COPEPODS IN THE STOMACH OF A NOTOTHENIID FISH, *TREMATOMUS BORCHGREVINKI* FRY AT SYOWA STATION, ANTARCTICA

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Abstract: Copepods in stomach contents of fry of a nototheniid fish, *Trematomus borchgrevinki* which were caught on September 6, 1970 were examined to acquire information on the winter populations of copepods in the sea covered with the fast ice near Syowa Station (69°00′S, 39°35′E), Antarctica. The stomach contents were composed of *Ctenocalanus vanus, Stephus longipes*, two unidentified calanoid species, *Oithona similis, Oncaea curvata*, a few unidentified harpacticoid species, nauplius of copepods and unidentified copepods. *O. similis* and copepod nauplius were dominant. The component species of the stomach contents resembled those of the samples collected by vertical hauls of a plankton net in late autumn and in early spring. However, the relative abundance of copepod species in the stomach contents differed from that in the net samples. This may be reasonably ascribed to possible food preference of fish. Therefore, it is possible to assume that the winter populations of copepods do not differ from the late autumn and early spring populations.

1. Introduction

Seasonal occurrence of copepods in the sea area covered with ice near Syowa Station (69° 00′S, 39° 35′E) preliminarily investigated by FUKUCHI and TANIMURA (1981). However, they missed winter samples. The present authors tried to acquire information on planktonic copepods in the winter season by the examination of the stomach contents of fry of *Trematomus borchgrevinki* BOULENGER which were caught on September 6, 1970 near the plankton sampling site of the Kita-no-seto Strait. Information that fry of *T. borchgrevinki* swim beneath the sea ice and feed mainly on copepods (GRUZOV *et al.*, 1976; ANDRIASHEV, 1968, 1970) was taken into account. At the same time, the authors considered that attention should be paid to the possible difference between the relative abundance of copepod species in the stomach contents and that in the plankton net samples, depending on the food preference of the fish.

2. Materials

By accident, 14 individuals of *T. borchgrevinki* fry were caught by a dip net from the water rushing into a hole which just had been bored through the sea ice. It is probable that they were driven by the water from just beneath the sea ice. Immediately after capture, they were frozen at temperature of about −25°C on the sea ice, and then fixed and preserved in 10 per cent formalin sea water. Stomach contents of five out of 14 fishes were examined for the present work.

3. Results and Discussion

Stomach contents of five fries were composed of copepods, appendicularians, tintinnids and others. More than 90 per cent of the stomach contents were occupied by copepods. *Ctenocalanus vanus, Stephus longipes*, two unidentified calanoid species, *Oithona similis, Oncaea curvata* and a few unidentified harpacticoid species were distinguished. In addition, nauplius of copepods and unidentified copepods digested to some extent were also counted. The component species substantially agreed with those of the net samples (FUKUCHI and TANIMURA, 1981).

The number of individuals and the relative abundance of copepods in the stomach contents are shown in Table 1. The most prominent species was *O. similis* and it occupied more than 50 per cent. The percentage of nauplius was high next to that of *O. similis* and it appeared to become higher with the degree of repletion of fish.

Species composition of copepods sampled with net in late autumn and in early spring is given in Table 2. The leading component in the net samples was nauplius and its percentage was 40 to 80 per cent. *O. similis* and *O. curvata* were prominent following nauplius except for the sample of November 22, 1970. Their dominancies were at an approximately equal level on March 28 and April 10. On October 23, the dominancy of *O. curvata* was higher than that of *O. similis* but not so much. In general, species composition of copepods in late autumn was similar to that in early spring. Moreover, such environmental conditions as water temperature, chlorinity, pH and dissolved oxygen seem to be uniform during the winter season (HOSHIAI, 1969). Therefore, it is assumed that the composition of copepods in winter may be essentially the same with those in late autumn and in early spring. Based on this assumption, a comparison between the relative abundance of copepods in the stomach contents and that in the net samples was made.

In Fig. 1, the relative abundance of copepods in the stomachs and the net samples is illustrated with 90 per cent confidence interval. The percentage of *O. similis* is higher than that of nauplius in the stomach, being reverse in the net samples. Probably the fish preferred *O. similis* to nauplii. Although the percentage of *O. similis* and *O. curvata* was approximately equal in the net samples, the former was higher than the latter in the stomachs. The *T. borchgrevinki* fry is likely to prefer *O. similis* to *O. curvata*.

The *O. similis* population was composed of adult and copepodit I to V. The *O. curvata* population consisted of copepodit II to III. The body length of *O. similis* was 0.53 to 1.00 mm and that of *O. curvata* was 0.36 to 0.51 mm. Nauplius was 0.20 to 0.41 mm in body length. If *T. borchgrevinki* selects larger copepods, the percentage of *O. similis* should become higher than that of nauplius and *O. curvata* in the stomach as observed here.

The *T. borchgrevinki* fry swim and feed on the copepods just beneath the bottom of the sea ice (GRUZOV *et al.*, 1967; ANDRIASHEV, 1968, 1970). From the bottom

Table 1. Copepods in stomach of T. borchgrevinki fry.

Fish	a		b		c		d		e	
Total length (mm)	45.5		45.4		38.7		49.8		47.9	
Copepod species	Individ. No.	%	Individ. No.	%	Individ. No.	%	Individ. No.	%	Individ. No.	%
Ctenocalanus vanus	7	4.83	3	0.64	1	0.26	3	2.08	6	1.20
Stephus longipes	0	0	0	0	0	0	1	0.69	1	0.20
Calanoid species	0	0	5	1.06	14	3.65	0	0	0	0
Oithona similis	102	70.34	250	52.85	244	63.54	79	54.86	257	51.61
Oncaea curvata	3	2.07	1	0.21	13	3.38	0	0	5	1.00
Harpacticoid species	2	1.38	9	1.90	15	3.91	11	7.64	25	5.02
Copepod nauplius	20	13.79	190	40.17	84	21.88	13	9.03	194	38.96
Unidentified copepods	11	7.59	15	3.17	13	3.38	37	25.69	10	2.01
Total	145		473		384		144		498	

Table 2. Copepods collected by vertical hauls of plankton net in the Kita-no-seto Strait (modified from FUKUCHI and TANIMURA, 1981).

Date	28 Mar. 70		10 Apr. 70		23 Oct. 70		22 Nov. 70	
Copepod species	Individ. No.	%	Individ. No.	%	Individ. No.	%	Individ. No.	%
Ctenocalanus vanus	4	0.93	2	0.25	1	1.25	0	0
Stephus longipes	0	0	0	0	0	0	2	0.68
Paralabidocera antarctica	0	0	0	0	0	0	0	0
Oithona similis	84	19.44	186	24.00	8	10.00	19	6.48
Oncaea curvata	80	18.52	191	24.70	17	21.25	12	4.10
Harpacticoid species	7	1.62	80	10.35	2	2.50	24	8.19
Copepod nauplius	257	59.49	315	40.70	52	65.00	236	80.55
Total	432		774		80		293	

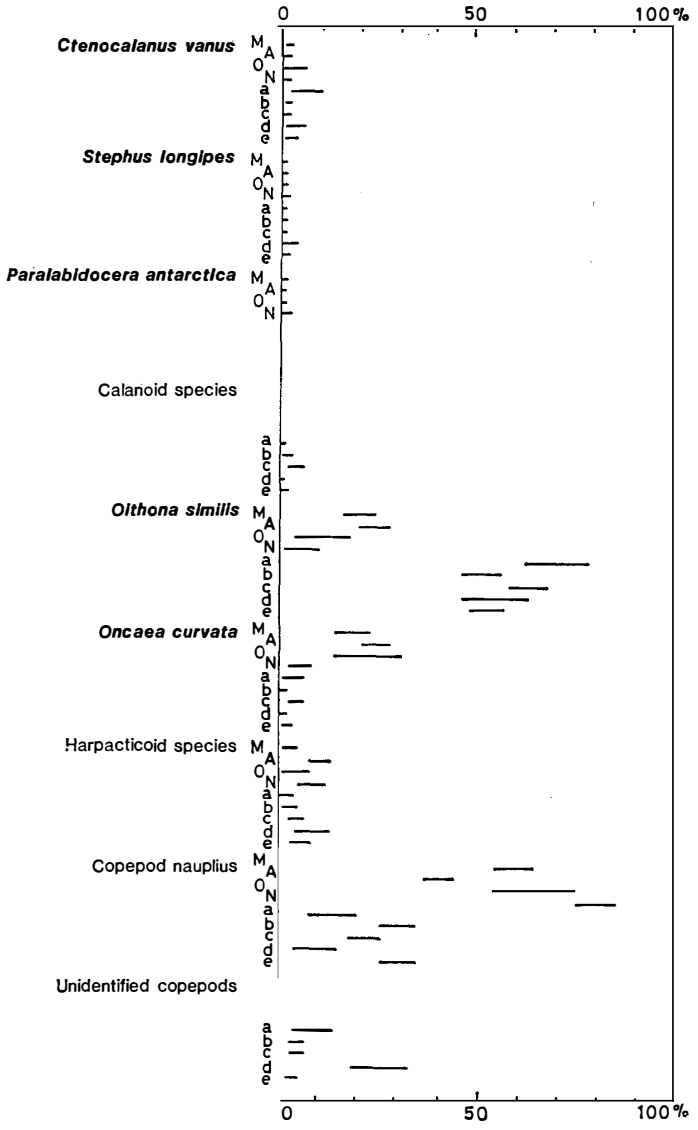

Fig. 1. Relative abundance of copepods in net samples and in stomachs of T. borchgrevinki. Bars show 90 per cent confidence interval of the abundance. M, A, O and N denote the net samples collected on March 28, April 10, October 23 and November 22 (see Table 2). Letters a to e denote individual fishes designated in Table 1.

part of the ice cores sampled in the Kita-no-seto Strait, abundant nauplii with a few unidentified adult copepods were commonly found in winter. The density of nauplius was 39/cm^2 on September 11, 1975. Consequently, it is thought that swarms of nauplius are formed just beneath the undersurface of the sea ice and the swarms make

feeding easier for fish. This may be a reason why higher percentage of nauplius was found in two fishes (Fig. 1), despite of their possible higher selectivity for larger copepods. During their selective feeding on *O. similis* just beneath the sea ice, they might frequently encounter with nauplius swarms.

Acknowledgments

The present authors thank Dr. Tatsuro MATSUDA, leader of the 11th Japanese Antarctic Research Expedition, and the members of the 11th and the 16th Japanese Antarctic Research Expeditions, in which the senior author participated, for their assistance in the field works.

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(Received July 21, 1980; Revised manuscript received September 1, 1980)