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THE BEAM-TRAWL FISHERY OF GREAT BRITAIN.

WITH

NOTES ON BEAM-TRAWLING IN OTHER EUROPEAN COUNTRIES.

BY

J. W. COLLINS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1889.

60.—THE BEAM-TRAWL FISHERY OF GREAT BRITAIN, WITH NOTES ON BEAM-TRAWLING IN OTHER EUROPEAN COUNTRIES, ETC.

By J. W. COLLINS.

ANALYSIS.

A. Introductory Note.

This report has been prepared for the purpose of placing before those directly interested in the fisheries of the United States such information as seems necessary to convey a moderately comprehensive idea of the British beam-trawl fishery. The history, development, and importance of this special branch of the fisheries in European waters have been dwelt upon at some length. Attention has been called to the possible influence of the beam-trawl on the abundance of fish, and the question of the introduction of this form of apparatus into the fisheries of the United States has been discussed.

But in view of the possible employment of the beam-trawl for the capture of fish in American waters, special attention has been given to the various details of its construction. It has also been deemed desirable, for the same reason, to describe at length the various forms of apparatus which are used in conjunction with the trawl, as well as the methods of fishing, the system of marketing the catch, and other matters relating to the prosecution of the work in Europe, since a knowl-

edge of these details will be required by American fishermen should they ever undertake to prosecute the beam-trawl fishery.

Less has been said concerning those subjects which seem to suggest little that may be of practical value, and for this reason much has been omitted which might perhaps appropriately be included in a report of this kind. For instance, the notes on the trawl fisheries of France, Belgium, Holland, Germany, and Spain might have been expanded to a greater extent, but it is believed that these contain all the data which may be of any importance to fishing communities in the United States.

It is proper that acknowledgments should be made to the following gentlemen, who have lent their aid in various ways, but more particularly in furnishing such information as is required for a work of this character. Foremost among those who have assisted by their kindly efforts are Mr. Harrison Mudd and Mr. O. T. Olsen, of Grimsby, Mr. Edward Jex, of London, and Mr. T. F. Robertson Carr, of North Shields, while others have furnished much interesting and valuable data concerning the British beam-trawl fishery.

Mons. A. Duchochois, of Boulogne, has supplied data relative to the French beam-trawl fishery. Mons. Jules Le Lorrain, of Belgium, has furnished many important facts concerning the fisheries prosecuted from that country. I am also indebted to Mr. A. E. Maas, of Scheveningen, for information relative to the Dutch trawl fishery.

The material upon which this report is based was chiefly gathered at Grimsby and Hull, and during a trip to the North Sea in 1880; also from a study of apparatus and methods at the International Fisheries Exposition at London in 1883. So far as I am informed, however, there has been little if any change since the last-mentioned date, beyond perhaps the introduction of additional steam-vessels in the beam-trawl fishery from the continental ports.

I.—*THE BEAM-TRAWL FISHERY OF GREAT BRITAIN.*

B. History and Present Importance.

Nothing definite can now be learned as to where or when the method of fishing with a beam-trawl in Great Britain originated. Undoubtedly trawl-nets of some kind have been in use for many centuries off the English coast, but there remain no records which would suggest that they were supplied with a beam to distend their months, and as the most primitive and oldest forms of trawl-nets now in use are unprovided with beams, it is probable that those first employed in England were of this type.

The earliest notice which we can find of the trawl fishery in England is contained in the following petition, which was presented to Parliament in 1376–'77 :[1]

[1] It will be noticed that there is nothing in this petition which indicates the use of a beam as a part of the apparatus: therefore one is left in doubt as to whether a beam-trawl or some other form is meant.

(Pet. 51, Edw. III, A. D. 1376-'77.—Petition No. 50.) "That whereas in several places within your said realm, in creeks and havens of the sea, where was accustomed before these times to be a good and plenteous fishery to the great profit of the realm, which is in part destroyed and rendered valueless for a long time to come, by some fishermen who have for times during seven years past by a subtlety contrived a new instrument, which is amongst themselves called a 'wondy choun,' made after the fashion of a 'dag' for oysters, which is usually long, to which instrument is attached a net (*rec*) of so small a mesh, no manner of fish, however small, entering within it can pass out, and is compelled to remain therein and be taken. And besides this, the hard and long iron of the said 'wondy choun,' that it destroys the spawn and brood of the fish beneath the said water, and also destroys the spat of oysters, muscles, and other fish by which large fish are accustomed to live and be supported. By means of which instruments called 'wondy chouns' in many places aforesaid, the fishermen aforesaid take so great abundance of small fish aforesaid, that they know not what to do with them, to the great damage of the commons of the kingdom, and the destruction of the fisheries in like places. For which they pray remity.

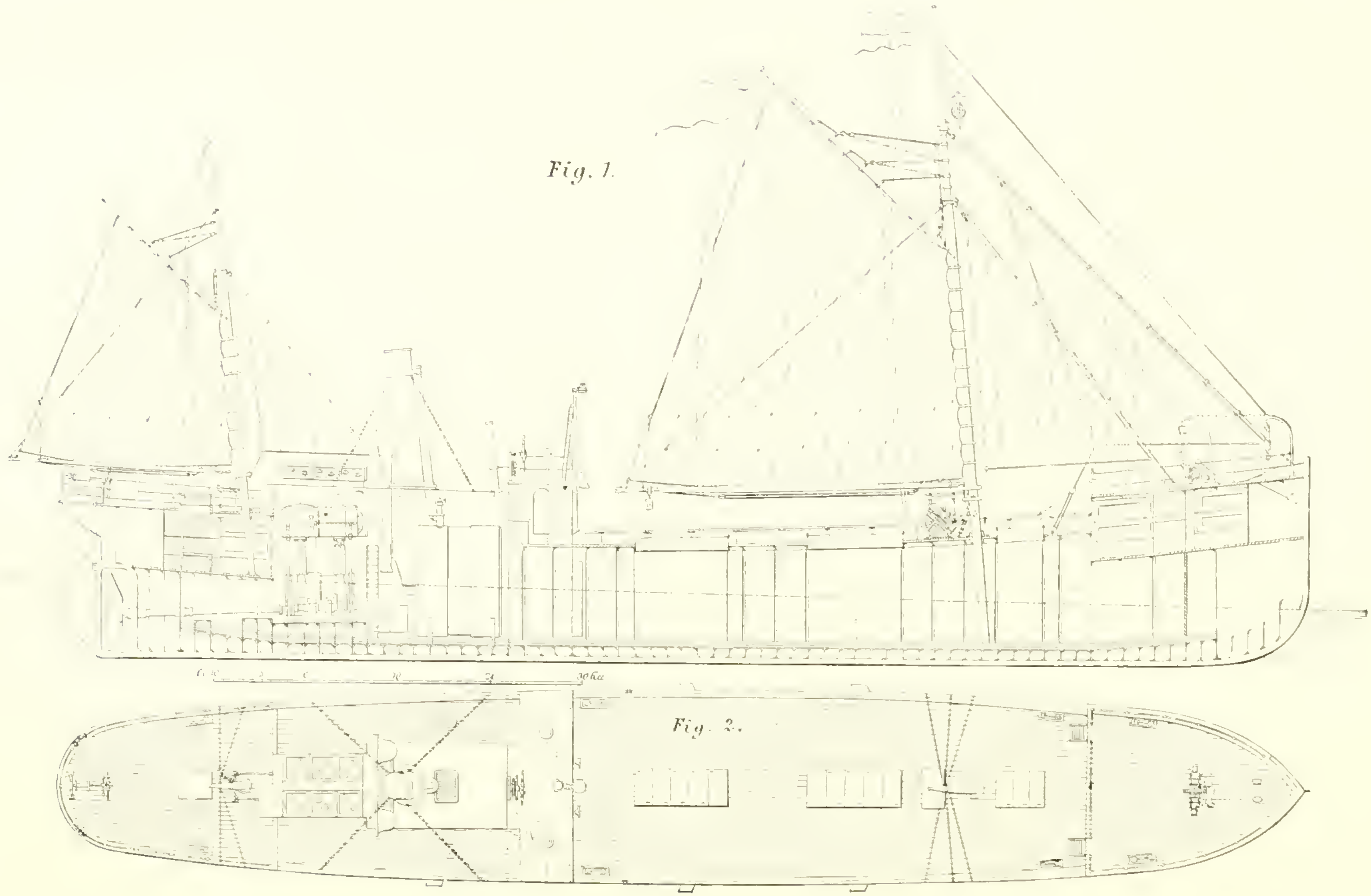
"*Responsio.*—Let commission be made by qualified persons, to inquire and certify on the truth of this allegation, and thereon let right be done in the court of chancery."

The fishing towns of Brixham and Barking, in their local traditions, both lay claim to the distinction of having been the first to introduce and establish the method of fishing with beam-trawls, but, as these claims are based solely on tradition, it still remains a mooted question as to which is the most entitled to the honor. One writer has attempted to prove the probability of this method of fishing having been introduced by the Dutch on the occasion of the landing, at Brixham, of the Prince of Orange in 1688.

He says, however, that "for the next hundred years there was no craft employed at Brixham at fishing, but open boats and half-deck yawls, the latter being the latest improvement. We have [he continues] heard our grandsires relate how they used to put the whole apparatus, or gear, as it is now called, on their back and carry it on board of the boat. * * * Shortly after this time the fishermen began to enlarge their crafts, to cover in the deck, fore and aft, and rig them as cutters—namely, boom, gaff, and bowsprit, and with topmast having a long pole on which was set a royal with the sheets leading down on deck, the same as the Dutch Scheviling bombs of the present day, and most probably the rig was taken from them."[1]

The trawl-net, in various forms, has unquestionably been used in the continental fisheries of Europe for many years, but the application of the beam is apparently of more recent date.

[1] The Fisherman's Magazine, March, 1881.



PLANS OF STEAM FISH-CARRIER AUSTRALIA.

FIG. 1. Sectional elevation and sail plan. FIG. 2. Deck plan.

The following remarks by Holdsworth on the origin of the trawl-net, though they do not throw any additional light on the matter, show, nevertheless, how difficult it is to find anything concerning the early history of this apparatus which may be considered reliable:

"The origin of the trawl-net appears to be unknown, but an eminently primitive method of working it is still in use on the Atlantic and Mediterranean coasts of Spain. * * * Its chief feature is that in order to keep the mouth of the net open so as to work efficiently, two vessels are employed. They are termed 'Parejas,' signifying pairs or couples, and they sail together at a certain distance apart, towing the net between them. An improvement on this plan, although very far from being satisfactory, is the hammer or pole-trawl, still used on some parts of the south and southwest coasts of Ireland. Only one vessel is required to work it, and the mouth of the net is extended by ropes leading from wings of netting on both sides of it to poles projecting one on each side of the vessel. It is but a clumsy contrivance, and only suited to smooth and shallow water. * * * The otter-trawl is the same kind of net as the one just noticed, but otter-boards are fastened to the ends of the wings, and by their peculiar and kite like action cause the extension of the mouth of the net without any necessity for poles. The otter-trawl is much used on board yachts, but does not meet with much favor from professional fishermen. Their preference is given entirely to the beam-trawl, which has been in use for many years, and, notwithstanding some disadvantages, has on the whole proved to be a productive and useful implement of fishing. There is nothing to show when the addition of the beam was first made to the trawl, nor is it certainly known whence the idea originated. There is some reason to think, however, that to Brixham is due the credit of having first adopted it in this country for deep-sea fishing, and possibly of having introduced it, although we believe Barking also puts in a claim to it. The commencement of the system probably dates from some period in the last century. Old fishermen at Brixham remember their grandfathers being trawlers; but the number of vessels and their size were then small compared with those of the present day, and we can obtain no further information on the subject than that beam-trawling had been carried on for a long time, or, as was said by one old fisherman, whose chronological ideas were perhaps not very clear, 'may be from the time of Moses'—a possibility not quite consistent with the general idea at Brixham that beam trawling originated in that long-famous fishing port."[1]

Although we may be left in doubt as to the time and place that witnessed the introduction of the method of beam-trawling in Great Britain, it is, nevertheless, a well-established fact that this fishery did not attain very important proportions until within the present century. Of late years, however, more especially since 1850, it has developed

[1] Deep-sea Fishing and Fishing Boats, by Edward W. H. Holdsworth. London. 1874, pp. 52, 53.

with remarkable rapidity, until now it is considered one of the most important fisheries of the British Isles, while in England it takes precedence of all others.

"The most important method of fishing," writes Holdsworth, "by which a regular supply of the best and most varied kinds of sea fish is obtained for the market is that commonly known as 'trawling'—a name evidently derived from trailing or dragging; the trawl being a bag-net which is towed, trailed, or trawled along the bottom; and it is so constructed as to capture those fish especially which naturally keep upon or near the ground."

The most noted ports in England from which trawling is prosecuted are on the east coast and most of them north of the Thames. They are, in the order of their importance as trawling stations, Yarmouth, Grimsby, Hull, Lowestoft, London, and Scarborough; while Brixham, Ramsgate, Plymouth, and Dover, in the south of England, are noted for their trawling fleets. Carnarvon and Tenby, in Wales, have small fleets of trawlers.

Aberdeen, Granton, and Leith, in Scotland, have each a number of trawling steamers,[1] though Mr. T. F. Robertson Carr, writing from Edinburgh under date of August 25, 1883, says:

"The General Steam Fishing Company, limited, is the only beam-trawling company of any importance in Scotland, and their headquarters are at Granton in the Firth of Forth, close to Leith."

When Holdsworth wrote in 1874, there was "no beam-trawling station of any importance on the coast of Scotland." The statement is made in the First Annual Report of the Fishery Board for Scotland, 1882, that—

"Beam trawling has been carried on for several years in the Moray Firth by sailing smacks and boats, principally belonging to Lossiemouth; and it has also been prosecuted for a considerable period by sailing smacks and boats in the Firth of Clyde. Beam-trawling by steamers, which has been more recently adopted, has greatly increased within the last two or three years."

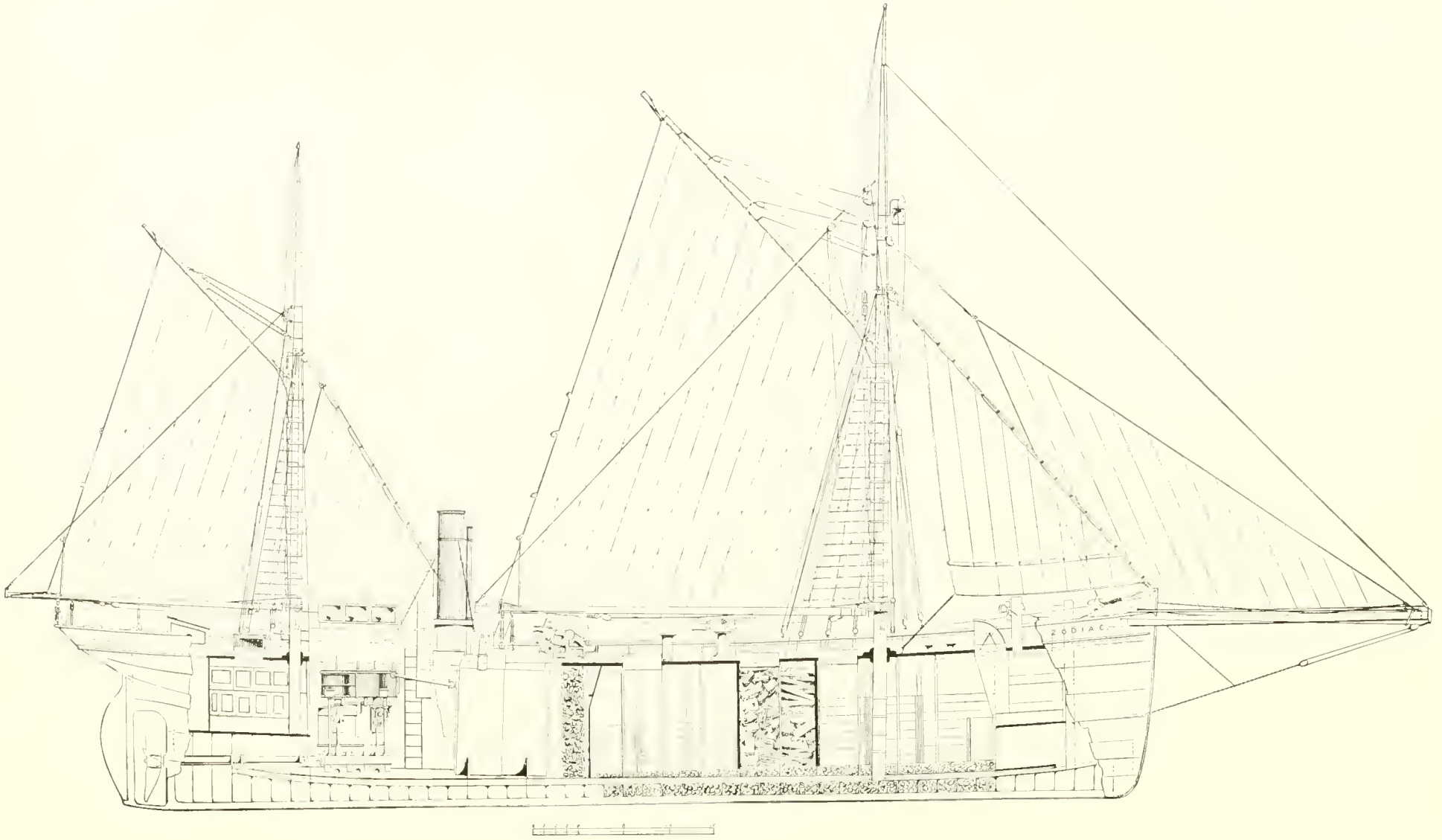
According to the Scotsman of December 8, 1883:

"At the present moment the fleet of screw trawlers belonging to Granton numbers fifteen, and the capital thus employed in the industry here alone may be roughly estimated at between £40,000 and £50,000."

Dublin, Galway, Waterford, and Dingle are the principal stations in Ireland from which large vessels are employed in trawling.

Besides all the fleets of large sailing smacks and steamers which en-

[1] Mr. David Allen, senior member of the building firm of D. Allen & Co., of Granton, states that, in 1883, Aberdeen had five screw boats and five paddle steam trawlers; Granton had a fleet of nine screw steamers, while a dozen side wheelers sailed from Leith. David Walker, trawl owner and skipper, of Johnshaven, before the Royal Commission appointed to inquire as to trawling operations on the east coast of Scotland, 1883, says: "There are now seven sailing trawlers and one steam trawler belonging to Johnshaven, working generally from Red Head down to Bervie. Formerly they went to Aberdeen Bay."



STEAM TRAWLER ZODIAC.

Sectional elevation and sail plan.

gage in this industry, more or less trawling is carried on near the shore on various parts of the coast of the British Isles, by small boats, but until recently the Scotch have employed this method comparatively little, and even now other means of catching fish are generally preferred by the boat fishermen of that country.

The remarkable development of the beam-trawl fishery of the east coast of England during the past forty years, the consequent increase in the trawling fleets, and the growth and prosperity of the principal fishing ports are, perhaps, without a parallel in the history of the British fisheries.

Take Grimsby, for example, which, about 1858, according to Mr. Harrison Mudd, a prominent citizen of that port, had a population of, approximately, from 10,000 to 13,000, and had just begun its career as a fishing town by sending out a few beam-trawlers; now it has increased to upwards of 30,000 inhabitants, and from its docks sail a fleet of nearly 800 fishing vessels, more than half of which are beam-trawlers. Mr. Edward Jex and other gentlemen say that they can recollect when Hull and Lowestoft (some thirty-five or forty years ago) did not have more than 25 or 30 sail of trawlers to each port. In 1881 Hull had a fleet of 737 and Lowestoft 467 vessels of all classes, the majority of which were trawlers.

"The rapid development of late years," writes Mr. Ansell, "may be traced to the introduction of ice and the spread of our railway system, by which the catcher has been enabled to get the fruits of his toil distributed to the many thousands dwelling in the inland towns—those who seldom or never saw or tasted salt-water fish."[1]

It may also be added that the introduction of the method of icing fish has given the trawlers an opportunity, which they have not been slow to improve, to visit distant and untried grounds where fish could be taken in much greater abundance than nearer home.

According to Mr. Ansell the advance of the trawling trade was so rapid on the east coast that Hull, which, in 1845, had only 21 vessels, aggregating 570 tons, and valued at £6,425, had, in 1882–'83, increased its fleet to 417 smacks, besides 9 steam carriers and 6 ice ships, with a tonnage of 29,233 tons, and a valuation of £555,000.

Still more remarkable has been the growth of the beam-trawl fishery from Grimsby. It was first introduced, according to Holdsworth, in 1858, at which time 5 smacks went there from Hull. The rapid strides which this fishery has made at that port may be judged from the fact that the amount of fish landed there had increased from 4,341 tons in 1858 to over 73,000 tons in 1881, while we are credibly informed that about 100,000 tons were landed in 1882–'83. Though all of these fish were not caught in beam-trawls a large percentage were so taken, and it is perhaps not too much to assume that the increase in the fisheries

[1] Papers of the conferences held in connection with the Great International Fisheries Exhibition (London, 1883), On Trawling, by Alfred W. Ansell.

at Grimsby is due more to the advance made in beam-trawling than to anything else. Besides the fish landed at Grimsby, large quantities caught by trawlers hailing from that port go by water in steam carriers to London.

As to the present status and importance of the British beam-trawl fishery, Mr. Ansell makes the following interesting statements:

"The number of British deep-sea trawlers may be taken at 3,000 (not including steam cutters), Yarmouth leading with 700, Hull and Grimsby next, making together about half the number, the rest being scattered around our coasts. Such smacks as sail from Yarmouth, Hull, and Grimsby I class as the deep-sea trawler. Taking the average catch of each of these at 100 tons, brings the total weight to 300,000 tons, irrespective of the inshore trawlers' catches (as in the case of Hull and Grimsby, and also Messrs. Hewitt's, and others *less* of coarse and *more* prime, we may take an estimate at £10 to £12 per ton as the price it fetches; this will give us a total money value of fish caught by the deep-sea trawler of £3,000,000 at £10, or £3,600,000 at £12."

The Duke of Edinburgh, in a paper read at the conferences at the London International Fisheries Exhibition, entitled "Sea Fisheries and Fishing Populations," makes a more moderate and probably a more accurate estimate. He places the total production by this method in the British Isles at 215,157 tons, worth £2,581,000, equal to about $12,905,000.

"If," continues Ansell, "we take capital employed in producing this at a total of £15,000,000 invested in floating and shore property, it is not overestimating it. We have ice-ships, ice houses, steam-carriers, curing-houses, storing-houses, and many other things too numerous to mention. The number of hands to man these vessels, at five or six hands per ship (though some carry more), makes from 15,000 to 18,000; the latter is more like the number. If to this we add 2,000 who are out of berth by changing ships, we have then 20,000 hardy and experienced hands employed in deep-sea trawling, and who have no *other calling or occupation.* Some of these have families, and calculating two only in each ship to be married, with each a wife and four children, we have 30,000 more who are *altogether dependent on the trawl for support.* But as the trade can not be carried on without assistance of shore labor, it gives employment to more than as many more, such as packers, curers, laborers, watchmen, coopers, net-makers, riggers, etc., and a vast number of other trades too numerous to mention."

C. Fishing Grounds.

The North Sea or German Ocean, from the Straits of Dover to Kinnaird's Head, on the Scottish coast, and the Skager Rack, on the continental side, is the most favorable field for the prosecution of the beam-trawl fishery. Within the area mentioned the water is generally shallow, varying from 5 to a little upwards of 50 fathoms, and may be

Fig. 1.

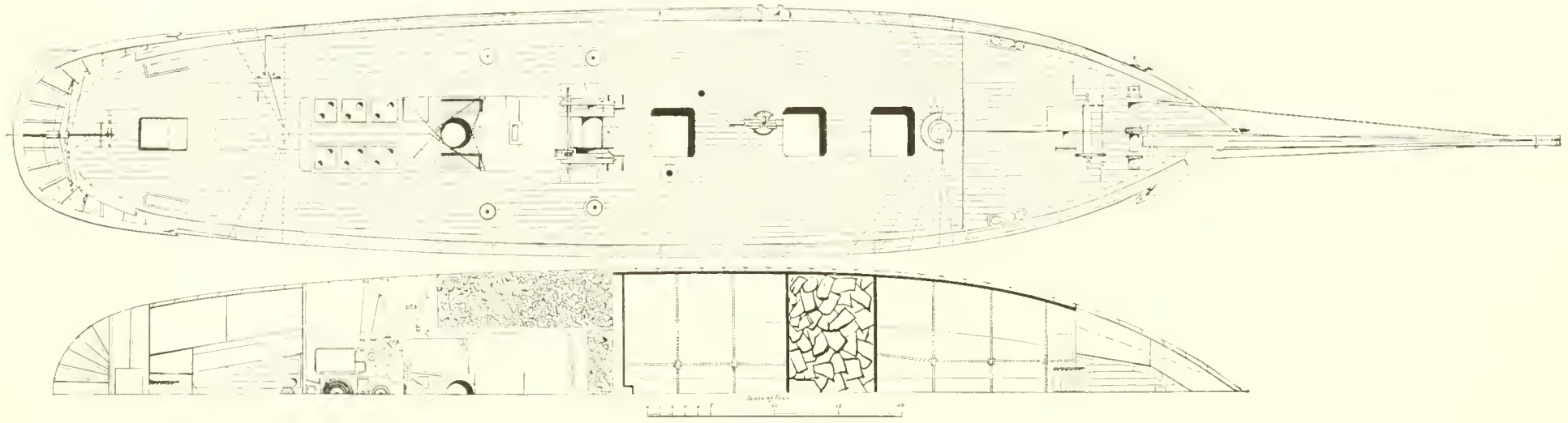


Fig. 2

PLANS OF STEAM TRAWLER ZODIAC.

FIG. 1. Deck plan.

FIG. 2. Half-breadth plan with deck removed, showing interior arrangement.

considered one vast fishing bank, though there are various areas of greater or less extent in this part of the North Sea that are specially noted trawling grounds, and to which specific names have been given.

A bottom of mud or sand, in a moderate depth of water, is the most favorable ground for the use of a beam trawl, providing, of course, fish can be taken thereon; but it often happens that fish are much more abundant on rocky grounds, known by the name of "roughs" among the North Sea fishermen. Therefore, though there is always a great risk of losing the trawl when working on rough bottom, the hope of obtaining a large catch is often sufficient inducement for the fishermen to make the venture.

The most noted of the North Sea fishing grounds is the Dogger Bank (divided into several sections, which are distinguished by local names): the Off Ground, the Great Silver Pits, Botney Ground, Brown Bank, the Coast, Leman Ground, and the Great Fisher Bank. Besides these, mention may be made of the Horn Reef, Jutland Reef, Flamborough Head Ground, Scarborough Ground, Hartlepool Ground, Sunderland Ground, Fladen Ground, the Cemetery, Flat or Well Bank, Sole Pit or Northeast Hole, Smith's Knowl, Cromer Knowl or Dowsing Ground, the South Ground, North Foreland Ground, Kentish Knock Ground, Margate Ground, the New Bank or Sandiethe, the Falls Ground, Ridge and Varn Banks, and Rye Bay.

"The fishing grounds most frequented by vessels from the Humber [Hull and Grimsby]" writes Mr. Ansell, "are the shoal of the Dogger, the southwest and northwest spit of the Dogger, Clay Deeps, the northeast part of the Dogger (called the 'Cemetery,' from the rough, stony nature of the bottom compared to grave stones), the Fisher Bank and beyond the Fisher Bank, Jutland Reefs, the Long Forties, the Horn Reefs, the Sylt, the Amram Bank, Heligoland, off the entrance of the Weser and Elbe, Nordeney, Borkum, Terchelling, Texel, etc., besides other grounds south of the Humber, such as the Wells Bank, etc. * * *

"Plaice are to be found only in the spring and fall on the shoal of the Dogger, and in summer on the Horn Reef and Borkum. In winter, below the Dogger and off the Flamborough Head.

"Haddocks are found in abundance on the southwest spit of the Dogger about October; in September and October they work along the pit edge of the Dogger, and when taken they are found to have plenty of herring and spawn in them.

"Soles are caught on hard, sandy ground in warm weather, taking to deep water, such as the pits, where the bottom is muddy and soft, in winter, for warmth."

The Dogger Bank, which is a very extensive ground, is situated nearly in the middle of the North Sea; its southwest prong is about 70 miles in an east-northeast direction from Spurn Point, at the mouth of the Humber. From there it extends northeastwardly a distance of 150

miles, ending in a point. It is somewhat irregular in form, being about 60 miles wide in the broadest place. Different parts of the Dogger are known by specific names among the fishermen. The "West Shoal," which is a shallow ground on the southwest part of the bank, is about 20 miles long ESE and WNW., with a depth of from 7 to 10 fathoms, and a fine sandy bottom. Then there is the "Outer Well Bank," or the "Southwest Spit," with from 15 to 18 fathoms, with a bottom of fine sand and occasional spots of coarse sand and small rocks. In this locality haddock and plaice are frequently found in abundance during the fall. Between the Southwest spit and the West Shoal the shallow part of the bank curves inwardly like a cove, with irregular soundings, varying from 20 to 40 fathoms. On what is known as the south part of the bank, east of the West Shoal, the bottom is chiefly fine sand, with a depth of from 11 to 20 fathoms. This is a good fishing ground, and is much visited. The "East End," in latitude 55° 25′ north, longitude 1° 30′ east, is noted for a fine brown sandy bottom, free from what the fishermen call "scruff" or "rubbish," the depth varying from 22 to 24 fathoms. This is now considered one of the best fishing grounds on the Dogger. To the southwest, in latitude 54° 50′ north, longitude 3° 20′ east, is the "Clay Deep," or "Southeast Swash of Dogger Bank," of soft ooze, 25 miles long, southwest and northeast, with rough ground on either side. The "North Shoal" and "Northwest Spit" are tracks of more or less rough bottom.

The Great Silver Pits, the west end of which lies due east of Spurn Point some 60 miles distant, is a gully or depression of the sea bottom between the Dogger Bank on the NNE. and Wells Bank on the opposite side. Its length east and west is about 60 miles, and its width varies from 10 to 11 miles. The depth ranges from 25 to about 50 fathoms, with patches of bottom of different kinds, such as black mud, fine sand, white mud, blue clay, stones, and gravel.

This celebrated fishing ground was discovered about 1843, and on it soles were found in extraordinary abundance.[1] It still is a favorite resort in winter for such of the trawlers as fish more particularly for soles.

The Great Fisher Bank is thus described by Olsen:

"This large space of ground, known by the name of the Great Fisher Bank, is situated in the northeast part of the German Ocean; it is of vast extent, and has recently been discovered as a trawling ground. The ground chiefly consists of sandy soundings of mud and ooze, with depths of water varying from 40 to 45 fathoms.

[1] Dr. Francis Day, in "Notes on Trawling," published in "Ashore or Afloat," London, 1883, states that: "When the Silver Pits were first discovered it was not an uncommon thing for a trawler to get a ton and a half of soles a night, of from £12 to £24 value."

Olsen says: "Large quantities of soles were caught for the first three years."

"When the Silver Pits were first discovered," writes Ansell, "and became frequented as a fishing ground, the sole was found in the winter months in such enormous quantities, that the name 'Silver Pits' was to the fishermen no unmeaning one, so prosperous were those who resorted thither."

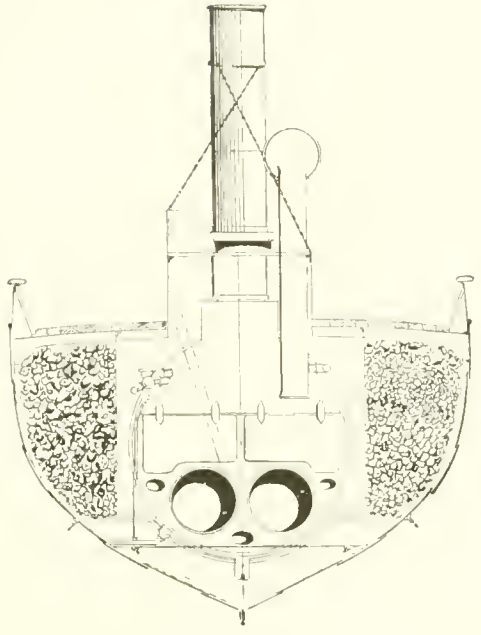
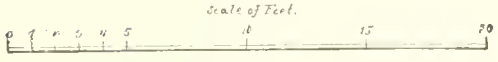


Fig. 1



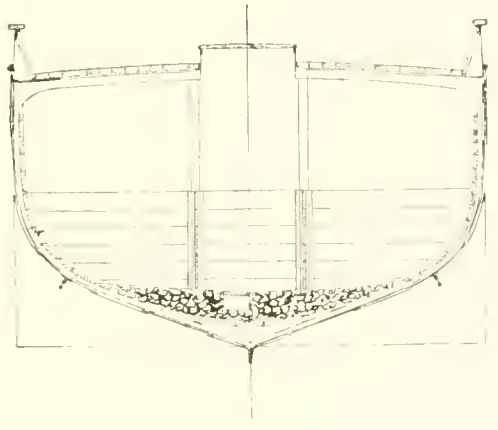


Fig. 2.

PLANS OF STEAM TRAWLER ZODIAC.

FIG. 1. Cross-section in boiler-room, showing location of boiler, coal-bunkers, etc.
FIG. 2. Midship section, showing construction, ballast, etc.

"The best track hitherto used (1877) is in latitude 57° 20′ north, and longitude 1° 40′ east. * * * As the bank is of recent discovery as a trawling ground, it is not considered as yet to be fully explored, but we find that the eastern part is foul, more or less, and that the north-western part is most productive, large quantities of fish, chiefly haddocks, plaice, and cod, being brought from here to the Hull and Grimsby markets. This ground has now (1881) been worked about 5 years."[1]

The Cromer Knowl, first fished on about 1858, lies north of the Leman and Dover Sands, between them and the Dowsing Bank. It has a depth varying from 12 to 18 fathoms, with generally clear bottom for trawling, on which, when first discovered, the more highly prized species of the North Sea fishes were found in abundance.

The foregoing will give a general idea of the most important North Sea trawling grounds, which, for the purposes of this report, it seems scarcely necessary to describe in greater detail.

Areas of bottom, suitable for fishing with a beam-trawl, of greater or less extent are found along the coast of the continent, near the east coast of Scotland, in the English Channel, along the west side of England,[2] and off the coasts of Wales and Ireland, but they are too numerous to mention even by name in this place. Suffice it to say that the southern and western grounds have generally been worked much longer than the majority of those in the North Sea, and in general characteristics, such as depth, kind of bottom, etc., they are like the latter, though as a rule of less extent.

The kind of fish chiefly taken on the above-mentioned grounds are turbot, sole, brill, plaice, lemon or cock sole, dabs, and halibut, of the *Pleuronectidæ*, or flat-fish family; cod, haddock, hake, ling, and whiting, of the *Gadidæ*; besides which conger eels, wolf-fish, skates, gurnards, and a variety of other less important species are caught.

At first, previous to the introduction of ice for preserving fish, the grounds nearest the British coast were the only ones which could be fished on, and trawling was then carried on chiefly in the English Channel from Dover to Land's End, and along the coasts of Wales and Ireland. With improved methods for preserving the fish in a fresh condition, the smacks were enabled to venture farther in pursuit of new and richer fields for carrying on their operations. In this way they continued to discover new fishing grounds, either by accident or design, until at the present time it is pretty safe to say that there is little

[1] Fisherman's Seamanship, by O. T. Olsen, F. R. G. S., F. R. A. S. Grimsby, 1881, p. 103.

[2] According to Mr. Edward Cattran, a veteran fisherman of Mount's Bay, the Plymouth and Brixham trawlers fish chiefly on what is known as the "Brixham Ground," and from there round to Mount's Bay. Off Mount's Bay, he says, sole and other species of flat-fish, with occasional ling, are taken, while "coarse fish" are chiefly caught off Brixham and Plymouth, though with the latter more or less soles and other flat-fish are taken. Hake are often found in abundance.

of the bottom of the North Sea suitable for trawling over which a beam trawl has not passed. Mr. Ansell thus describes what may be termed, perhaps, the accidental discovery of a new fishing ground some forty years ago, though it may more properly be said that this find was a happy combination of chance and enterprise, which so frequently influences the welfare of mankind:

"Chance brought about one of the most astonishing results in the history of the fishing trade about the year 1844, and founded the trade at Hull in consequence. One of the Ramsgate boats, in extending her searches for fish, was by adverse winds blown farther north than it was the intention of the crew, but, determined to make a try, they shot their trawl in what is now so well known as the Silver Pits, and their plucky venture and labor were rewarded by a miraculous draught of fishes, which were nearly all soles. Very soon this became noised abroad, and other boats followed, who were equally rewarded with good results."

According to Holdsworth, the Great Silver Pit was first worked over about 1843, during a severe winter.

"The Well Bank and Botany Gut [he writes] had been explored and discovered to be very productive grounds; and between them and the Dogger, and bearing nearly true east from Flamborough Head, the Admiralty chart showed a bed of deeper sounding, ranging in some parts of it from 30 to 40 fathoms; the whole extending for about 60 miles east and west and from 6 to 10 miles wide. This patch was marked the 'Outer Silver Pit,' and on trying it with a trawl, in the deeper parts at the western end and near the middle, soles were found during that very cold season in almost incredible numbers; the nets were hauled up bristling with fish trying to escape through the meshes; and such catches were made as the most experienced fishermen had never dreamed of. * * * In subsequent years the Silver Pit has again been found very productive whenever the winter has been very severe, or, as the trawlers call it, in 'Pit seasons.'"

The same author tells us, however, that "soles are generally distributed wherever there is clean sandy ground, but they are not found so much in very deep water, except during cold weather. The London market is principally supplied with this fish from the banks of the Norfolk coast and from the Channel. * * * It is rarely that any number of soles is landed at Hull, and the Grimsby shops are often supplied from London."

D. The Fishermen.

The crew of a beam-trawler varies from four to seven persons on a sailing vessel, and from six to eight on a steamer. The cutters of the south of England (from Plymouth, Brixham, Ramsgate, Dover, and other ports), which vary in size from 25 to 50 tons, usually carry four persons in a crew, one or more being boys. Many of the Yarmouth vessels, if not the majority of them, have seven in a crew, but the trawl-

PLATE V.

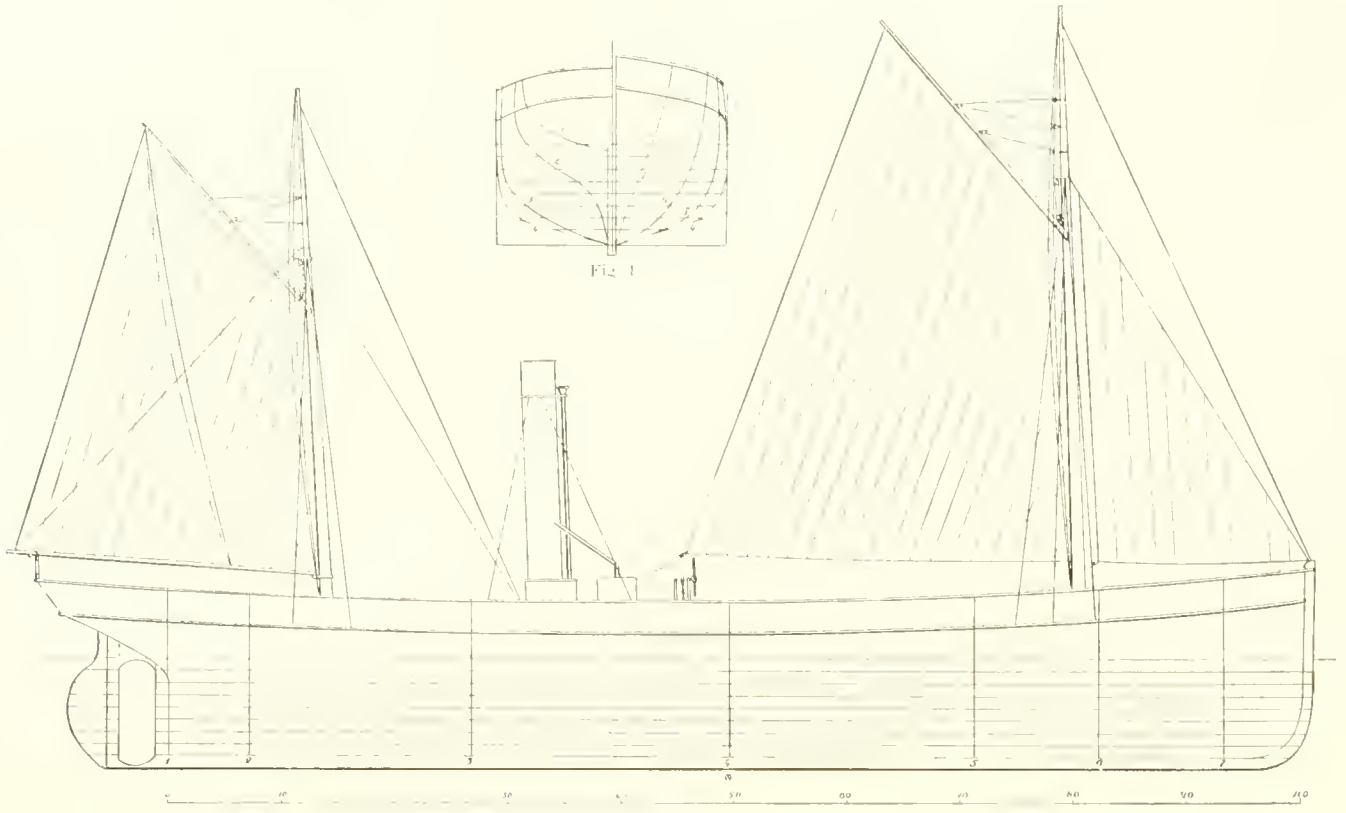


Fig. 1.

Fig. 2.

PLANS OF STEAM TRAWLER GRANTON.

Fig. 1. Body plan.

Fig. 2. Sheer and sail plan.

Drawn by D. Allan.

ers sailing from Hull and Grimsby, and which are the largest vessels of their class, carry only five persons in a crew, as a rule, though in exceptional cases the crew-list may be larger.

The Grimsby steam-trawlers carry eight in a crew, but the smaller class of steamers do not require so many men.

In any case, a number of boys are usually carried. The Grimsby sailing-trawler generally has two boys in its crew, and sometimes the three youngest members of a crew are mere lads, varying in age from twelve to seventeen years, in which case there would be only two men on board a vessel—the captain and "second hand." Ordinarily the crew of a sailing trawler of the larger class is constituted as follows: The cook is the youngest, and is usually from twelve to sixteen years of age. The "fourth hand" or "deck hand," the next in grade, is a lad of fifteen to eighteen years of age, and generally one who has served a term at cooking. Next in rank is the "third hand," who, according to his ability and experience, may be promoted to this position when he is from seventeen to eighteen years old, and may have to hold it for lack of further promotion for several years; therefore, third hands vary in age from seventeen to twenty-seven years or more. The "second hand" occupies the position next to the master, his duty and official position corresponding with that of a mate on a merchant vessel.

The skipper completes the crew. In almost every case promotions are made from the next lower grade, and, with comparatively few exceptions, the officers of a smack have served a long apprenticeship in all the inferior grades. Of course, there is much difference in the length of time men may have to serve before rising to command, this depending on their ability, and perhaps on other circumstances.

The duties of the various members of a trawler's crew are thus defined: The cook, or, as he is sometimes called, the "fifth hand," must cook the food for all hands, and take care of the cabin and store-room, where the provisions are kept. He must learn to steer by the compass, for he must take the helm while the trawl is being shot. He must also acquire a knowledge of making and mending nets and nettles, take care of the reefing gear and keep it in its proper place, and it is his duty to coil away the trawl-warp when the trawl is being hove up. Also, he is expected, with the assistance of the "deck hand," to prepare the lights and flares for use, and to see that they are in their proper places, while the spare pump-gear and fog-signals must receive similar attention. As may be easily surmised, it is no easy task for a small boy of twelve or thirteen years of age to properly perform these various duties, particularly in rough weather, when the energies of a strong man would be severely taxed to do the work which is allotted to the cook. But it is sometimes wonderful to observe what may be done by a mere child who has been trained to the work, and we are told that these boy cooks generally perform their duties satisfactorily, though, of course, there is much less refinement in the preparation of food than on American fishing vessels,

where the cook usually receives the highest pay of any one of the crew, the captain excepted, and must be a capable and active man.

The "deck hand" or "fourth hand" is generally a lad who has served as cook, and has been promoted a grade; therefore, he is supposed to be able to do all that the cook can do, besides the special duties belonging to his new position. The deck hand must know how to steer and keep a watch in fine weather when sailing or trawling. To do this, he must be able to manage a vessel under ordinary conditions of wind and weather.

"He should be able to manage a boat in fine weather, know the marks of the lead-line, and take soundings, splice small ropes and whip them, make nettles, gaskets or sennet, braid a cod-end, and learn to mend small holes in the net. He ought to tend the trawl in fine weather, keep the hold and forecastle clean and in proper order, know the sails by the marks [the sails are known by pieces of twine with knots on the end][1] in the dark, and keep them in their proper places, make tholepins for the trawl-warp rail and boat, help to prepare fish for the market, assist the cook to trim lights, and obey all lawful commands."[2]

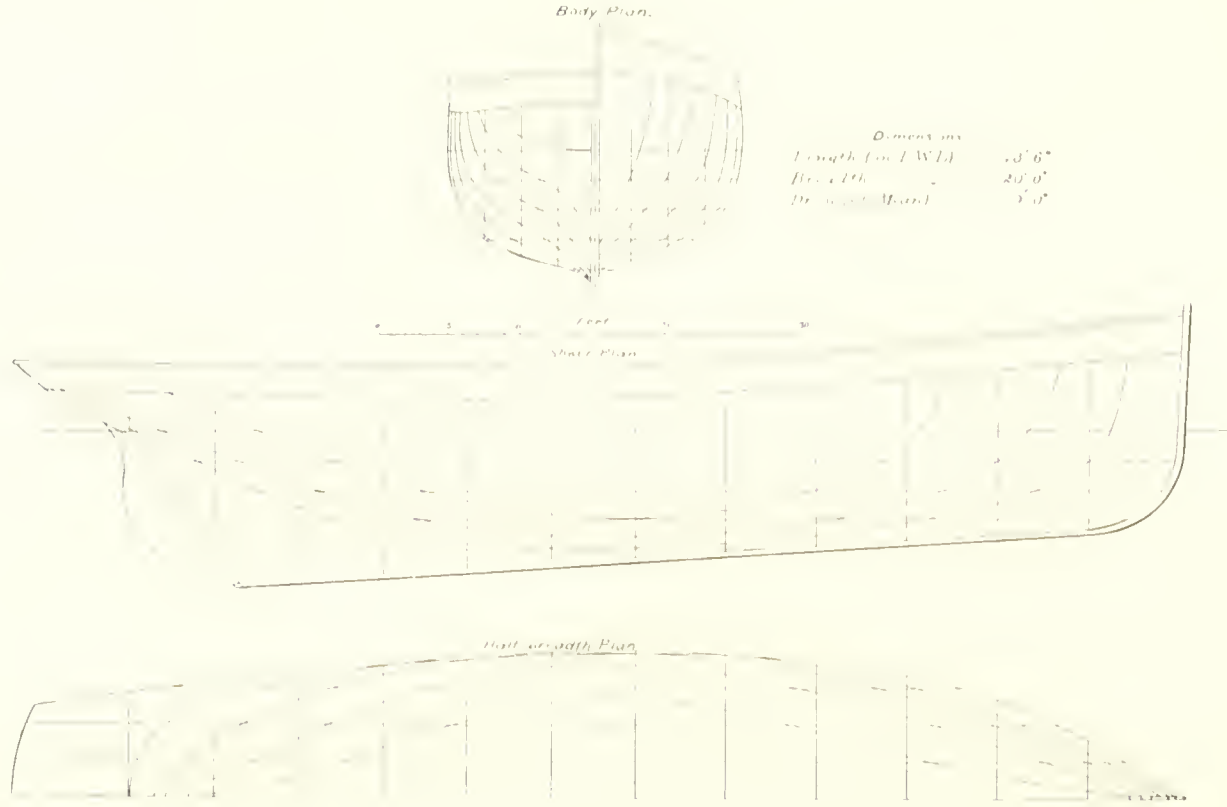
The "third hand" rates as an ordinary seaman, and usually has passed through the two lower grades. He should have sufficient experience to manage a vessel when her trawl is out as well as at other times, must be capable of keeping the ordinary long watches, which on a trawler may be six or eight hours on deck, and he must understand the "rules of the road," so as to avoid collision. It is required that he should learn the set of the tides, take soundings, understand how to make, mend, rig, and prepare a trawl for shooting; also it is a part of his duty to go in the boat when fish are to be "boarded" or taken to the carrier, while he is expected to have a care for the rigging, put on chafing gear, etc., besides assisting in the care of the fish.

The mate or "second hand" should be an able seaman, and be more thoroughly conversant with the general work than the third hand. It is important that he should have a very comprehensive knowledge of all that pertains to making a trawl, preparing the bridles, shooting the gear, managing the smack under all conditions of wind and weather, either sailing or fishing; while he ought to be familiar with the characteristics of the different fishing grounds, understand the tides on each, and also be proficient in the use of a sounding-lead. He is responsible

[1] This applies to the head-sails and gaff topsails. A trawler usually carries two or three sets of top-sails of different sizes, to be used according to the strength of the wind—a jib-header in strong or fresh winds, a large square-headed sail in light winds, and frequently an intermediate size, with a short yard. As many different sizes of stay-foresails and jibs are carried, these being set as circumstances demand, while the "spare sails" are stowed away below. Frequently, of course, it is necessary to change the sails at night, and it is therefore important that the members of a smack's crew should be able to determine at once what sail they put their hands on, since this knowledge obviates much work and difficulty.

[2] Fisherman's Seamanship, by O. T. Olsen, p. 33.

PLATE VI.



PLANS OF KETCH RIGGED SAILING TRAWLER.

for all the ship's stores, which must be kept in a proper condition for use. He should have a familiar knowledge of the buoys, beacons, light-houses, light-ships, and landmarks along the coast, and much experience in the management of a vessel under all circumstances, since, in the absence or inability of the master, the mate must take charge of the ship and carry on the work.

"The master's duty [says Olsen], when he takes charge of a smack, is to overhaul the rigging, sails, running gear, anchors, chain, pumps, side and mast-head light, see that his compass is correct, and order his provisions, ice, and stores for the voyage.

"He must *know* the duties of every man on board, and see that every man does his duty. He must *never* forget that he is the *master*, and as such answerable to the owner. He must be able to navigate his vessel skilfully, know how to use his chart, and find his position on it by soundings taken.[1] He should be able to find the latitude by meridian altitude of the sun, work a day's work, and find the time of high water. He must be well acquainted with the *rules of the road*, lights, buoys, beacons, and dangerous shoals, where his trade lies, and know the nature of the ground for fishing. He must be an able seaman as well as a good fisherman, so that he can manage his vessel in all weathers and under all circumstances, and pick a boat up in bad weather with safety. It is his duty to see the trawl-warp properly secured to the mast when fishing, see that side and mast head lights are properly trimmed, lit, and in their places at sundown. He should see to the icing and preparing of the fish for market and arrange them for sale in the market. He must see that the watches are properly kept at sea and at anchor, navigate the ship himself when going to sea until free of danger, and he must be ready at any moment (night or day) to come on deck when called, and use his superior knowledge in all emergencies. * * * He must act exactly as if handling his own property and not that of another man, keep his ship clean and in a seaworthy condition, and always keep a good lookout."[2]

The skipper and mate usually receive a share in the proceeds of the catch, and the third hand may be, and often is, paid a part of a share and a part in a certain stipulated sum per week, but the two younger members of the crew are hired.

[1] So far as I am able to judge by the observations which I had the opportunity of making, very little attention is paid to the higher branches of navigation on the trawlers. The principal dependence of the trawling skipper is on his long experience and familiarity with the soundings on the fishing grounds and along the coast, supplemented by his thorough knowledge of the set of the tides. By constant practice for years men become wonderfully expert in this peculiar kind of seamanship and navigation, and seem to reach accurate conclusions as to their position by a process which seems almost intuitive. The fishermen generally have a fair knowledge of charts, and understand the ordinary rules for keeping dead reckoning, but we were informed that observations of the sun or stars were seldom made for latitude, and we could not learn that chronometers are carried, though such may be the case in rare instances.

[2] Fisherman's Seamanship, etc., pp. 31, 35.

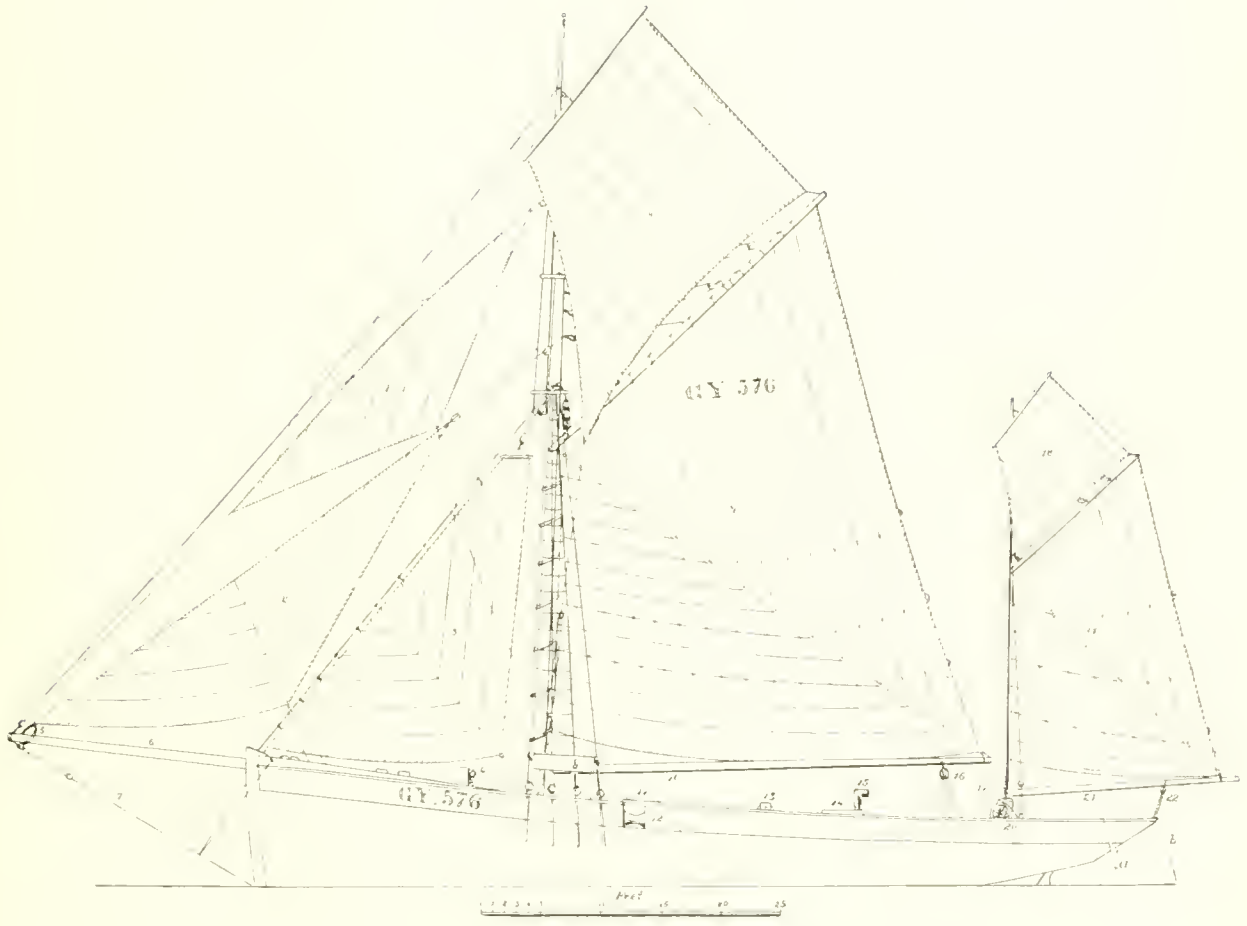
Formerly the cook and third hand were apprenticed to the master or owner of a smack for a term of years, and when their apprenticeship expired they were promoted to higher grades. This system has been much modified, if not abolished, by recent acts of Parliament, one of which, the "Merchant Seaman (payment of wages and rating) Act," of 1880, it is alleged, had a bad effect on the crews, since it took away the control which the owners had previously possessed over their apprentices. It also combined with other causes to materially decrease the number of apprentices from Grimsby and Hull, and their places were filled by inexperienced boys, taken from other trades, who frequently did not stay long enough on board the vessels to become serviceable and trustworthy. It has been put in evidence that—

"In some cases the skippers and second hands were not so efficient as formerly, though as a rule this was not the case; but the fear was generally expressed that this would steadily and rapidly increase as the existing men die out, and only men with inferior training are coming on to fill their places. * * *

"The deep sea fisherman's vocation appears to be a specialty, which requires time and special training to master, and one not easily taken up by the average seaman, however well trained in ordinary trades."[1]

The fishermen employed in the British beam trawl fishery are a hardy, robust class of men, and are distinguished for professional skill, bravery, and dogged perseverance; qualities which are such marked characteristics of seamen of the Anglo-Saxon race in all parts of the world. The majority of them are trained to the sea from childhood. A constant association with the perils and vicissitudes of a fisherman's life imbues them even at an early age with a sense of responsibility and fearlessness, qualifications which are necessary to their professional success. Then, too, the impressionable minds of the boys who constitute a portion of every trawler's crew soon become well stored with a knowledge of the details of fisherman's seamanship. Not only do the younger members of the crew learn the ordinary duties of a seaman, such as to "hand, reef, and steer," but they become familiar, as has been shown, with the construction and manipulation of fishing apparatus, acquire a knowledge of the different kinds of fish and their respective value, and later on secure important information relative to the fishing grounds and the seasons when fish are most abundant in special localities. All of this knowledge is, of course, of vital importance to the fisherman who aspires to success in his calling, and though the boy who begins his sea life at an early age may perhaps be deprived of many advantages that others may enjoy for obtaining a school education, it is, nevertheless, more likely that he will make a better and more successful fisherman than if he had more knowledge of books and less of his calling. Therefore, notwithstanding the system of apprenticeship which

[1] Report to the Board of Trade on the system of deep-sea trawl fishing in the North Sea, London, 1883, p. 10.



SAIL PLAN OF KETCH-RIGGED SAILING TRAWLER WILLIE AND ADA, OF GRIMSBY.

1. Jib-topsail
2. Jib.
3. Stay-foresail
4. Forward capstan.
5. Tack ring or traveler
6. Bowsprit.
7. Bobstay
8. Main gaff-topsail
9. Mainsail
10. Main boom
11. Capstan
12. Trawl-warp roller
13. Dummy
14. Cabin companion
15. Stove pipe
16. Main-sheet
17. Mizzen stay
18. Mizzen gaff topsail
19. Mizzen or spanker.
20. Dandy winch
21. Spanker boom.
22. Spanker sheet
a Quarter line.
b Canting line

Drawn by J. W. Collins

has been in vogue on the English trawlers may be open to many objections, it is nevertheless a fact, that the training which boys get under such a system is important in producing a hardy, brave, and capable class of seamen, who are specially fitted for their vocation.

E. Vessels.

The various types of vessels employed in the beam-trawl fishery, namely: steam-carriers, screw and side wheel steam-trawlers, the North Sea sailing trawler, and the single masted trawling smack (also the smack's boat) have all been described very much in detail in the chapter on fishing vessels and fishing boats of Great Britain, to which reference is made for further information as to the construction, rig, dimensions, and equipment of the British trawling fleet. Therefore, to avoid a repetition of the details, it is deemed necessary in this place to give only a general description of the various types of vessels alluded to above.[1]

The steam-carriers, employed in transporting the catch of the trawling fleets to the more important markets—London, Grimsby, and Hull—are iron, ketch-rigged, screw-steamers, designed especially for the trade. They have the reputation of being excellent sea-going vessels, and it is said that so well are the qualities of seaworthiness, capacity, and speed combined, that though they are able to make headway against heavy head winds and seas and to carry a large cargo, they nevertheless steam fast under ordinary conditions of wind and weather. Steam-carriers were first introduced in 1864, previous to which time large sailing cutters were employed for carrying the fish from the trawling fleets to the markets.

The size varies somewhat, but the following dimensions of the screw-steam carrier *Australia*, of Hull, one of the recent additions to the fleet, will give a fair idea of the proportions of the most approved type of these vessels: Length between perpendiculars, 135 feet; beam, 22 feet 6 inches; depth (to top of floors) 11 feet. (See Plate I, page 292.)

The steam-trawlers are built of iron in some localities, but in other places, particularly in Scotland, wood is used in their construction. The majority are ketch or schooner rigged screw-steamers, but a considerable number of side-wheel boats, chiefly tugs from the Tyne, are employed in trawling. The old Tyne tugs can not, in the true sense of the term, be called typical steam-trawlers, since they were designed for other purposes, and have been used for trawling only because they failed to find employment in towing shipping; a result brought about by the employment of steam screw coasting vessels and a general decline in the carrying trade from the Tyne. The steam-trawler proper came

[1]At the time this paper was written, the author had prepared an extensive report on the fishing craft of the world, which it was expected would be published at the same time as this. The report is still in manuscript, but will probably soon be published.

into use about 1882, two vessels having been built and set to work in that year by the Grimsby and North Sea Steam Trawling Company, which has the reputation of being the first in England to construct vessels specially for this trade; at least the first to employ steamers successfully, though it is on record that experiments had previously been made to utilize steamers for beam-trawling.

There is considerable variation in the size of the steamers employed in trawling. They range from about 40 to 120 tons. Among the largest are those from Grimsby, which generally act in the double capacity of catchers and carriers. The *Zodiac*, which was the pioneer vessel of the last mentioned class, is an iron, ketch rigged screw-boat, 92 feet long between perpendiculars, 20 feet beam, 10 feet 6 inches depth of hold, and 192 indicated horse-power.[1] The *Granton*, a Scotch built, schooner rigged, wooden, screw steam-trawler, one of the largest and finest of her class, is 108 feet long over all, 100 feet between perpendiculars, 19 feet beam, and 10 feet depth of hold. Her nominal horse-power is 45; effective horse-power 225. She steams 11 knots, and makes 14 knots under sail and steam.[2]

A few side-wheel steamers have recently been built in Scotland specially for beam-trawlers (and for towing herring boats as well), some of the fishermen preferring this class of vessel to the screw steamers. These depend more entirely on steam power than the propellers, and therefore have only one mast, stepped well forward, on which can be set a jib and mainsail.

As a rule, the screw steam trawlers are fine weatherly boats, and the best of them are probably not surpassed in sea-going qualities by any vessels in the world.

The North Sea sailing trawler is the most important type of vessel engaged in the beam trawl fishery, if the numbers employed and the work it has to perform are taken into consideration.

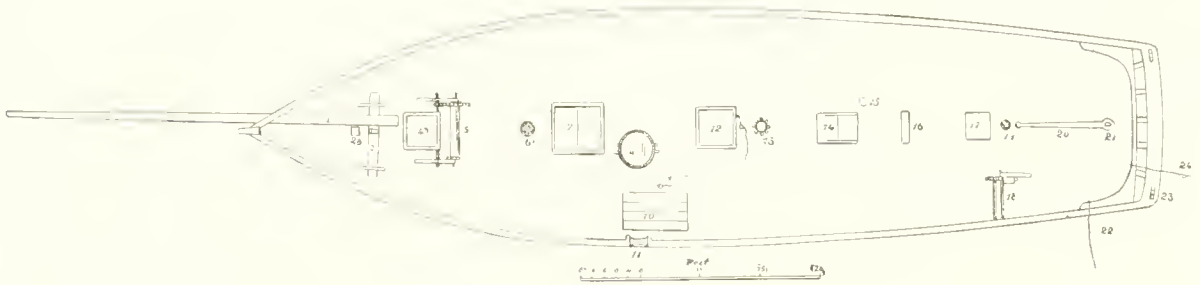
With comparatively few exceptions these vessels are built of wood; a few iron smacks have been constructed, but they do not appear to have met with great favor, judging from the fact that their numbers have not been materially increased of late years.

The North Sea trawler is designed to secure the maximum of seaworthiness with a fair amount of speed. In the former quality it is probably not excelled by any vessel of its size in the world, and although it is comparatively light rigged ("jury rigged," as it is called by some of the English fishermen), it nevertheless oftentimes attains a moderately high rate of speed.[3] It is ketch or "dandy" rigged—the arrangement of spars and sails being specially well adapted to the work it has to perform. It ranges in size from 35 to 85 tons, though comparatively few vessels of this class are smaller than 50 tons, while many of those now being built range upwards of 70 tons. The following dimensions

[1] See Plates II, III, and IV, pages 294, 296, and 298.

[2] See Plate V, page 300.

[3] See Plate VI, page 302.



DECK PLAN OF WILLIE AND ADA.

1. Bowsprit
2. Pawl bitt
3. Windlass.
4. Hatch to forecastle.
5. Forward winch.
6. Mainmast
7. Main hatch.
8. Capstan.
9. Rope stopper for lashing the forward trawl-head
10. Planks to prevent chafe by trawl-head
11. Trawl-warp roller
12. Hatch to fish and ice rooms
13. Dummy
14. Cabin companion.
15. Stove pipe
16. Cleat to secure main-sheet block.
17. Binnacle
18. After winch
19. Mizzenmast
20. Tiller
21. Rudder head
22. Rope stopper for lashing beam
23. Roller chock for "dandy bridle."
24. Canting line.

Drawn by J. W. Collins

of the smack *Willie and Ada*, of Grimsby (in which the writer made a trip to the Dogger Bank), may be taken as a fair illustration of the proportions of the first-class North Sea trawler, though this vessel is not so deep as the majority of the class to which she belongs: Length, over all (outside of stem to outside of taffrail), 77 feet 6 inches; beam, 20 feet; width at taffrail, 12 feet; depth of hold, 10 feet; 73.68 tons. The sail area would be from 700 to 750 running yards of 24-inch canvas, and the dimensions of spars as follows: Mainmast, deck to hounds, 35 feet 3 inches, total above deck, 45 feet; maintop-mast, 33 feet; main-boom, 37 feet; main-gaff, 30 feet; main gaff topsail yard, 17 feet; mizzen-mast, above deck, 37 feet (10 feet of this, above the eyes of the mizzen rigging, is tapered to form a pole top-mast); mizzen-boom, 19 feet 6 inches; mizzen-gaff, 14 feet; mizzen gaff topsail yard, 8 feet; bowsprit, outside stem, 20 feet. (See Plates VII and VIII.)

Of late years many improvements have been made in the equipment of the sailing trawlers, among which the most important, perhaps, is the introduction of improved apparatus for handling the trawl.

The next important type of trawling vessel is the single-masted smack or cutter, employed chiefly in the south and west of England, from Wales, and also from Ireland. These vessels are much smaller than the ketch-rigged trawlers, and seldom exceed 50 tons in size. As a rule, they adopt the "single boating" system, and it is necessary that they should be swifter than the vessels that follow "fleeting." We therefore find that the Brixham smacks, which may be taken as the type of this class, are very sharp, deep, and rather narrow, with a proportionately large spread of canvas, the form and sail area being such as to insure a high rate of speed. At the same time they have the reputation of being fine sea-boats, and there is probably not to be found in the fishing fleets of the world a higher combination of excellent sailing qualities and sea-worthiness than is possessed by some of the modern built trawling cutters of the south of England. A builder's model of one of these vessels, that was exhibited at London (1883), represented the following proportions: Length, 67 feet; beam 17.9 feet; depth, 9.7 feet; draught of water from 10 to 11 feet.

We quote from Holdsworth the following notes on the history, rig, and general equipment of the vessels employed in trawling when he wrote, which may answer very well for the present time, with the exception that the introduction of steam trawlers, iron smacks, and a few other changes which have been noted, have occurred since his report was published:

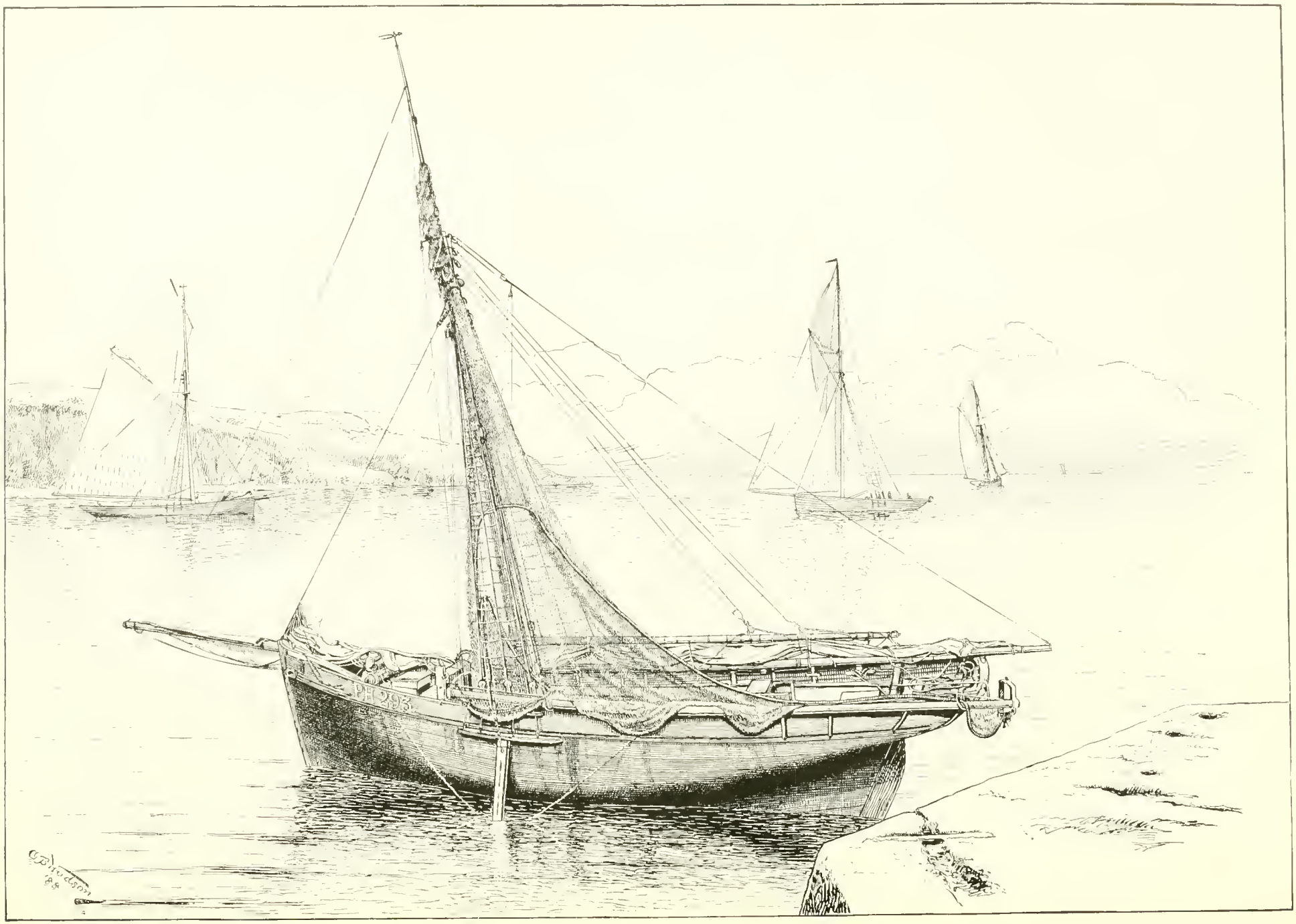
"The vessels used for trawling are commonly called smacks. During the last twenty years great improvements have been made in their design with the object of making them faster; and in some few cases it may be a question whether by the adoption of very fine lines sea-going qualities have not been to some extent sacrificed to the desire for increased speed. Formerly the smacks were much smaller than at the present time, and ranged from 23 to 36 tons N. M. They were

built with the principal object of living through anything, and rarely failed to make good weather of it at all times. Many of these strong well-built vessels are still at work, and would be likely to hold their own for many more years, were it not that sea-going qualities are not the only ones required at the present day. Now, the greater demand for fish and the increased number of smacks have led to more competition among the fishermen, and time has become more valuable; for the first boats in are liable to get the best price for their fish. Most of the modern trawl-vessels are of a large size, running up to 70 tons N. M., and are fine powerful craft of upwards of 60 feet keel and good beam. They are, as formerly, built high at the bow and with plenty of sheer, making them easy and comfortable sea-boats, and whilst their increase in size enables them to use larger trawl beams and larger nets, the general improvement in the knowledge of ship building has led to the adoption of easier lines in their construction, resulting in the much better sailing qualities which are now required to meet the demands of the trade. The quick delivery of the fish is every day becoming a more important object, as the demand for it increases all over the country; and the smacks may daily be seen racing back to the great trawling stations to land their fish, each one endeavoring, often with the help of balloon canvas, to bring her catch early to market, where the buyers are waiting with orders to purchase for all parts of the country.

"The vessels regularly employed in trawling are, as we have said, called 'smacks,' a term which appears to have been applied to fishing boats rigged as sloops or cutters. In these smacks the mast is stepped well forward so as to allow of a large and powerful mainsail, at the same time giving plenty of room for the stowage of a long trawl-beam and large net when not at work. The rigging of these vessels was formerly rough and simple, and a long head to the mast to support the short top-mast was all that was necessary when only a small top-sail was to be set; but the large light sails now carried commonly require the addition of cross trees and back-stays to secure the spar under the strain it has to bear. In the west country the bowsprit is without any rigging as the head sails are small, and it is desirable to have no bob-stay in the way of the trawl-warp, which, being always hauled in over the bow, has to be led thence outside clear of the rigging to one side or other of the vessel, according to which tack she is on when at work, and to be brought on board again amidships, where it is made fast to the pump-head. A large winch is fitted just before the mast for heaving in the trawl, and there is a small windlass astern, called the 'dandy wink,'[1] shipped between the head of the companion and the bulwark,[2]

[1] "Dandy" signifies small, and "wink" is the name applied to a windlass worked by short fixed levers instead of by movable handspikes.

[2] Since the increase in the size of the smacks of late years the relative position of the dandy wink has been changed farther aft. See description of dandy winch in another paragraph.



TRAWLING CUTTERS AT BRIXHAM.

Drawn by C. B. Hudson

for hoisting up the after end of the beam when the trawl is got on board. In the North Sea trawlers the trawl-warp is worked and got in over the side by means of a patent capstan shipped near the center of the vessel. This excellent contrivance is worked by two ordinary winch-handles acting on an arrangement of rack and pinion fitted either to the top of the spindle round which the capstan turns, or to an iron standard by the side of the capstan.

"The large trawl vessels now in use from Grimsby and Hull, and recently built, are rigged in a different manner from that which has long been the general custom with the smaller craft. It was found that the increased size of the mainsail and heavy main-boom necessary for these larger vessels required more hands to manage them; and as the quantity of fish taken by these vessels did not increase in proportion to the greater size—the nets used by them being only slightly enlarged—economy and convenience were both in favor of reducing the large mainsail if it could be done without seriously diminishing the working power of the vessel. The new trawlers were therefore built of considerable length, so as to give plenty of room for a good mizzen-mast; the mast being stepped well forward to allow sufficient steering room abaft, the large unmanageable mainsail was got rid of, and the reduction in its size made up by a good-sized gaff-mizzen. These vessels can now be worked economically, and the sails, being in comparatively small pieces, are managed with only one hand more than in much smaller craft. Although these large trawlers do not bring in much more fish than the vessels perhaps 15 or 20 tons smaller—for the longest beams now in use do not exceed 50 feet—it is believed their greater cost is compensated for by the additional accommodation provided.[1] The crew have more room and increased cooking conveniences, and there is much better stowage for the ice and fish; and it speaks well both for the owners and the prosperity of the fishing trade that the men who are exposed to the hardships and dangers of the deep-sea fisheries are taken good care of by those who, having in most cases themselves gone through with the practical part of the work, are now in the happy position of owners, and can remain comfortably on shore.

"At Yarmouth, and some other places on the North Sea coast, the luggers, when not employed in herring fishing, are in some cases converted

[1] In describing the discovery of the Great Silver Pit and its influence on the development of the trawl fishery, etc., Holdsworth writes as follows concerning changes which were made in the vessels: "At the time of the discovery of this ground the number of North Sea trawlers was very small; they were then only of about half the size of the majority of the smacks of the present day; and not enough was known of the fishing grounds to tempt the fishermen far from the land in vessels of such little power, either to face the weather they would be likely to encounter, or to seek for fish at a long distance from market. The first objection has been fairly met by the large increase in the size of the smacks; and the second has been practically removed by the great extension of railways along the coast, the employment of large, fast-sailing cutters or steamers as 'carriers' to collect and bring in the fish from the smacks."

into trawlers; and, as the lug-rig is not very suitable for that mode of fishing, a temporary change is made, and they are fitted out with a different set of masts and sails; the dandy, or perhaps speaking more correctly, the ketch-rig with gaff-sails being the one adopted, the same as just described in the large modern-built trawlers at Grimsby and Hull. Some of the Ramsgate and Brixham vessels are now rigged in the same manner, and we have no doubt that it will be very generally adopted for the new vessels on various parts of the coast where deep-sea trawling is carried on, although as a rule fishermen are not fond of giving up what they have been long accustomed to. * * *

"In 1862 a new trawler ready for sea, and what was then considered one of the larger class, could be built and fitted out for £700 or £800; but the vessels before mentioned as having recently come into use at Hull and Grimsby can not be turned out ready for work for much less than £1,200 each. This includes a fit out of all that is required for fishing, and costs about £70 or £80. A fit out consists of a double set of almost every part of the gear, to provide against accidents, and generally to save the time which would be lost if the smack were obliged to return to port before she had done a fair quantity of work. A trawl-net will perhaps last from two to four months, according to the nature of the ground worked on; but during that time parts of it will have to be renewed. The back of the net, being exposed to the least wear, lasts the longest; the under part will generally require renewing twice, and the cod five or six times, before the net is finally condemned. The cost of a new net is about £9 when made of ordinary hemp; but manilla is coming into use for this purpose, as it is very much stronger, although more costly. It is dressed with coal-tar, which preserves the material better than either Stockholm tar or tan. One of the large nets now used, and measuring about 50 feet across the square, can not be made for much less than £16.

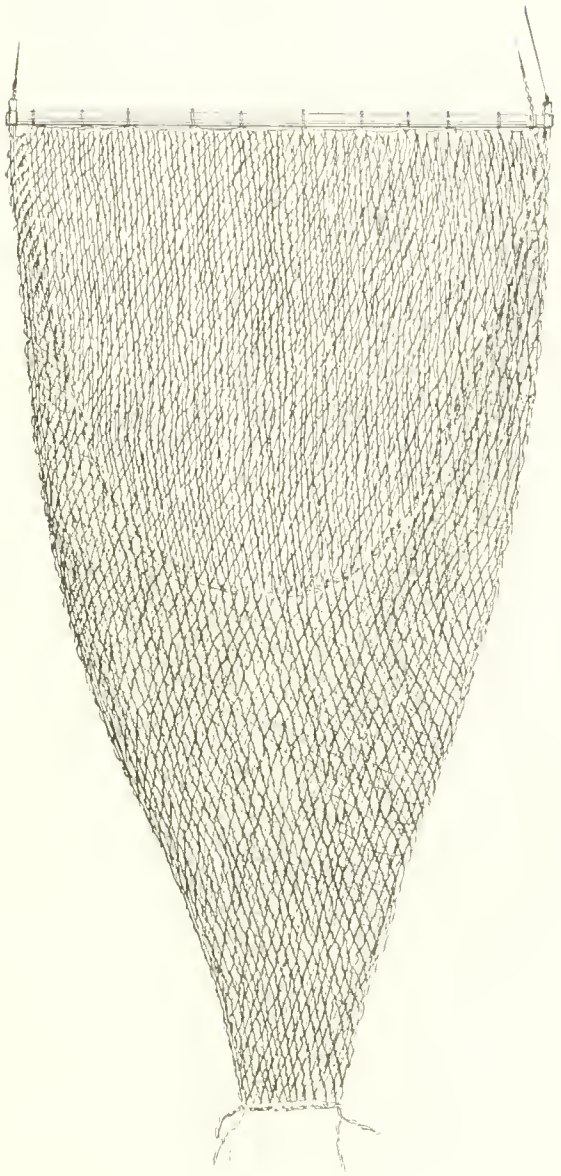
"'Barking' the sails of fishing crafts is almost universal in this country. It consists in mopping them over with a solution of oak-bark, tar, grease, and ocher, which acts as a good preservative to the canvas; this is done every six or eight weeks, and a yard is prepared and kept for the purpose at all the important fishing stations."[1]

F. Fishing Apparatus.

1. The Beam-Trawl.

The beam trawl has been described as "a triangular, flat, purse-shaped net, with the mouth extended by a horizontal wooden beam, which is raised a short distance from the ground by means of two iron supports or heads, the upper part of the mouth being fastened to the beam, and the under portion dragging on the ground as the net is towed over the bottom." The detailed description which follows refers more

[1] Deep-Sea Fishing and Fishing Boats, pp. 66–70.



BEAM-TRAWL, FROM ABOVE. COD-END UNLOOSED.

particularly to the style of beam trawl used in the North Sea by the Hull and Grimsby fishermen, though, it may be stated, this has a close affinity to the trawls which are worked in the waters off Plymouth, Brixham, and other places in Great Britain.

(*a*). *The Beam.*

The beam is made of a length to correspond with the dimensions of the net; and the size of both the net and beam is usually adapted to the length and ability of the vessel which is to tow the trawl. The length of the trawl-beams carried by the large vessels varies from 40 to upwards of 50 feet in length, though for inshore fishing the length is, of course, not so great, ranging anywhere from 10 or 12 feet upwards. The beam is usually made of ash, beech, or elm, the latter being preferred and most commonly used; oak also is sometimes employed for this purpose, but is generally considered too heavy.[1] For the larger beams it is sometimes necessary to use two or more pieces of timber, which are scarfed and banded with iron hoops, but a single stick, if easily obtained, is generally preferred. In either case the timber is selected as nearly the proper size as possible, and little more is done to it than to remove the bark from the stick and fit the ends so that they will slip into the sockets on the beam heads, where they are securely held by iron wedges driven around the wood. A piece of timber with a slight curve in it is generally preferred by the North Sea fishermen, this being so fitted to the trawl-heads that the middle of the beam curves up and is somewhat farther from the bottom than the ends are. This is considered much better than a straight beam when fishing for haddock, hake, and other free-swimming fishes, but probably would have no advantage over the latter if sole, turbot, plaice, and other flat-fish were the chief object of pursuit.

Holdsworth says: "The length of the beam for each vessel is mainly determined by the distance between the taffrail and the after shroud, convenience and security both making it desirable to carry the beam, when not in use, hoisted up alongside, with one end projecting just beyond the stern of the vessel, where it is made fast by a special rope or chain, and the other coming in front of the after shroud or shrouds. The advantage of this arrangement is obvious, as it is generally the case that the beam has to be hoisted up whilst the vessel is rolling and pitching about in a seaway. The after end of the beam is first got into place, and the forepart is then hoisted up until level with the top of the bulwark, over which and between two of the shrouds the iron head at the end of the

[1] "Beech is the best wood for the purpose," according to Wilcocks, "because it is so porous, drinking up the water like a sponge, and thus becoming very heavy, which enables it to keep the ground." In trawling ports spare trawl-beams are kept on hand, and these are put where they may be soaked with water for at least several hours a day for a considerable period before they are used.

beam finds a snug berth, and all danger of the heavy and somewhat unmanageable spar swinging on board as the vessel lurches is avoided. It would be often difficult to prevent this if the beam were not long enough to overlap the after shrouds."[1]

The above statement applies more particularly to the single-masted cutters, but it may be said that on the larger ketch-rigged trawlers the forward end of the beam usually comes in abaft the main rigging, and is prevented from swinging across deck by a guy rope (one end of which is fast to the after main shroud), which is taken around the head or the end of the beam by one man, who holds it firmly with a round turn on the rigging.

(b). The Trawl-heads.

The trawl heads, or head-irons, serve a variety of purposes, such as (1) weighting the trawl sufficiently to sink it; (2) supporting the beam, each end of which is firmly fixed at right angles into a socket, commonly called a "cap" or "joggle," above or below the top of the head-iron; (3) raising the upper part or back of the net, which is fastened to the beam, from the ground, thus keeping the mouth of the apparatus open sufficiently to permit the entrance of fish; (4) as a runner, which slides easily over the bottom, and to which are attached, on the front side, the towing bridles, while the foot rope and wings of the net are fastened to the rear of the trawl head.

There are several forms of head-irons used on different parts of the British coast, though those most commonly employed have a general resemblance to each other; local differences being due, in most cases, to some peculiarity which exists or has existed in the fishing from certain sections.

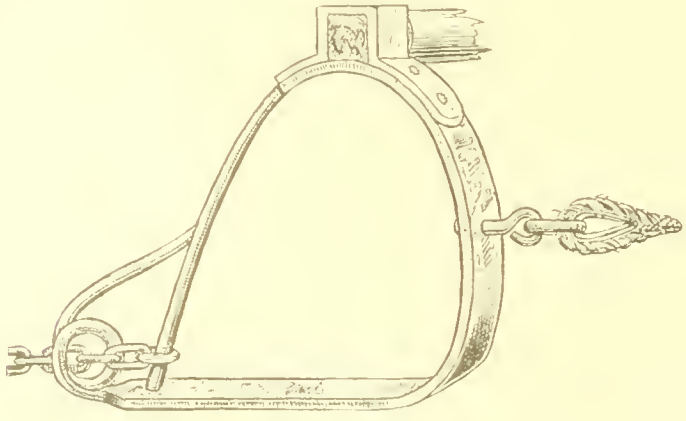
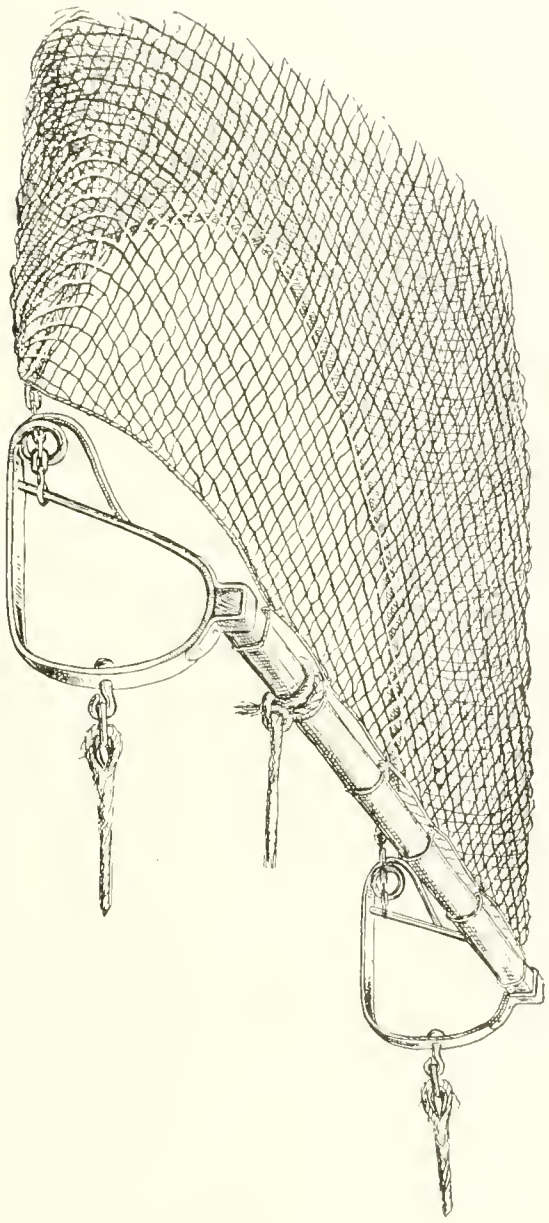


FIG. 1. TRAWL-HEAD.

From Grimsby, Hull, and other important fishing ports on the east coast of England a trawl-head like that shown in Fig. 1 is the prevailing

[1]Deep-Sea Fishing, etc., p. 55.



TRAWL-HEADS, BEAM, MOUTH OF NET, ETC.; SHOWS HOW BRIDLES ARE ATTACHED.

pattern. The size and weight varies considerably, depending chiefly on the dimensions of the net, but somewhat on the judgment of the skippers using them, some believing that a heavy head-iron is preferable, while others may think one of medium weight will fish as well and is easier to handle. On the larger class of North Sea sailing trawlers they range from about 300 to 450 pounds weight for the two heads.

Holdsworth says: "The weight of the two irons ranges on different parts of the coast from 230 to 360 pounds, and varies generally with the size of the net and beam, as they do with the size of the vessel; but in some parts of the North Sea, where the tides are very strong, moderate-sized trawls require a great deal of weight in the head irons to keep them on the ground. It is not to the interest of the fisherman, however, to weight his trawl-beam more than enough to keep his gear at the bottom under the ordinary conditions of working."

The trawl-heads of the smack *Willie and Ada*, of Grimsby, 73.68 tons, weighed 180 pounds each, were 4 feet high, 2 feet 10 inches wide, in the broadest part, the iron of which they were made being 4 inches wide and three-fourths of an inch thick. The head-irons used on the cutter *Sobriety*, 75.29 tons, of the same port, each weighed 230 pounds.

As the North Sea trawlers catch large quantities of haddock, and more or less of other species of free-swimming fishes, it is desirable to have the beam farther from the ground than if flat fishes were the only or chief object of pursuit; therefore the sockets into which the ends of the beam fit are placed on top of the trawl-head. Essentially the same form of head is used by the Brixham and Plymouth trawlers as that above described, these of course being somewhat lighter, as the vessels are generally smaller than those of the east coast ports; while the heavy head irons on the large vessels are perhaps generally lighter in proportion to their width than those commonly employed on the south coast. The trawl-heads are all made of wrought iron, the lower part—generally called the "sole" or the "shoe"—being of extra thickness, since this is exposed to the most wear as it slides over the bottom.

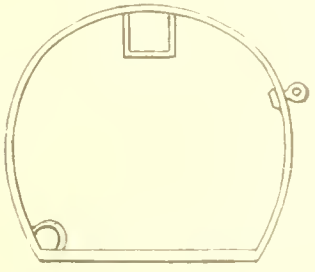


FIG. 2. BARKING PATTERN.

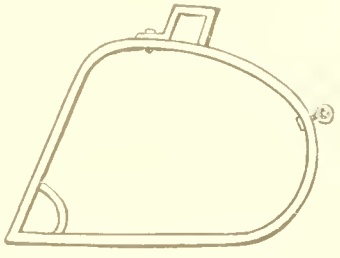


FIG. 3. TRAWL-HEAD FOR INSHORE.

The peculiar stirrup-shaped head iron, Fig. 2, known as the "Barking pattern," with its beam socket beneath instead of above the upper

part, has been a long time in use by vessels belonging to the Thames. The statement has been made that "it is now generally adopted by the Yarmouth smacks, having been introduced by the Barking vessels, many of which find it convenient to make that port their station."

The small trawlers, which fish inshore near various ports of the British coast, use another form of trawl-head which is very much like that used by the Brixham men; the difference is that the iron loop through which the ground rope passes before it is made fast is put inside instead of outside of the frame, as shown in Fig. 3.

Of late years several English inventors have brought out devices for improving the head irons. Perhaps the most noticeable of these is that invented by J. W. de Caux, Fig. 4, which was exhibited at London, and is constructed on the same principle as a Dutch pattern described in another paragraph. The trawl-head of de Caux's is wholly of iron, and consists of two strong iron plates, arranged in a triangle, joined together at the apex so as to form a socket for the end of the beam, and each having a crutch or fork at its lower end that fits over a wheel, to the hub of which the extremities of the fork is fastened by a bolt, upon which the wheel, when working, revolves. The front wheel is a little

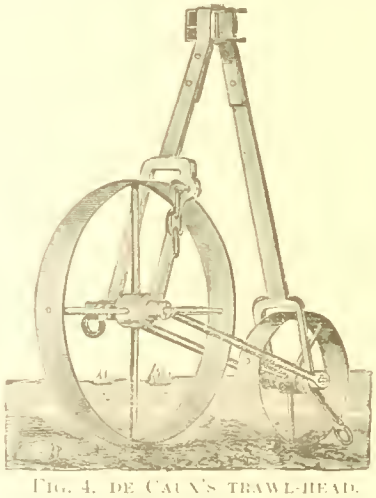


FIG. 4. DE CAUX'S TRAWL-HEAD.

more than double the diameter of the other; they are further connected by a stout iron bar, which runs on either side from one wheel to the other, being bolted to the hub. A shackle and link for bending the trawl foot-rope to is attached to the hub of the small wheel, while a large shackle for the towing bridle is secured by a heavy bolt to the larger wheel. The wheels are broad iron bands, with four spokes in the larger and three in the small one. The special advantages claimed for this apparatus are as follows: (1) It goes upon wheels, which roll over and are not dragged through the ground; (2) The trawl-beam can be carried at any height from the ground.

Though the advantages above named are perhaps important ones, several trawl-fishermen told the writer that they were opposed to using de Caux's device, because, as they said, "it is too liable to be broken in rough weather by slapping against the vessel's side, and it's not an easy matter to repair it at sea."[1]

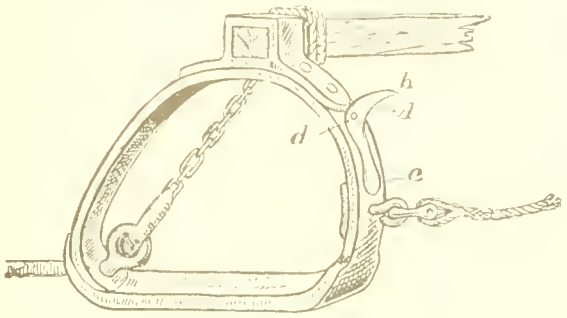


FIG. 5. SHEPHERD'S DEVICE.

H. C. W. Shepherd, of Lowestoft, exhibited at London a model of a beam-trawl, to each head of which was attached a device—shown in Fig. 5—for ascertaining when the trawl is bottom up on the ground. It was explained to the writer by Mr. Shepherd that the tides between Holland and the English coast frequently run opposite ways, setting one way at the surface and in a different direction at the bottom. This peculiar action of the currents frequently causes the trawl which a vessel is towing to be capsized without (so far as the fishermen are able to tell by the surface water) there being any apparent reason for it. Therefore, according to Mr. Shepherd, much valuable time is often lost by the fishermen, who, if using the ordinary form of trawl-head, are not able to tell whether it is upset or not; the result being that they continue to tow it without, of course, catching any fish, and they do not learn the gear is inverted until it is hove up. The head of the trawl represented by the model above referred to would have the following measurements: Greatest diameter from lower after corner to center of front (outside to outside), $2\frac{1}{2}$ feet; height, ground to top of beam end, $2\frac{1}{4}$ feet; shoe or sole, 6 inches by $\frac{7}{8}$ inch iron; front, $1\frac{1}{2}$ inches by $\frac{7}{8}$ inch iron; eye to which bridle shackles, 3 inches long; diameter of eye through which foot rope passes, $4\frac{1}{2}$ inches. To the upper front side of the head is attached, by a key-bolt, *d*, a movable catch, A, which has a stout, slightly curved and pointed upper end. The lower part (when the trawl head is in its proper position) lies against the front of the head-iron, being longer and broader than the other, and also pointed or rounded, so that it will dig into the bottom like the fluke of an anchor. The purpose of

[1] Mr. Sims, a veteran fisherman and smack-owner of Hull, in discussing the paper on trawling read by Mr. Ansell, said he "did not see any difference in the shape of the trawl now from what it was fifty years since, and the only difference was that it was extended in size."

this is as follows: If the trawl upsets, the point *b* of the catch, which is 4½ inches long, strikes the bottom and turns back, moving on the pin *d*, until it rests against the upper part of the head iron. This movement causes the point *c* of the device to stand out at right angles with the head iron, and as the trawl is dragged along over the ground this point sticks into the bottom, and either stops the progress of the vessel or causes the apparatus to have a sort of jerky motion, which indicates to the fisherman that his gear is capsized; he therefore proceeds at once to get it into proper position for fishing.

(*c*). *The Trawl-Net.*

That portion of the apparatus to which the term "trawl" is more especially applied is the net. It is formed of several sections, each of which has a technical name, there being, however, local differences as to the terms applied.

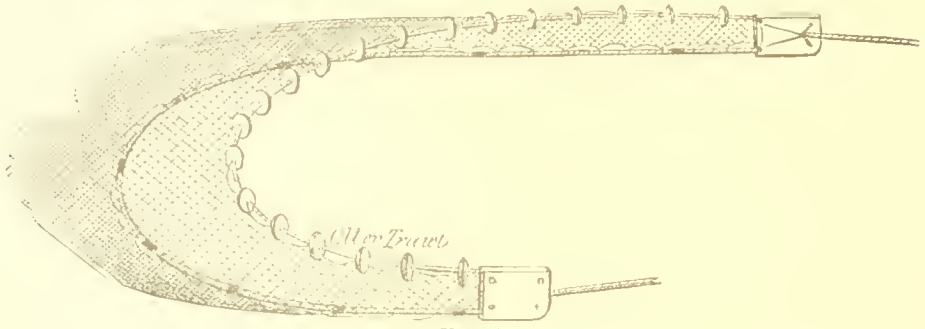


FIG. 6.

FIG. 7.

There are other kinds of trawl-nets, such, for instance, as the otter trawl (Figs. 6 and 7), which do not have a beam.

Holdsworth states that "the differences between them relate to the appliances in use for its effective working rather than to the principle of its construction or the object for which it is to be employed. In all cases it has the general form of a triangular bag or purse, and the variations in shape or fittings are due to the different plans adopted for insuring the mouth of the bag being kept open, so that the fish may enter whilst the net or bag itself is towed along out of sight at the bottom."

As has been stated, the trawl is triangular in form, and if one can imagine an elongated flat iron shaped purse lying on the ground, with the upper part of its mouth slightly raised and straight and the lower part very much hollowed out, so as to form a deep curve, he will have, perhaps, a fair idea of a trawl net. The upper surface of the net is called the "back," and the underneath part, which rests on the ground, is termed the "belly." The several sections of which the back and belly are composed are made separately, after which they are joined together to form the net. They are known by the names of the "square," "baitings" "batings" or "upper," "wings" or "gorings," "belly" or "ground," and "cod" or "cod end." The "square" is the front upper portion of the net; its straight edge is fastened to the beam, and it is usually about one half the length of the whole trawl. The section called the "baitings" is also on the upper surface of the trawl, and is joined on one side to the square and on the other to the cod end. The lower part of the trawl corresponding to the square is "cut away in such a manner that the margin forms a deep curve below, extending from one trawl head to the other, close to the ground, and with the center of the curve or bosom at some distance behind the beam and front of the net. The usual rule for the depth of the curve is that the distance from the beam to the bosom should be equal to the length of the beam. In French trawls it is very much less. There is, however, in all cases a considerable space of ground over which the beam and back of the net must pass before the fish lying on the bottom are disturbed by the under part of the net. The Yarmouth trawlers use a beam about 36 feet in length, and a much shorter ground rope in proportion than is employed by the Brixham and Grimsby fishermen; there being an idea on their part that when working in strong tides on the Dogger Bank the large-mouthed nets are liable to close up; a difficulty, however, which does not appear to have been discovered by the fishermen from other ports.

We were told by the Grimsby fishermen that trawls rigged chiefly for catching soles have foot ropes about four-fifths as long as those for general fishing.

[1] The portion of the trawl called the "baitings" by the Grimsby fishermen is known to the trawlers in the south of England as the "upper" according to statements made to the writer by Grimsby smacksmen, while the sections which the latter term the "belly" and "wings" are, they say, designated the "ground" and "gorings" by the Brixham and Plymouth men.

"Each fisherman has his own fancy as to the fixing of the trawl in his own particular way in order to make more or less *bosom* to the trawl.

"The narrow, straight sides of the net between the back and the ground rope, and extending from the trawl-heads to nearly on a level with the bosom, are called the 'wings' or 'gorings'; they are generally made of separate pieces of net, and are inserted when the several parts composing the net are put together."

The lower portion of the net immediately beneath the baitings, and of similar size and shape, is called the belly or ground.

"From the bosom the whole net, now forming a complete bag, tapers to the cod or purse a length equal to about two-thirds of that of the beam. The cod is a narrow bag, about one-seventh of the entire length of the trawl; it is that part of the net into which all the fish which pass over the ground rope sooner or later find their way, and in which most of them are collected when the net is hauled in. The extremity or 'cod-end' is closed by the draw rope or 'cod-line,'[1] which gathers the end of the net together and prevents the escape of the fish until it is got on board, when the rope is cast off, the cod end opened, and the fish fall out. The under part of the cod having a good deal of the weight of the fish on it, is of course exposed to a great deal of wear and tear as it is dragged over the ground; so, to protect it from chafing and being destroyed, old pieces of net, termed 'rubbing pieces' or 'false bellies,' are fastened across it in such a manner as to overlap one another successively from one end of the cod to the other, and thus to relieve the strain on the net itself. * * *

"Just above the entrance to the cod the 'pockets' are placed, one on each side of the interior of the main portion of the net. They are not separate parts of the net, but are made by simply lacing together the back and belly for a length of about 16 feet, in a line from the outer edge of the bag downwards and inwards to its small end and the commencement of the cod. This part of the bag is therefore divided into three spaces, and of nearly equal breadth at the lower end, those at the sides being the pockets, and the central space that through which the fish must pass on their way from the entrance of the net to the cod or general receptacle. This passage between the pockets is guarded by a veil of netting, called the 'flapper,' fastened to the upper part or back, and with its free edge directed towards the cod, so that the fish can easily make their way under it into that part of the net, but not so readily return. The mouths of the pockets face and open into the cod or end of the net where the fish are collected, and there being no means of escape for the fish at the cod end, many of them, and especially the soles, work their way along the sides of the cod into the pockets, continuing their progress in that direction till they are stopped by the

[1] This is called the "poke-line" by Grimsby fishermen, the term cod-line being applied to a piece of rope extending from the forward end of the beam to the cod-end.

PLATE XII

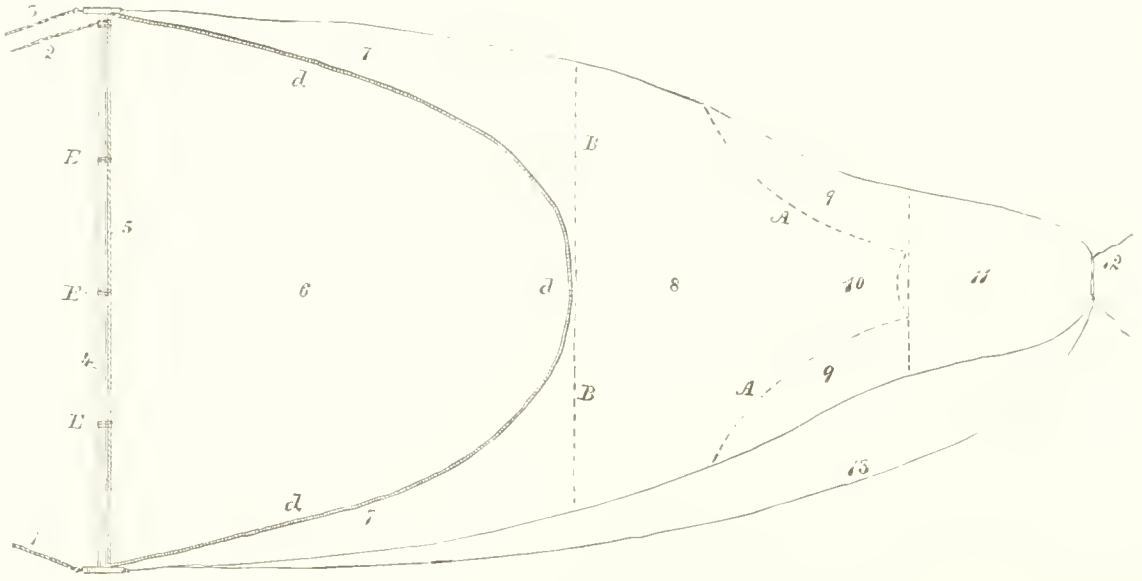


DIAGRAM OF BEAM-TRAWL.

1. Forward bridle
2. Dandy bridle
3. After bridle
4. Beam
5. Head line.
6. Square of net
7 7. Wings.
8. Baiting on top, belly underneath.
9-9. Pockets.
10. Flapper
11. Cod-end
12. Poke-line.
13. Cod-line

A, *A*. Where the net is sewed together to form pockets
B, *B*. Where the square joins the baitings.
d, *d*, *d*. Foot rope
E, *E*, *E*. Grommets

Drawn by J. W. Collins

gradual narrowing and termination of the long funnel-shaped inclosures."[1]

The several sections of the net having been joined together, the front edge of the square is hung to a 2¼ to 2½ inch manilla rope, called the "head rope," which is fastened to the beam at each end, and generally in three other places at equal distances on the beam. The end of the head rope that fastens to the after end of the beam, that is, the end of the beam which is aft when the trawl is on the vessel's rail, has a piece of chain 4 or 5 feet long attached to it; this is used to make fast to the trawl-head; and chain is preferred, since it can not be chafed by the dandy bridle. The "foot" of the net—that part which fastens to the foot rope—is first hung to a small manilla rope (about 1¼ inches in circumference), called the "baleh-line," which is a little longer than the foot rope, to which it is seized with marline, the seizings being put on a foot apart on the wings and about half that distance in the "bosom," as the middle of the curve formed by the foot rope is called.

The foot rope is generally made of old towing hawser, which on the large smacks from Grimsby is about 7½ inches in circumference. This is unlaid and laid up the opposite way, so that it will be more flexible. It is served or "rounded" from end to end with small rope, say from 2 to 2½ inches, this being, like the hawser, partly worn. This rounding is put on for the double purpose of (1) increasing the size of the foot rope, and thereby making it heavier, so that it will lie close to the bottom, while, being large, it is easier to drag along without "digging" into the ground; and (2) for preventing the chafe to which it otherwise must be exposed.

The rounding is generally put on by machinery, since it is difficult to get it on properly by hand.

The trawlers that fish principally for soles generally put a piece of chain 15 to 20 feet long in the middle of the foot rope, or else weight it with lead, to make it "bite" the ground; otherwise the soles would escape beneath it, as they lie so close to the bottom—often partially covered with sand or mud. When chain is used, it is first wound around with old net until it is made as large as the rest of the foot rope, when the whole is served with small stuff in the manner already described. To each end of the ground rope, and forming part of it, is attached a piece of chain, which is long enough to fasten around the trawl head. In the trawling apparatus invented by de Caux the ground rope is fitted

FIG. 8. DE CAUX'S FOOT ROPE.

with rollers (Fig. 8), which, it is claimed, facilitate its progress over the bottom.

[1] Deep-Sea Fishing, etc., pp. 60–62.

"The ends of the ground rope are made fast on each side by a few turns round the back of the trawl-head just above the shoe, and the rope rests on the ground throughout the entire curve; the fish, therefore, have no chance of escape at either the sides or bosom of the net, and their only outlet, when once the beam has passed over them is in front, so that they must dart forward in the direction in which the net is moving to enable them to get clear of it. The object of making the ground rope of old material is that it may break in case of getting foul of rocks or any chance obstruction which may be met with on the generally smooth ground, where a trawl can only be worked with advantage. If in such contingency the ground rope were strong and good, the least mischief likely to ensue would be anchoring of the vessel by her trawl, involving great loss of time in clearing it, and resulting probably in breaking the beam, and other damage; but as these nets are used in deep water, where there is always more or less sea or swell, the great danger to be feared when the net gets foul is the parting of the warp by which the trawl is towed, and the consequent loss of the whole gear. If, however, the ground rope give way, the only damage likely to result is in the under part of the net behind it being torn open; the whole apparatus then comes away clear, when it can be hoisted up overhauled, and the netting and rope repaired. It was formerly the custom to weight the ground rope to insure its close working over the bottom, and it is still sometimes the practice at Yarmouth to use short lengths of chain for that purpose, secured at each end by rope-yarns to the ground rope, so as to be easily torn away in case of getting foul. The French trawlers also use chain on the ground rope, but in those we have examined a great length of chain has been suspended in short festoons and secured by iron rings over the rope, and therefore not easily detached. Our west-country fishermen find that by giving a large sweep to the ground rope an old hawser is heavy enough without other addition than the small rope with which it is covered or rounded."[1]

The cod-end of a trawl-net (at least such as are used on the large smacks from Grimsby) is made of double twine, and the meshes are smaller than in the other sections of the apparatus, which are made of single twine. Four sizes of meshes are used in the large trawl-nets, increasing from 1½ inches at the cod end to 4 inches in the back, while the underneath part of the net is generally made of twine a size larger than is used for the back.[2]

The material used in the construction of the net is small manilla stuff about the size of marline, and essentially the same as the "lobster-twine" that New England fishermen employ for a number of purposes. The nets are coated with coal tar.

A piece of old rope, say 2½ to 3 inches in size, called the "cod-line" by the Grimsby fishermen, somewhat longer than the trawl, and having

[1] Deep-Sea Fishing, etc., pp. 59–60.

[2] "The size mesh of the trawl," writes Ansell, "is much smaller as we go south of Yarmouth. About Hull the mesh is about 3½ inches square down to 1¼ inches."

an eye-splice in one end, is used to haul up the cod-end when it is heavily weighted with fish, or when, as sometimes happens, it contains stones of considerable size. When either of these contingencies occur it is difficult, especially in rough weather, to pull the net over the smack's side with a heavy weight in the cod-end dragging down. One end of the cod-line is secured to the lower end of the net by the "poke-line" with which the cod is tied up, while its other end makes fast to the forward trawl-head.

(*d*). *The Trawl-Warp and Bridles.*

The trawl is operated or towed over the bottom by what is called a "trawl-warp" (A, in Fig. 9), usually a 6 to 7½ inch hemp or tarred manilla hawser 150 fathoms long, two strings of 75 fathoms each being spliced together to form it. One end of this, in which is an eye-splice and thimble (E, Fig. 9), is shackled to two other pieces of smaller hawser, termed the "bridles" or "spans" (F, Fig. 9), each of which is 15 to 20 fathoms long. These lead one to either side of the trawl's mouth, where they are shackled to the swivel eye-bolts in front of the trawl-heads.

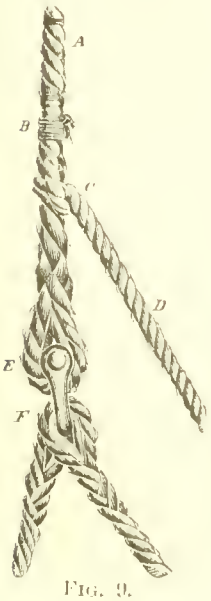


FIG. 9.

A smaller but somewhat longer rope, having a piece of chain at its lower end, is called the "dandy bridle" (D, Fig. 9). This is made fast permanently to that end of the beam which comes aft when it is taken on the rail, three or four turns of the chain on its end being taken around the beam; the extreme end is shackled to the trawl-head or to the standing part of the bridle. The other end is secured to the trawl-warp just above where the bridles shackle on, by a half-hitch (C), with the end stopped back (B, Fig. 9).

The dandy bridle is used for convenience in heaving up and securing the after end of the beam to the stern of the vessel, its use preventing the necessity of rigging a derrick, as otherwise it is usually necessary to do. At present, however, the dandy bridle is quite generally adopted on the larger class of vessels.

(*e*). *Dimensions and Method of Construction.*

As a matter of interest, in this connection I give detailed measurements of the trawls of two Grimsby smacks, the *Willie and Ada*, of 73.68 tons, and the *Sobriety*, of 75.29 tons.

The following are the dimensions of the trawl of the *Willie and Ada*:

Length of beam	feet	46
Diameter of beam	inches	8
Weight of heads, each	pounds	180
Height of heads from ground	feet	4
Breadth across widest part	feet	2½
Width of iron	inches	4
Thickness of iron	inch	⅜
Foot rope, length	feet	98
Foot rope, size	inches	7½
Length of chain on each end of foot rope	feet	6
Size of rope with which foot rope is served	inches	2¼
Size of head rope	inches	2½
Length of head rope, including chain at one end and allowing enough to make fast at each end	feet	52
Length of balch-line, including 9 feet at each end to reach from the foot rope to beam and fasten	feet	126
Whole length of trawl-net from beam to end	feet	84
Length of square from beam to baitings	feet	42
Length of baitings and belly, each	feet	30
Length of cod-end	feet	12
Width of opening at lower part of cod-end	feet	4
Length of "poke-line" used for tying up cod-end	feet	15
Size of "poke-line," (manilla rope)	inch	2¼
Length of "cod-line," (a rope leading from the lower part of the net to the forward end of the beam, generally old rope, and used for hauling the bottom of the net alongside when it is full of fish)	feet	96
Length of towing hawser (size, 7½ inches)	fathoms	150
Length of dandy bridle, not including chain on end	fathoms	21
Length of chain on end of dandy bridle	feet	9
Length of forward and after bridles (6-inch hawser), each	fathoms	20

The measurements of the trawl on board of the cutter *Sobriety* compared very nearly with the above, the principal difference being in beam, foot rope, and weight of the heads, the height of the latter being the same. The following will show the differences:

Length of beam	feet	48
Diameter of beam	inches	9
Length of foot rope	feet	91
Length of balch-line	feet	132
Weight of trawl-heads, each	pounds	230

The following are additional details of the construction and equipment of a beam-trawl of the size mentioned above:

In making the net, from 200 to 220 meshes are "set up" for the head of the "square," and from 190 to 200 meshes at the bottom. The baitings or "batings," which are joined to the square, are "set up" with the same number of meshes as the bottom of the square, either 190 or 200, and are "braided down" to 50 meshes, with 10 or 12 feet cod-end added.

The "ground" or "belly" is made the same as the baitings.

The wings would be about 43 feet long. They would be "set up" at

190 to 200 meshes, according to Olsen, with 55 in each wing. The remaining meshes form the bosom, and are braided down to 30 at the ends.[1]

The "flapper" should be "set up" at 40 meshes, and tapered to 20 meshes at its end. This, as has been explained, is fastened to the back of the trawl-net, and so arranged by lacing it in a line with the pockets that it will drop down and close the entrance to the cod-end when the apparatus is not moving through the water.

Olsen gives the following directions for putting together the several sections of a trawl-net and preparing it to bend to the beam and heads:

"I would first count the meshes in the lower part of the square and upper part of the batings; if they correspond, join them together. Next, I would count the meshes in the belly and wings, and join them together; then I would stretch the net along the deck, with the cod-end aft, and put the lower batings of back and belly together, make fast to a spar lashed across the deck, pull taut both belly and batings, and make them fast forward, then lace the trawl from the lower end upwards. Now I would stretch the wings and square forward, and lace from the head downward.

"I would [then] take the turns out of the balch-line, then balch the wings by finding the middle mesh of the bosom or center of the wings, and clove-hitch them onto the balch-line, so as to make the spaces a little larger than the mesh. I next stretch the ground rope along the deck and take the turns out, lay the bight aft and the ends forward, measure it and tie the center mesh of the wings, then lash the bight of the ground rope, set up taut with a tackle from forward, and keep the ground rope up from the deck by placing a spar across the deck. Now I would measure the bosom and tie up to the quarter, pull up the square from quarter to head, allowing 3 or 4 feet for shrinking, tie up the balch-line and complete the roping."

To put in the flapper and pockets he would join the former "on at 80 meshes under the back, lace the salvage to the belly—the flapper being 40 meshes, leaves 20 meshes on each side of the salvage—then I would lace up the pockets in a line with the flapper."[2]

The lower part of the cod-end must then be provided with "chafers"—pieces of old net, or some other material, lashed on to prevent the bottom of the trawl from being too quickly worn out by chafing on the ground.

For rigging up the beam, bridles, etc., 6 iron wedges are required for wedging the ends of the beam into the trawl-heads; 2 trawl warp and 4 bridle-thimbles; 1 dandy-chain shackle, 2 main-bridle shackles, and 2 trawl-warp shackles.

Various devices have been invented, besides those already mentioned, for improving the beam-trawl; most of these, however, being for the purpose of allowing small fish to escape from the cod-end. Among

[1] Fisherman's Seamanship, p. 28. [2] *Ib.*, pp. 28–29.

other advantages claimed by de Caux for improvements were the following:

1. Inside the trawl-net a smaller net is fixed so as to form a funnel to prevent the escape of large fishes.

2. The cod-end of the net is made so that when fishing the meshes are kept widely open to allow small fishes to escape therefrom.

3. At pleasure the net can be disconnected from the trawl-beam and the wheels at the bottom of the sea, and can be shut up and brought to the surface separately from them.

Whatever practical value these improvements have I am not prepared to say; the fact remains, however, that the common form of trawl is still almost exclusively in use. One inventor has an arrangement of frames, flat on the bottom and curved on top, over which the cod end is drawn in such a way that the meshes are kept distended. Another proposes to accomplish the same result—namely; to allow the small fish to escape—by having a number of rubber grommets put here and there in the cod-end, these being sufficiently large to permit the small fry to pass through; and still another device consists in having the cod-end distended with larger hoops, the mesh much enlarged, and the lower part provided with an apron to prevent chafe on the bottom.

2. Apparatus for Operating the Trawl.

In order that the manipulation of the beam-trawl may be more fully and clearly understood, it seems desirable that the various kinds of ap

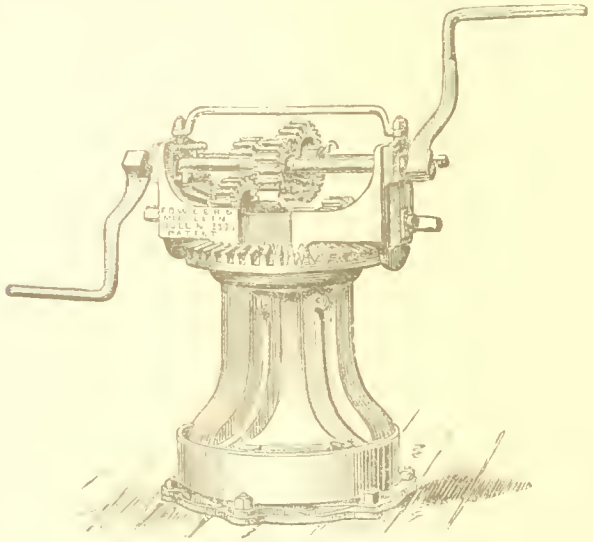


Fig. 10. An early type of capstan

paratus which have been devised especially for the purpose of handling it should be described in considerable detail. Though these form a portion of the vessel's equipment, and have been alluded to in a general way in that connection, still the various implements used in working a

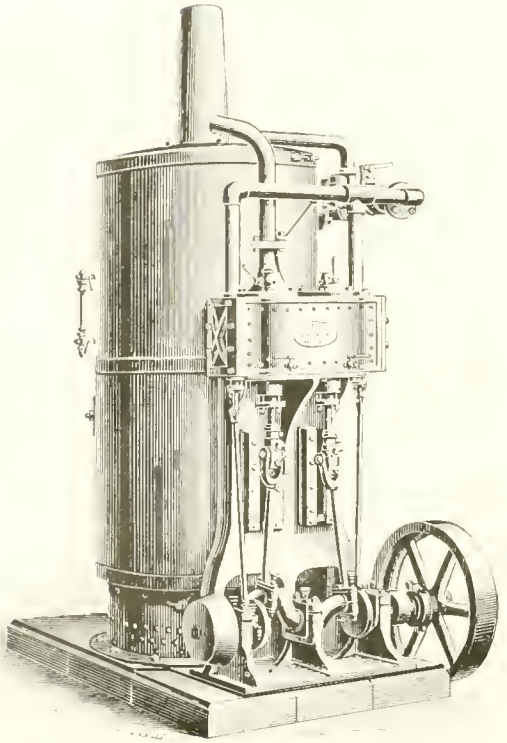


Fig. 1.

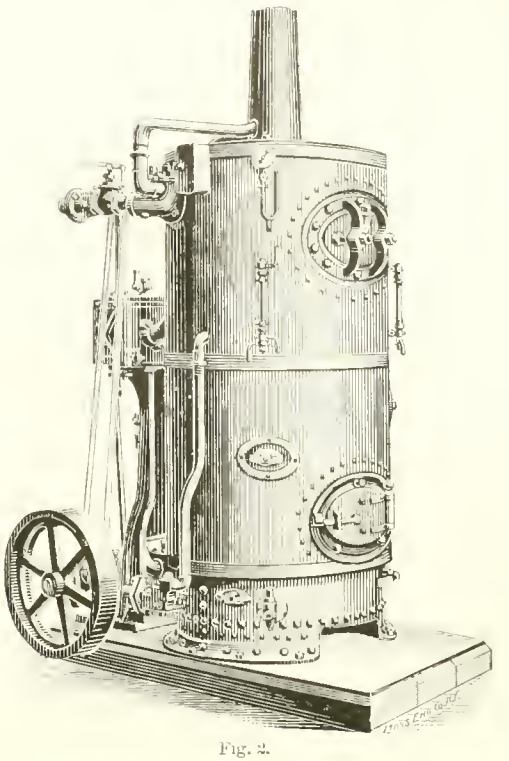


Fig. 2.

BOILER AND ENGINE USED ON SAILING TRAWLERS.

FIG. 1. Engine, front view.

FIG. 2. Boiler, front view.

beam-trawl are almost as much a part of the apparatus as the trawl itself, and the successful prosecution of the fishery has, perhaps, been more dependent upon improved appliances for manipulating the gear than on anything else. The descriptions which follow are based chiefly on a study of the two Grimsby smacks upon which I sailed and which subsequent investigation has shown to be fair representatives of their class.

(*a*). *The Capstan.*

Several forms of hand-power capstans have been used for working the beam-trawl. The increase in the size of the vessels and fishing apparatus has not, as a rule, been followed by an increase in the number of men constituting a smack's crew, and as, of course, greater power is required to heave up the large trawls now in use, this has to be supplied by improved capstans, which are so constructed by a system of cog-wheels and ratchets (see Fig. 11), that as many as four different purchases can be obtained on some of them, the first being a very quick motion for pulling in slack warp; the fourth, a slow but most powerful one for a very heavy pull, while the others are intermediate; various degrees of power and quickness being thus combined in the same implement.

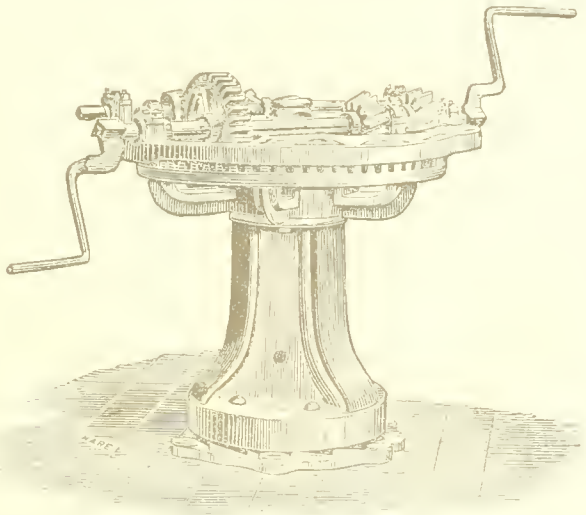


FIG. 11. AN IMPROVED CAPSTAN.

The necessity which exists for having increased facilities to raise the trawl from the bottom has led to the introduction, of late, of steam as a motive power for working the capstan, which is generally so made that it can be worked by hand as well, in case anything should make it impracticable to use steam. A vertical boiler and vertical engine are most commonly, if not exclusively, used, and the whole is made as simple as possible, in order that it may be managed by the fishermen with very little trouble. (See Plate XIII.) Steam capstans were first used on sailing trawlers in 1864, when the firm of Fowler & McCollin, of Hull, fitted one

on the smack *Monarch*. This firm was succeeded by the Vulcan Iron Works Company, Limited, which company, according to Mr. Charles Hellyer, a smack-owner of that place, now manufacture the most approved form of apparatus of this kind. This arrangement consists of a vertical steam-engine, fitted with two cylinders, each 4½ inches diameter, 8 inch stroke, fixed on a strong standard, independent of the boiler, and equipped with patent high-speed governor and throttle-valve, improved stop-valve, treble-valve, force-pump, etc. The boiler is vertical also, with cross-tubes in the fire-box, lagged and cased, and provided with a full set of mountings and fittings, consisting of double safety-valve, steam pressure-gauge, two water gauges, blow-off cock, chimney, and deck casing. The gearing consists of horizontal and vertical shafting, with the necessary foot-step and bearing, friction-clutch, bevel-wheel and pinion, and spur-pinion working into spur ring-wheel on capstan bottom. The friction apparatus is so arranged that it can readily be thrown in and out of gear by means of a lever on deck or in cabin companion.

Mr. George R. Dunell gives the following additional particulars, in (London) Engineering, July 27, 1883, concerning the use of steam on trawling smacks:

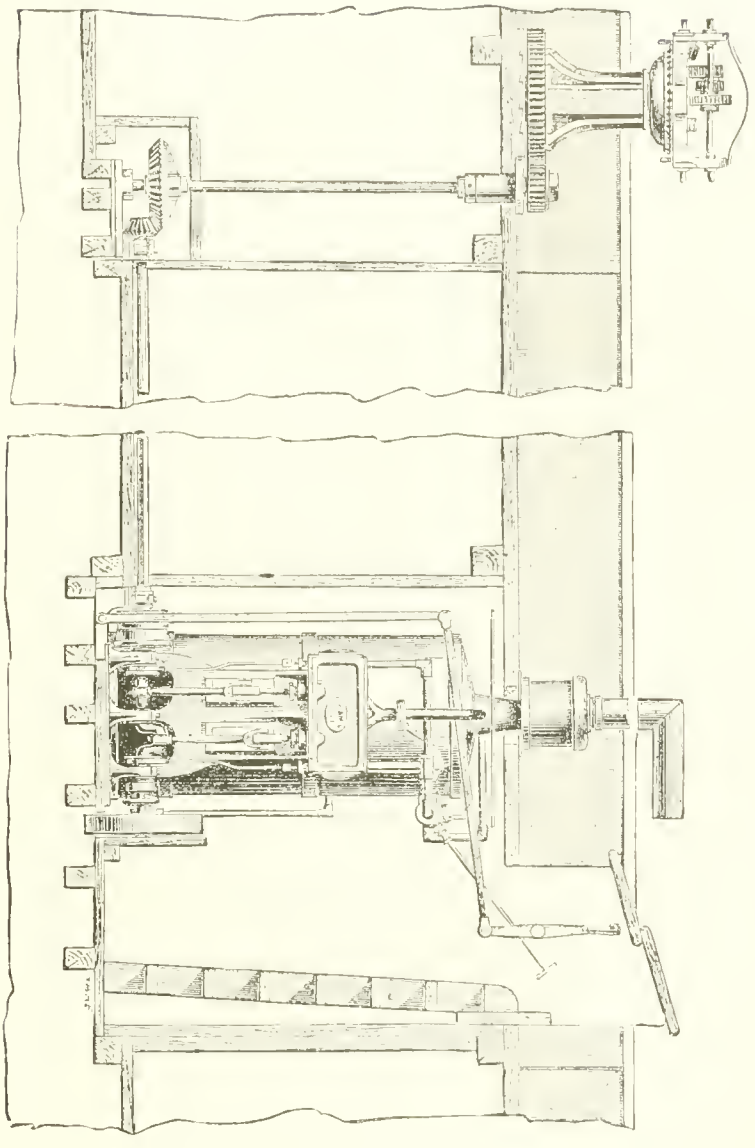
"Steam gear is fitted on most vessels of this kind for the purpose of handling the heavy trawl used in modern times. The machinery on the *Frank Buckland* consists of a vertical boiler and a pair of inverted vertical non-condensing engines.[1] The boilers generally used for this purpose are from 2 feet 9 inches to 3 feet in diameter and 6½ to 7½ feet high. They have only one or two cross-tubes, all parts having to be as simple and accessible as possible, for frequently the attendance is not that of a highly skilled operator, although some smacks carry a properly trained engineer attendant. The diameter of the cylinders is 5 to 6 inches and the stroke about 10 to 12 inches; the steam pressure ranges between 50 and 65 pounds. The price of such an engine and boiler complete (but exclusive of water-tank) is from £125 to £145. Most of the trawlers carry a tank for fresh water holding 800 to 1,200 gallons, but Mr. Alward thinks this an unnecessary refinement. Probably, with a properly-instructed and careful engineer on board, who will 'blow off' at intervals, and considering the simple nature of the boilers, salt water would answer very well for feed, and the room that would be occupied by the fresh-water tanks could be better utilized."

(*b*). *The Dandy Winch or Wink.*

Holdsworth has described the "dandy wink" as "being shipped between the head of the companion and the bulwark," and this description no doubt applied well enough to the Plymouth and Brixham trawlers at the time he wrote.

On the larger ketch-rigged vessels it is placed some 10 or 12 feet aft

[1] A fine model of this smack was exhibited at the International Fisheries Exhibition at London by Messrs. Alward & Eskritt, of Grimsby.



ARRANGEMENT OF BOILER, ENGINE AND GEARING FOR OPERATING CAPSTAN ON A SAILING TRAWLER.

of the companion, and generally almost directly abreast of the mizzen-mast. A strong bitt-head, firmly secured to the deck by a knee on its after side—similar in shape to an ordinary windlass bitt—serves as a support for one end of the dandy wink, and the gearing by which it is worked, while an iron spindle in the opposite end fits into a socket on the rail, to which is also secured a dog or pawl which, dropping into an iron ratchet on the end of the wink, prevents the latter from turning back. (See Fig. 12.) The arrangement of cog-wheel work on this winch

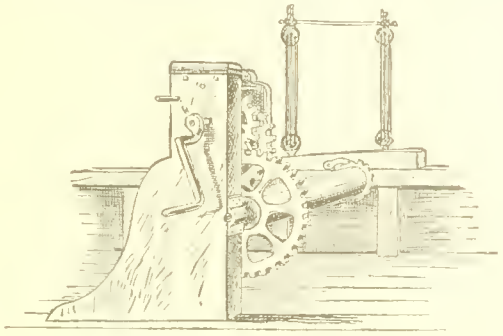


FIG. 12. THE DANDY WINK.

is such that two purchases can be obtained, one giving a rapid motion to the barrel of the winch, and the other, but more powerful purchase, turning it slower. It has already been explained that this is used to heave up the after end of the beam by means of the dandy bridle.

(*c*). *The Forward Winch.*

Another winch, which is used in handling the trawl, stands about half way between the windlass and mainmast on the larger ketch-rigged trawlers. This is worked, like the others, with a crank—one on each end if necessary. It is supported by two bitts, which are from 3½ to 4 feet high. On the starboard end is a large cog-wheel, into which plays a smaller cog-wheel on a shaft that is secured to the forward side of the bitts. If only a small power is required the wheels are uncoupled and the crank shipped on the shaft to which the power is to be applied.

(*d*). *The Dummy.*

Some 4 or 5 feet forward of the companion, and almost exactly in the center of the deck—either way—stands a large round post, some 3 feet high, called a "dummy." (See Fig. 13.) This has four or more "whelps" on it, and the trawl-warp is veered around it when the trawl is being shot, and to this stanchion, too, the warp is fastened while the gear is out and being towed over the ground.

(*e*). *The Trawl-Warp Roller.*

Fixed between two stanchions, on the port side of a trawler, and directly abreast of the capstan, is a large iron roller (see Fig. 11 for the trawl-warp to pass over when it is being hove in. This is provided with

ratchets on the forward end, into which a pawl falls to prevent its turning back.

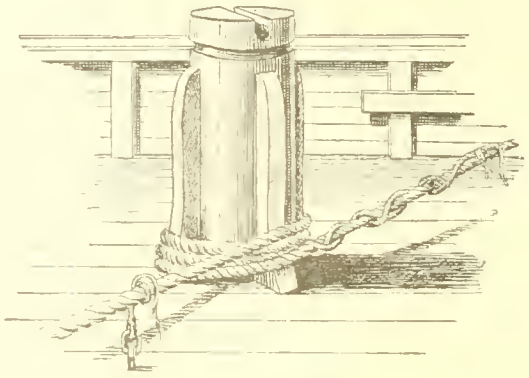


FIG. 13. THE DUMMY.

The trawl roller of a vessel of 70 to 75 tons will be 14½ inches long, 11 inches diameter at the ends, 7 inches diameter in the center. The rail is fixed so that it will turn back on a hinge, and a piece of bulwark is made to fit in snugly over the roller when it is not in use, but is, of course, removed whenever the trawl-warp is hove in. (See Fig. 15.)

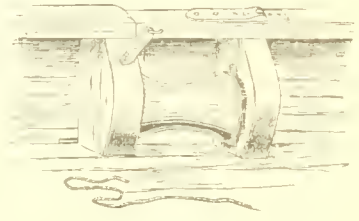


FIG. 14. TRAWL-WARP ROLLER.

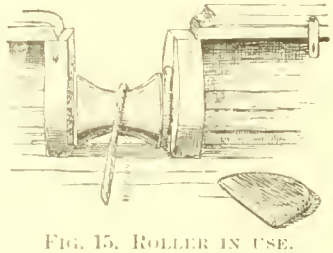


FIG. 15. ROLLER IN USE.

On the single-masted trawlers at Brixham and Plymouth the trawl-warp roller, which is much shorter, is placed on the port side of the stemhead.

(*f*). *Dandy Bridle Chock.*

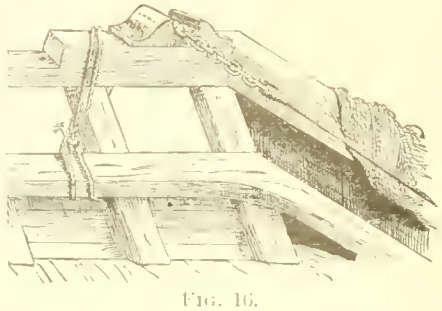


FIG. 16.

A large iron chock, with a roller fitted into it (see Fig. 16), is secured to the port side of the taffrail. When the after end of the trawl is being

hove up the dandy bridle is taken in through this chock and thence to the dandy winch.

(*g*). *Fish Tackle.*

A heavy purchase tackle is used for hoisting in the cod-end of the trawl. The upper block of this tackle is usually threefold, and hooks somewhere about the mainmast head or beneath the cross-trees; the lower block is double or treble; the fall is $2\frac{1}{2}$ to $2\frac{3}{4}$ inch manilla rope. When the lower block has been hooked into the strap that is put around the cod end, the end of the fish tackle fall is usually rove through a snatch block hooked near the foot of the mainmast, and taken thence to the forward winch.

3. Apparatus for Packing Fish, Etc.

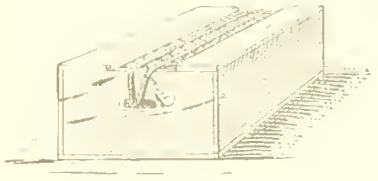


Fig. 17.

(*a*). *Fish Boxes.*

All of the trawlers which fish in fleets in the North Sea use oblong wooden boxes, generally called "trunks" (see Fig. 17), to pack their fish in. These are of uniform size, and hold from 85 to 95 pounds of fish, the difference in weight depending chiefly on the kind of fish; some species of flat fish—the sole, for instance—pack very closely, and consequently weigh more than a box of haddock or cod. The boxes are partly covered by a strip of board nailed on each side of the top, while an oblong hole, large enough for a man to get his hand in, is cut near the upper edge of each end. In handling the boxes after they are filled these holes are very convenient, as they afford a hand hold, and they are also of service for reeving through the line which runs from end to end of a box to hold the fish in position.

The Brixham trawlers, who carry their fish to market every day, or perhaps twice a day, use small baskets, called "pads" and "half-pads."

Holdsworth says: "The packages in which the trawl-fish are stored have lost much of their significance as denoting any particular capacity. Pads and half-pads were once recognized measures, and are still spoken of in some of the markets, although the quantity of fish contained in them is rather uncertain. Ten years ago [about 1864] they were the only packages used by the Hull and Grimsby trawlers. The 'pad' consisted of three 'pots,' and the 'half-pad' of two pots of fish. This division of a package into three or two imaginary parts called 'pots,' was for the convenience of the salesman and buyers; for instance, if two pads and three half-pads were to be sold, they were offered as twelve

pots; fish were said to be worth so much per pot one day, and so much another day. This measurement was also found very convenient by the fisherman, as in case they had not enough prime fish at the end of their packing to fill a half-pad they still put it into a half-pad basket and called it a pot. At one time pot baskets were used, but they have been long given up. Formerly speculative dealers used to bargain with some of the fishermen to take all their prime fish at so much per pot, and then a pot was to weigh 40 pounds; but a half-pad (two pots) subsequently came to weigh from 80 to 120 pounds, the difference being caused by the fish being more or less piled up on the top of the basket. A further change was made by the introduction of wooden boxes called 'trunks,' and they were used especially for the package of soles, a trunk or box of soles usually containing from sixty to seventy pairs, weighing about 100 pounds.[1] Plaice and haddocks are also packed in them, about forty of the latter, when sold for the fresh market, going to the 'box.'"

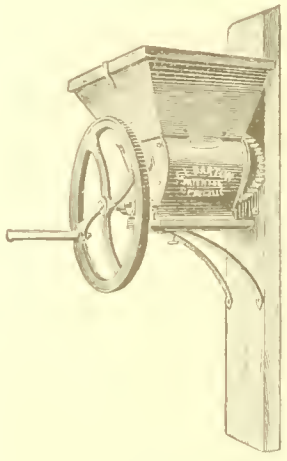


FIG. 18.

(*b*). *Ice Mill.*

Most of the North Sea trawling vessels, especially those which go "single boating" a portion of the year, carry an ice mill which is used for grinding up the ice that the fish are packed in. This mill is generally secured to a bulkhead in the ice house below deck. It has three revolving barrels fitted with strong steel teeth and is operated by a crank-wheel, which, by a system of connecting cog-wheels, causes the

[1] The more general adoption of the wooden box called the "trunk," as a package for all kinds of fish on trawlers, is probably due to the system of "fleeting," since these boxes are more readily handled and stowed than baskets could be under like conditions.

barrels inside to turn in such a way that the ice is broken or picked up fine enough for use.

(c). Boats.

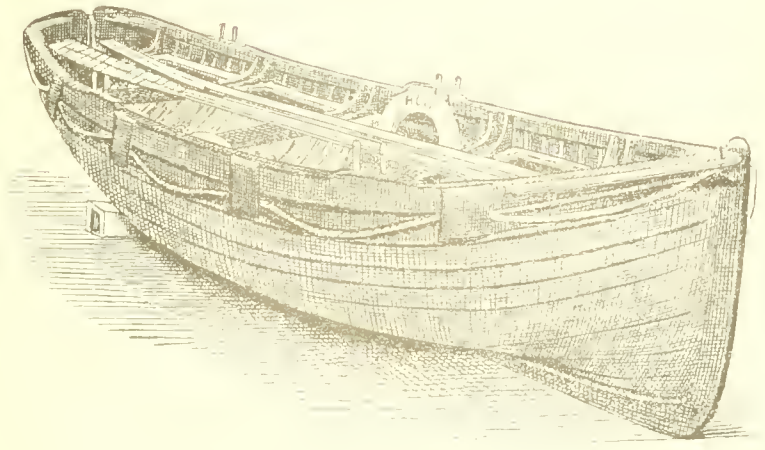


FIG. 19.—A TRAWLER'S BOAT.

The boat (see Fig. 19) used on the trawlers for transporting the fish from the catcher to the carrier is an open, clinker built, keel craft, wide, and rather clumsy looking, with full rounding bow and heavy square stern. It is strongly built, and has a large carrying capacity. The boats carried on the larger trawlers are about 17 feet long, 6½ to 7 feet wide, and 2 feet 9 inches deep.

The dangerous work performed by these boats is detailed elsewhere, but it may be said here that, because they are frequently capsized and the men in them drowned, an effort has been made to provide them with some kind of suitable appliance which may render them unsinkable and insure the greater safety of their crews. Many devices for attaining this much-desired end were shown at the London Fisheries Exhibition, in 1883, but none of them met with the full approval of the examining jury.

(d). Doddle Net or Diddle Net.

A dip-net, called a "doddle" or "diddle" net, forms part of the equipment of a trawler, and is used to dip fish out of the trawl when an unusually large catch has been made and the weight of fish in the net is too heavy to hoist in. At such times a hole is cut in the back of the trawl and enough fish removed with the dip-net to lighten it; on some extraordinary occasion perhaps two or more holes have to be made in the net. The doddle net resembles the dip-net used by the New England mackerel seiners, though it is not quite so large as the latter.

G. Methods of Fishing.

1. General Description of the use of a Beam-Trawl.

To obtain the greatest success in trawling one condition is especially desirable—that of having a moderately strong and favorable tide, since the trawl is always towed as nearly as practicable with the set of the current, but somewhat faster, as it will then work to the best advantage, being easily kept on the bottom over which it passes steadily. This is necessary, for the net being lighter than the beam (loaded as the latter is with the iron heads), would otherwise be liable to drift forwards and thus prevent the entrance of fish. A moderate excess of speed in the trawl over the tide, varying according to the strength of the wind from half a knot to about a knot and a half per hour, keeps the net expanded and in a proper position on the bottom, so that the best results can be secured.[1]

It is, perhaps, most desirable to have the tide setting nearly at right angles to the wind, since then the trawl can be towed equally well on either tack as the set of the current changes with the ebb or flood. As, however, the tides run as frequently to leeward, or to windward, as in any other way, much care and skill is necessary to work the trawl to the best advantage, so that it will keep the ground, will pass over the bottom as fast as is necessary, and also not be upset. It may be explained here that, with a weather tide, the vessel is (or should be) put on whichever tack will permit her to tow the trawl as nearly as possible in the direction the current is going, and the best authorities say the warp should be kept well aft. If working with a lee tide, considerable care is necessary to prevent the vessel from broaching to so that she will "run the tide," in which event she would be likely to upset the trawl.

"When a vessel has arrived on her fishing ground," according to Holdsworth, "the first part of the tide is chosen for beginning work in, as she can then tow for several hours in the same direction, and the usual practice is to keep the trawl down till the tide is done—about five or six hours."

This is doubtless correct, in a general sense, but in these days of sharp competition there are probably few skippers who will not put out their gear at half tide if they have reached a favorite fishing ground and the conditions are favorable for trawling.

When the ground is reached the vessel's head is laid in the direction in which she is going to tow—this, as has been explained, depending on the direction of the current; but, whether on the port or starboard tack, she lays up by the wind, or nearly so (say within 5 or 6 points), at least until the trawl is shot. After the trawl is out she may be kept off, nearly before the wind, but as a rule, especially with moderate breezes, the vessel's course is laid nearly at right angles to the wind, so that it

[1] See Plate xv.

TOWING A BEAM-TRAWL.

may exert its fullest force on the sails. If the wind is moderate all sail is kept on the vessel, but if it blows fresh or strong the canvas is reduced so that the smack will go along easily without unnecessary plunging or heeling over.

"What the trawlers like," writes Holdsworth, "is a fresh, steady breeze—one that would enable them to do 8 or 9 knots off the wind when the trawl is not overboard. They can then afford to lose 6 or 7 knots by the resistance of the net, and yet move fast enough to enable it to do its work properly. Winter is the great trawling time, because then there is pretty sure to be plenty of wind, and, if too much, sail can always be reduced; but unfortunately strong winds are accompanied by a good deal of sea, and when that is the case, although a great deal of extra warp be allowed in order to equalize the strain and prevent jerking, it is difficult to keep the trawl steadily moving over the ground. There is always danger in such cases of breaking the warp, and almost a certainty of doing so and of losing the whole gear if the net should then get foul; and, besides this, the difficulty of heaving up the trawl is greatly increased, two or three hours are often spent in the operation, and the fish are liable to be killed and very much knocked about before they can be got on board. All of these circumstances combine to induce the fishermen to wait for more moderate weather, it may be for only a day or two, or perhaps more, but in any case the supply of fish sent to market is lessened for the time, the weather which puts a stop to the work of one vessel having probably the same effect on most of those fishing in the same district. The Plymouth trawlers are especially subject to loss of time from bad weather in winter, as at that season southwesterly winds prevail at the mouth of the channel, and there is commonly a good deal of sea setting in over their very limited fishing ground, only a few miles from the land. Although they can and do work when it blows very fresh, a succession of heavy gales almost puts a stop to trawling there, and the supply of fish landed at Plymouth fluctuates more than on any other part of the coast."

2. Shooting a Trawl from the Port Side.

If a vessel has just arrived on the ground the bridles are first taken up from the hold—where they are stowed with the towing hawser when not in use[1]—and shackled to the trawl-heads and then coiled down on deck, "the fore bridle forward and the after bridle just before the dandy winch." The end of the towing warp is then taken up, two or three turns are thrown around the "dummy"—the inside or leading part of the warp being on top—and then the bridles are shackled to it, and their coils arranged to run clear. The dandy bridle is next run off the winch, the end passed outside the mizzen rigging, and bent to the towing hawser, just above where the other bridles are shackled on, with a half-

[1] When the vessel is on the ground and engaged every day, or almost every day, in fishing the bridles are rarely, if ever, unshackled from the trawl heads.

clove hitch, the end being stopped back with a small rope. In the mean time (or previously), the cod-end is tied up with the "poke-line," one end of which is taken through the eye-splice in the lower end of the long "cod-line," which reaches to the beam. The trawl is now all ready to be shot, and the beam lies stretched along the port side of the vessel, resting on or against the rail, from the taffrail nearly to the main rigging, with the net piled loosely over it, the forward trawl-head resting on deck and held in place by a stopper, while the after trawl head, which is outside the stern, is held by two short ropes, called "canting lines," and which serve the several purposes of supporting the after end of the trawl when the dandy bridle has been slackened off, securing and holding firmly in place the trawl-head, and also for "canting" the apparatus when it is being shot.

All hands are required to shoot a trawl.

"If on the port tack," writes Olsen, "the captain on the quarter deck gives his orders, looks to see the trawl all clear over the side, attends the after stopper, and squares the gear. The mate and third hand amidships, stream the trawl, and afterwards veer the gear away. The fourth hand stands by to let go the fore head, and the cook takes the helm."[1]

The following are the details of shooting a trawl as observed by the writer:

When all are ready, the lashing is taken off the forward trawl-head, the captain casts off the canting lines and holds them in his hands with a single turn around a cleat or stern timber. The "cod" is now thrown out, followed by the rest of the net, until the whole is clear of the side and trailing out from the beam; which still remains in its place. The time having now arrived, the trawl is lowered, and considerable skill is required to do this properly, for, simple though it may seem, much care must be exercised to insure the landing of the net and beam on the bottom in the right position, namely: With the ground rope below, and the beam upwards resting on the trawl-heads, the mouth of the apparatus being distended. Unless the lowering is skillfully performed the trawl may strike the bottom on its back, which would result in its mouth being closed; therefore no fish could be taken. After the forward head and end of the beam are thrown out, the captain slacks away a little on the canting lines, until the after end of the beam is nearly to the water, but he does not let go of them until the forward end of the beam swings off from the vessel's side at an angle of about forty-five degrees, being slacked away gradually by the fore bridle. When the beam is two or three fathoms astern of the smack, the fore bridle and dandy bridle are usually checked, in order that the skipper may see that the trawl is all right. As soon as the bridles are out the gear is again stopped from running to ascertain if the bridles lead clear, and a good fall is given the vessel, so that she may start ahead and straighten the trawl.[2] One

[1] Fisherman's Seamanship, p. 39.

[2] According to Holdsworth the Brixham fishermen do not bend on the dandy bridle to the towing warp before throwing over the trawl, though, so far as I could learn,

man is stationed at the dummy holding one end of a rope nipper, which is around the towing warp (see Fig. 13, page 328), the running of the latter being controlled by this nipper in accordance with the captain's orders. When 20 fathoms or thereabouts of the warp have run out, it is checked, and this is repeated every little while to straighten out the hawser and pull the trawl into shape, until sufficient scope is out; the amount of warp paid away after the gear is on the ground is determined by the skipper, who uses his judgment as to what is required for various conditions of current, weather, depth of water, and the kind of fish that are sought. It is evident that if he allowed the trawl to sink straight down, which would be the case if it was not occasionally stopped, while the vessel moved ahead, to straighten the warp, it would be liable to turn around in the water, in which case it would be somewhat a matter of "luck," whether the net struck the ground on its back or otherwise. It sometimes happens that such a mistake is made, even when the utmost precautions are taken. When this happens the irregular jerking of the warp as the trawl is pulled over the ground shows something is wrong, and, of course, nothing can be done but to get up the gear and shoot it properly.

If, however, the gear is upset in shooting, it can usually be turned back again, if the trawl has not sunk too far.

"To do this," writes Olsen, "I would lash the helm a-lee, haul down the foresail, take the dandy bridle forward over the bow, heave in on it, and cast the gear back again."

If the trawl seems to be working all right the towing hawser is finally made fast with a "trawl-rope stopper," a $2\frac{3}{4}$-inch manilla rope, about 5 fathoms long, the bight of which is secured to a stout rope collar on the lower part of the dummy. The ends of this rope are wound around the trawl-warp in opposite directions, over and under, so as to cross and overlap at each turn, which is the ordinary way of putting on a rope stopper, and one end is fastened to the hawser with a piece of small rope, called a "nettle." (See Fig. 13, page 328.) When this is done the rope nipper behind the dummy is cast off, and the turns of the trawl-warp slackened up—sometimes they are taken off the dummy altogether—so that the strain all comes on the stopper. The purpose of the stopper is to save the warp in case the trawl catches on the bottom; for being a

this is invariably done by the Hull and Grimsby men. In describing the shooting of a trawl he says: "The lowering is thus managed: The fore bridle is first slacked away until that end of the beam is well clear and stands out at a considerable angle from the vessel, the after part being still kept in place by the dandy bridle, which comes in over the taffrail to the small stern windlass or dandy winch by which it is worked. This rope is then slacked away till the whole beam is in the water, and the inner end of the rope is brought forward to be made fast to the warp, just above the shackle, till it is again wanted, when the beam has to be hoisted up. The beam is now held by the two parts of the main bridle, and they are slowly paid out till it hangs evenly from them; if the whole gear be then in proper position more way is got on the vessel and the warp given out so as to allow the trawl to sink to the bottom, which, as the vessel is under way, it will do at some distance astern."

small rope, and generally one considerably worn, it would, under any sudden strain, break before the hawser, and the trawl would not be lost. When this happens, more warp is paid out, and the vessel is steered in a direction which may, perhaps, clear the obstruction. If this is not accomplished, the next thing to be done is to try and heave up the apparatus. As the warp becomes nearly perpendicular, and the strain increases, the trawl generally comes away clear, frequently with only the net damaged, though the fishermen are not always so fortunate.

In winter a "hawse" is used instead of a trawl-rope stopper. This device is made of a piece of old towing hawser that is not good enough for towing. It is 19 or 20 feet long with an eye-splice at each end, and well parceled to prevent it from chafing on the rail. The inner end is shackled to a chain collar on the dummy and the other is fastened in the usual manner to the towing hawser and reaches just outside the rail. The "hawse" is used to save the towing rope from chafing on the rail. When towing a trawl, with strong winds, the warp is taken off the dummy, and the bight carried forward and stoppered to the forestay with a good piece of rope, and turns are put on the capstan ready for heaving. The bight is also supported along the rail with rope yarn. These precautions are taken to clear any vessel that may be seen to leeward, by coming in stays, which the smack will do at once if the stopper holding the "hawse" is cast off. They are also necessary to prevent the loss of the trawl when the latter comes afoul of rough ground or any object on the bottom, such as a wreck, anchor, etc. The "hawse" will part under a sudden heavy strain, and it can, of course, be cut if it can not be otherwise cleared soon enough; the vessel then swings at once head to the wind.

After being stopped the trawl-rope is parceled where it comes across the rail; it is then pushed into the proper place, where it is held by stout hard-wood pins which are stuck in holes bored in the rail. It may be explained here that on top of the main rail is fastened a false rail, 1½ inches thick, to take the chafe of the towing hawser, and through both of these rails are bored 1½-inch holes, 18 inches apart, near the after end, where the warp usually comes, and 2½ feet apart farther forward. The position of the trawl-warp on the rail depends on how the captain wants to keep the vessel's head. If, for any reason, it is desirable to keep her nearly before the wind the warp is shoved aft to the mizzen rigging, while if she lays off too broad, the hawser is put farther forward and a pin stuck in the rail abaft of it. Sometimes it is necessary to take the warp to the capstan, which is several feet forward of the dummy, but, generally, the vessel will lay near enough the wind without doing this.

When the trawl is out, the tiller is allowed to swing, the sheets are eased off a little, and, as a rule, the towing hawser is placed so that the smack will head a point or two free from the wind. The amount of sail set, when towing the gear, as has been stated, depends on the strength

of the wind. The trawlers are all provided with large light sails for use in moderate weather, as well as a large jib and stay foresail, the latter sheeting well aft of the mainmast, and having the special name of "towing foresail."

It will readily be understood that the resistance offered by the trawl materially decreases the speed of the vessel; a smack that is running along from 8 to 9 knots will not tow her trawl faster than 1½ to 2 knots, which is considered fast enough, since if the gear is pulled along too rapidly it will not keep on the bottom.

3. SHOOTING A TRAWL FROM THE STARBOARD SIDE, OR "SHOOTING AROUND THE STERN."

It has already been explained that the trawl, when up, is always carried on the port side, and is also hove up there; therefore it will be obvious that when it is put out from a vessel with her starboard tacks aboard, it must be shot around the stern. To do this (first supposing the bridles are shackled on the trawl-heads, and the cod-end tied up), the after bridle is passed around the stern and coiled down aft, the end being taken forward of the starboard mizzen rigging. The dandy bridle is next taken around the stern under the after bridle,[1] hauled taut and made fast to a cavil amidships, after which it is coiled down ready for running. The bight of the fore bridle is made fast aft of the port mizzen rigging with a slip stopper, and the end taken around outside of all and in forward of the starboard mizzen rigging. The end of the trawl-warp is next taken around (if astern) outside and beneath the bridles, and brought in amidships on the starboard side; enough is pulled over to take turns around the dummy, the bridles are then shackled on, and the end of the dandy bridle made fast. When all is ready, and the vessel going through the water 4 or 5 knots, the captain orders the men to "pay out the net," and at the same time gets the "quarter strap" and canting line all ready to slip, but holds on to them until the forward end of the beam swings clear of the smack's side as previously described. As he slacks away, the dandy bridle, leading from the starboard side, and the fore bridle from the port quarter take the strain and the trawl shoots around or across the stern nearly at right angles with the vessel's keel. When the beam is "square," the dandy bridle and fore bridle are slacked away, and the trawl warp paid out and stoppered in the same way as if the vessel was on the port tack.

[1] Sometimes the dandy bridle is used to haul the end of the towing warp under the vessel's bottom. In this case the bight of it is taken around the stern to the starboard side clear of everything, and the end is led forward on the port side and made fast to the trawl-warp, the bight of the bridle being allowed to drop down beneath the keel, so that the warp is pulled directly under the vessel, from the port to the starboard side. Any other piece of rope can, of course, be used for this purpose. As, however, the hawser is liable to chafe when underneath the keel, it is rarely left in that position except in smooth weather. As a rule, the warp is taken around the stern or bow, its bight being stoppered up, if necessary, after the trawl is down, to prevent chafing.

As a rule, when the trawl is out on the starboard tack, a guy is taken from the bow to the towing warp and securely fastened, or may be the bight of the hawser itself is taken up around the bow. This is a necessary precaution at night or in thick or rough weather, since all is then ready to tack ship, either to clear another vessel or to heave up the gear. If necessary, the trawl stopper is cast off, the jib-sheet slackened, the helm put down, and though she may have little way the vessel works quickly, the towing warp pulling at her bow materially assisting her in stays.

After the trawl is down, if it is during the day and reasonably good weather, the fourth hand—usually a lad of sixteen to eighteen years of age—keeps the watch, takes notice how the trawl is working, and looks out for signals from the admiral, if fishing in a fleet.[1] If fishing at night, the watches are kept by the second and third hands. It is a part of the duty of the watch to trim the sails, if necessary, and to note any change in the wind, as well as to observe how the trawl is working. By feeling the warp outside the rail one can easily tell whether the trawl is working right or not. A jerky, irregular motion, as though the trawl was constantly being caught on something, shows that it does not keep steadily on the bottom, or is evidence that it is going over rough ground, or possibly that it has capsized. If, however, the vibration is regular and comparatively slight, the experienced fisherman knows at once that the apparatus is going all right.

According to Mr. Hellyer, the best way to tell whether a trawl is upset or not is to put the ear down to the warp outside of the rail, though, as stated above, an experienced trawler will generally be able to tell whether his gear is fishing or not by putting his hand on the warp.

1. To Change the Tack with the Trawl Out.

It often happens, especially when fishing at night, that, owing to a change of tide, or because a vessel may have reached the limit of suitable ground, she is obliged to change her tack, if possible without upsetting her trawl, since in the latter case the gear would have to be hove up or else no fish would be taken. Of course, the gear could be hove up at the start, but this would cause the loss of much valuable time and perhaps two hours or more of good fishing; besides, the crew would be forced to do extra labor, and also have their night's rest broken.

(*a*). *To wear the Trawl around.*

When the tide is swinging around "by the lee," or when the wind is moderate, it is generally found the safest, in order to prevent the gear from upsetting, *to wear the trawl around.* This is done as follows: If towing on the starboard tack, with an ordinary breeze of wind, the bight of the trawl-warp is stoppered near the stern with a stout piece of rope,

[1] Little day fishing is done except in summer, and at that season the majority of the North Sea vessels, at least, fish in fleets.

the stopper at the dummy is cast off, the bight of the hawser hove over the rail, and the slack of it is pulled in on the port side. In the mean time the foresail is hauled to windward, the helm put hard up, and the after sheets eased off a little. As the vessel falls off—which she quickly does—and is about to jibe, the trawl-warp is stoppered at the dummy on the port side, and the fast on the starboard quarter is cast off. This generally has the effect of causing the smack to swing still more, the wind finally catches the sails on the port side when the vessel comes to at once, so that she heads, as it is intended she should, for towing.

In wearing from the port to the starboard tack the only difference is that the bight of the trawl-warp must be passed around the stern, and generally, after this is done, a few turns of it are hove over the dummy. Ordinarily a handy smack will wear the trawl round without difficulty, but in light winds it often takes some time to perform the evolution. This maneuver is described as I saw it performed on the *Willie and Ada*. Some fishermen have a slightly different method, I believe. They prefer to take a guy from the lee side around the stern, which they make fast to the bight of the trawl-warp, and putting this on the capstan, heave in on it. Of course they must, in the meantime, get their vessel well off the wind so that the warp leads aft; otherwise it might run under the keel without helping to wear the ship.

(*b*). *To stay the Trawl around.*

For various reasons it is often desirable to *stay the trawl around* instead of wearing with it. This operation is thus described by Olsen:

"First put the helm hard up and run the vessel off before the wind, then pass the warp round the bow to abaft the rigging onto the dummy. Then stopper the bight on the lee bow, let go to windward, put the helm a-lee, and when the foresail is a-back drop the mizzen-peak, let go the bight of the warp on the starboard bow, and when the vessel has paid off before the wind, and brought the warp taut, I would bring her slowly to."

(*c*). *To drop a Vessel around with her Trawl out.*

He would drop the vessel round as follows: "I would bring the vessel slowly to the wind with the foresail down, and when in the wind lash the helm a-lee. As soon as the vessel is steady I pass the bight of the warp round the bow in the same way as in staying, or I would pass a good guy round and heave the trawl-warp upon the starboard bow; then I take the bight of the warp aft on the dummy and secure it, slack away my guy, and set a piece of the foresail aback. In this way the vessel will gradually bring the gear off the weather side, steady her, and secure all.

"N. B.—This system is only used in bad weather when it is needful to bring the ship on the other tack."

(d). To catch the Vessel around with a Weather Tide.

To perform this evolution he says: "I should let the vessel settle up to windward of the gear by lashing the helm half a-lee, trim the sheets well aft; she will then bring the trawl-warp across the stern, which will ultimately cause the vessel to come round on the other tack. I would then trim the sails immediately and lash the helm a-lee. This can only be done in fine weather."

5. To Prevent a Vessel from Catching Around,

when towing with weather tide and light wind, and the smack is to windward of her gear, Olsen says: "I should bring the guy aft on the lee-quarter, pass it round the stern, and make it fast to the trawl-warp, heave taut with the capstan, slack the trawl-warp, and tow with a guy under the lee."[1]

6. The Working of a Trawl.

The methods of shooting a beam-trawl, and of managing it when out, having been discussed, it seems desirable and proper that something should be said of the action or working of a trawl on the bottom before a description is given of how it is hove up, etc.

From what has been said of the trawl it will be obvious that this implement is designed more especially for the capture of such fish as keep near the bottom and which are generally denominated "ground fish." Among these various species of flat-fish—several of which are the most highly prized of the European sea fishes—are perhaps more easily and surely caught by a beam-trawl than in any other way.

"With rare exceptions all the soles, turbot, and plaice brought to market are caught by the trawl. The various kinds of skate or ray are also obtained by the same means; and notwithstanding the peculiar habits of all these fish there is very little chance of their escaping when once the trawl-beam has passed over their heads."[2]

The movement of the trawl through the water, when it is being towed, keeps the net distended and the back raised some distance from the ground, and as it is traveling with the tide, and the natural tendency of fish is to head the current, it follows that they are liable to be frightened, when their first impulse would doubtless be to attempt an escape by darting in the direction they were heading; this action on their part would take them directly into the cod-end.

"Should the fish, however, by any chance turn around and dart towards the mouth of the net, there would probably be a considerable distance to go before they would be clear, for the ground-rope sweeps the bottom from the foot of the two head-irons to a distance of 40 or 50 feet backwards to the bosom of the net, and this whole space is in-

[1] Fisherman's Seamanship, pp. 31–32.

[2] Deep-sea Fishing and Fishing Boats, p. 74.

closed above by the back, and at the sides by the wings, so that there is no possible escape in any direction above ground, but at the entrance under the beam. The trawl is moreover moving forwards all the time, and as flat-fish when disturbed only swim a short distance before they again try to hide themselves, it almost amounts to a certainty that, if they do not bury themselves deeply, they will sooner or later pass over the ground-rope into the net. In the case of such round-fish as keep close to the bottom—haddocks, for example—the result is very much the same, for when they are disturbed by the ground rope they naturally rise and pass the slight obstacle without knowing it; if, on the contrary, they dart towards the mouth of the net, they may escape in that direction; but they also will probably have some distance to go before they can get clear, and the upper part or back of the net is an effectual barrier to their escape upwards."

It is generally found desirable, if there is sufficient wind, to tow a trawl much faster for free-swimming fish than for flat fish. Thus, while many fishermen think a speed of one half to 1 knot is ample for catching soles, the Brixham and Plymouth trawlers, when in pursuit of hake, generally tow their trawls from $2\frac{1}{2}$ to 3 knots.

Mr. Sims says: "In fishing hard ground for soles we should shorten the ground-rope and not drag the trawl quite so fast; just go with the tide. But if we are fishing for hake or haddock, then we say 'give her sheet:' that is, force it all you can, so that you do not lift it off the ground."

Of course, this increase of the rate at which the trawl travels over the ground renders the escape of these fish much less probable than it would otherwise be, since the net is kept almost clear of the ground, or barely skimming it, which seems to be necessary to catch hake or other free-swimming species. But, though the trawl scarcely drags on the bottom, it requires a brisk breeze of wind and every sail that can be spread on a vessel to obtain the requisite speed. On the Plymouth and Brixham smacks, according to Holdsworth, "a half square-sail or sort of lower studding-sail is frequently rigged up to a yard-arm on the weather side in addition to the ordinary sails, if the wind be sufficiently aft for it to stand, and the curious appearance is often presented of the vessel lying over to the breeze and apparently rushing through the water when in reality, with all the help of a great spread of canvass and a favorable tide, she is not going more than 5 knots over the ground."

From the foregoing it will be seen that the beam trawl is a very effective implement for the capture of ground fish on smooth bottom, in comparatively shallow water, where this form of apparatus can only be worked with the best success, as will readily be understood from what has previously been said concerning its construction and the fishing grounds where it is chiefly operated.

Deep-sea Fishing and Fishing Boats, p. 76.

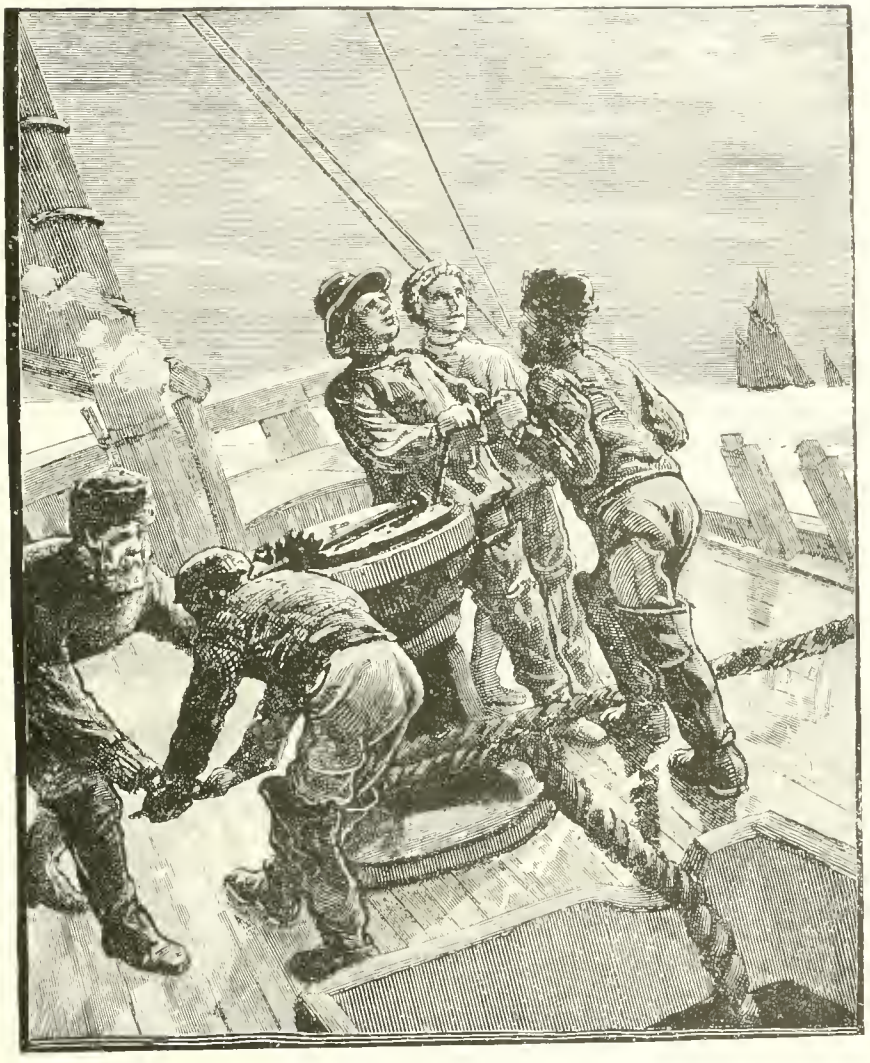
7. Heaving up the Trawl.

Under ordinary circumstances the trawl is hove up when the tide has done running, if it is day-time, or when the limit of a fishing-ground is reached and it is not practicable to tow back over it on the other tack. As a rule, the North Sea fishermen tow all night if the conditions are favorable—tacking or wearing the trawl round with the change of tide—haul in the morning, dress, box, and deliver the fish on board of the carrier,[1] and then, if the day is short, work to windward for another night's drift over the ground. In summer, the trawl is usually shot during the early part of the day, as well as at night, and hove up in the afternoon; thus two hauls are made instead of one. If fleeting, as is the general way in summer, the admiral signals when to shoot and when to heave up the gear. However, it frequently happens that a smack's trawl may catch afoul on the bottom, and therefore it is necessary to heave it up whether it has been out long or not, and it is often found desirable to get the gear at midnight and make a second "shot," especially when fleeting.

The following description of the method adopted on board of the *Willie and Ada* will give a fair idea of how the trawl is hove up and got on board of the ordinary North Sea sailing trawler, in moderate weather:

About 3 o'clock p. m. the fourth hand, a lad of some seventeen years of age, who was on deck, shouted down the companion that he thought the admiral was hauling. The captain instantly ran on deck, bareheaded, and satisfying himself that the report made by the watch was correct, came back into the cabin and called all hands; the men, in obedience to his call, soon making their appearance on deck. When they were all up, the jib sheet was eased off, the helm put down, and two or three of the men shoved forward on the trawl-warp until it was placed on the roller. Two turns of the hawser had previously been put on the capstan, and as the vessel swung slowly head to the wind—helped by the mizzen, which the skipper hauled to windward—the cranks were shipped on the capstan preparatory to heaving, while the cook jumped down into the hold to receive and coil the warp as it came in. When the vessel tacked—which she was assisted in doing by the trawl-warp being so far forward—she "went back over her gear," as it is called, slacking up the hawser, which the men hove in as rapidly as possible until it was tightened again, when the foresail was hauled down, the helm was put a-lee, and the smack brought on the other tack. In this way the skipper continued tacking the vessel, making short boards back and forth, "working up to the gear," while the men at the capstan hove away briskly until all the slack was in. The object of this manœuver was to get in the greater part of the warp with as little labor as possible, since, of course, it is far easier to heave in slack haw-

[1] If the vessel is fishing alone, or "single-boating" as it is called, the fish are dressed and packed in bins or pens in the hold.



HEAVING UP THE TRAWL.

ser than it would be if there was a strain upon it. Therefore, as the vessel stood back and forth the men at the capstan reported, in answer to the captain's inquiries, if the warp was "coming after her," and, if so, another tack was made. When the slack of the warp was in, the vessel was hove to on the port tack, with the jib-sheet eased off and the helm hard down, and the captain proceeded to assist in heaving at the capstan until the bridles were inside the trawl-warp roller.[1] The end of the dandy bridle was then cast off from the trawl-warp by the captain, who took it aft, passed it through the chock on the port side of the taffrail and thence to the dandy winch, upon which it was fixed so that it would wind up without slipping.

The captain generally heaves in most of the dandy bridle alone; sometimes he is assisted by one of the crew, and for the last few feet two or three men may lend him a hand. In the mean time, as soon as the end of the trawl-warp comes inside of the capstan, the after bridle is unshackled, its end taken off the capstan, and thrown on deck, or two or three loose turns taken with it around the dummy. This bridle has a piece of spun yarn wound around near its end, which is a mark whereby it can be told from any other rope at night as well as by day.

While two of the men were unshackling and clearing the after bridle one hand cast off the fall of the fish tackle, took it to the forward winch, and hove it taut, so that it might be ready for use when needed.

When this was done and the gear was all clear, the men returned to the capstan and hove away on the fore bridle—the skipper at the same time winding in the dandy bridle—until the beam was alongside, and a strap, which was spliced into the fore bridle a few feet from the trawl-head, was inside the roller. The after end of the beam was then hove snug up to the taffrail and secured. While this was being done two men had hooked the fish tackle into the strap on the fore bridle and began to heave away on the forward winch, lifting the end of the beam and the trawl-head over the rail. As it swung in, the trawl-head was lowered on deck and secured in its place. If there is any sea going, a guy (one end of a rope which is fast to the main shrouds) is rove through the trawl-head by one of the men, who takes a turn with the stopper around the main rigging, to prevent the forward end of the beam from swinging across deck. The next thing is to get in the net. If there is much weight of fish in the trawl, the end of the "cod-line" is taken to the capstan and the cod-end is brought nearly alongside. This is done in order to take the strain off the upper part of the net, which therefore can be more easily gathered in by the men. But when the catch is not large and the sea is smooth, this part of the work is generally omitted. All hands then gather the net in by hand, standing a few

[1] When there is a strong lee tide it is impracticable to work a vessel up over her gear in the manner above described, and in such cases all that can be done is to heave the smack to on the port tack and get the gear by main strength, and it frequently happens that two or three hours are required to get a trawl up and the fish on deck.

feet apart and leaning over the beam. (See Plate XVII.) As the vessel rolls to windward a pull is made to get in the slack of the net, which is hauled over the beam and held from slipping back by the men leaning their breasts against it, while they reach out for a new hold. Heavy, hard work this is for five persons to do—two of whom are usually boys—and it frequently happens that the eager looks which are cast over the side to ascertain what success has been met with are unrewarded by the appearance of enough fish in the pockets to indicate a good haul; "and it is a bad sign when nothing is said and the bag is got on board without a word."

On the occasion concerning which I am writing, though the catch was small, owing to the trawl having been torn on rough ground, the "cod" was not empty by any means. When, therefore, the net had been pulled in so that the cod-end was alongside, a selvagee strap was put around the trawl, the fish tackle hooked into it, and the bag of fish was hoisted up until it would swing in over the rail.

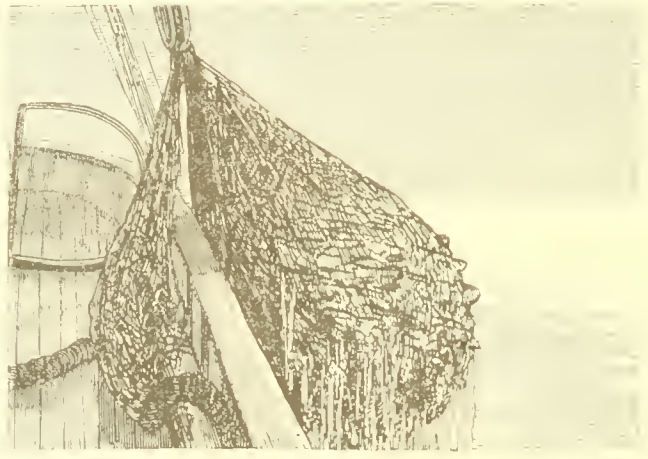


FIG. 20. HOISTING THE COD-END.

While it was being raised, a "bag-rope" was taken from the main rigging to the trawl-head and made fast, to prevent the fish from swinging across deck. When the net was in, the "poke-line" was cast off, the bottom of the trawl opened, and its contents fell on deck, a struggling, writhing, flapping mass. (See Fig. 21.) Nowhere else can one witness such a remarkable scene.

The contents of the net differ according to season and locality, but generally they are of a most varied character—a wonderful exhibition of marine life. Sliding back and forth on the slippery deck, as the vessel rolls in the sea-way, are soles, turbot, brill, and plaice, giving vigorous but rather spasmodic slaps on the plank with their tails: here may be seen the writhing body of a conger eel; there the fierce wolf-fish, with

PULLING IN THE NET.

its jaws armed with wicked-looking teeth, snapping at whatever comes in its way, while prominent in the crowd is one of those wide mouthed fishing frogs, which some one has called an "animated carpet bag." These, together with gurnards, iridescent with beautiful color, the vicious dog-fish—always the fisherman's enemy—wriggling about, shells, sea-anemones, sea-corn, etc., constituted a variety of animal life such as is rarely brought together by any other means.

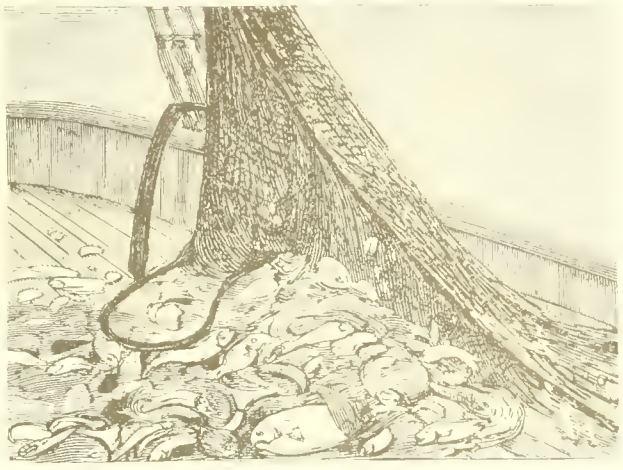


FIG. 21. THE TRAWL'S CONTENTS.

When the net is filled with fish to such an extent that it can not be handled, in the manner above described, a hole is cut in the back, as previously stated, and enough of the catch is bailed out with a dip net to allow of the trawl being taken in. Occasionally it happens that large stones are caught in the trawl and, getting into the "cod," hang down with such great weight that it is difficult, if not impossible, to raise the net in the ordinary way. At such times a long rope slip-strap, or a "clench," made with a running bowline, is put loosely around the trawl and sunk with the deep-sea lead, which is tied to the bight of the strap. When it is low enough it is hauled taut, taken to the capstan and hove up alongside.

The heaving up of a trawl on the single-masted cutters is about the same as that which has been described, the principal difference being that the warp is taken forward and comes in over the bow, the vessel lying head to the wind, the light sails and stay foresail being taken in before the work begins.

Mr. R. L. Asheroft, of Southport (near Liverpool), England, writing under date of November 14, 1884, gives the following description of the methods of handling a beam trawl on the west coast of England:

"I was out trawling from Fleetwood a fortnight since, with one of the large boats. I should like you to see how easily their gear is worked

in comparison with the east coast boats. Our smacks here fish a 56-foot beam of greenheart, and the boat is only 56-foot keel measurement. But we turn out when we haul the net and haul by the bow, and when we have got the bridle on the winch we take the 'dandy' or span bridle, or, as they call it here, the head rope, which is now made of steel wire rope, to a wink or Spanish windlass aft, between the cabin companion and the bulwarks, and get the after end of the net up. Afterwards, we winch the forward bridle up and let the after rope bridle surge until we have the forward trawl-head almost up, and then hook the fish-tackle into a becket on the forward bridle, and take the fall to the winch barrel and coil it on until the iron of the trawl is clear of the rail. Then one of the crew gets hold of the winch barrel under his arm, and, the pawls being lifted up, he watches the roll of the boat and lets the iron come inboard by letting the winch at liberty.

"In the boat I was in there are only four men in the crew, and they made all the nets required."

The time requisite for heaving up a trawl varies a great deal, depending chiefly on the state of the weather, roughness of the sea, depth of water, direction and strength of the tide, as well as upon whether the capstan is worked by hand or by steam. Captains who have used steam say that, under favorable conditions, they have got a trawl up—heaving in 120 fathoms of warp—in the short space of fifteen to twenty minutes, while some claim that from twenty to twenty-five minutes is sufficient to heave in the whole warp, even in rough weather.

Heaving a trawl up by hand is not only hard work, but the process is tedious to a degree, rarely occupying less than forty-five to fifty minutes, and sometimes, when the weather is rough and the vessel knocking about, taking between two and three hours.

It will be obvious that when steam trawlers are employed the conditions are quite different from those which obtain on board of a sailing vessel, since a steamer can go in any direction which it may be necessary for her to proceed, and consequently many of the various evolutions which have been described would not be performed. The shooting and hauling of the trawl is done in much the same way, except perhaps that some, if not all, steamers use a derrick for hoisting one end of the trawl and a davit for the other, and that there may be some difference in the minor details of the method of working. It will be readily understood that, owing to the fact that a steamer is always able to tow in any desired direction, so as to take the utmost advantage of tide and the "lay" of the ground, as well as to go at the requisite speed in calms as well as at any other time, vessels of this class are much more effective for working a beam-trawl than those which depend solely on sails.

The following account of a trial trip of the new steamer *Caller-Ou*, of Granton, Scotland, clipped from the Scotsman of December 18, 1883, may be of interest in this connection: "One of these exceptional days

in December, when there is a clear sky overhead, a sharp breeze off the land just sufficient to give a fair trial to a vessel under canvas, and when there has just been restored comparative calm to a sea which had been angry during the storms of a whole week before the *Caller-Ou* sailed down the Firth from Granton with a considerable number of gentlemen on board interested in trawling and deep-sea fishing. It was not until the vessel was off Craigleith, 18 or 19 miles down the Firth, that the trawl was put out. The depth of water was from 11 to 15 fathoms. Of course, the experiments were conducted more with a desire to test the working of the trawl and its appointments than to secure a large haul of fish; and therefore the trawl was kept out during an hour only. When at work under ordinary circumstances, these steamers trawl during, on an average, four hours. Ponderous as the trawl is—the heavy beam, the great net, and the massive iron hoop-like structures which at each end of the beam keep the mouth of the bag or net open as it sweeps along the bottom of the sea—the working of it by the machinery available was a matter of comparative simplicity and ease. Once cast into the sea, the trawl is dragged along at a speed of between 2 and 3 miles an hour, being attached to the ship by a great wire rope, which on Saturday was run out to a length of 75 fathoms. The most interesting part of the trial was when, after the lapse of an hour, the trawl was drawn on board. Here, again, the steam machinery appeared to work satisfactorily, and in the course of a few minutes the beam and the iron structures were lifted over the side of the ship. The net or bag was still in the sea, and as the crew hauled it on deck its contents were watched with much interest. Soon it was thrown on the deck, containing a couple of hundred weights of white fish—whiting chiefly, with three or four cod and codlings, a couple of skate, a few haddocks, some ray, a few flounders, a young turbot, and two crabs. This catch, it is obvious, was not a large one for a great trawl such as that described. But the brief period during which it was at work, and the fact that the ground covered was not considered good, or the ordinary fishing-ground, were said to account for the catch being so small. The fish, however, were taken up in splendid condition—full of life and in as cleanly a state as might be desired. Whether the short period during which the trawl was at work accounted for it, or whether it was that the condition of the sea-bottom was exceptionably favorable, the trawl was laid on the deck wonderfully clean—clear of mud, or of any perceptibly objectionable matter; and it was stated that this is the condition in which the trawls are usually taken on board in ordinary weather in the Firth of Forth. Attention was also directed to the quality—the intermixture of immature with mature fish. There were, it was admitted, very few immature fish. There was one codling only 10 inches long, but the other specimens were excellent. There were, probably, half a dozen very small whitings, one small skate, and one small, but not apparently immature, flounder. On the whole, however, the apparently

immature fish were, in number, hardly worth speaking of—not more, it was asserted, than would have been got among an equal total catch by net or line. If possibly disappointing as regards the quantity landed, the result of Saturday's trial was all that was anticipated in other respects; the fish were brought up in excellent condition, and the proportion of small fish to the whole catch was almost incredibly small. There were also in the net several varieties of the smaller conditions of life at the sea-bottom, many being well-developed forms, and others very minute. On this point one of the party pointed a comparison between the contents of the trawl net and that of a surface net which was worked from the deck of the vessel over three-quarters of a mile of sea. The contents of the surface net, it was stated, included a greater number and a greater variety of life—very minute forms, of course—than did the contents of the other; showing, as it was believed, that life was more abundant on the surface than at the sea bottom. But, one observer also remarked, the sea bottom here was not so rich in the smaller conditions of life, which form food of codlings and such fish, as is the ground over which trawlers usually work or on which the larger catches are taken. Such, briefly put, is the result of a trial trip the results of which, to those most closely concerned, were regarded with satisfaction. It may be added that the owners of the *Caller-Ou* contemplate the building of other vessels like her for the Granton deep-sea fishing should a reasonable experience of the working of this one prove remunerative."

5. Single Boating and Fleeting.

Two distinct methods of trawling are carried on by the British vessels, called "single boating" and "fleeting."

The single-boating system is the oldest, having been pursued since the advent of trawling. By this system each vessel goes to sea and fishes presumably by herself, or, at least, usually has no connection with any other craft, the master pursuing his work in whatever waters he deems most suitable. Ice is carried for the purpose of keeping the fish, when going to a considerable distance from the home port, the catch being packed below in bins or pens built in the hold of the vessel, until she arrives in port, which may be anywhere from one to twenty days. The Brixham trawlers, in summer, frequently land their catch twice a day, when the conditions are favorable, in which case no ice is required, but the North Sea single boaters are generally out from one to three weeks. According to the report to the Board of Trade, "some of these vessels go out a very long way in order to find the fish, quite as far if not farther than is the practice with the fleets, and it often happens that many of them are found to be congregated together on the same fishing-ground, sometimes as many as from fifty to one hundred at one time. The 'admiral' of Hewitt's fleet stated it to be his opinion that if all the smacks in the North Sea went single boating it

would lead to a crowding of vessels at times which would be more dangerous than fleeting."[1]

Of course, where the fishing grounds are near the home port, and the fish can easily be taken to market in an absolutely fresh condition, as at Brixham, for instance, the single boating system prevails, and wherever this is pursued each skipper is thrown upon his own resources in choosing his ground, shooting and hauling his trawl, as well as in the care of the fish and getting them to market. Where, however, as in the North Sea, the best fishing grounds lie at great distances, comparatively speaking, from the market ports, and, consequently, the vessels must be out several days, it sometimes happens that the fish are in poor condition before they arrive. This, therefore, is a serious objection to this system, which, notwithstanding, is preferred by many fishermen to fleeting, the latter being considered much more dangerous, especially in winter. The trawling fleets from many, if not most, of the large ports pursue the system of single boating in winter, and more or less of the vessels from all other places do likewise.

A portion of the fleets, however, from Hull and Yarmouth follow the "fleeting" or "boxing" system even in winter, and nearly all of the trawlers along the east coast of England adopt this method during the summer. Under this system arrangements are made for a number of vessels to trawl in company, thus forming a "fleet" the movements of which are governed by an "admiral," who is appointed *pro tempore* and who is known to be an expert and experienced fisherman. He decides where fishing shall be carried on, when the trawls shall be shot and hauled, and the movements of the other smacks are controlled by signals which the admiral makes. All the vessels in a fleet generally shoot and haul their trawls at the same time, and sail together on the same tack, in obedience to the signals made by the admiral, who, it may be mentioned, usually receives some extra pay for his services.[2]

Flags are used for signaling by day, and rockets or flares at night.

"Each fleet has its own particular code," writes Mr. Ansell, "one of which is the following:

Admiral's signals by day

For sailing	Flag at foremast head.
For trawling	Flag hauled down.
Not to board	Flag at mizzenmast head.
Sailing before boarding	Flag both mast heads.
Cutter wanted	Flag half mast.

[1] Report to the Board of Trade on the system of deep-sea trawl fishing in the North Sea, London, 1883.

[2] Mr. Samuel Plimsoll, chairman of the South London Market Company, in an article published in the London Fish Trades Gazette of June 2, 1883, states that the admiral receives, in addition to his pay as skipper, 3*d.* for each boat every time her fish are taken out by the steam carrier.

Admiral's signals by night.

For sailing ..... White rocket at intervals.
For tacking ..... Flare on quarter and a white rocket.
For trawling on port tack ..... Three flares and a red rocket.
For trawling on starboard tack ..... Three flares and a green rocket.
For hauling (getting the trawl) ..... Two flares and two white rockets at one time.
For laying to ..... One flare at mast-head and one on the quarter with a white rocket.

In strong winds the fleet sometimes get scattered, and to facilitate their gathering again without loss of time, different places of rendezvous are arranged according to the season of the year, thus:

From February 1 to March 1 ..... Tail end of the Dogger.
From March 1 to August 1 ..... Off the Horn Reef Light-boat.
From August 1 to October 1 ..... Clay Deeps.
From October 1 to February 1 ..... The Silver Pits.

These are well-known places to all fishermen."

Messrs. Hewett & Co., of London, are reputed to have been the first to establish the fleeting system, which they did by arranging to have the large number of smacks they owned combined into one or more fleets, that, as now, were controlled by an admiral, while each day's catch was shipped on board of a swift-sailing cutter which took the fish to market, several of these cutters being in attendance on a fleet so that no time was lost. In all weathers these "carriers" could be seen hovering about the North Sea fleets, and nowhere in the history of seafaring life can there probably be found any better examples of courage and hardihood than were exhibited by the crews of these cutters. Winter or summer, so long as they could show any canvas, they were driven through all weathers almost to the verge of destruction. The object was to bring the fish to market fresh, and so long as this was accomplished little was thought of hardships, perils, and discomforts, which it is difficult for one to imagine who has not had the experience of continually forcing a passage at sea in a small and deeply-laden vessel.

Even at the present time, at least as late at 1880, essentially the same system was carried on from Hull and Grimsby; a limited number—anywhere from ten to thirty—vessels would combine interests and form a fleet, which frequently would be all the property of one firm. These vessels would, as a rule, all share alike, and the smacks took turns in carrying the catch to port, the admiral's flag being transferred to some other craft when his "turn" came to go to market. A fleet of this kind is called a "cutter fleet"[1] in distinction from the "steamer fleets," which

[1] Sometimes the crew of the cutter which receives and carries the fish to market pack the cargo in bulk, putting ice among the fish, as on the single-boaters, rather than to use boxes. A fleet, therefore, which sends its catch to market by one of its own sailing vessels is often called a "bulking fleet," because of this system of packing fish in bulk.

are much larger—numbering from seventy-five to one hundred vessels or more—and are attended by several ketch rigged screw steamers, called steam cutters, which carry out a supply of empty boxes for the fleet, to take the place of those filled with fish, also provisions and letters for the fishermen. But their chief work is to carry the fish from the fleet to the port where they are to be landed, generally London, Grimsby, or Hull.

"One of these cutters is generally arriving every day at the fleet, and the fish which has been caught by the smacks, and has on board of them been packed in boxes, is transferred or 'boarded' in the smacks' boats to the steam cutter, with which she then goes back to her port of discharge.

"Single boats also are in the habit of transferring their fish to these cutters if they chance to fall in with them, and if the cutter has room, which is usually the case, the steam cutters charging so much per box for carriage.

"The smacks engaged in 'fleeting' remains at sea for periods varying from six to eight to ten weeks, when they return to their port to refit. From Yarmouth there are about six hundred and seventy smacks engaged in 'fleeting,' and from two hundred to two hundred and fifty in 'single boating' in the winter, and in the summer nearly all are engaged in 'fleeting,' and from Grimsby there are about three hundred engaged in 'fleeting' and one hundred in single boating in summer, but none of them go fleeting in winter."[1]

The same necessity exists now for getting the fish to market as soon as possible which led to the hard driving of the sailing carriers, and probably no vessels in the world are forced harder in all weathers than the steam carriers which now attend upon the North Sea fleets, and which rarely fail to make their passages from the most distant fishing grounds to Hull, Grimsby, or London, in from thirty-six to forty eight hours.

A writer in Land and Water, who made a cruise in a North Sea trawler in December, and returned to port on a steam carrier, gives the following account of the passage, which will convey a good idea of the conditions under which these vessels frequently make their trips to or from the fishing grounds: "It is impossible to convey even a general idea of the journey back without entering into an amount of nautical detail, for which I have not time. The present age is certainly remarkable for earnestness and zeal in most official men; but there was in the dear, good, clever, brave, old man who brought that vessel home an intensity of devotion which it was positively refreshing to observe. He carried sail when the sea washed all over the ship, and every now and then came down in deluges into the stoke hole, all but extinguishing the furnaces. As to the little cabin, in which we were supposed to live, it was literally drowned, hardly a dry thing being left in it, and the little stove being almost instantly extinguished every time it was lighted.

[1] Report to the Board of Trade on the system of deep-sea trawl fishing, etc.

At one time I thought to go in for the luxury of dry boots, so I put a pair before the fire; but in a few moments after a sea struck us, and when I looked down the companion again I saw one boot jammed upright at the foot of the ladder full of water, and the other gaily careering all over the floor upon the bosom of a festive wave, which had floated up all the small gear and so-called furniture, and was then engaged splashing the table underneath. All this time the good skipper never wearied for a moment, and never left the deck except for a few seconds to snatch a mouthful of food, or a drink of cold, creamless tea, which was his only beverage; but forced the vessel through the heavy sea with steam and sail combined until he carried away the gaff, and then with steam alone, until he brought us safely, in what even he owned to being 'coarse weather,' through some of the most dangerous and intricate channels on the coast, and finally reaped the reward of all this great labor and anxiety when he heard from his employers that his cargo was in time for market, and that they were pleased with his exertions."

In regard to the system of fishing pursued by the Grimsby trawlers, Mr. Mudd writes as follows under date of April 29, 1882: "Our vessels fish in fleets principally in summer, and one or two fleets continue all winter. A fleet of about one hundred and fifty smacks are attended upon by four or five steam carriers of 130 to 150 tons register, fifty to sixty horse-power engines, which carry their fish to market in ice; so that the smacks carry no ice; they [the smacks] go on the grounds for eight or ten weeks' fishing, then come home for a week and off again. This is the most profitable system of fishing.

"Steam trawling is a great rage just now. I helped to form a company last year. We have two boats which have been at work three months with fair success. We are going in for four more."

Steam trawlers, as a rule, go on the single-boating system, generally carrying on their operations within 20 to 60 miles from the land, from which distance they can easily reach the markets while their catch is in good condition. Sometimes they act in the capacity of carriers and trawlers, too, fishing in a fleet, the product of which as well as their own catch, they take to market. It may be explained in this connection that it sometimes happens that sailing trawlers can do little fishing for several days at a time, because of a continuance of calm weather. On such occasions the steam trawler finds her opportunity, and by the time that the fleet gets a good day's fishing she may have obtained a large catch herself, which adds materially to the income she may derive from the carriage of fish.

"When single boating," writes Dunell, "they often average £60 per week in their gross catch. During the summer they act as carriers to a large fleet of sailing smacks. After being out about a week they will catch £40 to £60 worth of fish themselves, and at the same time bring in a cargo in boxes from the sailing smacks. This arrange-

ment is found lucrative to the company and a great advantage to the sailing vessels, as it insures the fish being delivered in good condition and obviates the necessity of the smacks making long voyages to and from their port, often with contrary winds. The advantage of this system to that of having steam carriers proper, is, that in the calm weather, frequent in summer time, the smacks can not work their trawls, so that the carriers having no fish to take must lie idle, their resources unemployed, and their ice running to waste. On the other hand, the steam trawler is enabled to work without wind, and may catch fish which will be, perhaps, additionally valuable on account of the enforced idleness of the other vessels."

Higher prices can generally be obtained for fish which are taken to market by the steam carriers than for those brought in by the single boaters, though this is not an invariable rule.

It may occasionally happen, according to the report to the Board of Trade, that smacks fleeting are obliged to keep the fish on board for several days on account of the rough weather preventing their being conveyed to the steam cutter, and as the fleeting vessels do not carry ice like the single boats, it is quite possible, under such circumstances, that the fish may arrive in inferior condition. One witness stated that he had known salesmen to fill the steam-cutters' boxes with fish out of a single boating smack in order to enhance the price.

The fleeting system is preferred by the owners, though the fishermen are in favor of single boating. It is claimed that the fleeting system is more profitable, that it is a necessity for the owners that the returns should be not only quick and large, but subject to as little fluctuation as possible. Whilst, however, "a difference of 20 per cent. in the returns may make a difference to the owner of a fair profit or a decided loss, it only makes to the man sailing on shares a reduction of, say, from £2 to £1 12*s.* per week, and to the man on wages it makes no difference at all." Therefore, it is not, perhaps, to be wondered at that the fishermen prefer the system of single boating, and that several objections are urged by them against fleeting. Chief among these objections are the hard and perilous work of "boarding" the fish, and the much longer time that they are obliged to be absent from home.

The Duke of Edinburgh, in his excellent paper on the Sea Fisheries, etc., gives a graphic picture of the dangers incident to boarding fish as carried on under the fleeting system, which he concludes by saying:

"No one will deny the great importance to the owners of smacks of getting their fish to market in a salable condition, but they are bound to effect this object without exposing the fishermen to dangers, such as I have above indicated, but against which no means of prevention have, as yet, been devised or adopted. I have alluded to this subject here as an illustration of the risks of a fisherman's life, and can not leave it without expressing my opinion in favor of a careful and searching inquiry being made on each occasion on which a fishing vessel re-

turns to port having lost any of her crew whilst at sea. This inquiry, it seems to me, should be conducted by a competent authority, whose duty it would be to satisfy himself and place on record the manner in which the life was lost, whether by one of these preventable causes or not. For, at present the fact of a life being lost at sea is the only record which exists, no matter how it occurred."

"To sum up the advantages or otherwise of these two systems," says the report of the Hull investigation, "we are of opinion that the 'single-boating' system, whilst insuring to the men less hardship and possibly conducing to instruct them in a more perfect knowledge of their business as fishermen, is also productive of a great waste of fish. The fleeting system, on the contrary, is calculated to secure a more regular and continuous supply in a fresher state. We are not inclined to attach much importance to the argument that in 'single boating' there is less danger from the congregating together of a number of vessels. We have it in evidence that a great number of 'single-boating' vessels are found together, and we are of opinion that the fact of their then sailing each at his own will without the regularity insured by acting in concert, as in a fleet, is of itself an increased danger. A single boat getting mixed up with a fleet would have a similar effect. The danger of collision to these vessels has been shown by numerous witnesses to occur chiefly in fine weather and in the daytime, not owing to circumstances connected with 'fleeting' *per se*, but to a habit amongst the skippers of visiting one another in such weather when trawling can not be carried on for want of wind, and leaving their smacks in charge of the boys. The same results may ensue when two or more single boats meet together under similar circumstances."

9. Care of Fish, "Boarding" Fish, etc.

The various kinds of fish taken in trawls are classified under two general heads of "prime" and "offal," while all other material, such as invertebrates, radiates, etc., receives the name of "scruff" or "sculsh." "Prime" fish are the choicest varieties, which bring the highest price in market, such, for instance, as the sole, turbot, brill, and dory, while cheaper and less desirable species, such as haddock, gurnards, plaice, flounders, skate, etc., are called "offal."

"Red mullet must be excepted, however," says Holdsworth, "for, although not strictly coming under the head of 'prime,' they are what the Billingsgate salesmen look upon as 'West End' fish."

The fish are dressed, sorted, and packed away as soon as is practicable after the trawl is taken up. As has been stated, the fish fall on deck from the cod-end in a slimy, struggling mass, and, if there be any sea, they go scurrying and sliding from side to side as the vessel rolls back and forth. The fishermen use ordinary clasp-knives, or what are usually termed "jack-knives," of a large size, for dressing the catch, each

DRESSING THE FISH.

man being provided with one of these, that he carries in his pocket when not using it, and which he employs for various other purposes for which a knife may be required, such as filling his pipe, cutting rope, etc. Dressing fish, so far as we have had an opportunity of observing it, is carried on in a primitive way, differing very much from the elaborate methods employed by American fishermen. The men either stand in a stooping position, picking the fish up from the deck, or else sit down and grab whatever comes first to their hands as the fish are carried back and forth when the vessel rolls. The fish are simply eviscerated, such as are dressed, for it often happens that, when "boxing," certain species are not even gutted. If it be a round fish (that is, a cod, haddock, etc.), a slit is made in the belly, the viscera pulled out, and the "poke" cut off where it joins the gills. If a flat fish, it is cut across on the upper or dark side of the abdominal cavity, and the intestines are pulled out with the right hand, the operator holding the fish by its head in his left hand. The fish are packed in the boxes with the white or belly side up, and the slit does not show, while any blood or water that may be in it will escape. As the fish are dressed they are sometimes, though not always, roughly sorted into the grades of prime and offal, but more attention is paid to the culling after the whole have been washed. Up to this point there is little difference in the methods employed on board of either the single-boaters or vessels that are fleeting, except it may be on trawlers like those from Brixham, the catch of which is rarely dressed at all, but taken in and landed in small baskets.

If the vessel is single-boating the fish are, as previously mentioned, stowed in bulk in pens or "pounds" made in the hold by shifting or adjustable bulkheads. The prime fish are generally kept separate.

If, however, the vessel is fleeting, the fish are disposed of in a very different manner. As soon as they are dressed and washed, a number of empty boxes or "trunks" are taken on deck (each smack always has a supply of these), and the fish are carefully packed in them, according to grade, after which a string is tied across the top opening, to prevent the contents from falling out while being transshipped. Each box is labeled with a wooden tag, on which is the name of the vessel and that of the salesman on shore to whom it is consigned, while a note or duplicate bill of lading, showing the number of boxes of each kind of fish going from the smack, is made out to send with the shipment. The fish are now ready to be taken on board of the carrier, near which the whole fleet of smacks has gathered in the mean time, numbering, if it be a "steamer" fleet, anywhere from seventy-five to one hundred and fifty vessels. The operation of "boarding" or "ferrying" the fish from the catcher to a steam carrier has been so graphically described by a correspondent of "Land and Water," that I can do no better than to quote it here:

"The boat is then launched over the side, no matter how heavy the

sea may be,[1] and the necessary number of men, generally three, jump in, and their mates on board hand them down the boxes, which when full weigh about one hundred-weight each. Sometimes there are very few boxes to go, or in certain cases none at all; at other times there may be as many as fifteen or twenty, or, in the event of the smack having been unable to send any for a day or two previously, there may occasionally be more, but this is not very usual. The boat is then towed behind the smack with a painter of about 10 fathoms in length, and the smack makes sail either ahead or astern of the steamer, or sometimes round and round until she has got it into such a position that they are likely to be able to reach by themselves, when she lets go and they make their own way with oars. The whole of this proceeding is little short of wonderful; in fact, it is impossible for any one to understand what these men can do with their boats without seeing it. A common, awkward-looking row-boat is first pushed over the gunwale into a heavy sea, and almost before the fact of its having got safely in without being swamped is realized, a man has somehow swarmed over the side and got on board, a turn of the painter is taken round a belaying-pin on deck, two other men follow the first, and the crew hand in the fish, the sea all the time rising and falling to a height of 18 feet or 15 feet, and not one of those engaged appearing to take the slightest notice of it or in any way betraying the smallest consciousness that there is a sea at all. Then the towing with a long rope, which I have never seen before, is most remarkable, and the effect of a number of vessels running down together towards the carrier, each every now and again on the crest of one wave while its boat is on the crest of the next and the long painter is taut in the mid-air between, is something quite beyond one's ordinary experience, and forms a rather interesting study. The quietness, too, with which they knock about among each other in a heavy sea is somewhat instructive, no special lookout or symptom of anxiety being anywhere apparent, and yet all giving each other clear berths and no collisions happening. Verily, great is the confidence inspired by real knowledge and constant practice. And now the boats approach the carrying vessel, the men in them sing out, 'Let go!' those on board reply, 'All gone!' and then the rowing begins, and up and down they go on seas so heavy that every now and then they are lost to sight for an uncomfortable length of time. At last they approach the vessel, and though to an unaccustomed eye it might be sup-

[1] "This work," writes the Duke of Edinburgh, "is carried on in almost all states of weather, such is the importance attached to the immediate dispatch of the fish that the men never seem to think of the possibility of danger to themselves. I have heard of a trawler's boat, with its cargo and crew, being actually lifted by a sea to the deck of a carrier and there left.

"In the excitement and struggles of a large number of these tiny boats, each of which is striving for the first place, or in the subsequent endeavors to reach their own vessels, accidents are necessarily of frequent occurrence, too often attended by loss of life."

BOXING THE FISH.

posed that they must be swamped in coming alongside, they come on all the same, not even keeping a lookout, so far as one can observe, but running in every direction full tilt onto the ship, and as each boat touches, a man watches his chance, and just when the boat rises takes hold of the rail and swarms up over it and fairly tumbles on the deck, holding one end of the long painter in some way, either in his hands, under an arm, or sometimes in his teeth.

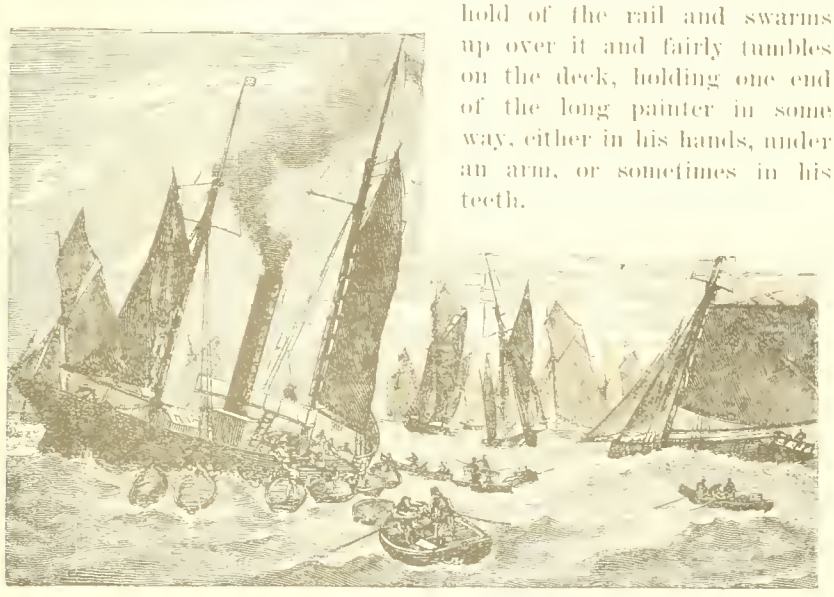


FIG. 22. BOARDING FISH.

"He picks himself up at once, rushes on to the shrouds or to a belaying-pin, takes a turn, and sings out, 'All fast!' and then one of his mates in the boat, who has been paying out, hauls short on the painter until he gets abreast of the waist of the ship or some other part that may be vacant; the men in the boat immediately hand up the boxes one by one, their own man receives them over the rail and tosses them on deck, then puts his delivery note into a basket in the galley, and his work is done. It is the business of each smack to deliver her own cargo on the deck, and no help is given for the purpose, not even in the small matter of making fast a painter or helping in a trunk, and the short time occupied in the operation, as well as the apparent certainty and safety of the whole proceeding, are, to say the least, surprising. Indeed it seems little short of miraculous that in a sea with a rise and fall of quite 10 feet some eighty or ninety open boats should be launched overboard, manned and loaded, towed and rowed a considerable distance, brought alongside a vessel, unloaded, brought back, and hoisted on board again without a single accident, yet I saw this done without anything approaching to a misadventure, and from the general bearing of all concerned I could observe that there was no anxiety whatever on the subject."

Notwithstanding no accident occurred on the occasion referred to above, and although the fishermen exhibited no anxiety, it is nevertheless a fact that the ferrying of fish is accompanied with a great deal of risk and peril, and it not unfrequently happens that men are drowned while engaged in this service. Concerning this the following report was made to the Board of Trade: "During the progress of the investigations held before us it was repeatedly shown that this operation of 'boarding' the fish is conducted without regard to order or system of any kind whatever. So soon as the steam cutter arrives at the fleet, each smack hastens to send its boat alongside first, to fetch stores, letters, etc., and empty boxes for future use, and again to load the full ones on board the steam cutter. The smacks sail up close to the steam cutter, some on one tack and some on the other, dropping their boats alongside as they pass ahead of her, where they lay to, waiting to pick up their boat again. Many boats by this means get congregated alongside the steam cutter at the same time, and a struggle ensues as to who shall unload his fish first. The result is that boats are frequently smashed and sometimes capsized, occasionally entailing loss of life to the hands in them. Some of the smacks also are in the habit of running so close to these boats that a wash is produced, which increases the danger. In the Hull and Grimsby fleets the men who man the boats discharge the boxes onto the deck of the steamer and then generally lower them into the hold, where the steamer's crew stow them away, assisted by a certain number of smack hands, who are paid a gratuity for this work. In Hewett's fleet it is the rule for the boxes to be placed only on the deck of the steamer by the boat's crew."

It may be mentioned here that attempts have been made to devise some other means for transferring the fish from the catcher to the carrier. A sketch was exhibited in the British section at the International Fisheries Exhibition at London, showing how the transfer could be made by means of an endless rope working between a smack and a carrier, the fish boxes being tied to the rope, and pulled on board the steamer through the water. Laboring under the mistaken idea that the beam-trawl fishery is carried on in American waters, Mr. John Bland, of London, who, it would appear, is the deviser of this scheme, addressed a letter to the President of the United States, in which, after speaking of the danger attending the "boarding" of fish, he takes occasion to say: "I would suggest that at a distance of 60 or 100 yards the collecting steamer throw by rocket a slight line to the smack. By means of this line the smack would draw to itself an endless rope, to be arranged over a loose block 6 or 8 feet above the deck. A box or barrel of fish would be attached to the lower part of the rope by means of a simple hook, then dropped overboard, and drawn to the steamer by steam-power. A few minutes immersion would not do the slightest harm to the boxes, and as the water would support the greater part of the weight, a dozen packages of fish might be attached to the rope at the

same time, with a short distance between them, say one box for every 6 yards of rope. By this means I believe the catch could be transferred, day or night, and in almost all weather, with a tenth part of the present labor, and no risk to life or boats, as quickly as the steamer could haul the boxes up her sides. A supply of empty cases could be sent to the smack in the same manner."

Whether this plan will be found feasible or not it is difficult to say. We could not learn that any practical test of it has been made. But the difficulty of keeping two vessels at the proper distance to work in a heavy sea without danger of collision would unquestionably be found very great, and then only one could work at a time, which would be of small consequence when a hundred others were waiting to discharge their fish.

In a remarkably brief space of time the steamer's deck is filled with boxes, which as fast as possible are being transferred from the deck to the hold, this transfer being actively conducted by the carrier's crew, who are sometimes assisted by the men from the fishing-smacks. Each steamer has a compartment in which enough ice is carried to preserve the fish. This place is called the "ice-house," and is connected with the main hold—where the fish are stowed—by a hole in the bulkhead which can be opened and closed as required. While part of the steamer's crew are busied in passing down and stowing the "trunks" of fish others are hard at work converting the blocks of ice into fine particles, and when a tier of boxes have been stowed in the hold a layer of fine ice is thrown on them, and so the work goes on until the hold is filled (if there be fish enough) with alternate layers of fish and ice, a few baskets of the latter being thrown on top of the last tier of boxes. Over all is laid a cloth, and then the hatches are closed and securely battened down.

In the mean time the confusion, incident to getting the fish on board and the chaffing of the smacksmen who crowd the steamer's deck, has ceased; most if not all of the boats have returned to their respective vessels, which may now be seen stretching off together in obedience to the admiral's "sailing signal," while the carrier's bow is pointed for port, and no time is lost in getting all sail set that she will carry, for no effort is spared to increase the speed.[1]

II. Marketing the Catch; Fish Carriage, etc.

1. *Landing the fish at Billingsgate.*—The arrival of a steam carrier in the Thames is immediately telegraphed to London from the signal stations near the river's mouth, and Billingsgate makes all necessary provision for receiving and disposing of her cargo. As soon as she arrives her load is rapidly transferred from the steamer's hold to the

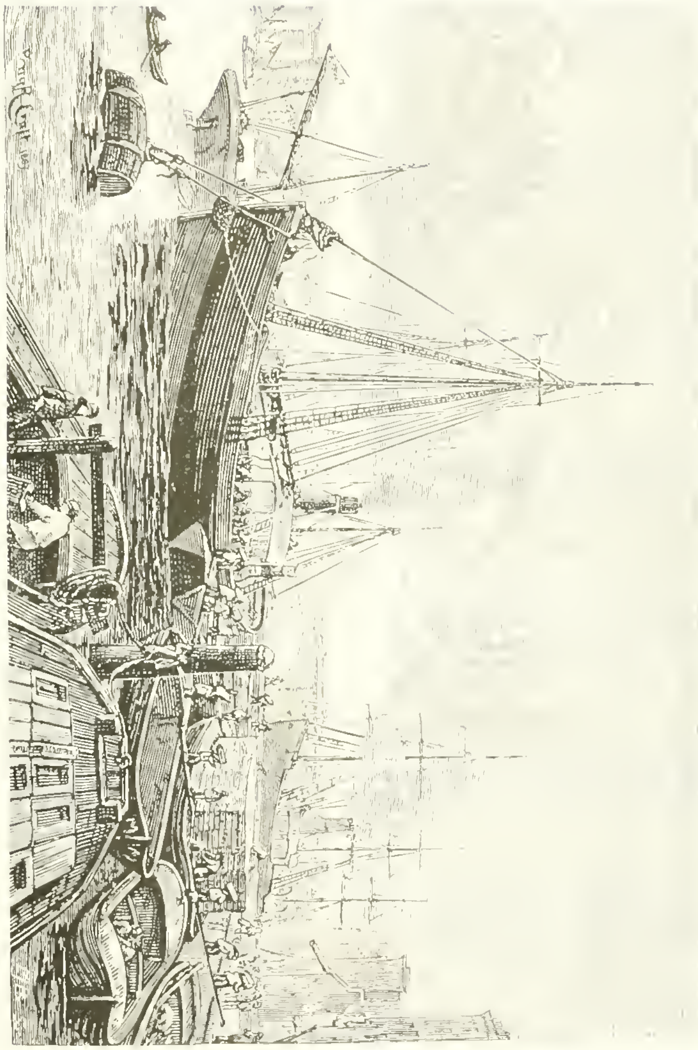
[1] It does not always happen that enough fish are taken to make a sufficiently full cargo for a carrier to go to market with, in which case she may wait until another day to complete her load.

market by a gang of men, who take the trunks of fish on their shoulders and heads, and passing in single file back and forth over gang-planks that stretch across the decks of barges, or pontoons, form one of the most peculiar and grotesque processions one ever has the opportunity to see. By some dock regulation, or because of a lack of sufficient depth of water, the steam carriers are prohibited from coming alongside of the pier, upon which the market building stands, to discharge their cargoes. Large pontoons are moved in front of the market, and to these the vessels make fast, so that the fish must be carried a distance of 75 to 100 feet or more. Gangways of plank are laid from the steamer to the pier, but as these are often unprotected by railings of any kind, it sometimes happens that one of the fish porters falls into the river, a mishap which is liable to have fatal consequences. But since it is the business of those bringing fish to Billingsgate to "make their own roads," less attention is paid to safety than would seem desirable. Nothwithstanding an occasional accident the work goes on vigorously until the whole cargo is landed, and the carrier is once more ready to proceed to sea in quest of the "fleet" she attends, and to brave again the perils and discomforts of a passage to and from the North Sea fishing grounds.

2. *Selling fish by auction.*—The great gong striking the hour of 5 in the morning announces that the salesmen of the market are to begin business, and with a hurry-scurrying rush they reach their desks, surrounding which are a number of low benches or tables, upon which are placed the fish that are put up at auction, sold, and speedily cleared away to give place for new stock, this process being repeated over and over again until the sale closes. As fast as the fish arrive in Billingsgate, after the day's sales begin, they are rapidly disposed of at auction,[1] the salesmen using their long account books, instead of a hammer, to knock down the goods. One can not imagine a more novel sight than can be witnessed here in the early morning when business is at its full swing, the porters rushing hither and thither with packages of fish on their heads, quite regardless of whom they may jostle or be-

[1] "The auction," says a writer in "The Fisheries of the World" [published by Cassell & Co., London, 1883], "was formerly conducted in Dutch fashion, so called; the prices sinking till they reached the level of some one of the purchasers, who was not allowed to inspect, except in the most cursory manner, the bargain he was trying to secure. Nowadays most salesmen are licensed auctioneers, and the goods are quickly knocked down to the purchasers in the usual manner. Soles, plaice, fresh haddocks, skate, etc., are sold in 'trunks,' but cod and ling by the score or half score. Herrings are sold on the vessels alongside by the long hundred, a very long hundred, for it exceeds that number by thirty. Eels are also sold for the most part on the Dutch boats which bring them, and sprats are sold on board the vessels by the bushel. Salmon, salmon trout, and some of the finer fish are sold by private contract."

The average wholesale prices, as stated by a leading salesman of Billingsgate to Mr. R. W. Duff, M. P., are as follows: Sole, salmon, brill, gray mullet, John Dory, whiting, and eels 1s. (equal to 24 cents) per pound; haddock, sprats, cod, herring, coal fish, plaice, ling, and hake bring an average of only 2*d.* (4 cents) per pound.



DISCHARGING A STEAM CARRIER AT BILLINGSGATE.

daub, for no one stands on ceremony, and politeness can not be observed in the midst of a pushing, surging crowd, every individual of which seems to think only of the business that he is intent upon.

"The only comparison," says Sala "I can find for the aspect, the sights and sounds of the place is—a rush. A rush hither and thither at helter-skelter speed, apparently blindly, apparently without motive, but really with a business-like and engrossing preoccupation for fish and all things-fishy. Baskets borne on the shoulders of the *facchini* of the place skim through the air with such rapidity that you might take them to be flying-fish. Out of the way! Here is an animated salmon leap. Stand on one side! a shoal of fresh herring will swallow you up else."

On all sides may be heard above the general din the stentorian tones of the loud-voiced salesmen, who perched on their stands, and raised somewhat above the heads of the hurrying crowd around, shout their calls to attract buyers. From one we hear the cry: "Here, ye sole buyers, sole buyers, sole buyers, who'll have this fine trunk of soles?" While a rival calls out: "This way, ye haddock buyers, come on haddock buyers, give us an offer for this lot of fine haddocks." Others call for "cod buyers," "plaice buyers," etc., through the whole list, perhaps, of edible fishes, until the confusion of sounds is so great that a stranger can scarcely comprehend how business can be conducted under such circumstances, and it would be impossible for one who has not seen it to form any conception of such a scene as may be witnessed on any week-day morning at Billingsgate. One thing is more remarkable, perhaps, than anything else, namely, the method of bidding, which seems peculiar to the place, for though we tried hard to catch the sound of a buyer's voice, or to detect a sign by which he indicated his bid, we ingloriously failed in every instance, which was rather mortifying when we were made aware that the sharp eyed or keen-eared salesmen had received dozens of offers from persons in the crowd almost at our elbow.

As fast as the fish are sold they are removed by porters and the vacant places filled by new material until the sales end for the day. While fish are sold at auction in Billingsgate, the system of selling by Dutch auction generally prevails in the markets of the smaller ports where there are no licensed auctioners.

"On the coast the fish is generally bought by a buyer who is in direct communication with some firm at Billingsgate, which acts as the buyer's salesman. At Billingsgate the fish is either bought by the retailer direct, or by a middleman, who is known in the market as a 'bomaree.' The 'bomaree' fulfills the same functions in the fish market which the 'regrater' used to discharge in the corn market. He buys fish for which there is no immediate demand at the moment, and sells it again later on in the day. * * * But for his intervention many small retail tradesmen would be forced to attend the market at an hour when their attendance would be inconvenient to them. The 'bomaree' enables the

small costermonger to postpone his visit to Billingsgate till he has disposed of his purchases of the previous day."[1]

Such are some of the features connected with the selling of fish at Billingsgate. Elsewhere mention is made of the methods of receiving, selling, and shipping of fish at Grimsby, which differ somewhat from those in vogue at London.

3. *Fish sale at Brixham.*—In the summer of 1883, while making a brief visit to Brixham, the writer had an opportunity of learning something of the methods of trawling, as pursued from that port. Since the description of the care of fish, marketing, etc., which we have given applies more particularly to the methods adopted by the North Sea fishermen, and at the larger ports, it may be of interest to say something here of how the business is conducted at Brixham. The vessels employed from Brixham are mostly single-masted cutters which fish not far from its harbor, though a number of ketch-rigged trawlers which go to the North Sea are owned there, and for about two months in summer a few Brixham boats fish off Tenby, in Wales. With the exception of those fishing in the North Sea, each of these vessels carry a crew of three men and a boy. The vessels fishing about home stay in harbor on Sunday, as a rule. They generally land their catch every day—usually in the morning—sometimes twice a day when the conditions are favorable. They carry no ice. As soon as the trawl is got on board in the morning the vessel is headed for Brixham, and all necessary sail is set. The fish are assorted and packed in small baskets called "pads," of which there are two sizes, one holding about 10 or 12 pounds, and the other double that quantity.

If the weather is fine the cutter heaves to outside the pier, the boat is got out, the fish put into her, and two of the crew take the "lot" to the harbor, where they land their cargo at the market. As soon as the fish are sold—sometimes before—the men return to their vessel that, in the mean time, has been jogging outside, and which immediately heads off for the fishing ground again. If the wind blows fresh this can not be done; therefore the smack anchors outside, if the wind is off the land; otherwise she goes to Dartmouth, Torquay, or Plymouth.[2]

The baskets have the vessel's mark attached to them, so that they may be known. All fish are sold at auction to the highest bidder, and not at "Dutch" auction, as at Grimsby, where the *first* bidder takes

[1] The British Fish Trade, by Sir Spencer Walpole, lieutenant-governor of the Isle of Man, pp. 58, 59.

[2] In a paragraph entitled "Sea Fishing on the Southwest Coast," by J. C. Wilcocks, which appeared in the London Field of February 28, 1885, the following statement was made relative to the Brixham smacks going to other ports: "The largest number of trawlers delivering fish at Plymouth during the past week was a hundred. Between thirty or forty of the vessels were from Brixham, the whole of the smacks belonging to Plymouth being a little under seventy in number. The increase in number of vessels delivering fish at Plymouth was owing to a strong east wind. At Brixham the largest number of vessels delivering fish was only thirty-five, a small number for this important fishing port."

SELLING FISH AT BILLINGSGATE MARKET.

whatever is being sold. The sales at Brixham begin at 9 o'clock a. m., and continue as long as fish arrive at the market.

They are conducted by a number of salesmen, who dispose of the fish as fast as it arrives, 15*d.* in the pound being charged for commission on sales, and dock fees. The prime fish goes chiefly to London, offal mostly to country trade, the greater part of the conger eels finding a market at Manchester. A number of women were at work cleaning and packing the poorer grades of fish, chiefly small haddocks, which are hawked about the interior towns, while a somewhat better grade was being packed in carts and wagons with ice; these, it was said, were for sale at Torquay.

4. *Shields as a fish market.*—Shields has of late grown into considerable importance as a market for trawled fish, since it now has a large fleet of steam trawlers.

The following account of the arrival of a fleet of steamers at the Shields fish market, and the sale and shipment of their cargoes, is quoted from the (London) Fish Trades Gazette of October 17, 1885:

"When mild September gives place to chill October, and the last of the herring boats has spread its brown wings and disappeared, north or south, as the case may be, then the steam trawler seems to settle itself down to business, to proudly take sole possession once more of the fish quay at Shields, just like some party who had been bewildered and harassed by summer visitors and was right glad to get rid of them. There is a wealth of all that is picturesque in the herring fleet, its toilers, and their doings; but the steam trawler, in full winter vigor, gives you a picture that is thrilling—one that serves to make you totally oblivious to the keenest blast from the North Sea when you have screwed up the courage to steal from beneath the blankets and venture down to the low lights in the early morning. A befitting companion picture is to be had in the scene on the quay after the fish is landed, and salesmen are bawling themselves hoarse, when big consignments are being hurried away and fishwives are in full tongue. Being anxious to look on the scene as a whole, from beginning to end, the writer the other morning found himself shortly after 6 endeavoring to secure shelter from a biting sea breeze, under the lee of a pile of casks and boxes, beneath a huge shed, which serves as dispatching department to the various dealers. There was little astir that indicated the scene of life and bustle which was soon to follow. Everybody seemed to be bent on shelter like myself, and the spacious boarding of the quay was tenanted only by awkward lorries lying here and there. Eventually, there was a movement of one or two individuals, who looked as if something to do would come as a relief, towards the extreme end of the jetty, which reaches out into the river and gives a view down the harbor and out to sea. There they stood, hands thrust elbow-deep into their pockets, and, sucking vigorously at local twist tobacco, gazed out onto the waters. 'What's the matter with those fellows?'

I asked of a neighbor. 'They're only looking if anything's coming,' was the reply. Presently, signs of animation amongst the group drew others along, myself amongst the number. The first trawler was in the offing. However, there was some dispute on the point. 'I tell yee it's not the ——,' says one. 'It's the tug ——,' says another, and so on, until one ancient looking individual, who pits his eyesight against the younger of the crowd, exclaims, 'It is the ——. There's her derrick. And there's her beam.' The object of dispute seemed some miles away. I watched her for some half hour, growing larger and larger, now sinking to all appearances in the water up to the top of her funnel, then riding in bold relief on the top of a wave. Several others had been sighted in the meanwhile, and all were voted trawlers. The first one seemed bent on getting first to the river, and again and again huge rolls of black smoke came from her funnel, mingling with occasional puffs of steam which rose from her valves as she lifted to the seas, these demonstrations of activity bringing forth the remark, 'He's firing up, anyhow.' At length she came between the piers and into the smooth water of the river, and with her paddles slowly dabbing the water, drew alongside the quay. It was low water, and from the quay above an over-all view could be had of her decks. Her black funnel was powdered like a wedding cake several feet upwards, where the spray had struck it and left the white salt hard baked on. The last shot had evidently been a good one, for the sorting of it up had not been completed. Several of the hands encased in oilskins, and looking like yellow lobsters standing on end, were busy putting the cargo to rights. The fore-deck was divided into pens, like a cattle market, each kind of fish being stuck amongst its own kith and kin. During the whole of the operation the quick pulsations of the donkey-pump were heard, and one of the hands vigorously plied the hose-pipe right and left as a kind of polishing up of fish, deck, boxes, and boards. A pile of baskets were then put aboard, and filled, so much into each, as far as the smaller fish would go. These, with the larger fish, brought up in twos and threes, were then hauled on to the quay, and taken charge of by assistants of the salesman who usually had the 'selling' of the boat. Whilst all this was going on, other trawlers had arrived, one after the other, and assembled round the quay, until there was a general hauling up of fish going on, to the accompaniment of donkey-pumps working, lorries rolling to and fro, and shouts from the men ashore and afloat.

"The scene on the quay was now one of great animation. The fish had been taken along from the trawlers and placed in various lots upon the quay. The larger fish were sorted up into groups; for instance, you might see two or three cod, or two or three ling, lying together, and here and there a conger, a grim-looking cat-fish, halibut, turbot, or monster skate. The plaice, soles, codlings, whitings, etc., remained in baskets. It was a sight to see this mustering of the tribes of the

deep all still in death, save generally the refractory conger, who always did refuse to adapt himself to fish market circumstances; and the plaice, with their beautiful orange spots. With the latter the auctioneer's hand, of course, had no trouble, for they, jammed head first into baskets, could only feebly flip their tails. But as to the conger, he invariably shows that 'there is life in the old dog' by wriggling astray from his proper squad, and joining the stock in trade of some other dealer. A knock on the head generally brings him to his senses—or, rather, knocks them out of him—for awhile; but he invariably tries another move when the fit is over, and so on until, like a sensible fish, he agrees that 'it ain't no use going agin the grain.' The cargoes of the trawlers are almost invariably eked out by a basket or two of crabs, crawfish, and a whole category of nondescripts, which give an interesting insight into marine life of the lower depths of the ocean. Soon some five or six auctioneers were busily engaged in selling the fish, and the running-fire of chaff appeared to be endless. The sales, on an average morning, last over some hours, and on turning attention from the group which are standing round the collections of fish on the floor we find that the trawlers have, for the most part, either gone, or are in the act of casting off from the quay, to go up river to secure coals for the next trip. The close of the auction sales does not, by any means diminish the animation on the quay. For a long while afterwards buyers were busy moving their purchases to their respective packing sheds, where a number of busy hands were always to be found. About the most queer sight of the fish quay was that of operations at the 'gutting' tubs. The corporation have provided a proper place for the fishwives—who hawk fish locally—to gut and cleanse their purchases before setting forth on their rounds. Here some half dozen quaintly-dressed women were up to their wrists in the animating operation of emptying haddock, cat fish, and the like, their tongues keeping up a round of merry gossip.

"Before the trawlers were seen going to sea again, the bustle of the day was about over. I watched several of the boats depart, and could not help thinking that their calling was as risky as it was hard. They have to bear up against downright bad weather before giving in, for when the sea is rough and trawlers are few, then high prizes are made. The boats often suffered by sudden outbursts of bad weather; and sometimes, thinking that it might blow over, have had to plow their way home through a perfect hurricane. As if to preface them for this kind of ordeal, they invariably get a dusting during October. Despite their daring, however, accidents are few, and happily it is several years since any of them got into serious trouble. Somehow they always seem to be unlucky in the spring, for when the approach of Easter sends up the price of fish, the weather is generally so rough as to defy them leaving home."

5. *Fish carriage.*—The subject of fish carriage is one of great impor-

tance so far as the success of the British beam-trawl fishery is concerned, but for obvious reasons its various features will not be discussed at length in these notes. As has been shown, large quantities of fish are taken direct from the fishing fleets in the North Sea to London; the amount of fish thus carried from sea to Billingsgate has been estimated by competent authority at 42,000 tons yearly, while 90,000 tons reach London by land.[1]

"Owing to the fact," writes Mr. Plimsoll, "that Grimsby and Hull are so much nearer the fishing ground than London is, by far the larger portion is carried into those ports and thence off by night trains to London.

"The more valuable kinds of fish on being landed are packed into large boxes or hampers, but the 'kit' haddocks are put loose into what are called machines. These machines are long boxes lined with lead, some 15 feet long by 5 feet broad and 2 feet deep, which are divided internally into four equal spaces, each of which holds half a ton of fish, and the machine is carried on the railway on a truck or wagon with low sides. On arriving in London these machines are lifted bodily from the railway wagon by a powerful hydraulic crane, lowered onto a strong street trolly, and drawn by horses into Thames street, where they form a line sometimes a quarter of a mile long, and these are the things (and these only, as any one may see any day by going into Thames street that cause the obstruction and overcrowding, as containing the less valuable fish, they wait until the vans containing the prime, which is sold first, are unloaded. The detention is sometimes for eight or nine hours (the average over a long period was found to be four hours and forty-nine minutes), so that the average detention of the tanks containing offal is probably not under six hours. Some cod and other kinds of prime are carried in these tanks or machines, but the quantity is very small indeed, compared with that of the 'kit' haddock—the great bulk of cod, etc., being packed in boxes and hampers."[2]

Much fault has been found with the rates charged for the transportation of fish by rail, it being claimed by interested parties that these are excessive. As, however, this is somewhat of a local matter, it does not seem necessary that anything more than a passing allusion should be made to it.

It is proper, however, to remark that the carriage of fish, notwith-

[1] "It must not be supposed," says Walpole, "that the whole of the fish brought to London are consumed in the metropolis. On the contrary, London is the central source of the supply of a district which every year tends to become larger. One of the most certain consequences of improved locomotion is the concentration of trade. It is found practically more convenient for buyers and sellers to meet in one place than to scatter themselves among a great many places. In nothing is this tendency more perceptible than in the fish trade. London and Birmingham, and to a lesser extent Manchester and Liverpool, are the markets from which nearly the whole of England is supplied with fish; and London is annually becoming to a greater extent the center of supply."

[2] Fish Trades Gazette, June 2, 1883.

standing complaints that have been made concerning delay, seems to have reached a high state of perfection, and it would, no doubt, be to the advantage of the American fish trade if swift-running trains could be employed in the United States, as in Great Britain, for transporting fish. According to the Duke of Edinburgh, only about 400 tons of fish were condemned at Billingsgate in the year 1881 as unfit for food, a large proportion of which was shell-fish. This, he thinks, speaks well for the system of carriage, as London receives a yearly supply of about 143,000 tons of fish.

I. Method of Dividing the Profits.

There are certain local differences for the division of the money obtained from sales of fish caught by trawling smacks, but the following table showing the apportionment of a trawling smack's assumed earnings of £800, furnished by Mr. Sims, of Hull, and published in the report of the inquiry at Hull, by the Board of Trade, will give a clear idea of the methods adopted for settlement at the large trawling ports on the North Sea:

Assuming that a smack earns £800 to "settle on," that is, available for division between owners and crew:

	£	s.	d.
The skipper's share is	137	10	0
The second hand's share is	112	10	0
Provisions found by owner for the three other hands, say	60	00	0
Wages for three other hands, say, £1 15s., and 10s. per week	117	0	0
Insurance, on £900, the assumed value of the vessel, at 3 per cent	27	0	0
Repairs for wear and tear of vessel, sails, spars, fishing-gear, cleaning bottom, etc	250	0	0
Interest on £900 at 5 per cent	15	0	0
Depreciation of vessel	50	0	0
	799	0	0

The skipper's share	137	10	0
Less provisions	20	0	0
	117	10	0
	or £2 5s. per week.		
Second hand's share	112	10	0
Less provisions	20	0	0
	92	10	0
	or £1 15s. 1d. per week.		

The foregoing statement suggests the approximate earnings of a first-class North Sea trawler and her crew. As a matter of course there is considerable variation in the amount earned by different vessels, some stocking more than £800 and others much less; the average gross earnings of sailing trawlers, according to Dunell, for the three years ending in 1883 was £650 per annum.

The earnings of steam trawlers are much greater, as a rule. The steam trawlers belonging to the Grimsby company for the year ending February, 1883, averaged £2,500 to each vessel, but as these carry more men and their expenses are necessarily much larger, the crew's share is not so large in proportion as the difference in the relative stocks would seem to indicate.

In conversation with the skipper of a Brixham smack, I was told that 400 pounds of fish (exclusive of rays) is considered a good day's catch for one of the trawlers working off that port, and this amount is rather above than below the average. If a vessel stocks £4 a day it is thought she is doing well, and a skipper's share does not generally exceed £1 per week, and if he make 5*s*. or 10*s*. more than that he is thought to be "lucky."

According to Mr. Charles Hellyer, of Hull, the maximum earnings of a sailing trawler from that port, clear of stock charges, are £1,400 a year, while he thinks the fleet average £850.

He thinks an average year's work for a skipper not owning any of the vessel would be £116. The skipper takes eleven sixty-fourths of net stock, mate nine sixty-fourths, and third hand, if by share, gets occasionally nine sixty fourths, but generally eight sixty-fourths, or is paid by the week, the wages being about £1 per week and found by owner. The deck or fourth hand is generally hired, as there are few apprentices now, and gets 18*s*. per week, while the cook's wages—he being the smallest—ranges from 10*s*. to 12*s*. per week; both of these are "found" by the owner. In addition to the shares and wages the crew have exclusive right to the fish livers, the proceeds from which are divided into four shares, the skipper, mate, and third hand getting a share each, the deck hand two thirds and the cook one-third of a share.

According to the Duke of Edinburgh:

"The crews of the trawlers engaged in the North Sea are fed by the owners, and receive a certain rate of pay weekly, in addition to which they are paid a percentage of the amount realized by the sale of all fish caught."

This statement, that the crews of the North Sea trawlers are fed by the owners, is only partially correct, as has been shown, since the shares-men pay a part of the "grub bill." And it is also a fact that a portion of the crew are hired, at least from some of the larger ports, and have no pecuniary interest in the catch. The statement he has made may apply to certain localities, as Yarmouth, for instance, but it is not generally applicable.

"The system of division on the Channel trawlers is somewhat different, namely:

	Shares.
Owner receives	3¾
Master receives	1¼
Two men, each 1 share	2
Total	7

The boys do not share in the catch.

Mr. Jex tells me that the crews of all the Yarmouth trawlers are hired by the week, receiving, however, a certain part of the stock resulting from the sale of the fish. The weekly wages paid at the present time to the skipper and crew amounts in the total to £3 12*s.*, equal to about $17.50. Besides this, three twentieths of the net stock is divided among the crew, the skipper taking nearly half—1*s.* 5*d.*—while the rest is divided among the other men. This is called "poundage," because it is a certain part of each pound earned by the vessel. It should be stated that when the drifters (herring vessels) are at work the wages frequently are much larger than quoted above, for the reason that the men are sought after by the skippers of the herring catchers. At such time it is often necessary for the owners of trawlers to pay as much as £5 (about $25) per week for the skipper and crew, to keep the men.

The Yarmouth men are "found" in gear and provisions, the owner paying all expenses.

The skippers and men are shipped as they can be obtained, as in New England. The men often make a demand for increased pay, and, if the vessel is ready for sea and men scarce, they frequently succeed in obliging the owners to pay high wages.

J. Effect of Beam Trawling on the Abundance of Fish on Grounds frequented by British Vessels.

Much has been said and written, *pro* and *con*, concerning the effect of beam trawling upon the abundance of fish. Among practical fishermen there appears to be a remarkable consensus of opinion on this subject. With few exceptions they believe that there has been a very marked diminution of fish on all the grounds ordinarily visited by beam-trawlers, and not a few are ready to predict almost the entire destruction of many species, while instances are cited of fishing grounds that were formerly rich fields for trawling, now being so poor that they are seldom visited. It is a somewhat remarkable fact that the first notice obtainable of the use of trawls, the petition to Parliament in 1376–'77, quoted on page four of this report, speaks of the destruction of immature fish and the consequent evil effect on the fisheries liable to result from the use of such apparatus. The same thing has been repeatedly brought to the notice of the British Government, and a great mass of evidence has been submitted to establish this point, and urged as a reason for putting restrictions upon beam-trawl fishing. The annual report of the London Fish Trade Association for 1883 calls attention to the report of the fish-supply committee, dated August and November, 1881, and which, among other matter, contains the following:

"The first point which struck us, and upon which undoubted stress should be laid, is the destruction of spawn and small fish, and the taking of immature fish. The evidence proves conclusively that large

quantities of immature fish are uselessly destroyed, and also that many of the ancient fishing grounds have been and are greatly deteriorated and have ceased to be productive, and we are of opinion that the court should communicate with Her Majesty's Government, urging that legislative steps be promptly taken to remedy these evils."

On the other hand several eminent scientists have claimed that it is quite impossible for man to materially influence the supply of fish life in the ocean. And it is a singular fact that almost at the very time (winter of 1883–'84) when the Scotch fishermen (chiefly those engaged in line fishing) were testifying before a royal commission, and stating with scarcely a dissenting voice, that the system of beam-trawl fishing was ruining the inshore grounds to such an extent as to make them almost worthless, fish of all kinds should be found off the Scottish coast in numbers not equaled for many years. Mr. T. F. Robertson-Carr, writing under date of February 12, 1884, says:

"Both trawler and line fishermen have had heavy catches of cod, ling, haddocks, and flat fish; both as to size and quality all are agreed that this season's fish are rarely surpassed."

The following clipping from the Edinburgh "Scotsman" of February 21, 1884, is corroborative of Mr. Carr's statement. Under the heading of "Remarkable Success of the Winter's Fishing on the Scottish Coasts," it says:

"At the last meeting of the Scottish Fishery Board returns from the various districts were presented, showing that unprecedented success had attended the prosecution of the winter fisheries on certain parts of the Scottish coasts. In the Eyemouth district no less than 92 tons of haddocks were caught in one week, the value of which was £1,300. The average earnings reached nearly £15 per boat, and during the season the total quantity of haddocks landed by 30 boats was computed at 924 tons, realizing to the fishermen something like £12,666. This, it is estimated, would give an average yield and value per boat probably exceeding that for the corresponding period of any previous year. The Montrose fishermen met with similar success—the haddock fishing in that district having been rarely, if ever, so remunerative. In one week some of the crews realized from £36 to £45 per boat.[1] The enormous hauls obtained for some time have not, however, been confined to haddocks. In the Anstruther district there were 12,365 crans of herrings landed in one week, during which 3,100 telegrams were dispatched and 800 fish wagons loaded. At Wick, in one week there were landed, in addition to an estimated catch of 911 crans of herrings, immense quantities of whitefish, comprising about 16,413 cod and ling, 690 saithe, 10¾ tons of plaice, 2½ tons of haddocks, 2½ tons of halibut, 3½ cwt. of brill, 4½ cwt. of soles, 760 skate, etc."

Though the above would seem to throw considerable doubt upon the correctness of statements which go to show the decrease in the abund-

[1] The crews alluded to here number seven persons to each boat.

ance of fish on trawling grounds, we nevertheless can not lose sight of the fact that the testimony of those best qualified to know positively the merits of this question can scarcely be thrown aside as of no value. The following extracts from a lecture delivered by Mr. Edward Jex, C. C. (a salesman at Billingsgate, formerly a practical fisherman, and still a smack owner), at the Norwich Fisheries Exhibition, in 1881, will be of interest in this connection as showing the other side of the question:

"I am well aware there are those who will not admit of any falling off in the supply of trawl fish, but the old proverb, that facts are stubborn things, is strictly applicable to this case; and I do not doubt that, by adducing the plain incontrovertible facts without any distortion, I shall be able to prove that the answer just given by me is the perfectly correct one. For this purpose it will be necessary for me to go back for a few years from the present—twenty to twenty-five will suffice. At that period a first-class trawling vessel was not more than half the size of many of the splendid vessels of to-day, some of them from 50 to 80 tons, and working a beam nearly if not fully double the length; consequently the mouth of one of these nets will go over double as much ground as a net would twenty-five years back, and with what result? One of the small vessels, with a net about half the size, would at that period take, in nearly every case, as much fish in one night as one of these large vessels now obtains in a week, and the fish were much larger; in fact, the full-grown matured fish were so plentiful that the small fish, such as taken now, would at that time have been valueless. The gentlemen present who have been engaged in the trawl fishing for so long a period will, I have no doubt, be able to corroborate my statements. I also wish to impress upon you, my hearers, that there are now fully five or six times the number of vessels employed in the deep-sea fisheries around our coasts than there were twenty-five years ago; yet with all this increase in vessels, and the increased size of the net, we at the present time find, and have found for some time past, a very large falling off in this branch of the fisheries.

"Thirty-five years back there were from the port of Hull 25 vessels engaged in trawling, their combined tonnage was 625 tons, and their insurance value £6,000, but to-day there are 150 vessels, their tonnage 31,500 tons, and insurance value £150,000.

"The surest index to the supply of fish is and always will be the quantity which is upon sale in the various markets, and the prices of the same. Twenty years ago soles were sold 12*s.* to 20*s.* a trunk, plaice and haddocks at 5*s.* per pad, and all other kinds of trawl fish at equally low prices and within reach of the humblest families of the land. But as time has gone on so has the trawl fishing gone on, I am sorry to say, for the worse. That splendid and nutritious fish, the sole, is being swept out of our seas, is no more the cheap food of the poor and middle classes, but is nearly a luxury on the rich man's table, and is almost a rarity to some fishmongers' shops. During this last month I have sold

trunks of soles at from £5 to £10, and plaice at from 15*s.* to 21*s.* per trunk, haddocks from 12*s.* to 16*s.*, and all other kinds of fish have been proportionately high.

"To what cause can we assign these high prices? Simply that the shortness of the supply of fish is out of all proportion to what it was for vessels twenty or twenty-five years back. If it were not so, we should find it bear strongly in favor of the purchaser, but with the large numbers of vessels of the finest class, and every means man can use for the capture of fish, we have found the decrease in the catches has had such an effect on the advance in prices that the smack owner of to day, in many cases, is quite unable to live by his industry; his vessel and gear, instead of being a source of profit, are a burden upon his means. For the past few years I fear there are but few who have cleared their way, particularly trawlers. Not only in the price is the difference to be noticed, but in the size at the period of which I am speaking; twenty-five years ago the fish sent to the various markets of the kingdom were of a proper size, but such is not now the case. At the present time a very large proportion of the fish sent for sale to the various markets are but little more than small brood and fry, and ought not to be captured. This is not only the case of one particular description, but is applicable to every description of fish taken with either the trawl, drift, or seine, and other nets I have before named. Take, for instance, the small plaice and haddocks from several parts; likewise let us look at the small immature fish sent for sale from all parts of the coast. The sole, which has acquired the designation among the buyers of 'slips' and 'tongues,' these tongues vary from 5 to 9 inches in length (and it must be borne in mind that I am speaking of the appearance of such fish in our markets not as infrequent but as of daily occurrence), there are of these small immature fish as many in one box as would fill four to six boxes, at least, if they were allowed to grow twelve months longer. These small fish frequently fill only half or two-thirds of a box, and are covered over with a few middle and large-sized fish. No person will for a moment contend that such small immature fish are fitted for the food of mankind. Why is it that these small fry are caught and the food of our increasing population destroyed?

"I will here mention some of the principal fishing grounds, and I can say most emphatically that many of them are depopulated to such an extent that very few will pay a trawler to work them; others are becoming in a like state as rapidly as possible. There is not one of the fishing grounds I will here name have the fish upon them there were a few years back—Rye Bay, the Diamond Ridge and Varne, the Falls, Inner and Outer Gabbard, the Flats, Smith's Knoll, the Lemon, Shoals of the Hurry, Winterton Ridge, North Northeast Hole, Well Bank, Black Bank, Smrat Bank, Botany Gut, Silver Pits, Southwest Pit, Northwest Pit, Clay Deep, Southwest Flat, West Shoal, Dogger, Swash, Dogger Bank, East Rough, Inner Ground and Off Ground, Outer and

Inner Rough, on the coast of Jutland, Horn Reef, Borkum, Ameland, Texel Hakks, also the Little and Great Fisher Bank, and the grounds off Penzance, Plymouth, Brixham, and Dartmouth."

Mr. Jex, like many others, believes the cause of this depletion, is due, in a great measure, to the smallness of the mesh in the cod-end of the trawls. This fact is so well recognized by many trawl fishermen that, as has been mentioned in a previous chapter, various devices have been brought forth to insure the escape of immature fish.

Just what will be the final result of beam-trawling on the supply of fish it is now difficult to say; time alone can tell. While, however, it may be conceded that many who are in good positions to judge accurately have grave apprehensions of the future, it goes without saying that the fisherman who depends on his work to support himself and family can not afford to look beyond the present, but must use his utmost endeavors to catch all the fish he can, since it is for that purpose he ventures forth to brave the perils which always surround him.

K. A Cruise on a British North Sea Trawler.

Previous to my departure from the United States to attend, on the staff of Prof. G. Brown Goode, the International Fishery Exhibition held at Berlin, Germany, in 1880, I was instructed by Prof. Spencer F. Baird, United States Commissioner of Fish and Fisheries, to make one or more cruises on a first-class beam trawler, if it was found practicable to do so. The object in view was that a practical study of the beam-trawl fishery might be made, and as much information gathered of its details as would enable me to prepare a report sufficiently full and explicit to convey to American fishermen a comprehensive idea of the apparatus used and the methods of fishing. Professor Baird, being fully cognizant of the importance of the beam-trawl fisheries of Europe, and having in mind the enormous extent of the fishing grounds to which citizens of the United States have access, deemed it desirable that this should be done. The result of my studies of the British beam-trawl fishery, then and subsequently, has been given in the preceding pages, to which the following account of a cruise in a Grimsby trawler may, perhaps, be appropriately added.

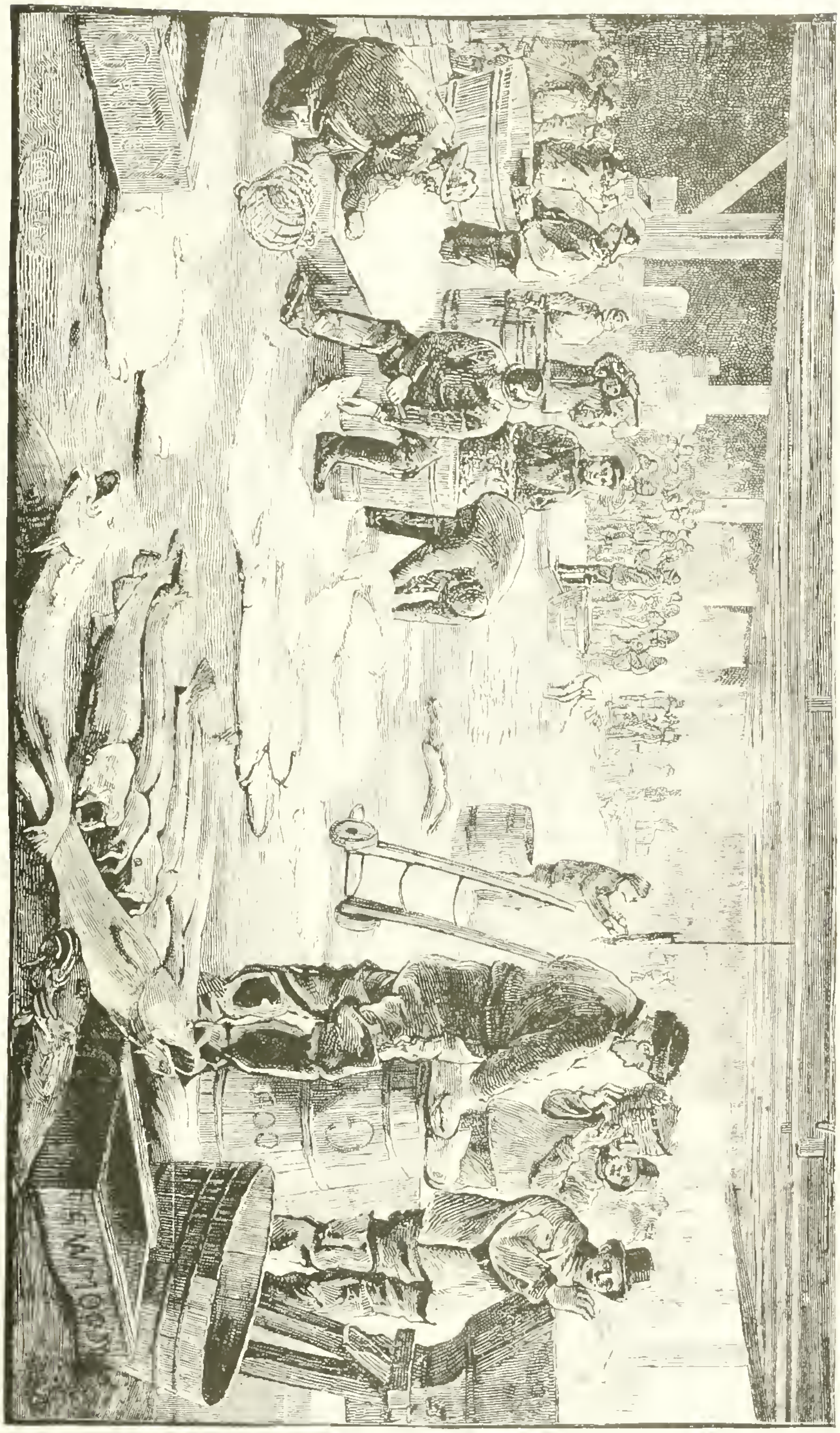
Leaving Berlin on the evening of June 20, 1880, with Professor Goode and his private secretary, Mr. Julius E. Rockwell, we reached Flushing the following evening, and arrived in London on the 22d. On the next day after our arrival, Professor Goode and myself met Mr. Spencer Walpole, now lieutenant-governor of the Isle of Man, but then inspector of British salmon fisheries, who very kindly gave us the benefit of his knowledge and advice in regard to the best locality to visit in order to gain definite information of the beam-trawl fishery. This he decided to be Grimsby, at the mouth of the Humber River, and which is one of the most important fishing stations in Great Britain. He also

provided me with a letter of introduction to Mr. Harrison Mudd, a gentleman largely interested in the fisheries of Grimsby, and who held the official position of a town counselor of that port.

Passage for New York had been, provisionally, taken for our party on the North German Lloyds steamship *Neckar*, which was booked to sail from Southampton July 6, and it was thought that if I could get away on a trawler within a day or two there would be ample time to make a short cruise—long enough to get an idea of the fishery—and for me to reach Southampton soon enough to join the rest of our party on the *Neckar*, though this was only a secondary consideration, which was not to interfere at all with my trip. Accordingly, I left London next morning (June 24), and reached Grimsby the same day. After some delay I had the gratification of meeting with Mr. Mudd, who, having been made aware of the object of my visit, assured me in the kindest manner that he would aid me all he could in procuring a chance to go out on a trawler. It is proper that acknowledgment should be made here of the obligation I am under to this gentleman, who interested himself to get me a berth on a good vessel, and to whose courtesy I am much indebted for any success which may have been obtained in gaining a knowledge of the beam-trawl fishery.

No trawlers were sailing that evening on which Mr. Mudd thought I ought to go, but he believed it probable some might go out the following day. He thought it would not be advisable—as my time was so limited—for me to go out on a "single-boater," which might be gone two or three weeks; neither would he advise that a cruise should be made on a cutter bound to the "steamer fleet," which at that time was working off the German coast, some 300 miles or more distant from Grimsby, since, with the prevailing light winds, the vessel might be nearly a week in reaching the fishing ground and the fleet with which she worked. The best chance for me, it was considered, would be to go out on a smack that was to join one of the small "cutter fleets" on the Dogger Bank, which would probably be reached in twenty-four hours with favorable winds; thus I might have several days on the fishing ground, observe the method of working the beam trawl, etc., and return by another vessel in time to reach Southampton and sail on the *Neckar*. The smack *Willie and Ada* was fitting out to join one of the cutter fleets. Mr. Mudd thought she would sail the next day, and he assured me I could have a chance on her whenever she went to sea. I learned, however, on the following day (which was Friday, June 25) that the *Willie and Ada* would not sail before the Monday following, because of the accidental sinking of her boat in the dock, by which mishap two of her crew were nearly drowned and rendered quite unfit, for a day or two, to go to sea. As no other smacks were sailing to the cutter fleets before Monday, either from Grimsby or Hull—as was ascertained later—there was nothing to do but to wait.

In the interim, there was an opportunity to note the various phases



GRIMSBY FISH MARKET; RECEIVING, SELLING, AND PACKING FISH.

of the fish trade as conducted at Grimsby, which differ considerably from the methods adopted in the United States. In a previous paragraph the statement has been made that Grimsby had little importance as a fishing port previous to 1858, when beam-trawling was first introduced. And for many years previous to 1800 the harbor was practically closed to navigation by the accumulation of mud and silt at its mouth, which, in the reign of Charles I, became so formidable "that the smallest fishing vessels could with difficulty approach the town." At present it has several large docks, two of which are exclusively devoted to the fisheries, and known as the old and new "fish docks." These have a total area of 23 acres, with a market attached (on what is locally known as the "pontoon") 1,600 feet in length; on one side of which the smacks lay and discharge their cargoes, while on the other side stand the railway cars, or "fish vans," upon which are sent away to Billingsgate and other markets the fish that are constantly arriving. These facilities for receiving, packing, and shipping fish are as excellent as they are unique, and have resulted in an increase of the fish trade of Grimsby from between 1,000 and 5,000 tons in 1858 to over 73,000 tons in 1882, while it is claimed that the population has about trebled itself, and the fleet increased from a few small smacks to about eight hundred sail of the finest fishing vessels in Great Britain.

The following statements relative to the fish trade of the port are vouched for by three of the largest firms in Grimsby, and no doubt may be accepted as correct:

"That Grimsby is unquestionably the largest and most promising fishing port in the kingdom may be seen by the following facts. In the year 1853 there were but 12 fishing vessels in this port, and no facilities for the trade whatever. At the present time there are 825 vessels belonging to the port solely engaged in fishing, with an estimated registered tonnage of 42,000, valued at £725,000, carrying 1,710 men and boys. Besides the above, the port is frequently visited by many Dutch and other fishing vessels for the sale of their cargoes. There are 50,000 tons of ice imported annually, which is not only used by the smacks at sea, but for packing in the market, and is sent in various forms to all parts of the kingdom.

"The railway company has expended nearly half a million sterling in the making of docks and otherwise providing for the fishing trade, and are still extending and ever increasing.

"From 2,000 to 20,000 live codfish, besides a large quantity of other fish, are kept ready for sale in boxes in the fishing dock. The advantages (offered to the trade) of Grimsby over other markets are found in the great variety, the constant supply, the means of storing fish alive, the many curing houses, the care and facilities given by the railway company, the superior quality by the adoption of steam trawlers and carriers, and the ready and cheap supply of ice.

"Extensive business is now carried on with the far north of Scotland,

Dublin, Belfast, Carmarthen, Plymouth, Torquay, Hastings, Brighton, the Isle of Wight, Rotterdam, Hamburg, and Paris."

FIG. 23. ICE MILL USED BY FISH PACKERS.

As the tide approaches nearly to its full, the dock gates are opened, which is a signal for a busy and exciting scene. All is hurry and bustle on board of the smacks that are ready for sea, and which are rapidly got under way and either sail or are towed out to sea through one of the entrances to the "fish dock," while through the other gate may be seen entering, one after the other, the vessels which have been hovering just outside—waiting for the rising tide—and whose signals and numbers have communicated to those on shore the welcome news of their arrival. Smacks from the "cutter" and "bulking" fleets, "smack-boaters," steam carriers from the "steamer" fleets, long-liners, hand-liners, freighters from Norway, some with lobsters others with fresh mackerel; on they come, shooting through the narrow entrance, to quickly find their berths in dock. On the pier-heads are gathered scores of men, and occasionally women and children—if the day be fine—some waving a salute and wishing "good luck" to their departing friends, while others stand ready to give a greeting of welcome to the hardy fishermen returning, perhaps, from an absence of months. As the smacks arrive no time is lost in getting them into their respective berths, and if there be a considerable number they haul in and make fast, head on, to the "pontoon," upon which the cargoes are discharged with as little delay as possible. As the fish are taken out they are sorted according to their grades or the condition in which they arrive. For instance, the fish taken alive from the well of a smack, having first been knocked on the head to kill them, are laid out in rows according to their species,

or grade, while the "boxed" fish from the trawling fleets are sold in another lot. No busier scene can be imagined than transpires here every day, and considering the quantities of fish displayed one can not help being occasionally surprised at the prices they sell for. All fish are disposed of by a number of salesmen, each of whom is empowered by contract to sell the catch of a certain number of smacks, he receiving a percentage on the sales for his services. Cod are sold by the score (that is, 20 fish), and these, with halibut and ling, are knocked off to the highest bidder; trawled fish are, however, generally sold at Dutch auction, which is thus described by Holdsworth:

"A lot of turbot, perhaps, is to be sold; the salesman's bell is rung and the stentorian voice of the auctioneer is heard calling out, 'Now then, turbot buyers, turbot buyers, turbot buyers, come along, ye turbot buyers.' A knot of people collects and the salesman descants in a few words on the quality of the fish; a price is named, no one responds,

FIG. 24. LOADING FISH VANS.

or indeed is expected to do so, for it begins too high for any dealings; it comes down by degrees until a nod from one of the crowd closes the transaction, and the sale is booked. Then calls may be made for 'sole buyers,' 'plaice buyers,' 'ling buyers,' or 'cod buyers,' and the work is rapidly got through, for there is no time to be wasted over individual lots where they are so many to be sold, packed, and sent away as soon as possible."

They are packed with ice in crates, barrels, and in box cars, specially designed for the purpose, and shipped by swift-running trains to the various markets they are consigned to.

All arrangements for the cruise having previously been made, I went on board the *Willie and Ada*, Capt. Henry Tidder, on Monday morning, June 28, and at 9 o'clock a. m., soon after the dock gates were opened, our smack was shoved out beyond the pier-heads, all sail was set, and, with a moderate southwest breeze and fine weather, we left the Humber's mouth, passed Spurn Point, and headed away from the land toward that famous fishing ground of the North Sea, the Dogger Bank, where we expected to meet with the fleet we were to join, and where our fishing operations were to be carried on. The *Willie and Ada* was 73.68 tons register, ketch or "dandy" rigged, and manned by a crew of five, three of whom were men, the other two—the "fourth" hand or deck hand and cook—being boys of respectively seventeen and fourteen years of age.[1] The crew slept and ate in the cabin, which, considering the number to be accommodated, was roomy and comfortable, being painted and grained, but differing from the cabins of modern American fishing schooners in being under deck, and in some details of arrangement.

The wind died entirely away during the afternoon, and we lay becalmed until evening, when a moderate breeze again sprang up from the southwest. The day was fine throughout, and was spent by me in gathering information concerning the construction of the beam-trawl, the peculiarities of the vessel—so far as speed, ability in a gale, etc., were concerned—and in making sketches.

Tuesday, June 29.—The wind continued moderate during the night, but, as it was fair, the vessel slipped along easily through the water, which was so smooth that scarcely any motion could be noticed unless one glanced over the side and saw the scintillating, phosphorescent sparkle of the sea go by as we glided through it. At 5 a. m. the captain sounded and "struck the rough" on the Dogger Bank. Two hours later we spoke a homeward-bound cutter. Our skipper inquired the whereabouts of "Bascomb's lot," meaning the fleet we were to join, of which a captain by the name of Bascomb was "admiral." He was told that they were some three hours' sail—15 or 16 miles—distant in the direction we had been going. We then resumed our course, and at 9 o'clock a. m. the captain, who had been aloft at the masthead looking out for "Bascomb's lot," came on deck and reported seeing two fleets nearly ahead. We steered for the nearest fleet, which, however, did not prove to be the one we were in search of, but the skipper of one of the smacks which we hailed pointed to leeward and said: "That's Bascomb's lot, down there, I think." This proved to be the case, and soon after the order was given to our crew to: "Get up the trawl bridles and shackle them on," our skipper remarking, at the same time, "They have their gear down and I don't know how long it's been out." As

[1] Details will be avoided, since many facts that were originally included in these notes have been given elsewhere, and also because more or less details are shown in the illustrations.

we drew nearer the fleet the captain exclaimed: "Ah, there's the *Clara* with her craydon [a small flag for signaling] over her stern," and a moment later he said: "There's the admiral's flag; we'll steer for him." It may be explained that in this instance the admiral's vessel was distinguished by a flag flying on a stay extending from her bowsprit end to the main-topmast head.

After the usual hail of, "What cheer? oh, what cheer, my hearty?" our skipper shouted the inquiry, "How long you're going to tow?" to which the admiral replied: "Oh, till about 4 o'clock."

It was then shortly after noon. A moderately brisk southwest breeze was blowing, which continued with little change during the day. After receiving Admiral Bascomb's answer we tacked and ran back to the *Clara*, which belonged to the same owner as the *Willie and Ada*, and the skipper of which had hoisted his flag at the mizzen peak as a signal that he wished our captain to speak with him. We had brought out letters, outfits, etc., for this vessel, which had been absent from port several weeks, and her captain was naturally desirous of learning the news from home, as well as to obtain some additions to his food supply. However, we did not stop to go on board of her at this time, for immediately after speaking with the admiral and learning that he would "tow till 4 o'clock," our skipper remarked: "Then we've got four hours; we'll put it out," meaning the trawl, of course. All hands were busy at work in the mean time getting ready to shoot the trawl. The bridles had been shackled to the trawl-heads, and now the towing hawser was got up and shackled to the bridles; the dandy bridle hauled off the winch, made ready for running, and bent on to the trawl-warp. While this was being done we had reached the *Clara*, and as we passed under her lee our skipper shouted: "What cheer? what cheer, my boy? I've got something for you." It seemed to be understood by the *Clara's* crew that they must wait for a more favorable opportunity to get what we had for them, and the assurance that we had "something" seemed to satisfy them for the time being.

Being curious to know if there was any choice in selecting a berth for fishing among the various vessels which formed the fleet, I asked our skipper the question: "Where will you shoot the trawl?" He replied: "Oh, any place where we can get it out." The inference is that no judgment is exercised beyond that of getting sufficient room (or far enough from other vessels) to tow the gear without danger of collision. Accordingly, a few minutes after speaking with the *Clara*, the trawl was shot from the port side. After it was down, the warp parceled and put in its proper place, so that the vessel, with tiller swinging, headed about at right angles with the wind, all hands went below and turned in for a nap except the oldest boy—commonly called the "deck hand," or "fourth hand"—who staid on deck to look out for the vessel, note the working of the trawl, and watch for the admiral's signals.

A little after 3 o'clock p. m. the boy on deck shouted that the ad-

miral was hauling, and the crew tumbled out of their bunks, hurriedly pulled on their heavy leather boots, and, jamming their hats or sou'westers on their heads, ran on deck and began to get up the trawl.[1] The process was an interesting study for me, as I then saw it for the first time. I assisted in the work, heaving on the capstan and helping the skipper to get the dandy bridle in and the after end of the trawl-beam up to the vessel's stern.

We had been towing over ground which was more or less rocky, and which is known to the fishermen by the technical name of "The Rough," so that when they are fishing on such bottom, which they sometimes do in summer because fish are more abundant there than elsewhere, they call it "working The Rough." As a result of our "working The Rough" on this occasion, the trawl had been badly torn, which mishap was first announced while the net was being gathered in; the second hand exclaiming, in a somewhat disheartened voice: "She's all gone to smither ends!" The rip was not quite so bad, however, as was at first expected; and about 300 pounds of fish still remained in the "cod-end," which was hoisted on board, and the catch let out on deck. In this small lot there were many varieties, chief among which were turbot, sole, "cock" sole (which is a different species from the common sole, *Solea solea*), plaice, cod, hake, ling, gurnard, goosefish or monkfish (*Lophius*), besides a large number of star-fishes, anemones, sea corn (eggs of whelks), and sea pears, which, together with small rocks, and more or less sea grass and shells, made up a very interesting collection, though it was not "fishy" enough to have any special merit or attraction for the smack's crew.[2]

As soon as the trawl was emptied of its contents the (stay) foresail was hoisted and the vessel filled away by the wind, the fourth hand took the helm and was ordered to "keep her along after the fleet," which was then to windward of our vessel, working up for a new berth. (See Fig. 25.) The skipper, second, and third hands went to work to mend the net, but when this job was well advanced the mending was continued by the two former, while "Tom," the third hand, was ordered to "box the fish"; which order implied that he should dress and pack in boxes such as were marketable, about two-thirds of the lot, and throw the remainder overboard. In this instance, however, only the hake, turbot, cod, and haddock were dressed—that is, eviscerated; the others were simply washed before being packed, but were not gutted.

In the mean time the diminutive cook was actively employed in the cabin preparing supper, which all seemed glad to partake of; the ap

[1] The *modus operandi* of heaving up a beam-trawl, as conducted on this occasion, has been described in detail in the paragraphs on methods of fishing, page 342 of this report.

[2] In subsequent hauls several other species of fish were taken, among which may be mentioned pollack (coalfish), whiting, catfish or wolf-fish, dabs, flounders, skates, etc.

petites of the crew having been sharpened somewhat by the vigorous exercise of heaving up the trawl.

Having worked to windward for about two or three hours, the trawl was shot again at 8 p. m. This time the vessel was on the starboard tack and the trawl was "shot around the stern." This was a new feature of the business, and, as the weather was fine, an excellent opportunity was afforded to note all the details. After the trawl was down the watch was set and the rest turned in.

FIG. 25. WORKING UP FOR A BERTH.

Wednesday, June 30.—All hands were called out to heave up the gear at 4 o'clock a. m. I had staid up late the previous evening to gain some additional information about trawling, and to watch the fleet as the vessels worked slowly along, the bright lights of the smacks being plainly discernible in the hazy darkness of the summer's night, as the vessels rose and fell in the long undulating swell of the North Sea. Therefore, though it was bright sunlight at the time the admiral signaled to "haul trawls," I was first wakened by the skipper shouting to the tired and sleepy third hand: "You Tom! You Tom! come, rouse out here and haul!" Out we tumbled and on deck, where the cranks were already shipped on the capstan; the hatch off, and down in the hold, ready to coil away the trawl-warp, was the small boy, who not only officiates in the capacity of cook but must always be promptly on hand to assist wherever his services are required. All hands fell to

with a will, the skipper tacked the vessel back and forth, "working up over the gear," while the clank, clank, clank of the capstan told that the trawl-warp was being rapidly got on board.

The catch on this occasion did not exceed over 200 pounds weight of marketable fish, though nearly everything was saved, including skate, dabs, and catfish. As in this case, however, the net had not been torn, the skipper offered, as a reasonable explanation of the small catch, the statement that there was little or no wind during much of the past night, consequently the vessel could not tow the trawl fast enough over the bottom to catch any fish—in fact, for much of the time, we had been doing little else than drifting with the tide in a calm. In the morning the wind breezed up quite briskly, and continued fresh throughout the day.

After the trawl was up, all sail was set and the smack worked to windward to join the rest of the fleet, which had not drifted quite so much to leeward during the night. Meanwhile, the fish were "boxed," and it was announced that one of the smacks, which had her "craydon" flying, would leave the fleet this morning for home, after the catch of the other vessels for the previous day and night had been put on board of her.

It is difficult to imagine a more lively and inspiriting nautical scene than was presented on this summer's morning by the little fleet to which our cutter belonged, and the center of which was the homeward-bound craft, lying to, with her flag flying. All around her were collected the other vessels of the fleet, standing back and forth under all sail, their heavy square-headed gaff-topsails aloft to catch the breeze; boats passing to and fro going to the "carrier" to take their fish, to send letters, etc., visiting other vessels of the fleet, recently out from the land (one of which was our smack), to hear the news from home, obtain letters, and secure supplies that had been sent to them. The picturesque tanned sails, gleaming blood red in the sunlight, the shouting back and forth between the crews of the different vessels as they came within hail, were additional interesting characteristics of the scene.

On our own vessel the boat had been launched stern foremost over the lee side. As soon as she struck the water one man sprang into her, and to him were passed the few "trunks" of fish we had caught, these being dropped or roughly stowed in the middle of the boat. A second man then jumped into the boat, and when the proper time arrived she was cast off and pulled away for the carrier-smack to discharge the fish. "Boarding the fish," as it is called, on this occasion, when the sea was smooth and only a moderate breeze blowing, was a very tame affair compared with such work when the weather is rough. Many wonderful tales are told by the fishermen of hair-breadth escapes from drowning while engaged in transporting their fish from their vessels to the carrier, and considering that this work is done in almost all kinds of weather, one can easily believe that it is extremely hazardous, to say the least.

The catch being small on this occasion the boating was soon finished, the crews returned to their respective vessels, the admiral showed his signal for sailing, and as the fleet stood off, close-hauled for the fishing ground, their companion, the homeward-bound cutter, set all sail and filled away for Grimsby.

I sent a letter by her to Professor Goode, in London, and decided to stay out until the next carrier went in.

The fleet kept under full sail, working to windward about two hours, when, at 10 o'clock a. m., the trawls were shot where the ground was rather rocky.

After towing about an hour our trawl caught afoul of the bottom, so as to stop the vessel entirely. We hove it up and found it had swept an old anchor weighing about 150 pounds that was still hanging to the net, which had been so badly torn by it that all the fish, if there were any in the trawl, had made their escape. This was rather discouraging to the crew, the members of which, however, took the matter rather cooly, and with far less grumbling than one might naturally expect, they pulled in the net and began to mend it. As soon as the repairs were completed, the trawl was put out again, but misfortune again awaited us, for in about an hour and a half it got fastened to the bottom, and it was necessary to heave it up. By this time several other vessels of the fleet were seen in the same predicament, and, perhaps on the principle that "misery loves company," our crew seemed to derive a certain sort of grim satisfaction from the fact that they were not the only ones having ill luck, and it was thought that when so many of the fleet met with this mishap the admiral would lose faith in "working The Rough."

When it was up, we found the trawl badly split; indeed, in this instance, it would have been no exaggeration to say it was "all gone to smither ends"; and five or six plaice, that were jammed in the pockets, constituted its entire contents. The skipper, second and third hands turned to again to repair damages, and as the rest of the fleet hove up their gear about the same time, we all filled away and stood along by the wind until 8 p. m., when, in obedience to the admiral's signal, the trawl was shot in 20 fathoms. We had previously fished in from 18 to 25 fathoms, and for the most part, as has been indicated, on rough ground.

Capt. Tidder believes that little can be done "working The Rough," even where fish are comparatively plenty, since the gear is liable to much damage, and may possibly be rendered entirely useless. Spare trawl nets, beams, heads, etc., are carried on the smacks to replace losses which may occur, but it is evident that should these be unusual even all the spare gear may be destroyed and the vessel compelled to leave the ground and go in for more. This rarely happens, so far as could be learned.

The day was spent by me, like its predecessors on this trip, in taking notes and making sketches, varied by assisting the men to heave up

the gear, and steering when it was necessary for all the others to be at work.

Thursday, July 1.—At 3.45 a. m. the watch came below, called the skipper, and told him that the admiral was hauling. As the skipper tumbled out of his berth he gave a quick glance around to see if all of the crew were up. His eye rested on the third hand, who, having been on watch all the first part of the night, was naturally very sleepy, and was still slumbering in profound unconsciousness of the admiral's order. But the sleeping man was quickly brought to a realizing sense of the situation, and swarmed out of his berth in obedience to the order of the skipper, who shouted in stentorian tones: "You Tom, here; rouse out here and haul the trawl." All hands were on deck and at work in a remarkably brief space of time. No minutes are wasted in preparing for the day's duties; there is no stopping to wash, not the faintest attempt at personal cleanliness, even the boy cook is begrimed with coal dust, smoke, and soot; it is evident that little is thought of refinement, even such as may be obtained from a dip in a bucket of salt water. The main idea is *to catch fish*, and the toil and hardship incident to this vocation, the necessity that always exists for tumbling out "all standing," and rushing on deck, serves to make these men—as well as all other fishermen, the world over—rather indifferent while fishing to the simplest forms of neatness, which to people on land are considered indispensable.

When, in obedience to the call to work, as on this occasion, the half-wakened fisherman springs out of his bunk to the cabin floor, he realizes, first of all, the necessity of getting on deck with the least possible delay; therefore, with eyes still half closed, he gropes for his boots, pulls them on, snatches his hat from some convenient place where it has been put, and jams it on his head. This, if the weather be fine, completes his equipment, but, if it is stormy, oil clothes are also donned. In either case, the least possible time must be occupied, and frequently the men are not fairly awake until after they reach the deck.

When the end of the trawl-warp was inside the roller, the skipper looked over the vessel's side and exclaimed, "She's capsized again!" meaning that the trawl was upset, which he could easily tell by the bridles being crossed.

It was explained by the skipper, in answer to my inquiry, that the capsize was caused by the vessel, when working up to the gear, bringing the warp taut in the opposite direction from which the trawl was being towed over the bottom. This turned the trawl over on its back, bringing the beam underneath, and a twist in the bridles, since the forward end of the beam is aft; the position can therefore be told as soon as the upper ends of the bridles are in. The dandy bridle was cast off the trawl-warp, and a stopper put on the after bridle, which was then unshackled. By passing the ends of these around the forward bridle, outside of the smack's rail, the turns were taken out so that they led clear.

The dandy bridle was then taken over the taffrail (through the chock) and led to the dandy winch; when the bridle was hove taut and the trawl beam turned end for end and swung into its proper position, after which it was hove up in the usual way.

The catch of fish was small this morning, amounting only to two trunks of plaice, one trunk of mixed fish—cod, small haddock, skate, a conger eel—and one or two turbot in number, a little over 300 pounds weight in all. The fishermen agree in saying that the catch so far this trip is unusually light, though at this season fish are generally scarce in this region. They tell of catching 1,000 and 5,000 pounds of fish a day, and mention instances when as many as 10,000 pounds have been taken at a single haul, the species captured on these occasions being chiefly haddock.

When the trawl was up we "made sail"—that is, got under way—and stood along a short distance to join the rest of the fleet now gathered around the smack *Sobriety*, which was the next to sail for Grimsby. The morning's catch of the fleet was put on board of her, and I learned that she would sail the next day for market, providing fish enough were taken in the mean time to complete her cargo.

There was a brisk northerly breeze in the morning with light rain, but the wind moderated considerably during the forenoon and it stopped raining about 9 a. m.

At 11 a. m. we shot the trawl around the stern in 19 fathoms of water and towed away to the westward on the starboard tack. At 1 p. m. the gear was got on board again, and about 200 pounds of fish were found in the trawl, most of which were plaice.

We then stood along by the wind on the starboard tack, heading about northwest, until 8 p. m., when the trawl was shot for the night, the vessel still heading westerly. On this occasion the trawl-warp was taken around the smack's bow instead of being hauled under her bottom, as it formerly had been. This was done to prevent it from being chafed, also that it might be in a position to bring the vessel in stays in case we met with other smacks during the night towing in an opposite direction.

Friday, July 2.—A little after midnight—about 12.15 a. m.—I was awakened to see the vessel wear around while towing the trawl.[1] The object of this maneuver is generally to change the tack with the turn of the tide, and thereby tow the trawl back nearly over the same ground it passed across during the first of the night. Or, perhaps, as on this occasion, it is done to keep clear of rough bottom, which the lead gives warning of. A smack can, of course, be tacked around with the trawl out, as has been mentioned, and this can be done quicker and easier than to wear, but unless the conditions are favorable the trawl is very liable to be upset.

[1] The manner of "wearing a trawl around" has been described in the chapter on Methods of Fishing.

There was a brisk westerly breeze in the morning with fine clear weather, but later in the day the wind moderated slightly and there were light showers of rain in the evening.

The trawl was hauled at 5 a. m. and, though it was torn considerably, there were about 1,200 pounds of fish in the "cod." These were chiefly small haddock, such as the New England fishermen call "scrod" haddock. According to the skipper, we "struck The Rough" about half an hour before we began to heave up the trawl, which accounted for its being torn.

Most of the vessels in our fleet got fair catches of fish this morning, compared with what they had previously taken, and not a few of them had their nets torn. After the trawls were up, and while the crews were busy dressing and boxing the fish and repairing damages to the gear, the fleet filled away and beat to windward to regain the position where they began fishing last evening. The catch was not sufficiently large to complete the cargo of the *Sobriety*, and consequently she did not start for market to-day. But I concluded, however, to change my quarters, and when the boat left the *Willie and Ada* to transfer the morning's catch of fish I went in her, on board of the *Sobriety*, where I was welcomed by the captain and crew, and where I staid for the remainder of my cruise.

It was an interesting sight to witness, from this point of view—on board of the carrier—the various phases of boarding the fish which have been alluded to elsewhere. Along the lee side of the *Sobriety* were crowded the boats of the fleet, the crew of some of them actively engaged in getting their fish on deck, upon which was gathered a group of hardy fishermen belonging to the other vessels, and who, now their fish were on board and their boats dropped astern, were interchanging news, chaffing the newcomers, and apparently enjoying this break in the monotony of their lives on board their own vessels.

The crew of the cutter which takes the fish in generally have to stow the boxes below and ice them, putting down alternate layers of trunks of fish and ice, the latter being ground fine in a mill which each smack of the fleet is provided with. Sometimes the carrier's crew receive assistance from the men belonging to the other vessels, who, after they have discharged their boats and deposited their bills of lading in the companion, lend a hand to get the trunks below deck. When, however, all the vessels in a "cutter fleet" are sharing alike, each receiving an equal portion of the catch, no tallies are put on the trunks of fish and no bills of lading are needed.

At 1.30 p. m. the admiral signaled to "shoot the gear," and accordingly the trawl was put out. But it got caught up on the bottom soon after it was down, and we had to heave it up and repair the damage which the net had sustained. As this took some time it was decided by our skipper that it would scarcely pay to make another shot during the afternoon, and as several other smacks met with a similar mishap,

and none of them put out their gear after repairing it. they all gathered around a vessel just out from home, and the skippers went on board of her to learn the news and inquire for letters. As our captain was going, too, I joined him and spent two or three hours very pleasantly, learned some new facts about beam-trawling, and was gratified to find the fishermen communicative and intelligent, many of them possessing a comprehensive knowledge of the business in which they were engaged, and some having considerable general information.

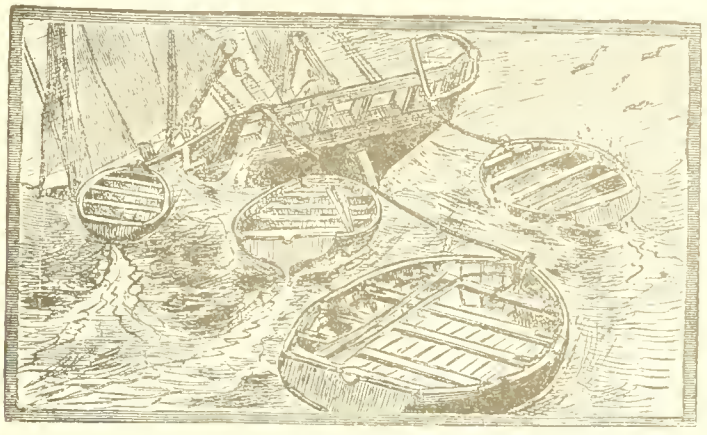


FIG. 26. VISITING.

I did some sketching to-day, but, owing to the prevalence of rainy weather since the cruise began, there have been few opportunities for securing sketches.

Saturday, July 3.—There was a fresh southwest breeze in the morning—a head wind for Grimsby, which materially decreased my chances of reaching Southampton to join the *Neckar*.

We began to heave up the trawl at 2.30 a. m., and at 5 o'clock it was alongside. About 800 to 1,000 pounds of fish were taken on this haul. After the trawl was up the smack filled away, and stood along to the westward, by the wind, with the rest of the fleet in company, until the fish were ready to put on board the *Sobriety*, when we hove to and waited for the morning's catch to be "boarded."

Several of the skippers, among whom was Captain Tidder, came aboard the *Sobriety* to bid me good bye, and to wish me a safe and speedy passage home. From all of these men I received uniform kindness and courtesy, while they have shown a willingness to give me all the information possible concerning their vocation.

As soon as the fish were all aboard our guests took their leave, our smack filled away, all sail but the jib-topsail was set, and we headed along about west by south, close hauled on the port tack. When the fish were all below and iced the bobstay was hooked on and hove taut,

and the jib topsail set. This was at 11 a. m., at which time the wind was moderating, and it gradually decreased until it finally fell calm in the evening.

Sunday, July 4.—Began with light northerly breeze and drizzling rain. Wind increased, at 4 a. m., to a fresh breeze, and after 11 a. m. it blew strong and squally.

At 4.30 a. m. we made the land a short distance north of Flamborough Head, which is 30 miles from Grimsby, and at 11 o'clock we passed Spurn Point. After rounding the point we took in the gaff-topsails and big jib, set the small jib, and took a reef in the mainsail and mizzen, thus putting the vessel under easy sail to wait for the rising tide to reach its full. No vessel can enter the Grimsby docks until the signal is hoisted—an hour or so before high water—which, on this occasion, was displayed a little before 2 p. m.

In the mean time we lay by off the harbor's mouth, slowly reaching back and forth in company with several other inward-bound vessels. Shortly after the signal was run up we shot into the dock, and the *Sobriety* soon lay securely moored in her berth, ready to discharge on the following morning.

I immediately sent a telegram to Professor Goode, acquainting him with my arrival at Grimsby, and stating the hour when I should be in London on the following day.

In the evening I called on Mr. Mudd and informed him of my return and of the success which had attended the cruise.

Monday, July 5.—I reached London at noon, and joined Professor Goode; the same evening we arrived at Southampton, in ample time to secure our berths on the *Neckar*, which was expected the following day.

II.—*NOTES ON THE BEAM-TRAWL FISHERY OF CONTINENTAL EUROPE.*

A. France.

Though beam-trawling is prosecuted to a considerable extent by the French, this fishery has not assumed, in France, anything like the important proportions which it has attained in Great Britain. No statistics are available showing to what extent the beam-trawl fishery has been carried on in France; but when it is stated, on the authority of Mons. A. Duchochois, of Boulogne, that only twenty five sailing trawlers go out from that important fishing port, and that France has no steam trawlers, some idea may be gained of the status of this fishery.

1. Fishing Grounds.

The fishing grounds of the North Sea and the English Channel are visited by the French trawlers, in common with the English, though it is probable the former keep nearer the continental coast than the English do.

TRAWLERS IN THE FISH-DOCK AT GRIMSBY.

2. Vessels.

Smacks are used for beam-trawling; these carry crews of eight men each. Some of them are ketch-rigged, but others are cutter-rigged, carrying only a single mast.

3. Apparatus.

The beam-trawls used by the French have the same general features as those employed by the English, which have been fully described.

"In the French trawls the net is very much shorter in proportion to the length of the beam; it tapers regularly to the end, has no distinct cod, as in the English nets, and the rubbing pieces extend across the under side of the trawl for some distance from the end, which is specially protected from chafing by having a stout hide underneath."[1]

The ground rope is sometimes weighted with chain that is fastened to it in festoons, similar to the plan adopted by Belgian fishermen.

The same pattern of head-iron that is used by the English is also, I am informed, now most generally adopted by French fishermen. At the time Holdsworth wrote, other forms were in favor in France to a considerable extent, though he mentions that even then the Brixham pattern was used.

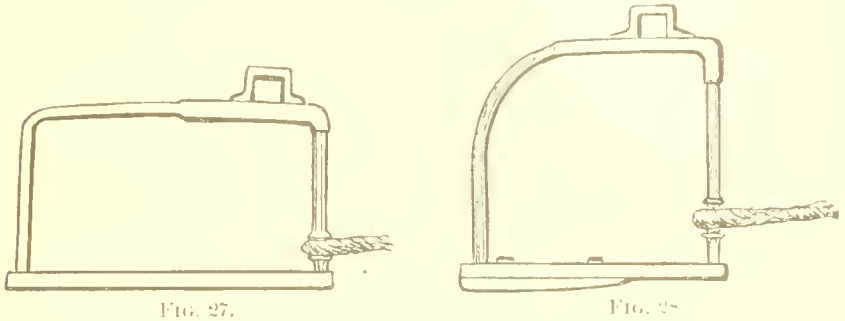


Fig. 27. Fig. 28

French Trawl-heads (after Holdsworth).

Concerning these peculiar forms of trawl-heads he writes as follows:

"Among other varieties of trawl-head may be mentioned those we have found used by some of the French trawlers, and the noticeable feature in them is that the beam is placed so near the front of the head as to require the tow-rope to be fixed very low to prevent the fore part of the shoe burying itself in the ground. This is further guarded against in one variety [see Fig. 27] by the additional length of the frame behind the beam. There appears to be a want of balance in these French irons which is not the case with those used by our own fishermen. No doubt there is some degree of fancy in the shapes adopted; but the English irons strike one as better adapted for their work, and the Brixham pattern is now being much used by the French trawlers. By means of these irons the trawl-beam is kept nearly 3 feet above the ground, so that it neither touches nor causes any disturbance

[1] Deep Sea Fishing, etc., p. 61

of the bottom whatever; its sole use is to extend the mouth of the net, and if it were to touch the ground, as many persons believe it does, it would effectually frighten away the fish and prevent their going into the net."[1]

4. METHODS OF FISHING.

The methods of fishing, so far as shooting and hauling the trawl are concerned, are essentially the same, according to M. Duchochois, as those adopted by English fishermen.

B. BELGIUM.[2]

According to M. Jules Le Lorrain, there are about 222 vessels employed in the beam-trawl fisheries from Belgium; 170 of these sailing from Ostend and the remaining 52 from Heyst and Blankenberghe. There are also 22 small boats, commonly called "sloops," engaged in this fishery on the Belgian coast. The foregoing will give an idea of the importance of the trawl-fishery of Belgium, though it should be stated that some of the vessels do not, like the English, pursue this business throughout the year, but frequently engage in other branches of the fisheries.

1. FISHING GROUNDS.

The fishing grounds resorted to are essentially the same as those upon which the English pursue their work in the North Sea.

2. VESSELS.

The vessels employed in beam-trawling from Belgium are of two classes. The larger and more important type so closely resembles the English ketch-rigged trawler that the description given of the latter will apply as well to the Belgian smack, which differs from the other chiefly in having less rake to her stern-post, and, perhaps, in a less elaborate equipment for working the gear. A capstan exhibited in the Belgian section at London was of the old-fashioned type, and as this was intended to represent the kind used for heaving up beam-trawls, it is evidently far less effective than the improved and powerful capstans carried on English trawlers.

The other class of Belgian trawlers are large, open, clinker-built boats, very wide, with round bilge and flat bottom. They have a peculiar lug rig, average about 20 tons, and, like the "*bomschuiten*" of Holland, are specially designed for fishing from a coast where harbors are not easily accessible.

[1] Deep Sea Fishing, etc., pp. 57–58.

[2] The statements made here relative to the Belgian beam-trawl fisheries are based partly upon a study of models of vessels and full-sized apparatus exhibited at the International Fisheries Exhibition, London, 1883, and partly upon information very kindly furnished by Mons. Jules Le Lorrain, of Belgium.

The vessels sailing from Ostend carry each six men in a crew, while four men is the average crew on the Heyst and Blankenberghe trawlers.[1]

3. Apparatus.

In most essential particulars the trawls used on the larger class of Belgian trawlers are constructed on the same general plan as those employed by the English.

There are some differences, however, in details, as may be gathered from the following description of a trawl exhibited in the Belgian section at London.

The foot of this net was first hung to a small hemp rope about the size of ordinary nine-thread ratline stuff. This small rope is seized, at intervals of six inches, to a larger hemp rope—about $1\frac{3}{4}$ inches in circumference—and the latter is fastened, by galvanized iron-wire seizings, to the foot-rope proper, which is $4\frac{3}{4}$-inch manilla. Attached to

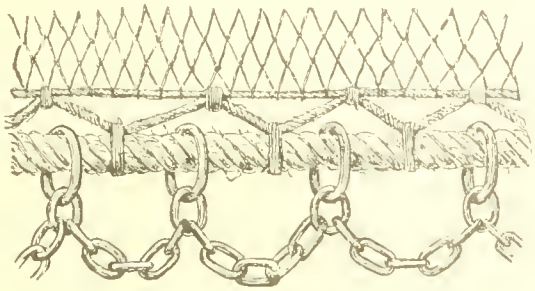


Fig. 29. Foot rope of Belgian trawl.

the ground rope, by stout iron rings, are festoons or loops of chain, the rings being 6 inches apart and there being five or six links of chain in each loop. Fig. 29 is a section of the foot of a Belgian trawl, and shows this peculiarity of construction. This chain attachment is for the purpose of making the ground rope "bite" the bottom; that is, dig into it so as to disturb any flat fish, like soles, for instance, that cling close to the ground and partially bury themselves. One would think, however, that this plan might be objectionable, because if the ground rope should be caught up on rough bottom, it seems probable that the trawl-warp would part before the chain, and, consequently, the whole gear would be lost.

The Belgian trawl-head (Fig. 30) has very nearly the same shape as the head-irons used by the Hull and Grimsby fishermen, differing chiefly from the latter in the after part of the curve, from the beam to the shoe, being of round iron instead of flat, and in having the eye for the ground rope to bend into inside of the lower after corner instead of forming a

[1] Since the above was written steam trawlers have been built in Scotland for the Belgian fishery.

projecting ear behind as in the English trawl-head referred to, though in this respect it is similar to the (English) "Barking pattern."

The end of the beam projects several inches beyond the socket and is held in place by a stout iron key. Iron wedges are not used to secure the beam ends, as is customary in England.

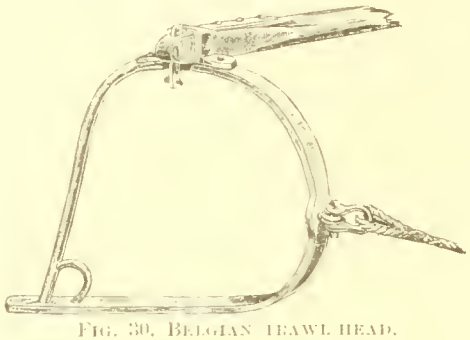


FIG. 30. BELGIAN TRAWL HEAD.

The following are the dimensions of the trawl-heads exhibited at London: Height (inside) or vertical diameter from top of shoe to lower part of beam, 2 feet 6½ inches; horizontal diameter, 3 feet 6 inches; shoe, 4 inches by ⅞ inch iron; front of head, 3 inches by ⅞ inch iron; back, 1½ inches diameter.

The bridles were of four-stranded, 6½-inch manilla rope.

The trawl used on the smaller craft, and which is pulled in by hand or by means of a small winch, is of a peculiar pattern, so far as the beam and trawl heads are concerned, the net itself having the same general appearance which is characteristic of this form of apparatus. The following is a description of one of these trawls exhibited at London:

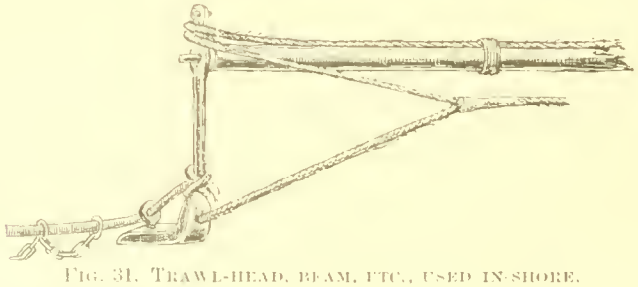


FIG. 31. TRAWL-HEAD, BEAM, ETC., USED IN-SHORE.

The beam was 21 feet long and 4 inches in diameter. In each end of it was fixed an iron bolt 3 or 4 inches long, which passed through a hole in the top of the head-iron, and was prevented from getting out of its socket by a rope which was tightly stretched along the top of the beam and fastened at each end to the top of the head-irons, one end of this rope being hauled tight by a small lanyard rove through roughly-made

bulls eyes. The head iron is of a peculiar pattern, and an idea of its form can best be obtained from the illustration, Fig. 31. A broad lower part or sole curves up in front like the runner of a sled, but about 6 or 8 inches above the ground the "shoe" is joined to a round bar of iron, 2 inches in diameter, which at the top is flattened slightly and perforated with two holes, one for the beam iron and the other for the head rope. On the upper side of the sole or shoe is an eye, through which passes the ground rope, the end of which makes fast to the round part of the head iron. The sole is 1 foot long where it rests on the ground, made of 4 by 2¾ inches flat iron. The head is 3 feet 3 inches high to the extreme top; the beam is raised about 2½ feet above the ground. The ground rope of this trawl is fitted with chain festoons in the same manner as the larger Belgian trawl.

In order to make this tow over the ground without upsetting, a short bridle or span is attached to each head iron; the lower part of this bridle (which is 4 feet 3 inches long and well parceled to prevent chafe) passes through a hole in the front part of the shoe 5 or 6 inches above the ground, being knotted on its end to prevent it from coming out; the upper part (3 feet 8 inches long) fastens around the head above the end of the beam. Beyond this span the bridle proper extends to the towing warp.

4. Methods of Fishing.

The methods of working the trawls on the larger class of Belgian vessels, according to M. Lorrain, are the same as those employed on the English trawlers.

The "single-boating" system is the only one followed, each vessel taking its own catch to market. Ice is carried for preserving the fish. The smacks from Ostend usually make trips of eight to ten days in length, while the Heyst and Blankenberghe craft rarely stay out more than one or two days. The fish are packed in boxes on board the vessels and brought to market in baskets. All the fish caught by the Ostend boats are sold at that port and from thence they are distributed by the dealers.

C. Holland.

The fisheries of Holland are of a mixed nature, differing from those of most English ports in that the same vessels which follow herring fishing for a portion of the year may at other times engage in beam-trawling, or the beam-trawler of to-day may be employed in fishing with long lines to-morrow. It is therefore somewhat difficult to say precisely what is the relative importance of beam trawling among the fisheries pursued by the Dutch. That it is an important branch of the fisheries of Holland is well known.

"Next to the herring fishery," says a Dutch writer, "the capture of fresh fish is the principal one in Holland. The fish are sometimes caught with hooks, but more frequently with trawls and other drag nets. In

this fishery all the '*bomschuiten*' of the coast take part during the winter, and some of the luggers which carry on the herring fishery in summer; also the fifty large vessels referred to above (as being employed a portion of the year in fishing for cod with lines), and all sorts of other vessels, great and small, hailing from the small towns along the coast."[1]

Assuming that there is probable truth in the belief held by some writers that the use of beam-trawls was first made known to the English fishermen by the Dutch who accompanied the Prince of Orange to England in 1688, there is reason to believe that this system of fishing has long been practiced by the Netherlanders.

1. Fishing Grounds.

While the larger vessels commonly fish in the North Sea, the "*bomschuiten*" usually carry on their work not far from the Dutch coast. Genrally the Dutch vessels resort to many of the same grounds for trawling that are visited by the fishermen of the countries previously mentioned.

2. Vessels.

The larger class of vessels employed in beam-trawling are, as has been said, generally employed in herring fishing during the season when herring are most abundant in the North Sea. As the herring fishery is, par excellence, the most important of all the Dutch fisheries, the vessels are constructed and rigged with especial reference to their fitness for catching herring, while their adaptability to beam-trawling is, in most cases, considered of secondary importance. These vessels—the so-called luggers, or loggers—range from about 45 to 70 tons; they are not so sharp forward as the British smack; are nearly of the same relative proportions as to length, breadth, and depth, being possibly not quite so deep as the English craft. They are flush-decked, ketch or yawl rigged, and generally with mainmast arranged so that it can be lowered. They have an ordinary capstan that stands well aft—so as to be out of the way of the nets when herring fishing—and the trawl-warp leads over the side abreast of this capstan. The winches, "dummy," etc., that form a part of the deck equipment of a first-class English trawler, were not attached to the models of Dutch vessels exhibited at Berlin, 1880, or London, 1883; therefore it may be assumed that these are not used.

The "*bomschuiten*" are a peculiar class of smaller fishing craft, designed especially for use on parts of the coast where harbors are not easy of access or where there are no harbors. They are made extraordinarily wide, being about two-thirds as broad as long, while the bottom is flat and constructed with especial reference to being hauled out on a beach or again launched through the surf. They are clinker-built, usually about 30 feet long, both ends shaped nearly alike, rounding yet almost

[1] Introduction to the official catalogue of the Netherlands exhibit at London, 1883.

square on top; have flush decks, and each carries a large capstan near the stern that is the motive power for getting on board two trawls which they use. They have a peculiar sort of yawl rig, supplemented occasionally by a small square topsail on the mainmast.

3. Apparatus.

The beam-trawls commonly used by the larger class of the Dutch vessels are about the same in all essential details as those used by English fishermen.

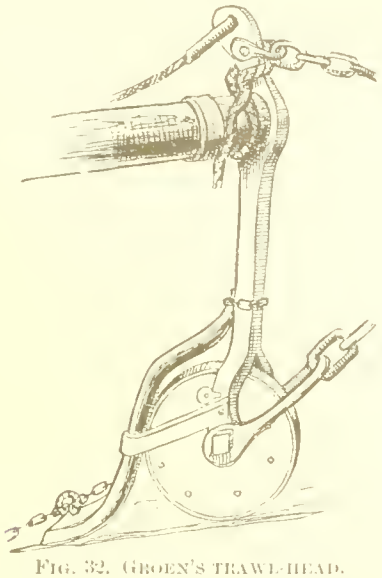


Fig. 32. Groen's trawl-head.

A peculiar form of trawl-head iron, Fig. 32, was exhibited in the Netherlands department at London, 1883, by W. Groen, of Scheveningen. This was the invention of the exhibitor, and was attached to a trawl-net designed for sole fishing, such as is used by the *bomschuiten*, and which it is desirable to have pass easily over the ground. The idea is somewhat similar to that of de Caux's, but is less elaborate.

This trawl-head is somewhat difficult to describe. The upper part is a square bar of iron, forked at the lower extremity to fit over the wheel, and having holes through the extremities for the axle of the wheel to pass through; the upper part of this iron is bent slightly backwards and broadened out somewhat to admit of holes being made in it, one for the end of the trawl-beam iron and others for the bridle shackle and head rope. To the rear lower part is welded a sort of foot, recurved, extending over the back of the wheel and resting on the ground behind, being held in place by a stout U shaped iron clamp which passes around it and each end of which is bolted to the prongs of the head-iron, a little above the wheel axle. At the extremity of this foot, on top, is an eye for the ground rope of the trawl to pass through. The wheel itself is of hard

wood, banded with iron, and at equal distances around it, near the edge, are a number of holes. These holes are so placed for the purpose of stopping the wheel from revolving, if deemed desirable, by shoving a key through the prong of the iron into any one of the holes that chances to be uppermost. A large shackle, one end of which is connected with the wheel by the axle bolt, comes in front of the wheel, and from this and the shackle at the top of the iron extends a short chain span that connects with a shackle at its end, to which also the bridle is attached. The following are some details of the measurements: Total height, 3 feet 1 inch; diameter of wheel, 11½ inches; thickness of wheel, 5 inches; size of iron between wheel and beam, 1½ by 1½ inches; hole for beam iron, 1⅜ by ⅝ inches; lower part of foot is quite flat, 3½ by ⅝ inches; lower chain bridle, from axle of wheel, 2 feet 8 inches; upper bridle, 1 foot 10 inches.

In this case a flat bar of iron is fitted into the end of the beam (which is banded to prevent its splitting), and this iron, projecting beyond the beam, slips into an oblong hole at the upper part of the trawl-head.

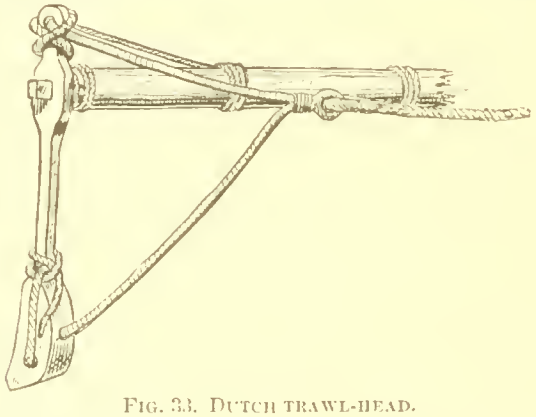


FIG. 33. DUTCH TRAWL-HEAD.

The trawls ordinarily used by the *bomschuiten* have some peculiarities. The following is a description of one of these trawls, exhibited at London, 1883: The beam is made of soft wood, 25½ feet long, 3¾ inches in diameter, backed by a square iron bar ¾ inch square, which is seized to the beam. Projecting from the beam ends are iron bars which pass through the holes in the top of the head-irons. The head-iron is 3 feet high; it is straight, small at the top, but with a heavy square foot that is 10 inches high and 4 inches square, rounded on the lower front part so that it will slip over the bottom. (See Fig. 33.) Through this foot are two holes, one about in its center, from front to rear, for the lower part of the span to pass through, and the other transversely, near the lower extremity, for the ground rope to reeve through. The whole affair is simple and primitive. A rope span extends forward from the head, a large thimble being seized in its bight, and into this thimble is

bent the bridle. One end of this span fastens to the upper part of the head-iron, and is 2 feet long; the other or lower part of the span is 2 feet 7 inches long, and passes through the foot of the head-iron and is held by a knot on the end of the rope.

FIG. 31. SECTION OF FOOT ROPE.

The ground rope is in striking contrast to those used by British fishermen. It is a small sized hemp rope, scarcely larger than an inch, and on it are strung, at distances of 3½ inches between each two, a number of lead sinkers, these being 1½ inches long and 1 inch in diameter, with holes through them sufficiently large to admit the rope. (See Fig. 31.) The net itself does not differ materially from other trawl-nets.

4. METHODS OF FISHING.

The methods of fishing with beam-trawls on the larger Dutch vessels are essentially the same as those adopted by the English, so I am assured by Mr. A. E. Maas, of Scheveningen. Holdsworth says: "The same method of fishing is general on the coasts of Holland, Belgium, and France; but the Dutch are peculiar in using two trawls at once, one being towed from the bow and the other from the stern of the vessel."

It is a question, he thinks, whether, taking the year through, much advantage is gained from this system, although undoubtedly large catches are made by it sometimes. It is possibly true that, at the time Holdsworth wrote, the Dutch were not using the large beam-trawls—a single trawl to a vessel—as they now do in the North Sea. His remark on the system of trawling pursued by the fishermen of the Netherlands applies more particularly to the "*bomschuiten*," all of which, according to Mr. Maas, still use two trawls—each with a beam about 20 to 21 feet long, of the kind last described—one of which is put out from the stern and the other from the bow. The peculiar construction of the "*bomschuiten*" makes it possible for them to operate two trawls, though this might be found impracticable and unprofitable on vessels of the ordinary form. The "*bomschuiten*" are so modeled that, when their lee boards are up, they have a minimum of lateral resistance; therefore, when towing their gear, they slide off almost dead to leeward, drifting very much faster, of course, than a deeper vessel would. With a fresh breeze of wind and a lee tide effective work may be done, but with the tide running to windward it is difficult to understand how these boats can work to advantage.

All of the Dutch vessels take their own catch to market, and are what would be termed "single boaters" in England. The "*bomschuiten*"

rarely stay out more than a day or two, but the larger vessels make longer cruises, in most if not all cases bringing in a portion of their fish alive and the rest in ice.

D. GERMANY.

Though trawling in various forms is quite extensively prosecuted by the Germans, beam-trawl fishing proper has not assumed very important proportions as compared with this fishery in some other countries.

1. FISHING GROUNDS.

The German trawlers fish chiefly, if not wholly, in the North Sea, but, as a rule, not far from their own coast. As the shore soundings off the west coast of Prussia constitute some of the best of the North Sea fishing grounds, more especially in summer, there is no need for the German vessels to go such long distances from home ports as the English trawlers often do. But, since the larger trawling vessels often market their catch at English ports, they are placed in essentially the same position as the British trawlers, so far as nearness to fishing grounds is concerned. The small craft, of course, fish quite close to the land, but the larger vessels often go some distance off when the inshore fisheries are not profitable.

VESSELS.

Among the most important types of beam-trawlers from Germany may be mentioned the luggers or "loggers" of Emden, and a peculiar ketch-rigged class of vessels that have been designed by Blankenese builders. The first named of these were, like many of the Dutch trawlers, originally designed for the herring fishery, and, in fact, were either built in Holland or modeled after the vessels of that country. They are about 60 to 70 tons, rather full, flush-decked, and ketch-rigged, the lower masts being somewhat longer than those of the English smack, and the mizzen mast a trifle farther forward.

The Blankenese-built vessels are of a similar rig, but are sharper, and provided with a well for keeping their fish alive. The striking peculiarity of this type of craft is the shape of its bottom. Though a keel vessel, the lower part of the bottom, which is about half the width of the deck, is nearly flat and sharp at each end, like the bottom of an American dory. This flat section has flaring sides, that are 2 to 3 feet high, and which are joined to the upper part of the hull, that is shaped like the top of an ordinary vessel. It is claimed that these vessels are swift and seaworthy, and that they have the special qualification of keeping their fish alive much longer than they can be kept in round-bottomed smacks.

Several forms of sharp-sterned decked boats are employed in trawling along the German coast, though this can not in any way be called beam-trawling since the apparatus has no beam attached to it, and is

most commonly operated by two boats working together, in a manner precisely similar to the method practiced by the Spanish fishermen for working the large "bou-net."

3. APPARATUS.

The beam-trawls used on the German vessels are the same as those employed by English fishermen, the latter having been taken as the standard.

4. METHODS OF FISHING.

The methods adopted by the Germans are like those of the English, as might naturally be expected, when it is stated that fishermen from the east coast of England have been employed by German firms to act in the capacity of experts or instructors in this branch of the fisheries.

The vessels fish singly, each marketing its own catch, and on some occasions the fish have been sold in English ports.

E. SPAIN.

The use of the beam-trawl in Spain is, I think, of recent date, though other forms of trawls or drag-nets have long been employed in that country.

One of the most common forms is worked by two boats, each of which is attached to and tows one wing of the net. This is used extensively on the Mediterranean coast of Spain. It is called a "bou net," or, sometimes, a "parella," or "parenzella."

Of late years, however, several screw steam trawlers have been built in Scotland for the Spanish fisheries. These are owned at San Sebastian. They are fine, seaworthy, ketch-rigged vessels of 35 to 70 tons and well adapted for beam-trawling, which they carry on chiefly in the Bay of Biscay.

1. THE "BOU NET" OR PARELLA.

It is believed that the "parella," which is probably identical with the Italian parenzella, was invented in the sixteenth century. This name, according to Captain Commerma, means a pair in the Catalan language. It is applied to a plow that two oxen are required to work, and likewise to this net, which is towed by two boats. The net has two long arms or wings, the lower edges of which are weighted with small sinkers, while the upper edges are raised from the bottom, and, consequently, the mouth of the net is kept open by a number of cork floats. The arms are 130 meshes, or about 3½ fathoms deep (the size of mesh being 2 inches) and 7 fathoms long, the cork rope and ground rope having nearly the same curve; the body of the net, from where it is joined by the wings, tapers so as to form a cone 11 yards long, which is joined by a small neck to the end, the extremity of which is flat and spread out considerably: this end corresponds to the "cod" of a beam-

trawl. To the end of each wing is attached a towing span, a double rope, distended in the middle with a wooden spreader or cross-bar, one bight of which is secured to the extremity of the wing and the other bight having an eye for the towing rope to bend into. These nets are used in different depths, sometimes in as much as 100 fathoms. The towing warps are about 300 fathoms long. When the boats are towing the "parella" they keep at a distance of 400 to 500 fathoms from each other, so that the arms of the apparatus will be well extended that they may sweep a wide area of sea bottom.

The following are the dimensions of the "parella" as given by Captain Commerma: Total length, about 30 fathoms; length of arms, each, 7 fathoms; width of arms, about 3½ fathoms, or 130 meshes; size of mesh in arms, 2 inches; size of mesh in body of net, 1 inch and ¾ of an inch. The lead sinkers weigh about 1 pound each, and are placed 18 inches apart on the ground rope.

The "parella" is used from October 20 to Easter Monday, during which season the various species of fish that occur near the bottom in the Mediterranean are captured.

Captain Commerma is authority for saying that the "bou net" is used by steamers on the north coast of Spain, two steamers towing the net. Trawling in this manner is, however, carried on only to a limited extent in the north of Spain, but very largely in sail-boats in the Mediterranean.

III.—*ATTEMPTS TO USE THE BEAM TRAWL IN THE FISHERIES OF THE UNITED STATES.*

Several attempts have been made to use beam-trawls in the fisheries of the United States, as detailed in the following statements, and it is quite possible that similar trials have been made by other parties which I have no knowledge of. It will be noticed that the attempts alluded to here resulted in failure. The trial made off Cape Cod could scarcely be called a fair test of the apparatus, while Mr. Booth holds the opinion that a longer practical test in the lakes, by a competent expert, might lead to far different results from those which he obtained in his experiment.

The following are the facts relative to the trials which have been made:

Capt. Sylvester Walen, of Boston, Mass., states that about 1861 Capt. Richard Leonard, a native of Ireland, but then fishing from Boston, had the schooner *Sylph* built on purpose for trying the experiment of fishing with a beam-trawl off the New England coast. Captain Leonard visited Ireland and brought back with him sufficient apparatus for making the experiment. The trawl was tried off Cape Cod, but with no success; therefore that method of fishing had to be abandoned.

"The captain and crew of the *Sylph*," says Captain Walen, "anticipating excellent results from this innovation in American fisheries, kept

their proposed experiments a profound secret, hoping not only to profit by being first in the field in this new enterprise, but also fearing the antagonism of other fishermen not similarly provided."

Mr. J. H. McManus, of Boston, who was part owner of the *Sylph* at the time the experiment above referred to was tried, says she carried a beam-trawl of the largest size, having a 50-foot beam, that it was set five times off Cape Cod in 10 to 20 fathoms of water, but no fish of any consequence, except flounders, was taken in it. The crew of the *Sylph*, being all poor men, according to Mr. McManus, could not afford to continue the trials. Therefore the attempt to use this form of apparatus was given up, and the three trawls which had been brought over from Ireland were sold to parties in Virginia to use for some unknown purpose in Chesapeake Bay.

Mr. McManus thinks that possibly one cause of this failure to introduce the beam-trawl was due to the foot-line not being heavy enough for that purpose, but he is, nevertheless, of the opinion that it can not be used to good advantage north of Cape Cod.

Mr. A. Booth, of Chicago, well known throughout the United States as an extensive packer of fish and oysters, told me while at London, July, 1883, that he imported a beam-trawl from England as early as 1873. He tried to use it for the capture of whitefish (*Coregonus*) on Lake Michigan; but although a few were taken, the attempt was a failure, since the trawl could not be successfully used there, because it became frequently entangled with the sunken logs that were more or less numerous on the bottom of the lake. He also stated that he had no one experienced in this particular fishery to handle his trawl, and therefore he is not fully satisfied that it is impracticable to use this form of apparatus in some of the lake fisheries.

In the scientific investigations made by the U. S. Fish Commission off the Atlantic coast, from Cape Hatteras to Halifax, Nova Scotia, the beam-trawl has been extensively used, and among the various new species of fish that have been captured in it may be mentioned the pole flounder (*Glyptocephalus cynoglossus*), which was first taken on the New England coast in 1877. This species, which for food purposes is pronounced quite equal to the European sole, has a very small mouth, and can therefore be taken in large numbers only in a beam-trawl. It occurs in greater or less abundance off the New England coast, and northwardly to the Grand Bank.

Lieutenant Commander Z. L. Tanner, who has for several years been in command of the Fish Commission's steamers, has used the beam-trawl very extensively for scientific purposes in the waters of Massachusetts Bay and off Cape Cod, as well as elsewhere along the coast. He says that there are large areas on the eastern slope of Stellwagen Bank and east of Cape Cod, outside of a depth of 45 fathoms, where a beam-trawl could be employed to advantage, the bottom being a mixture of sand

and mud. These localities are noted for an abundance of flat-fish, among which the pole flounder occurs in large numbers. He believes it would be entirely practicable to carry on beam-trawling in those waters, but thinks it would be necessary to have a steam capstan to get the gear up.

The peculiar form of trawl-net which is used in the Mediterranean is successfully worked in the waters off the west coast of the United States.

Prof. David S. Jordan, who investigated the Pacific coast fisheries in 1879–'80, writing of the Italian fishermen of San Francisco, Cal., says that in 1876 the "paranzella" was introduced in the fisheries of that port. The fishermen of other nationalities threatened to burn up these nets, and the boats used when the nets were employed. San Francisco is the only place in this country where this style of fishing has been introduced. There were two antagonistic companies who used these nets; they have now consolidated and divide the profits equally. Each company has three boats and employs twelve or thirteen men, one of whom is constantly engaged in selling fish in the market. The stock is owned chiefly by men not actually engaged in fishing. This is divided irregularly, one man owning a net, another a boat, etc. Out of the gross profits are paid, first, the entire expenses, including provisions of the men, wear of the boats and nets, etc. The remainder is divided into shares, one share to each boat, one to each actual fisherman, and one-half share to each net actually in use. In these two companies, there being six boats, two nets, and twenty-five men, the whole is divided into thirty-two shares. The captain sometimes received one and one fourth shares.

IV. *POSSIBILITIES OF SUCCESSFULLY USING THE BEAM-TRAWL IN THE SEA FISHERIES OF THE UNITED STATES.*

So far as the ocean fisheries of the United States are concerned, more especially on the Atlantic coast, there is little probability that the beam-trawl will be employed for some time to come, chiefly for the following reasons: First, many parts of the fishing grounds, now most commonly frequented, are not suitable for beam-trawling, being too rough, and in many localities the water is too deep;[1] second, our most valuable ground fish—cod, haddock, halibut, etc.—occur in such abundance that far greater catches can generally be obtained with lines or gill-nets than it would be possible to get in a beam-trawl, and as bait can usually be obtained at a moderate outlay, the lack of this is not an inducement, as it is in Europe, to adopt beam trawling; third, the flat fishes—several species of flounders, dabs, etc.—that occur off the east coast of

[1] Though it is true that large tracts of the best fishing grounds are too rough for beam-trawling, it nevertheless is a fact that there are extensive areas where trawls can be used, and should this form of apparatus ever be introduced into the fisheries of the United States, no doubt it will be found that grounds now little frequented may prove unexpected store-houses of wealth, so far as fish life is concerned.

the United States, and for the capture of which the beam-trawl is more specially adapted, are now of comparatively little value in our markets, and half a ton of them would scarcely bring as much as is obtained in London for a hundred pounds of soles.

The following statement of the arrivals of fishing vessels at Boston, Mass., in a single day, and the quantity of fresh haddock or cod on board of each, shows what enormous captures of these fish are sometimes made with trawl-lines. When it is understood that these fares of fish are often taken in a single day, and that a vessel seldom fishes longer than two or three days consecutively, it will be apparent enough that like results can not be obtained by using beam-trawls: "Schooner *Mabel Kennison*, Georges, 40,000 pounds haddock. Schooner *Emily P. Wright*, Georges, 40,000 pounds haddock. Schooner *Gertie E. Winsor*, La Have, 30,000 pounds haddock and cod. Schooner *Col. French*, Georges, 45,000 pounds haddock. Schooner *Hattie I. Phillips*, Georges, 75,000 pounds haddock. Schooner *Carrie and Annie*, Georges, 60,000 pounds haddock. Schooner *Rebecca Bartlett*, Georges, 45,000 pounds haddock. Schooner *Henry W. Longfellow*, Georges, 60,000 pounds haddock. Schooner *Eben Parsons*, Georges, 60,000 pounds haddock. Schooner *Dido*, Georges, 40,000 pounds haddock. Schooner *Mascott*, Georges, 50,000 pounds haddock. Schooner *A. R. Crittenden*, Georges, 35,000 pounds haddock. Schooner *Mystic*, Georges, 30,000 pounds haddock. Schooner *Charles P. Boynton*, Georges, 40,000 pounds. Schooner *Loring B. Haskell*, Georges, 60,000 pounds haddock. Schooner *Pendragon*, Georges, 30,000 pounds haddock. Schooner *Iolanthe*, Georges, 30,000 pounds haddock. Schooner *J. W. Campbell*, Georges, 45,000 pounds haddock. Schooner *J. A. Garland*, Georges, 60,000 pounds haddock. Schooner *Clytie*, Georges, 45,000 pounds haddock. Schooner *Rebecca Bartlett*, Georges, 50,000 pounds haddock. Schooner *Edward Treroy*, Georges, 60,000 pounds haddock. Schooner *Matthew Kenny*, Georges, 50,000 pounds haddock. Schooner *Tidal Wave*, Georges, 50,000 pounds cod. Schooner *D. D. Winchester*, Georges, 60,000 pounds haddock. Schooner *Andrew Grimes*, Georges, 30,000 pounds haddock. Schooner *Fannie W. Freeman*, Georges, 60,000 pounds haddock. Schooner *Annie D.*, Georges, 50,000 pounds haddock. Schooner *Sarah C. Wharf*, Ipswich Bay, 35,000 pounds cod. Schooner *Grover Cleveland*, Georges, 25,000 pounds haddock. Schooner *Rapid Transit*, Georges, 50,000 pounds haddock. Schooner *Mary A. Clark*, Georges, 50,000 pounds haddock. Schooner *W. Parnell O'Hara*, Georges, 40,000 pounds haddock. Schooner *Carrier Dove*, Georges, 45,000 pounds haddock. Schooner *New England*, Georges, 45,000 pounds haddock. Schooner *Ethel Maud*, Georges, 45,000 pounds haddock. Schooner *Ellen Swift*, Georges, 45,000 pounds haddock. Schooner *Addie Winthrop*, Georges, 40,000 pounds haddock. Schooner *Chester R. Lawrence*, Georges, 50,000 pounds haddock. Schooner *Reporter*, Georges, 75,000 pounds haddock. Schooner *Phil. Sheridan*, Georges, 60,000 pounds haddock. Schooner

Gertie Evelyn, Georges, 48,000 pounds haddock. Schooner *Edith Emery*, Georges, 60,000 pounds haddock."[1]

It is therefore evident that, with such conditions prevailing, the beam-trawl can not be profitably employed off the Atlantic coast, even supposing extraordinary catches could be taken in it. However, should the demand for flat-fish increase in the future, which is extremely probable, it will doubtless be found that beam-trawling can be prosecuted off our eastern shores with profit and success, while, in a country having such a vast extent of sea-coast as the United States has, and such varied fisheries, it is impossible to say what may not be done with an apparatus which is so effective as is the beam-trawl for the capture of ground fish. The fact that the "paranzella" has been profitably employed on the Pacific coast is a matter of interest in this connection, and indicates that there may be, in that region, an opportunity to use the beam-trawl, which is a much more effective form of apparatus.

[1] Boston Daily Herald, February 12, 1886. The names "Georges" and "La Have" refer to Georges Bank and La Have Bank, where the fish were caught.

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