of the gill-net cod fishery.

The United States Fish Commission, while it has in so many ways done a useful and important work in the artificial propagation of food-fishes, has not confined itself solely to fish-culture as a means for improving the American fisheries. It has also accomplished fully as important objects by disseminating among our fishermen knowledge of

methods of fishing, &c., to which they were previously strangers, and which has been of the utmost advantage to them for the successful prosecution of their work. The introduction of the use of gill-nets in the cod fisheries may be mentioned as an instance in point, and viewed in the light of results already attained (though we may yet consider this method of fishing only fairly begun), it seems not too much to claim that the bringing about of such an innovation in the ocean fisheries is entitled to rank among the most important works of the Commission. The change which has been made in the method of taking cod and other species of the *Gadidæ* has proved of such immense advantage to the New England fishermen that an entire revolution has been created in the winter shore cod fishery, and it is difficult to predict to how great an extent the gill-net fishery for cod may be prosecuted in the future. It is not now possible to say with any degree of certainty whether or not gill-nets may be successfully employed in the cod fisheries of the outer banks, since a thorough and careful trial needs to be made to settle that question. A few unsatisfactory attempts have already been made by the fishermen to use gill-nets on the outer banks, but in no case have these trials been so extensive and thorough as to demonstrate fully what might or might not be done. In consideration of the results which have already been attained, it seems desirable that a brief historical sketch should be given here of the introduction of gill-nets into the cod fisheries of the United States, and also of the varying success which has attended their use since they were first adopted by American fishermen.

Though gill-nets have long been used in Northern Europe, more especially in Norway, as an apparatus for the capture of cod, and are considered by the Norwegians as quite indispensable, they have not, until recently, been employed by American fishermen. In 1878 Prof. Spencer F. Baird, United States Commissioner of Fish and Fisheries, knowing how profitably these nets were employed by the Norwegian fishermen, decided to make experiments with them at Cape Ann, with a view to their introduction among the fishermen of this country. He accordingly secured a number of the Norwegian nets, which were forwarded to Gloucester and there tested by the employés of the Commission.

Experiments were made when the winter schools of cod were on the shore-grounds in Massachusetts Bay; but the results obtained were not entirely satisfactory, owing chiefly to the fact that the nets were found far too frail for the large cod which frequent our coast in winter. This was apparent from the numerous holes in the nets, which indicated plainly that large fish had torn their way through, none being retained excepting those that had become completely rolled up in the twine. The current also swept the nets afoul of the rocky bottom, which injured them still more, so that they were soon rendered nearly unfit for use. They were invariably in bad order when hauled from the water, but

even under such unfavorable circumstances nearly a thousand pounds of fish were caught on one occasion. This seemed to indicate that nets of sufficient strength might be used to good advantage, at least on some of the smoother fishing grounds along the coast.

These preliminary trials, therefore, having demonstrated that nets could be employed advantageously in the American cod fisheries, Professor Baird availed himself of the first chance that offered for obtaining definite knowledge of the methods of netting cod in Norway, with the intention of disseminating this information among American cod fishermen.

The opening of the International Fishery Exposition at Berlin, Germany, in the spring of 1880, presented a favorable opportunity for accomplishing this purpose. Professor Baird, having appointed me as one of the Commission to attend the exposition on the staff of Prof. G. Brown Goode, desired that I should make a careful study of the foreign methods of deep-sea fishery as represented at the exhibition. The method of capturing cod with gill-nets, as practiced by the Norwegian fishermen, was mentioned as a subject which should receive especial consideration.

In the meantime Professor Baird offered to lend the nets to any responsible fishermen who would give them a fair and thorough test. But the fishermen were conservative and hesitated to adopt any "new-fangled notions" for catching fish. This disinclination to try the new method was due chiefly to the fact that fishermen cannot usually afford to spend any time in making experiments, especially when they feel fairly confident of good returns by continuing in their old ways of fishing.

Mention has been made of the introduction and trial of cod gill-nets by the United States Fish Commission in 1878, but no attempt was made by the fishermen to use them until the fall of 1880, when Capt. George H. Martin, of Gloucester, Mass., master of the schooner Northern Eagle, fitted out with them for the winter cod fisheries off Cape Ann and in Ipswich Bay. The immediate cause which led to this trial was the difficulty of getting a supply of bait, the procuring of which is a source of considerable trouble to our shore fishermen, and its cost, even when obtainable, is such a heavy tax on this branch of the fishing industry that often the fishermen hesitate to engage in it, fearing that the result may be a loss rather than a gain. It was to obviate this difficulty about bait, and to render our cod fisheries more valuable in consequence, that led Professor Baird to bring the cod gill-nets to the notice of the American fishermen. The bait principally depended on by the shore fishermen in the vicinity of Cape Ann during the fall and early winter is young herring (*Clupea harengus*), known as the "spirling." The appearance of these fish about the cape is somewhat uncertain; sometimes large schools remain for several weeks, and at other times but few can be taken. There was so little probability of getting a supply of bait in the

fall of 1880 that Captain Martin hesitated about fitting out for trawling, fearing that the cost and difficulty of securing a supply of this article, which is indispensable to the trawl-line fishery, would render the undertaking unprofitable. While the matter of fitting out in the old way was under consideration gill-nets were suggested by the father of Captain Martin, an employé of the Fish Commission, as a means of solving the perplexities of the bait question. He thought the idea a good one, and, together with several of his crew, visited the station of the Commission at Gloucester, looked at the Norwegian nets which were there, and consulted with the agent in charge as to the probabilities of success. The result of this interview was that Captain Martin decided to fit out and give the new method a thorough trial, and nets were therefore obtained for this purpose, part of them being supplied by the Fish Commission.

Before the trial trip was made Captain Martin had an interview with me at Gloucester in order to get some additional information as to the management of the nets. I explained to him briefly the methods adapted by the Norwegians. He thought, however, that the nets might be "underrun," as trawls sometimes are, which would enable one man to handle a gang of nets for which an entire boat's crew, six to eight men, is required in Norway. I could see no reason myself why the nets could not be underrun, providing the current was not too strong and the water not too deep. It may be explained here that the Norwegians set their nets late in the day and take them up on the following morning, the apparatus being carried to the land, the fish removed from the meshes, and the gear prepared for setting again. This involves a large amount of labor and much loss of time as compared with the method of underrunning, which may be considered another Yankee invention.

When the nets are set for underrunning, the anchor is first thrown over and 25 fathoms of line paid out, when the buoy-line is attached to it. The buoy and line are then thrown over, and the remainder of the anchor-line is then paid out, the end of the latter being made fast to the nets, which are the next to follow. A middle buoy is attached to the center of the gang. When the nets are all out, the other anchor-line, with the buoy-line attached, is veered out, and last of all the anchor is thrown over, which finishes the work. The nets are usually set in the afternoon, and allowed to remain in the water for several days, unless for some reason the vessel leaves the fishing ground. Even then, when the vessels have been forced to seek the shelter of a harbor during a storm, the nets have frequently been left out. Fish are caught only at night, and, consequently, the nets are underrun only in the morning, unless the men are detained by unfavorable weather until later in the day. In underruning, the fisherman goes to one of the buoys on the end of his gang of nets, takes it in the dory, and hauls away on the buoy-line, the buoy being thrown out on the other side, and the line allowed to run out on one side as fast as it is hauled in on the other.

When the anchor-line (or underrunning-line, as it is sometimes called) is up, it is taken across the dory, and the fisherman hauls along towards the net. The gear is underrun by pulling the nets in on one side of the dory, and, as fast as the fish are removed, allowing the apparatus to pass over the other side into the water; the anchors, which remain firmly fixed in the bottom, holding the nets in position until the work is accomplished. When the end of the gang is reached, it is thrown off the dory, and the nets remain setting as before, needing no further attention until the next day.

As will be readily understood, this method of fishing can be carried on with the minimum of labor; and it also has this additional advantage, namely, while the gear is still out, the vessel may take her morning's catch to market, or, if the weather is threatening, she may remain quietly at anchor overnight in the nearest harbor, though in the meantime her nets are fishing.

Ipswich Bay, where the nets have been chiefly used, more particularly in the winters of 1880–'81 and 1881–'82, lies north of the prominent headland of Cape Ann, which divides it from the waters of Massachusetts Bay on the south. A sandy beach extends along the northern and western sides of the bay, and the bottom sinks gradually from this, reaching a depth of 25 to 30 fathoms only at a distance of several miles from the land. The bottom of the bay is a sloping sandy plateau, with only here and there small patches of rocks or clay, supporting but a small amount of animal life which may serve as food for the cod. It is therefore a spawning rather than a feeding ground for these fish; and large schools visit the bay during the winter for the purpose of reproduction, and generally remain until late in the spring. The nets are usually set along the northern part of the bay, only a few miles from the shore, in about 15 fathoms of water, where there is less current than at many other points along the coast.

In this connection may be mentioned a curious fact which has been observed concerning the fish that have been taken in Ipswich Bay during the past two or three winters. It is stated that a large portion of the fish caught in this bay have been netted on a small area not exceeding three-fourths of a mile in diameter. This piece of ground, I have been told by the fishermen, for a considerable portion of the season seems to be swarming with cod, while the adjacent bottom appears to be quite barren of fish. According to Capt. S. J. Martin, the center of this area bears south by west from Whale's Back light, Portsmouth, and southwest by west from the light-house on the Isle of Shoals. It is somewhat irregular in outline, the fishermen say, judging by where the fish are taken, but so far as anything can be told of its physical conformation, it does not differ at all from the rest of the sandy slope immediately surrounding it. It is said that there is no "feed" on the bottom. The fishermen have a curious theory that there are freshwater springs in this particular locality, around which the cod love to gather;

nor, indeed, can they assign any other reason, since there appears to be no special feature in the character of the bottom to attract the fish. So persistent are the cod in clinging to this locality, that it almost invariably follows that nets placed within its limits come up well filled with fish, while gear that is set a dozen or twenty fathoms outside get very few, if any, cod. The fishermen confess that it is a mystery to them, and they are exceedingly puzzled to know how the fish get there and escape the walls of netting which surround this spot in all directions. They do not believe it is possible that enough cod could be there at once to fill the nets night after night for months, and they arrive at the conclusion that the fish must reach the place during the day, at which time they are supposed to rise above and swim over the nets that bar their progress near the bottom, and which of course can be seen by daylight.*

The results which were obtained from the use of nets by the Northern Eagle during the winter of 1880–'81 were considered very remarkable. The amount of codfish taken in the first three trials (which were made in Massachusetts Bay), in unfavorable weather and with inferior nets, was 4,000, 6,000, and 7,000 pounds, respectively. On a trip ending January 11, 35,000 pounds of cod were taken by the Northern Eagle, 8,000 pounds of which were caught in a single morning. Two other vessels, which were absent the same length of time, fishing at the same place with trawls, got only 4,000 and 8,000 pounds, respectively. After that time she made another trip, taking the same amount, 35,000 pounds, in four days' fishing, 18,000 pounds of which were caught in one day. On this day the schooner Christie Campbell, of Portsmouth, set ten trawls (each trawl having 1,000 hooks) close to the nets. The 10,000 hooks caught about 2,000 pounds of fish to the 18,000 taken in the nets.

The Northern Eagle began fishing with nets on November 27, 1880, and as early as January 20, 1881, she had taken 111,000 pounds of cod. None of the trawlers during that time caught more than one-third of that amount, though they were fishing at the same place. The netted fish were much larger than those taken on trawls, averaging during the first six weeks' fishing 23 pounds each. Among these were individuals which weighed 75 and 80 pounds apiece, but there were no small fish, such as are frequently taken on trawls, and which can be sold only at reduced prices. This, it may be stated, has invariably been the case when gill-nets have been used. No immature fish, or what is termed "trash" by fishermen, have been taken. At first the nets met with the same opposition from the trawl-line fishermen that trawls, when first

* Capt. S. J. Martin, writing from Gloucester to Professor Baird, under date of January 7, 1884, says: "In Ipswich Bay the fish are in one place. Four hundred nets are set in a place one-half mile wide by one-half mile long. The nets are across one another. The vessels have set their nets all over the bay, but find only a few scattering fish except in that one spot. There they get good hauls every morning when there is a chance to haul the nets. * * * The fishermen think strangely of the fish being in one place. They can find nothing there to keep them alive."

introduced, did from the hand-liners, some thirty years ago. Notwithstanding, however, that many of the fishermen were inclined at the start to inveigh against "building a fence" to prevent the fish from moving about on the bottom, it was not long before they all began to realize the advantages of using gill-nets. It is said that whenever in port the deck of the Northern Eagle was crowded with fishermen anxious to learn about the method of capture which she had adopted. Before the close of the first winter several vessels, both from Gloucester and from other ports, fitted out, to a greater or less extent, with nets. As a rule those schooners commenced their operations so late in the season that they could not make a fair test of the gill-nets, for the school of spawning fish that had been in Ipswich Bay began to leave the shore-grounds soon after the vessels began operations.

Gill-net fishing for cod and pollock opened favorably in the winter of 1882, but the shore codfish were much less abundant during the greater part of that winter than in the previous year; and consequently the success of this branch of the fisheries was not so pronounced as has generally been the case.

Writing under date of November 15, 1881, Captain Martin says: "I find that pollock will mesh as well as codfish. The first night the schooner Maud Gertrude set her nets, twelve in number, they caught 3,000 pounds of pollock and 2,000 pounds of cod. The nets were set on 'Browns.' [This is a small rocky shoal lying off to the southward of Eastern Point, at the entrance to Gloucester Harbor.] * * * Captain Gill told me that if the nets had 8-inch meshes they could get them full of pollock. The 10-inch mesh catches large pollock, some of them weighing 20, 21, and 21½ pounds." The nets were often very badly torn by the pollock, which is well known to be a remarkably strong and active fish.

It does not seem necessary that I should go into detailed statements of statistics of the amount taken each season, since the following instances that are given of catches made on various occasions will, I think, serve to convey a fair idea of the results obtained.

Although the winter of 1881–'82 was unquestionably the least productive of any season since the introduction of gill-nets into the shore cod fishery, we find that the catches were often of considerable magnitude. For instance, Captain Martin mentions the following facts: Early in November twelve nets set in Ipswich Bay caught 12,000 pounds of cod in two nights' fishing. A little later the Northern Eagle landed 33,000 pounds of large cod from an eight days' trip, stocking $800, and each of her crew sharing $63. Captain Martin, writing under date of December 6, said that during the previous week there were 145,000 pounds of codfish caught in gill-nets, and he makes this remark, "If it were not for the gill-nets we could not get fish enough to eat." He also says, "All the vessels that were fishing with trawls are getting nets." Again, on December 22, he states, "There were 165,000 pounds of

codfish caught in gill-nets last week." This, too, was when codfish were remarkably scarce upon the shore-grounds, and when there was only a small fleet of about 25 or 30 vessels engaged in the net fishery.

The importance of the introduction of the method of catching codfish with gill-nets was more fully demonstrated than ever before in the winter of 1882–'83, and the operations carried on during that season in the inshore fisheries may be considered as having first fairly established this method of fishing in New England; since, previous to that time, there had been many persons rather skeptical as to the benefits that might be derived from the use of nets for catching cod.

Owing to the almost total failure of the bait supply in the latter part of 1882 and the beginning of 1883, it was found impracticable to carry on the shore cod fishery by the old method of hook-and-line fishing. Such a scarcity of bait had never been previously known, and if the fishermen had been ignorant of the use of gill-nets for the capture of cod, a valuable and important industry must have been almost abandoned, for that season at least, while it may be considered probable that the scarcity of fresh cod, which would have resulted, must have increased the price in our markets very materially, possibly in some cases to such an extent as practically to have placed this desirable article of food beyond the reach of the masses. But during the previous two years the New England fishermen had learned a great deal about catching codfish in nets, not only by practical experience but also from an illustrated pamphlet containing descriptions of all the methods, which had been freely circulated by Professor Baird. The fishermen were, therefore, prepared to meet this unforeseen emergency—an almost entire absence of bait. Instead of being compelled to give up the shore cod fishery, as they otherwise must have done, they met with a success which had seldom or never before been equaled. Such excellent results were obtained by the use of gill-nets that the local papers in the fishing ports contained frequent notices of successful catches. As an instance, may be mentioned the following from the Cape Ann Advertiser of December 8, entitled The good results of net cod fishing: "On Tuesday, December 4, boat Equal, with two men, took 5,000 pounds of large codfish in seven nets off shore, sharing $40 each. The Rising Star has stocked $1,200 the past fortnight fishing in Ipswich Bay. The Morrill Boy has shared $101 to a man net fishing off this shore the past three weeks."

The Morrill Boy met with unexampled success, her crew of five men having shared $320 apiece, clear of all expenses, by the last of December, the time employed being less than six weeks.

From the port of Gloucester alone, according to Captain Martin, there were employed in the gill-net cod fishery during December, 1882, 20 vessels, carrying 124 men. In the period between November 19 and the last of December, 600,000 pounds of large shore codfish were landed in Gloucester, while 150,000 pounds were marketed at Rockport and Ports-

mouth, making a grand total of 750,000 pounds. When to this is added the amount which was probably taken by the vessels from other ports, it is perhaps safe to say that not less than 2,000,000 pounds of this highly valued and most excellent food-fish were caught in nets during the month of December and the latter part of November.

In the early part of the winter of 1882–'83 codfish were taken in nets in great abundance on the rocky shoals in Massachusetts Bay. After the beginning of January, however, the fish were found to be most plentiful in Ipswich Bay; and, in consequence of this, the fleet of shore cod fishermen resorted to that locality, where they met with the most remarkable success, the catch during the first month of 1883 being, it is said, much larger than at any previous time. According to Captain Martin's report for January, 1883, 121,000 pounds of netted cod were landed in Gloucester during the month. Writing to Professor Baird under date of February 6, he made the statement that "ten sail of small vessels which had been fishing in Ipswich Bay, had landed at Rockport, Mass., and Portsmouth, N. H., during the previous twenty days, 230,000 pounds of large codfish." Calculating on this basis, the total catch of the whole fleet during the month of January, 1883, must have been very large.

It was not, however, until the winter of 1883–'84 that the real value and importance of the introduction of gill-nets into our cod fisheries could be fully and fairly estimated. The results obtained during the winter of 1882–'83 had inspired the fishermen with more confidence to engage in the net fishing in the succeeding fall. Consequently, we find that the shore fishermen were prosecuting this method of fishing earlier in the season than ever before, even employing it for the capture of pollock before the winter school of cod had reached the shore grounds. This method of fishing was found especially well adapted for taking the large pollock, which generally visit, in the fall, the inshore fishing grounds in Massachusetts Bay. The singular fact was also discovered that many of the finest pollock, like the cod, may be taken with nets when they utterly refuse to bite a hook, and consequently cannot be captured by the old methods.

Writing under date of October 28, 1883, Captain Martin says: "Pollock and cod have been scarce this fall. Forty sail of small craft, which were out two days on the pollock grounds, came in with 2,000 pounds. Captain Gill, of the boat Gracie, had four cod-nets given him that were worn out in catching codfish last winter. He set them, together with two new ones, and the first night he caught 5,500 pounds of pollock and 400 pounds of large codfish. The pollock averaged 21½ pounds apiece, while those caught on hand-lines averaged 13 pounds apiece. * * * There are three boats which have nets set. They catch three times as much pollock and three times as much codfish as they do on hand-lines. There will be more cod gill-nets used this winter than there have been since they began to use them. * * * There are no spirling this fall,

so that most of the boats will use nets." Under date of October 31, 1883, he gives the following statement, which shows in a most striking manner the advantages that are sometimes derived from the use of gill-nets, and, at the same time, affords us an insight into the way in which the fishermen are often induced to adopt this method of fishing: "The schooner S. W. Craig, of Portland, one of the high-line pollock catchers," says Captain Martin, "was in here last Wednesday. I went aboard to see the skipper and to gain what information I could concerning the pollock fishery. The conversation ran thus: 'How do you find the pollock, captain?' 'Pollock! there ain't none. I have been out two days with 12 men and got 2,000 pounds; that is bad enough.' I said: 'They are catching a good many pollock in nets. Do you see that small boat coming? that is Horace Wiley's; he caught 3,000 pounds the night before last, and caught as many last night. He has got nets.' 'Where does he catch them?' 'Off on a spot of rocks called Brown's.' The captain said: 'I will get some spirling to-night, and go off where they have got their nets set. We will give them fits if we can get some new spirling.' I answered: 'Cap., it is of no use to go where they have got their nets set. If you do you will get no fish.' He replied, 'That be hanged for a yarn! I think you can catch fish with spirling as well as you can with nets.' I said: 'No, sir; you can't do it.'

"The next day he went out with some new spirling to where Wiley was hauling his nets. (The latter had picked out a dory full of cod and pollock, about 2,000 pounds.) He let go his anchor close to the nets and gave the order, 'All hands over lines!' He lay there two hours, but did not catch a fish.

"I was aboard again yesterday, and said: 'Captain, how did they bite where the nets were?' 'That beats all,' he replied; 'we never felt a bite. I am going to Boston to order 25 nets.'"

The boat Gracie, which began fishing with nets about the middle of October, did remarkably well; her crew made $145 apiece up to November 11. According to Captain Martin she had landed 15,000 pounds of large cod and 30,000 pounds of large pollock, and he writes: "Some of the line fishermen have not caught as much as 10,000 pounds in the same time. * * * All the shore-fishing will be done with nets this winter, as the spirling are scarce." This success had the effect to induce others to engage in this fishery, and at the date just given (November 11) there were 16 boats using nets. Each one was provided with 15 nets, each 50 fathoms long, 2½ fathoms deep, with a 9½-inch mesh.

The first vessel to go to Ipswich Bay began fishing there early in November, and on her first trip, with only 5 nets, she caught 6,000 pounds. By November 18 there were 26 boats, setting 390 nets, in Massachusetts Bay. This would make 39,000 yards of netting. Besides this there were two or three vessels in Ipswich Bay; and the schooner Onward, which left Gloucester that day to go around the cape, had a gang of 35 nets. The little schooner Morrill Boy, previously

alluded to, set her nets for the first time on the Sunday preceding November 18, and at the last-mentioned date she had landed 43,000 pounds of cod and pollock, stocking $1,066.75. There were 7 men in the crew, who shared $124 for their week's work, and this, too, when two days of the time were lost on account of high winds. On one day (Wednesday) they made $50 to a man. At the same time bait was so scarce and difficult to obtain that the hook-and-line fishermen could do almost nothing. Spirling, when obtainable at all, brought the high price of fifty cents a bucketful, which was a very heavy tax on the cod fishermen. On the six days ending November 25th, 487,000 pounds of cod and pollock were taken in gill-nets set in Massachusetts Bay, and during the same time four small gill-netting vessels caught 55,000 pounds of fish in Ipswich Bay. Writing under the last-mentioned date Captain Martin says that "about all the fish caught inshore are taken by nets;" and he remarks that "if they could be knit fast enough the whole fleet would have nets." So urgent was the demand for cod-nets at that time that many of the women at Gloucester were employed in making them. Captain Martin tells us that "everybody is at work," and he continues, "A great winter's work is anticipated." By the latter part of November the fleet of netters had increased to 35 vessels, and it is probable that a larger number might have been engaged in this fishery at that date if they could have obtained gear. The fishermen were often bothered to get nets, and on one occasion several boats had to wait four days to get a supply of glass floats, which are so essential in this fishery. By the last of January the fleet numbered 52 vessels, which appears to be the maximum, for about the middle of March only 42 schooners were engaged in netting, a few of the boats having probably worn out their nets, and not caring to refit so late in the season, left shore-fishing to go to the outer banks, or else, perhaps, to fit out for the spring mackerel fishery. In addition to the vessels, a few open boats engaged in the gill-net cod fishery last winter; and as early as December, according to Captain Martin, five dories were thus employed from Salisbury, each having three nets.

The gill-net fishery has not been exempt from loss of gear, though perhaps this loss is much less than it would be if trawls only were used. In a gale that occurred on January 4, 1884, considerable property was destroyed or injured. Captain Martin reports that thirty-five nets were lost and many others badly damaged. "No fish," he says, "were caught for four days after the storm." Curiously enough, the fishermen say that they never get many fish just previous to a heavy storm, and the netters have learned by experience that a sudden falling off in the catch is generally an indication of the near approach of bad weather. Another feature of the net fishing is that, in addition to the various species of the *Gadidæ* which have been taken, porpoises (locally called "puffers"), monk-fish or fishing-frogs, and dogfish (*Squalus*) have been caught, though fortunately the latter, which are considered especially

obnoxious by net fishermen, are not on the coast during the coldest weather.

In addition to the instances already given of catches made last winter, the following have been recorded. For the week ending December 9, 1883, there were landed at Gloucester 590,000 pounds of netted fish, while 84,000 pounds were marketed at the two ports of Rockport and Portsmouth, the week's catch amounting to the total of 674,000 pounds. The following week Gloucester received 430,000 pounds, Rockport and Portsmouth a total of 81,000, and Swampscott 48,000, making a total of 559,000 pounds. This large amount was taken, too, when the weather was so unfavorable that nothing could be done for three nights and days of the week. For the week ending March 23, 1884, there were landed 520,000 pounds of cod that had been caught in gill-nets. For the week ending March 30, 18 vessels landed 483,000 pounds. The following statement of the total amount of fish captured by the use of gill-nets during the past winter has been compiled for me by Mr. Chas. W. Smiley from the reports of Captain Martin, who has made it a special object to collect all possible statistics and information relative to this important branch of the fisheries.

Total amount of fish landed from gill-nets during the months of October, November, and December, 1883, and January, February, March, and April, 1884, compiled from the note-books of Capt. S. J. Martin, Gloucester, Mass.

Months.	Cod.	Pollock.	Haddock.	Hake.	Cusk.	Grand total.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
October, 1883	35, 500	573, 000	45, 000	36, 000	30, 000	709, 500
November, 1883	1, 275, 500	185, 000	249, 000	20, 300	9, 000	1, 738, 800
December, 1883	1, 373, 000	3, 000	264, 000	.....	15, 000	1, 655, 000
January, 1884	932, 000	.....	40, 000	.....	.....	972, 000
February, 1884	923, 000	.....	75, 000	.....	.....	998, 000
March, 1884	1, 248, 000	.....	.....	.....	.....	1, 248, 000
April, 1884	705, 000	.....	.....	.....	.....	705, 000
Total	6, 492, 000	761, 000	673, 000	56, 300	54, 000	8, 036, 300

An important matter for consideration in connection with the cod gill-net fishery is that not only can fishing be successfully carried on, even when bait is not obtainable (for, of course, no bait is required when nets are used), but there is a very great saving of money and time that must be expended in procuring the bait and baiting the lines when hook-and-line fishing is followed. As an instance of the expense involved, it may be stated that the average bait-bill of a shore-trawler is not, under ordinary circumstances, less than from $150 to $250 per month, when herring are as high as they usually are in winter. It is, therefore, safe to estimate that when as many vessels are employed in gill-netting as there have been during the past two winters, the money saved to the fishermen, which otherwise must have been paid for bait, could not be less than from $30,000 to $70,000 each season. Besides this, a very large percentage of the time is saved, as has been stated, which otherwise must be lost in seeking for bait.

In this connection it may be well to say that last winter nets cost

$14.25 apiece, and the glass floats could not be obtained cheaper than 22 cents each. It will, therefore, be seen that a "set of gear" for a vessel carrying thirty to thirty-five nets costs a considerable sum, and if this had to be renewed every few weeks, it would be a material drawback to the prosperity of the fishery.

In pursuing the cod gill-net fishery the men have been to some extent handicapped by the rotting of their nets, and in some cases—more especially in the fall, when the waters are filled with animal life—the nets have decayed very rapidly, so that they have been found quite unfitted for use after being in the water for five or six weeks. While at Gloucester last fall I had this matter brought to my attention by the fishermen, who were anxious to obtain some preservative which would prevent their nets from rotting. I addressed a letter to Professor Baird on the subject, and the result was that the matter having been brought to the notice of Messrs. Horner & Hyde, of Baltimore, these gentlemen forwarded to Gloucester a barrel of their net preservative for the purpose of having its merits tested on the cod gill-nets. It was applied to a portion of the nets of several small vessels in January last, and after the apparatus had been in use from that time to the middle of April sections of the net so prepared were forwarded to me, at Washington, together with a statement by Captain Martin as to what the fishermen said regarding its use. Previous to this, however, I had talked with some of the fishermen concerning the nets treated with Horner & Hyde's preservative, and they asserted very positively that not only did it prevent the nets from rotting, but that they were fully impressed with the idea that a great many more fish were caught in nets so treated than in the others prepared in the ordinary way. The sample of netting sent me by Captain Martin shows little sign of deterioration, notwithstanding the fact that the net from which it was taken had been in constant use for upwards of three months.

Whether future trials of this material will sustain the statements made by the fishermen who have already experimented with it, I am unable to say, but if such should be the case there can be no question but that a very important step has been attained through the labors of the Commission in perfecting the work of cod gill-netting, which it commenced in American waters five years ago.

It is perhaps proper to state here that some of the North Carolina fishermen who have tried Horner & Hyde's treatment on their nets have complained most bitterly that their gear was much injured, if not almost entirely ruined, by it. I have seen copies of two letters from fishermen of the South containing such complaints. This being the case, it will perhaps require a longer test to settle definitely whether or not this treatment has all the merit that the Gloucester fishermen say it has, though it is altogether possible, the conditions being so very different, that what might give excellent satisfaction when properly applied and intelligently used in the ocean fisheries, might prove unsatisfactory under other conditions.

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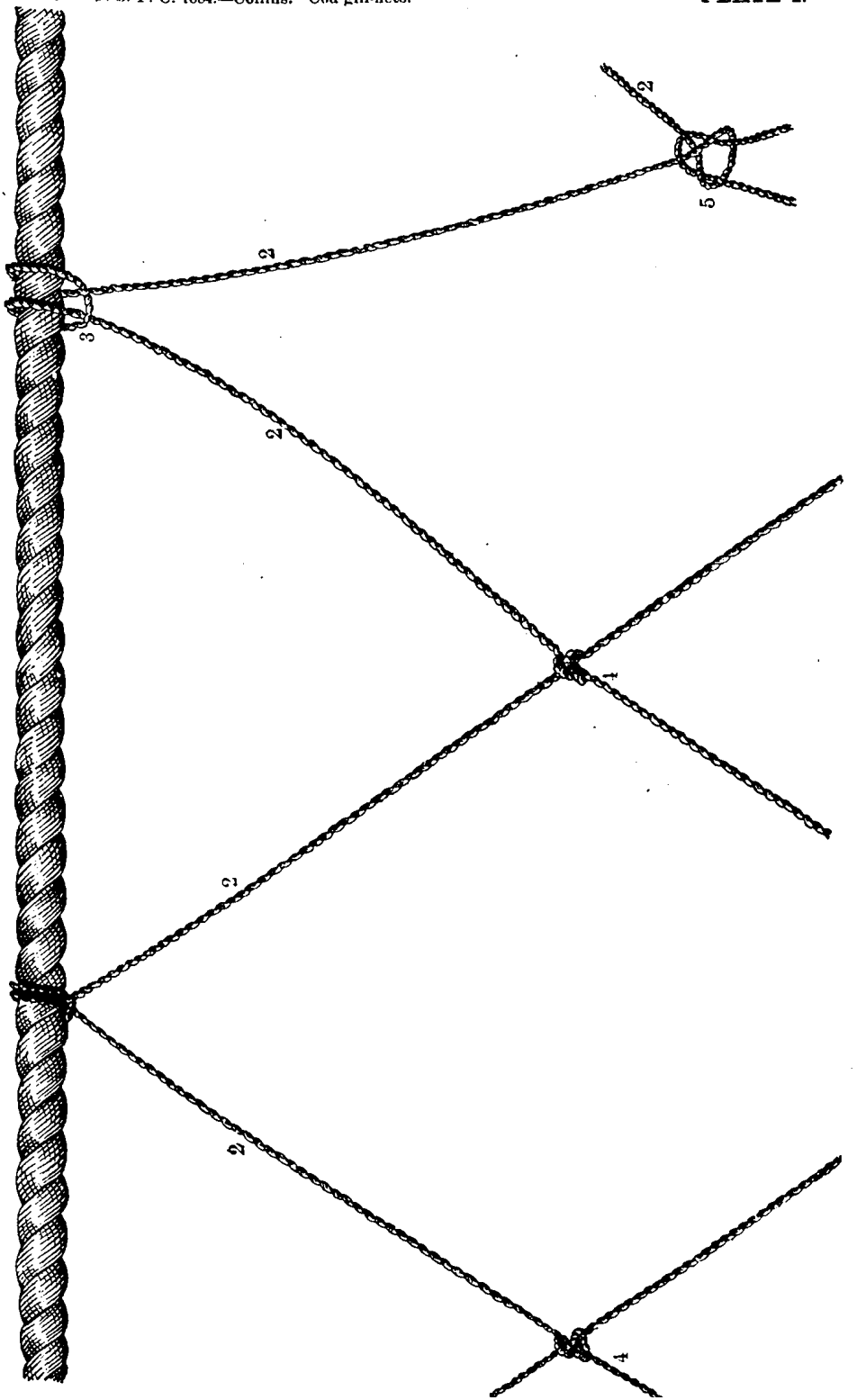
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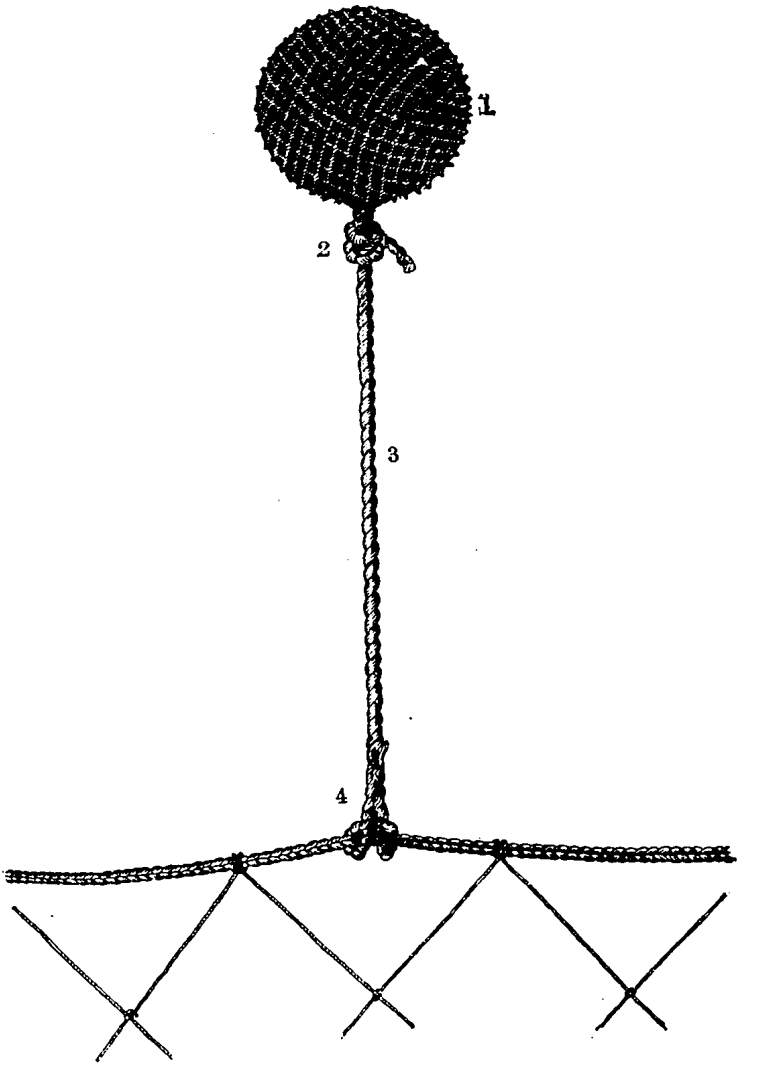
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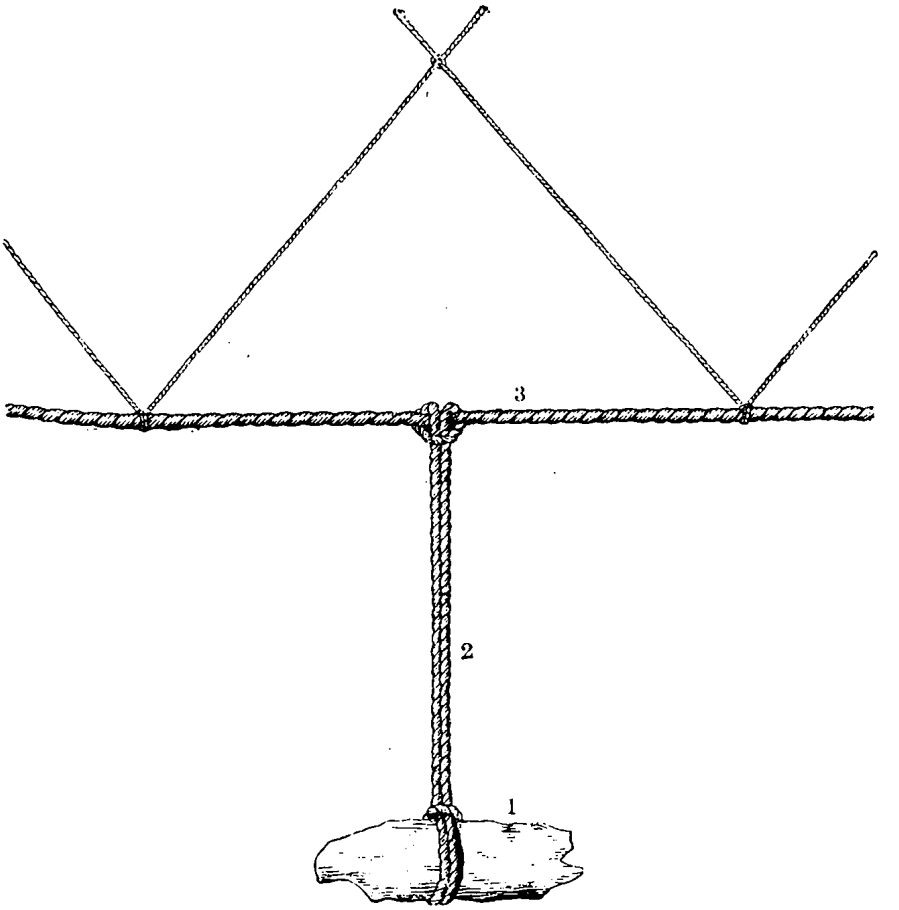
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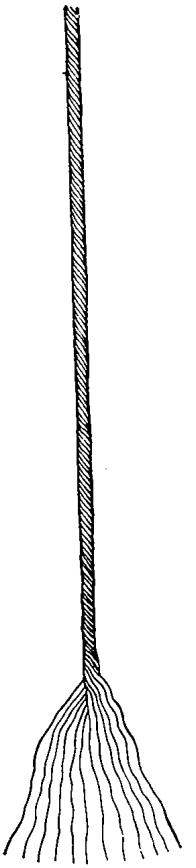

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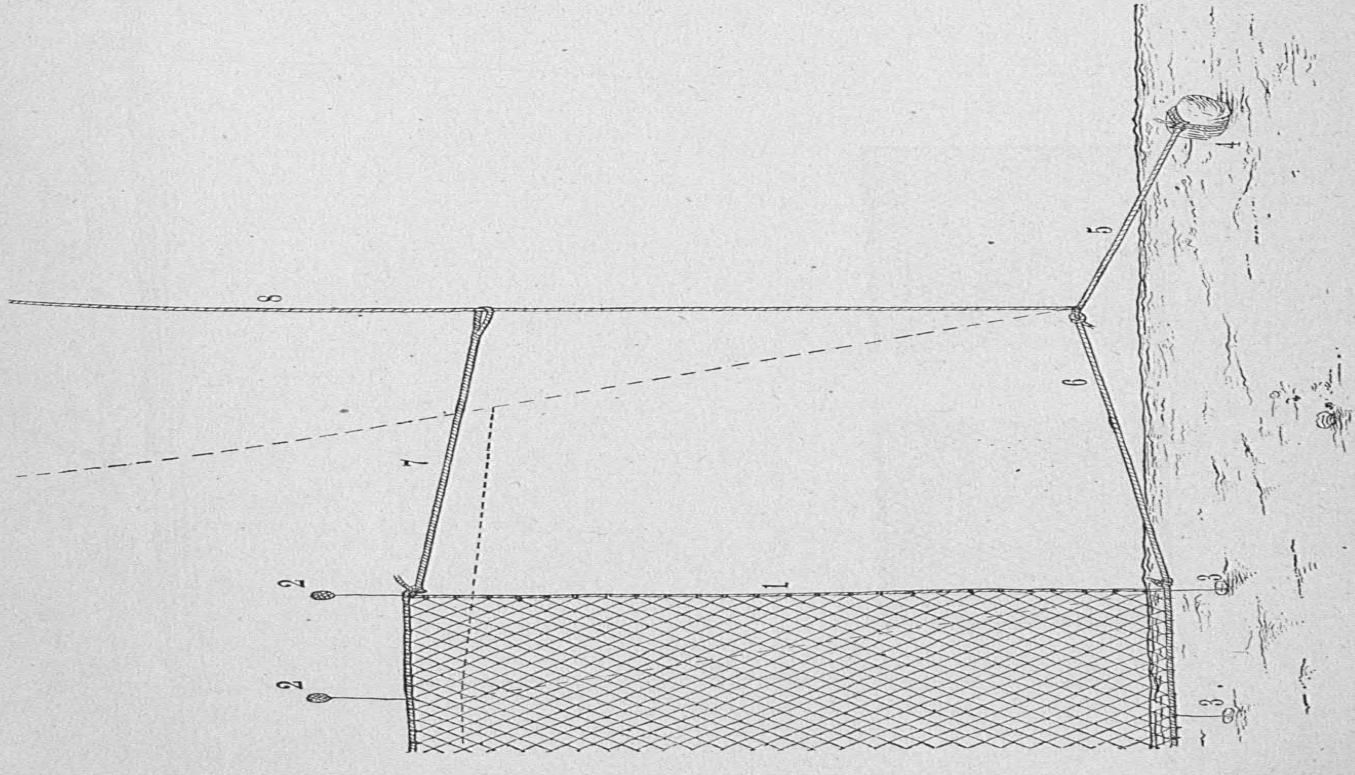
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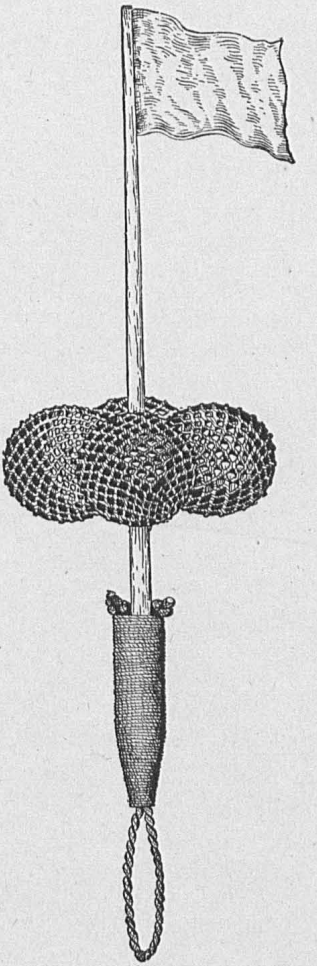

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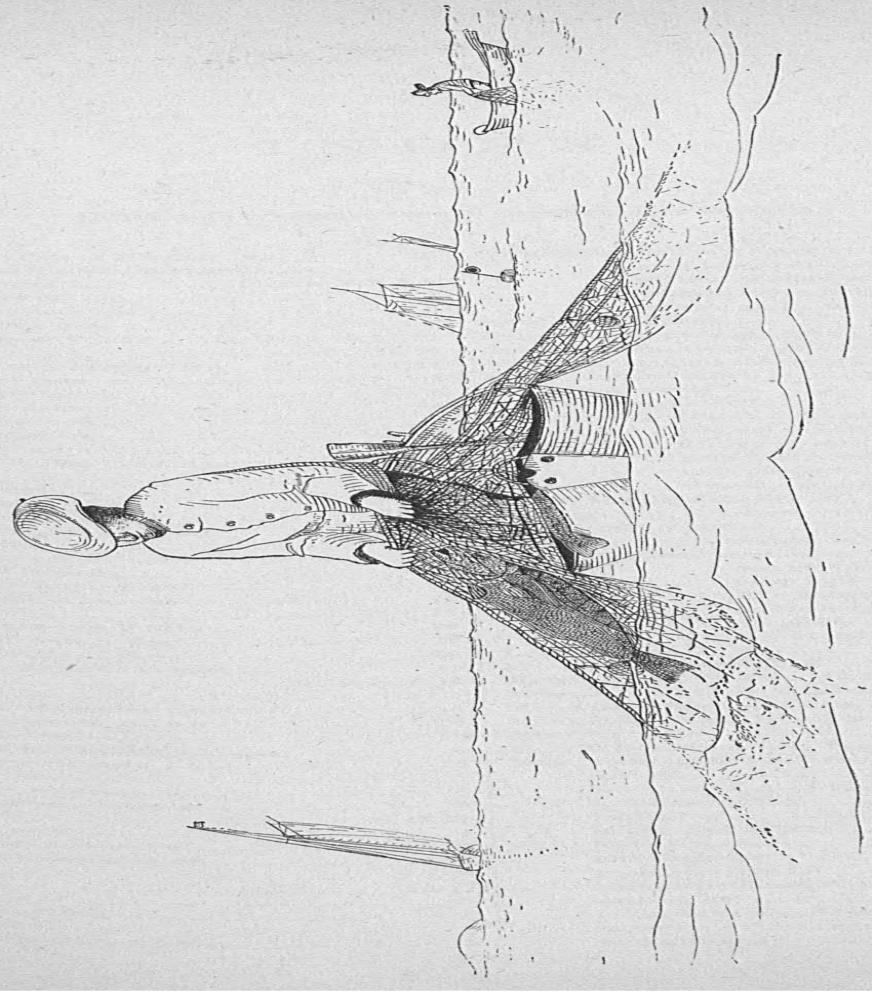

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[NOTE.—The references are to page-figures in brackets.]