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YOUNG SQUIDS COLLECTED WITH 10-FOOT IKPT NET DURING THE JARE-28 CRUISE, 1987

Tsunemi KUBODERA

National Science Museum, 23–1, Hyakunin-cho 3-chome, Shinjuku-ku, Tokyo 160

Abstract: Fifty young squids were obtained from the samples collected with 8 oblique tows of the 10-foot IKPT in the Antarctic and Indian Oceans during February–March, 1987 on the JARE-28 cruise. Seven species were identified among which *Alluroteuthis antarcticus* was the dominant. The distribution patterns differ by species and they are correlated with oceanographic domains. The Antarctic endemic species tended to be abundant in near coastal water suggesting the importance of mixing waters of Antarctic Circumpolar Current (ACC) and coastal water for their reproduction.

1. Introduction

In the Antarctic waters, pelagic squids are no doubt important food items for higher predators such as sperm whales (CLARKE, 1977, 1980), seals (CLARKE and MACLEOD, 1982a, b), penguins (CROXALL and LISHMAN, 1987) and other sea birds (RODHOUSE *et al.*, 1987). From the viewpoint of potential fisheries resources, pelagic squids in the Antarctic waters have also been the object of attention (VOSS, 1973; ROPER, 1981).

Although a large biomass of pelagic squids in the Antarctic waters has been thought to exist, they have never been caught adequately by conventional sampling gears corresponding to the presumption. This is partially due to the strong swimming and net avoidance capabilities of pelagic squids. The seasonal and regional differences of their abundance may also affect the scarcity of squid catch. The recent study using the large opening-closing net, such as RMT 1+8 M, for an Antarctic squid *Galiteuthis glacialis* (RODHOUSE and CLARKE, 1986) showed details of latitudinal and vertical distributions in their early life stage. This indicates that the investigation on the early life stages is one of the effective approaches for clarifying the distribution of animals that have a high swimming ability in the adult stage. Studies on the early life stages are also important for understanding their reproductive strategy.

For the purpose of clarifying distribution of pelagic squids of the early life stages in the Antarctic Ocean, 10-foot IKPT net sampling was carried out during the JARE-28 cruise on board the SHIRASE, February–March, 1987.

2. Materials and Methods

The 10-foot IKPT net consisted of the diving vane of 10-foot IKMT (ISSACS and KIDD, 1953) and the net having about 9 m^2 mouth opening and 16 m long with 0.5 mm mesh throughout. The net was released with a drawing-out wire at a speed of 1 m/s till 3000 m wire was paid out. Then the net was pulled horizontally for about one hour before it was retrieved with wire speed of 1 m/s. The ship's speed was kept at about 2–3 knots during the operation. Eight sampling operations were carried out all in daytime. The components of each sample were classified into large jelly, zooplankton, fish and squid, which were all preserved in a 5–10% sea-water formalin. Dorsal mantle length of squid and wet weight of zooplankton were measured in the laboratory. Zooplankton biomass was converted into wet weight in grams per nautical mile from the record of a depth-distance meter.

3. Results

3.1. Oceanographic domains and zooplankton biomass

According to the oceanographic observation made during the cruise, sampling area was divisible into three domains, namely, the Antarctic region where water temperature at a depth of 100 m was below 3°C, the Subantarctic region where water temperature at 100 m was between 3–7°C, and the Tropical region where water temperarure at 130 m was over 13°C. Among eight sampling stations, five were in the Antarctic, one in the Subantarctic and two in the Tropical region, respectively. The relative zooplankton biomass was the highest in the Subantarctic region and that in the Antarctic region was generally half thereof. In the Tropical region, the relative zooplankton biomass was less than half that of the Antarctic region (Fig. 1).

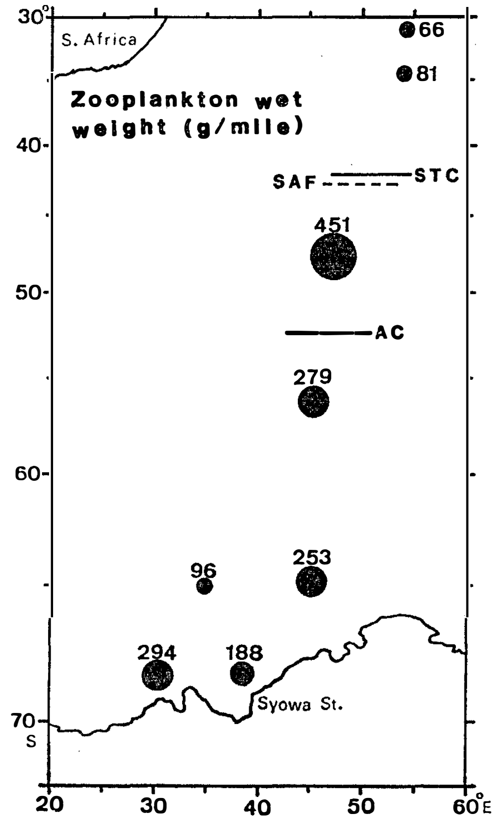


Fig. 1. Stations at which 10-foot IKPT net was towed and zooplankton biomass was converted into wet weight (g/nautical mile).

3.2. Cephalopod collections

Fifty young squids were obtained from the present samples and seven species were identified (Table 1). *Alluroteuthis antarcticus* was the dominant species yielding 18 individuals. *Galiteuthis glacialis* was the next with 13 individuals plus three that were too small to be determined to species level but presumably belong to this species. It was followed by nine specimens of *Psychroteuthis glacialis*, four specimens of *Brachioteuthis picta*, one each specimen of *Onychoteuthis banksi* and *Histioteuthis atlantica* in decreasing order.

Table 1. Young cephalopods collected by oblique haul of 10-foot IKPT net during the JARE-28 cruise on board SHIRASE in the Antarctic and Indian Ocean, February–March, 1987.

Date Position	Feb. 4 68°21′S 38°19′E	Feb. 5 68°31′S 30°37′E	Feb. 24 65°03′S 34°42′E	Feb. 26 64°56′S 45°10′E	Mar. 4 56°19′S 45°10′E	Mar. 7 47°42′S 47°03′E	Mar. 10 34°59′S 53°24′E	Mar. 11 30°59′S 54°08′E	Total
Onychoteuthis banksi	0	0	0	0	0	0	0	1	1
Histioteuthis atlantica	0	0	0	0	0	0	1	0	1
Psychroteuthis glacialis	1	5	2	1	0	0	0	0	9
Alluroteuthis antarcticus	0	7	8	3	0	0	0	0	18
Brachioteuthis picta	0	0	0	0	0	4	0	0	4
Galiteuthis glacialis	0	0	4	6	2	1	0	0	13
Galiteuthis sp.	0	0	1	2	0	0	0	0	3
Unidentified	0	0	0	0	0	1	0	0	1
Total	1	12	15	12	2	6	1	1	50

3.3. Distribution pattern by species

Four different distribution patterns were recognized: (1) appearing only in the area near the coast (*A. antarcticus* and *P. glacialis*: Fig. 2a, b); (2) appearing widely in the Antarctic and Subantarctic regions (*G. glacialis*: Fig. 2c); (3) restricted in the Subantarctic region (*B. picta*: Fig. 2d); (4) appearing only in the Tropical region (*O. banksi* and *H. atlantica*: Fig. 2e).

3.4. Size composition

A. antarcticus had a narrow size range between 13–19 mm DML with the peak at 14–16 mm. *P. glacialis* had the size range between 8 and 18 mm DML. *B. picta* contained individuals of relatively large size of 24–30 mm DML. *G. glacialis* had wide size range between 9 and 60 mm DML (Fig. 3). The size of *O. banksi* and *H. atlantica* was 17.8 and 7.3 mm DML, respectively.

4. Discussion

According to OKUTANI (1984), ROPER *et al.* (1984) and LUBIMOVA (1985), 12–13 species of squids are distributed in the Antarctic region, among which only 5–6 species are considered to be endemic to the Antarctic. LUBIMOVA (1985) pointed out that the scarcity of squid beaks in the bottom sediments in the Antarctic suggested that all squids migrate from the Subantarctic and northern area into the Antarctic only in the summer season, or the abundance of true meso- and bathy-pelagic squids is very low in the Antarctic. She also suggested that Antarctic squids might be distributed densely in the area around the Polar Frontal Zone judging from the distributions of squid predators and prey.

The specimens obtained in the present survey were too few to draw any conclusion about biology and ecology of Antarctic squids. But, the collection of early life stages of *P. glacialis* and *A. antarcticus* suggests their reproductive activities in the Antarctic region. Both species appeared restrictively in the coastal water, and this fact indicates the importance of mixing water of Antarctic Circumpolar Current (ACC) and coastal water for their reproduction. *G. glacialis* is also considered to reproduce in the Antarctic region. However, the distribution pattern and size composition of *G. glacialis* differed from those of the above-mentioned two species. These observations indicate the different reproductive strategies among species. RODHOUSE and CLARKE (1986) showed that *G. glacialis* is distributed densely in the depth stratum of 300–400 m in its early life

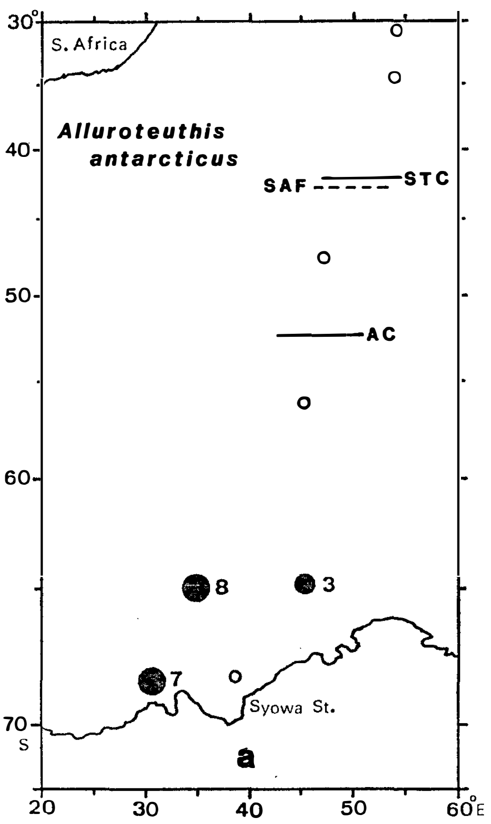


Fig. 2a.

Figs. 2a–e. Distribution of young squid by species with the number of individuals collected. AC; Antarctic Convergence, SAF; Subantarctic Front, STC; Subtropical Convergence.

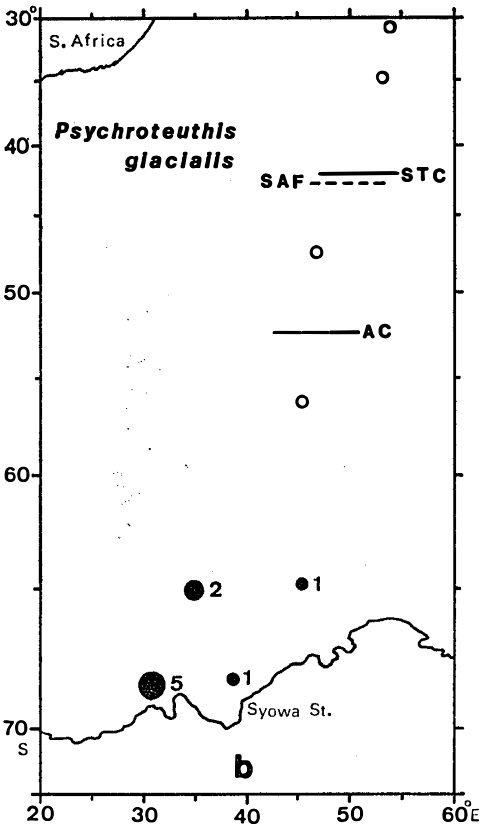
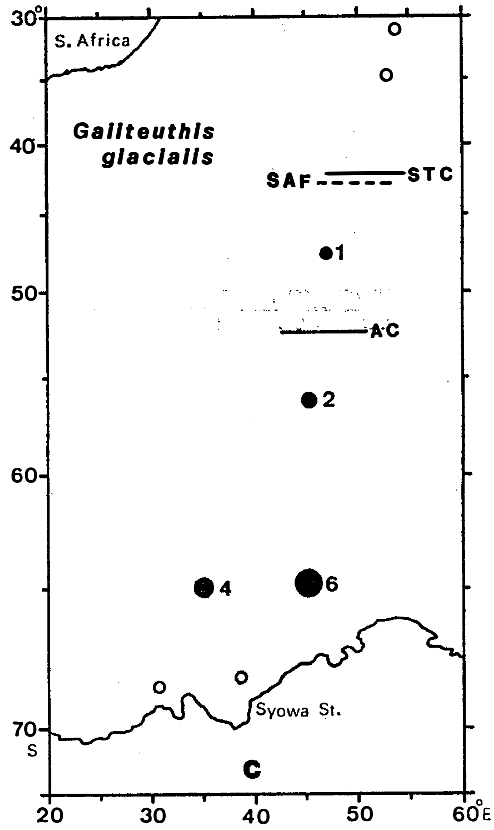


Fig. 2b.



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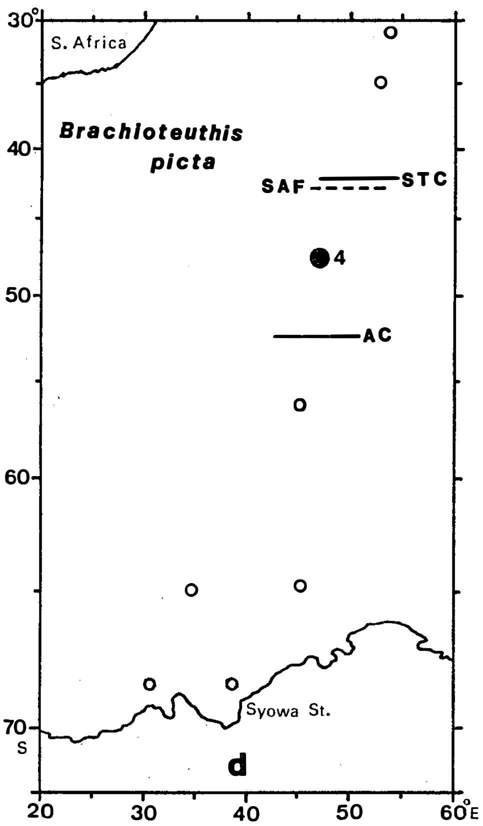

Fig. 2d.

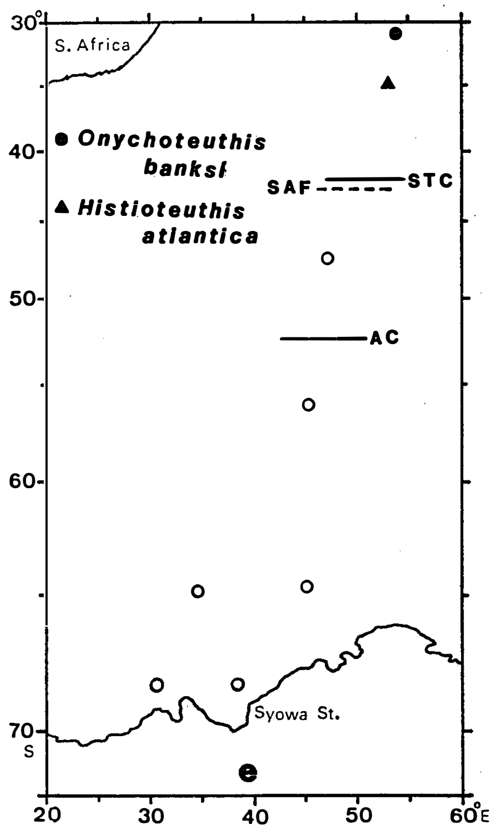

Fig. 2e.

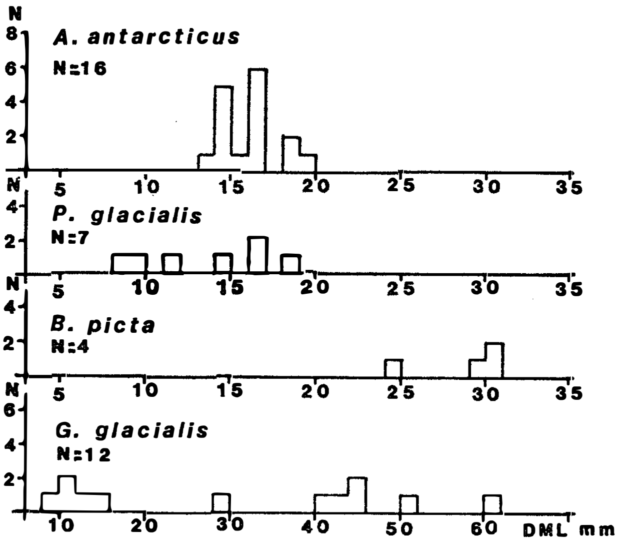

Fig. 3. Size composition of four species in the present collection.

phase smaller than 20 mm DML and they ontogenetically spread to greater depths. They also pointed that this densely distributed layer is just beneath the density discontinuity at Antarctic cool surface layer and warm deep waters, where intensified biological activity arises from peaks of phytoplankton biomass. Such stratum yielding a large primary production may also be important for early life stage of pelagic squids in the Antarctic through the food chain there. Occurrence of *B. picta* from the Indian sector of Antarctic indicates possibility of circumpolar distribution of this species. This species seems to be distributed around the Polar Frontal Zone.

KUBODERA and JEFFERTS (1984) reported distribution and abundance of the early life stages of squid in the northern North Pacific. Comparison of relative abundances between their results and the present sampling is not appropriate due to the differences of net construction and sampling protocol. However, more than 45 individuals of young squids were collected on average by 10 min towing of Larva net, which had only one meter square mouth opening, in the northern North Pacific in summer. The present collection of young squids in the Antarctic waters was by far less in number than the Pacific. Is such a scarcity of young pelagic squids in the Antarctic Ocean true in nature, as was suggested by LUBIMOVA (1985)? It is also considered that the present sampling area and season did not coincide with their aggregation due to reproductive activities. In order to solve the problem, further extensive research is necessary, especially in the mixing waters of ACC and coastal water, and in the boundary layer of cool surface water and warm deep water in the offshore waters of the Antarctic Ocean.

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