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# SCOTTISH REDFISH LARVAL INVESTIGATIONS 1962

by

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## SUMMARY

An echo/plankton survey off south-west Iceland in May 1962 by F.R.S. "Explorer" showed that the greatest concentration of redfish larvae was to the west of the Reykjanes Ridge over deep water. Larval abundance figures of 235 million under each $km^2$ were obtained in this area of high abundance and of 23 million under each $km^2$ over the whole area investigated. All attempts to catch adult redfish in the area failed and there were no fish traces on the echosounder. It is felt that only a large-scale expedition in this area can hope to answer the questions of where and at what depth this huge spawning occurs.

A note on the presence of sub-caudal melanophores or tail spots, in larvae extruded from a marinus-type parent, is added.

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In May 1962 a survey was made south-west of Iceland by F.R.S. "Explorer" in association with a programme of exploratory fishing for redfish. The principal aim of the cruise was to ascertain whether concentrations of spawning redfish could be located in the area of the Reykjanes Ridge. This has been suggested as one of the principal areas of redfish spawning in the North Atlantic by many redfish workers. Henderson (1961) gives results of larval distribution and abundance from surveys made with the continuous plankton recorder, sampling at a constant depth of 10 metres; he states that his assessments of larval abundance must be considered minimal. They are, however, very large and he suggests a figure exceeding 100 million larvae under each $km^2$ for the most prolific areas in April and May.

As part of the programme a series of 46 plankton hauls were made during the survey from 11th to 18th May. The distribution of stations in relation to the Reykjanes Ridge can be seen in Fig.1. The gear used was a 1 metre oblique tow net with 26 meshes to the inch. The area sampled was between latitudes 59°30'N to 63°30'N and longitudes 22°00'W to 31°00'W. All hauls were made with 500 metres of wire, this being considered sufficient to sample the deepest larvae, and the ship's log was used to record the distance towed. The samples were subsequently corrected to a standard tow of 1 mile.

In addition the larvae, extruded from four female redfish, caught in a series of trawl hauls along the south coast of Iceland, were examined for the presence of sub-caudal melanophores.

## Results

The distribution of redfish larvae over the area sampled is shown in Fig.1. The main concentration lay over deep water to the west of the Reykjanes Ridge, where an average of the corrected catch estimates gave 736 larvae per haul. No fish larvae of species other than Sebastes occurred in significant numbers in the samples. These results are in agreement with Henderson's (loc.cit.) figures for this area in May.

Using the data for the whole area surveyed it is possible to estimate the numbers of redfish larvae under each square kilometre of sea surveyed. During tests at the laboratory, the filtering rate of a 1 metre 26 oblique tow net has been shown to be approximately 450 cubic metres of water in a one mile tow from commencement of shooting to the end of hauling (Saville: personal communication). The geometric mean catch over the complete area sampled was 72.56 larvae per haul. This gives a figure of 0.16 larvae per $m^3$ over the whole area sampled. The warp used was 500 metres in all cases so by taking different depth/warp ratios for the net and assuming that all the larvae were in the top 50 metres of water some larval abundance figures can be obtained (Table I). For this purpose it has been assumed that the towing wire to the net is in a straight line. However, the error of using this assumption is negligible, when compared with the total error in calculations of this type.

It is not possible to say to what depth the net was fishing on any one occasion but it is fairly safe, for the present purposes, to assume that on average a depth/warp ratio of between 1:3 and 1:4 is the most likely. The calculation gives a figure of between 16 and 40 million larvae under each square kilometre with a mean of 23 million.

Table I

1 m 26 Oblique townet filters 450$m^3$ in 1 mile (Saville).
Log. mean catch per 1 mile tow = 72.56 larvae.
Number of larvae per 1$m^3$ = 0.16.

Warp out was 500m in all cases.
Assuming larvae were all in top 50 metres:-

| Depth/Warp Ratio | Maximum Depth of Net (metres) | Proportion of Time Net is in top 50m | No. of Larvae per 1$m^3$ in top 50m = "n" | No. under 1 $km^2$ = n x $50^7$ |
|---|---|---|---|---|
| 1:5 | 100 | $\frac{1}{2}$ | 0.32 | $1.60 \times 10^7$ |
| 1:4 | 125 | $\frac{1}{2.5}$ | 0.40 | $2.00 \times 10^7$ |
| 1:3 | 167 | $\frac{1}{3.34}$ | 0.53 | $2.65 \times 10^7$ |
| 1:2 | 250 | $\frac{1}{5}$ | 0.80 | $4.00 \times 10^7$ |

If the larvae extend to 100 metres, the estimates in Table I for numbers under 1 $km^2$ are not affected but the numbers per $m^3$ will be reduced to half the values given. Redfish workers such as Taning (1949), Einarsson (1960) and Templeman (1959) all state that larvae are most commonly found in the upper 50 metres of water. So a depth/warp ratio of 1:3.5 is fairly sure to have sampled the larval population adequately.

If we consider the area of greatest larval abundance where an average of 736 larvae per haul were caught, again assuming an average depth/warp ratio of 1:3.5, the figure of 235 million under each $km^2$ is obtained. This is of the same order of magnitude as Henderson's (loc.cit.) figure of 100 million.

Where the numbers were sufficient 50 larvae were measured from each haul to the millimetre below. The length range is shown in Table II. The mean length was 8.51 mm and the variation between sample means small, the range of means being from 6.96 mm to 9.32 mm.

Table II

Larval length distribution.

| Millimetres | Numbers | Mean Length (mm) | Corrected Mean |
|---|---|---|---|
| 5 | 3 | | |
| 6 | 53 | | |
| 7 | 483 | | |
| 8 | 848 | 8.01 | 8.01 + 0.50 |
| 9 | 408 | | = 8.51 |
| 10 | 90 | | |
| 11 | 9 | | |
| Total | 1894 | | |

Discussion

The figure of 23 million larvae under each $km^2$ of the area covered gives a total population at the time of the survey of 13 x $10^{14}$ larvae. Henderson (loc.cit.) quotes a figure for redfish fecundity of about 150,000 larvae. This means that to produce the number of larvae found in the area investigated would have required 8.9 x $10^9$ female redfish. This can only be a very conservative estimate since Fig.1 suggests that the area of highest larval abundance extends to the west of the area

covered in the survey. It would seem then that at this time of the year there must be a very large concentration of redfish west of the Reykjanes Ridge. The larvae found were only a few millimetres larger than the extrusion size of 6 mm suggested by most workers and it would appear that they could not have drifted far from the area of spawning. No echo-traces of fish concentrations were found during the survey and pelagic lines set at varying depths from the surface to 600 metres caught nothing. The pelagic trawl only caught large jellyfish (Periphylla hyacintha) and some bathypelagic fishes. Kotthaus (1961) described the same result from the joint Icelandic-German survey of this area last year and could only suggest that the redfish were spawning at depths of 500 metres or more. It appears that only a large-scale international effort in this area can hope to plot the entire redfish larval distribution in order to answer the questions of what the spawning depth of the redfish is and where the principal area of larval release occurs.

Sub-Caudal Melanophores in Redfish Larvae

The presence of sub-caudal melanophores or pigment spots below the tip of the notochord was used by Taning (1961) to distinguish the larvae of Sebastes viviparus from those of S. marinus. Templeman and Sandeman (1959) also noted their presence in the majority of young stages from mentella type redfish in the N.W. Atlantic.

In the present investigation a total of 1,894 larvae from the plankton samples were examined for the tail spot and only one specimen possessed it. The following figures, however, were obtained from larvae extruded from four ripe-running redfish caught along the south coast of Iceland:

| Type of Female | No. of Larvae Examined | No. with a tail spot |
|---|---|---|
| Mentella | 100 | 0 |
| Marinus | 100 | 1 |
| Marinus | 100 | 12 |
| Intermediate | 100 | 1 |

It is felt that with such a small number of fish examined little conclusion can be drawn but it is interesting to note that Kotthaus (1961) reports the absence of tail spots from larvae extruded from marinus, mentella, giant and intermediate type adult redfish off Iceland in 1961.

References


Einarsson, H. 1960. The fry of Sebastes in Icelandic waters and adjacent seas. Rit. Fiskid., 2, (7):1-67.

Henderson, G. T. D. 1961. Continuous plankton records: the distribution of young Sebastes marinus (L.). Bull. Mar. Ecol., 5:173-193.

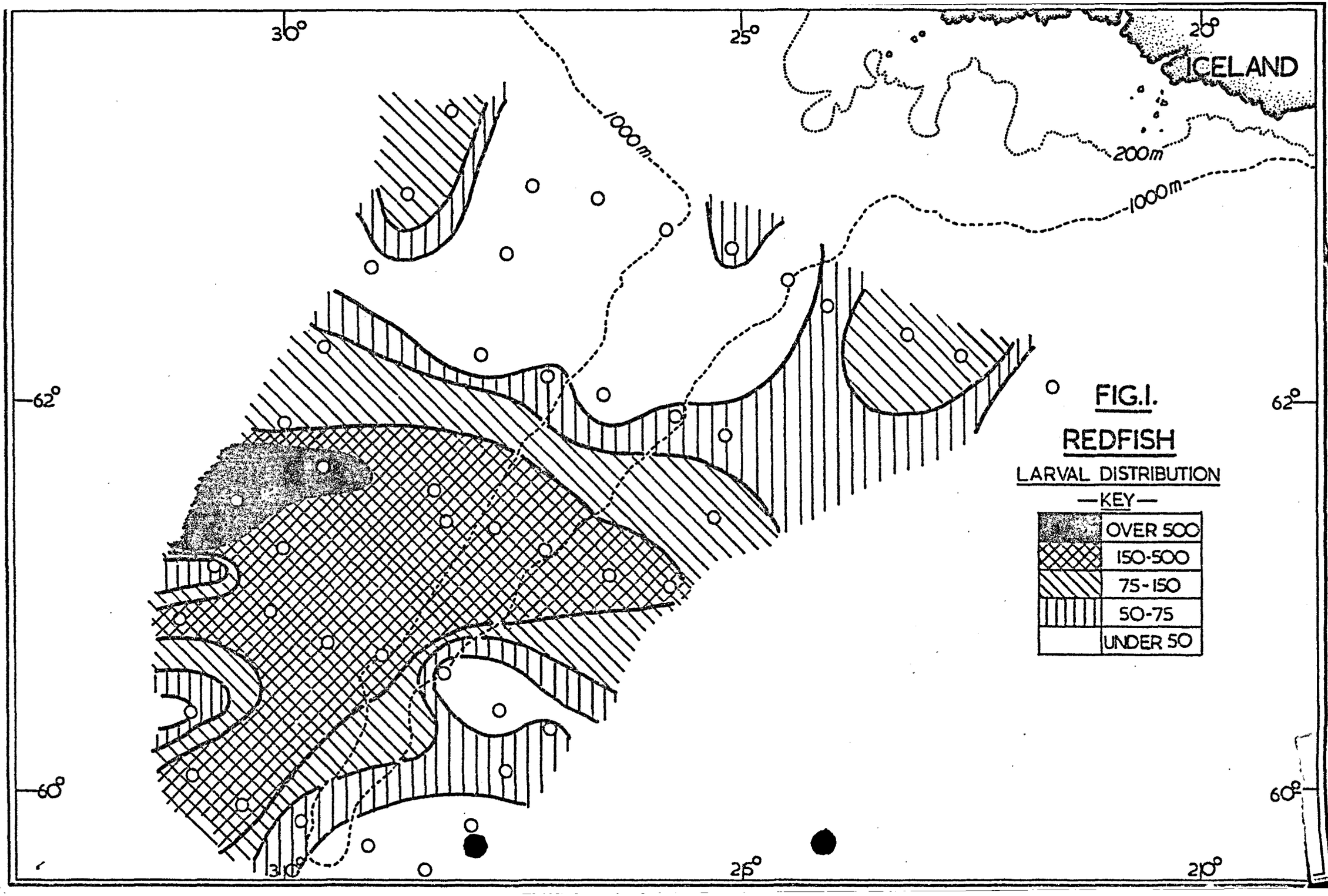
Kotthaus, A. 1961. Redfish larvae investigations in the Central North Atlantic in 1961 (Preliminary Report). I.C.E.S., C.M. 1961, Distant Northern Seas Ctte., No.4.

Taning, Å. V. 1949. On the breeding places and abundance of the redfish (Sebastes) in the North Atlantic. J. Cons. int. Explor. Mer, 150:234-240.

----- 1961. Larval and postlarval stages of Sebastes species and Helicolenus dactylopterus. Rapp. Cons. Explor. Mer, 150:234-240.

Templeman, W. 1959. Redfish distribution in the North Atlantic. Bull. Fish. Res. Bd Can., 120:1-73.

Templeman, W. and Sandeman, E. J. 1959. Variations in caudal pigmentation in late-stage pre-extrusion larvae from marinus- and mentella-type female redfish from the Newfoundland area. J. Fish. Res. Bd Can., 16:763-789.


30°
25°
20°
ICELAND
1000m
200m
1000m
62°
62°
60°
60°
31°
25°
21°
FIG.I.
REDFISH
LARVAL DISTRIBUTION
—KEY—
OVER 500
150-500
75-150
50-75
UNDER 50