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The food of herring larvae of Norwegian spring spawners

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INTRODUCTION

To study the relationship between gut content of herring and the zooplankton composition, an investigation was carried out in a locality off Møre in spring 1967. The material was collected during the period 4 - 10 April, around a current cross placed in a larval consentration (drift station 1 in Dragesund and Nakken 1968).

Oblique hauls were taken at noon and midnight with 3 Clarke-Bumpus plankton samplers equipped with nets of nylon, mesh size 90 μ . The total towing time was five minutes and the samplers were raised in 5 m steps each minute. After the outburst of phyto-plankton, the duration of the total towing time was reduced to one minute to prevent clogging. The sampling depths were 25-5 m, 50-30 m and 75-55 m and the towing speed was 1.5 - 2 knots. The samples were each divided into hundred sub-samples with The Whirling Wessel (Wiborg 1951) and two of these samples were counted. The sizes of the larvae and the yolk were measured. Dissection of a randomly sample of 100 larvae, showed that the gut content

could be detected as external bulges by superficial examination.

RESULTS AND DISCUSSION

The zooplankton was evidently denser in the upper 25 m than in the lower depths. Also a heavy increase in copepod eggs were recorded at the end of the sampling period. The copepods and the copepodites distributed more evenly through the whole sampling depth, but also for these organisms a small increase could be traced for the upper haul. Calanus finmarchicus-eggs constituted about 90 % of the copepod eggs, and C. finmarchicus nauplii about 80 % of all copepod nauplii. Of the other species Oithona similis was most frequent.

Of 440 larvae examined 223, or 51 % contained food particles. Of the larvae caught in daylight, 76 % had gut content, in contrast to 32 % of the larvae caught at night. Thus the feeding activity was redused by night.

The larvae were seperated in four groups depending on the size of the yolk sac (Table 2). Larvae at the beginning of the yolk sac stage occurred less frequently with gut content than larvae at later stages. This indicates that the larvaes need for food - or its feeding ability increased at an age of three to four days after hatching.

The gut content was divided in four groups, and of the total number of food particles Calanus finmarchicus-eggs constituted 94 %; C. finmarchicus-nauplii 3 %, copepodites and adults of Microsetella norvegica 1 % and others 2 %. In numbers, eggs of Copepods constituted 63 % in the plankton samples, copepod-nauplii 25 % and Microsetella spp. 7 % . Due the found differences in the composition between available plankton and gut content it is assumed that the larvae selected Calanus-eggs, either because of preference, or because eggs were easier to catch. Bowers and Williamson (1951) stressed the importance of copepods at all stages as food for larval. But, although copepods in our samples constituted 43 % of the plankton samples, they only represented 3 % of the gut content. Soleim (1942) found that eggs at Calanus constituted the only food of animal origin in herring larvae, but his material was rather scarce. Byside the eggs he found green food remains in the guts. Exsept for one Cosinodiscus sp., no green food remains were observed in the present material.

No correlation was found between the number of copepod-

eggs present in the daylight hauls and the number of eggs in the guts (Table 4). The percentage of larvae of larvae containing food (51 %), is relatively high compared with other findings; Bowers and Williamson (1951), found a percentage of 28. It is therefore reasonable to assume that larval food was abundant during the period of our investigation.

SUMMARY

1. The gut content of herring larvae in plankton samples taken around a current cross located in a larval-concentration was examined.

2. Calanus finmarchicus-eggs constituted in numbers 93 % of the particles in the gut content.

3. No correlation was found between the number of eggs in the samples and number of eggs in the guts.

4. It is assumed that larval food was abundant during the period of investigation.

REFERENCES

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Table 1. Density of zooplankton.

Sampling depth	Station number	2a	3c	4a	5	6	7	8	9	10	11	12	Total
25-5 m	Copepod eggs	2199	889	495	857	3664	12113	11004	11904	17338	29333	14386	104182
	Copepod nauplii	791	2330	388	1011	428	4262	5676	3009	3773	3435	5498	30601
	Copepodites and adults	430	128	35	608	110	176	1074	835	1752	1487	1867	8502
	Microsetella spp.	11	13	13	102	-	393	174	134	46	358	-	1244
	Others spp.	11	-	13	122	69	163	873	89	281	830	549	3050
50-30 m	Copepod eggs		1192	994	2579	2957	1549	1977	1543	1214	2257	1167	17429
	Copepod nauplii		1683	1183	1308	2834	1250	1322	876	1587	963	2077	15038
	Copepodites and adults		603	293	749	473	289	463	544	592	490	511	5007
	Microsetella spp.		23	138	25	219	-	386	104	159	48	128	1230
	Others spp.		46	50	150	68	30	124	83	63	280	299	1193
75-55 m	Copepod eggs		544	2201	1185		1754	2284					7968
	Copepod nauplii		278	1650	251		2383	870					5432
	Copepodites and adults		194	349	244		1118	141					2046
	Microsetella spp.		-	14	2		-	19					35
	Others spp.		-	-	4		52	96					152

Table 2. Number of herring larvae in different yolk sac stages during the investigation period. Number of larvaes with food in the guts, in brackets. Daylight hauls even station numbers, night hauls uneven numbers.

Station numbers	1	2a	2b	3a	3b	3c	4a	4b	5	6	7	8	9	10	11	12	Total
Depths of sampling	25-0	25-0	25-0	25-0	25-0	75-0	25-0	75-0	75-0	50-0	75-0	75-0	50-0	50-0	50-0	50-0	
Without yolk sac	1	4(4)	4(4)	5	10(3)	27(8)	21(15)	26(23)	31(11)	16(15)	10(5)	4(3)	3(1)	1(1)	4(1)	3(1)	170(95)
Small yolk sac	3	6(6)	7(5)	10(3)	-	28(6)	11(9)	17(12)	27(11)	18(17)	10(5)	1	-	-	6(1)	2(1)	146(76)
Medium yolk sac	4(4)	4(2)	1(1)	5(1)	-	20(6)	2(2)	4(4)	10(7)	2(2)	4	4(2)	9(5)	3(2)	-	1	73(38)
Large yolk sac	-	3(1)	-	1	1	8	2(2)	2(2)	4(3)	3	4(1)	3	8(1)	6(1)	6(3)	-	51(14)
Total	8(4)	17(13)	12(10)	21(4)	11(3)	83(20)	36(28)	49(41)	72(32)	39(34)	28(11)	12(5)	20(7)	10(4)	16(5)	6(2)	440(223)

Table 3. Numbers of different food particles in the guts of the sampled herring larvae.

Station number	1	2a	2b	3a	3b	3c	4a	4b	5	6	7	8	9	10	11	12		
Sampling depth	25-0	25-0	25-0	25-0	25-0	75-0	25-0	75-0	75-0	50-0	75-0	75-0	50-0	50-0	50-0	50-0	Total	%
Calanus eggs	5	37	26	16	5	35	53	106	43	140	30	14	32	13	13	2	570	94
Calanus nauplii	1	1	-	-	-	-	-	-	-	5	-	10	-	-	-	1	18	3
Microsetella spp.	-	-	-	-	-	1	-	2	4	2	-	-	-	-	-	-	8	1
Others spp.								2z	1x	4x	1y	3x					11	2

x: Unidentified remains

y: Coscinodiscus sp.

z: Eggs of Oithona similis

Table 4. Number of larvae caught, (in brackets larvae with gut content), number of Calanus finmarchicus-eggs pr larvae, and number per larvae of Calanus finmarchicus-eggs found in the gut.

Sampling depths	Station number	2a	4b	6	8	10	12
25-5 m	Number of larvae	17(13)	27(24)	9(7)	1(1)	5(8)	2(1)
	Calanus finmarchicus eggs per larvae	550	70	2400	12600	3700	5600
	Numbers per larvae of Calanus-eggs found in the guts	2.17	2.25	3.00	9.00	2.40	1.00
50-30 m	Number of larvae	-	15(14)	30(27)	6(11)	5(1)	4(1)
	Calanus finmarchicus-eggs per larvae	-	250	350	1400	1150	1350
	Numbers per larvae of Calanus-eggs found in the guts	-	2.67	3.78	0.83	0.20	0.00
75-55 m	Number of larvae	-	7(3)		5(0)		
	Calanus finmarchicus-eggs per larvae	-	1100		9700		
	Numbers per larvae of Calanus-eggs found in the guts	-	0.57		0.00		