ON THE SEASONAL ABUNDANCE OF YOUNG FISH. VII. THE YEAR 1939, JANUARY TO AUGUST

By F. S. Russell, F.R.S.

Naturalist at the Plymouth Laboratory

(Text-figs. 1–4)

In a number of previous reports observations on the seasonal abundance of the pelagic young of teleostean fish in the plankton off Plymouth have been recorded for the years 1924 to 1938 inclusive. Owing to the outbreak of war the series for the year 1939 is unfortunately not complete. Collections were, however, made until the last week in August. Previous records have always shown that the numbers of young fish caught in the last four months of the year, September to December, are insignificant and in consequence it is

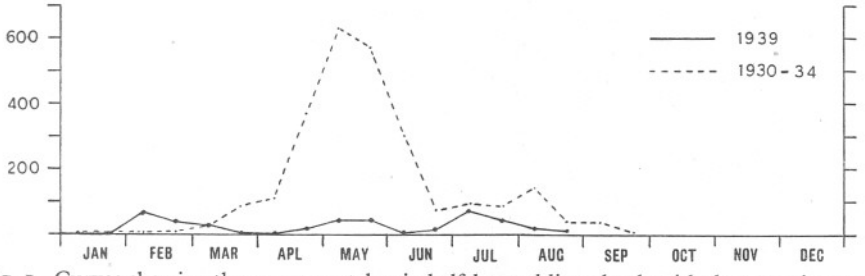

Fig. 1. Curves showing the average catches in half-hour oblique hauls with the 2 m. ringtrawl for each fortnight for all young fish, excluding clupeids, in 1939 (——) and the same averaged over the period 1930–4 inclusive (-----).

desirable that the results for 1939 should be published since they cover fully the period of production of almost all species of fish. It is, also, essential that these records should not be lost as the year 1939 has been the worst yet recorded and sets a new low limit to the production of fish. It is much to be deplored that the sequence of observations may be broken, so that we may never know what point the trough of the decline may reach.

The results are published in the same form as in previous reports. The dates on which collections were made with the 2 m. stramin ringtrawl are given in Table I, and the monthly average catches of the young fish per half-hour oblique haul in Table II. In Fig. 1* is given the curve for the average catches for each fortnight of all young fish, excluding clupeids, and

* In the corresponding Fig. 1 for 1938 in Russell, 1939, p. 381, the point for the second fortnight in June was omitted from the curve for 1930–4 in error.

superimposed upon this the corresponding curve for the average catches over the period 1930–4 inclusive.

The results show a complete absence of the peak for the young of spring spawners and a disastrous state of affairs in general. The sum of the monthly average catches of those post-larvae which show maximal abundance in the months June to October inclusive, excluding clupeids, was 57 in 1939, as against 135, 174 and 114 in 1938, 1937 and 1936 respectively. If records had continued to the end of the year this figure might have been slightly higher, but in the light of the results for previous years it is doubtful whether it would have exceeded 70, unless some unusual change took place.

The sums of the average monthly catches of the more important species for the year 1939 divided by the corresponding average sums for the period 1930–4 inclusive are given below. In the second column are the figures for the best year divided by the worst year from 1930 to 1939 inclusive.

	$\frac{1939}{\text{Av. 1930–4}}$	$\frac{\text{Best}}{\text{Worst}}$
G. merlangus	0·08	23·6 ('32/'39)
G. minutus	< 0·13	> 40·3 ('32/'39)
Onos spp.	0·08	29·3 ('30/'39)
Arnoglossus sp.	0·30	11·5 ('31/'34)
S. norvegicus	0·04	43·0 ('32/'39)
P. limanda	0·06	28·0 ('31/'39)
P. microcephalus	< 0·04	> 41·0 ('32/'39)
S. variegata	0·05	32·5 ('32/'39)
Callionymus sp.	0·07	15·7 ('30/'39)
S. scombrus	0·23	11·2 ('30/'35)
Gobiid sp.	0·05	119·0 ('30/'37)

Of the species shown above all except *Arnoglossus* are normally practically absent by September, and it can be seen that the year 1939 has been the worst for all except three species during the period 1930–9.

All species except *Arnoglossus* and *Scomber* were less than one-tenth of their average for the period 1930–4.

If the number of young of summer spawners (57) be subtracted from the total young fish excluding clupeids (215), we are left with 158 for the remaining young fish most of which are the young of spring spawners. This is far and away the lowest number yet recorded and is nearly one-ninth of the 1395 specimens recorded in 1931. The results for the years 1930–9 are summarized in Fig. 2.

It is of interest to record the unusual occurrence of young plaice in the catches in February and March. They have not been seen before during the long period of observations.

The evidence supplied by the plankton indicator species (Figs. 3 and 4) shows that until the end of the observations the conditions were very similar

to those of 1938, although the numbers of *Sagitta* were on the whole even lower than in that year. In this respect the rather high proportion of *S. elegans* shown in the lower half of Fig. 3 is somewhat misleading since the numbers of both *S. elegans* and *S. setosa* were generally so small as to be almost insignificant. There were indications of a slight incursion of *elegans* water in January and February. No occurrence of unusual plankton organisms was recorded and *Muggiaea atlantica* was remarkably scarce. The total number of medusae of all species was even lower than in 1938.

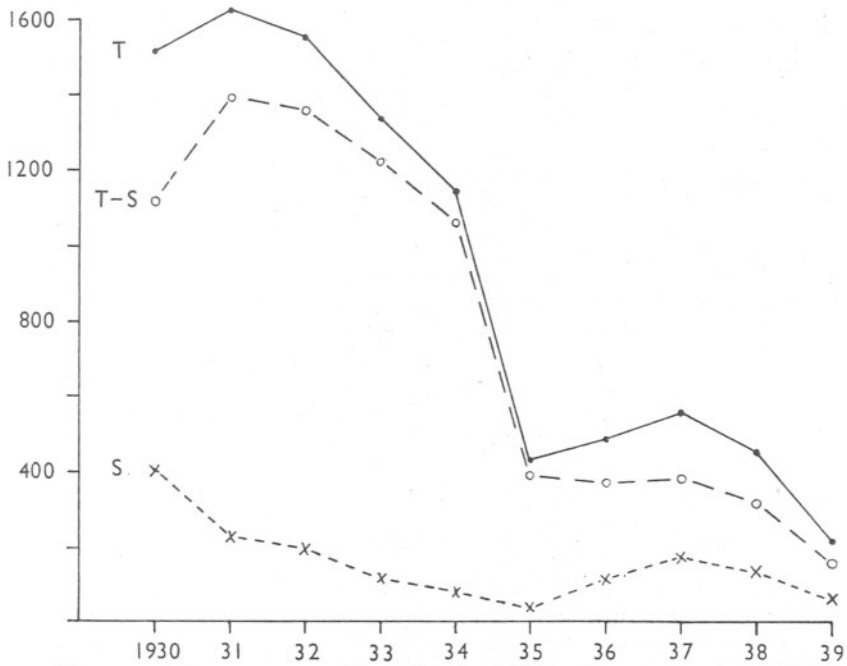

Fig. 2. The sums of the average monthly catches for each year from 1930 to 1939 in half-hour oblique hauls with the 2 m. ringtrawl for: *T*, total young fish (excluding clupeids); *S*, the young of summer spawners; and *T–S*, total young fish less the young of summer spawners.

There were again large numbers of pilchard eggs, which were present from April until the end of August when collections ceased. Their approximate numbers in the catches in which they occurred were as follows: April 17 (40), 25 (1370); May 1 (370), 8 (380), 15 (3890), 23 (2070), 31 (8020); June 2 (2940), 19 (19,480), 26 (19,340); July 4 (4820), 10 (680), 17 (1260), 24 (280), 31 (560); August 15 (10), 21 (620), 28 (20).

REFERENCE

RUSSELL, F. S., 1939. On the seasonal abundance of young fish. VI. The year 1938. *Journ. Mar. Biol. Assoc.*, Vol. XXIII, pp. 381–6.

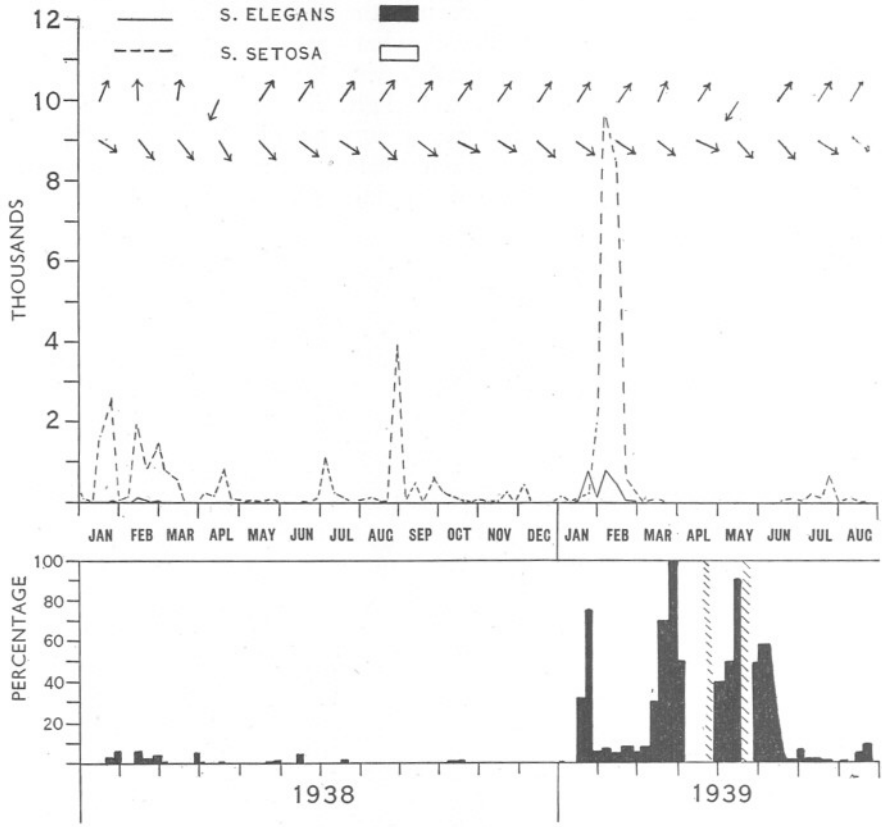

Fig. 3. Above, curves showing the actual abundance of *S. elegans* (——) and *S. setosa* (- - - - -) in half-hour oblique hauls with the 2 m. ringtrawl during the period January 1938 to August 1939. Below, the percentage composition of the *Sagitta* populations during the same period: *S. elegans*, black; *S. setosa*, white; no *Sagitta*, hatched. At the top of the diagram the arrows indicate the mean directions (true) of the flow of water past the Varne Lightship (above) and the Royal Sovereign Lightship (below) from data kindly supplied by Dr J. N. Carruthers. (Continued from Russell, 1939, p. 383, Fig. 2.)

TABLE I. DATES ON WHICH COLLECTIONS WERE MADE, 1939

All 2 miles east of Eddystone unless otherwise stated

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
2	8	6	3	1	2	4	8
9	13	14	12	8	19	10	15
17	21	20	17†	15	26	17	21
24	27	27	25	23		24	28
30*				31		31	

* Off Stoke Point. † 6 miles W.S.W. of Rame Head.

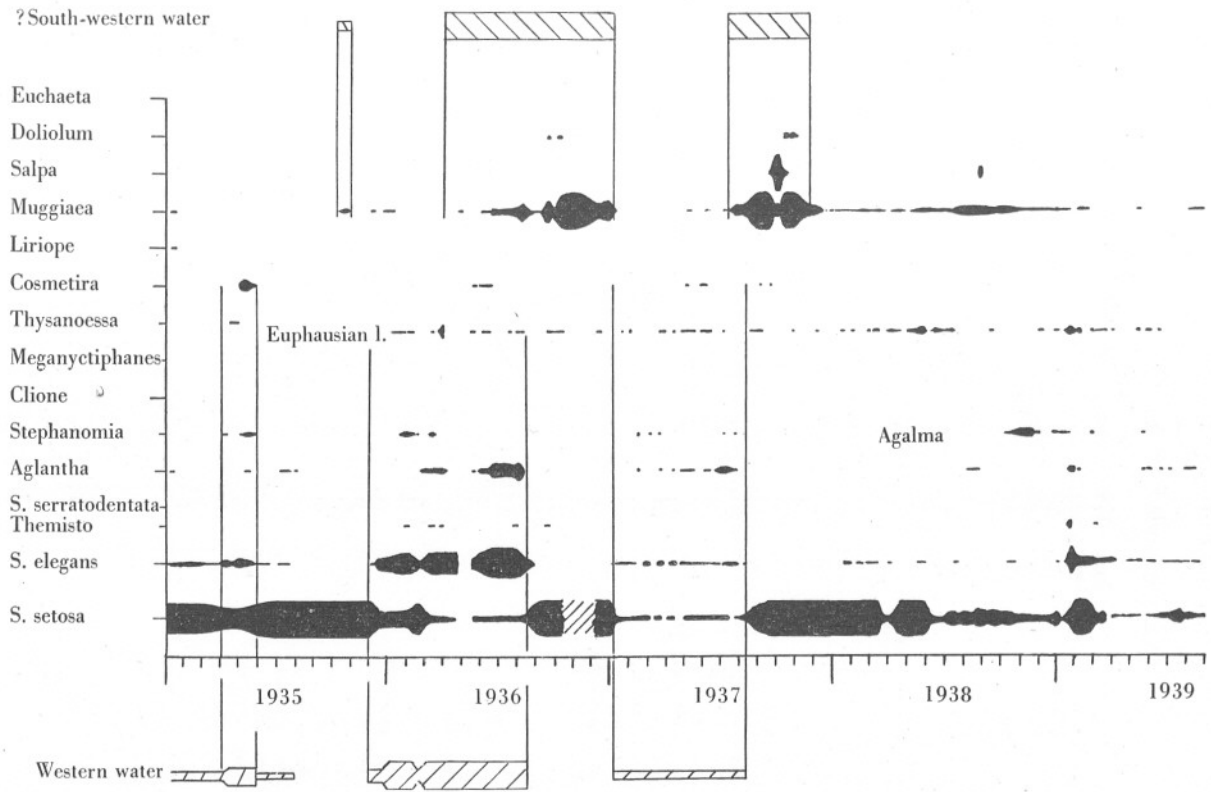

Fig. 4. Diagram showing the occurrence of the various plankton indicators in the collections off Plymouth during the years 1935 to 1939 inclusive. (Continued from Russell, 1939, p. 384, Fig. 3.) The *Muggiaea* species were *M. kochi* up to January 1937, and thereafter *M. atlantica*; the salps were *S. fusiformis*, and the doliolids *D. nationalis*.

TABLE II. AVERAGE MONTHLY CATCHES OF POST-LARVAE PER HALF-HOUR

Oblique hauls with 2 m. ringtrawl, 1939

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Σ
Total young fish	83	204	46	15	46	46	260	32	732
Ditto, less Clupeids	2	54	19	11	41	13	57	18	215
All Clupeid spp.	81	150	27	4	4	33	203	13	515
Clupea harengus	80	47	..	..	..	..	..	..	127
Gadus pollachius	..	+	..	..	1	..	..	..	1
Gadus merlangus	..	1	..	+	15	+	..	..	16
Gadus minutus	..	..	..	..	+	..	..	..	+
Gadus luscus	+	2	..	..	1	..	..	+	3
Gadus callarius	..	..	..	..	..	..	..	..	..
Onos spp.	..	..	..	+	3	1	+	..	4
Molva molva	..	..	..	..	..	..	..	..	..
Merluccius merluccius	..	..	..	..	..	..	..	..	..
Raniceps raninus	..	..	..	..	..	..	+	..	+
Capros aper	..	..	..	..	..	..	..	+	+
Zeus faber	..	..	..	..	..	..	..	..	..
Arnoglossus sp.	..	..	..	..	..	3	5	2	10
Rhombus spp.	..	..	..	..	..	+	..	1	1
Scophthalmus norvegicus	..	..	..	..	1	..	1	..	2
Zeugopterus punctatus	..	..	..	..	1	..	1	..	2
Zeugopterus unimaculatus	..	..	..	..	..	..	+	..	+
Pleuronectes platessa	..	18	1	..	..	..	..	..	19
Pleuronectes limanda	..	..	..	1	2	..	..	..	3
Pleuronectes flesus	..	..	+	1	..	..	..	..	1
Pleuronectes microcephalus	..	+	..	..	+	..	..	..	+
Solea vulgaris	..	..	+	..	1	..	..	..	1
Solea variegata	..	..	..	..	1	..	3	..	4
Solea lascaris	..	..	..	..	..	..	+	+	+
Solea lutea	..	..	..	..	..	+	+	..	+
Serranus cabrilla	..	..	..	..	..	..	..	..	..
Caranx trachurus	..	..	..	..	..	..	+	1	1
Mullus surmulletus	..	..	..	..	..	..	+	..	+
Morone labrax	..	..	..	..	..	..	..	..	..
Ammodytes sp.	1	31	12	1	..	..	+	..	45
Ammodytes lanceolatus	..	..	..	3	+	2	3	+	8
Cepola rubescens	..	..	..	..	..	..	..	3	3
Callionymus sp.	..	..	..	2	15	1	13	6	37
Labrus bergylta	..	..	..	..	..	+	..	..	+
Labrus mixtus	..	..	..	..	+	1	+	..	1
Ctenolabrus rupestris	..	..	..	..	..	+	20	3	23
Crenilabrus melops	..	..	..	..	..	1	1	+	2
Centrolabrus exoletus	..	..	..	..	..	..	1	..	1
Trachinus vipera	..	..	..	..	..	..	+	+	+
Scomber scombrus	..	..	..	..	..	..	3	2	5
Gobius spp.	+	+	..	..	+	+	2	..	2
Lebetus scorpioides	..	..	..	..	..	..	..	1	1
Blennius ocellaris	..	..	..	..	..	..	..	..	..
Blennius pholis	..	..	..	..	..	..	1	..	1
Blennius gattorugine	..	..	..	..	..	3	2	1	6
Chirolophis galerita	..	2	2	1	..	..	..	..	5
Agonus cataphractus	..	..	..	..	..	..	..	..	..
Trigla spp.	..	..	..	..	+	..	+	+	+
Cottus sp.	..	+	4	2	+	..	..	..	6
Liparis montagui	..	..	..	..	..	..	..	..	..
Lepadogaster bimaculatus	..	..	..	..	..	..	..	..	..
Lophius piscatorius	..	..	..	..	..	..	..	..	..
Pipe fish	..	..	..	..	..	..	..	..	..