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Redfish Larvae in the Irminger Sea in May 1961

by

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Introduction

In May 1961 a joint German/Icelandic redfish survey was carried out in the central North Atlantic. This joint survey has already been outlined on the last year meeting by Dr. Kotthaus, Germany.

This paper will deal with the redfish larvae of the Icelandic part of the survey. The Icelandic part covered the Irminger Sea south to 60°N as shown in Figure 1. The Icelandic cruise was divided into two parts:-

Part I, from 30th April to 17th May (Station nos. 1-102)
Part II, from 22nd May to 1st June (Station nos. 103-173).

Gear and Methods

For vertical zooplankton sampling, the Helgoländer larvae net was used, which has an opening of 1.6 m^2. Hauls were taken from 50 m up to the surface. For the horizontal sampling, the Icelandic high speed plankton sampler was used. Three samplers were attached to one wire with a Scripps brass depressor at the end. The samplers were towed at following depths:- 3, 15-20, and 25-30 m. (These depths were controlled by a B.T. test). All samplers were towed with a speed of 8 knots on each station 1.5 n.m. which gives a filtration of 19.7 m^3 for each sampler.

Material

The redfish larvae were as far as possible taken from the zooplankton samples and counted simultaneously on sea. Measurements were carried out in the institute laboratory. The number of redfish larvae collected on this cruise is given in the following table.

Table 1. Redfish larvae. Cruise B 61, May 1961

	Part I		Part II		Total	
	Number of Larvae		Number of Larvae		Number of Larvae	
Gear	Counted	Measured	Counted	Measured	Counted	Measured
Helgol.Larv.Net	2310	1506	339	267	2650	1772
H.Sp.Spl.I	576	511	340	320	916	831
H.Sp.Spl.II	1706	1152	1127	718	2833	1870
H.Sp.Spl.III	909	777	555	375	1464	1152
Total	5501	3946	2361	1680	7863	5625

Distribution and Abundance

Redfish larvae were found in almost the whole oceanic region of the area surveyed. On the other hand, rather few larvae were found on the continental shelf at this time of the year.

This can be seen from the following Table 2.

Table 2. Redfish larvae. Relation between the Shelf and Oceanic areas in the Irminger Sea. Cruise B 61, May 1961.

Area	No. of Stations	No. of positive stations	Total no. of larvae	Average No. per station	Average No. per pos. Stat.
Shelf	79	34	275	3.5	8.1
Oceanic	99	93	7588	76.6	81.6
Total	178	127	7863	44.2	61.9

Relatively few larvae were found in the western part of the Irminger Sea. This is shown in Figure 2. This chart was prepared to give a general view of the distribution and abundance of redfish larvae during the survey. The chart is based upon the relative number of larvae per 1o m^3 all gear counted. The density of larvae is given by gradual shading to call special attention to the main features in the abundance. We can see from the chart that the redfish larvae are most abundant in the eastern part of the surveyed area. Here, all stations are positive with the exception of those on the continental shelf, where a great part of the stations were negative.

We can also see from the chart that the main concentrations of redfish larvae are west off the Reykjanes Ridge. Here, the larvae are found to be in two main density zones, one running along the western slope of the Reykjanes Ridge between 1ooo and 2ooo m depth lines, the other one mainly outside the 2ooo m depth line. The two main zones seem to maintain in the northern part (Part II) of the surveyed area although the observations of Part II were made later. Further, some other density zones were found west of the region with the main larval concentrations, and also east off the Reykjanes Ridge. These above-mentioned regions correspond well to those which were found south and east of the surveyed area as described by Kotthaus.

Figure 3 shows the temperature in 2o m depth. A comparison between the abundance of redfish larvae and the temperature at a depth of 2o m shows that the main concentrations of larvae are found within 7-8°C. However, the redfish larvae were also abundant in higher and lower temperatures but no great quantities of larvae were found below 6°C. Only very few larvae were obtained in temperatures below 5.5°C. A comparison between Figure 2 and Figure 3 demonstrates how the abundance of redfish larvae seems to depend on certain isotherms.

The use of 3 high speed samplers in different depths at each station simultaneously makes it possible to study the abundance of redfish larvae in 3 different levels. We find that the redfish larvae are most abundant in sampler II, i.e. at a depth of 15-2o m. It is somewhat less abundant at 25-3o m (Sampler III) but most scarcely just below the surface, i.e. 3 m (Sampler I). See also Table 3. It is worth noticing that for the last-mentioned level, most of the positive stations were obtained during the night. This is at least the case in Part I of the cruise. These vertical movements are not so apparent for the other levels.

Localising of extrusion regions for redfish by length of larvae

We have tried to localise the main "spawning" places for redfish in the investigated area by means of length frequencies of the larvae caught. All larvae of 7 mm size and smaller are supposed to be just extruded. This size limit is based upon measurements of intraovarial larvae from several specimens where the size range was found to be from 5.2 to 7 mm. The development of the intraovarial larvae were of the same stage within each specimen, but differed from one specimen to another. The most developed larvae which seemed to be just before extrusion were of 6-7 mm size.

For the purpose of localising the extrusion areas of redfish, a chart was prepared which shows the distribution and abundance only for larvae of 7 mm size and smaller (see Figure 4). It should be noticed here, that almost 8o% of all larvae caught in Part I of the cruise were of 7 mm size and smaller. Figure 4 shows that the extrusion of larvae takes place in almost the whole oceanic area surveyed. But there is a great difference in the density of small larvae between the western and eastern part of the area surveyed. In the eastern part, we find great concentrations of newly extruded larvae. But in the western part, the extrusion is by far not as intensive as in the eastern part. There, no great concentrations of newly extruded larvae were found except at some stations of the southernmost section.

In Part II, the relation between small and big larvae was reversed to that of Part I. Here, the catches consisted mainly of larvae bigger than 7 mm, i.e. drifted larvae. These occurred in considerable quantities and the location of their concentrations indicates a drift of the larvae concentrations found in Part I. Only 5.3% of the larvae caught in Part II were of 7 mm size and smaller. However, the quantity of small larvae at certain stations in this northerly region at this time indicates that an extrusion of redfish larvae is still going on but not in the western part of the area surveyed where small larvae were lacking.

We see therefore from the observations that the "spawning" places of redfish are not limited to certain areas in the Irminger Sea. "Spawning" is taking place in almost the entire oceanic region of it. But the intensity of the extrusion differs considerably, at least at this time of the year. Therefore it is possible to localise areas with heavy extrusion.

Table 3. Part I. Table showing the number of redfish larvae by station and gear. Cruise B 61, May 1961.

No. of Stat.	Helgoländer Larvae Net		High Speed Samplers								All Gear
			I		II		III		I-III		
	No. of Larvae	No. per m^2	No. of Larvae	No. per m^3	No. of Larvae	No. per m^3	No. of Larvae	No. per m^3	No. of Larvae	No. per m^3	No. of Larvae
5	o	o	2	o.1	-	-	o	o	2	o.o3	2
7	1	o.6	o	o	8	o.4	o	o	8	o.13	9
8	o	o	o	o	o	o	3	o.2	3	o.o7	3
9	o	o	o	o	o	o	1	o.o5	1	o.o2	1
lo	1	o.6	o	o	5	o.3	o	o	5	o.lo	6
11	35	21.9	13	o.7	32	1.6	16	o.8	61	1.o3	96
12	11	6.9	34	1.7	o	o	36	1.8	7o	1.17	81
13	139	86.9	4o	2.o	4o	2.o	22	1.1	lo2	1.7o	241
14	6o	37.5	3	o.2	31	1.6	6o	3.1	94	1.63	154
15	6	3.8	1	o.o5	3	o.2	4	o.2	8	o.15	14
16	11	6.9	o	o	1	o.o5	1	o.o5	2	o.o3	13
17	3	1.9	9	o.5	1	o.o5	3	o.2	13	o.25	16
18	o	o	o	o	1	o.o5	o	o	1	o.o2	1
19	2	1.3	o	o	o	o	o	o	o	o	2
2o	lo	6.3	o	o	o	o	1	o.o5	1	o.o2	11
21	2	1.3	o	o	o	o	o	o	o	o	2
22	o	o	o	o	1	o.o5	o	o	1	o.o2	1
24	1	o.6	o	o	o	o	o	o	o	o	1
26	o	o	o	o	1	o.o5	o	o	1	o.o2	1
34	o	o	o	o	1	o.o5	2	o.1	3	o.o7	3
35	14	8.8	o	o	o	o	o	o	o	o	14
36	4	2.5	o	o	o	o	25	1.3	25	o.43	29
37	1	o.6	o	o	2	o.1	lo	o.5	12	o.2o	13
38	28	17.5	3o	1.5	15	o.8	2	o.1	47	o.8o	75
39	252	157.5	46	2.3	28	1.4	28	1.4	lo2	1.7o	354
4o	55	34.4	8	o.4	26	1.3	12	o.6	46	o.77	lol
41	45	28.1	1	o.o5	o	o	-	-	1	o.o2	46
41A	54	33.7	o	o	o	o	-	-	o	o	54
42	18	11.3	o	o	o	o	9	o.5	9	o.17	27
43	23	14.4	o	o	27	1.4	2	o.1	29	o.5o	52
44	5o	31.3	58	2.9	-	-	o	o	58	o.97	lo8
45	24o	15o.o	-	-	52	2.6	lo	o.5	62	1.o3	3o2
46	89	55.6	-	-	78	4.o	31	1.6	lo9	1.87	198
47	4	2.5	-	-	6	o.3	4	o.2	lo	o.17	14
48	4	2.5	-	-	6	o.3	o	o	6	o.lo	lo
49	o	o	-	-	o	o	2	o.1	2	o.o3	2
5o	15	9.4	5	o.3	17	o.9	1	o.o5	23	o.42	38
51	52	32.5	12	o.6	35	1.8	6	o.3	53	o.9o	lo5
52	19	12.o	3	o.2	3	o.2	4	o.2	lo	o.2o	29
53	14	8.8	o	o	4	o.2	4	o.2	8	o.13	22
54	18	11.3	o	o	8	o.4	6	o.3	14	o.23	32
55	8	5.o	o	o	12	o.6	1	o.o5	13	o.23	21

(continued on next page)

Table 3 continued

No. of Stat.	Helgoländer Larvae Net No. of Larvae	Helgoländer Larvae Net No. per m^2	High Speed Samplers I No. of Larvae	I No. per m^3	II No. of Larvae	II No. per m^3	III No. of Larvae	III No. per m^3	I-III No. of Larvae	I-III No. per m^3	All Gear No. of Larvae
56	46	28.8	2o	1.o2	43	2.2	7	o.4	7o	1.2o	116
57	21	13.1	o	o	53	2.7	8	o.4	61	1.o3	82
58	6	3.8	o	o	3	o.2	7	o.4	1o	o.2o	16
59	87	54.4	1	o.o5	14	o.7	15	o.8	3o	o.52	117
6o	3	1.9	6	o.3	17	o.9	2o	1.o	43	o.73	46
61	-	-	16	o.8	1o1	5.1	127	6.5	244	4.13	244
62	-	-	29	1.5	8	o.4	15	o.8	52	o.9o	52
63	-	-	4	o.2	6o	3.1	7o	3.6	134	2.3o	134
64	35	21.9	o	o	2	o.1	5o	2.5	52	o.87	87
65	183	114.4	o	o	3	o.2	7	o.4	1o	o.2o	193
66	-	-	5	o.3	9	o.5	22	1.1	36	o.63	36
67	-	-	21	1.1	17	o.9	1	o.o5	39	o.68	39
68	5	3.1	1	o.o5	o	o	1	o.o5	2	o.o3	7
69	5	3.1	o	o	7	o.4	9	o.5	16	o.3o	21
7o	4	2.5	o	o	o	o	7	o.4	7	o.13	11
71	11	6.9	o	o	6	o.3	5	o.3	11	o.2o	22
72	3	1.9	o	o	o	o	1	o.o5	1	o.o2	4
74	1	o.6	o	o	o	o	o	o	o	o	1
75	o	o	1	o.o5	o	o	o	o	1	o.o2	1
76	o	o	o	o	o	o	1	o.o5	1	o.o2	1
8o	1	o.6	o	o	o	o	1	o.o5	1	o.o2	2
81	7	4.4	o	o	o	o	o	o	o	o	7
82	o	o	o	o	1	o.o5	2	o.1	3	o.o5	3
83	15	9.4	8	o.4	71	3.6	1o	o.5	89	1.5o	1o4
84	66	41.3	44	2.2	8o	4.1	16	o.8	14o	2.37	2o6
85	4	2.5	o	o	28	1.4	5	o.3	33	o.57	37
85A	29	18.1	-	-	-	-	-	-	-	-	29
86	3	1.9	o	o	16	o.8	19	1.o	35	o.6o	38
86A	-	-	o	o	92	4.7	1	o.o5	93	1.58	93
87	26	16.2	o	o	73	3.7	o	o	73	1.23	99
88	33	2o.6	o	o	131	6.7	14	o.7	145	2.47	178
89	76	47.5	32	1.6	31	1.6	1o	o.5	73	1.23	149
9o	-	-	1oo	5.1	216	11.o	24	1.2	34o	5.77	34o
91	-	-	4	o.2	33	1.7	11	o.6	48	o.83	48
92	1o	6.3	o	o	1	o.o5	25	1.3	26	o.45	36
93	22	13.8	o	o	14	o.7	16	o.8	3o	o.5o	52
94	2o	12.5	4	o.2	8	o.4	6	o.3	18	o.3o	38
95	14	8.8	1	o.o5	4	o.2	o	o	5	o.o8	19
96	18	11.3	2	o.1	4	o.2	12	o.6	18	o.3o	36
97	31	19.4	1o	o.5	26	1.3	5	o.3	41	o.7o	72
98	38	23.8	2	o.1	1o	o.5	1o	o.5	22	o.37	6o
99	3o	18.8	o	o	33	1.7	13	o.7	46	o.8o	76
1oo	3o	18.8	o	o	17	o.9	16	o.8	33	o.57	63
1o1	138	86.3	o	o	3o	1.5	14	o.7	44	o.73	182
Total	231o		576		17o6		9o9		3191		55o1

Table 3. Part II. Number of redfish larvae by station and gear. Cruise B 61, May 1961

No. of Stat.	Helgoländer Larvae Net		High Speed Samplers								All Gear
			I		II		III		I-III		
	No. of Larvae	No. per m^2	No. of Larvae	No. per m^3	No. of Larvae	No. per m^3	No. of Larvae	No. per m^3	No. of Larvae	No. per m^3	No. of Larvae
110	-	-	0	0	0	0	9	0.5	9	0.17	9
113	-	-	-	-	0	0	2	0.1	2	0.03	2
114	-	-	-	-	6	0.3	8	0.4	14	0.23	14
115	-	-	19	1.0	81	4.1	29	1.5	129	2.20	129
116	7	4.4	23	1.2	174	8.8	0	0	197	3.33	204
117	27	16.9	80	4.1	4	0.2	4	0.2	88	1.50	115
118	39	24.4	0	0	41	2.1	3	0.2	44	0.77	83
119	2	1.3	44	2.2	37	1.9	3	0.2	84	1.43	86
120	26	16.3	60	3.1	97	4.9	90	4.6	247	4.20	273
121	2	1.3	2	0.1	4	0.2	5	0.3	11	0.20	13
122	12	7.5	0	0	1	0.05	0	0	1	0.02	13
123	0	0	0	0	5	0.3	0	0	5	0.10	5
1[illegible]	3	1.9	10	0.5	0	0	8	0.4	18	0.30	21
125	6	3.8	0	0	22	1.1	7	0.4	29	0.50	35
126	4	2.5	5	0.3	29	1.5	9	0.5	43	0.77	47
127	3	1.9	1	0.05	1	0.05	2	0.1	4	0.06	7
128	1	0.6	-	-	0	0	0	0	0	0	1
133	1	0.6	0	0	0	0	0	0	0	0	1
140	0	0	0	0	1	0.05	1	0.05	2	0.03	2
141	1	0.6	2	0.1	0	0	0	0	2	0.03	3
142	1	0.6	0	0	0	0	0	0	0	0	1
143	1	0.6	0	0	0	0	0	0	0	0	1
145	3	1.9	1	0.05	0	0	1	0.05	2	0.03	5
146	0	0	0	0	0	0	2	0.1	2	0.03	2
147	3	1.9	2	0.1	28	1.4	4	0.2	34	0.57	37
148	5	3.1	0	0	0	0	6	0.3	6	0.10	11
149	0	0	1	0.05	0	0	0	0	1	0.02	1
152	1	0.6	0	0	26	1.3	0	0	26	0.43	27
153	0	0	0	0	53	2.7	0	0	53	0.90	53
154	4	2.5	19	1.0	9	0.5	0	0	28	0.50	32
155	2	1.3	23	1.2	15	0.8	3	0.2	41	0.73	43
1[illegible]	9	5.6	32	1.6	6	0.3	11	0.6	49	0.83	58
157	121	75.6	1	0.05	151	7.7	122	6.2	274	4.98	395
157A	5	3.1	0	0	99	5.0	106	5.4	205	3.47	210
158	4	2.5	0	0	111	5.6	66	3.4	177	3.00	181
159	9	5.6	0	0	37	1.9	19	1.0	56	0.97	65
160	1	0.6	0	0	57	2.9	17	0.9	74	1.27	75
161	16	10.0	0	0	27	1.4	10	0.5	37	0.63	53
162	18	11.3	11	0.6	4	0.2	3	0.2	18	0.33	36
163	1	0.6	4	0.2	1	0.05	2	0.1	7	0.12	8
165	0	0	0	0	0	0	2	0.1	2	0.03	2
166	1	0.6	0	0	0	0	1	0.05	1	0.02	2
Total	339		340		1127		555		2022		2361

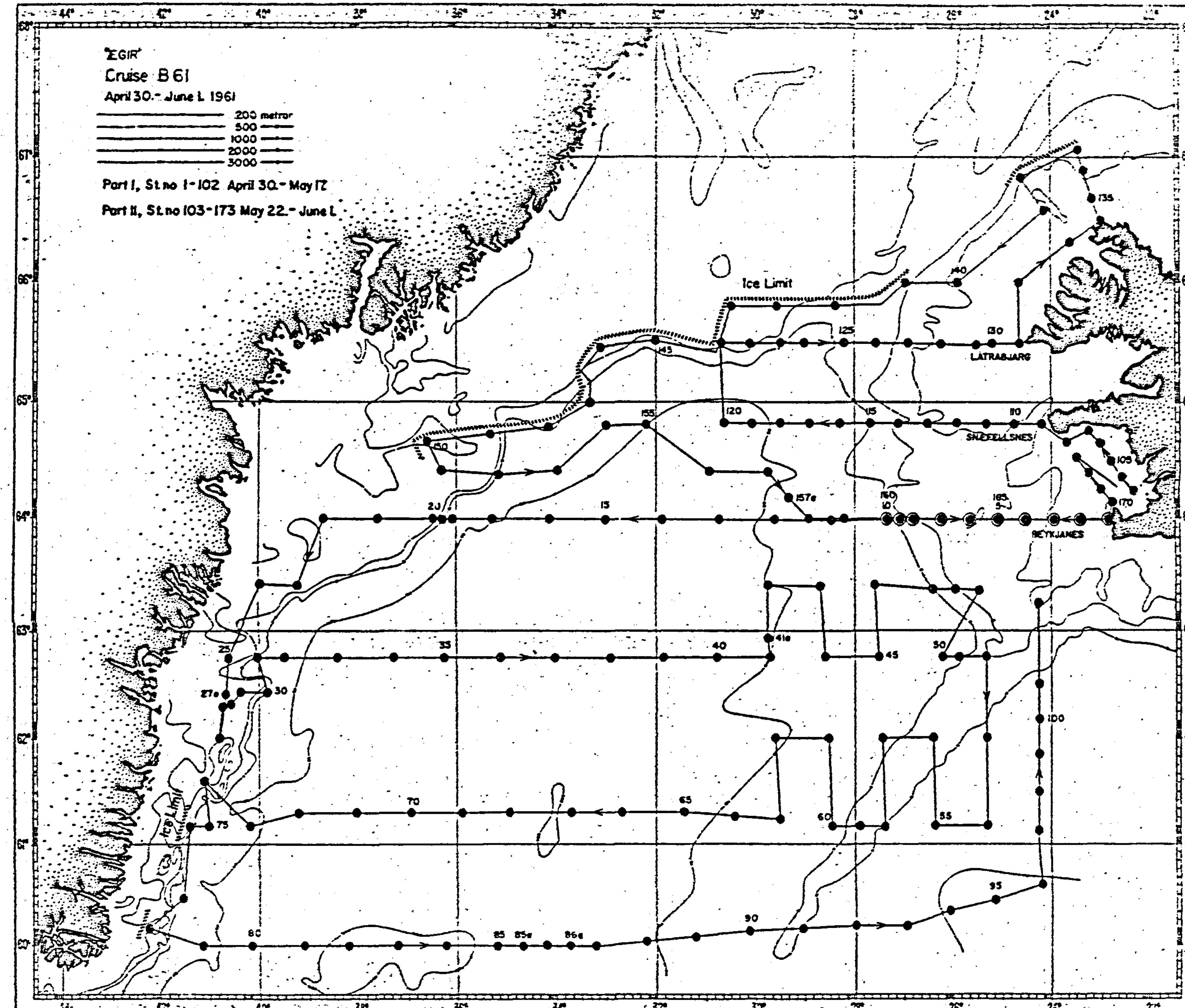

Fig. 1. The Route of the Icelandic Redfish Larvae Cruise in the Irming[illegible]ea in May 1961

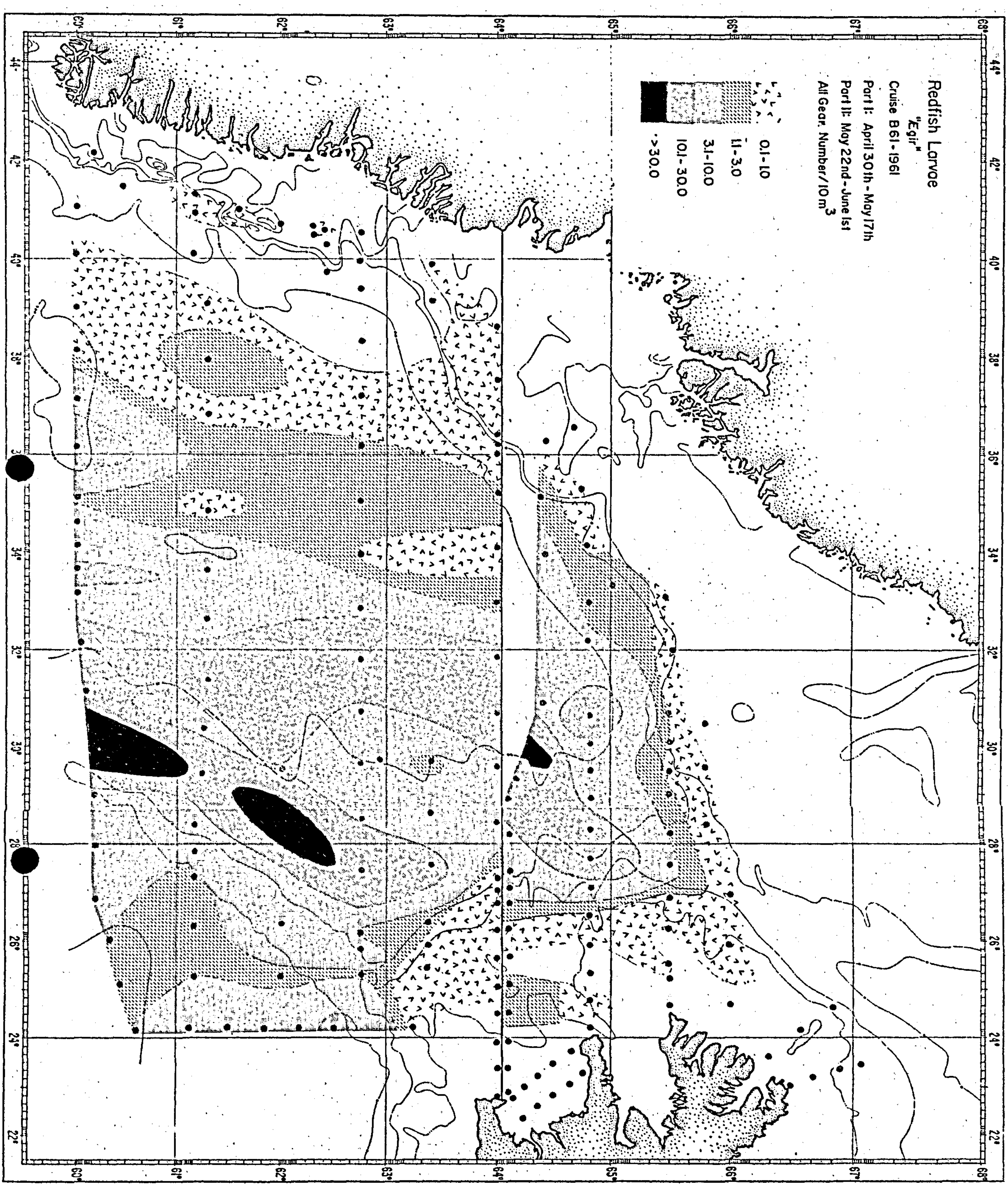

Fig. 2. Distribution and Relative Abundance of Redfish Larvae in May 1961.

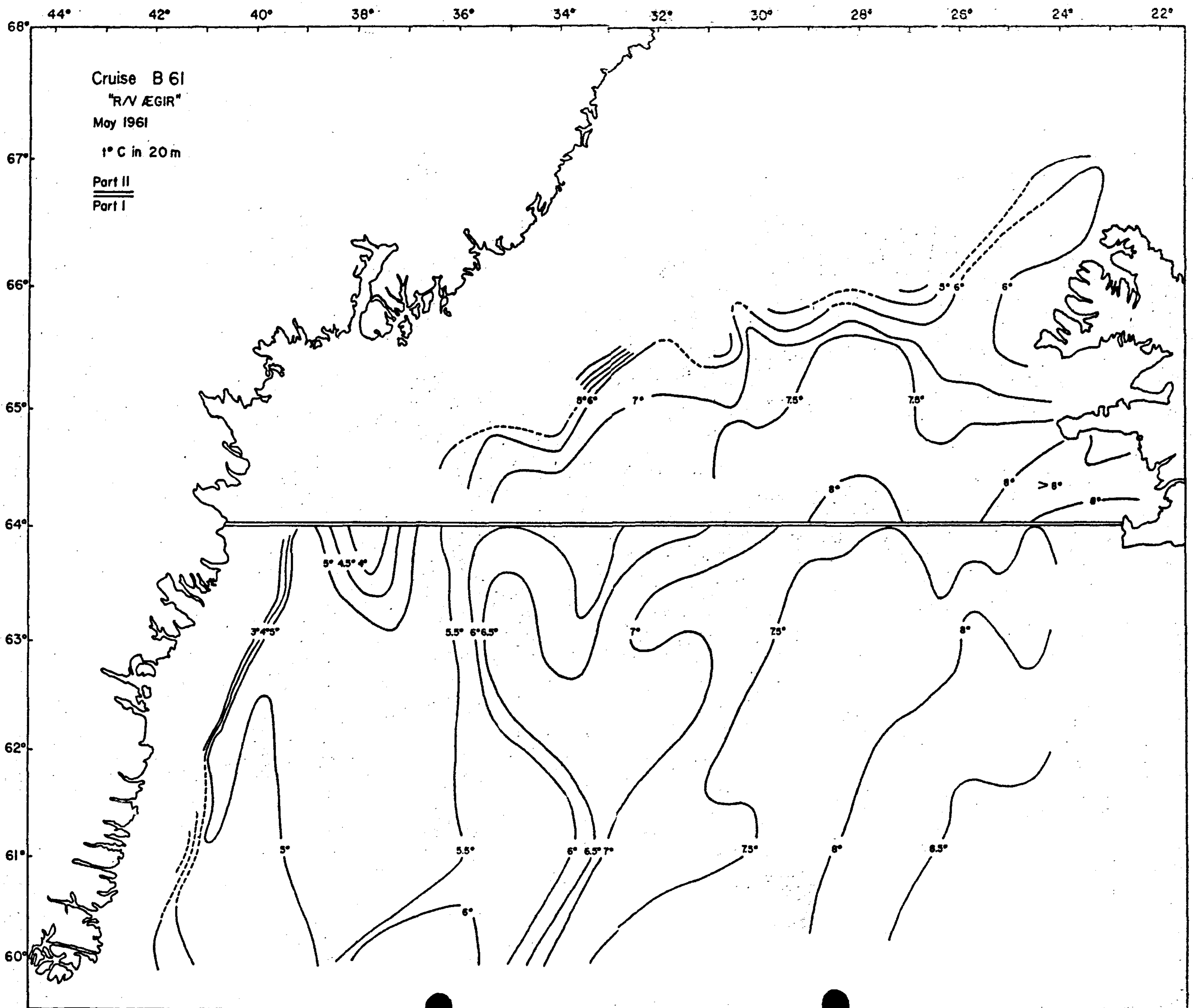

Fig. 3. Temperature in 20 m Depth in May 1961.

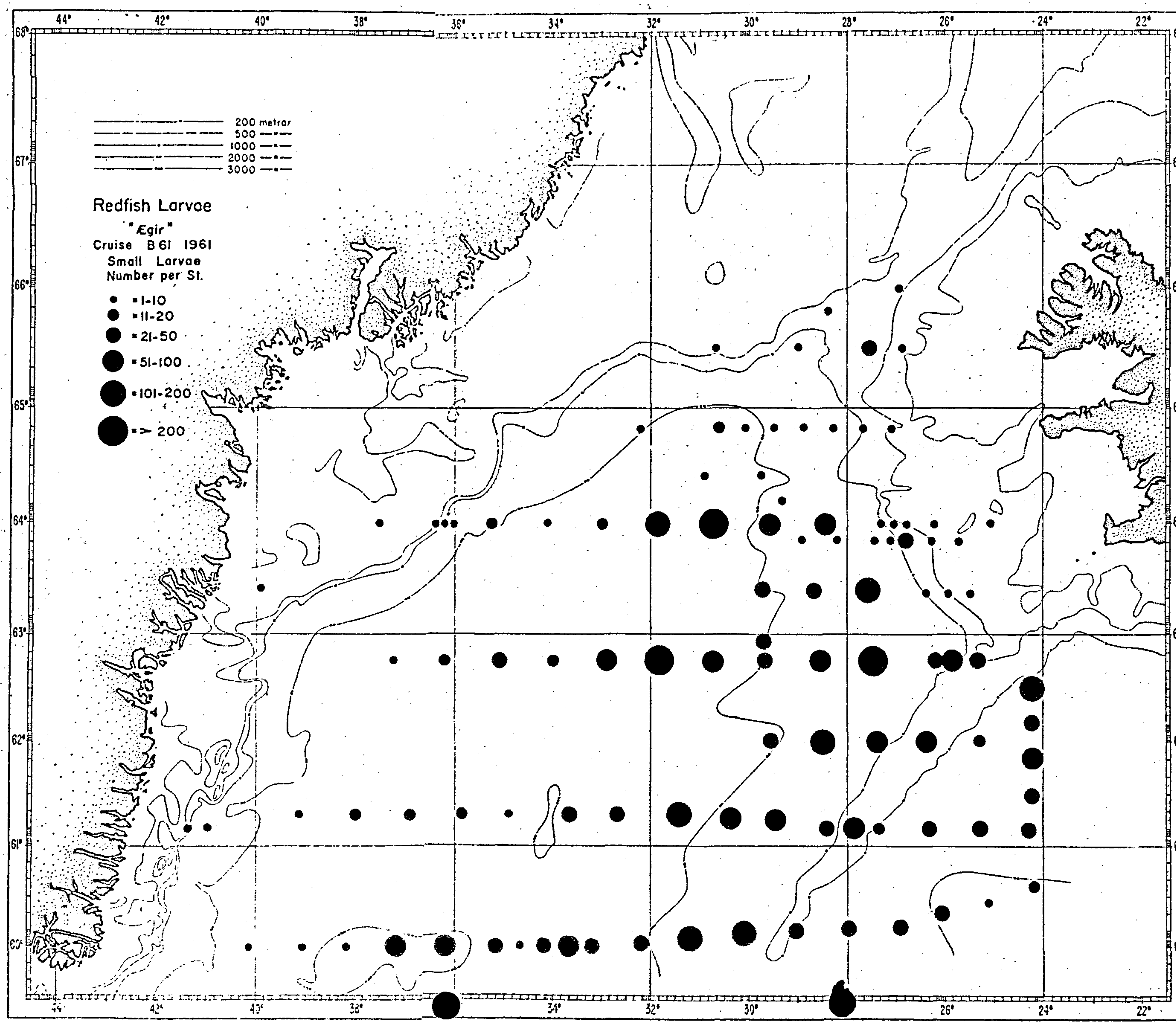

Fig. 4. Distribution of Small Redfish Larvae (7 mm and Smaller) in May 1961.
Negative Stations Omitted.