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The Vertical Distribution of Marine Macroplankton. II. The Pelagic Young of Teleostean Fishes in the Daytime in the Plymouth Area, with a Note on the Eggs of certain Species.

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With 5 Figures in the Text and an Appendix.

CONTENTS.

INTRODUCTION.

During the years 1924 and 1925 the writer carried out some preliminary researches on the vertical distribution of the pelagic post-larval stages of Teleostean fishes. It has long been known to those who have studied young fish that there is not absolute uniformity in the vertical distribution of the post-larvæ of different species, and that many forms are comparatively rare in the surface layers in the daytime, occurring most abundantly at a depth of a few fathoms. It is only necessary to examine records given by earlier writers to realise this. It is obvious that their vertical distribution is an important factor in the horizontal scattering of young fish, if currents at different depths vary in strength and direction, thus separating the fish in one layer from those in another. It is now well known that an inshore wind will set up a surface current shorewards, causing a heaping up of the water on the windward shore, and a consequent flow of water in the deeper layers in the reverse direction away from the coast ; the opposite effect will be produced by an offshore wind. Such currents might play an important part in carrying the young of some species in to the shore or out into deeper water.

It has not been possible for previous workers to state accurately the depth from which collections have been taken ; there has in consequence been no detailed study made of the vertical distribution of pelagic young fish. In this case, however, a graphic depth-recording instrument has been used, and we are thus enabled to state with a considerable amount of accuracy the depths at which the net has been fishing. Apart from studying the vertical distribution of the early stages of fish, observations on that of the other planktonic animals present at the time have been made, that is of those forms which compose the food of the small fish or act as their enemies, and may be of direct importance in their distribution. The results will be given in a future paper.

The writer is indebted to Dr. E. J. Allen, F.R.S., and other members of the staff for much helpful criticism and advice, especially to Mr. E. Ford for his assistance in the identification of many specimens ; to Captain V. Lord and the crew of s.s. *Salpa* for the co-operation they have given during the somewhat irksome work of collecting at sea.

I should like also to take this opportunity of expressing my gratitude to Dr. R. S. Clark for the invaluable training he gave me from his wide knowledge of the literature and identification of young fishes, when I first took up the study of this subject.

Methods of Collecting.

The majority of the samples were taken with a stramin ring-trawl (diameter at mouth, 2 metres ; length, 6 metres). From May to July in 1924 six daylight stations were made, at each of which the net was used at four or five different depths; in 1925, from April to August, sixteen similar stations were made, in these cases the net was almost always used at six different depths at each station. All these stations were in depths of 50 metres or more. The positions of the various stations are given in the Appendix on page 145. In addition, in 1924, a tow-net of silk (40 strands to the inch), with a mouth 1 metre in diameter and a length of 2 metres 60 centimetres, was used close inshore at four stations sampling four or five depths at each; and also at one station working at six depths in 1925. On the last two occasions on which this net was used it was employed as a closing net towed horizontally: the releasing apparatus used is described in a previous paper (**20**), and closing took place without fail at every depth. The net was fitted with a folding mouth, as figured by Schmidt (**23**).

In 1925 a small "medium" silk (50 strands to the inch) tow-net was also used in conjunction with the ring-trawl; this was attached to the warp just above its junction with the bridles of the net. The diameter of the net mouth was 29 cm., and the length of the net 95 cm. The ring at the mouth was made of wood to allow the net always to float clear of the bridles of the large ring-trawl. By this means a sample of the plankton was taken from the same body of water as that from which the young fish were captured; owing to the size of the mesh this collection should give a comparative picture of the vertical distribution of many of the copepods, which form the chief items of food for the young fish.

On every occasion, both with the ring-trawl and the metre net, the depth-recording instrument was used.

The nets were towed horizontally at a speed of about $1\frac{1}{2}$ to 2 knots: attempts were made to keep this speed as constant as possible. The duration of all hauls from the time at which the required length of wire was out until hauling in began was *ten minutes*. A total of 126 hauls was made with the ring-trawl and 24 with the metre net. Fifty-one hauls were also taken with the ring-trawl between sunset and sunrise on July 15th to 16th, 1924, and June 16th to 19th, 1925, in order to examine the diurnal movements of the young fish: the results of this collection will be given in a future paper. (The observations on macro-plankton on July 15th to 16th, 1924, are already published (**19**).)

All material was preserved in formalin immediately on capture.

The Fishing Depths.

With the help of the depth-recording instrument, kindly lent by Admiralty authorities, the actual path of the net through the water is known in almost every case. Owing to the wavy course that the net very often follows throughout the period of haul it is at times impossible to state actually that the water level at one depth was sampled. A figure has been found called the " average depth " by taking the depth at ten or more equidistant points along the curve and finding the mean ; far more than ten should be taken for greater accuracy, this, however, is not

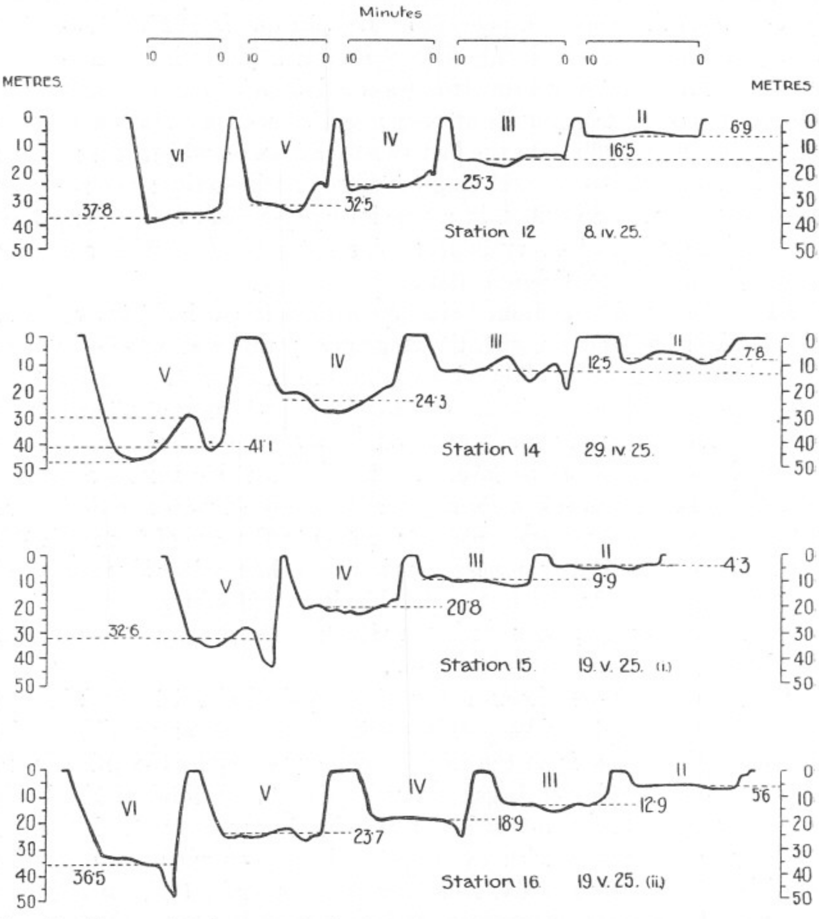

FIG. 1.—Four series of curves obtained on the dates given showing the path of the net through the water for each haul. (The surface haul is not included.) The net enters the water on the right-hand side of each curve. The dotted lines indicate the calculated " average depth." (The differences in the lengths of the curves are due to irregularities in the speed of the recorder clock and not to errors in timing.)

required, as it must be borne in mind that the net itself has a diameter at the mouth of 2 metres. In all tables and text figures these " average depths " have been used ; at the same time in the Appendix (p. 146), under the list of stations, I give the outside limits of the depths at which the net has fished in each case. Fig. 1 shows four tracings of the curves produced by the depth-recorder on the dates indicated : they are a fair sample of the results obtained by the depth-recorder throughout, showing how on one occasion the net fishes fairly constantly at one depth and on another it may rise and sink considerably throughout the ten minutes' haul. Also it can be seen that whereas the " average depth " in many cases is a sufficient approximation to the depth at which the net was fishing, at other times it is in a way a misstatement. For instance, in haul V on April 29th, 1925, the " average depth " is 41·1 m. ; in reality the net fished at this level twice for a fraction of a minute only, i.e. at the points indicated where the line 41·1 m. cuts the curve, wandering for the rest of the time up and down between 30 and 47 metres. The tracings for four other stations have been already published. (Stations 4 and 8 (**21**) ; 9 and 10 (**19**).)

During all surface hauls the net was kept so that the top edge of the ring was just cutting the surface of the water.

Examination of Material.

After measuring the total volume of each catch by allowing to settle for twenty-four hours in a graduated jar, all the young fish were picked out singly and all species measured to the nearest half millimetre, except *Callionymus* sp., and *Gobius* sp., which were so numerous that it was thought sufficient to measure a few samples only. The remainder of the plankton was then dealt with, the larger organisms being picked out singly, and the rest sampled in the manner described in a previous paper (**19**). In addition the material collected by the small tow-net attached to the ring-trawl remains to be worked up. It is hoped that with this material, which includes the post-larval fish and the majority of species of copepods that form their food, as well as the larger plankton organisms, some of which are known to prey on the young fish themselves, a general picture may be obtained of the density of these members of the plankton population in relation with one another. These results will be published in a future paper.

GENERAL RESULTS.

In considering the results shown in the second half of this report one realises that it has many shortcomings, not the least important of which is the paucity of observations. This is necessarily controlled by the limited amount of material that it is possible for a single worker to examine in a given time. It is, however, regrettable that more observations were not obtained in the month of May, at which time most of the more important food-fish post-larvæ are present in the plankton in greatest abundance ; bad weather conditions were responsible.

In order to obtain a true picture of the vertical distribution of young fish regular daily collecting over a considerable area is a necessity. With such observations one should be able better to discern the changes that probably occur at different times of the season and in the various states of the weather and sea. On this account no attempt has been made to trace the effect of weather conditions in this paper: such factors will be considered at a later date, when many more observations are available.

Under the present circumstances the writer does not feel that it is safe to make generalisations. It is, though, fairly evident that during the months, May to August, under the sea and weather conditions existing at the time these collections were made, the post-larval stages of many species of fish were rarely taken in daylight in the water layers between the surface and a depth of 10 metres.* In the first half of April, however, there were indications that some species, found in the deeper layers in the later months, may frequent higher levels and even the surface at this time. Possibilities of errors arising from irregularities in horizontal distribution must be taken into consideration, in view of this no attempt has been made to locate a depth at which a maximum abundance may be expected for any one species, if, indeed, such exists. I have merely given the depth above which the numbers of fish taken, if any, were low and below which the young fish were abundant. When more observations have been made it may be possible to give evidence on this point, but after results shown by Gardiner and Graham (**9**), who have recently examined the irregularity in distribution as shown by the Petersen Young Fish Trawl, a net made of the same material as the ring-trawl and probably with a somewhat similar fishing capacity, this is not yet practicable. These workers conclude from the results of ten successive oblique hauls during daylight "that the standard deviation (expressed as a percentage of the mean) varies from $\pm$ 27 to $\pm$ 54 per cent. That of the Cod larvæ of 8 mm. length is $\pm$ 38 %;" and that this variation is "due either to the irregularity of the horizontal distribution of the plankton or to the error of the net."

* Since going to press an interesting paper has reached us by Dr. A. C. Johansen "On the Diurnal Vertical Movements of Young of Some Fishes in Danish Waters": Meddelelser fra Kommissionen for Havundersogelser, Serie Fiskeri. Bind VII, Nr. 2, 1925. In it Dr. Johansen compares results of day and night collections with the ring-trawl at the surface and an intermediate layer. He remarks that the results suggest "that the majority of the larvæ kept down below the 16 metres level during the day." He also discusses the question of young fish avoiding the net in the daytime and comes to the following conclusion: "With regard to fishing experiments with the ring-trawl . . . it may be doubtful whether any conclusions can be drawn from these as to diurnal vertical migrations on the part of large, rapidly moving larvæ; it seems justified, however, in the case of the tiny larvæ." Seeing that throughout the paper the term "larvæ" has obviously been used to include "post-larvæ," this last statement seems confirmed by my results, which show that post-larvæ actually living at the surface, such as those of *Gadus pollachius* and *Onos* sp., are captured by the ring-trawl, indicating that species which only occurred in collections from deeper layers were really absent or very scarce at the surface.

There appear to be specific differences in the vertical distribution of the post-larvæ of the various kinds of fish dealt with. The following types of distribution were indicated by the post-larvæ of the species mentioned, in offshore waters of 50 or more metres depth, at the seasons at which they were common in the plankton, in daylight :—

1. Occurring mostly at surface and in layers immediately beneath the surface. *Gadus pollachius.*

2. Occurring at all depths with at times a preference for the surface layers. *Onos* sp.

3. Distributed apparently indiscriminately from surface to bottom, sometimes showing a preference for deeper layers, at other times most abundant at small depths.

Clupea sp. (*Clupea sprattus* and *Sardina pilchardus*); *Ammodytes lanceolatus ; Gadus merlangus* (in early April).

4. Present at any depth with usually a maximum abundance between the surface and 25 metres.

Scomber scomber : Trachinus vipera : Blennius gattorugine, Blennius pholis and *Blennius ocellaris ;* Labridæ ; *Caranx trachurus.*

5. Abundant from a depth of about 10 metres downwards.

Gobius sp.

6. Abundant from a depth of about 15 metres downwards.

Scophthalmus norvegicus ; Trigla sp. ; *Callionymus* sp.

7. Abundant from a depth of about 20 metres downwards.

Pleuronectes limanda ; Pleuronectes microcephalus ; Solea variegata ; Molva molva.

8. Abundant from a depth of about 25 metres downwards.

Gadus minutus.

9. Living below a depth of 30 metres and very near the bottom.

Liparis montagui ; Lepadogaster bimaculatus.

10. Showing a gradual descent with advance of season.

Gadus merlangus.

The depths given in the above scheme must not be taken as fixed : they, no doubt, change to a certain extent from day to day. The important feature is that different forms begin to become abundant at different depths. I feel that this conclusion should be regarded as rather tentative to be confirmed or disproved by further evidence. These types of distribution have, however, shown repetition on occasions on which the young fish were sufficiently abundant to indicate definite preferences for different depths.

The differences in the vertical distribution of *Gadus pollachius, G. merlangus, G. minutus,* and *Onos* sp. are striking. In this case it is interesting to bear in mind the somewhat different abodes haunted by the adolescent stages. The *Onos* sp. probably collected in this case are definitely inshore fish, and the young of the Pollack frequent the shore line; the post-larvæ of both these species occur commonly at the surface; at the time of the year that they are present in the plankton the prevalent winds are inshore, driving the surface layers towards the coast. Whether similar conditions would hold good elsewhere I do not know.

As with the rest of the plankton (**19,** p. 770) the post-larvæ of many species of fish become abundant at much smaller depths below the surface close inshore over shallow water than they do a few miles from the coast over depths of 50 m. or more.

That in the study of the horizontal distribution of the pelagic stages of young fish a very thorough sampling of the water from bottom to surface is necessary is a point much emphasised by the results of this research. If, for instance, we were to study the horizontal distribution of *Gadus minutus* post-larvæ over a region with an average depth of 50 metres, surface and midwater hauls might indicate an almost complete absence of this species, seeing that they are rarely found above the 20-metre level. An oblique haul is very necessary, and in depths of ca. 50 m. ten or more levels should be fished: the net should go well to the bottom, and in a haul of thirty-minutes' duration the wire should be wound in a tenth of its original length every three minutes.

The very great quantities of the post-larvæ of *Callionymus* sp. is, as usual, a prominent feature of these collections. Of the total of 21,058 young fish dealt with in this paper 8743 were *Callionymus* sp. Next in importance are the young *Gobius* sp. with a total of 3562, practically all of which were caught in 1924. The figures show an amazing absence of young Gobies during the months dealt with in 1925. In 1924, 3232 young Gobies were captured, and the total number of hauls taken was 44, while in 1925 only 330 were caught in more than twice as many hauls, 98 in all.

The number of the more important fish caught were :—

Clupea sp., 1407.
Gadus merlangus, 1004.
Scophthalmus norvegicus, 954.
Solea variegata, 891.
Ammodytes lanceolatus, 741.
Gadus minutus, 628.
Trigla sp., 545.
Pleuronectes limanda, 508.
Pleuronectes microcephalus, 425.
Labrid sp., 417.

The Labridæ also showed a marked scarcity, like the Gobies, in 1925; while 359 were taken in 1924, in 1925 there were only 58.

The two stations taken on May 19th, 1925, are of interest: at Station 15 there were four species whose post-larvæ were present at the surface, which were absent at the surface at Station 16, *Gadus merlangus*, *Scophthalmus norvegicus*, *Solea variegata*, and *Callionymus* sp. (see Appendix, p. 155); at Station 15 there was a very large swarm of *Corystes* megalopas at the surface, the numbers being 4050, 3970, 2110, 153, and 1214, from surface to bottom at the five depths; at Station 16, however, they were very scarce, the numbers being respectively 34, 8, 5, 25, 59, and 430.

Little discussion on the possible causes of the various types of vertical distribution is given; the evidence is too small as yet for such considerations to be fruitful: it is considered sufficient at present to try to find out exactly what does actually occur in the sea, and to collect as much information on the conditions as possible. Although on one or two occasions temperatures and chemical conditions are available from different depths, these have not been included in this paper; however, it is to be hoped that in time sufficient observations may be forthcoming to make possible an attempt to throw light on causes that may influence the vertical distribution of the post-larvæ, and bring about the changes that occur in it from time to time.

Observations on Seasonal Distribution.

In Table 1 I have drawn up figures to attempt to show the seasonal distribution for the more important species during the years 1924 and 1925. In order to obtain the average catch per ten minutes' haul at each station I have only included those hauls which occurred below the depth above which each species was scarce in the daytime, that is, as near as possible in the layers in which they were most abundant.* I have only included the catches made with the ring-trawl, and these should be fairly comparable.

It is at once evident that there is a distinct difference in the seasonal distribution of some of the spring spawning species between the two years. In the table are printed in heavy type all average hauls of ten or more individuals per ten minutes. It will be seen that, while the post-larvæ of *Gadus merlangus*, as shown by the collections, were abundant well into June in both years (in 1924 on June 25th and in 1925 on the 17th), *Gadus minutus*, *Scophthalmus norvegicus*, *Pleuronectes limanda*, *Pleuronectes microcephalus*, and *Solea variegata* all appeared to be suddenly cut short in their seasonal distribution in 1925, at some time about the end of May or beginning of June, whereas in 1924 all these species were abundant up to the end of June and *S. norvegicus* even into the middle of July.

It is extremely unfortunate that there are no accurate observations on the earlier dates from April to May in 1924. I have included, however, at the end of the Appendix (Table 10, p. 159) a list of young fish

* In most cases this was taken as 5 m. above the depths given on p. 107 to allow a safe margin.

TABLE I.

SHOWING THE AVERAGE NUMBER OF SOME OF THE MORE IMPORTANT YOUNG FISH FOR TEN-MINUTE HAULS, COMPUTED IN EACH CASE FROM COLLECTIONS TAKEN BELOW THE DEPTH ABOVE WHICH EACH SPECIES IS SCARCE IN DAYLIGHT.*

	Depths in metres from below which these figures are estimated.		April.				May.			June.							July.					Aug.
			2	8	22	29	19 (i.)	19 (ii.)	29	4 (i.)	4 (ii.)	17	18	19	25	1 (i.)	1 (ii.)	15	16	29	6
Gadus merlangus	15	1924							**37**			6			**52**	3·6		—	—		
		1925	8·2	4·5	2·2	**36**	**21·5**	**74·6**		**17**	**19·5**	**21·7**	—	7·5		4·3	5		0·7	0·6	—
Gadus minutus	20	1924							**32**			**15**			**16**	3·5		—	—		
		1925	**11·5**	**10·3**	**23**	**84**	**35**	**50·5**		**12**	4	—	—	—		—	—	—		—	—
Scophthalmus norvegicus	10	1924							**15**			**65·6**			9	4·6		**16**	8		
		1925	—	—	0·25	**31·3**	**84**	**40**		5·7	**19·6**	2	1	4		0·7	4		0·7	—	—
Pleuronectes limanda	15	1924							**20**			2·5			**10·5**	1·6		—	—		
		1925	4·3	6·2	3·2	**43**	**36·5**	**62·3**		4·7	4	0·25	1	1·5		0·6	0·6		—	—	—
Pleuronectes microcephalus	15	1924							**21**			**63**			**14**	3		4	3		
		1925	0·3	0·25	0·5	**10**	**17**	**16·3**		3	8	0·5	—	2·5		—	1		0·7	0·3	—
Solea variegata	15	1924							**18**			**45·5**			**70·5**	1·6		3·5	7		
		1925	—	—	—	**24·5**	**105·5**	**46·3**		2·7	7·5	3·2	1	3		1	0·6		0·25	—	—
Ammodytes lanceolatus	0	1924							4			9·2			5·2	3·4		13	18·8		
		1925	3·1	1·5	—	5·6	6·2	18·6		5·3	6	1·1	—	0·1		3	5·8		5·3	11	1·6
Callionymus sp.	10	1924							170			148			490	73·6		39·3	42·6		
		1925	3	4·7	9·7	83	308·5	248·2		159·5	125·3	30·2	22	10·2		57·2	62·3		42·7	8	1·7
Gobius sp.	10	1924							3·5			157			123·6	50		78·6	14·8		
		1925	—	—	—	—	—	0·25		9	2·6	0·25	0·5	1·7		0·7	19		9	2	5·7

* A dash (—) signifies that although a station was made no post-larvæ of that species were captured at any depth.

taken during this period by the ring-trawl without the depth-recorder: these figures show that the species concerned were fairly abundant as early as they were in 1925, especially is this so if we consider that most probably the "bottom" hauls are not far below the midwater line, and hence that the region of greatest abundance for most of the species has not been thoroughly sampled.

It is natural in considering these results to turn to the temperature observations made in these months. I give below the temperatures existing at the hydrographical Station E1, ten miles beyond the Eddystone Lighthouse, at depths of 10 m. and near the bottom (72 m.). These figures were taken from the *Rapport Atlantique*, 1924 (**7**), for the year 1924, and I am indebted to Mr. H. W. Harvey for the 1925 observations; the degrees are centigrade.

1924.	E1. 10 m.	Nr. Bottom.	1925.	E1. 10 m.	Nr. Bottom.
Jan. 2nd	9·50°	9·51°	Jan. 19th	10·79°	10·79°
Feb. 15th	8·67°	8·76°	Feb. 17th	10·01°	10·01°
(Mar. 10th	7·90°	7·88°)*	Mar. 14th	9·19°	9·16°
April 8th	8·15°	8·30°	April 22nd	9·47°	9·44°
May 20th	10·84°	9·55°	May 13th	10·3°	9·95°
June 17th	13·89°	10·32°	June 3rd	10·92°	10°

In January, February, March, and April the temperatures in 1924 were considerably lower than in 1925. A curve of the temperature at E1 has been given by Harvey (**10**), that shows that this year was also considerably lower than the two preceding years, 1922 and 1923.

There appear to be two possibilities:—

1. That in 1924 there was a prolonged spawning season, owing to the long period of low temperature as compared with 1925, when the cold period was extremely short (March), and hence the extended appearance of post-larvæ in the plankton until the end of June in 1924.

2. A later spawning in 1924, due to the water reaching some optimum temperature above the lowest some time later than in 1925.

There is insufficient evidence to argue either way except that as noted above the young fish did not appear, from inaccurately collected samples, to be absent in the hauls in April and May, 1924, at which time they were fairly abundant in 1925; this would point to an extended spawning season in 1924.

I have thought it worth while, however, to draw attention to this point, and record it as a possible guide to elucidating the results obtained in future years.

One other interesting feature is emphasised by these figures: this is the almost complete absence of the young of the various species of Gobius

* Taken at L6, five miles beyond the Eddystone Lighthouse.

(see p. 108) from the 1925 collections. It seems impossible that they could have been missed by the net on so many occasions if they had been present. These with Callionymus are always extremely abundant in the ring-trawl collections. Their absence this year is unaccountable, unless spawning for most species took place in August, and is of importance as the young Gobies form an important part of the food of many fish (**5**). The post-larval Wrasses were also markedly scarce in 1925.

The year 1924 was marked by an unusual abundance of the post-larvæ of *Molva molva* and of *Lophius piscatorius*.

In the following pages the distribution of each species is dealt with in detail. In order to economise in space the actual numbers of the different species taken at each station have been placed together in the Appendix, Tables 3–10, at the end of the paper (pp. 152–158).

CLUPEIDÆ.

Clupea sp.

Specimens of young clupeids, 6–20 mm. in length, which consist of a mixture of both *Clupea sprattus* L. and *Sardina pilchardus* (Walb) occurred fairly frequently in my collections. Figures show that they seemed to be somewhat indiscriminately distributed from surface to bottom with perhaps a tendency to avoid the actual surface layer in the hotter months, as shown by the 1925 results. In 1924, however, when they were more numerous, they were also present on the surface in May, June, and July, and showed a tendency to be most abundant between 5 and 25 m. (Fig. 4, p. 128).

A comparison with figures given by Wallace (**24**) for post-larvæ of *Clupea harengus*, the Herring, shows that for this species also from the months September to April they were distributed irregularly among the surface, midwater, and bottom hauls : the time of day, however, is not given.

A station taken with the metre closing net is worthy of mention here, as at it were captured many very early stages of *Clupea sprattus*, 6–10 mm. in length. Although no depth-recorder was used it can be seen from the figures that there was a definite congregation of these young stages a little below the actual surface.

12.iii.24. C.M.N. Bigbury Bay.

Surface (estimated depth).	Number	of young	sprat	4
Upper layers, ca. 7 m.	,,	,,	,,	63
Midwater, ca. 13 m.	,,	,,	,,	23
Bottom layers, ca. 19 m.	,,	,,	,,	13
Bottom, ca. 25 m.	,,	,,	,,	13

There is a possibility of this distribution being due to mechanical action of the water movement as the distribution of *Onos* sp. eggs given on page 139 is almost similar.

GADIDÆ.

The species of this genus whose pelagic young occur in the Plymouth region are *G. merlangus*, *G. minutus*, *G. pollachius*, *G. luscus*, *Molva molva*, *Merluccius merluccius*, *Raniceps raninus*, *Onos mustelus* and probably *O. cimbrius*, and *O. tricirratus*.

Of these *Merluccius merluccius*, *Raniceps raninus*, and *Gadus luscus* only occurred very rarely in my collections, and insufficient evidence is forthcoming as to their vertical distribution.

Results, however, have shown that there were striking differences in depths at which the post-larvæ of the remaining species occurred in greatest abundance.

G. pollachius, the Pollack, preferred the surface and layers immediately below the surface.

G. minutus, the Poor Cod, was always found in the deep layers below 20 and 25 metres, increasing in numbers thence towards the bottom.

Onos sp., the Rockling, occurred at all depths with perhaps a partiality for the surface layers.

G. merlangus, the Whiting, showed a gradual change in its vertical distribution as the season advanced. While in early April it was present, like Onos, at all depths, as the year advanced it deserted the surface layers, gradually going deeper until in June the majority were below 24 metres. However, when the Whiting sought the deeper layers the depth at which they became abundant was nearly always higher in the water than that of *G. minutus* (Fig. 2 and Table 2).

Gadus merlangus L.

Post-larval Whiting occurred at twelve stations (sixty-seven hauls) in sufficient numbers to bring evidence on their vertical distribution. Collections made with the ring-trawl between April 2nd and June 17th, 1925, showed a marked seasonal change in the depth at which this species was most abundant: at the same time there was a gradual desertion of the surface water layers, as the season advanced.

This is best illustrated by Fig. 2 (p. 118), which shows the curves of percentage distribution at the different depths. If we now look for the points

TABLE 2.*

	1924 May 29th	June 5th†	June 17th‡	June 21st†	June 25th	1925 April 2nd	April 8th	April 22nd‡	April 29th	May 19th (i)	May 19th (ii)	June 4th (i)	June 4th (ii)	June 17th
(a) GADUS MERLANGUS.														
Between 0 and 5 m.	–	–	–	{ –	–	13	4	{ –	–	{ 3	–	–	{ –	{ –
				1				–		1			1	–
„ 5 „ 10 „		1		10		8	10		2	4	–	–		
„ 10 „ 15 „	5	23	–	8	3	2		1	15		47	1	4	
„ 15 „ 20 „						3	3				124	9		3
„ 20 „ 25 „	37	16						2	40	17	85		25	7
„ 25 „ 30 „			8			{ 8						21		44
						15	8							
„ 30 „ 35 „		8					2			26			14	
„ 35 „ 40 „							5				15	21		
„ 40 „ 45 „									32					
„ 45 „ 50 „					69									33
„ 50 „ 55 „					35			3						
„ 55 „ 60 „			4											
„ 60 „ 65 „								3						
„ 65 „ 70 „														
(b) GADUS MINUTUS.														
Between 0 and 5 m.	–	–	–	{ –	–	–	–	{ –	–	{ –	–	–	{ –	{ –
				–				–		–			–	–
„ 5 „ 10 „		–		–		–	–		1	–	–	–		
„ 10 „ 15 „	2	–	–	–	1	–		–	–		2	–	–	
„ 15 „ 20 „						–	1				12	–		–
„ 20 „ 25 „	32	–						–	81	4	43		–	–
„ 25 „ 30 „			7			{ 4								–
						19	3					7		
„ 30 „ 35 „		–					13			66			8	
„ 35 „ 40 „							15				58	29		
„ 40 „ 45 „									87					
„ 45 „ 50 „					16									–
„ 50 „ 55 „					16			36						
„ 55 „ 60 „			23											
„ 60 „ 65 „								33						
„ 65 „ 70 „														
(c) GADUS POLLACHIUS.														
Between 0 and 5 m.	–	–	–	{ –	–	7	–	{ –	8	{ –	–	–	{ –	{ –
				–				–		–			–	–
„ 5 „ 10 „		–		–		4	10		13	–	–	–		
„ 10 „ 15 „	–	–	–	–	–	–		–	5		–	–	1	
„ 15 „ 20 „						–	4				–	–		–
„ 20 „ 25 „	–	–						–	5	–	–		–	–
„ 25 „ 30 „			–			{ 1	–							–
						–						–		
„ 30 „ 35 „		–					–			–			–	
„ 35 „ 40 „							–				–	–		
„ 40 „ 45 „									–					
„ 45 „ 50 „					–									–
„ 50 „ 55 „					–			1						
„ 55 „ 60 „			–											
„ 60 „ 65 „								–						
„ 65 „ 70 „														

* A dash (–) signifies that none of that species were taken at the depth given.
† These two stations were taken close inshore. ‡ Bottom at depth of 72 metres.

TABLE 2.*—*continued.*

	1924 May 29th	June 5th†	June 17th‡	June 21st†	June 25th	1925 April 2nd	April 8th	April 22nd‡	April 29th	May 19th (i)	May 19th (ii)	June 4th (i)	June 4th (ii)	June 17th
(d) ONOS SP.														
Between 0 and 5 m.	11	–	14	3 –	–	11	5	14 8	22	12 –	5	2	– –	– –
,, 5 ,, 10 ,,		11		–		4	11		11	–	–	–		
,, 10 ,, 15 ,,	1	–	7	–	1	1		2	18		–	–	–	
,, 15 ,, 20 ,,						1	8			–	5	3		–
,, 20 ,, 25 ,,	3	6						7	17	1	2		–	–
,, 25 ,, 30 ,,			25			1 4	6					2		–
,, 30 ,, 35 ,,		–					2			2			1	
,, 35 ,, 40 ,,							5				3	–		
,, 40 ,, 45 ,,									4					
,, 45 ,, 50 ,,					1									–
,, 50 ,, 55 ,,					2			–						
,, 55 ,, 60 ,,			12											
,, 60 ,, 65 ,,								2						
,, 65 ,, 70 ,,														

on these curves at which the percentage first reaches ten below the surface we find that they occur at the following depths :—

April 2nd	Surface.	Dull and overcast.
,, 8th	,,	Bright sunshine.
,, 29th	10·5 m.	,, ,,
May 19th (i)	10·5 m.	Sunshine.
,, 19th (ii)	10·5 m.	Dull and overcast.
June 4th (i)	18·5 m.	Bright sunshine.
,, 4th (ii)	14·5 m.	,, ,,
,, 17th	24 m.	,, ,,

Thus we see that the period between the beginning of April and mid-June was marked by a gradual descent of the region at which the young Whiting started to increase markedly in abundance.

There may be many causes which bring this about, the most important of which might perhaps be found among the five given below :—

1. Increase in light intensity.
2. Seeking of deeper layers as growth proceeds.
3. Association with Cyanea.
4. Descent of organisms, e.g. copepods which form chief food.
5. Rise in temperature of surface layers.

* A dash (–) signifies that none of that species were taken at the depth given.
† These two stations were taken close inshore. ‡ Bottom at depth of 72 metres.

1. Increase in light intensity is possibly the fundamental factor, and this presumably also controls the distribution of the food and of Cyanea.

2. I have closely examined the lengths of all the young Whiting and I can find no evidence that there is necessarily any descent with age. The numbers of Whiting of different lengths found at the depths shown, on April 2nd, 29th, and May 19th, were as follows. It can be seen that

	Depth in metres.	Length in mm. 4	5	6	7	8	9	10	11	12	13	14	15	16	17
2.iv.25	S	–	1	2	2	3	4	1	–	–	–	–	–	–	–
	5	–	2	2	4	–	–	–	–	–	–	–	–	–	–
	12·5	–	–	1	1	–	–	–	–	–	–	–	–	–	–
	19	–	–	1	1	1	–	–	–	–	–	–	–	–	–
	27	3	–	1	–	1	2	1	–	–	–	–	–	–	–
	29	2	3	6	1	2	1	–	–	–	–	–	–	–	–
29.iv.25	S	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	7·8	–	–	1	1	–	–	–	–	–	–	–	–	–	–
	12·5	–	7	2	5	1	–	–	–	–	–	–	–	–	–
	24·3	–	3	13	10	6	3	4	1	–	–	–	–	–	–
	41·1	–	4	4	14	6	3	–	1	–	–	–	–	–	–
19.v.25	S	–	–	–	–	–	–	–	–	–	–	–	–	–	–
(ii)	5·6	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	12·9	–	3	5	5	7	9	2	6	2	5	1	1	–	1
	18·9	–	3	12	14	19	19	24	14	6	2	5	2	3	1
	23·7	–	2	9	23	20	6	9	8	3	3	–	1	1	–
	36·5	–	–	1	4	4	2	2	2	–	–	–	–	–	–

in this case specimens of all sizes were found from 5 mm. to 14 mm. at each depth, if anything there is evidence that the younger forms lie deeper than those slightly larger, the mode at 18·9 metres being 10 mm. and that at 23·7 m. 7 mm. on May 19th, 1925. Results show that whereas there is a slight average increase in size from April to June very small post-larvæ are still present in June, and do not show any difference in distribution from larger specimens.

3. *Cyanea capillata* only appeared in three hauls out of the sixty-seven, the three specimens being all between ½ in. and 2 in. in diameter. It is doubtful whether these were of a large enough size to afford shelter to the number of Whiting taken. They occurred at 18·9 metres on May 19th, when a specimen of less than 2 in. diameter was present with 124 young Whiting, and on June 17th, one of ½ in. diameter at 23·4 m. and 2 in. diameter at 29·8 m., both too small to afford protection for 7 and 44 fish respectively.

Damas (**6**) was convinced that on the Norwegian coast Cyanea plays an extremely important part in the distribution of young Whiting, and that the vertical distribution of these small fish is more or less controlled by that of the jellyfish. When the Cyanea migrates to the surface at night the Whiting follow them, and they descend together again the next day. However, Damas says that it is after the fish has almost completely metamorphosed, with a length of 23 mm., that this association begins. None of my post-larvæ had attained this length, in fact the majority were under 12 mm. in length, so that I think it is fairly safe to conclude that the distribution of these stages was not controlled by association with Cyanea. Additional evidence is given by the fact that Cyanea does not become very abundant in this area until late July and August: it is at the end of June that the Whiting becomes absent from my hauls, probably indicating the new period in their life-history, as at this time if a Cyanea is captured there are many Whiting of 30–50 mm. long present with it.

4. Catches of the food of the young fish were made at each depth by the use of a small medium silk tow-net fixed just above the junction of the warp and bridles of the ring-trawl. Thus these samples were taken from the same body of water as the young fish themselves.

These collections have not yet been worked out, but it is hoped at a later date to compare the vertical distribution of the copepods and that of the young fish.

5. From May to September a warm surface layer usually exists in the waters of the English Channel.

The months, however, that concern us at the moment are April, May, and June. I am indebted to Mr. H. W. Harvey for the following temperatures at L4 during these months for 1925:—

April 22nd	Surface	9·7° C.
	40 m.	9·31° C.
May 13th	Surface	10·4° C.
	40 m.	9·81° C.
June 3rd	Surface	12·4° C.
	40 m.	10° C.

Whereas in April the difference in the temperature of the surface from that at the bottom was 0·4° C., in May it was 0·6° C., and in June 2·4° C. The differences in the first two months are too slight to be likely to influence the distribution of the young fish. In June, however, a difference of 2·4° might be considered of importance.

Damas (**6**, p. 55) says that in the North Sea young Whiting were only present at temperatures above 10° C., and that this isotherm serves as a lower limit for their vertical distribution. In this case it would seem unlikely that a temperature of 12·4° C. would be avoided. A stronger argument against raised temperature being a factor is that in mid-

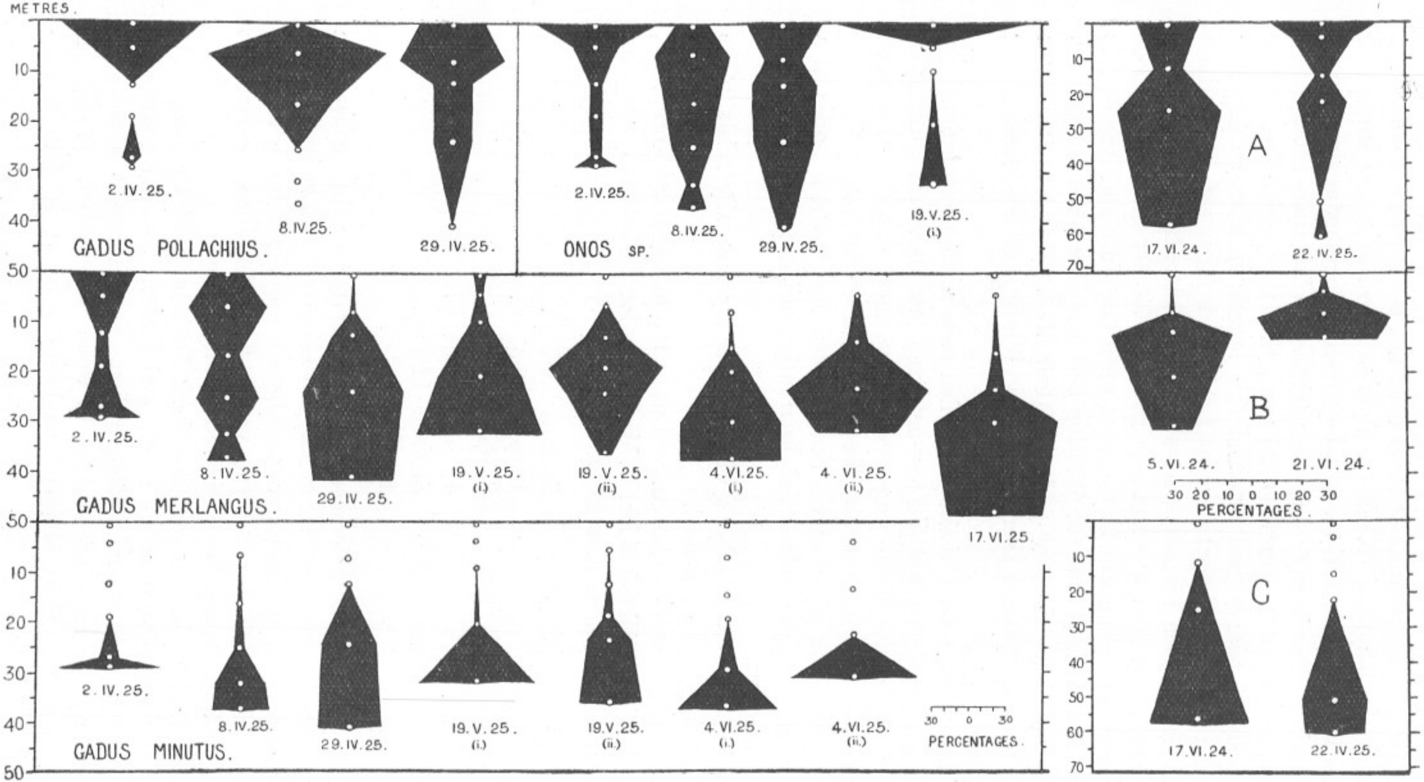

FIG. 2.—Shows percentage vertical distribution of *Gadus pollachius, Onos* sp., *Gadus merlangus* and *Gadus minutus* at stations of 50 m. or more depth. A, *Onos* sp., and C, *Gadus minutus* at E1. B, *Gadus merlangus* at two close inshore stations.

NOTE. The percentage scale, as marked, for *G. minutus* is half that used for the remaining species. The white spots and black circles indicate the "average depth" at which the hauls were taken.

June Whiting were present in the surface layers in the hours between dusk and dawn.

Whether the higher temperature may set up a state of negative phototropism in the young Whiting is worthy of consideration. On this point there is no experimental evidence.

Two stations taken in shallower water within two miles of the coast show that the Whiting increase in abundance at a smaller depth than farther offshore in the corresponding month: they were both taken in June, and the depths at which increase occurred were about 7 to 10 metres as against 18·5, 14·5, and 24 m. farther out (Fig. 2, B). This is in agreement with the general vertical distribution of most of the larger plankton organisms (*vide* **19**, p. 770).

Gadus minutus (O. F. Müll).

Post-larval stages of the Poor Cod were present at ten stations (fifty-seven hauls) in sufficient numbers to show their vertical distribution.

It is at once obvious that *G. minutus* differs from the other species of Gadidæ recorded in that the post-larval stages occupy a position normally much deeper in the water in the daytime.

Fig. 2 shows the percentage distribution at different depths. If as in the case of the Whiting we note the depths at which the value 10% first occurs below the surface we find in 1925—

April 2nd	26 metres.	Dull and overcast.
,, 8th	25·5 ,,	Bright sunshine.
,, 29th	16·5 ,,	,, ,,
May 19th (i)	21 ,,	,, ,,
,, 19th (ii)	19 ,,	Dull and overcast.
June 4th (i)	26·5 ,,	Bright sunshine.

We see from these figures that from April to June the small Poor Cod were always deep in the water in striking contrast to the seasonal changes in depth exhibited by the small Whiting. And further if the above figures be compared with those for the Whiting we see that even when this form has deserted the surface layers, *G. minutus* is considerably deeper in the water.

The majority of post-larvæ caught were between 5 and 10 mm. in length, and there is no evidence of any differentiation in the distribution of the various sizes within these lengths; for those above 10 mm., however, there is an indication that they live deeper down. I give below the sizes at the two stations at which the post-larvæ were most numerous :

	Depth in metres.	Length in mm. 4	5	6	7	8	9	10	11	12	13	14	15	16
29.iv.25	S	–	–	–	–	–	–	–	–	–	–	–	–	–
	7·8	–	–	1	–	–	–	–	–	–	–	–	–	–
	12·5	–	–	–	–	–	–	–	–	–	–	–	–	–
	24·3	2	13	28	22	13	2	–	1	–	–	–	–	–
	41·1	–	11	31	32	9	2	1	–	–	1	–	–	–
19.v.25 (ii)	S	–	–	–	–	–	–	–	–	–	–	–	–	–
	5·6	–	–	–	–	–	–	–	–	–	–	–	–	–
	12·9	–	1	1	–	–	–	–	–	–	–	–	–	–
	18·9	–	5	2	4	–	–	1	–	–	–	–	–	–
	23·7	–	4	6	10	8	6	7	1	1	–	–	–	–
	36·5	–	3	8	8	12	11	7	3	1	3	1	–	1

Of this species Schmidt (**22**, p. 71) says : " With regard to the depths under the surface in which the pelagic fry of *Gadus minutus* live, our tables show distinctly that but few or none are found close under the surface, but that the numbers increase with the depth."

As regards the vertical distribution of this form in close inshore waters, as shown by the metre-net, it is worthy of note that it hardly ever occurred, possibly showing that it keeps to the deeper water.

Two stations taken at the hydrographical Station E1, twenty miles from land, showed that here the young Poor Cod hugged the bottom layers.

Gadus pollachius L.

At only three stations (seventeen hauls) were the post-larvæ of this species abundant, and then the numbers were comparatively small.

From these observations, however, it is fairly evident that young Pollack, from 4·5 to 10 mm. in length, showed a preference for the surface layers, and regions immediately below the surface (Fig. 2).

Further evidence is available from three stations taken early in 1924 before the depth-recorder was in use, so that we do not know the depths of the deeper hauls.

These were :—

Feb. 7th,	Surface	2.	Mar. 30th,	Surface	14.	May 7th,	Surface	6.
	Midwater	—		Midwater	1.		Midwater	—
	Bottom	—		Bottom	1.		Bottom	—

This is in agreement with records given by Schmidt, who remarks (**22**, p. 48) : " . . . this species keeps perhaps in a special degree to the neighbourhood of the surface. . . . Most of our pelagic Pollack were thus taken quite close to the surface, with only 10 metres line out."

GADUS LUSCUS L.

The post-larvæ of *Gadus luscus* were very rare in both the 1924 and 1925 collections. Only nineteen specimens were taken in the ring-trawl; of these two occurred between 10 and 15 metres, seven between 20 and 30 m., and ten below 30 m.; none were taken at the surface. Close inshore in the metre-net, on June 13th, 1924, two were captured from 3·4 and 8·7 metres respectively, and on June 5th, 1924, in the metre-net two at 31·4 metres.

ONOS SP.

Young Rockling, perhaps mostly *O. mustelus* although *O. cimbrius* and *O. tricirratus* may have occurred, were present at nine stations (forty-seven hauls) in sufficient numbers to examine their vertical distribution.

From these observations it is obvious that young Rocklings of the lengths captured in this case, 4–10 mm., like the small Pollack, show a partiality for the surface layers; they are, however, to be found in all layers from surface to bottom, although usually the largest numbers are taken near the surface (Fig. 2).

Ehrenbaum (**8**) says that they are found sporting on the surface or hiding under floating seaweed.

Mielck (**17**) refers to the young stages of *Onos cimbrius* as surface living forms.

MOLVA MOLVA L.

Post-larvæ of the Common Ling only occurred in small numbers. In 1924, however, they were unusually abundant for this region, 51 individuals being taken; in 1925 they were only caught on three occasions: May 19th, 3; June 4th, 1; and July 16th, 1. Of the 51 specimens captured in 1924, 45 occurred below 20 metres, and all 5 taken in 1925 came from below 30 m.

The sizes of the post-larvæ at the station at which they were most numerous were :—

17.vi.24

Depth in metres.	Length in mm. 5	6	7	8	9	10	11	12	13	14	15	16
S	–	–	–	–	–	–	–	–	–	–	–	–
12·4	–	–	–	–	–	1	–	–	–	–	–	–
25·2	1	–	2	1	2	1	2	2	1	–	–	1
57·8	–	–	2	5	1	2	1	–	–	1	–	–

Of this species Clark (**5**) records in 1919 ten post-larvæ in July; he also states that " For 1914 Dr. Allen records a similar number, 8–20 mm. in length, from May to July "; investigations during the years 1906–13 produced only twenty post-larvæ 5–13 mm. in length (**4**).

Schmidt (**22**, p. 99) says : " . . . relatively very few specimens were found near the surface (hauls with 10–25 metres' wire). The majority were taken in depths of 30–100 metres under the surface, and this holds good not only for the slightly older, but also for the smallest specimens."

Merluccius merluccius L.

Two specimens only occurred in my collections : these were taken on June 25th, 1924, with the ring-trawl. A specimen, 9 mm. in length, came from a depth of 45 metres, and the other, 5 mm., from 52 metres.

Two post-larval Hake captured in the ring-trawl before the depth-recorder was in use are worthy of record here, on account of the time of year at which they occurred ; on January 1st, 1924, at L6 (five miles beyond the Eddystone Lighthouse) in the bottom haul, two specimens occurred 5·5 mm. and 8·5 mm. long respectively.

Raniceps raninus L.

Three post-larvæ of this species were taken only : on July 1st, 1925, one of 4·5 mm. at L4 from a depth of 36 metres ; one of 4·5 mm. on July 16th, 1925, from 26 metres ; and one, of 13·5 mm., on August 6th, from 19 metres.

BOTHIDÆ.

Arnoglossus sp.

Post-larvæ of this species, probably *Arnoglossus laterna* (Will), were only abundant at one station, on July 29th, 1925 ; on this occasion the maximum catch was taken from a depth of 25 metres.

The sizes of these specimens were as follows :—

	Depth in metres.	Length in mm. 7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
29.vi.25	S	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	4·8	–	1	–	–	–	–	–	–	–	–	1	–	–	–	–
	9·1	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	20·6	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–
	25·8	3	4	11	4	3	4	4	5	1	1	–	1	2	1	–
	29	–	2	3	–	2	2	1	–	1	3	–	2	–	–	2

At other stations at which *Arnoglossus* sp. occurred the numbers taken were very small ; none were present in surface hauls, and although they occurred on occasion at as small depths as 5 metres, most were taken below 10 metres.

Scophthalmus norvegicus (Gunther).

Post-larvæ of this species were numerous at seven stations (thirty-three hauls). They generally occurred in greatest numbers below a depth of about 15 metres, with the exception of April 29th, 1925, when they were decidedly higher in the water.

Fig. 3 shows the percentage distribution of these young fish at three stations. It is interesting to compare these with the distribution of *Pleuronectes limanda* at the same stations (shown on the same figure). It is noticeable that *S. norvegicus* always occurred slightly higher in the water than the young Dab, the value of 10% first occurring below the surface in the case of the Topknot at 5·5, 12·5, and 11·5 m. respectively, and in the case of the Dab at 12·5, 16·5, and 16 m.

The post-larval *S. norvegicus* were almost all of lengths between 4 and 10 mm., and there is no evidence that the larger forms occurred more in the deeper layers than the smaller, as the following figures at the three stations at which post-larvæ were most abundant show :—

	Depth in metres.	Length in mm. 4	5	6	7	8	9	10	11	12	13
17.vi.24	S	–	–	–	–	–	–	–	–	–	–
	12·4	2	4	3	6	3	2	–	–	–	–
	25·2	13	29	26	34	23	13	4	1	–	–
	57·8	1	–	7	10	6	6	3	–	–	1
19.v.25 (i)	S	–	3	2	–	–	–	–	–	–	–
	4·3	–	–	–	–	–	–	–	–	–	–
	9·9	–	–	–	–	–	–	–	–	–	–
	20·8	–	4	18	16	21	12	3	–	–	–
	32·6	–	4	34	31	16	8	1	–	–	–
19.v.25 (ii)	S	–	–	–	–	–	–	–	–	–	–
	5·6	–	–	–	–	–	–	–	–	–	–
	12·9	–	14	4	3	2	–	–	–	–	–
	18·9	4	15	17	14	11	2	–	–	–	–
	23·7	2	15	11	12	7	2	2	–	–	–
	36·5	–	3	6	8	6	–	–	–	–	–

This species was not at all abundant at the stations close inshore at which the silk metre-net was used.

Zeugopterus punctatus (Bloch.).

Post-larvæ of *Zeugopterus punctatus* were fairly abundant at only one station, on May 19th, 1925. The lengths of the specimens from the different depths were :—

	Depth in metres.	Length in mm. 5	6	7	8	9	10
19.v.25 (ii)	S	–	–	–	–	–	–
	5·6	–	–	–	–	–	–
	12·9	–	–	1	–	–	1
	18·9	–	1	4	3	2	–
	23·7	4	5	2	3	2	–
	36·5	1	1	5	6	3	–

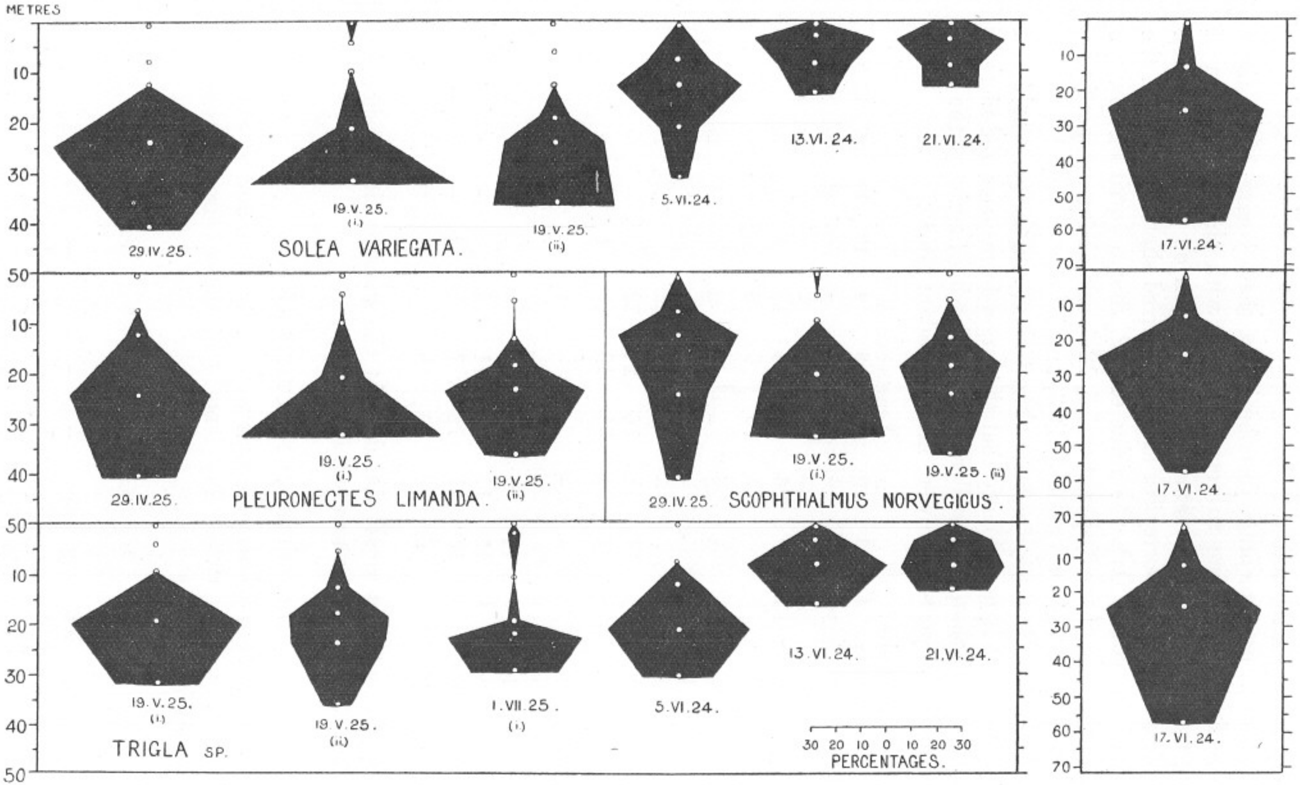

Fig. 3.—Shows percentage vertical distribution of: *Solea variegata* at three 50-m. stations, three inshore stations and E1 respectively; *Pleuronectes limanda* at three 50-m. stations; *Scophthalmus norvegicus* at three 50-m. stations and E1; *Trigla* sp. at three 50-m. stations, three inshore stations, and E1. The white spots and black circles indicate the "average depth" at which the hauls were taken.

On other occasions on which this species occurred the numbers were very small: all, however, were caught below a depth of 10 metres.

Scophthalmus unimaculatus (Bnp).

Only three post-larvæ of this species occurred in the collections; on June 17th, 1924, at 12·4 m. one of 4·5 mm. length, and at 25·2 m. one of 7 mm.; on July 1st, 1925, at position A, one of 4·5 mm. was caught at 23·1 m.

PLEURONECTIDÆ.

Pleuronectes limanda L.

The post-larval Dab only occurred abundantly at five stations (twenty-three hauls). Results show that in the daytime their region of maximum abundance occurred always below 20 metres, and that they were present in considerable numbers between that depth and the bottom (Fig. 3). At other stations at which only few individuals were caught they were always taken below a depth of 15 to 20 metres.

Below are shown the numbers in which the different sized fish occurred at the depths sampled at the three stations at which they were most numerous:—

	Depth in metres.	Length in mm. 5	6	7	8	9	10	11	12	13	14	15
29.iv.25	S	–	–	–	–	–	–	–	–	–	–	–
	7·8	–	–	–	–	1	1	–	–	–	–	–
	12·5	1	1	2	4	2	–	–	–	–	–	–
	24·3	–	2	5	9	19	7	5	7	1	–	1
	41·1	–	–	5	3	7	2	5	3	3	2	–
19.v.25 (i)	S	–	–	–	–	–	–	–	–	–	–	–
	4·3	–	–	–	–	–	–	–	–	–	–	–
	9·9	–	1	–	–	–	–	–	–	–	–	–
	20·8	–	1	1	5	6	1	–	–	–	–	–
	32·6	–	1	8	12	14	12	11	–	1	–	–
19.v.25 (ii)	S	–	–	–	–	–	–	–	–	–	–	–
	5·6	–	–	–	–	–	–	–	–	–	–	–
	12·9	–	1	–	1	–	–	–	–	–	–	–
	18·9	1	1	6	18	7	1	–	–	–	–	–
	23·7	1	–	16	37	23	19	10	1	–	–	–
	36·5	–	–	4	9	12	13	5	3	–	–	–

From these figures we see that young Dab between the lengths of 7 and 12 mm. occurred in all the hauls below 20 metres. Perhaps there is a tendency for the fish with greater lengths to occur in proportionately larger numbers in deepest hauls, but this can in no case be said to be at all marked. It seems most likely that the post-larval Dabs may be met with at any depths below 20 metres until they have attained the length at which they normally descend to the bottom, and that they do not necessarily sink deeper as growth proceeds, which would give rise to a congregation in the bottom layers of fish just ready to adopt their new mode of life.

Ehrenbaum says (**8**, p. 156) that Dabs of 13–14 mm. upwards are seldom taken in the plankton, as at this length they seek the bottom.

Pleuronectes microcephalus (Don).

Post-larvæ of this species occurred at seven stations (thirty-two hauls) in fair numbers.

It would appear that their distribution is very similar to that of the small Dab, the region of maximum abundance being below a depth of 20 metres. There was one exception to this when, on April 29th, 1925, they were numerous at a depth of 12·5 metres.

I give below the lengths of the young *P. microcephalus* occurring at different depths at the two stations where they were most abundant :—

	Depth in metres.	Length in mm. 4	5	6	7	8	9	10	11	12	13
17.vi.24	S	–	1	–	1	1	–	–	–	–	–
	12·4	–	3	5	4	4	2	1			
	25·2	1	7	23	28	24	13	10	8	2	–
	57·8	–	–	1	4	2	–	1	–	1	1
19.v.25 (ii)	S	–	–	–	–	–	–	–	–	–	–
	5·6	–	–	–	–	–	–	–	–	–	–
	12·9	–	1	2	–	1	2	1	–	–	–
	18·9	–	–	2	–	3	1	–	–	–	–
	23·7	–	–	2	6	11	7	6	1	–	–
	36·5	–	–	–	–	5	2	1	2	–	–

Pleuronectes flesus L.

Only thirteen specimens of post-larval Flounders occurred in the collections : of these nine were taken from depths greater than 20 metres.

SOLEIDÆ.

Solea variegata (Don).

Post-larval Thickback occurred at five stations (twenty-four hauls) in the ring-trawl in sufficient numbers to show its vertical distribution. These young fish were never in quantity above a depth of 20 metres over water 50 or more metres deep.

Fig. 3 shows their distribution at four offshore stations. Below are given the sizes of fish caught at various depths at three stations :—

	Depth in metres.	Length in mm. 3	4	5	6	7	8	9	10	11	12
19.v.25 (i)	S	–	–	–	7	1	1	–	1	–	–
	4·3	–	–	–	–	–	–	–	–	–	–
	9·9	–	–	–	–	–	–	–	–	–	–
	20·8	–	3	7	12	5	3	1	–	–	–
	32·6	–	9	48	45	34	28	10	4	1	1
19.v.25 (ii)	S	–	–	–	–	–	–	–	–	–	–
	5·6	–	–	–	–	–	–	–	–	–	–
	12·9	–	–	1	–	–	–	–	–	–	–
	18·9	–	–	5	9	3	–	–	–	–	–
	23·7	–	4	18	19	4	6	2	2	–	–
	36·5	–	2	9	10	18	8	9	6	4	1
25.vi.24	S	–	–	–	–	–	–	–	–	–	–
	13·6	–	–	4	2	1	–	–	–	–	–
	45·5	–	1	6	18	21	11	1	1	–	–
	52	2	10	29	23	12	3	3	–	–	–

From these figures it would seem that up to 9 mm. the post-larval Thickback may be met with at any depth below 20 m., but after this length they tend to keep to the deeper layers. Although metamorphosis is not complete at 12 mm., it is probable that by the time this length is attained the majority are seeking the bottom for their new mode of living.

In addition to these records *S. variegata* post-larvæ occurred at three stations taken closer inshore, on June 5th, 1924, over a depth of ca. 35 m., and June 13th and 21st, 1924, over a depth of ca. 25 m. On these occasions we see that the young fish were abundant at a much higher level in the water than farther offshore, the largest numbers being taken at 12·5 m., 3·4 m. and 3·8 m. respectively (Fig. 3) :—

	Depth in metres.	Length in mm. 3	4	5
5.vi.24	S	–	–	–
	8	1	–	–
	12·4	15	–	–
	21·2	3	2	–
	31·4	1	–	1

	Depth in metres.	3	Length in mm. 4	5	6	7
13.vi.24	S	3	–	–	–	–
	3·4	–	17	6	–	–
	8·7	–	6	6	1	1
	14·5	–	1	2	2	3

	Depth in metres.	3	4	Length in mm. 5	6	7	8
21.vi.24	S	–	2	2	1	–	–
	3·8	3	3	–	5	3	3
	9	–	6	1	–	2	–
	13·3	–	5	–	1	2	1

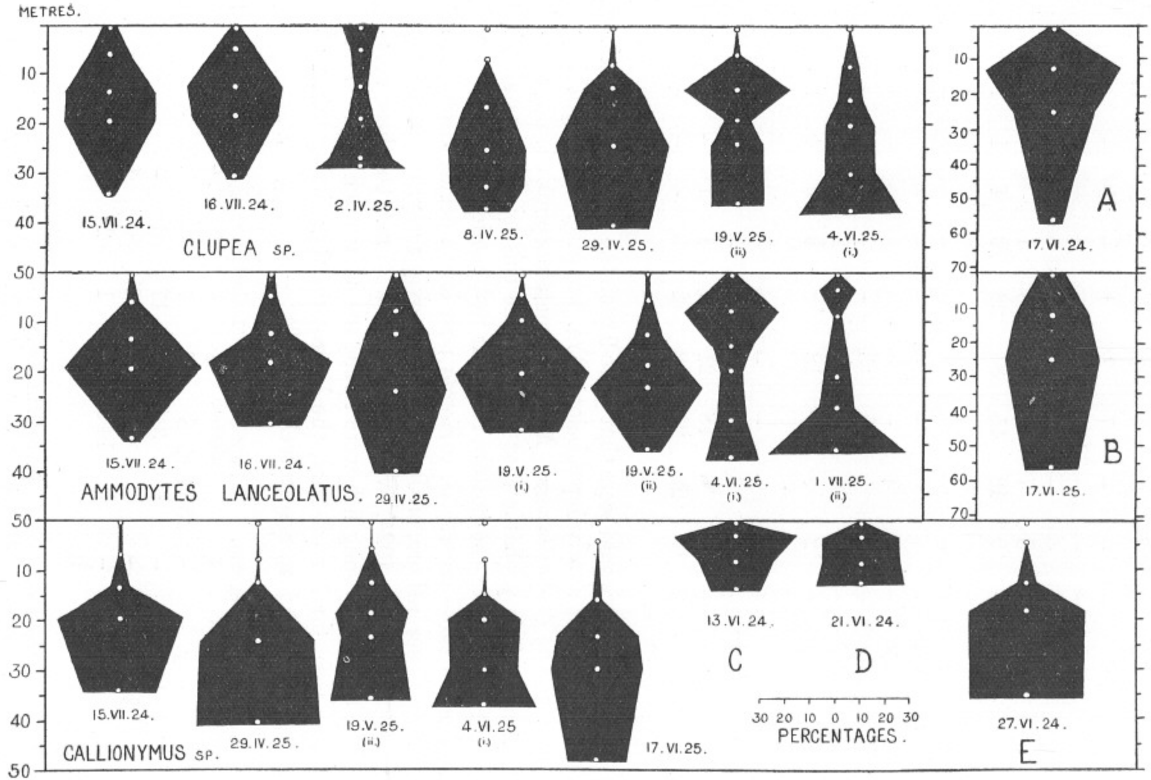

FIG. 4.—Shows percentage vertical distribution of *Clupea* sp. at seven 50-m. stations and one at E1; *Ammodytes lanceolatus* at similar stations, and *Callionymus* sp. at five 50-m. stations, two inshore stations and one over 45 m. with the metre closing net. The white spots and black circles indicate the "average depth" at which the hauls were taken.

Solea vulgaris (Quenn).

Only thirty specimens of the post-larvæ of the Common Sole occurred in the collections, of these none were taken between the surface and 10 metres, one was caught at 12 metres, six between 20 and 25 metres, and the remaining twenty-three below 25 metres, most of these occurring at depths greater than 30 metres.

Solea lutea (Risso.).

Only one post-larval, *S. lutea*, was caught: this was taken from a depth of 23 metres on July 1st, 1925, in the ring-trawl.

CARANGIDÆ.

Caranx trachurus (L.).

Post-larvæ of this species occurred on only two occasions, on July 15th and 16th, 1924, at L4 in the ring-trawl. All specimens were taken above a depth of 20 metres. On July 16th, five, 4–5 mm. in length, occurred at a depth of 12·5 metres: at the four other depths sampled on this day none were taken.

The following were the sizes of the individuals at the five depths sampled on July 15th :—

Depth in metres.	Length in mm. 4	5	6	7	8	Total number of fish.
S	1	1	–	–	–	2
6·6	3	2	–	–	–	5
13·6	1	9	1	–	1	12
19·5	1	5	2	–	–	8
34·5	–	–	–	–	–	–

AMMODYTIDÆ.

Ammodytes lanceolatus (Lesauv).

Of the two species of Sand-eel taken in this region *Ammodytes lanceolatus* was most evident in my collections, *A. tobianus* only occurring singly on one or two occasions.

In their vertical distribution *A. lanceolatus* post-larvæ, mostly 5–20 mm. in length, show a distinct resemblance to that of *Clupea* sp., being somewhat irregularly distributed from the surface downwards with a tendency to be absent from the superficial layers (Fig. 4).

CALLIONYMIDÆ.

Callionymus sp.

Probably the majority of post-larvæ under this heading were *Callionymus lyra* : *C. maculatus* being a late spawner (**5**) the young stages would be in the plankton mostly in July and August, later than most of the stations were made.

This species was by far the most abundant of all the young fish in the collections. In 1924 of 11,553 young fish examined 4595 were Callionymus, and in 1925 out of 9505 examined 4148 were Callionymus. So that of the 21,000 young fish over 8700 were Callionymus. This is a very large proportion, and one naturally concludes that this species is a serious competitor for the food of other young fish.

These post-larvæ, nearly all below 8 mm. in length, occurred abundantly at almost every station, both close inshore and far out. Generally they increased in number suddenly below about 12 m. ; from this level downwards they were very abundant, usually increasing in numbers towards the deeper layers, the region of maximum abundance lying below 20 metres (Fig. 4). Above 12 metres to the surface very few were taken (see Appendix). At the stations taken close inshore, as with other species of fish, post-larval Callionymus were present in large numbers much higher up in the water than farther offshore.

With the metre-net the following results were obtained :—

	Depth of water.	Depth below which Callionymus species were abundant.
13.vi.24 . . .	25 m.	2·3 m.
21.vi.24 . . .	27 m.	2·3 m.
5.vi.24 . . .	35 m.	ca. 10 m.
27.vi.24 . . .	45 m.	10 m.

LABRIDÆ.

Post-larvæ of the Wrasses were never very numerous in the catches. All species showed a tendency to be most abundant above 20–25 metres.

Labrus bergylta Asc.

This species was never numerous. I give below the sizes of the specimens from different depths on the two dates when they were most abundant :—

25.vi.24. L4. R.T.

Depth in metres.	Length in mm. 5	6	7	8	Total number of fish.
S	–	–	–	–	–
13·6	3	5	3	1	12
45·5	3	4	5	–	12
52	–	5	2	1	8

1.vii.24. L4. R.T.

Depth in metres.	Length in mm. 5	6	7	8	9	Total number of fish.
S	–	–	–	1	–	1
5·4	3	1	–	3	–	7
16·4	4	–	1	2	–	7
29·2	–	2	2	–	1	5
39·3	–	–	1	1	–	2

In these two cases the post-larvæ occurred slightly higher in the water than many other species of fish. In the remaining collections in 1924 and 1925 with the ring-trawl only twenty-three individuals occurred, of these sixteen came from levels above 25 m. and eight below this depth.

Labrus mixtus (L.).

Post-larvæ of this species were even less abundant than those of *L. bergylta*. The largest numbers were taken with the ring-trawl on July 1st, 1924. The details were as follows :—

Depth in metres.	Length in mm. 7	8	9	10	Total number of fish.
S	–	–	–	–	–
5·4	–	3	1	–	4
16·4	3	4	–	1	8
29·2	2	1	–	–	3
39·3	–	1	–	–	1

Only nineteen specimens appeared in the remaining collections, of which thirteen came from above a depth of 25 metres.

Crenilabrus melops (L.).

The two most abundant catches of this species with the ring-trawl were on July 1st and 16th, 1924, when the details were :—

1.vii. 24. L4. R.T.

Depth in metres.	Length in mm. 4	5	6	7	Total number of fish.
S	–	–	–	1	1
5·4	2	7	4	3	16
16·4	1	4	2	–	7
29·2	–	–	1	–	1
39·3	–	–	–	1	1

16.vii.24. L4. R.T.

Depth in metres.	Length in mm. 4	5	6	Total number of fish.
S	1	–	–	1
5·3	1	5	1	7
12·5	1	5	4	10
18·3	1	6	3	10
31·1	1	–	1	2

In the remaining catches with the ring-trawl only twenty-two specimens occurred, twelve of which came from depths above 25 metres.

This species occurred fairly abundantly at two inshore stations with the metre-net : in both cases there was a marked maximum of abundance just below the surface at about 3 to 4 metres.

13.vi.24. M.N.

Depth in metres.	Length in mm. 3	4	5	Total number of fish.
S	1	–	–	1
3·4	20	16	1	37
8·7	–	4	–	4
14·5	–	5	–	5

21.vi.24. M.N.

Depth in metres.	Length in mm. 3	4	Total number of fish.
S	2	–	2
3·8	23	2	25
9	6	3	9
13·3	1	1	2

Ctenolabrus rupestris (L.).

Only forty-four specimens (4–9 mm. in length) occurred in the catches with the ring-trawl in 1924 and 1925 ; of these 15 came from above 10 metres, 18 between 10 and 20 metres, 2 between 20 and 25 m., and 9 between 25 m. and the bottom.

Centrolabrus exoletus (L.).

Only fifty specimens occurred in the catches with the ring-trawl in 1924 and 1925 ; of these 5 were caught above 10 metres, 32 between 10 and 20 m., 1 between 20 and 25 m., and 12 between 25 m. and the bottom.

TRACHINIDÆ.

Trachinus vipera C. and V.

Post-larvæ of *Trachinus vipera* were never numerous in the collections. In all fifty-one specimens were taken in the ring-trawl and closing metre-net in water of 50 m. depth; of these 19 occurred between the surface and 10 metres, 12 between 10 and 20 metres, 9 between 20 and 25 metres, and 11 between 25 metres and the bottom. Thus there would appear to be a tendency for these post-larvæ, most of which were between 5 and 8 mm. in length, to occur in the upper water layers above 25 metres in the daytime. At the majority of stations, however, at which they occurred the weather was extremely dull; this is a factor that must not be lost sight of, but many more observations will be required before it will be possible to determine such causes.

SCOMBRIDÆ.

Scomber scomber (L.)

Post-larval Mackerel were never very numerous; the main spawning region is probably considerably farther to the westward. They appeared to show a preference for the levels above a depth of 25 metres.

I give below the sizes of the specimens at the three stations at which they were most numerous :—

	Depth in metres.	Length in mm. 4	5	6	7	8	9	10	11	12	13	15	Total number of fish.
17.vi.24	S	–	–	–	–	–	–	1	–	–	–	–	1
E1. R.T.	12·4	5	1	1	7	3	1	1	–	–	–	–	19
	25·2	–	2	1	5	4	2	–	2	–	–	–	16
	57·8	–	–	2	1	3	–	–	–	–	–	–	6
15.vii.24	S	–	1	1	–	1	–	–	–	–	–	–	3
L4. R.T.	6·6	–	1	–	–	3	7	2	3	–	–	–	16
	13·6	–	–	–	–	–	–	1	1	–	–	–	2
	19·5	–	–	–	1	–	1	–	–	–	–	1	3
	34·5	–	–	–	–	–	–	–	–	–	–	–	–
17.vi.25	S	–	–	–	–	–	–	–	–	–	1	–	1
L4. R.T.	4·5	–	–	4	–	5	1	4	1	1	–	–	16
	16·2	–	–	–	4	–	–	1	–	–	–	–	5
	23·4	–	–	–	1	1	1	–	–	–	–	–	3
	29·8	–	–	–	–	3	1	2	1	–	–	–	7
	48·8	–	–	–	–	–	–	–	1	–	–	–	1

GOBIIDÆ.

Gobius sp.

In 1924 there were large numbers of post-larval Gobies (species unidentified) at almost all the stations. At all the stations of a depth of 50 metres or more these post-larvæ became suddenly very abundant just below the 10-metre level, between 10 metres and the surface they were either absent or present in comparatively very small numbers. As with other species they occurred in abundance close under the surface well inshore (Fig. 5).

In 1925 they were extremely rare: on the few occasions on which the largest numbers were taken they occurred mostly much deeper down than in 1924, below 25 metres.

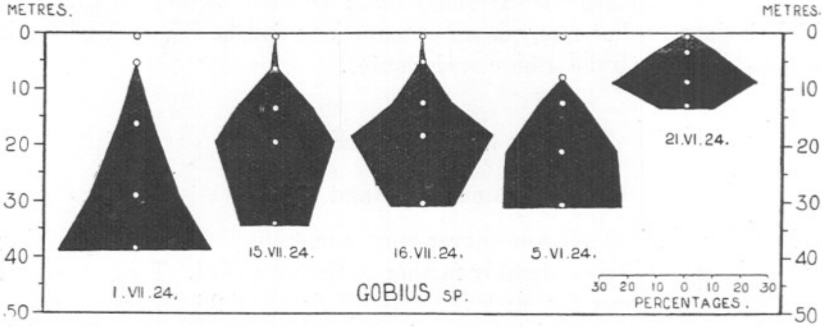

FIG. 5.—Shows the percentage vertical distribution of *Gobius* sp. at three offshore stations where the depth was 50 or more metres, and at two inshore stations in a depth of 35 and 27 metres respectively. The white spots and black circles indicate the "average depth" at which hauls were taken.

Lebetus scorpioides (Coll.)

Only thirty-one post-larvæ of this species occurred in the ring-trawl collections: none were taken from between 10 metres and the surface, 10 occurred between 10 and 20 metres, 7 between 20 and 30 metres, and 14 between 30 metres and the bottom.

BLENNIIDÆ.

Post-larvæ of three species occurred in the collections in the ring-trawl: *Blennius ocellaris* L., *B. pholis* L., and *B. gattorugine* L. Of these *B. gattorugine* was the most common: none of the three, however, were abundant in any haul, six being the highest catch recorded for a single species.

Blennius ocellaris (L.)

Nine specimens only occurred: of these 2 occurred between the surface and 10 metres, 2 between 10 and 20 metres, 4 between 20 and 25 metres, and 1 below 25 metres.

Blennius gattorugine (L.)

In all ninety-one individuals were captured in the ring-trawl in 1924 and 1925: of these 37 were taken between the surface and 10 metres, 27 between 10 and 20 metres, 12 between 20 and 25 metres, and 15 between 25 metres and the bottom.

Blennius pholis (L.)

Nineteen individuals were taken, of which 6 occurred between the surface and 10 metres, 5 between 10 and 20 metres, 1 between 20 and 25 metres, and 7 between 25 metres and the bottom.

From these figures it would appear that on the whole the majority of the post-larvæ of the above three species frequented the water layers above a depth of 25 metres right up to the surface itself.

TRIGLIDÆ.

Trigla sp.

These are probably mostly *Trigla gurnardus* L.

Post-larvæ of *Trigla* sp. occurred at five stations (twenty-four hauls) with the ring-trawl in sufficient numbers to give evidence on their vertical distribution. They hardly ever occurred above a depth of 10 metres, and generally began to become abundant at about 15 metres. Fig. 3 shows the percentage vertical distribution of this species at three stations in water of 50 metres depth, and at three stations taken close inshore with the metre-net. It will be seen that, as with many other species, they are abundant quite high up in the water close to the coast. I give below the sizes of the specimens taken from different depths at four offshore stations.

	Depth in metres.	Length in mm. 4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
17.vi.24	S	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
E1. R.T.	12·4	–	2	2	5	1	1	–	–	–	–	–	1	–	–	1
	25·2	1	16	15	11	5	2	3	–	–	–	–	–	–	–	–
	57·8	–	5	5	8	1	–	2	–	–	–	–	–	–	–	–
25.vi.24	S	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
L4. R.T.	13·6	–	–	–	–	2	4	4	3	1	–	–	–	–	–	–
	45·5	–	1	3	6	9	8	13	5	8	–	1	1	–	–	–
	52	–	2	3	3	4	6	1	1	1	–	–	–	–	–	–
19.v.25 (i)	S	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
A. R.T.	4·3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	9·9	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
	20·8	–	1	4	6	14	12	8	–	1	–	–	1	–	–	–
	32·6	–	1	9	7	4	1	–	–	–	–	–	–	–	–	–
19.v.25 (ii)	S	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
L4. R.T.	5·6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	12·9	–	3	1	–	2	–	–	–	–	–	–	–	–	–	–
	18·9	–	2	4	9	7	5	1	1	–	–	–	–	–	–	–
	23·7	–	–	5	11	9	2	1	–	–	–	–	–	–	–	–
	36·5	–	–	–	3	2	3	–	–	–	–	–	–	–	–	–

COTTIDÆ.

Cottus bubalis (Euphr.)

Only eight post-larvæ of this species occurred in the ring-trawl collections, of these seven were taken below a depth of 20 metres.

CYCLOPTERIDÆ.

Liparis montagui (Donov.)

Thirteen post-larvæ of this species were taken in the ring-trawl; of these twelve occurred below a depth of 30 metres. Three specimens only were caught in the metre-net. This points to *L. montagui* post-larvæ being very deep living forms.

GOBIESOCIDÆ.

Lepadogaster bimaculatus (Penn.)

In all fifty-nine individuals occurred in the collections in the ring-trawl; of these 8 were caught between a depth of 10 and 20 metres, 6 between 20 and 30 metres, and 45 between 30 metres and the bottom. This species is then most probably a deep living form in the daytime. Ehrenbaum (**8**, p. 120) says that larvæ 5 and 5·5 mm. long were taken in the deeper water layers.

Lepadogaster candolli (L.)

Only one specimen of this species was caught: this was taken from a depth of 33·6 metres in the ring-trawl on August 6th, 1925.

LOPHIIDÆ.

Lophius piscatorius (L.)

The post-larvæ of this species occurred in unusual abundance in 1924, when sixteen specimens, 5–8½ mm. in length, were taken; in 1925 none occurred in the collections. They were captured from depths between 12 and 25 metres in the deeper offshore water, and between depths of 4 and 15 metres at the stations close inshore with the metre-net.

The early pelagic stages of the Angler are not often taken in this region: Allen (**1**) records one of 6·2 mm. taken seven miles west of Rame Head on July 16th, 1914; my specimens in 1924 occurred from June 4th until July 16th; on June 18th a small portion of angler spawn was caught at L4 (Lebour, **16**).

THE VERTICAL DISTRIBUTION OF THE EGGS OF CERTAIN SPECIES.

In the spring of 1924 I attempted to obtain evidence on the vertical distribution of fish eggs, particularly that of the later developmental stages.

Much evidence is required on this problem, especially as the observations of previous workers appear somewhat conflicting.

Hensen and Apstein (**11**) state that the older stages are generally suspended at greater depths than the younger. Hjort and Dahl (**13**), however, found no evidence for this, working in Norwegian waters. Kramp (**15**), in 1913, could not confirm Apstein's statements. " On the contrary," he says, " in each species the percentage of eggs with pigmented embryo is larger in the upper water layers than in the bottom-surface hauls."

Bowman (**2**), however, states that " as the embryo advances in development the specific gravity of the egg increases, and it tends to sink to the lower water layers." And in a previous paper (**3**) he gives figures that substantiate this statement.

Jacobsen and Johansen (**14**) have shown that the egg is capable of altering its specific gravity after extrusion into the sea-water throughout its development, the changes depending " partly on the temperature and salinity of the water in which the eggs remain." Remotti (**18**) showed an increase in specific gravity for the eggs of many species with age, preceded in some cases by a slight decrease in specific gravity. He found that the eggs of deep water fish behaved very differently from those of shallower water forms, showing at first a decrease in specific gravity and then a great and sudden increase in weight during development.

My observations are somewhat meagre, but as they deal with fairly large numbers of eggs I think they are worthy of record.

The three stations made with the ring-trawl unfortunately occurred before the depth-recorder was in use. We have, therefore, no certain idea at what depths the samples were collected. It is probable from results shown by the recorder that they were not nearly as deep as the expressions " Midwater " and " Bottom " indicate : perhaps in the region of 15 and 25 metres respectively. However, it is fairly safe to conclude that " bottom " hauls were taken at deeper levels than " midwater," while the latter will most certainly have been deeper than the surface hauls.

Three other stations were taken with a closing metre-net towed horizontally, and here again no depth records are available. However, care was taken to keep the angle of the warp extremely steep, and furthermore a large weight suspended a fathom below the net was felt to touch bottom at the beginning of each bottom haul.

Practically all the material was examined alive, so that error due to identification is very small, in fact with the species I record here it is nil; eggs of *Clupea sprattus*, *Onos* sp., and *Clupea* (*Sardina*) *pilchardus* being at once separable from those of other species.

The eggs were laid on a slide with grooves made by cementing fine glass rods parallel with one another as designed by Todd and used by Wollaston (**25**).

I have divided the eggs into five or six stages of development, splitting Bowman's stages β and γ (**3**) each into two. The stages were, *0* equal to Bowman's α, i.e. the egg in its earliest period of development before there is any indication of form in the embryo; ¼ in which the formation of the embryo is appearing, but not completely visible towards the caudal region; ¼* in which the embryo is more advanced, but the tail does not go beyond half-way round the egg, and has not yet lifted from the yolk; ½, with the embryo over half-way round the yolk, but under three-quarters; ¾ the embryo three-quarters way round the yolk, but not completely; and 1 in which the embryo is completely coiled round the yolk equivalent to Bowman's δ-stage.

I am much indebted to my wife for the great assistance she rendered me in recording the results while I examined the eggs under the microscope.

The results for the eggs of *Clupea sprattus* were as follows :—

February 2nd, 1924. L4. R.T. Sea: moderate. 25 min. hauls.

	0	¼	½	¾	*1*
Surface	2826	640	186	38	3
Midwater	2910	411	469	159	2
Bottom	2353	182	104	60	6

March 3rd, 1924. L4. R.T. Sea: moderate, after two days' storm.

	0	¼	¼*	½	¾	*1*
Surface	1234	58	24	45	45	31
Midwater	1860	49	23	36	38	38
Bottom	1105	49	17	44	36	25

March 6th, 1924. L4. Closing net. Sea: calm. 15 min. oblique hauls.

	0	¼	¼*	½	¾	*1*
Surface (oblique haul from ca. 15 m. to surface)	189	88	11	54	67	13
Midwater (ditto from ca. 30 m. to 20 m.)	171	130	11	88	79	18
Bottom (ditto from ca. 50 m. to 40 m.)	50	32	5	13	27	6

March 6th, 1924. L4. Closing net. Sea : calm. 15 min. horizontal hauls.

	0	¼	¼*	½	¾	*1*
Surface	298	270	1	41	31	23
Midwater (ca. 26 m.)	414	128	33	40	41	21
Bottom (ca. 41 m.)	445	276	3	75	68	32

March 7th, 1924. L4. R.T. Sea : moderate.

	0	¼	¼*	½	¾	*1*
Surface	70	40	17	62	49	26
Midwater	82	38	11	29	25	30
Bottom	48	40	18	56	44	41

These results show little evidence of the accumulation of the more developed eggs in the deeper layers. If under calm conditions such sinking might occur it is probably counteracted by the effects of the boisterous weather prevalent at this time of the year which keeps all water layers tolerably well mixed.

Observations were made on eggs of *Onos* sp. at five different depths with the metre closing net.

March 12th, 1924. Bigbury Bay. Closing metre-net. Hauls, 10 min. horizontal.

	0	¼	¼*	½	¾	*1*
Surface	102	15	15	10	3	6
Upper Layers (ca. 7 m.) . . .	632	128	111	82	24	28
Midwater (ca. 13 m.)	516	91	93	46	29	10
Bottom Layers (ca. 19 m.) . .	379	44	15	18	5	9
Bottom (ca. 25 m.)	207	16	14	14	8	8

Eggs at all stages were present at all depths, but there was a tendency for the majority of all stages to lie a little below the surface. This may possibly be due to movements of the water, as young Sprat showed the same type of distribution (see p. 112). In addition to the above observations I obtained samples from four depths with the ring-trawl on July 9th, 1924, at the Hydrographical Station E2, half-way across the English Channel between Plymouth on the English coast and Ushant on the French coast. On this occasion the depth-recorder was used. The collections contained large numbers of eggs of the Pilchard, *Sardina pilchardus :* this is the first occasion on which Pilchard eggs have been taken in really large quantities in the Plymouth records.* The catches were additionally remarkable in that they were practically devoid of all the plankton organisms that are usually taken at this time

* Further large catches varying from one to three thousand were made on April 22nd, 1925, at E1.

of the year, they may be said to have consisted almost exclusively of pilchard eggs. One is tempted to wonder whether the water had been stripped of the larger plankton organisms by the large shoal of Pilchards that had evidently been spawning in that body of water. This scarcity of plankton is even more extraordinary seeing that the samples were taken at dusk, at a time at which on the following day and a fortnight later in localities nearer the coast (Longships Lighthouse and L4), the upper water layers were teeming with organisms that had migrated up from deeper levels.

The material was preserved in formalin: on examination I separated the eggs into two groups only. I picked out all those in which the embryo was fully formed and evidently very nearly ready to hatch out: these could be at once distinguished from all other stages, even with the naked eye, by the appearance of the small fish curled up in the large clear egg. All other stages I lumped together in a separate group. The following table gives the numbers of the two stages at the depths indicated by the depth-recorder. (The tracings obtained have been reproduced elsewhere (**21**).)

July 9th, 1924. E2. R.T. Sea: moderate. Dusk.

Depth.	1st stage.	2nd stage (embryo fully formed).
1·2 metres	2623	155
15 ,,	2209	1849
24·6 ,,	2633	1325
60 ,,	1453	691

Clearly here we have the earlier stages distributed at all depths with a falling off towards 60 metres. The latest stages of development, however, seem definitely to be massed about the 15–24 metre region: they are very few in number at the surface, but at what depth they began to become abundant we do not know.

That this sinking is a purely mechanical phenomenon accounted for by increase in specific gravity as development advances does not seem probable from the figures; if that were the case, one would expect the numbers from the surface to 60 metres to show a steady increase, the reverse is, however, the case, the increase in numbers taking place as we pass up from 60 metres to 15 metres. The possibility that these figures may be an expression of variations of the time of development for individual eggs combined with the time taken to sink should, however, not be lost sight of.

I am fortunate in having hydrographical observations taken at the same station just an hour before the ring-trawl was used. These figures have been published elsewhere (**7**), but I will repeat them here.

July 9th, 1924. E2.

Depth in metres.	Temperature °C.	Salinity ‰
0	15·7°	35·19
5	15·53°	35·18
15	14·43°	35·18
25	13·90°	35·18
35	11·99°	35·19
50	11·69°	35·17
70	11·69°	35·16
85	11·61°	35·17

The figures given show that as regards the salinity the water from top to bottom was homogeneous. There is, however, a definite temperature gradient, a warm layer of water being present above 25 metres: this will give rise to a considerable decrease in the viscosity of the water (**12**), and hence a sinking of those objects that maintain the same specific gravity. If, however, decrease in viscosity were the cause of the sinking of the most developed eggs we should expect to find also sinking of the early stages unless they alter their specific gravity to meet the circumstances.

In the warmer layers development will be accelerated and the majority of the later stages might have already hatched out; there is, though, no evidence of the presence of newly hatched larvæ in the collection; although very fragile, it is probable that if they had been present in large numbers in the water layers a few at any rate would have appeared in the catch; actually there was only one.

There is the further possibility that the well-advanced embryo is already susceptible to light of strong intensity, and may be able to alter its specific gravity, and so sink into the dimly lit layers, where it would once more resume its original weight. This should be possible to test experimentally.

We have further evidence of the sinking of later stages of the Pilchard egg from a previous station at which the ring-trawl was used, but the fishing depths unknown.

30.iv.24. R.T. L4. Sea: rough.

	0	$\frac{1}{4}$*	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1
Surface	407	176	9	24	11	9
Midwater	163	151	63	32	24	14
Bottom	353	224	118	74	50	27

In this case there are definitely less of the more advanced stages at the surface than in the deeper layers: whether there are necessarily more in the " bottom " than " midwater " hauls is rather open to question; it may be that where the " bottom " haul was taken all stages were more numerous in the water, i.e. floating in a denser mass, as the proportions of all stages in " midwater " and " bottom " hauls are very similar, the number of eggs in the " bottom " haul being just about twice as many as in the " midwater."

From the above evidence it would appear that while the eggs of *Clupea sprattus* were evenly distributed from surface to bottom at all stages, those of *Sardina pilchardus* differed in that the later stages were found deeper in the water. Far more evidence is, however, required before conclusions can be drawn, as the conditions are constantly changing. In these times, however, when the cry is for more and more observations, I am convinced that every observation, in which the conditions and definite numbers can be given, should be recorded to swell the evidence of past workers and assist future observers.

SUMMARY.

1. Horizontal hauls were made with a " stramin " ring-trawl and a silk net at different depths in 1924 and 1925 to determine the vertical distribution of the pelagic post-larval stages of Teleostean fish in daylight. The depths at which the nets fished on every occasion were obtained by means of a graphic depth-recorder.

2. It was indicated that there are specific differences in the behaviour of the post-larvæ of various fishes as to their vertical distribution in daylight, some preferring the surface layers, others apparently indifferently distributed from surface to bottom, and others preferring the deeper layers and avoiding the surface; of these last it was found that some species became abundant at deeper levels than others. A tentative list of distribution types is given on page 107.

3. Results emphasise the necessity when examining the horizontal distribution of young fish of sampling *all* layers: oblique hauls are to be desired fishing at as many levels as possible.

4. Mention is made of seasonal distribution: the year 1924 appeared to differ from 1925 in that certain post-larvæ which were prevalent in the plankton well into June or July in the former year were cut short a month earlier in 1925.

The post-larvæ of *Molva molva* and of *Lophius piscatorius* were unusually abundant in 1924; post-larval Gobies (*Gobiidæ*) and Wrasses (*Labridæ*) were extremely scarce in 1925 during the months April to beginning of August.

5. Certain observations on the vertical distribution of the floating eggs of *Clupea sprattus*, *Onos* sp., and *Sardina pilchardus* are

given. While all stages of development of the eggs of the Sprat were equally abundant at all depths, on the two occasions on which Pilchard eggs were taken in quantity the more advanced stages were more numerous a little way below the surface. The eggs of *Onos* sp. at all stages on this occasion were most numerous a few metres beneath the surface.

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APPENDIX.

The three positions at which stations were made, mentioned in these lists, are situated as follows :—

L4. Half-way between the coast and the Eddystone Lighthouse.

A. Two to three miles east of the Eddystone Lighthouse.

L6. Five miles beyond the Eddystone Lighthouse in a south-westerly direction.

E1. Ten miles beyond the Eddystone Lighthouse in a south-westerly direction.

Abbreviations :—

R.T. Ring-trawl (not closing). (Stramin).
M.N. Metre-net (not closing). (Silk).
C.M.N. Closing metre-net. (,,).

All depths and lengths of warp are given in metres.

All times are Greenwich mean.

An asterisk * denotes that the clockwork drum of the recorder was not rotating ; the depth given is therefore the maximum depth attained and not the average depth.

† Denotes on 2.iv.25 that the recorder was damaged, indications of depth were, however, shown, and the figures arrived at are guessed by comparison with other results : if anything they probably err in that they are not quite deep enough.

On 4.vi.25, Station 17, the clockwork drum was loose and the tracings badly confused, the figures are in consequence possibly not highly accurate.

List of Stations.

Station.	Date.	Position.	Depth.	Net.	Time.	Duration of Haul.	Length of Warp.	Fishing Depths Average.	Fishing Depths Limits.	Remarks.
1	29.v.24	L4	51	R.T.	10.58 a.m.	10	—	—	Surface	Sea : moderate.
					10.40 ,,	10	36	11.2	7–12	
					10.20 ,,	10	73	22.2	16–26	
2	5.vi.24	4°11′30″W. 50°17′20″N.	35	M.N.	1.10 p.m.	10	—	—	Surface	Weather : Dull and overcast. Sea : calm.
					12.53 ,,	10	13	8*	—	
					12.21 ,,	12	23	12·4	8–16·5	
					11.57 a.m.	11	38	21·2	15–22·5	
					11.35 ,,	10	53	31·4	25–35	
3	13.vi.24	4°10′W. 50°18′N.	25	M.N.	10.45 a.m.	10½	—	—	Surface	Weather : Bright intervals. Sea : calm.
					10.31 ,,	10	10	3·4	2–4	
					10.14 ,,	10	20	8·7	5–10	
					9.56 ,,	9	30	14·5	12–18	
4	17.vi.24	E1	72	R.T.	12.34 p.m.	10	—	—	Surface	Weather : dull. Fres heasterly wind. Sea : moderate.
					12.14 ,,	9	55	12·4	7·5–22	
					11.56 a.m.	9	101	25·2	20–31·5	
					11.30 ,,	8	184	57·8	53–70	
5	21.vi.24	4°10′W. 50°18′30″N.	27	M.N.	10.7 a.m.	10	—	—	Surface	Weather : bright intervals. Sea : calm.
					9.48 ,,	10	10	3·8	3·5–4	
					9.30 ,,	10	20	9*	—	
					9.1 ,,	10	35	13·3	11–16	

6	25.vi.24	L4	55	R.T.	9.10 a.m.	10	—	—	Surface	Weather: dull. Sea: very calm.
					9.26 ,,	10	36	13·6	8–20·5	
					9.44 ,,	10	75	45·5	34–50	
					10.5 ,,	10	110	52	48–54	
7	27.vi.24	4°11′W. 50°17′N.	45	C.M.N.	12.33 p.m.	9	—	—	Surface	Weather: sunny. Sea: calm.
					12.51 ,,	10	10	4·3	2–5	
					1.9 ,,	10	20	12·7	11–15	
					1.29 ,,	10	30	18·1	15–20	
					1.53 ,,	10	50	36·2	30–42	
8	1.vii.24	L4	51	R.T.	9.20 a.m.	10	—	—	Surface	Weather: cloudless, bright sunshine. Sea: very calm.
					9.47 ,,	10	18	5·4	2·5–7·5	
					10.3 ,,	11	36	16·4	14·5–17	
					10.20 ,,	10	55	29·25	22–35	
					10.40 ,,	9½	92	39·3	32–45·5	
9	15.vii.24	L4	51	R.T.	4.34 p.m.	10½	—	—	Surface	Weather: bright sunshine. Sea: calm.
					4.18 ,,	10	18	6·6	—	
					4.1 ,,	10	36	13·6	—	
					3.44 ,,	10	55	19·5	—	
					3.25 ,,	10	92	34·5	—	
10	16.vii.24	L4	51	R.T.	10.00 a.m.	11	—	—	Surface	Weather: sun shining. Sea: moderate.
					9.43 ,,	10	18	5·3	—	
					9.26 ,,	10	36	12·5	—	
					9.8 ,,	10	55	18·3	—	
					8.47 ,,	10	92	31·1	—	
11	2.iv.25	L4	51	R.T.	10.7 a.m.	10	—	—	Surface	Weather: very dull and overcast. Sea: calm. No wind.
					10.26 ,,	10	18	5†	—	
					10.45 ,,	10	36	12·5†	—	
					11.4 ,,	10	55	19†	—	
					11.24 ,,	10	73	27†	—	
					11.45 ,,	10	92	29†	—	

LIST OF STATIONS—*continued.*

Station.	Date.	Position.	Depth.	Net.	Time.	Duration of Haul.	Length of Warp.	Fishing Depths. Average.	Fishing Depths. Limits.	Remarks.
12	8.iv.25	L4	51	R.T.	10.33 a.m.	10	—	—	ca. 2 m.	Weather : bright sunshine. Sea : very calm.
					10.52 ,,	10	18	6·9	5–7·5	
					11.10 ,,	10	36	16·5	15–18·5	
					11.29 ,,	10	55	25·3	20–27·5	
					11.48 ,,	10	73	32·5	25–36	
					12.7 p.m.	10	92	37·8	35–40	
13	22.iv.25	E1	72	R.T.	12.30 p.m.	10	—	—	Surface	Weather : sunshine. Sea : moderate.
					12.48 ,,	10	18	4·6	3·5–6·5	
					1.9 ,,	10	46	15	12·5–18·5	
					1.30 ,,	10	73	22·1	20–24·5	
					1.54 ,,	10	110	51·4	47–58	
					2.17 ,,	10	146	61·2	52–63	
14	29.iv.25	L6	65	R.T.	1.2 p.m.	10	—	—	Surface	Weather : cloudless, bright sunshine. Sea : very calm.
					1.20 ,,	10	18	7·8	5–10	
					1.42 ,,	11	46	12·5	7–20	
					2.4 ,,	10	73	24·3	18·5–28	
					2.27 ,,	10½	110	41·1	30–47	
15	19.v.25 (i)	A	54	R.T.	12.10 p.m.	10	—	—	Surface	Weather : sunshine until 1.18 p.m. Sea : moderate.
					12.29 ,,	10	18	4·3	3–5	
					12.48 ,,	10	36	9·9	7·5–12	
					1.9 ,,	10	55	20·8	17·5–22·5	
					1.31 ,,	10	92	32·6	27·5–42	

16	19.v.25 (ii)	L4	51	R.T.	9.36 a.m.	10	—	—	Surface	Weather : dull and overcast. Sea : moderate.
					9.54 ,,	10	18	5·6	5–6	
					10.12 ,,	10	36	12·9	11–15	
					10.33 ,,	10	55	18·9	17–25	
					10.55 ,,	10	82	23·7	21·5–25	
					11.18 ,,	10	110	36·5	32·5–48	
17	4.vi.25 (i)	A	54	R.T.	10.14 a.m.	10	—	—	Surface	Weather : cloudless, bright sunshine. Sea : calm.
					10.32 ,,	10	18	8†	—	
					10.50 ,,	10	36	15†	—	
					11.10 ,,	10	55	20†	—	
					11.31 ,,	10	92	30†	—	
					11.55 ,,	11	128	38†	—	
18	4.vi.25 (ii)	L4	51	R.T.	12.50 p.m.	10	—	—	Surface	Weather : cloudless, bright sunshine. Sea : calm.
					1.9 ,,	10	18	4·6	2·5–5·5	
					1.48 ,,	10	36	13·6	10–15·5	
					1.29 ,,	10	55	23·4	15–27	
					2.8 ,,	11	82	31·8	25–40	
19	17.vi.25	L4	51	R.T.	4.19 p.m.	10	—	—	Surface	Weather : cloudless, brilliant sunshine. Sea : calm.
					4.00 ,,	10	18	4·5	4–5·5	
					3.40 ,,	10	36	16·2	15–17·5	
					3.21 ,,	10	64	23·4	18–27·5	
					2.58 ,,	10	82	29·8	26–33	
					2.35 ,,	11	110	48·8	37–52	
20	18.vi.25	L4	51	R.T.	9.3 a.m.	11½	—	—	Surface	Weather : sunshine. Sea : calm.
					8.45 ,,	10	18	3·2	2–5	
					8.27 ,,	10	36	7·5	6–9	
					8·6 ,,	10	64	9·9	7–13	
					7.46 ,,	10	82	20·8	17–25	
					7.25 ,,	9½	110	31·4	22·5–35	

List of Stations—*continued.*

Station.	Date.	Position.	Depth.	Net.	Time.	Duration of Haul.	Length of Warp.	Fishing Depths.		Remarks.
								Average.	Limits.	
21	19.vi.25	L4	51	R.T.	9.12 a.m.	10	—	—	Surface	Weather : cloudless,
					8.54 ,,	10	18	4	1·5–6	bright sunshine.
					8.35 ,,	10	36	11·1	5–13	Sea : calm.
					8.16 ,,	10	64	12·7	6·5–20	
					7.56 ,,	10	82	23·3	15·5–26	
					7.35 ,,	10	110	28·5	25·5–32	
22	1.vii.25 (i)	A	54	R.T.	9.51 a.m.	10	—	—	Surface	Weather : cloudless,
					10.12 ,,	10	18	2	exact	bright sunshine.
					10.31 ,,	10	36	11	exact	Sea : calm.
					10.50 ,,	10	64	19·8	18–21·5	
					11.14 ,,	10	82	23·1	20–26	
					11.35 ,,	10	110	30·2	26·5–32	
23	1.vii.25 (ii)	L4	51	R.T.	12.25 p.m.	10	—	—	Surface	Weather : cloudless,
					12.41 ,,	10	18	3·5	exact	bright sunshine.
					12.57 ,,	10	36	8·8	7–11	Sea : calm.
					1.15 ,,	10	64	21.3	16–25	
					1.33 ,,	10	82	27·1	21·5–29	
					1.53 ,,	10	110	36.7	31·5–40	
					9.40 a.m.	10	—	—	Surface	Weather : very dull
24	16.vii.25	A	54	R.T.	9.58 ,,	10	20	4	1–8	and foggy. Sea :
					10.16 ,,	10	40	16·5	14·5–20	very calm.
					10.36 ,,	10	60	22·2	17·5–25·5	
					11·00 ,,	10	80	32·3	30–36·5	
					11·24 ,,	10	110	38·8	35–41·5	

25	16.vii.25	A	54	C.M.N.	12.43 p.m.	10	—	—	Surface	Weather: very dull and foggy. Sea: very calm.
					12.58 ,,	10	10	2·7	1–5	
					1.13 ,,	10	20	6·5	5–8·5	
					1.30 ,,	10	40	25·8	17–35	
					1.47 ,,	10	60	26·8	23·5–32·5	
					2.5 ,,	10	80	41·8	32–51	
26	29.vii.25	A	54	R.T.	10.4 a.m.	10	—	—	Surface	Weather: mist and rain, very thick, dull. Sea: moderate.
					10.24 ,,	10	18	4·8	2–6	
					10.43 ,,	10	36	9·1	7·5–14	
					11.3 ,,	10	64	20·6	18–24	
					11.21 ,,	10	82	25·8	22·5–30	
					11.45 ,,	10	110	maximum	only 31*	
27	6.viii.25	A	54	R.T.	9.52 a.m.	10	—	—	Surface	Weather: raining, very dull. Sea: moderate.
					10.12 ,,	10	18	5	exact	
					10.32 ,,	10	36	11·1	10–14	
					10.52 ,,	10	64	19·2	17–24	
					11·4 ,,	10	82	23·1	21–25	
					11.26 ,,	10	115	33·6	30–37	

Table 3.

	Depth in metres.	Clupea sp.	Gadus merlangus.	G. minutus.	G. pollachius.	G. luscus.	Molva molva.	Onos sp.	Arnoglossus sp.	Scophthalmus norvegicus.	S. unimaculatus.	Zeugopterus punctatus.	Pleuronectes limanda.	P. microcephalus.	Solea variegata.	Ammodytes lanceolatus.	Callionymus sp.	Labrus bergylta.	L. mixtus.	Ctenolabrus rupestris.	Crenilabrus melops.	Centrolabrus exoletus.	Scomber scomber.	Gobius sp.	Lebetus scorpioides.	Blennius ocellaris.	B. gattorugine.	Trigla sp.	Lepadogaster bimaculatus.	Cottus bubalis	Lophius piscatorius.	Liparis montagui.	*Total Young Fish.*
May 29th, 1924.	*S*	7	–	–	–	–	–	11	–	2	–	–	–	1	–	3	6	1	–	–	–	–	–	–	–	–	–	2	–	–	–	–	**33**
L4. R.T.	*11·2*	20	5	2	–	1	1	1	–	–	–	2	4	–	2	4	21	–	–	–	–	–	–	1	–	–	–	0	–	–	–	–	**64**
	22·2	45	37	32	–	2	9	3	–	30	–	9	20	21	18	5	320	–	–	–	–	–	–	6	–	–	–	8	–	1	–	–	**566**
June 5th, 1924.	*S*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
4° 11′ 30″ M.N.	*8*	4	1	–	–	–	–	11	–	–	–	–	–	–	1	–	2	–	–	–	2	–	1	–	–	–	–	–	–	–	–	–	**22**
50° 17′ 20″	*12·4*	20	23	–	–	–	1	–	–	4	–	–	–	6	15	–	25	2	–	–	3	1	9	25	–	–	–	4	–	–	1	–	**139**
	21·2	10	16	–	–	–	–	6	–	–	–	–	–	1	5	–	70	–	–	1	4	–	–	62	–	1	–	12	–	–	–	–	**188**
	31·4	5	8	–	–	2	1	–	–	4	–	–	–	2	2	–	52	–	–	2	4	–	–	67	–	–	–	5	–	1	–	–	**155**
June 13th, 1924.	*S*	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	11	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	**15**
4° 10′ M.N.	*3·4*	1	3	–	–	1	–	–	–	5	–	–	–	4	23	1	433	4	1	–	37	1	–	217	–	–	1	6	1	–	–	–	**739**
50° 18′	*8·7*	1	6	1	1	1	–	–	–	7	–	–	–	–	14	1	256	–	–	–	4	–	1	70	–	–	–	16	–	–	–	1	**380**
	14·5	1	4	1	–	–	2	–	–	3	–	–	–	–	8	–	178	–	–	–	5	–	–	73	1	–	–	6	1	1	–	–	**284**
June 17th, 1924.	*S*	11	–	–	–	–	–	14	–	–	–	–	–	3	2	4	–	–	–	–	–	–	1	7	–	–	–	–	–	–	–	–	**42**
E1. R.T.	*12·4*	184	–	–	–	–	1	7	3	20	1	–	1	19	8	11	12	–	1	1	1	2	19	114	1	–	–	13	–	–	–	–	**419**
	25·2	107	8	7	–	1	13	25	1	143	1	1	5	116	59	14	121	1	–	–	–	1	16	262	3	–	–	53	1	–	2	–	**961**
	57·8	35	4	23	–	1	12	12	–	34	–	–	–	10	32	8	311	–	1	–	1	–	6	95	4	–	–	21	8	–	–	–	**618**
June 21st, 1924.	*S*	–	–	–	–	–	–	3	–	1	–	–	–	–	5	–	5	–	–	–	2	–	–	7	–	–	–	–	–	–	–	–	**23**
4° 10′ M.N.	*3·8*	1	1	–	–	–	–	–	–	2	–	–	–	1	17	3	144	1	1	–	25	4	1	107	1	–	–	9	–	–	1	–	**319**
50° 18′ 30″	*9*	–	10	–	–	–	–	–	–	2	–	–	–	–	9	5	149	–	3	1	9	–	1	229	–	–	1	12	1	–	–	–	**432**
	13·3	4	8	–	–	–	–	–	–	5	–	–	–	5	9	3	166	–	2	–	2	–	–	83	–	–	–	8	–	–	1	1	**297**

TABLE 4.

	Depth in metres.	Clupea sp.	Gadus merlangus.	G. minutus.	G. luscus.	Molva molva.	Merluccius merluccius.	Onos sp.	Arnoglossus sp.	Scophthalmus norvegicus.	Pleuronectes limanda.	P. microcephalus	Solea variegata.	Ammodytes lanceolatus.	Callionymus sp.	Labrus bergylta.	L. mixtus.	Ctenolabrus rupestris.	Crenilabrus melops.	Centrolabrus exoletus.	Scomber scomber.	Gobius sp.	Lebetus scorpioides.	Blennius ocellaris.	B. pholis.	B. gattorugine.	Trigla sp.	Cottus bubalis.	Lepadogaster bimaculatus	Lophius piscatorius.	Caranx trachurus.	Liparis montagui.	Trachinus vipera.	*Total Young Fish.*
June 25th, 1924.	*S.*	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	2	–	1	–	–	1	–	4	–	–	–	–	–	–	–	**10**
L4. R.T.	*13·6*	3	3	1	–	–	–	1	–	2	–	1	7	9	52	12	–	–	1	–	8	78	–	–	–	–	14	–	–	–	–	–	–	**192**
	45·5	22	69	16	1	6	1	1	1	12	16	16	59	8	884	12	2	1	6	1	7	165	–	–	–	1	55	2	7	–	–	2	–	**1373**
	52	13	35	16	1	4	1	2	–	13	5	12	82	3	534	8	1	1	–	–	4	128	1	–	1	–	21	–	8	–	–	3	–	**897**
June 27th, 1924.	*S.*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
4° 11′ C.M.N.	*4·3*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
50° 17′	*12·7*	1	–	–	–	–	–	–	–	–	1	–	–	1	30	–	–	–	2	–	–	9	–	–	–	2	3	–	–	–	–	–	–	**49**
	18·1	1	1	–	–	1	–	–	–	1	–	1	3	8	172	2	–	–	–	–	1	474	1	–	–	–	4	–	–	–	–	–	–	**670**
	36·2	–	1	–	–	–	–	–	–	1	–	1	3	1	166	–	1	–	3	–	–	101	–	–	–	–	1	–	1	–	–	1	–	**281**
July 1st, 1924.	*S.*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**3**
L4. R.T.	*5·4*	4	–	–	–	–	–	1	2	–	–	–	1	1	1	7	4	–	16	3	1	–	–	–	1	–	–	–	–	–	–	–	–	**42**
	16·4	13	6	–	–	–	–	1	5	2	1	–	2	11	64	7	8	2	7	4	3	20	–	–	1	1	17	–	–	4	–	–	–	**179**
	29·2	4	5	2	–	–	–	–	–	7	2	5	1	2	50	5	3	–	1	–	–	47	–	–	–	–	9	–	1	–	–	–	–	**144**
	39·3	5	–	5	–	–	–	–	2	5	1	4	2	3	107	2	1	1	1	1	–	83	–	–	2	–	7	–	4	–	–	–	–	**236**
July 15th, 1924.	*S.*	11	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	1	–	–	3	1	–	–	–	–	–	–	–	–	2	–	–	**20**
L4. R.T.	*6·6*	33	–	–	–	–	–	1	–	1	–	–	–	3	3	–	1	7	1	–	16	9	–	1	–	3	–	–	–	–	5	–	–	**84**
	13·6	70	–	–	–	–	–	–	2	10	–	–	2	22	14	–	2	3	–	10	2	68	–	1	–	4	2	–	1	–	12	–	–	**225**
	19·5	70	–	–	–	–	–	1	1	37	–	7	4	36	62	–	4	2	1	1	3	106	1	–	1	5	6	–	4	1	8	–	–	**361**
	34·5	8	–	–	–	–	–	–	–	1	–	1	3	4	42	–	–	–	1	–	–	62	1	–	–	1	–	–	2	–	–	–	–	**126**
July 16th, 1924.	*S.*	4	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	1	1	–	1	2	–	–	–	6	–	–	–	–	–	–	–	**18**
L4. R.T.	*5·3*	20	–	–	–	–	–	–	–	–	–	–	–	5	2	–	–	2	7	1	9	10	–	–	–	4	–	–	–	–	–	–	–	**60**
	12·5	45	–	–	–	–	–	–	5	2	–	–	3	15	19	–	4	2	10	5	2	103	–	1	1	–	2	–	–	2	5	–	3	**229**
	18·3	41	–	–	–	–	–	1	3	14	–	3	12	47	59	–	–	3	10	5	3	236	2	–	–	4	4	–	1	1	–	–	–	**449**
	31·1	8	–	–	–	–	–	–	1	8	–	3	2	24	50	–	–	3	2	4	–	105	–	–	–	2	2	–	5	–	–	–	–	**219**

TABLE 5.

	Depth in metres.	Clupea sp.	Gadus merlangus.	G. minutus.	G. pollachius.	G. luscus.	Onos sp.	Scophthalmus norvegicus.	Zeugopterus punctatus.	Pleuronectes limanda.	P. flesus.	P. microcephalus.	Solea vulgaris	S. variegata.	Ammodytes tobianus.	A. lanceolatus.	Callionymus sp.	Labrus bergylta.	Chirolophis sp.	Trigla sp.	Cottus bubalis.	Liparis montagui.	*Total Young Fish.*
April 2nd, 1925.	*S.*	30	13	–	7	–	11	–	–	1	–	–	–	–	–	–	–	–	–	–	1	–	**63**
L4. R.T.	*5*	18	8	–	4	–	4	–	–	–	–	–	–	–	–	4	–	–	1	–	–	–	**39**
	12·5	12	2	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	2	–	–	–	**18**
	19	21	3	–	–	–	1	–	1	5	–	–	–	–	–	4	1	–	–	–	–	–	**36**
	27	49	8	4	1	–	1	–	–	4	–	1	3	–	–	5	3	–	–	–	–	–	**79**
	29	75	15	19	–	–	4	–	–	4	–	–	2	–	–	6	7	–	–	–	–	–	**132**
April 8th, 1925.	*S.*	–	4	–	–	–	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**9**
L4. R.T.	*6·9*	1	10	–	10	–	11	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	**34**
	16·5	19	3	1	4	–	8	–	–	8	–	–	–	–	–	2	1	–	–	–	–	–	**46**
	25·3	33	8	3	–	–	6	–	–	6	1	–	–	–	–	–	3	–	–	–	–	–	**60**
	32·5	32	2	13	–	–	2	–	–	6	3	1	3	–	–	6	7	–	1	–	–	–	**76**
	37·8	20	5	15	–	1	5	–	–	5	1	–	2	–	–	1	8	–	–	–	–	–	**63**
April 22nd, 1925.	*S.*	–	–	–	–	–	14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**14**
E1. R.T.	*4·6*	–	–	–	–	–	8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**8**
	15	3	1	–	–	–	2	–	–	1	1	–	–	–	–	–	1	–	–	–	–	–	**9**
	22·1	1	2	–	–	–	7	–	–	4	–	–	3	–	–	–	1	–	–	2	–	–	**20**
	51·4	1	3	36	1	–	–	1	–	3	–	2	4	–	–	–	24	–	–	–	–	–	**75**
	61·2	3	3	33	–	–	2	–	–	5	–	–	5	–	–	–	13	–	–	–	–	–	**64**
April 29th, 1925.	*S.*	–	–	–	8	–	22	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	**31**
L6. R.T.	*7·8*	1	2	1	13	–	11	19	–	2	1	6	–	–	–	4	4	–	–	–	–	–	**64**
	12·5	9	15	–	5	1	18	55	3	10	1	16	1	–	–	7	7	–	–	3	–	–	**151**
	24·3	17	40	81	5	4	17	28	4	56	–	16	2	37	–	11	117	–	–	3	–	–	**438**
	41·1	11	32	87	–	4	4	11	1	30	–	4	1	12	1	5	125	1	–	1	1	1	**332**

TABLE 6.

	Depth in metres	Clupea sp.	Gadus merlangus.	G. minutus.	G. pollachius.	Molva molva.	Onos sp.	Scophthalmus norvegicus.	Zeugopterus punctatus.	Pleuronectes limanda.	P. flesus.	P. microcephalus.	Solea vulgaris.	S. variegata.	Ammodytes lanceolatus.	Callionymus sp.	Labrus bergylta.	L. mixtus.	Scomber scomber.	Gobius sp.	Lebetus scorpioides.	Blennius pholis.	Trigla sp.	Lepadogaster bimaculatus.	Cottus bubalis.	Liparis montagui.	*Total Young Fish.*
May 19th, 1925 (i)	*S.*	–	3	–	–	–	12	5	–	–	–	–	–	10	–	15	–	–	–	–	–	–	–	–	–	–	**45**
A. R.T.	*4·3*	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	**2**
	9·9	1	4	–	–	–	–	–	–	1	–	1	–	–	4	7	–	–	–	–	–	–	–	–	–	–	**18**
	20·8	1	17	4	–	–	1	74	1	14	–	15	–	31	17	109	–	1	–	–	–	–	47	–	–	–	**332**
	32·6	3	26	66	–	3	2	94	4	59	–	19	–	180	9	508	1	–	–	–	–	–	22	–	–	–	**996**
May 19th, 1925 (ii)	*S.*	–	–	–	–	–	5	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	**7**
L4. R.T.	*5·6*	1	–	–	–	–	–	–	–	–	–	–	–	–	4	11	–	–	–	–	–	1	–	–	–	–	**17**
	12·9	16	47	2	–	–	–	23	2	2	–	7	–	1	13	130	3	–	–	1	–	–	6	–	–	–	**253**
	18·9	4	124	12	–	–	5	63	10	34	1	6	–	17	32	292	–	–	–	–	–	–	29	–	–	–	**629**
	23·7	8	85	43	–	–	2	51	16	107	3	33	1	55	50	249	1	–	–	–	–	–	28	–	2	1	**735**
	36·5	8	15	58	1	–	3	23	16	46	1	10	3	67	12	322	1	–	–	–	–	–	8	1	–	4	**599**
June 4th, 1925 (i)	*S.*	–	–	–	–	–	2	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	**4**
A. R.T.	*8*	2	–	–	–	–	–	–	–	–	–	–	–	–	12	–	3	–	–	–	–	–	–	–	–	–	**17**
	15	3	1	–	–	–	–	–	–	–	–	–	–	–	5	8	1	–	–	1	–	–	1	–	–	–	**20**
	20	6	9	–	–	–	3	2	–	2	–	2	–	2	3	187	–	–	–	–	–	–	1	–	–	–	**217**
	30	6	21	7	–	–	2	6	1	9	–	7	–	3	4	173	1	–	–	12	–	–	5	–	–	–	**257**
	38	12	21	29	–	1	–	15	1	8	–	3	–	6	7	270	–	2	–	23	–	1	3	–	–	–	**402**
June 4th, 1925 (ii)	*S.**	(*4*)	(*6*)	(*4*)	–	–	–	(*7*)	–	(*2*)	–	–	–	(*4*)	(*2*)	(*161*)	–	–	–	(*6*)	–	–	(*1*)	–	–	–	(*197*)
L4. R.T.	*4·6*	1	1	–	–	–	–	–	–	–	–	1	–	–	12	23	1	–	–	–	–	–	–	–	–	–	**39**
	13·6	–	4	–	1	–	–	6	–	1	–	–	–	8	4	54	–	–	–	1	–	–	1	–	–	–	**80**
	23·4	1	25	–	–	–	–	45	–	6	–	12	–	8	5	164	2	–	–	2	–	–	6	–	–	–	**276**
	31·8	8	14	8	–	–	1	8	–	2	–	4	–	7	3	158	1	–	–	5	1	–	2	–	1	–	**223**

* This catch contained a certain amount of obvious deep-living forms both of plankton organisms and postlarval fish. I think there can be no doubt that a small portion of the previous deep-haul collection must have been overlooked either in a fold of the net or bottom of the bucket. This haul has accordingly been discounted.

TABLE 7.

	Depth in metres.	Clupea sp.	Gadus merlangus.	G. luscus.	Onos sp.	Arnoglossus sp.	Scophthalmus norvegicus.	Zeugopterus unimaculatus.	Pleuronectes limanda.	P. microcephalus.	Solea variegata.	Solea lutea.	Ammodytes tobianus.	A. lanceolatus.	Callionymus sp.	Labrus bergylta.	Ctenolabrus rupestris.	Crenilabrus melops.	Centrolabrus exoletus	Scomber scomber.	Gobius sp.	Lebetus scorpioides.	Blennius pholis.	B. gattorugine.	Trigla sp.	Lepadogaster bimaculatus	Trachinus vipera.	*Total Young Fish.*
June 17th, 1925	*S.*	1	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	–	–	–	–	–	–	–	**3**
L4. R.T.	*4·5*	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	16	–	–	1	–	–	–	–	**18**
	16·2	4	3	–	–	–	–	–	–	–	–	–	1	–	6	–	–	–	1	5	1	–	–	–	–	–	–	**21**
	23·4	4	7	–	–	–	4	–	–	–	7	–	–	1	40	–	–	–	–	3	–	–	–	–	–	–	–	**66**
	29·8	10	44	–	–	–	3	–	–	2	5	–	–	5	45	–	1	–	–	7	–	–	–	–	3	–	–	**125**
	48·8	3	33	1	–	–	1	–	1	–	1	–	–	1	30	1	–	–	–	1	–	–	–	–	–	2	–	**75**
June 18th, 1925	*S.*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
L4. R.T.	*3·2*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	2	–	–	–	–	–	–	–	**3**
	7·5	4	1	–	–	–	–	–	–	–	1	–	–	–	2	–	1	–	–	4	–	–	–	–	–	–	–	**13**
	9·9	1	–	–	–	–	–	–	–	–	–	–	–	–	2	–	1	–	–	4	1	–	–	–	–	–	–	**9**
	20·8	2	–	–	–	–	–	–	–	–	–	–	–	–	26	–	–	–	–	1	1	–	–	3	1	–	–	**34**
	31·4	8	–	–	–	–	2	–	2	–	2	–	–	–	18	–	–	–	–	–	–	–	–	–	–	–	–	**32**
June 19th, 1925	*S.*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	**2**
L4. R.T.	*4*	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	**3**
	11·1	5	3	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	**12**
	12·7	4	10	–	–	–	–	–	–	–	–	–	–	–	11	–	–	–	–	3	1	–	–	–	–	–	–	**29**
	23·3	1	2	–	–	–	8	–	2	2	5	–	–	1	21	–	–	–	–	2	3	–	–	2	2	–	–	**51**
	28·5	4	13	–	1	–	7	–	1	3	1	–	–	–	9	–	–	–	–	10	2	–	–	–	2	–	–	**53**
July 1st, 1925 (i)	*S.*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	**1**
A. R.T.	*2*	4	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	4	–	–	–	1	1	–	–	**12**
	11	5	2	–	–	2	–	–	–	–	–	–	–	1	13	–	2	1	–	1	–	–	1	5	–	–	1	**34**
	19·8	2	1	–	–	–	–	–	1	–	–	–	–	4	31	–	2	–	–	1	–	–	1	4	1	–	1	**49**
	23·1	5	10	–	–	–	1	1	–	–	1	1	–	5	56	1	–	–	–	1	1	1	1	4	11	–	1	**101**
	30·2	12	2	1	–	–	2	–	–	–	2	–	–	7	129	1	–	–	–	–	2	1	–	2	7	–	3	**171**

TABLE 8.

	Depth in metres.	Clupea sp.	Gadus merlangus.	Molva molva.	Arnoglossus sp.	Scophthalmus norvegicus.	Pleuronectes limanda.	P. microcephalus.	Solea variegata.	Ammodytes lanceolatus.	Callionymus sp.	Labrus bergylta.	Ctenolabrus rupestris.	Crenilabrus melops.	Centrolabrus exoletus.	Scomber scomber.	Gobius sp.	Lebetus scorpioides.	Blennius pholis.	B. ocellaris.	B. gattorugine.	Trigla sp.	Lepadogaster bimaculatus.	Trachinus vipera.	Raniceps raninus.	*Total Young Fish.*
July 1st, 1925 (ii)	*S.*	–	–	–	–	–	–	–	–	–	9	–	–	–	–	1	–	–	1	–	2	–	–	–	–	**13**
L4. R.T.	*3·5*	4	–	–	–	–	–	–	–	5	4	–	–	–	–	2	–	–	1	–	3	–	–	–	–	**19**
	8·8	5	–	–	4	–	–	–	–	1	10	–	–	–	–	4	–	–	–	–	3	1	–	3	–	**31**
	21·3	1	12	–	1	–	–	–	–	4	23	–	2	–	–	–	1	–	–	–	2	4	–	3	–	**53**
	27·1	2	2	–	3	1	–	–	–	5	21	–	–	2	–	–	–	–	–	–	4	2	–	3	–	**45**
	36·7	10	1	–	2	11	2	3	2	20	143	–	–	–	–	–	56	–	2	–	1	11	1	1	1	**267**
July 16th, 1925.	*S.*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	**1**
A. R.T.	*4*	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	3	–	–	1	–	**5**
	16·5	–	3	–	–	–	–	–	–	7	34	1	1	–	–	–	11	1	–	–	2	–	2	4	–	**66**
	22·2	1	–	–	5	1	–	–	–	11	59	–	–	–	–	3	8	–	–	–	–	1	3	3	–	**94**
	32·3	–	–	–	3	1	–	2	1	8	43	–	–	–	–	–	9	1	–	–	–	–	2	–	–	**70**
	38·8	–	–	1	–	1	–	1	–	6	35	–	–	–	–	2	8	–	1	–	–	3	2	1	–	**62**
July 16th, 1925.	*S.*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	**1**
A. C.M.N.	*2·7*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	**2**
	6·5	3	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	1	–	–	9	–	**15**
	25·8	14	–	–	2	–	–	–	–	24	43	–	–	–	–	–	9	–	–	–	–	1	–	2	–	**95**
	26·8	5	–	–	1	1	–	–	–	13	88	–	–	–	–	–	25	–	–	1	–	1	–	–	1	**136**
	41·8	9	1	–	–	2	–	2	–	10	149	–	–	–	–	–	116	–	–	–	–	2	1	–	–	**292**
July 29th, 1925.	*S.*	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	2	–	–	–	–	**4**
A. R.T.	*4·8*	–	–	–	2	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	–	–	–	**4**
	9·1	–	–	–	2	–	–	–	–	3	9	–	–	–	1	–	–	–	–	–	–	–	–	1	–	**16**
	20·6	1	–	–	1	–	–	–	–	11	5	–	–	–	–	–	1	–	–	1	–	–	1	–	–	**21**
	25·8	–	1	–	44	–	–	1	–	21	5	–	–	–	1	–	–	–	–	–	–	–	–	1	–	**74**
	29	1	1	–	18	–	–	–	–	30	14	–	1	–	3	–	5	3	–	–	3	–	–	–	–	**79**

TABLE 9.

	Depth in metres.	Clupea sp.	Arnoglossus sp.	Ammodytes lanceolatus.	Callionymus sp.	Ctenolabrus rupestris.	Crenilabrus melops.	Centrolabrus exoletus.	Gobius sp.	Lebetus scorpioides.	Blennius pholis.	B. ocellaris.	B. gattorugine.	Trigla sp.	Lepadogaster candolli.	L. bimaculatus.	Liparis montagui.	Trachinus vipera.	Raniceps raninus.	*Total Young Fish.*
August 6th, 1925.	*S.*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**0**
A. R.T.	*5*	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	2	–	**3**
	11·1	–	–	1	–	–	–	–	2	2	–	–	–	–	–	–	–	3	–	**8**
	19·2	1	1	1	4	–	3	3	1	3	–	–	1	–	–	–	–	–	1	**19**
	23·1	1	6	8	–	–	2	1	11	–	–	3	1	1	–	–	–	2	–	**36**
	33·6	–	2	–	3	1	–	1	9	5	–	–	2	–	1	2	2	–	–	**28**

TABLE 10.

	Depth in metres.	Clupea sp.	Clupea sprattus.	Gadus merlangus.	G. minutus.	G. pollachius.	G. luscus.	Molva molva.	Onos sp.	Scophthalmus norvegicus.	Zeugopterus punctatus.	Z. unimaculatus.	Pleuronectes flesus.	P. limanda.	P. microcephalus.	Solea vulgaris.	S. variegata.	Ammodytes tobianus.	A. lanceolatus.	Ammodytes sp.?	Callionymus sp.	Chirolophis sp.	Trigla sp.	Lepadogaster bimaculatus	Cottus bubalis.
March 3rd, 1924.	*S.*	3	38	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	2	–	–	–
L4. R.T.	*M.*	8	86	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	B.	17	77	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
April 25th, 1924.	*S.*	3	–	7	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	2	–	–	–	–
L4. R.T.	*M.*	4	–	20	1	–	–	–	1	–	–	–	–	14	1	13	–	2	–	–	21	–	3	–	–
	B.	11	–	7	7	–	1	–	1	–	–	–	–	14	–	5	–	1	–	–	18	–	2	–	–
April 30th, 1924.	*S.*	40	–	9	–	14	–	–	–	–	1	–	1	–	–	–	–	3	1	–	3	–	–	–	2
L4. R.T.	*M.*	5	–	4	–	1	–	–	1	–	–	–	–	14	–	2	–	–	–	6	2	–	1	–	–
	B.	13	–	5	3	1	–	–	1	1	–	–	–	13	–	3	–	1	–	4	3	–	–	–	–
May 7th, 1924.	*S.*	1	–	14	–	6	–	–	1	–	–	–	–	3	–	–	–	–	–	–	8	–	1	–	2
L4. R.T.	*M.*	8	–	17	2	–	–	–	–	–	1	–	–	11	–	1	4	–	14	–	46	–	3	1	–
	B.	1	–	35	13	–	2	–	–	6	2	1	–	42	1	12	1	–	–	13	83	–	8	–	–
May 12th, 1924.*	*S.*	3	–	–	–	–	–	–	7	3	–	–	–	–	2	2	–	–	–	–	4	–	–	–	–
L4. R.T.	*M.*	1	–	11	5	–	–	–	2	19	–	–	–	54	1	4	–	–	14	–	67	–	6	–	–
	B.	3	–	24	165	–	1	3	–	41	–	–	–	80	3	6	26	–	66	–	195	–	10	–	2
May 19th, 1924.	*S.*	–	–	1	–	–	–	–	2	1	–	–	–	–	–	–	2	–	–	–	4	–	–	–	–
L4. R.T.	*M.*	1	–	23	3	–	–	–	–	2	1	–	–	21	–	–	1	–	–	1	17	–	5	–	–
	B.	–	–	7	4	–	–	–	–	2	1	–	–	12	1	–	1	–	–	1	34	–	3	–	–

* 20 min. hauls.

S.=Surface. *M.*=Midwater. *B.*=Bottom.