

Remarks on Trawling.

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FIRST SERIES.*

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I. GENERAL REMARKS.

FULLY ten years having elapsed since the Report on Trawling on the eastern shores was presented to the Trawling Commission (composed of the late Earl of Dalhousie, chairman; Right Hon. Edward Marjoribanks, M.P., now Lord Tweedmouth; Prof. Huxley; Mr. W. S. Caine, M.P.; and Mr., now Sir, T. F. Brady), it appears to be desirable to review the statements contained therein in the light of the information which the impetus given by the Commission has produced. Moreover this examination of results is all the more necessary, since last year another important body—viz. the Select Committee of the House of Commons on Fisheries, presided over by Mr. Majoribanks, M.P.—issued a new blue-book containing the finding of the Committee, and a mass of evidence.

In criticising this Report on Trawling, it is necessary to bear in mind that certain definite instructions were given by the Commission in regard to the hauls of the trawl. These fall under Section 6, and are as follow:—"The results of each haul of the trawl, so far as regards food-fishes, should be carefully registered, in order that positive data may be obtained.

"(a) As to the proportional quantity of immature fishes taken at various seasons.

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“(b) As to the destruction of the spawn of food-fishes.

“(c) As to the proportion of live and dead fishes.”

It is important to remember, also, that the choice of ground lay with the trawler in almost every case, and that the most productive ground, so far as could be ascertained, would in all probability be selected.

In the Report of 1884 the fishes were grouped into “saleable,” “unsaleable,” and “young,” the latter term being synonymous with that now in general use, viz. “immature”—a term, indeed, which was introduced prominently in this Report. These three heads are well understood, and need cause no ambiguity, since even the fishing community are quite able to understand them—a size limit, of course, in every case having been considered. To the Royal Commissioners the fact that a young or immature dab was under 7 inches was not of great utility, but the number of such young forms was of the utmost importance in view of the statements then prevalent. Due care was taken to see personally that every example was authenticated, and if any weight is to be attached to the statement that the “great defect of the Report* is that no information whatever is given as to the limit of size dividing the saleable fish from the immature,” there will be little difficulty in remedying it. Besides, it was not the scientific observer who regulated the sizes of the saleable fishes, but fishermen engaged in an industrial pursuit, and who had to bear in mind the demands of the public. Moreover a fish of a size that was saleable at St. Andrews might not be so at Aberdeen, and *vice versa*, though, as a rule, the variation under this head was not great. According to the state of the market, again, fishes—*e.g.* gurnards—that were saleable at one season were unsaleable at another. As pointed out in the Report, “it is remarkable that so good a fish should be liable to variation in this respect, and that it should not always be taken to market, even during the height of the herring season.” Frog-fishes even occasionally found a ready sale in the great central towns of England after the head, skin, and fins were removed; and in the Outer Hebrides dog-fishes formed, and still form, an important item in the crofters’ diet-roll, the piles of skins in front of their huts being characteristic.

To take the fishes in the order in which they are mentioned in the Trawling Report, the following sizes formed the lower limit of the saleable fishes:—Skate (including grey, thornback, starry, sandy, &c.), 10—12 inches across the pectorals; herring, 7—8 inches, but those obtained were all much larger; codling (young cod), 8—10 inches, but no example so small occurred in the series;

* Prof. Ray Lankester, *Sea Fisheries*, Chicago Exhibition, 1893, p. 64.

haddock, 8—9 inches,—when so small their price is insignificant, about 1s. per box; whiting, 8—9 inches; poor-cod, 7 inches; bib, 6—7 inches; coal-fish, 1 foot; hake, 1 foot, though seldom seen below 15 inches; ling, 15—20 inches; halibut, 13 inches; sail-fluke, 8 inches; craig-fluke (witch), 7 inches; long rough dab, 7 inches; turbot, 6—7 inches; brill, 7—8 inches; plaice, 7 inches; dab, 7 inches; lemon-dab, 7 inches; sole, 7 inches; flounder, 7 inches, rarely sold; grey gurnard, 9 inches; bream, 9—10 inches; cat-fish or wolf-fish, 15 inches, though all those obtained were large. By the term “saleable,” of course, saleable in the food market is meant, since much smaller examples of every species might be utilised for manure, either as landed or after preparation in a factory.

In regard to the unsaleable round fishes, the remarks of the Commissioners of 1866 were—“It has never been alleged that ling, cod, and conger, in which the line fishermen are so largely interested, or mackerel, pilchards, or herrings, upon which the seine and drift fishermen depend, are caught by the trawl in an immature and uneatable condition.” “Whiting and haddocks of small size, thought marketable, are taken by the trawl; but fish of similar dimensions are also captured by the liners, against whom, indeed, the charge of taking immature cod has especially been brought.”

In the Report of 1884 it was stated that “a considerable number of young cod were present in most of the good hauls, but all were saleable fishes. Quite as many immature cod (codling) were caught by the liners in the same waters; and off the Bell Rock perhaps the proportion is even greater.” The same state of matters exists at this moment. On the other hand, the number of very small haddocks caught by the liners, *e. g.* last year off the east coast of Scotland, far exceeded anything of the kind captured by trawlers. The one mode of fishing was as destructive to these immature forms as the other. The small fishes swarmed on the ground, and were caught in every haul of the liners just as they were swept into the trawl, but many of the smaller forms escaped from the latter through the meshes, while they were held fast by the hooks and so injured that, although they had been returned to the water, it is doubtful if they would have survived.

The remarks made then (1884) on the capture of very young cod and very young haddocks, therefore, remain suitable for to-day; and the same may be said of those on whiting, ling, hake, gurnards, coal-fishes, pollack, bib, and poor-cod. In the Trawling Report it was stated that large cod and other adult fishes were now seldom caught within the limits of the Bay of St. Andrews, and this was in accordance with the evidence then obtainable. The use of anemones

as bait, together with the closure of the bay, shows that as many as sixty or eighty good cod are occasionally caught by a single boat, the lines being buoyed and left in the water all night. Some fine congers are also occasionally obtained off the east rocks. Moreover excellent haddocks are procured in the same area early in the year, and for two years small haddocks have abounded. Large green cod also occasionally leap out of the water in pursuit of their prey, and are captured on the beach, while a few pollack are got in the salmon-stake nets or on hooks. It would thus appear that further experience leads to a modification of the statement in the Trawling Report. How far the increase in numbers has been due to the closure and the absence of molestation, and how far to the fixed and extensive lines and special bait, are open questions.

The closure of the inshore waters—*e. g.* St. Andrews Bay—must have conduced to the prosperity of the turbot and the brill of that neighbourhood, most of the turbot (ranging from 9—11 inches) which formerly were captured by the trawlers (sailing and steam) now being unmolested, and reaching the outer waters when of some size. The salmon stake-nets, however, on the west sands still prove destructive to many turbot from $5\frac{1}{4}$ inches upwards. These small examples of this valuable fish are only used as bait for crab-pots. It is true the trawlers sweep the outer waters into which the young turbot and brill pass, but the area is wider, and the size of those captured considerably larger.

No fish formed the subject of greater solicitude in the Trawling Report than the plaice, both from its wide distribution and its great abundance, as well as from the supposed view that this was a form specially destroyed by the trawl, which had cleared out of St. Andrews Bay, for example, all the full-grown adults, and left only the smaller forms. It is apparent, therefore, that during the past nine years such inshore waters have had sufficient time for recuperation—at least to some extent—if these views can be maintained. The results of the trawling-work of the “Garland” up to 1892 have already been dealt with in this connection,* so that other observations, and the statistics of fishes captured by the liners in this area, have only to be considered. Without at present going into detail, it is found that comparatively few full-grown plaice are captured in the enclosed waters of St. Andrews Bay. Most of the large specimens that have occurred have been either diseased—*e. g.* blind or emaciated—or injured. An enormous number of immature or half-grown plaice, however, are reared in the area, and are captured by the liners, chiefly with lobworm, their lines being buoyed and left in the water for such periods as they please, relays

* A Brief Sketch of the Scottish Fisheries, 1882-92, p. 6.

of lines being often used. The success with which the local fishermen ply their trade in early spring amongst the plaice is indicated by the fact that a single haul of the lines of a small fishing-boat last February produced a sum of £9, and that a larger "catch" was procured by the same boat within the week. The closure of the inshore waters, therefore, while it places the trawl-fishermen at a disadvantage, benefits the line-fishermen, and does not deprive the public altogether of the supply of flat-fishes from the enclosed area. It does not, however, produce many large flat-fishes, for as these get older they appear to seek the deeper waters outside the limit, either from a natural habit, or as the result of constant interference by man. This habit, indeed, was noticed in the Report when dealing with the question of instituting the closure within the three-mile limit—thus:—"The flat-fishes, such as turbot, brill, plaice, soles, dabs, and thornback (skate) would certainly be left in comparative security in certain bays, as at St. Andrew's, the larger only, perhaps, seeking the grounds in the offing." These larger flat-fishes, many of which are mature (that is, spawning) are captured outside the three-mile limit in great numbers, and thus the supply of ova and young fishes for the inshore waters is affected, for, as previously pointed out, the latter waters depend to a large extent on the former in this respect. Few or no spawning plaice (none within our experience) are ever captured within the bay, though eggs and young in various stages are not uncommon. It is stated, however, that adult ripe plaice were formerly procured by hook and line off the rocky shore towards the mouth of the bay between Boar-hills and Fife-Ness, on hard ground on which no trawl could work. The adult spawning plaice in greater numbers occur in the offshore waters, and, so far as known, there is no passage of these from the outer to the inner area for the purpose of discharging their eggs—as was formerly believed in regard to many fishes. If it had been for the advantage of the eggs and larval plaice that the adults should only spawn close inshore in the shallow water, there is no reason to doubt that such would have been the arrangement. It is apparent, however, that it is otherwise. Before reaching the shallow water of the bays the scattered ova have advanced towards hatching or have hatched, the majority probably in the latter condition, the open water being perhaps better suited for their safety. The yolk-sac of the larval fish is soon absorbed, the symmetrical post-larval condition is reached, by-and-by transformation occurs, and the little fish takes to the bottom, swarms being found in the muddy rock-pools towards the end of April and beginning of May. The life-history of this species would seem to show that—in dealing artificially with the eggs and larvæ—the

most natural method is to place the larval fishes—just before the yolk-sac is absorbed—some distance from shore. They are more or less transparent, and will escape many of the dangers they run in such waters, and, before being carried close inshore, will either be transformed or about to be transformed, and more capable of escaping by their own exertions from their enemies. If the larvæ are placed in the sea close to a rocky beach or stretch of tidal sand or gravel, it is possible that many would be stranded by the tide. Therefore, though the observation that the young plaice (with eyes now on the right side) abound in spring in the shallow rock-pools and elsewhere is perfectly correct, it is no argument for placing the larval fishes in their neighbourhood, when in a truly pelagic condition. In the same way the spawning ling are found far from the inshore waters, their minute eggs being hatched in the open ocean, and the young stages passed long before reaching the margin of low water. The ling has not, indeed, been found in inshore waters till it reaches about 3 inches ($3\frac{1}{2}$) in length, and then in very limited numbers. It is more frequently secured when from 6 to 8 inches in length—at extreme low water at the margins of the rocks. As it gets larger it seeks the offshore, and thus, as in the plaice, there is a double migration—the wafting of the eggs, larval and young fishes shorewards, and the return of the adolescent and the larger forms seawards. A similar life-history appears to be present in many of the food-fishes—*e. g.* the turbot, brill, and halibut, though in the case of the dab, long rough dab, and some others there are marked exceptions, as pointed out in the Trawling Report. Thus, “the large proportion of immature dabs found 15 miles off St. Abb’s Head is interesting, and shows that such are not confined to shallow bays like that of St. Andrew’s. Moreover, the occurrence of relatively small specimens at this and even greater distances from land would raise a doubt as to whether all such young forms have been reared on a sandy beach inshore.”* Since the foregoing was written, opportunities, by aid of the “Garland,” for using the special trawl-like tow-net and the mid-water net near and at the bottom on the grounds 15 to 20 miles south-east of the Island of May, have been afforded, and great numbers of larval, post-larval, and young dabs, long rough dabs, and other forms have been obtained, thus confirming the opinion formerly expressed. Moreover, the trawling work of the “Garland” on its various stations from the Moray Firth to the Forth bear out the same conclusion. Again, the deeper water is the home of the post-larval frog-fish, even the pelagic eggs being rather uncommon near shore. The adolescent and adults, on the other hand, are frequent in shallow sandy bays like St. Andrew’s.

* Report, Royal Commission on Trawling, p. 361.

It is apparent, from certain remarks in the preceding paragraph, that it is a mistake to say that the trawl alone can capture flat fishes. If the bait be suitable the lines are tolerably effective in regard to plaice, lemon-dabs, dabs, and flounders. Again, halibut-fishing (by hook) is the most productive method off the coasts of Iceland, Faröe, and elsewhere, and even the turbot and the sole are occasionally caught by the liners.

II. CHANGES IN THE TRAWLING-VESSELS AND THEIR APPARATUS.

With the exception of a few small sailing vessels and boats, trawling in Scottish waters is carried on, as it was in 1884, almost exclusively by steam-vessels; but, whereas at the latter period many of the vessels were old tugs or modified paddle-steamers formerly used for other purposes, most of the modern vessels, *e. g.* sailing from Granton and Aberdeen, are specially built for the purpose. The finest vessels do not cost much more than the serviceable vessels of the General Steam Fishing Company did in 1884, *viz.* £4,500, but very considerable improvements have occurred in the arrangement and equipment. Some of these iron ships are 100 to 120 feet between the perpendiculars, and considerably more on deck, with a depth of 10 to 12 feet. The paddle-ships at Montrose* are 116 feet between the perpendiculars, 21 feet broad and 10 feet deep; while the fine screw vessel is no less than 120 feet between the perpendiculars, 21 feet broad, and 11 feet 6 inches deep. The three latter have comparatively low bows, like many of the ships from Granton. The newer ships at Granton have also increased in size. Moreover, greatly increased height is given to the bow of the vessels at Aberdeen, so that the foot-hold on the fore-deck must be very uncertain, especially if slippery; but the water is kept out of the ship by such an arrangement. The after-part of the ship, however, is more or less flat, so that the trawls can easily be worked. These vessels range from 140 to 180 tons burthen, with engines from 40 to 65 horse-power.

Instead of having the steam-winch near the fore-cabin, in the newest ships it is placed on deck close to the engine-room, so that the steadiness of the ship is increased, and the bow kept out of the water. The screw-vessel at Montrose has two winches, one being behind the foremast, the other (smaller) behind the mainmast. The latter is very useful in discharging fishes and in working the dandy. In general, the Granton ships have the steam-winch in front, with the capstan behind, just before the engine-room—a different arrangement from that at Aberdeen. Moreover, a decided improvement is introduced by the presence of a "brake" in connection with this

* Messrs. Joseph Johnston and Sons.

apparatus. In 1884 reliance was placed on the old hawser fixed to the trawl-warp in the case of the net being held by a sunken wreck or a rock. Now, the moment the net is fixed, the "brake" (which is secured to a moderate degree) permits the trawl-warp to run out, and thus save the net from serious rupture or total destruction while the ship is being stopped. In the Granton ships an iron wire rope is used instead of a hawser from a hook on the mainmast, to save rubbing on the rail. This is fixed to the trawl-warp by spun-yarn. The length of the trawl-warp, which is of steel-wire rope, ranges from 200 to 240 fathoms. The warp has six outer and a central strand. The older warps had a Manilla centre, but the newer have wire. A change has also been made in the teeth of the wheels of the winch, for instead of being transverse, they are now helical or oblique in such ships as the "Belcher." The warp is run round a capstan in rear, and out by a slit with rollers in the bulwarks of the ship. The large ends of the winch are used, as formerly, for winding the bridles and all ropes and tackle, the latter being still the method of hoisting on board the bag of the trawl. Instead, however, of the snatch-blocks being fixed to the deck, they now are attached to the top of the engine-room. A considerable number of the paddle-ships still use a 9-inch Manilla hawser as trawl-warp, and it is wound round a capstan from wheels beneath the deck. These also have the piece of old hawser (at Montrose of about 13 fathoms) as a guard during trawling, but, as indicated, the best screw-trawlers have the "brake" on the winch. In one or two of the older trawlers at Granton, the narrowness of the ship has caused the winch to be placed on the fore part longitudinally, not transversely.

In some of the ships at Aberdeen the steering or wheel-house has a roof, with side-panels and panes, so as to protect the men, and it occupies the same position, viz. in the centre of the vessel. Others have simply a canvas shelter above the wood. In one of the newest vessels at Aberdeen, the steering-house is open, as it is stated the men are apt to sleep in the covered houses, and prefer to be in the open air during their watches, while it is interesting to note that the Granton General Steam Fishing Company's ships have always had open wooden wheel-houses. Besides a spirit-compass on a stand, a new vessel has an inverted one on a wooden pole, so that two are available in steering. Coals are still carried in the side-bunkers, which in the best ships have a floor of cement, so as to minimise the danger from fire. At Aberdeen small English coals are largely used,* and instead of being piled loosely on deck at starting, as in some of the vessels from Granton, the extra coals are stored in bags, and are thus more easily handled. The finest vessels carry about 60 tons of coal in

* At 11s. per ton.

the side-bunkers adjoining the engine-room, and burn about $2\frac{1}{2}$ tons per diem, with surface-condensing boilers; but fairly good ships often exceed this quantity.* The consumption of coal in such cases is, of course, a vital point in the economy of the trade, and a vessel which will consume 60 tons in 12 days is seriously handicapped. Some think that the larger vessels, which require more coal, are less fitted for remunerative work, since they catch no greater number of fishes. They might, however, be safer at sea. An improvement is the placing of the iron water-tank, which will hold about 270 gallons, under the deck, thus economising space and avoiding accidents. It is filled by a hose-pipe fixed to a screw-hole on deck. In the large screw-vessel from Montrose the tank is placed behind the bulk-head of the engine-room, and a hand-pump raises water to the deck. In the newest ships an oil-tank, to hold from 40 to 50 gallons, is filled beneath deck in the same way.

The bulwarks of the new ships have self-acting scuppers for heavy seas, besides the usual small permanent ones, but no cement gutters are now present at the sides, as it was found that they were rather a disadvantage, for, in such as have seen service, the cement becomes dilapidated. In 1884 the ships working off Aberdeen usually carried their fishes in covered compartments at the bulwarks in front, or even permitted them to lie loosely on deck. This arrangement is now seldom seen, probably owing to the use of ice and the greater distances traversed. The bag of the trawl containing the fishes is emptied in the Aberdeen ships in a series of pounds (about 5 in number), formed by passing stout planks into upright grooves on deck in front of the winch, and in these the fishes are sorted and "gutted," preparatory to being placed in the fish-hold in ice. The labour involved by this method is a contrast to that of previous years off the eastern Scottish shores. Hence, when the catch at night includes haddocks of from 8 to 10 inches in length, these are considered unremunerative to treat in this way, and are thrown overboard.

In the ships of 1884 the stout boat of the trawler was either carried on deck or suspended from davits at the sides. They can be easily launched from the latter, but may be carried away, and, besides, the top weight of the vessel is increased. At Granton the vessels formerly described have now placed their boats on strong iron rails, 6 feet 6 inches high, on the starboard side, and bolted to the engine-room on one hand and the bulwarks on the other. Now a larger boat in the newer vessels is placed on rests in the centre of the ship over the engine-room, while in the most recent it occupies the centre of the stern, and the front "stock" or support

* This is much less than the quantity consumed by some of the old paddle-ships in 1884, *e.g.* about 35 tons a week.

has a swivel. Moreover, in the "Belcher" the hook of the chain-lashing is jointed and fastened with a ring, so that the boat can be made ready in a minute. The modern boat is considerably larger, and is covered with canvas.

In connection with the fittings on deck, the use of raised or projecting figures or letters of sheet-iron on the funnel is one of the modern changes; they are very easily seen at a distance. The initial letter of the owner is sometimes added. Each vessel is, of course, marked likewise on quarter and bow.

The ice-house, which had just been introduced in 1884, is now an important part of the vessel, usually in front of the fish-hold. Five tons of broken ice are taken in the larger vessels to the distant grounds. It is sent from the stores in barrels, and passed from the cart to the hold by a funnel. So important has this feature become, both for liners and trawlers—in Aberdeen, for instance—that special factories have been erected for the manufacture of ice by the ammonia system, about twenty tons being made daily in one* near the harbour at present, and extensions are in progress to manufacture forty tons daily. On the distant grounds, where most of the work of the larger vessels occurs, the ice is placed over the fishes after they are "gutted" and consigned to the hold, as was done by the English trawlers from the distant grounds in 1884. The price of ice (at present 17s. 6d. per ton) is thus an item of moment in the trawling expenditure. On discharging the fishes from Iceland, Faröe, or the Great Fisher Bank, the old ice is thrown overboard, and, though it might seem economical to keep it for use in a subsequent voyage, *e. g.* for the preservation of the offal, for which 10s. per ton is got from the manure companies, yet it is certainly the safer method. No wind-sails are now employed.

The fish-hold in the best ships is from 9 to 10 feet in height, divided into compartments, each with two shelves. In the "Southesk," a screw-vessel at Montrose, there are two holds. When fishes are stored with alternate layers of ice, the front of the compartment is closed with planks, unpainted or coated green with enamel-paint, which is readily purified by washing. The shelves, again, in each division, are useful in diminishing compression. This alone is a marked change on the Granton trawling-vessels of 1884, for the newest ships then had only an ice-chamber surrounding a central compartment in which the fish-boxes were placed. The smacks from Grimsby and other parts in England, it is true, used ice in the manner now described in 1884 and previously, but it was comparatively rare in Scotland at that period. It is necessitated now by the lengthened voyages to the more distant grounds.

* Mr. Lang's.

During the voyage the water which collects from the fishes and the melted ice is carefully pumped out by a "donkey" engine, so as to keep the fish-hold dry. The hold will contain about 700 boxes of fishes, and great care is taken to keep it pure. In the Granton General Steam Fishing Company's ships ice is not used during the winter, for the fishes can be carried fresh to the market by means of one ship acting as "carrier" daily. In the warmer weather, however, ice in bags is taken on board each vessel. Few ships at Granton, indeed, have the compartments for packing the fishes in ice, with the slips of board for closing them. This shows that the majority fish in the less distant waters.

In some of the newest vessels the accommodation for all the crew is in the aft-cabin, the fore part of the vessel being relegated to the fish-hold and stores. This appears to be a decided improvement in regard to the maintenance of a cool temperature and pure air near the fishes, especially when long voyages are undertaken. Formerly the crew had a fore-cabin, and the captain and mate an aft-cabin, and in many vessels the same arrangement still occurs.

The engine-room of the newer vessels is better ventilated, and the arrangements for the working of the engines facilitated. Even the ventilators are utilised for the hoisting of cinders from the hold by the aid of a small windlass. Moreover, in one the engine-room has an entrance from the galley as well as from the side—a convenience in stormy weather. A feature in contrasting the ships at Granton and Leith with those at Aberdeen is the small elevation of the engine-room above deck in the former.

In some ships the shrouds from the mizzen-mast are fastened to the deck about a yard from the bulwarks, so as to leave a clear space for working the trawl. In the larger ships, however, this is not necessary, the space in rear of the shrouds being sufficient for the trawl, or shrouds are altogether dispensed with, as in the Montrose paddle-ships, which have only a foremast.

The galley for the cook is in many under the bridge in front of the engine-room, or in some in the fore-castle peak;* but in the Montrose paddle-ships it, with the water-tank, is at the side near the paddle. These also have two tow-rails, one in front of the cabin for the crew, and one behind the cabin for the captain (aft), as the vessels are used for towing. A hand-windlass for raising the anchor is also present.

The average length of the trawl-beam in the best ships is 54 feet, it being found that a longer beam does not work so satisfactorily or catch so many fishes. At Montrose the beam is 52 feet. As before, it is composed of two or three pieces of oak or French

* The presence of a water-closet opposite, in one instance, appears to be objectionable.

elm, though occasionally it is in a single piece, and has a diameter varying from 10 inches to a foot. The shape of the iron trawl-head is scarcely altered, the posterior iron plate in a few being somewhat more abrupt than in 1884, thus conforming to the English type of trawl. The height of the beam from the ground varies from 3 feet 8 inches to about 4 feet. The "Athole," one of the General Steam Fishing Company's ships, is at present provided with an "otter" trawl with gigantic wooden ends about 12 feet long by 5 feet broad, which takes the place of the "hammer" of the pole-trawl described by the Commissioners of 1863,* and which are simply the much enlarged wooden ends in use in the otter-trawls in the Forth in 1858. These huge wooden (door-like) ends have on one side in front two powerful iron bars meeting to form a V, and supported by two accessory stays, the whole forming a projecting apparatus to which the chain connected with the warp is fixed. Towards the rear a perforated iron plate gives passage to two chains (one from each of the powerful iron bars above mentioned) for the attachment of the swivel for the trawl-net. The lower edge of the wooden end is weighted anteriorly with a heavy bar of iron, which occupies nearly half the length of the apparatus. A special and powerful rectangular frame of wood, with a top snatch-block, is fixed at the port-bow and taffrail for hoisting the ends on board; and they form a striking feature from a distance, as—with the boards—they project 6 or 7 feet above the bulwarks. The foregoing trawl is said to capture cod more freely than the beam-trawl, as many as 20 score having been secured in April. It is, however, still on its trial, having only been introduced about six months ago.

It was formerly pointed out that, when the iron trawl-head was dislodged, great difficulty was experienced in repairing it—especially in rough weather. The new trawls at Aberdeen have a broad band of iron, which bends round the end of the beam, and on which the loop of the trawl-head goes. It is secured by an iron pin and safe. This sheath protects the end of the beam, and must save much time at sea. At Granton the ends of the trawls are guarded by flat iron plates, but they do not form a loop over the ends. The trawl-heads are secured by a pin, as already mentioned. In the finest ships the length of the trawl-net is about 118 feet, and the arrangement is as follows:—For the first 56 feet next the beam the mesh of the net is 3 inches from knot to knot; the next 38 feet has at first a 2½-inch mesh, diminishing to 2 inches towards the posterior end, while for 24 feet the bag or "cod"-end of the trawl-net has 1½-inch mesh. At Montrose the trawl-net consists of 44 feet of 3-inch mesh next the beam, then 44 feet ranging from 2½ inches

* Report, Sea Fisheries of the United Kingdom, vol. i, Appendix, p. 3.

downwards, while the last 14 feet has $1\frac{1}{2}$ -inch mesh. There is thus no diminution of the mesh at the "cod"-end. Moreover, no improvement in the shape of a "bonnet" or apparatus for preventing the compression of the fishes has been found serviceable. The net has various rubbing pieces of old net and "bass" ropes, and the usual pockets internally. The ground-rope is variable in composition. The majority have this part of the trawl composed of rope only—an outer layer being wound round a central rope. The ground-rope of the Montrose ships is of Manilla soaked in tar, 8 inches in circumference, and made up to 13 with others twisted round; and in the finest ships elsewhere it is 124 feet long. In some, two pieces of chain are inserted at the ends, thus making three divisions of the ground-rope, viz. a central, entirely of rope, and two lateral, with a centre of 18 feet of chain, each being tied to the other with spun-yarn. Ground-ropes with chain throughout are not now used. In certain ships the ground-rope has a centre of wire-rope with a series of wooden rollers, with occasionally here and there a pair of metal rollers (12 in all—Gunn's patent). The rope is also in three divisions, and costs about £6 10s., or 30s. more than the ordinary form composed only of Manilla ropes. This arrangement is thought at Aberdeen to give an increased catch of fishes—sometimes about 5 or 6 baskets more than by the ordinary ground-rope. In some ships, again, the port and starboard-trawls have each a different ground-rope; in the one the rope is all of one piece, whereas in the other three breaks occur, viz. two of wire and one of chain. In one ship the ground-rope had only 8 feet of chain at each end, while the centre had rope. All, however, do not think that the rollers are so satisfactory as a ground-rope with pieces of lead in the centre. Moreover, one of the features which contrasts strongly with the condition in 1884 is the fact that the newest ships, with the exception of the Montrose vessels, now carry two trawls—a starboard and port-trawl—complete in all respects. This arrangement has been in force for at least four or five years, and probably was introduced from England. At Aberdeen, however, the second trawl is, as a rule, used as a reserve apparatus, and is not put into requisition until the first has received damage. The mode of working the two trawls would thus appear to differ materially in the respective countries, since, according to an interesting paper by Mr. W. L. Calderwood,* as soon as the contents of the first trawl are placed on the deck, the second is immediately "shot" overboard. The same arrangement has been found at Grimsby by Mr. Holt, who mentions, however, that the reserve-trawl is shot while the "cod"-end with its fishes is still hanging from the tackle.

* *British Sea Fisheries and Fishing Areas*, Scottish Geogr. Mag., Feb. 1894, p. 73.

The General Steam Company's ships at Granton (nine in number) have not varied in regard to the single trawl-beam, but they carry a second net. Consequently the large snatch-block and rollers occur on the port-side only. As before, the net is attached to the trawl-beam by grummet-lashings or by cord. The other parts, comprising the dandy and bridles (each about 25 fathoms) and the chain for the former do not differ materially from previous descriptions. The steel-wire rope is about the same length, viz. 200 to 240 fathoms, and lasts about ten months. The aluminium trawl-warp does not seem to have met with favour in Scotland. In some ships it is not, as formerly, left on deck after the check of wire-rope is fixed to the mizzen-mast, but carried outside the bulwarks, so as to avoid accident to the men. Those which, like the Montrose ships, use a Manilla rope (generally about 180 fathoms), require a new one every six months, the old one being utilised in preparing ground-ropes.

The shooting of the trawl is carried out in a similar manner to that of 1884, only there are no trawl-davits at the taffrail in the best Aberdeen ships; and, instead of the snatch-block then in general use, more convenient "dandy" scores (snatch or tumbling blocks), of which Sudron's or Scisson's patent are the best. At Granton and Montrose the trawl-davits are still in use, with snatch-blocks on deck. The lid of the block is opened during trawling. The trawl-warp leaves the drum, passes round a capstan, and out through rollers, either on the port or starboard-side, according to the trawl in use. Blocks on the mizzen-mast are still employed to hoist the stern-end of the trawl, and the foremast has a derrick. In "shooting" the trawl the ship goes at full speed. When the "cod"-end of the trawl is unshipped, the mate at the same time orders the fore-trawl-beam lashings to be freed, and when the beam is at right angles to the ship the "stopper"-rope is let go, and the order "ware forward" then sends off the trawl-warp from the drum.

A better arrangement now exists for assisting in unshipping the heavy trawl-heads, for these rest on a stout wooden platform about 18 inches high, and thus are easily swung over the rail; and, besides, the deck is saved from injury. In one or two ships at Granton larger platforms for the fore-end of the trawl have been fitted. In a new vessel, indeed, a square of plate-iron has been put on the deck at the point most injured by the trawl-head. In rough weather a chain fastens the trawl-head to the nearest iron stanchion at the bulwarks, and is used in bringing the front trawl-head on board. In the same way an additional chain at the stern-end is sometimes useful. In the Montrose paddle-ships the wheels for winding the trawl-warp (a Manilla rope) are below, and only the

capstan is on deck. The latter (capstan) in some trawlers is made too high, and is wrenched out of its fastenings.

The trawl is usually down for five hours on the "Great Fisher Bank" and other grounds, though trawlers working near home regulate the time rather by the nature of the bottom than anything else, in some cases spending as much time (three hours) in mending the net as in trawling on hard ground, or where wrecks and anchors occur. The trawling period, indeed, on hard ground is about three hours, on soft ground five hours. When productive ground is discovered, a "dan," or buoy, with a red or black flag by day, and a white globe-light, close to the surface, at night, is put in the water to mark the spot, though it is liable to be carried away by other ships, and the lamp broken. This buoy has a pole, with heavy iron bars, at one end, and towards the other about ten flat pieces of cork, upwards of a foot square. In one or two ships floats of skin—such as the liners use in herring-fishing, with pole and flag, were substituted for the cork buoys, or small pieces of cork on a string. The rate of speed when trawling is, as formerly, about $2\frac{1}{2}$ knots an hour, though on muddy ground a higher rate is sometimes maintained. In sailing, the best ships go about 11 knots. At night the captain and mate take watch alternately with one of the crew.

The crews on board the trawling ships remain very much as in 1884, the usual number being eight, though there are only seven in the Montrose paddle-ships, one of whom is cook. The latter may be either an old man or an adolescent. Each is furnished in the newest ships with a life-jacket of cork, and there are besides two life-buoys on deck. Only two at Aberdeen, the captain and mate, now have a percentage on the amount of fishes captured. The rest of the crew have ordinary wages. At Montrose the captain and two fishermen have a share in the "catch;" the rest have wages. There are seven men on board the ships of the General Steam Fishing Company at Granton, instead of eight as formerly. The percentages given to each remain almost as in 1884, a graduated series running from the "deck-hands" to the captain. The first engineer gets 5*s.*, and the second 3*s.* 4*d.* per ton of fishes.

In 1884 the Granton General Fishing Company's ships used "cringles" in transferring, during stormy weather, the fish-boxes to the "carrier" for the day. This practice has now been abandoned, and the ships either run to quiet water, and place the boxes on the deck of the "carrier," or they are at once transferred by boarding. It is during the latter operation that considerable injuries occur to the bulwarks and rail of the ships, the former having the stays bent, and the latter being frequently driven in.

One of the newest ships* at Aberdeen is a steel vessel—with a well—for fishing at Iceland and Faröe. It is 103 feet between the perpendiculars, and 114 feet on deck, 21 feet broad, and 12½ deep. The well is one of Houston and Mackie's patent fish-wells, and occupies the entire centre of the ship, the roof of the well sloping inward about half-way up the side of the ship, and leading to the hatches—the opening thus being much smaller than the bottom. The water accordingly will be somewhat steadied during the motion of the ship, though, as the cod will have a roof to rub against as well as walls, injuries may readily occur. The water is driven in during the voyage, rises to the surface of the well, and overflows by an opening in the side of the ship. A constant current is thus kept up. A grating at one end (the lower) permits the removal of refuse from the bottom of the well. While the cod swim freely in the tank, the halibut are tied, as usual, by the tail to the iron rail at the margin. The vessel has been specially fitted for the capture of these by hook and line; and at present no trawl is aboard, though such can be shipped at any time, and the newest apparatus (*e. g.* steam-winch and Sudron's patent dandy-score) is in readiness. The foremast has a derrick-boom, and the anchor-winch is worked by steam. The boat rests on a swivel-stock on the port bow, and is intended to be used as an accessory well. The cabins for the crew (*viz.* captain, two engineers, and nine men) are at the stern, while in the high bow is a store, and behind a convenient hold for fixing on the bait (herring). An ice-house, fish-hold, and all the newest fittings in the engine-room and other parts show the care that has been bestowed on the construction of the vessel. The consumption of coal is estimated at 3 tons daily.

Similar ships to the foregoing have been employed for some years at Grimsby for line-fishing in Iceland, but several improvements have been introduced in the new ship. Moreover, it can also be used as a trawler when required.

III. THE PRESENT STATE OF THE BEAM-TRAWL FISHERY IN RELATION TO THE FISHING-GROUNDS AND THE FISHES.

In 1884, under the head of "General Remarks," a careful survey of the situation of the fisheries in connection with both line-fishing and trawl-fishing was drawn up.† In reading over these remarks at the present time the position does not seem to have been misunderstood; indeed, there is little at variance with the condition as now shown by ten years' experiments and observations. Amongst other remarks it is stated that "steam-trawlers at present can only

* "Ocean Bride"—Mr. Drummond's.

† Vide Report of the Commissioners, pp. 377-380.

fish profitably within a moderate distance of the land ; and were the fishes to become so thinned that, with all the skill and energy shown in managing the ships, the returns proved unsatisfactory, trawling might voluntarily disappear. There is no reliable evidence, however, that before such a result would happen irreparable injury would have been done to the sea-fisheries."

Now, at that time there were in Scotland a total of 61* trawling-vessels—of which probably about one-half were steamers, the other half being sailing boats or vessels used for trawling. The exact numbers cannot be obtained, but there were from 12 to 20 boats used in trawling at St. Andrew's, 6 to 8 came from Broughty Ferry, 2 or 3 each from St. Monan's and Cellardyke, and others existed in the Moray Firth. Trawling, indeed, at St. Andrew's was an old custom, the Buckhaven fishermen having introduced it early in the century, and subsequently the local fishermen carried it on more or less regularly, generally trawling in September and October, and in March and April, though occasionally much longer. The frequent presence, however, just before the period of the Trawling Commission, of 10 or 12 powerful steam-trawlers to compete with them on their own ground quite altered the aspect of affairs. The energy with which the steam-trawlers generally worked—for trawling went on by night as well as by day, and in weather unsuitable for the liners—introduced in Scotland a new era into the department. Fishing was to be carried out no longer by more or less independent crews, bound together by blood-relationship or other ties, and whose working hours were largely regulated by the weather and tides, or their own convenience and necessities. Moreover, their whole domestic life was interwoven with the time-honoured pursuit. Their wives and daughters laboriously baited the hooks and arranged the lines in the baskets for "shooting," they gathered the "bent" grass for separating the layers of the line, and with the sons dug lob-worms or procured mussels for bait. In the olden time, indeed, their wives and daughters were likewise their fish-merchants, and disposed of their captures to the best advantage. Now (1883) active and powerful vessels, propelled by steam, and thus more or less independent of the weather—manned by a captain responsible to owners or their manager, a crew bound together only by discipline and pay, and whose fishing apparatus required no bait, appeared on the field. Further, instead of following the pursuit on grounds familiar to generations before them, the new fishermen not only ranged over these, but sought new and sometimes more distant fields. Capitalists took up the question, and fitted out powerful

* The numbers are taken from the Report of the Select Committee of the House of Commons, 1893, p. 396.

ships in both Scotland and England, and sent them into Scottish waters, so that the liners met with most formidable rivals. The complaints of the line-fishermen at this period (1883) and subsequently necessarily attracted much attention, and great sympathy has always been expressed in regard to their condition, for undoubtedly the larger and more regular supply of fishes had a tendency to diminish prices, and this caused a reduction of income to the liner, and the fishes on certain of the nearer grounds were thinned, and perhaps rendered more wary. In the Report of 1884 it was said that "two competitors are in the field instead of one, and for the liner it may take closer work, even with all the help improved modern appliances in boats and material can give, to keep pace with his rival;" and, further, that it would be a great calamity if any mishap should befall such a fine race of men—hardy, willing, and adventurous. Complete destruction, or, at any rate, most serious interference with the fishing-grounds, and the destitution of the fishing population, was then predicted, and many anxious eyes watched the development of events, since about 45,000 men at least were dependent on the net-and-line-boats of the country, whereas only a few hundred—perhaps between 200 and 300—were at that time engaged in the trawling industry.

Since 1884 the trawling vessels have steadily increased in number, so that within the ten years they have been considerably more than doubled, the returns for 1893 showing that there are no less than 142 vessels and 720 men thus employed,—the total value of vessels, exclusive of gear, being about £240,737. Or, to go more minutely into details, of this number 72 are steam-trawlers, having a tonnage of 2,625 tons, and valued at £237,004, to which has to be added the fishing gear, £10,746—making a total of £247,750. These vessels are manned by 544 men. The rest (70) are sailing trawlers, having a tonnage of 423, and valued at £3,733, while their gear is estimated at £1,332—making a total of £5,065, with 176 men on board.

In addition to the foregoing there were 39 steam-trawlers belonging to English owners, fishing regularly from Scottish ports, and the tonnage of which was 959 tons, valued £92,100, and value of gear £3,850—making a total of £95,950. These had 296 men on board. The disproportion between the number of men employed and the cost of the material is chiefly brought out when it is mentioned that for 1892 the liners and net-fishermen were 45,629, while they had 13,865 boats, valued at £680,000. It will thus be seen that, while the average is about £1,695 for each trawling ship, for the liner it is about £49. The disproportion, again, in the trawling vessels, between the first-class and the small sailing-boat, *e. g.* of the Clyde, is very great, the former being about £5,000, the latter under £40.

If the returns of round, flat, and other fishes landed, irrespective of herrings, sprats, sparlings, and mackerel, which do not prominently bear on the present question, be considered, it is found that in 1892* the liners brought to shore 1,229,809 cwts. of round fishes, viz. cod, ling, torsk, saithe, whiting, haddock, and conger, which realised, at 8s. per cwt., £516,524; the trawlers landed 261,200 cwts. at 10s. 11d., or £143,062; the liners produced 100,228 cwts. of flat-fishes, viz. flounders, plaice, brill, skate, halibut, lemon-dabs, and turbot, at 10s. 9d.=£53,973; the trawlers, 77,649 cwts. of flat-fishes at 25s. 4d.=£98,295; while of other kinds of fishes, which include hake, bream, gurnard, cat-fishes, and sillock, the liners had 61,224 cwts. at 4s. 9d.=£14,646; and the trawlers, 41,256 cwts. at 4s. 7d.=£9,410. The total in each case are, for the liners 1,391,261 cwts. and £585,143; for the trawlers 380,105 cwts. and £250,767.

In glancing at the returns (1892) of the board, which were handed in by the Chairman to the Select Committee last year, it would seem that one fish, viz. the green cod or coal-fish, is included both amongst the round-fishes and the "other kinds of fish," in the former having the name of "saithe" (adult), and in the latter "sillocks" (young); but this is not a point of much importance in regard to the results. As might be expected, the liners, and notably the long-liners, have the predominance in the round-fishes, especially in regard to cod, ling, and conger, the latter being apparently seldom caught in a trawl on the Eastern coast. These large fishes, moreover, would appear to protect themselves to a considerable extent from this apparatus, especially when it is in frequent use, so that it is only in water that is disturbed by gales or by working at night that they are caught in numbers under these circumstances. Nor is this surprising, since even a tiny cod, of little more than one-eighth of an inch, can avoid the forceps intended to capture it. The cod and saithe are also largely caught by gill-nets on the West coast; while the great lines, with hooks baited with herring, are the chief means of capture used in the case of the conger. Further, it has to be remembered that the trawlers, both near and distant, as a rule, throw overboard their small haddocks (8 to 9 and 10 inches), in both cases because it is not worth their trouble to bring them to market and pay dues for the trifling sum obtained for them; and in the instance of the distant trawler, to avoid, in addition, the labour of "gutting" and the expense of ice. Yet the liners bring these to market and they are included in their returns. It

* The full value of the labours of the Royal Commission of 1883, and especially of the late Lord Dalhousie, in establishing a series of proper statistics for the fisheries of Scotland, cannot be over-estimated.

is an interesting fact that, notwithstanding the recent remarks concerning the condition of the trawled fishes, that the price of the latter surpasses that of the former by 2s. 11d. per cwt. It is true the trawler can more readily reach the market with his fishes, but against this has to be placed the great number of local fishing-boats which have only brief distances to traverse, and the fact that the trawlers who go to distant banks bring fishes "gutted" as well as preserved in ice, and the appearance of which is not always in their favour.

When the flat-fishes are considered, it is found that though the liners produced considerably more in weight, yet the price obtained per cwt. is not half (by 3s. 10d. less) that got by the trawlers, so that the total value of the flat-fishes procured by the latter is nearly double that of the former.* Yet we know that halibut are largely caught by the liners, and that the three-mile limit and the closed waters in addition are at the disposal of the latter for relays of lines wherewith to capture plaice, dabs, and flounders. In all probability, however, it is the plaice, the witches, and especially the lemon-dabs and the turbot which prove so advantageous to the trawlers.

Of the "other kinds of fish" little need be said except that comparatively few hake come into the trawl, whereas the liner perhaps obtains a larger number; that while the liner brings the gurnards to shore and often eats them, they are frequently thrown overboard by the trawler; and that the cat-fish (wolf-fish) is caught by both in considerable numbers, but whereas, in certain trawlers, this fish is taken to port on the Tuesdays, it is thrown overboard at the end of the week.

In 1893 the equivalent returns show that the liners brought to land 1,136,389 cwts. of round-fishes = £466,399, this being 93,419 cwts. and £50,125 less than last year. The most marked deficiency has been in haddocks, 69,766 cwts. and £35,092; cod, 54,260 cwts. and £20,661; and whiting, 15,381 and £5,741. An increase had taken place both in line- and trawl-fishing in the other round fishes, viz. ling, torsk, saithe, and in the conger caught by line. How far this diminution was due to the unfavourable weather of 1893 is an open question. It certainly must have had some influence. The abundance of very small haddocks is another fact to be remembered, since many were not brought to shore, and they occupied hooks on which larger fishes might have been caught. The trawlers landed 309,862 cwts. of round fishes = £178,304, or 48,662 cwts. = £35,242 more than last year. With regard to flat-fishes, the liners produced 57,149 cwts. = £43,306, or 4,685 cwts. and £48 more than last year; the

* At Montrose, for instance, the flat-fishes landed by trawlers realised nearly 20s. per cwt., while those caught by line produced only 9s. 11d. per cwt. But turbot alone was sold at £3 6s. 2d. per cwt., so that the trawlers had the advantage in this respect.

greatest increase, 5,594 cwts. and £566, having been in halibut, but these apparently were largely caught in distant waters, such as off the coast of Norway, Iceland, Faröe, and elsewhere, so that they confuse the returns from British waters. An increase also exists in soles (lemon-dabs?) of 50 cwts. and £120. A slight decrease, again, occurs in flounders, plaice, and brill. The trawlers landed of flat-fishes 71,024 cwts. = £89,781, a decrease of 604 cwts. and £7,243 on last year, this decrease being largely due to the deficiency of lemon-dabs, viz. 6,133 cwts. and £8,448, and a deficiency in turbot of 94 cwts. and £762, while an increase occurred in halibut and a larger increase in flounders, plaice, and brill, 5,197 cwts. and £1,597. This year skate form a separate return, which shows that the liners produced 52,626 cwts. and £10,725, or 4,862 cwts. more than in 1892, yet with only a trifling excess of income over that year, viz. £9 10s.—a result probably due to diminished prices. The trawlers landed 5,383 cwts. = £1,015, or 637 cwts. and £253 less than in 1892. Of “other kinds of fishes” the net fishermen brought 3,517 cwts. = £891, or 102 cwts. and £731 more than in 1892, while the liners landed 46,461 cwts. = £10,726, or 11,347 cwts. and £3,160 less than in 1892. The trawlers again caught 39,418 cwts. = £9,215, or 1,838 cwts. and £195 less than in 1892.

The price of the round fishes in 1893 is respectively for the liner 8s. 2½*d.* per cwt., and the trawler 11s. 6*d.*, or a balance of 3s. 3½*d.* in favour of the latter, and therefore a higher proportion than in 1892. In regard to flat-fishes the inclusion of skate makes a considerable difference; thus the average price for flat-fishes, inclusive of skate, is for the liner 9s. 10*d.*, for the trawler 23s. 9*d.* per cwt., whereas, when the skate are excluded, it is for the liner 15s. 2*d.*, for the trawler 25s. 3*d.* In the former case the trawler receives no less than 4s. 1*d.*, more than double the amount obtained by the liner; in the latter case the trawler receives 10s. 1*d.* per cwt. more than the liner. The disproportion in any case is marked. In connection with prices, however, it has to be borne in mind that in many cases the liner is compelled to sell his fishes in remote districts or unfavourable markets, whereas the trawler takes care to put his fishes into the best market, and in quantity.

Again, the grand total of all kinds of fishes landed in 1892 was 5,436,138 cwts. If herrings, sprats, sparlings, and mackerel (viz. 3,664,771) are deducted, 1,771,367 cwts. are left, of which 1,391,262 cwts. were caught by liners, and 380,105 cwts. by trawlers, or, in other words, the liners caught more than three times the quantity of fishes landed by the trawlers. In 1893 the grand total of all kinds of fishes notably exceeds that of 1892, and is no less than

6,208,018 cwts., or 771,880 cwts. more than in 1892. The greater proportion of this, however, is made up of herrings, viz. 4,486,187 cwts.,—that is to say, a fish which is more or less unprotected at all stages of its life is apparently able to hold its own against its destroyers. It is, however, a purely pelagic form, and depends on the pelagic or floating fauna for its food. If the herrings, &c., are deducted a balance of 1,721,831, cwts. is left for the liners and trawlers, being 49,536 cwts. less than in 1892. Of this 1,296,144 cwts. were the produce of the liners (less by 95,118 cwts. than in 1892), and 425,687 cwts. the quantity landed by trawlers (45,582 cwts. more than in 1892). While the liners, therefore, showed a marked diminution in their total, the trawlers showed a considerable increase.

When the returns, however, of the fishing-boats of all kinds (other than beam-trawlers) are considered, it is found that there were in 1893, 363 fewer boats and vessels than in 1892, and a decrease of 1,689 fishermen and boys. This condition of things is sufficient to account for a considerable diminution of line-caught fishes, without regarding the unfavourable weather of the season. Moreover, it has to be remembered that fishery statistics are far from being complete, for though the returns show that the quantity of fishes mentioned has certainly been landed, they do not indicate those fishes which have been landed and not reported. On the other hand, the number of the trawlers has increased by two (probably powerful steam-vessels) and eighteen men during the year.

In 1884 trawling was carried on within a "reasonable distance" of land, so that the paddle-ship could deliver the catches of the night in time for the market next morning, or the daily "carrier" of the fleet of steam-trawlers from Granton, by leaving the fishing-grounds in the afternoon or evening with the united catch, could reach that port early next morning. The vessels from the Moray Firth could land their fresh fishes at Macduff or Aberdeen, and the vessels from Montrose and Dundee carried fresh fishes to those towns.

For ten years the trawl-fishery has been prosecuted with vigour, and it is interesting now to see what areas the ships frequent, and with what results. To commence with the most northerly, viz. Aberdeen, at which trawling has made great progress since the former date (1884), it is found that, whereas the chief supplies were brought fresh from the adjoining sea by the older paddle-ships, or from the Moray Firth by the more powerful vessels, the main supply of the present day comes from the "Great Fisher Bank" or from Iceland. Instead of the activity displayed in 1884 in the strip of sea from 10 to 20 miles off the coast, between

Aberdeen and Montrose, only a few vessels are now seen at work here and there in good weather. Fishes are by no means absent from this area, and at certain times occur in considerable abundance, but the individual catches at other times are limited; and on the rough ground 10 or 11 miles off, in 33 fathoms, it sometimes happens that, after three hours' trawling, about the same time has to be spent in mending the net. Yet lemon-dabs and sail-flukes or "megrimms" (*Arnoglossus megastoma*) in the deeper and softer parts, with the larger haddocks and other forms, render the work there still worthy of attention. If small haddocks brought fair prices, the work would, indeed, be tolerably remunerative, as they are at present in very great numbers. The liners work on the same ground and catch chiefly the latter fishes. There is no indication that fish-food has been seriously interfered with on this ground, but, on the contrary, invertebrate life of all kinds is in great abundance. Moreover, the enormous numbers of pelagic sand-eels, from 15 to 33 mm. in length, intermingled with swarms of young flat-fishes, on these grounds, and on which many of the fishes were feeding in May, is a feature of moment. In 1884 the captures on the northern part of this area during the summer months were comparatively limited, and it was only the advent of the herring in autumn that caused a notable increase of white fishes. To-day, at the distance from land just mentioned, each haul in daylight produces from a basket to a basket and a half of lemon-dabs, about three-fourths of a basket of large haddocks, and 4 to 5 boxes of small haddocks. At night, a few ling, cat-fishes, and cod are added to the catch. Few whiting are procured, and the same feature was occasionally seen in 1884, for the whiting are often in the upper parts of the water. Very few cuttle-fishes occurred in May. The "catch" just mentioned is not a heavy one, and is probably surpassed by other ships, but it at any rate shows that fishes are still present in considerable numbers. This is further demonstrated by examining the "catch" of a liner with six men on board, and which had been at sea about 32 hours, fishing on the 28th and 29th of May, probably from 28 to 30 miles off Aberdeen, viz. 9 boxes of large haddocks, the largest fish reaching the length of 20 inches, the rest smaller (at 24s. per box), 3½ boxes of small haddocks, a few cod, dabs, one lemon-dab, and a few whiting—making a total of about £12 for the six men. In the same market lately the large haddocks brought 29s. per box, so that the above is probably not an unusual price.

At the southern end of the ground just mentioned, viz. off Montrose, a trawler working, three years ago, about 25 miles off, in August, landed the very high catch of 500 boxes of haddocks in a

single night. At present the takes range, per week, from 100 to 140 boxes of haddocks and flat-fishes, besides cod, coal-fishes, and gurnards. Plaice are said to be rather scarce, even lemon-dabs being more abundant. For the night of the 29th May 18 boxes of haddocks and flat-fish were landed, besides cod and ling. For each box of good haddocks (7 stones) 16s. were obtained—a much lower price than in Aberdeen, where, however, the box was heavier (8 stones or more). The “catch” for the night was about a ton in all. A small liner, with five men on board, which went out between 9 and 10 A.M. on the 29th, landed at 5 P.M. (*i.e.* in 8 hours) $\frac{3}{4}$ box of large, $\frac{1}{2}$ box of medium, 2 boxes of small haddocks, many about 9 inches long; 1 lemon-dab, 2 very fine cod, and 4 codling, and this though their lines were “shot” in broad daylight. The fishing-ground was from 8 to 10 miles off. This is a small “catch,” but the circumstances under which it was made were not favourable. There can be no doubt that the entire Eastern coast abounded with multitudes of small haddocks, and that these have been captured in immense numbers by both liners and trawlers.

The best trawling ships, which are about 30 in number, at Aberdeen at present chiefly frequent the Great Fisher Bank, about 200 miles off, and from 30 to 40 fathoms in depth, it being a general opinion amongst fishermen that this, and up to 60 fathoms, is the most favourable depth for their pursuit, for they think that in deep water (100 to 175 fathoms) they get only conger, halibut, and skate; and elsewhere, as off the coast of Portugal, only sharks are procured at 500 fathoms. Yet the Rev. W. S. Green, off the west coast of Ireland, got “witches,” ling, haddocks, and conger at 170 fathoms, and skate and forkbeard at 500 fathoms. On this ground (Great Fisher Bank), which is about 120 miles from east to west, and from 60 to 80 miles from north to south (a larger area than the enclosed region of the Moray Firth), the “catches” of these trawlers vary from 80 to 180 boxes or more, consisting of plaice, haddocks, turbot, and other fishes, which are procured in from 8 to 13 days, including the time spent on the voyage. Since the Moray Firth was closed, these ships, therefore, find it remunerative to undertake this long journey, and bring their fishes preserved in ice to the market in Aberdeen. They do not seem, however, to find it so profitable to fish in the waters near the Scottish shore. In the same way, the powerful ships which proceed to Iceland bring from 200 to 400 boxes of fishes in about 14 days. The plaice procured in this region are recognised by the dark spots; and as these, the haddocks, cod, and other forms have been “gutted” and preserved in ice, they do not have so attractive an appearance as those caught by the liners.

Besides the areas just mentioned, some trawlers proceed to Blacksod Bay, off County Mayo, on the West coast of Ireland, for soles and turbot, while in February and March others go to ground 20 to 40 miles off Scarborough, where, perhaps, 20 score of cod are caught in a night. Some, again, work on the turbot-ground, from 80 to 90 miles off Aberdeen, and others find on the Dogger Bank catches of from 18 to 20 boxes of plaice.

When the trawlers from Granton and Leith are considered, it is found that, notwithstanding the closure of the Forth (for 3 miles beyond the Island of May), these ships have increased in number, have been improved in equipment, and have been able to overcome the difficulties with which they were handicapped—in comparison with the liners. In the case of the General Steam Fishing Company's ships, and probably in others, however, very definite instructions—based on carefully-recorded data, compiled during the last twelve years—are issued to each captain as to the distance to be traversed (by the log), and the direction on every occasion. No haphazard selection of fishing-grounds is made. Thus in December, besides the ordinary fishes, numerous cuttle-fishes (so valuable for bait) are procured off the Isle of May. In January, February, March, and April they work from 5 to 10 miles S.E. of the Isle of May, viz. more or less on the grounds frequented in 1884. In March and April the cod are captured, as before, in considerable numbers as they congregate during the spawning season, and in the earlier months as they follow the herrings. In June, July, August, September, October, and November they take to the more distant grounds off the Forth—about 40 miles E. by N.E.

The opinions somewhat freely expressed by some in 1884 as to the decline of the trawling industry in the Forth and the adjoining area—notwithstanding all the advantages of a free area from inshore to offshore then possessed—do not seem to have been borne out by further experience. Even with the entire area of the Forth and St. Andrew's Bay closed, these vessels, now considerably increased in numbers, have found fishing profitable on the more distant grounds. They work on a certain area, either by means of a flag-buoy or otherwise, and strictly in accordance with the instructions given from headquarters. If the captures are observed to be decreasing, either from the thinning of the fishes or their being scattered, they change ground, as, indeed, was very noticeable in 1884, returning after an interval to the same area, to find that an increase has taken place. In connection with this filling up of areas over which trawling has been assiduously carried on, it is an interesting fact that the local boats—from 12 to 20 or more in number—found for many years that, on the whole, their best ground in St. Andrew's Bay was a

line about 2 miles from shore ("Scooniehill," in a line with "the steeples"), and about 4 fathoms in depth. Boat after boat trawled along that line, wind and weather permitting, for four months of the year, and sometimes longer, and to the closing day it maintained its position as the best area for plaice. The same observation has been made at Brixham, where trawling has been in operation about a hundred years. It is quite evident, therefore, that other fishes took the place of those captured, and that this continued month after month and year after year. The whole question, therefore, in the larger areas outside the 3-mile limit is—Can the supplies from the neighbouring waters keep pace with the rate of capture now going on by both liners and trawlers? These supplies consist of the growth of the young from eggs on the area itself, and the immigration of eggs, young, and adults from other areas or the open water beyond. It is seen that, so far as human observation can go, the supplies of herrings are as plentiful as formerly, notwithstanding the absence of restriction and the great waste that annually takes place in this fishing. On the other hand, it is a matter of observation that the first hauls of the trawl on virgin ground are the most successful, and that by-and-by the catch diminishes, and the same occurs with the liners on their new "banks" or "reefs." Yet it cannot be said in either case that the fishes have been extirpated, but they probably have become more wary as well as diminished in numbers, and, moreover, they may have changed their ground, for fishes are constantly roaming. It has to be remembered that the food-fishes are not altogether confined to the shallower water in which they are usually followed, but they likewise extend into the deeper water beyond. Such deeper water and unfrequented regions, therefore, form reserves, in which the species is reproduced, the eggs, young, or adults passing into those areas in which the food-fishes have been more or less thinned.

The area last mentioned, viz. that off the Forth, is perhaps one of the most important in Scotland, in regard to the number and variety of its fishing-grounds. For the present purpose the area may be defined as that bounded by a line drawn eastward from Arbroath on the north, and a similar line from St. Abb's Head on the south. Between these points the Tay and the Forth pour considerable bodies of fresh water into the sea, while the Eden debouches into St. Andrew's Bay between them. The amount of microscopic food—both plant and animal—as well as of the smaller invertebrates which are carried to sea in this area, is very considerable, and in all probability is closely related with the richness of invertebrate life both in the waters and on the bottom. The enormous numbers of pelagic mussels swept from the Tay and the Eden

alone form a remarkable feature. It is not surprising, therefore, that the fishing-grounds in this region still continue fairly prolific, notwithstanding the increased demands on their resources. In the same way the Moray Firth is another rich fishing-area on the East coast, though the rivers entering it are smaller.

The steam-liners and trawlers frequent the more distant grounds, not because the fishes are absent from the nearer grounds, but because their "catches," as a rule, far exceed in bulk those obtained on the latter. While, therefore, the present statistics show no serious diminution, it may be truly said that the total is kept up only by the supplies from Iceland, Faröe, and the Great Fisher Bank. But the nearer grounds would have produced a considerable supply if they had been perseveringly worked; and it cannot be doubted that they contained, at any rate, an immense number of small haddocks.* Moreover, these small haddocks had migrated from the distant waters, for it is a remarkable fact that, so far as ascertained, no great shoals of very small haddocks (*i. e.* less than 3 inches) have been encountered in inshore waters. The life-history of the haddock, indeed, between its post-larval condition and the adolescent stage of between 2 and 3 inches, is still comparatively unknown. Before the appearance of these hordes of small haddocks, it was generally asserted that the haddock had been more or less extirpated; hence the necessity for caution in dealing with such subjects. Again the question as to the completeness of the statistics of fishes caught round the Scottish shores has to be considered, and there are some who think much improvement is required in this direction. Indeed, the only satisfactory method would be for every liner, trawler, net-, crab-, or other fisherman to hand to the official on reaching the port a slip stating the amount and kind of the "catch," and the ground on which it was made, as indicated in the Trawling Report of 1884. Taking all these circumstances into consideration, therefore, there is no reason for despairing of the fisheries, especially when the enormous powers of reproduction of the round and flat-fishes, their transparent, floating eggs, and the vastness of the medium which encircles our shores are remembered.

The condition of the inshore waters (within the 3-mile limit) has elsewhere been dealt with,† and will again form the subject of future remarks. All that need be said at present is that, so far as can be ascertained, it would not appear that the closure of the inshore waters

* An idea of the numbers of these may be given by stating that a trawler brought on board, in two hauls, about ten tons of small haddocks, which were, however, freed. Many were probably killed.

† A Brief Sketch of the Scottish Fisheries, 1882-92, p. 6.

has made any marked increase in the fishes of the offshore waters, yet the younger fishes have now had time to pass outward and become mature; nor have the larger fishes been driven shorewards by the more frequent interference with the more distant areas. No change, however, could be expected if the scarcity were due to general over-fishing.

(To be continued.)