FISH FAUNA IN THE NORTHEASTERN PARTS OF LÜTZOW-HOLM BAY WITH SOME NOTES ON THE STOMACH CONTENTS

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Abstract: The investigation on the fish fauna was performed in the northeastern parts of the Lützow-Holm Bay in 1980 by trap gear and angling in winter season of May to September and summer season of December respectively. Total 35 stations were set in selected depth range such as 20–100 m of littoral zone, 100–200 m of continental shelf or sublittoral zone, and 200–840 m of glacial trough zone to study vertical distribution. The stomach contents of 75 specimens were also preliminarily investigated.

The dominant fish species was *Trematomus bernacchii* in littoral zone, however, *T. hansoni* took dominant place in continental shelf or sublittoral zone. In the deeper glacial trough zone, *T. scotti*, *T. loenbergii* and *Austrolycichythys brachycephalus* appeared. The some Amphipoda, Euphausiacea, fish eggs and Polychaeta appeared in high frequency (20–40%) in the stomach of these fishes, and they were revealed to be important prey of these fishes.

1. Introduction

The benthic fish fauna in the waters around the Antarctic Continent was studied in the northeastern parts of the Lützow-Holm Bay, where wide variation of submarine topography exist. There were compiled quite small information concerning on the fish fauna in this region. Only some check list of fishes collected in this region was reported by ABE and HOSHIAI (1972). The author, merely intending to add some information on its distribution, collected the fish samples from different depth to know the vertical distribution, species composition by different depth and food items. Concerning the vertical distribution of the fishes in the Antarctic continental region, many workers had reported and DEWITT (1971) reviewed them, even though this study was the first trial in this region. Recently, krill was seemed to be most important preys for some of Antarctic benthic fishes (TARGETT, 1981; TAKAHASHI, 1981), therefore the study on stomach contents is also undertaken.

2. Materials and Methods

The investigation on fish fauna under the coastal ice in the northeastern parts of the Lützow-Holm Bay, Antarctica, was performed in winter season from May to

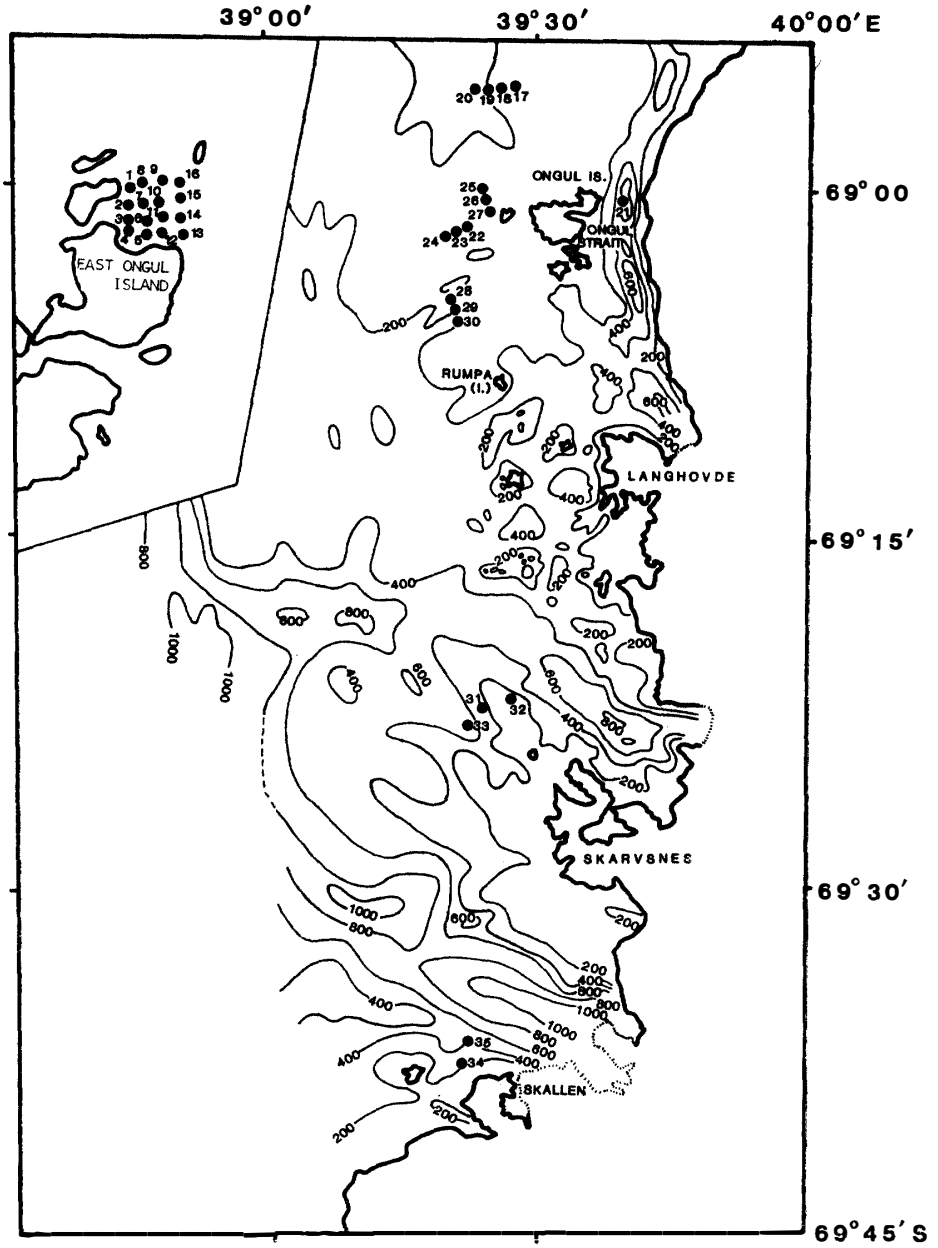

Fig. 1. Submarine topography and the location of Stns. 1–35 for trap sampling in the northeastern parts of Lützow-Holm Bay.

September by trap nets, and additionally in December by angling. The trap sampling was operated at 35 stations (Fig. 1), repeating 4 times of hauling nets in 1–6 days intervals at each station. Concerning the hauling interval, the trap nets were left in water bottom for several days due to bad weather condition, even though it was designed to operate once a day. In each station water depth was measured by the depth meter (Yanagi Co., Ltd. model BS-04) or the fish echo sounder (Furuno Electronic Co., Ltd. model FE-D614). The bottom trap gear used in this study was the trap nets for mid-water shrimp fishing (commercial use in Japan Sea–Fig. 2). The bait fish was the mackerel and the sardine, and in the most stations, trap sampl-

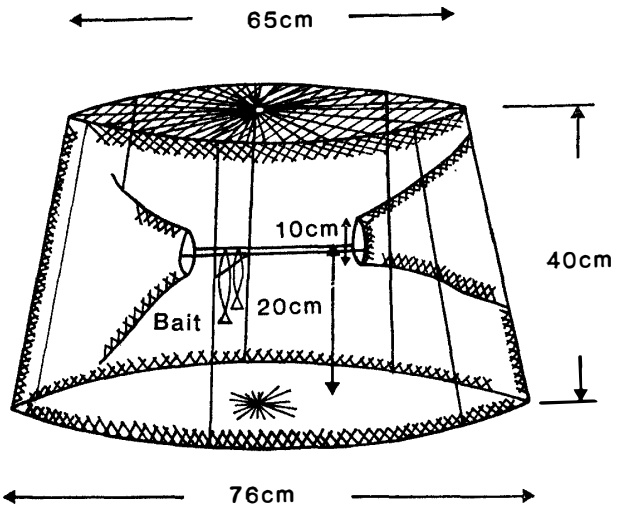

Fig. 2 Size and structure of the trap nets used in this study.

ing was successfully performed, however, in Stns. 19 and 28 trap gear was lost without obtaining any data owing to the ice break caused by pressured ridge of ice. The range of depth distribution was 18–840 m.

Concerning the angling in December, it was undertaken in coastal shallow water (less than 200 m, minimum 1.5 m) without setting any routine sampling stations to collect the surface or mid-water fishes and so on.

All collected samples were kept in the deep freezer at Syowa Station, and after taking back to the laboratory of the Institute samples were transferred to the 10% formalin to examine the stomach contents.

3. Submarine Topography of the Study Area

The submarine topography is relatively well-known in the northeastern parts of Lützow-Holm Bay where the present study was undertaken. As shown in Fig. 1 and Table 1, the area where the Stns. 1–16 were settled is very shallow and littoral area that is named Kita-no-ura Cove. According to FUJIWARA (1971), the Kita-no-ura Cove is characterized by the shallow water (mostly less than 50 m) with gentle slope and shallow basin forming the rocky floor. The area of the Stns. 17–20, 22–27, 28–30 is relatively shallow forming the upper continental shelf that develope in the off northeastern part of Prince Olav Coast where several tens of islands scatter. The Ongul Strait area where the Stn. 21 settled is very deep water forming the glacial trough (FUJIWARA, 1971). This trough (maximum depth more than 600 m) does not connect to the deep sea ocean in the north but isolated like basin. The Stn. 21 and Stns. 31–35 (except Stn. 32) were settled in the much deeper sea where the glacial troughs on lower continental shelf develope. These deeper trough seemed not to be basin-like but connected to the larger trough developing in the central part of the Lützow-Holm Bay (Fig. 1).

As written above, in the present study, the sampling stations were classified into three categories. 1) Coastal and littoral zone less than depth of 100 m, 2) Up-

Table 1. Depth of station, date of operation and fishes collected in each station.

Station number	Depth (m)	Date (1980)	Numbers of fishes collected	
Stn. 1	42.5	May 6–10	*T. bernacchii*	9
			T. hansoni	2
Stn. 2	21.0	〃	*T. bernacchii*	5
			T. hansoni	1
Stn. 3	43.0	〃	*T. bernacchii*	4
			T. hansoni	6
Stn. 4	22.5	〃	*T. bernacchii*	3
			T. hansoni	4
Stn. 5	20.5	June 11–17	*T. bernacchii*	1
Stn. 6	23.0	June 7–16	*T. bernacchii*	6
Stn. 7	55.0	〃	*T. bernacchii*	9
			T. hansoni	1
Stn. 8	72	June 5–15	*T. bernacchii*	3
			T. hansoni	4
Stn. 9	47.0	June 19–24	*T. bernacchii*	5
Stn. 10	51	〃	*T. bernacchii*	4
			T. hansoni	1
Stn. 11	31.5	〃		0
Stn. 12	29.0	〃	*T. bernacchii*	15
			T. hansoni	4
Stn. 13	17.0	June 26–30	*T. bernacchii*	11
Stn. 14	33.0	〃	*T. bernacchii*	2
Stn. 15	18.0	〃	*T. bernacchii*	5
Stn. 16	34.0	〃	*T. bernacchii*	10
Stn. 17	128	July 2– 6	*T. bernacchii*	5
			T. hansoni	3
Stn. 18	143	——	——	—
Stn. 19	164	July 3–10	*T. bernacchii*	4
			T. hansoni	5
Stn. 20	123	〃	*T. bernacchii*	1
			T. hansoni	5
Stn. 21	680	July 12–16	*T. hansoni*	1
			A. brachycephalus	6
Stn. 22	89	July 22–29	*T. bernacchii*	7
			T. hansoni	4
			T. centronotus	1
Stn. 23	69	〃	*T. bernacchii*	2
			T. hansoni	1
Stn. 24	182	〃	*T. bernacchii*	2
			T. hansoni	1
Stn. 25	147	Aug. 3–12	*T. bernacchii*	3
			T. hansoni	6
Stn. 26	163	〃	*T. bernacchii*	2
			T. hansoni	5
Stn. 27	73	〃	*T. bernacchii*	2
			T. hansoni	5
Stn. 28	220	——	——	—
Stn. 29	127	Aug. 12–16	*T. hansoni*	2

T.: *Trematomus*, *A.*: *Austrolycichthys*

Table 1. (Continued)

Station number	Depth (m)	Date (1980)	Numbers of fishes collected	
Stn. 30	168	Aug. 12–16	*T. bernacchii*	2
			T. hansoni	3
Stn. 31	450	Sept. 3– 7	*T. scotti*	1
Stn. 32	83	Sept. 3– 5	*T. hansoni*	1
Stn. 33	307	Sept. 6– 8	*T. bernacchii*	3
			T. scotti	4
Stn. 34	316	Sept. 10–13	*T. hansoni*	6
			T. loennbergii	1
Stn. 35	840	Sept. 12–14		0

T.: *Trematomus*, *A.*: *Austrolycichythys*

per continental shelf or sublittoral zone, depth of 100–200 m, 3) Glacial trough or lower continental shelf zone, depth of 200–800 m.

4. Species Composition

The fishes collected in this study amounted to 350 specimens (209 by traps and 141 by angling). As shown in Table 2, these samples were composed of 6 genus and 11 species. As regards the fish species in this study waters, ABE and HOSHIAI (1972) reported 8 species such as *Trematomus bernacchii*, *T. hansoni*, *T. newnesi*, *T. nicolai*, *T. centronotus*, *Pagothenia borchgrevinki* and *Gymnodraco acuticeps*. As regards *T. vicarius*, it also having been reported by them, it was supposed to be the variation of *P. borchgrevinki* as described by NORMAN (1940). *Austrolycichthys brachycephalus* and *Pleuragramma antarcticum* also have already found in this re-

Table 2. The list of fishes collected from Syowa Station and adjacent waters in 1980.

Species		n.s.	%
Trematomus bernacchii	+*	220	62.9
T. hansoni	+*	88	25.1
Pagothenia borchgrevinki	*	18	5.1
Austrolycichthys brachycephalus	+	6	1.7
Trematomus centronotus	+*	4	1.1
T. scotti	+	4	1.1
T. newnesi	*	3	0.9
Dissostichus mawsoni	*	3	0.9
Gymnodraco acuticeps	*	2	0.6
Trematomus loennbergii	+	1	0.3
Pleuragramma antarcticum	(+)	1	0.3
Total		350	100.0

+: by trap fishing, *: by angling, ( ): tangled by the ceiling net of the trap gear.

gion (HOSHIAI 1976; FUKUCHI 1978). These species except *A. brachycephalus* were caught in the littoral zone near around Syowa Station (69°00′S, 39°35′E). In this study, it was tried to collect samples in the deeper zone of glacial trough, and some of new species such as *T. scotti* and *T. loennbergii* to this region were recorded.

The species composition as a whole as shown in Table 2, shows clear tendency that *T. bernacchii* is most dominant occupying 62.9% and *T. hansoni* also 25.1% of total catch. These two species occupyed 88% of total catch. However, sampling method was not standardized in this study, therefore midwaterfish like *P. antarcticum*, *P. borchgrevinki* appeared much lower frequency than what it is.

5. Vertical Distribution

As already mentioned, trap gear sampling was carried out at 35 stations which were settled in separate depth range. In this chapter, vertical distribution of the fishes collected only by trap sampling in the winter season was studied. As seen in Table 3, total 245 specimens including 2 genus and 6 species were collected by the gear. The number of species is about half of the number listed in Table 2, that included the samples of angling collection performed in the very shallow littoral zone in summer season. This reduced number of species in Table 3 may be due to that trap sampling mostly had been carried out in much deeper waters and in dark winter season where fish fauna is getting much poor and when the fishes are inactive as compared with in the shallow zone and in summer season.

Species composition differed very much by the depth. As in Table 3, in the littoral zone of 0–50 m and 50–100 m depth range, *T. bernacchii* is quite dominant occupying 83.6% and 63.5% of total catches. In the upper shelf zone of 100–150 m and 150–200 m range, however, *T. hansoni* occupied the dominant species instead

Table 3. Species composition by the different water depth (including 36 samples caught by trial trap operation undertaken in April).

Depth (m)	Species	n.s.	%
0-50	*Trematomus bernacchii*	92	83.6
	T. hansoni	18	16.4
50-100	*T. bernacchii*	33	63.5
	T. hansoni	18	34.6
	T. centronothus	1	1.9
100-150	*T. bernacchii*	9	29.0
	T. hansoni	22	71.0
150-200	*T. bernacchii*	11	36.7
	T. hansoni	19	63.3
200-	*T. bernacchii*	3	13.6
	T. hansoni	7	31.8
	Austrolycichthys brachycephalus	6	27.3
	T. scotti	5	22.7
	T. loennbergii	1	4.6

of *T. bernacchii* showing the 71.0% and 63.3% respectively. In the much deeper waters such as the glacial trough or the lower shelf zone the different species such as *Austrolycichthys brachycephalus*, *T. scotti* and *T. loennbergii* appeared, despite the appearance of *T. hansoni* in the high frequency of 31.8%. In this study, the deepest station (Stn. 35) was settled at 840 m depth point where none of fishes or benthic organisms were caught. The second deepest station (Stn. 21) was at 680 m depth point in the isolated basin where *A. brachycephalus* and *T. hansoni* were collected. *T. scotti* and *T. loennbergii* were collected at the depth 340 m and 450 m where the glacial trough connect to the offshore deep sea in the center parts of the Lützow-Holm Bay. This may indicate that *T. scotti* and *T. loennbergii* are much more offshorelike and do not appear in the littoral zone.

From above, the vertical distribution range of some fishes was obtained by the result of both trap and angle sampling. *T. bernacchii* appeared from 1.5–307 m and *T. hansoni* from 1.5–680 m, while the distribution other species was not determined due to the small number of collection. However, *Gymnodraco acuticeps*, *T. cintronotus* and *T. newnesi* were collected by angling gears in the shallow waters less than 30 m, and seemed to be littoral zone fishes. As regards the deeper fishes, as already mentioned *T. scotti* and *T. loennbergii* appeared in the waters deeper than about 300 m, and *A. brachycephalus* was collected from depth of 680 m of isolated glacial trough basin. From above, despite the short data, tentative schematic vertical distribution was drawn in Fig. 3.

According to DEWITT (1971), *T. bernacchii*, *T. newnesi*, *T. nicolai* (recorded by ABE and HOSHIAI, 1972), *T. centronotus* and *G. acuticeps* are near-shore (sublittoral) species, and *T. hansoni*, *T. scotti*, *T. loennbergii* and *Dissostichus mawsoni* are nearshore (sub-

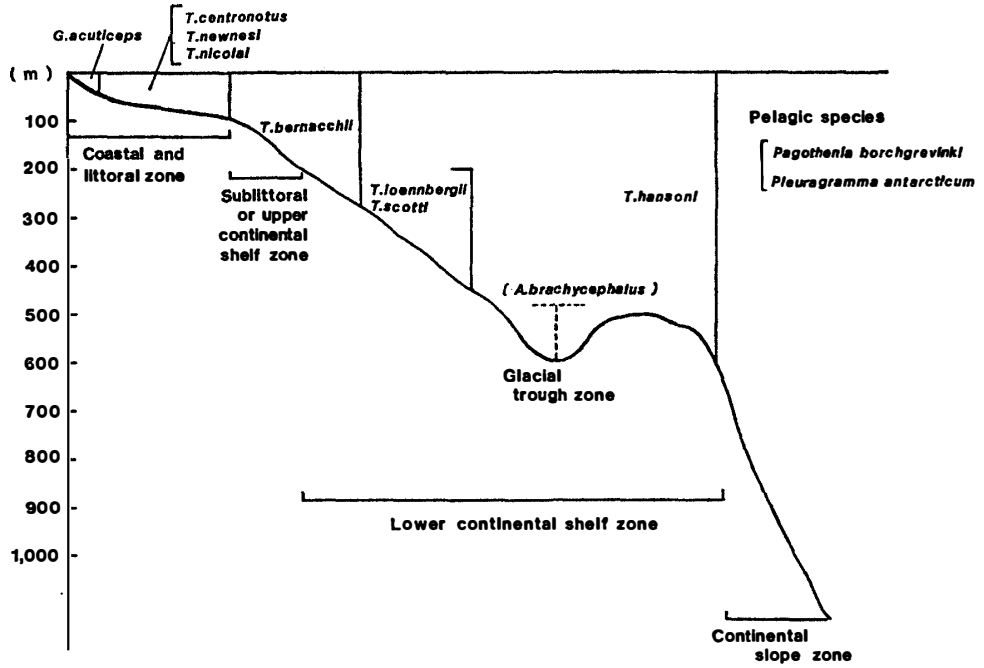

Fig. 3. Schematic vertical distribution of the fishes in the northeastern parts of Lützow-Holm Bay.

littoral) and continental-shelf species. He also referred *A. brachycephalus* as continental-shelf and upper-slope (bathyal) species. In this respect the result of this study showed a good accordance with his review.

6. Stomach Contents

The stomach contents of the 209 fishes caught by trap sampling were investigated. From the stomach of 134 fishes out of 209 fishes examined, none of food or only bait fishes were found. The stomach contents of 75 specimens were sorted and preliminary identified. In this study, the dry weight or wet weight of the stomach contents were not recorded either, but only appearance frequency of each food item was recorded. As shown in Table 4, the fishes prey the fish eggs, Amphipoda, Euphausiacea or Polychaeta at almost the same frequency (15.3–30.2%) without showing clear specific differences. Despite the importance of these food items, as regards Amphipoda which were attracted by the bait fish, the importance of the Amphipoda as prey, therefore, may be reduced to a certain degree. It is also very questionable that fish eggs became important prey of benthic fish, because the fish eggs are very seasonal product themselves and produced by themselves. In this study egg species were not identified, two kinds of eggs, however, were found. The digestive condition of the eggs in each stomach was almost the same, and maximum 207 eggs were found. These may indicate that fishes swollen the eggs at a month that were spawned in a block. As regards the Euphausiacea, it is decidedly concluded that the fishes eat the Euphausiacea on the bottom. Nothing being known about the krill distribution and abundance in the coastal ice coverage area, it may be true that the benthic fishes strongly depend on the krill not only in coastal ice region, but in offshore region. TAKAHASHI (1981) reported that Nototheniidae fishes heavily prey the krill on the bottom of the South Shetland Islands. TARGETT (1981) also reported the importance

Table 4. Appearance frequency of prey consumed by fishes collected in this study.

Food item	*T. hansoni* (31)	*T. bernacchii* (42)	*T. scotti* (1)	*A. brachycephalus* (1)	Total
Myctophidae	1(2.3%)				1(1.0%)
Fish eggs	13(30.2%)	9(15.3%)			22(29.3%)
Euphausiacea	10(23.3%)	14(23.7%)		1(50.0%)	25(23.8%)
Amphipoda	10(23.3%)	15(25.4%)	1(100.0%)	1(50.0%)	27(25.7%)
Isopoda	4(9.3%)	3(5.1%)			7(9.3%)
Macrura	1(2.3%)				1(1.0%)
Pycnogonida		1(1.7%)			1(1.0%)
Polychaeta	2(4.7%)	12(20.3%)			14(13.3%)
Adamussium colbecki		1(1.7%)			1(1.0%)
Gastropoda	1(2.3%)				1(1.0%)
Opisthobranchia		3(5.1%)			3(2.9%)
Porifera		1(1.7%)			1(1.0%)
Hydrozoa	1(3.2%)				1(1.0%)
Unidentified	5	16		3	24

of krill as a prey of Nototheniidae fishes. It being still uncertain that, from the point of view of food supply, the krill is much more adaptive on the bottom in the austral winter when phytoplankton production reduces. It is hypothetically considered that on the bottom phytoplankton (sediment-like) that was produced in the surface, may not be desolved and will be exist for longer time for the sake of cool water.

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