

## North Sea Investigations.

(Continued.)

By

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### I. ON THE DESTRUCTION OF IMMATURE FISH IN THE NORTH SEA.

INTRODUCTORY.—Owing to enforced idleness during the period which would otherwise have been devoted to preparing my reports for publication, I am under the necessity of reserving much of the information collected during the last four months for a future occasion, and of treating only in the briefest possible manner the few subjects selected for present discussion. I have again to express my obligations for much courtesy and assistance received from members of the Grimsby fishing community, and to the Marine Fisheries Society of the same town for cordial co-operation in the work carried on at their laboratory and aquarium at Cleethorpes.

The subjoined remarks are continued from those which appeared in the last number of this Journal, and the subject is treated in the same manner.

As I explained when endeavouring to compute the proportion to the total borne by the undersized fish recorded in the reports of last year, the method adopted by the Board of Trade statisticians in collecting their figures is not such as to inspire the most implicit confidence in the accuracy of their results. Accordingly, since during the present season more time was available for statistical investigations, I have relied for my totals on the method previously adopted only in the case of small fish, viz. on observations based on the number of boxes landed on the Grimsby pontoon. In this work

I have received the most valuable assistance from Mr. W. Clark, the laboratory attendant.

It is to be regretted that it was not possible to extend the statistics thus collected so as to comprise all members of the various species under discussion, but so little time elapses before the fish landed from the boats are sold and scattered that a considerable staff would be necessary for this purpose. I have therefore confined my efforts to obtaining an accurate account of all the plaice landed, since there is no doubt that, in view of the objects of these investigations, the plaice is the most important species. The haddock, no doubt, is equally or even more important in a general sense; but since it is a species which in no way lends itself to protection by means of a size limit, and which, on the whole, appears to have suffered less from over-fishing than any other, I have postponed for the present any attempt to collect full statistics. That my statistics are absolutely accurate is more than I can claim, but I believe that the method adopted presents less opportunities of error than any other feasible under existing circumstances. It will be noticed that in some months one or more days are omitted. I have purposely abstained from completing them by the deduction of an average, since the variation of the supply from day to day is so great that such an average is quite unreliable. In the case of large plaice, home consumption (by fishermen) is a not inconsiderable item. For this I have allowed, with, as I believe, approximate accuracy, by counting the level boxes landed from the only fleet fishing the grounds frequented by large fish as full boxes. So far as I know, no allowance is necessary in the case of the small plaice.

*Plaice.*—In my last report I enumerated the number of boxes containing only small fish landed up to the 20th March.

The figures for the whole month are as follows :

From the Eastern grounds . . . . .	439 boxes.
From the Lincolnshire coast . . . . .	40 „

During the following months the statistics deal with the whole quantity of fish landed. Boxes containing only small fish are recorded as “small,” other boxes figuring as “large.” Boxes from Iceland contain only large fish, and are enumerated separately.

Month.	Total boxes from N. Sea.	“Large” N. Sea.	“Small” N. Sea.	Iceland.
April . . . . .	8,533 ...	7,864 ...	2,669 ...	300
May, less one day . . . . .	15,176 ...	7,532 ...	7,644 ...	4,683 *
June . . . . .	12,205 ...	6,880 ...	5,325 ...	7,351
July, less one day . . . . .	13,304 ...	10,585 ...	2,719 ...	11,376
August, less four days . . . . .	12,287 ...	10,668 ...	1,619 ...	6,854

\* This number includes all days on which fish were landed from Iceland.

In April 145, and in May 85 cases of small fish were sent to Grimsby market from the Continent by cargo boat.

Comparison with the figures for last year (N. S., vol. ii, p. 381) shows a very considerable increase in the quantity of "small" landed in the early part of the season, which commenced this year as early as March. This is due very largely to the early summer of the present year, which brought the fish, and, in their train, the boats, on to the eastern grounds sooner than usual. Moreover, instead of only sending one fleet to the Terschelling ground, during the present season Grimsby has furnished no less than four small fleets to assist in the work of destruction, whilst, in addition to steam trawlers hailing from our own and other British ports, we have been favoured with frequent visits from foreign vessels bringing small plaice from the same grounds. Thus in May 22 "voyages" of "small" were landed by British steam trawlers, whilst foreign vessels from Hamburg, Bremen, Gelstemünde, and Rostock contributed seven "voyages." The destruction was apportioned as follows:—by British steam trawlers, 3917 boxes; by foreign steam trawlers, 1642 boxes; by smacks, 2085 boxes. The latter were much hampered throughout the season by want of wind. Besides Grimsby boats, fleets from other east coast ports also visited the Terschelling and neighbouring grounds, including boats from Lowestoft. In view of the fact that our own boats brought practically none but small plaice from these grounds, it is somewhat surprising to learn from evidence given before the Parliamentary Committee that Lowestoft fishermen are so fortunate as never to catch any small fish at all.

Since the method of collecting statistics has during the present year been the same in the case of "large" and "small," we may venture to compute the comparative numbers of each with more accuracy than could be hoped for before. Taking the month of May as before, I found that 100 fish was the average contents of a box of "large," and that of these about 40 per cent. failed to reach what I consider to be the biological standard of maturity. There would therefore be in the boxes of "large" landed during May some 753,200 fish, of which 451,920 would be mature and 301,280 immature; whilst in the boxes of "small," containing each about 250 fish, practically the whole 1,911,000 fish would be immature. Thus of the total of 2,664,200 no less than 2,212,280 would be below the biological limit. This may be of some interest, but is of perhaps little practical importance, since, as I have endeavoured to show in former reports, we may hope to afford the necessary protection to the species without having recourse to the biological standard for legislative purposes. Indeed, from the experience of two seasons, I

now believe that a limit of only 13 inches, but not an inch less, would serve the required purpose. Now in the boxes of "large" only about 7 per cent. are less than 13 inches in length, whilst in the boxes of "small" 10 per cent. is a very generous estimate of the proportion of fish above 13 inches. Hence we find that of the total given above 1,772,624 fish fail to reach the limit of 13 inches. Figures for every month might be computed on the same basis, allowing for some variation in the number of fish in a box of large. This depends largely on the grounds worked. In May, as it happened, no boats were at work on the Great Fisher Bank, where the proportion of large fish is the highest for the North Sea. During June and the following months a certain amount of trawling was done on that ground; later in the season the "Holman" catches would materially lessen the average number in a box, which would reach its minimum in the winter months, when comparatively few small plaice are brought ashore from any ground. It appeared to be a general idea amongst experienced men that the average number of fish in a box of large was about fifty, but I have been able to convince any who were willing to put the matter to the test that nowadays this estimate is far under the mark.

As to the Iceland fish, judged by North Sea standards, those from the open grounds are all large, and a box of 10 stone contains only some thirty fish. As those landed in May were all from such grounds the total number would be about 140,490. As the number of Iceland boxes during that month nearly equals a third of the North Sea total, the great difference of the total numbers of fish from each district is not uninteresting. From all accounts it appears to be much as though we were comparing the condition of the Dogger when first trawled with that to which we have now reduced it.

With regard to the "large" plaice landed, it may be mentioned with some satisfaction that the only Grimsby fleets which have during this year refrained from persecuting the small fish appear to have met with tolerable success. Of these the largest always lands its fish in London; and beyond that it was fishing the north-west corner of the Dogger during the summer I have no information as to its movements. The smaller fleet at first fished the same ground, and after refitting visited the "off grounds" of Scarborough, *i. e.* the ground lying about thirty-five miles off that port.

With regard to the Humber "flat-fish," they have this year formed an even more insignificant item in the market than was the case last year, and the District Fisheries Committee having now taken steps to enforce their bye-laws, it may be supposed that the appearance of small fish from our own territorial waters will in future years be extremely rare.

Probably the Humber plaice, which I found to be unusually abundant this summer, owed their comparative immunity in great part to the abundance of the prawns, which was such as to restrict the energies of the river trawlers to the legitimate objects of their industry. On the other hand, the general abundance of shrimps at the margin, by attracting unusual attention from the shore fishers, no doubt caused some increase in the destruction of very small plaice by the shove-nets and shrimp "seines." By substituting a cheese-cloth bag for that usually employed in the construction of a shove-net I succeeded in obtaining examples smaller than any which came under my notice last year. The first of these, measuring 15 mm., occurred on the 20th April, and probably represents the minimum size at which the species enters the river.

*Turbot, brill, and soles.*—On the whole the amount and proportion of small turbot landed during this season did not appear to differ greatly from the conditions recorded for last year. Amongst brill, however, I noticed that the proportion of immature fish landed from the eastern grounds was considerably higher than before, but still not such as to afford, from market observations alone, any evidence of very great destruction of the young of this species. A very marked improvement in the Terschelling sole fishery, attributed by fishermen to the warm summer, was the principal reason why so many of our smacks worked that ground during the present season; and it is to be regretted that the pursuit of this species entails so much destruction of small plaice, since the soles landed from Terschelling comprised only a small proportion of immature fish. Humber soles first made their appearance in the market on the 31st March; the fish, consisting, as last year, chiefly of immature specimens, remained abundant in the river throughout the season, but no very great catches were landed by the shrimp-trawlers. Very small examples, so far as I could ascertain, were taken by the shore shrimpers less frequently than last year; and on no occasion, when using the shove-net, did I catch any myself. The 8th August was the earliest date on which I obtained fish which appeared to be undoubtedly of this season's hatching. They were taken in a fine-mesh trawl, and measured  $1\frac{3}{8}$  inches (35 mm. ca.) in total length, and others only slightly larger were taken during the few succeeding days. All other soles taken at the same time measured from 5 inches upwards.

*Lemon soles.*—No very large numbers of immature fish were observed in the market during the present year. From continuous observations of the catches of several shrimp-trawlers, who were kind enough to reserve for my examination all unmarketable fish obtained by them from time to time, I find that very small examples,

such as those taken last year in the "Vallota," were present in the river from the beginning of April, and I have little doubt that some remain there throughout the whole year.

*Haddock.*—The appended figures show the total number of boxes of "small" landed during the months specified.

March, less six days . . . . .	1,107 boxes.
April . . . . .	2,424 "
May, less one day . . . . .	2,890 "
June . . . . .	3,596 "
July, less one day . . . . .	3,841 "
August, less five days . . . . .	5,761 "

*Cod.*—The appended figures relate to the boxes of small codling, as explained in the previous number of this Journal, landed by trawlers only, during the months specified.

March, less six days . . . . .	2,037 boxes.
April . . . . .	1,596 "
May, less one day . . . . .	1,204 "
June, less one day . . . . .	1,490 "
July, less one day . . . . .	1,838 "
August, less five days . . . . .	2,717 "

In the last number of this Journal I expressed the opinion that statistical inquiries would confirm the general belief that the amount of small haddock and codling landed by trawlers was less during the summer than during the winter months. The above figures, compared with those given for last winter, point, however, to the opposite conclusion, especially in the case of haddock, which show a steady increase throughout the summer. Codling, it is true, show a diminution between March and August, but it is only a slight one. However, since in the case of this species the summer supply of fish of all sizes was undoubtedly greater than that of the winter, it follows that the proportion of undersized fish was considerably larger during the latter period. This is very probably true also with regard to the haddock, but I have not the figures to show it. It is lamentable to reflect that whilst these wretched immature haddocks found a ready sale, at least double the quantity of large fish, of magnificent quality, had to be thrown overboard by Iceland trawlers as utterly unmarketable.

*Whiting.*—From examination of the catches of shrimp-trawlers, and from my own trawling operations in the Humber, I found that small whiting were very scarce in the river during the spring and summer, so that there was no possibility of any great destruction of the young of this species by river fishermen. I found some difficulty in obtaining sufficient numbers of small fish, even from deep-

sea boats, to arrive at a conclusion as to the average size at which the fish reaches maturity. This appears to be about 9 inches, and fish of a less size are seldom brought to market. Considerable numbers are sometimes caught, but I have no doubt that a great proportion of immature whiting escape through the meshes of the ordinary deep-sea trawl.

## II. ON THE ICELAND TRAWL FISHERY, WITH SOME REMARKS ON THE HISTORY OF NORTH SEA TRAWLING GROUNDS.

A result of the ever increasing scarcity of trawl fish in the North Sea has been that the more enterprising members of the fishing community are constantly seeking new grounds.

Thus in past years boats have been pushed out from Hull and Grimsby to the west of England, the west of Ireland, and during last year as far south as the Bay of Biscay; but though I am convinced that there is a great future for trawling on some of the off-shore grounds of the west of Ireland, I am not aware that up to the present time the results have been sufficiently remunerative to warrant any great influx of boats in any of the directions mentioned.

On the other hand, the boats which have pushed to the northward have been infinitely more successful. In this direction the line-fishers have always been the pioneers of the trade.

Thus the Great Fisher Bank, long known as a fine lining ground, was accidentally discovered to be suitable for trawling some twenty years ago, and it is only within about the last fourteen years that it seems to have been regularly trawled.

It has chiefly been fished in the winter, since it seems to be most productive at that season, whilst the east coast grounds have afforded occupation to the fleets in the summer.

Nowadays, however, the eastern grounds have so deteriorated, and public opinion has been so strongly directed against the destruction of undersized fish on these grounds, that the discovery of new grounds for the summer has been a matter of the highest importance.

The discovery of the splendid lining grounds (for halibut, &c.), commonly known as the Faroe "banks," was followed some years later by the opening up of the southern coasts of Iceland for similar operations, and for some years past Iceland has been the chief source of our supply of halibut during the summer months.

Trawling vessels which have been sent from time to time as far north as the Orkneys do not seem to have encountered much luck, though it appears that Scotch vessels have been more successful in this direction. Trawling has also been carried on, but as yet with

only moderate success, to the east of the Shetlands, but the enterprise of one of our firms has at last opened up a trawling ground, the resources of which, if properly husbanded, can hardly be estimated.

In the summer of 1891 the s.s. "Aquarius" (Grimsby Steam Trawling Co., Mr. T. Cutton, master) shot a trawl off Ingol's Hofde Huk ("Ingol's Hoof" according to Grimsby pronunciation), on the south coast of Iceland, and returned with a fine catch of plaice and haddock. In the winter the Iceland grounds are closed, partly by ice, but more by the prevalence of foggy weather; but in the summer of 1892 about nine steam trawlers renewed the experiment.

#### *Nature of Catch.*

Large catches of plaice and haddock were made, the quantity varying from about 100 to 400 boxes of each per trip. Other items of the catch included witches (*P. cynoglossus*), common dabs, whiting, and Norway "haddock" (*Sebastes norvegicus*), all abundant; cod, ling, cat-fish (*A. lupus*), and skate, fairly plentiful; megrims (*Rh. megastoma*) common in certain parts of the ground; halibut moderately plentiful, but local. Lemon soles were very scarce, and no turbot, brill, or true soles were taken.

Of unmarketable species one specimen of *Molva abyssorum* and of *Gadus saida* respectively have reached my hands from Iceland trawlers. Long rough dabs and prickly rays (*B. radiata*) I have ascertained to be common, but my inquiries have failed to elicit evidence of the presence of any other species of food-fish.

#### *Fishing Grounds.*

The ground principally worked is known to our fishermen by the name of "Ingol's Hoof," and is described to me as lying off a fairly even stretch of coast which extends about S.W. from Ingol's Hofde Huk. The shore consists of low cliffs or banks, awash with the tide and pierced by the mouths of numerous streams draining the gradual incline of cindery volcanic soil which stretches seaward from a line of hills parallel to the shore. The bottom consists of very dark mud, the colour being due to its volcanic origin. Trawling is carried on at between 6 and 7 fathoms, close inshore, and about 40 fathoms in the offing, but a large part of the fishing took place in 1892, within three miles of the land. Another ground, more to the westward, is known as "Madam Piper's Bay," and trawling has also been carried on, with good results, off the West Horn at some distance off shore. In addition to these grounds, some of the fjords

were also explored in 1892; and during the present year, in spite of a prohibition on the part of the Danish Government against fishing in territorial water, the practice has been continued by British boats. Several of these have had reason to regret it, having encountered rocks; whilst I am informed that one Danish steam trawler has become a total wreck. There can be no doubt, however, that there will be found ample room for the development of a large trawling industry without encroaching on the territorial waters; and we may here recall that when the Faroe banks were first found suitable for line-fishing, boats used to go there in twos and threes, it being supposed that the productive area was so limited that a single boat might miss it, whereas it has since proved to extend for hundreds of miles.

The plaice are very large as compared with North Sea fish, especially those from the Ingol's Hoof and West Horn grounds. The smallest fish I have ever seen brought in measured 12 inches; only an insignificant quantity were of less than 17 inches, whilst specimens of about 27 inches were a large item in the catch. The largest I measured was 30 inches long, but I am quite sure that I have seen specimens which were several inches longer. The maximum size recorded for North Sea fish is 28 inches. I have never seen any longer than 27 inches, and comparatively few above 24 inches.

The pigmentation is characteristic, and should serve to avoid the confusion that might otherwise arise in the minds of such naturalists as are apt to record anything they see on their fishmonger's stall as British. The ground colour, due to the darkness of the soil all along the coast, is a dark greyish brown, often very dark; the spots are usually much fewer than in North Sea fish, and often of very irregular outline; the central region is rust-colour, or a dark brown flecked with the former tint, and is surrounded by a broad and very distinct margin of a lighter shade, either white, cream-colour, or a brown much paler than the ground colour. In large examples this margin may measure from  $\frac{1}{4}$  to  $\frac{1}{2}$  an inch in width. In a few fish, however, in all cases small specimens, I have seen the spots as numerous, and of as bright an orange as one finds in Dogger fish, and I have reason to believe that the colour of the spots is not, as might be expected, dependent on that of the ground. This description applies, of course, only to dead fish, which would not show any mottlings that may exist in the ground colour during life.

In 1892 the fish were found in abundance at Ingol's Hoof from the beginning of June until the end of July, when a trawler who went there could find none. They seem, however, to have shortly returned. The other grounds were not worked in the beginning of

the season, but yielded plenty of fish in July and August. After that the boats ceased to go there, and whether the fish remained on the grounds or not is unknown.

Haddock form an item no less important than the plaice. They appear to have been very abundant the whole time the trawlers were at work. They are of great size, the extreme length of those which I have measured in 1892 being 19 and 33 inches,\* though no doubt both larger and smaller fish occurred. I should say that a North Sea haddock seldom attains a length exceeding 27 inches, whilst fish of only 10 inches are often thought worth bringing ashore. Without having submitted them to very minute comparison I can only say that the points in which Iceland differ from North Sea haddock appear to be only such as are dependent on the growth of the fish. They exhibit a very strong ridge in front of the first dorsal fin, and the lump in front of each eye is very prominent, but an approach to this condition is always apparent in the largest North Sea fish.

The witch (*P. cynoglossus*) is, I suppose, the next important species. On the whole I concluded that Iceland fish were rather smaller than their North Sea allies; they are also much darker in colour, and would appear to extend into more shallow water.

Common dabs are, on the whole, considerably larger than North Sea fish, though I have occasionally noticed a specimen from the latter region as large as any from Iceland. In colour the northern representatives are a very dark sepia, devoid of spots or markings in the condition in which they reach this country. When long rough dabs have been brought in they have been of very large size, and similar in colour to the common dabs.

Not very many halibut were trawled at Ingol's Hoof, and such as were taken there were mostly of good size. On some other grounds, however, small fish, 14 inches and upwards, seemed rather abundant.

Megrim (*R. megastoma*) attain a very large size, but not, I should say, larger than in the Irish seas. I was told by the skipper of a trawler that they were chiefly caught in shallow water near fresh-water outlets. This is in marked contrast to the habitat of the species on our own coasts, but every student of ichthyology knows that the vertical distribution of a fish is often found to vary with the horizontal.

Whiting are very large, and, I believe, in good condition when caught, but as this fish requires to be very fresh to be valuable, it is not likely to form an important feature in the Iceland fishery.

Norway "haddock" (*Sebastes norvegicus*) appear to be very abundant, but in 1892 only those taken in the last few hauls were

\* The fish from Madam Piper's Bay are rather smaller than those from the other grounds.

brought ashore, while in 1893 very few were landed at all. They ranged in size from 11 to 22 inches, the last being much the nearest to the average size. I was at pains to find out whether smaller specimens than those brought ashore were met with, but have only heard of one, which was brought to me, and measured about 7 inches. Day says the species attains a length of 4 feet, but no examples were met with by our trawlers larger than the size I have indicated. The colour is a reddish orange rather than scarlet, and the opercular spot is very faint. No transverse markings are apparent in the dead condition. They thus differ somewhat from the smaller specimens which are occasionally brought in from the neighbourhood of the Great Fisher Bank, and from the single small Iceland specimen. These agree in colour with the descriptions of *S. viviparus*, doubtless a synonym of the same species. As long as the Iceland fish continued to be brought in I found no marked change in the condition of the reproductive organs. The sperm-sacs in the male were charged with milt, and in the females the ovaries were small and flaccid, containing ova in various stages of development, but unripe, and a few larvæ, the bulk of the brood having apparently escaped.

Cod appeared to be in rather poor condition when landed, but this may have been as much due to want of space to pack them properly as from any other reason.

The skate which I examined corresponded for the most part with the descriptions of *Raia macrorhynchus*, but I was unable to satisfy myself that there were anything but varieties of *R. batis*. The same applies to all specimens of the larger species of *Raia* which I have seen brought in, whether by trawlers or liners, from the Iceland and Faroe grounds. Though there is infinite variety, so many intermediate forms occur that I have so far found no characters that denote the existence of more than one species. *R. alba* and *R. oxyrhynchus* are not represented, and I have not been able to detect *R. nidrosiensis* (Collett), if it has occurred.

#### *Present Condition of the Industry.*

It must be admitted that at present the Iceland trawl fishery has not been a great success from a pecuniary point of view, and it may be feared that if continued on the existing lines it may even deteriorate. The fishing grounds lie 900 miles from the mouth of the Humber, and the voyage thither consequently takes about 90 hours, ten knots being considered a very fair speed for a steam trawler to maintain during a long run. The utmost coal-carrying capacity of a boat, even when the fish hold is utilised as a bunker, and as much coal as the Board of Trade officials will permit is piled

upon the deck, is for about three weeks' consumption. Consequently, the run to and fro occupying about a week and half a day, there remains at most only about a week for fishing operations. This, nevertheless, has been found quite enough to fill the ship, and indeed some vessels have landed large catches after only twelve days' absence. The Danish, and other continental steam trawling vessels, are rather larger than our own, and can therefore, I suppose, remain at sea for a longer period, but our fishermen consider that any advantages that may be gained by increasing the size of vessels are more than counterbalanced by the injury which a large vessel is apt to inflict on the trawl in a heavy swell. This distrust may ultimately be overcome, since we know that similar fears which manifested themselves at every increase in the tonnage of smacks have never been realised.

There have been two causes which account chiefly for the poor results of the pecuniary results of the Iceland venture—the great size of the plaice and haddock, and the poor quality of the former. This last character was especially noticeable in 1892. The spawning season off Iceland is much later than with us, many fish spawning as late as June. Consequently the plaice first landed last year were for the most part recently shotten, and they had hardly recovered condition to any appreciable extent before the season closed. Moreover they were only landed during the time when fish of all sorts were tolerably abundant, and had to contend in the market against great quantities of much smaller examples of their own species from the eastern grounds. It might be thought, after all the clamour that we have heard about the diminution in size and numbers of North Sea trawl-fish, that a good supply of large specimens would be welcome, but it is one of the most regrettable features in the trade (in view of the facility for obtaining legislation based on the size of fish landed), that very moderate sized or even small fish are in far greater demand than large ones.\* Thus in 1892 the Iceland plaice could only fetch from 8s. 6d. to 11s. per box, though the boxes were piled so high that none could have contained less than 10 stone; as much or more could often be obtained for a box of small fish from the eastern grounds, and if the condition of the Iceland plaice left something to be desired, most assuredly that of the others was not much better.

Against the haddock nothing could be urged except that they were too big, the quality being undeniably splendid; yet in 1892 they were even less remunerative than the plaice. Boxes of 10 stone sold for eighteenpence or two shillings, and seldom brought as much as three shillings. Since I have been at Grimsby I have seldom

\* *Vide infra*, p. 139.

known the smallest North Sea haddock fetch so little, though they are often none of the sweetest.

The "Norway haddock" also found a very poor market, but that is no more than could be expected in the case of a fish quite new to the consumer, and possessing, at least according to my own taste, but little intrinsic merit. They seem to me to resemble sea-bream more than anything else, but have less flavour and are drier. Still, being worth about 4s. a box, they paid the fisherman in 1892 better than the haddock, though it is probable that if brought ashore in larger numbers the market would soon have been glutted. In 1893, though as abundant as ever, very few indeed were brought ashore, in consequence, as I suppose, of the failure of an attempt to cure them during the previous year.

Taking advantage of the early summer of the present year, a start was made in April, the first boat landing its catch on the 14th. A very marked improvement was noticeable in the condition of the plaice, which were mostly fine firm fish, not yet ready to spawn, but as large as any that were brought in last year. The haddock were also in good condition, and as there was a good demand for fish, there was a ready sale. The plaice fetched 50s., and the haddock 9s. per box. This seemed to promise better business for the Iceland boats, and it was not long before other "voyages" were landed, but the price was not maintained. Thus on the 2nd May plaice fetched only 17s. 9d., and haddock 4s. per box, but witches found a ready sale at 27s. 3d. Prices remained about the same throughout the month, but in June we find plaice as low as 9s. 9d., and never higher than 15s. The change is, of course, due in part to the greater abundance of fish in the market, and in part to the deterioration of the quality of the Iceland plaice, many of which were by that time shotten. Good prices were still obtainable for witches, but the haddock were driven out of the market, and it became the practice of fishermen to heave overboard all haddock except those caught in the last haul. Witches acquired an importance which they had not previously been suspected of, and the success of an Iceland voyage depended greatly on the quantity of that species landed. Cod continued to be brought ashore in considerable numbers, but, whatever their quality, the appearance of this fish after it has been some time in the fish-hold becomes unattractive, and I have known Iceland fish sell for only 8s. per score.

It is only natural that fishermen should have made endeavours to procure Iceland plaice more in accordance with market requirements than those with which I have been dealing, and in this they have been to some extent successful. I have seen several "voyages" of fish similar in size, and to a great extent in appearance, with ordinary

North Sea plaice; some of these were avowedly taken in fjords, where fishing by vessels other than Danish is illegal, and, though the fishermen observe a certain reticence on the subject, I have no doubt that all the small fish landed were caught close inshore. They commanded a ready sale at a remunerative price, but I am inclined to think that the prospects of the fishing are by no means improved by this circumstance. Though large enough by standard of North Sea fish to escape criticism, it is probable, taking into view the large size attained by the species in northern waters, that they are chiefly young and immature fish, the destruction of which is rather to be deplored, whilst any extensive poaching on Danish preserves in Iceland seems likely to hinder an understanding with that power which may become necessary with regard to other areas.

#### *Comparison with North Sea Grounds.*

The opening up a virgin trawling ground at a time when public (including scientific) attention is so much directed to fishery questions is of peculiar interest, since by watching its development we may be able to form a judgment as to the correctness of theories deduced from such accounts as we possess of the earlier history of the grounds off our own coasts.

These accounts are extremely meagre, consisting as they do of the reminiscences of a generation of fishermen which is now fast disappearing. Moreover to some minds they are prejudiced by the rather general idea that the conditions of the seafaring profession are not altogether unfavourable to the development of the imagination, and that the grain of salt proper to the assimilation of piscatorial narratives is not a small one.

Nevertheless there are certain facts which appear with remarkable regularity in all narratives, whether of those who actually witnessed the occurrences, or received them from their immediate predecessors. To take the Dogger Bank, which, as essentially a plaice and haddock ground, is well suited for comparison with the Iceland trawling grounds, I am given to understand on all hands that when the trawl was first used there an extraordinary number of large plaice were taken: they were not so large as the Iceland fish, nor in fact, so far as I can learn, any larger than some few which are still to be got in the same place; but the quality was very poor, and (Mr. G. Alward is my authority for this statement) the spots were brown and not red. Fishermen called them "elephants' lugs" in derision.

As trawling was continued a great improvement in quality was noticed, "shoal" fish becoming, as they have since remained,

notable for their prime condition, and (again on Mr. Alward's authority) the improvement was accompanied by a change in the colour of the spots. It was some years before any scarcity of fish became noticeable, and when such scarcity induced fishermen to explore new grounds—*e. g.* the Brown Bank and some of the east coast grounds—the same phenomena were experienced so far as plaice were concerned.

There is thus a consensus of experience that trawling at first improves the quality of plaice, but that this process may be carried out with such hearty good-will that the fish incur the danger of being improved off the face of the earth, is an axiom which does not find such universal acceptance. Trawlers appear to consider that the action of their gear in stirring up the bottom and uncovering molluscs, worms, &c., is the principal cause of the improvement in plaice, but there is perhaps a more probable explanation.

The plaice is a fish which, after attaining a certain size, is little subject to the attacks of other species; in fact, I do not recollect ever to have found the remains of this fish in the stomach of any other, though I know that it occasionally falls a prey to the angler (*L. piscatorius*); nor can I find, by watching their habits in captivity, that plaice are much given to molesting each other. Consequently, on a ground which is never fished, it might well be that plaice would increase to such an extent that they would overtax the food supply, and, under such conditions, they would be of very poor quality. Seeing that the action of the trawl is infinitely more destructive to the plaice than to the organisms which form their food, trawling would at first, by thinning the numbers of the fish, increase the supply of food available for the survivors, and allow them to get into better condition than they were before. But as it is quite evident, if this theory is correct, that the quality is only raised at the expense of the quantity, it follows that unless this process is exercised in moderation the result must finally be disastrous. Nevertheless, in the face of universal experience to the contrary, there may yet be found those who assert that the more you trawl the more fish there will be.

As to the condition of the haddock in the early days of Dogger trawling I have no very definite information. They were very abundant, but I have not heard that they were of inferior quality, except on a ground lying to the east of the Dogger; there it appears that the objectionable smell of the viscera, due, no doubt, to the organisms on which they fed, was the worst fault that could be urged against them. The truth is that haddock were so utterly worthless to trawlers until a curing establishment was started at

Hull some time in the forties, that little or no attention was paid to them; they were amongst the perquisites of the apprentices, and this circumstance may have prevented them from being thrown overboard in very great numbers, but certainly many of them must have been treated in this way. I have endeavoured to show in the last number of this Journal that it is of little use returning trawled haddock to the sea, and there can be no doubt but that the shovelling overboard of large quantities of dead fish is injurious to a fishing ground. We may suspect, indeed, that this practice, which was extensively carried out in the case of small plaice, on some, at any rate, of the North Sea grounds, may have had its share in the diminution of the general fish supply, and it is matter for the greatest regret that it has been commenced, in the case of large haddock, on the Iceland grounds. It is hardly to be supposed that much effect would be felt as yet, but it is a fact that the liners can no longer get their fish on the grounds where the trawlers have been at work this season, and I am inclined to think that they, the liners, are right in attributing this circumstance as much to the fouling of the bottom with great quantities of dead haddock as to the disturbance caused by the trawl. As I have said, no improvement is possible in the condition of the haddock, and we must look to market considerations only to check the present waste of large specimens; but in the case of plaice I think we may reasonably hope that a slight diminution by trawling may effect an improvement in condition, and should this be attained, and the grounds be not unduly fouled, the climatic conditions of the locality not less than its distance from the markets may probably, by providing a most efficient close season, suffice to avert for many years the final and disastrous stage arising from over-fishing.

#### *Alleged Cause of Low Prices.*

A few words as to the apparent causes of the low price of Iceland fish may not be out of place. I have made inquiries amongst members of the buying fraternity most interested in the matter, but I fear the relations of supply and demand in fish are beyond the comprehension of the lay mind, and can only give the facts as they are told to me, with such comments as may occur.

The Iceland plaice are too large to be sold fresh, and have therefore been mostly drysalted and sent to Holland and Germany, but they are difficult to cure, being very watery, and do not sell well.

Granting the present poorness of quality, which we may hope to see disappear as the fishery develops, I do not understand why it should be necessary to cure and export them. If the demand for

cheap fresh fish in our own country is a genuine one, it is surely possible to place these fish, which only cost the buyer something less than a shilling a stone, before the consumer at a price at which the latter would not complain, and which would yet leave to the former, and also to the fishmonger, a decent margin of profit. There seems no difficulty in disposing of undersized fish, of which the quality is certainly not better.

As to the haddock, I am informed that they are too large for smoking, for this reason,—that it is impossible to place a smoked haddock of that size on the market for less than sixpence (though it may be remarked that it only cost the curer about a penny when fresh); and that the consumer, who for the most part belongs to the poorer classes, has usually only a penny or twopence to spend, for which sum he can obtain a small cured haddock. The retailers will not cut up the fish, because it spoils the appearance *and lowers the price*. I am told that most of the Iceland haddock brought here in 1892 were split, drysalted, and exported, but that the profits were infinitesimal.

In the fresh condition, available, as they were in 1892 and will probably be in most future years, only in the summer, Iceland haddock have to contend in the market with the immense supply of herrings prevalent during that season. There is no doubt that they would sell splendidly in the winter, and even later in the autumn I am told there would be a good market for them in Rotterdam. Line-caught fish suffer from the same competition, and I have seen 285 from 21 to 30 inches in length sold on the 13th September for twenty-five shillings, the seller informing me that he could confidently reckon on getting a shilling each for such fish a month later. For myself I cannot but think that they could be placed on the market in the fresh condition at a price at which they might compete favorably with the herring; and the only conclusion I can form on the whole matter is that the producer and consumer would find it to their mutual advantage to be brought into closer relationships.

Though not to any great extent a product of the trawl fishery, there is another northern species to which I would like to advert here briefly, viz. the tusk (*Brosmius brosme*). Great numbers of tusk are caught by our liners on the Faroë grounds all the year round, and on the Iceland grounds during the time they are worked,\* but the fish are seldom brought ashore except in the winter, as that is the only time when they command a sufficiently high price to make it worth the fisherman's while. Nevertheless the tusk experiences no immunity in the summer, being the unfortunate possessor of a

\* I am told that in these latitudes tusk come into quite shallow water.

very large liver, which goes to fill the liver cask.\* There is thus a most regrettable waste of good food.

Dr. Günther originally directed my attention to the impossibility of procuring this fish, which he, with reason, considers one of the best that swims, in London, and I find, on inquiry, that they can only be sold either to workhouses and such institutions, or to fish-hawkers who take them into the country and dispose of them under the name of "Deep-sea Ling." This vernacular name is at least as apt as that by which they are known to naturalists and fishermen in this country, torsk or tusk being etymologically identical with Celtic, German, and Scandinavian names applied to the cod and some of its congeners.

If the merits of this fish as an article of food were more widely recognised it could not but be beneficial to the industry, and would do away with the almost wanton waste that now takes place in the summer, whilst the advantage to the consumer would be commensurate.

In this connection it may be interesting to glance at the fate of certain other fishes after they reach the market. Every one knows that the parts of the skate which appear at table are the wings or pectoral fins, but it may not be so generally known that the removal and preparations of these wings is a separate though small industry, and that the only consideration received by those engaged in it is the refuse of the skate, viz. the head, abdomen, pelvic fins, and tail. Nevertheless the business is said to be a paying one. After the wings have been removed there remain certain lumps of flesh on the carcass, those of most account being the masseter muscles. These are carefully removed and disposed of to fried-fish shops as "skates' nobb," a delicacy much in favour with the patrons of such establishments, and reputed to possess the peculiar virtue ascribed to skate's flesh in its greatest degree. I believe, however, I am betraying no secret in remarking that there may be ingredients in the preparation which are not mentioned in its title. Cat-fish (*Anarrhichas lupus* and *A. minor*) are prepared for transmission to the fishmonger by removing the skin and head, and in this instance again the refuse is the recompense of the operator, who cuts out the very large cheek muscles. The tail of the monk or angler (*Lophius piscatorius*) when skinned and cut up into lumps is not unlike the flesh of the skate; at all events, like the fragments of *Anarrhichas*, it is used to adulterate "skates' nobb," and I do not know that the latter are considered any the worse for it.

\* The livers and roes of fish are about the only remnants of the old "stocker-bait," the perquisite of the inferior members of the crew. It may not be generally known that haddocks were once included in this term. Livers fetch about 10s. and roes about 6s. per cask. The former are not infrequently adulterated with *Actinoloba dianthus*!

Coal-fish (*Gadus virens*), whether from liners or trawlers, are common enough in Grimsby market, and the trawlers often bring in a few large pollack (*G. pollachius*), the largest I have measured being forty-three inches in total length. Both of these species are extensively bought by country hawkers, who scrape off the scales, and find a ready sale for them under the title of "white salmon."

#### Conclusions.

To return to matters more essentially germane to the subject under discussion in these remarks, I would submit that the present condition of the Iceland trawl-fishery forms no insignificant argument for preventing the destruction of undersized fish. I think it will be admitted that if the market could once be cleared of the immense quantities of small plaice which flood it during the summer months an improvement of price for full-grown fish, by no means confined to that species, would be one of the first results; at the same time the large quantities of haddock, torsk, &c., which are at present wasted, would, by becoming moderately profitable to the fisherman, serve to supply the market sufficiently to prevent any undue strain on the purse of the consumer; at the same time the present practice of fouling the Iceland grounds with dead fish would be checked, to their incalculable benefit. It matters little by what means the sale of small plaice is prevented so long as it is done effectually; and though I see no reason to alter my opinion that the enforcement of a reasonable size-limit for flat-fish is the most feasible plan, I am quite prepared to bow to the superior wisdom of those in favour of geographical restrictions, whenever, by such means, their object shall have been attained.

I have before this endeavoured to show that the size-limit for plaice which I have recommended would have the same result as the geographical restrictions generally desired in closing the eastern grounds of the North Sea to trawlers; and if this object is attained, by whatever means, it becomes apparent that we must look for an outlet for our boats during the summer months. Such, in my opinion, is offered by the Iceland grounds, and, as we have seen, the steam trawlers have largely availed themselves of it. It cannot be denied, however, that smacks working there would be liable to risks which at present are more or less prohibitive. It is a dangerous coast, apparently not too well charted, subject to fogs, and hardly lighted at all. It is a great distance from our ports, and it is absolutely impossible for a vessel which may be disabled there to refit without sending for supplies from home. It appears, therefore, that whilst single boating would be out of the question, smack-owners

could hardly think of sending their fleets there without establishing depôts on the island and arranging for some improvement in the lighting during the fishing season. The establishment of depôts would of course bring profit to the inhabitants, and for this consideration the Government of the latter might perhaps be induced to undertake the duties of lighting and of improving the present harbour accommodation, which is, I understand, of the scantiest. I make these suggestions with all due deference, since those engaged in the North Sea fishing trade are about the last persons to be accused of a want of enterprise or of incapability of safe-guarding their own interests; but I have no doubt that the check on the fish supply of the North Sea, which, until the beneficial action of such has time to make itself felt, must ensue from legislative action, or, in the absence of that, the continued depletion of the grounds, will before long result in the establishment of Iceland fleeting during the summer.