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Eel larvae in the Skagerak

by

Armin Lindquist

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The catches of eel in the Skagerak, the Kattegat and the Baltic basin are considerable. According to ICES statistics they amounted in 1969 to 5477 tons, to which must be added the eel caught in freshwater.

All these eels originate from larvae which drift from north of Scotland into the Skagerak, from where they drift farther into the Baltic. Little information is available as to how this drift occurs in the North Sea area, and none at all on how eel larvae are distributed in time and space in the Skagerak and the Kattegat.

Variations in the catches of eel have been great during recent years and to ascertain the causes it was considered of great value to get some idea of the quantities of immigrating eel larvae. This gave rise to the present work.

Occasional unpigmented eel larvae, c. 7-9 cm long, have been observed in the open Skagerak during the period February to April. They were caught in plankton nets and sledge net in daylight. These old finds, which were made during plankton studies with entirely different objectives, give no information at all about the occurrence in time and space.

ASK, BERNTSSON & LINDQUIST (1971) showed for the first time how, by light experiments, it was possible to obtain some knowledge of the abundance and horizontal distribution of eel larvae (Table 1). Most of the larvae were observed (and caught) during the darkest hours of the night, between 2100 and 0300 hours.

The experiments did not give any information about the vertical distribution of the larvae. During work with underwater television, larvae were observed only in the surface layer. Horizontal and vertical hauls with plankton nets during daylight at the same stations gave no catches. We tried, therefore, to find some means of straining large quantities of water. Numerous trials were made with a high speed plankton sampler, type Gulf III, of Dutch construction, but no eel larvae were caught.

We then decided to try other gear, made to catch larger species of plankton, the Isaacs-Kidd Midwater Trawl (IKMWT). This is described in Figure 1. The mesh size in the cone during the first trial was 0,5 cm, which implies that the net was stretched the meshes were almost completely closed. The trawl was used at different depths[1] according to the situation of and just above the thermocline. Since nothing was known with certainty about the vertical distribution of eel larvae, this was considered to be a good approach, particularly as the trials were made at station after station continuously day and night. The results were totally negative, for no eel larvae were obtained.

[1] The depths were determined by means of wire length and angle or at a depth of >25 m by a wireless netsonde.

At the next trial an extra short cone was sewn inside the large one, with fixed square meshes 0.15 cm in size (see Fig. 1). A check with living eel larvae (caught round an underwater lamp) showed that the larvae could not pass through meshes of this size. The inner, fine-meshed cone was very short in relation to the trawl, to counteract water resistance.

Hauls were made at different depths (see Table 2); hauls from 0830 to 1130 hrs in the daytime and from 2130-0030 hrs at night. Eel larvae were caught only at night and at the surface (there was one exception: since the IKMWT cannot be closed, however, this larva may have entered the net while it was on the way to the surface). It should be borne in mind here, that "surface" means a considerable volume of water, for the IKMWT, on account of its construction, fishes at least the top three metres. No special lighting was used at the surface with the IKMWT during night fishing.

The results encouraged us to make a trial during the darkest hours of the night (2100-0300 hours) to cover a large area with many stations. The results are shown in Figure 2. In view of the system of currents within the area, it can be concluded that the eel larvae drift in with the Jutland Stream.

The region studied north of Denmark has an area of approximately 20'x 20' and our catches were, on an average, 14 larvae per hectare. The Jutland Stream flows eastward from the surface to the bottom, and has a velocity of at least one knot (according to Swedish pilots' manuals). This current velocity implies that during twenty-four hours the larvae can drift from the region and that the stock of eel larvae within the 20'x 20' area is renewed. This means 2.10^6 larvae a day. A month's intensive immigration at this rate would give 60.10^6 larvae. Since the earliest larvae were found in February, immigration into the Skagerrak certainly goes on for several months, with unknown variations in intensity.

The figure calculated above, 2.10^6 larvae/day, is a minimum, for some of the eel larvae no doubt pass through the meshes in the front part of the IKMWT.

A comparison with similar studies is of interest. DEELDER (1960) fished eel larvae off the coast of Holland with long nets, with a diameter of 1 m, anchored at the surface and bottom. These experiments showed that silver eels are more active at night and that they swim mainly with the tides. DEELDER quotes CREUTZBERG regarding the possibility that the eel larvae burrow in the sediment at low water, but considers himself that many larvae swim at greater depths in the daylight. In the laboratory at Lysekil, eel larvae have been kept in aquaria, and it was observed that in the daytime they remained at the bottom. In the open sea it is also possible that during the daytime they are scattered widely in the water and are thus practically impossible to catch.

At our studies, the catches made with the IKMWT during the night at the surface amounted to only 5-15 eel larvae per half-hour haul. Eels do not swim very rapidly as far as can be observed round a lamp at the surface. The IKMWT was towed at the rate of two knots, and this speed is therefore quite sufficient. In an aquarium the larvae do not swim very rapidly either.

The present material gives no further information about the hydrographic situation. DEELDER's work shows, however, that higher temperatures of water (4-5° C) have no effect except in assemblies round brackish water. The results of experiments made in the Gullmarfjord in 1970, when there was a rich occurrence of larvae, neither confirm nor refute this observation.

The total material of plankton comprises at least twelve species and the occurrence of some of them is interesting, particularly the distribution of herring larvae (Fig. 3). This refers to herring larvae 4-6 cm long, obviously originating from autumn spawning in 1971. Hauls at different depths show

that herring larvae occur not only in the surface water, but also down to a depth of at least 40 m. Their occurrence should therefore be studied by means of oblique hauls. Since herring larvae are caught in small numbers only in the daytime, investigations of these larvae must be made at night, too, (cf. Tab. 1).

Summary

1. Unpigmented eel larvae can be attracted with light at the surface of the water; they are most numerous in the middle of the night.
2. Unpigmented eel larvae can be caught with the Isaacs-Kidd Midwater Trawl at the surface; they are most numerous in the middle of the night.
3. During April 1972, per 24 hours at least two million eel larvae drifted with the Jutland Stream into the Skagerak.
4. It seems probable that during the daytime eel larvae are widely scattered in the free water, some may be near the bottom.

References

ASK, L., BERNTSSON, L.-E. & LINDQUIST, A., 1971: Ålyngel in Skagerak. - Meddelande från Havsfiskelaboratoriet, Lysekil, No. 101, 3 pp + 3 figs.

DEELDER, C.L., 1960: Ergebnisse der holländischen Untersuchungen über der Glasaalzug. - Arch. Fischereiwiss. 11(1): 1-80.

Tab. 1. Number of eel larvae which has been observed at the surface round an underwater lamp. The lamp was of 500 W and hang abt. a half metre below the surface. The observer's eyes were abt. 2 m above the surface. For stations see Fig. 1. Information regarding 1969 and 1970 from ASK, BERNTSSON & LINDQUIST 1971.

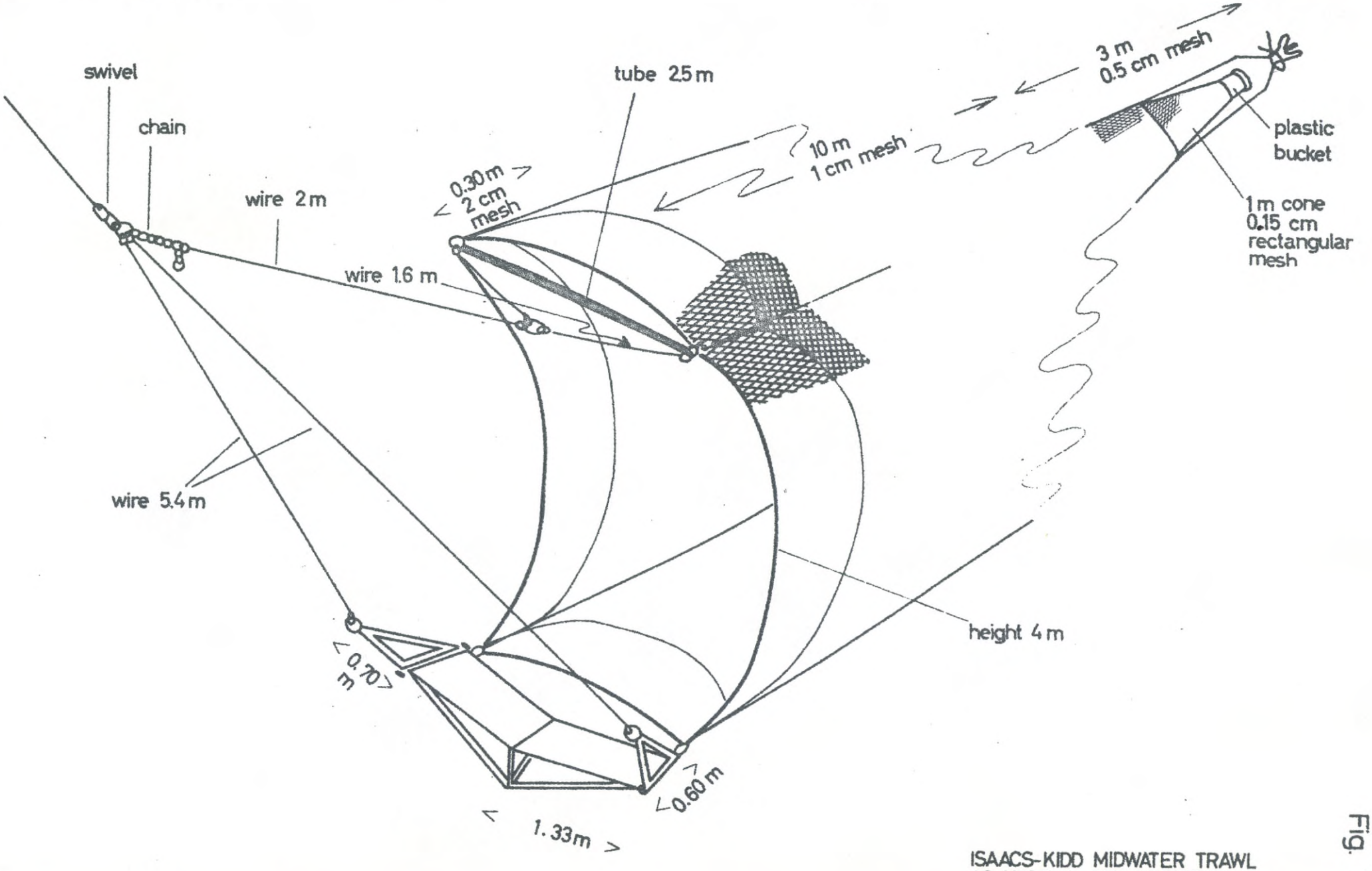
Station No.	1. Kosterfjord		2. Brofjord			3. Fiskebäckskilsbukt			4. Askerö fjord	5. Marstrands-fjord	6.	7.	8.
Date	21.-22.4.69	2.4.70	16.4.69	15.4.70	6.4.72	15.4.69	6.4.70	4.4.72	7.4.70	8.4.70	14.4.70	9.4.70	13.4.70
Kl													
1930-2030		-		-	-		3	1	-	-	-	1	1
2030-2130		-		-	1		51	54	-	2	3	-	3
2130-2230		15		-	19		116	36	-	14	3	-	8
2230-2330		11		-			121	53	1	5	2	-	13
2330-0030		12	ca 25	1		ca 28	106	86	1	1	1	-	2
0030-0130	ca 60	10		1			52	71	-	4	2	-	2
0130-0230		3	?	-	?	?	2	13	-	4	2	-	-
0230-0330	?	-		-			-	-	-	7	1	-	2
0330-0430		-		-			2	-	-	1	1	-	3
Total		51		2			453	314					

Tab. 2. Vertical distribution of fish larvae in the Gullmarfjord (off the Bay of Fiskebäckskil). Day and night 5./6.4.1972. Hauls with an Isaacs-Kidd Midwater Trawl.

Haul No.	Time haul	Depth of headline m	Catch of larvae											
			Ammodytas	Anguilla	Aphya+Cry-stallogobius	Blennidae excl. Lumpenus	Clupea	Hippoglossoides	Limanda	Lumpenus	Liparis ad.	Syngnathus	Trisopterus	Sprattus ad.
Dagen														
18	0829-0859	0.5	1							1				
19	0905-0935	8				1							1	
20	0940-1010	17.5								2				
21	1025-1055	26.5-33			2								1	
22	1103-1133	38			11									
Natten														
27 & 28	2334-0037	0 x)	0.5	6	2.5		5.5	0.5				0.5		7.5
26	2300-2330	9			6		10						1	194
25	2224-2254	18			38	4	3			1	1			168
24	2144-2214	32	1	1	54	4	2		1					77
23	2105-2135	43			66	1				7 ad.				108

* 2 hauls 1/2 hour each; mean value.

Institute of Marine Research
S-453 00 LYSEKIL SWEDEN



ISAACS-KIDD MIDWATER TRAWL AS USED IN EEL INVESTIGATIONS APRIL 1972

Fig. 1

Fig. 2

UNPIGMENTED EEL LARVAE

APRIL 1972

Number of larvae in half-hour night hauls with IKMWT at surface

⊗ =light stations

59°

58°

Fig. 3
HERRING LARVAE
(apparently born autumn 1971)
APRIL 1972

Number of larvae in half-hour night hauls with IKMWT at surface

59°

58°

40

12

22

20

>97

71

42

201

40

14

53

53

6

64

20

602

16

3

5

8

2

1

4