THYSANOËSSA MACRURA AS A FOOD OF BALEEN WHALES IN THE ANTARCTIC

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A giant euphausiid, *Euphausia superba* has been only considered as the staple food of baleen whales in the Antarctic waters, because almost all baleen whales in the Antarctic feed exclusively on the swarms of *Euphausia superba*. Some other euphausiids, such as *Euphausia crystallorophias*, *E. frigida*, *E. triacantha* also widely distribute from the sub Antarctic to high Antarctic zone. But few of above species have been noted as the food of Antarctic baleen whales. The Antarctic neritic species, *Euphausia crystallorophias* is considered to bear some value as a food of little piked whales, some blue and fin whales in the high latitude of Ross Sea (Marr, 1956), however, it has never been observed in waters out of the pack ice.

An Antarctic *Thysanoëssa*, *Thysanoëssa macrura* G. O. Sars distributes largely in the Antarctic waters and it is a very common euphausiid next to *E. superba* (Rustad, 1930 ; Ruud, 1932), though it has never been observed in the stomachs of whales in previous studies except three cases by Peters (1956). Rustad (1930) describes on this point that *E. superba* and *Thysanoëssa macrura* play the predominant part as food for larger animals, e.g. whales seals, and birds. Of the two species *E. superba* seems to play the greater part, this species alone being recorded from almost all stomach contents containing euphausiids. And *T. macrura* has never been found as a staple diet of baleen whales.

In 1956, Japanese whaling expeditions operated in the so called whaling area I and VI where the whaling operation had been forbidden until that year. In some euphausiids samples collected through above operations, dominant appearances of *Thysanoëssa macrura* are observed. These Japanese collections covered wide areas from 50° east to 100° east longitudes, from 170° west to 80° west longitude. And so many numbers of samples have been collected in the following season of 1957. *T. macrura* is found again in considerable number of samples. Thus, *T. macrura* is considered to play some part as the staple food of Antarctic baleen whales, though in has never been noticed by any investigations before this report.

The result that *Thysänoessa macrura* was not observed in collections in 1955, might be due to the fact that the samples of 1955 were restricted to the waters from 80° east to 130° east longitude in the so-called

whaling area IV. The numbers of whales examined and samples collected in the successive years are listed in tables from 1 and 2.

TABLE 1. NUMBER OF WHALES EXAMINED AND SAMPLES COLLECTED IN THE WATERS WEST OF 100° E IN 1956 AND NUMBER OF WHALES EXAMINED AND SAMPLES COLLECTED IN THE WATERS EAST OF 170° W IN 1956

West	Whale species				East	Whale species			
Number of whales	Fin	Blue	Humk-back	Sei	Number of whales	Fin	Blue	Humk-back	Sei
Whales examined	978	97	95	1	Whales examined	3535	278	145	6
Whales fed	496	52	55	1	Whale fed	2477	148	92	5
Collected samples	25	4	1	—	Collected samples	69	3	3	—
Unknown	8	1	—	—	Unknown	—	7	—	—

TABLE 2. NUMBER OF WHALES EXAMINED AND SAMPLES COLLECTED IN THE WATERS EAST OF 170° E IN 1957

	Whale species			
Number of whale	Fin	Blue	Humk-back	Sei
Whales examined	5832	611	71	133
Whales fed	2478	311	47	55
Collected samples	301	37	4	5
Unknown	1	—	—	—

Description of *T. macrura* G. O. Sars

The rostrum is narrow and lanceolate, reaching to a little back to the end of the first antenuular segment. Lateral margin of carapace bear a denticle on its two-third from the tip of the margin. Eyes are large with a transverse constriction above the middle. Antennulae with the upper flagellum is somewhat shorter than the sum of the two distal peduncular joints. Second thoracic legs are very elongate, with the merus reaching beyond the end of the antennular peduncle. Oschium and merus are very strong and heavy. Carpus somewhat is curved distally bearing about 6 or more setae. The propodus is about one-fourth as long as carpus, bearing about 7 to 14 setae on both margins. The dactylus is broad and bears 4 to 5 strong setae and 3 to 5 slender setae. Abdomen without any keel or spine, telson bears two pairs of dorsal spines. Six abdomnal segment is fully as long as the sum of the two preceeding segments. Preanal spine of females is indented, but rather smooth in males. This sexual distinction is well developed in young specimens. Terminal process of the copulatory organ distally expanded in both sides and especially outwards. Proximal process and lateral process are rather

slender and terminal parts curved. Spine-shaped process is curved through about 90° angle. Females attain to about 29 mm from the tip of the rostrum to the last of telson, on the other hand the adult males

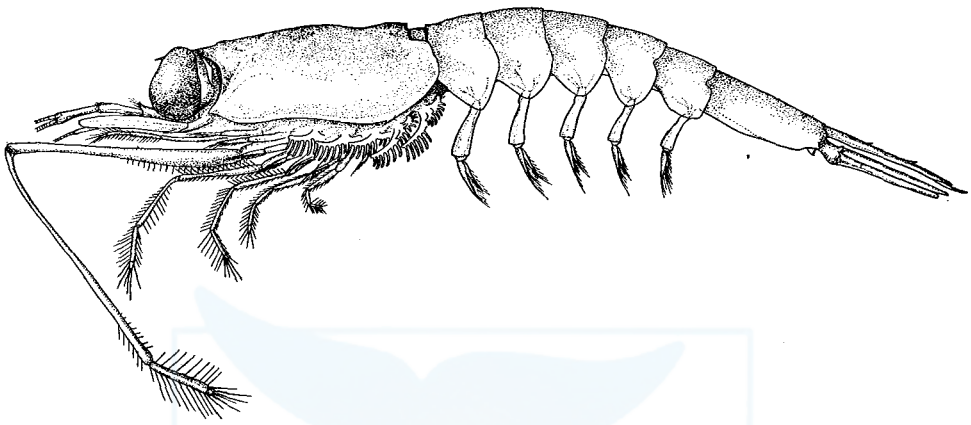

Fig. 1. Adult female of *Thysanoëssa macrura* G. O. Sars.

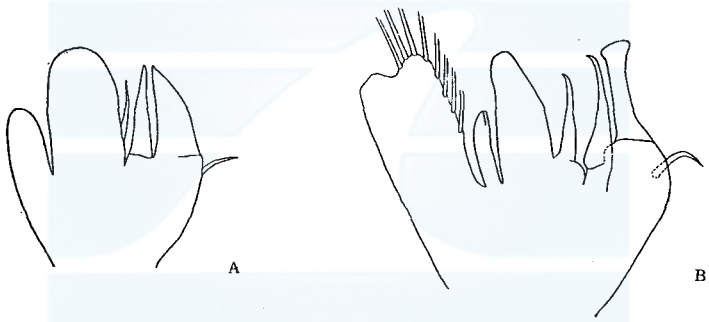

Fig. 2. Male copulatry organs of *T. macrura* A. inmature male B mature male.

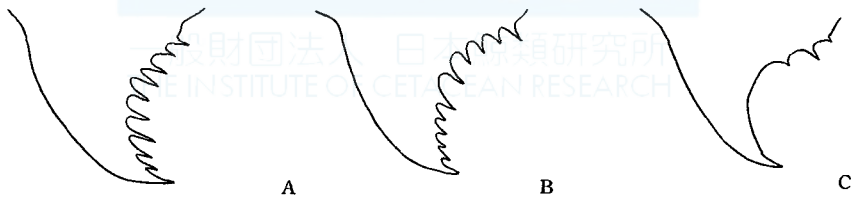

Fig. 3. Preanal spines of *T. macrura*. A. inmature female. B. mature female C. mature male

are far smaller, only 20 mm in the largest specimens as described by Hansen (1911). Females are always dominant in number among the patches of *T. macrura* like northern Pacific euphausiids.

OCCURRENCE

Thysanoëssa macrura is found in our collections as shown in tables 3 and 4. In 1956, 5 samples are found containing *T. macrura* in 105 ones. No other euphausiid is observed in these 5 samples, and observations by biologists on board confirm that the stomachs were satiated only with this *T. macrura* in above 5 samples. The further collections in 1957, show also such ratio of occurrences as in the previous year. Of course other collected samples consist of only *Euphausia superba* in various stages. The mingled collections with *E. superba* and *T. macrura* are also observed in less number in both years. In these mingled collections, specimens of *E. superba* are rather young ones and full grown euphausiid have never been observed. So the sizes of *E. superba* is not so large as adult specimens in these mingled samples.

The eyes of *T. macrura* is fragil like the North Pacific *Thysanoëssa T. longipes* (Nemoto, 1957). When *T. macrura* is found among *Euphausia superba*, the eyes of *T. macrura* are nearly digested. On the other hand, those of *E. superba* remain undigested.

As shown in table 5, the occurrences of *T. macrura* differ in each month of the whaling season. The most dominant appearance is observed in the late decade of January and the first decade of February. In other decades, comparatively few samples of *T. macrura* are observed, and we see none of them in many samples in March. From above facts, some seasonal or distributional pecuriarity of *T. macrura* is suggested.

In 1956, a Japanese fleet operated in the waters from 40° east to 90° east longitudes so called whaling area III. From these 30 samples, *T. macrura* is found in two samples collected in the waters near 40° east line, and none of *T. macrura* is found in other collection from 50° 90° east longitude as shown in figure 4. And 5 samples of *T. macrura* are found in the waters near 130° east longitudes

In 1957, many samples of *T. macrura* are collected in the area from 135° west to 100° west longitudes. Except the waters near the pack ice in this area, *T. macrura* is considered to be important as a food of whales as shown in figure 5. In the waters from 170° west to 140° west, many collections of stomachs of whales are all *E. superba* but one *T. macrura*. In this area we have also none of *T. macrura* in the previous year. It may be considered from above facts that *E. superba* does not distribute so uniformly, and perhaps *E. superba* is scarce or *T. macrura* is very common in this area. Thus many whales that fed on *T. macrura* may be found in our researches.

During the Antarctic whaling season in 1957, oceanographical data were collected on the board of the factory ship "Nisshin-maru" at in-

terval of 4 hours, the discussion of which will be published after the examination and we may state simply its quatation here for our study. Oceanographic conditions of January and February show, generally, water masses of the lower temperature and salinity are formed by melting ice towards the north. On the other hand, water masses of the higher temperature and salinity run towards the south.

TABLE 3. OCCURRENCE OF *THYSANOËSSA MACRURA* IN THE JAPANESE COLLECTION OF STOMACH CONTENTS OF BALEEN WHALES IN 1956

Euphansiid species	East of 170° W Whale species			Euphansiid species	West of 100° E Whale species		
	Fin	Blue	Hunp-back		Fin	Blue	Hunp-back
E. superba	65	3	3	*E. superba*	23	4	1
T. macrura	4	—	—	*T. macrura*	1	—	—
				E. superba *T. macrura*	1	—	—

TABLE 4. OCCURRENCE OF *THYSANOËSSA MACRURA* IN THE JAPANESE COLLECTION OF STOMACH CONTENTS OF BALEEN WHALES IN 1957

Euphansiid species	Whale species			
	Fin	Blue	Hunp-back	Sei
E. superba	274	36	1	5
T. macrura	21	—	3	—
S. superba & *T. macrura*	6	1	—	—

TABLE 5. OCCURRENCE OF *THYSANOËSSA MACRURA* IN 1957

Species	January			February			March	
	1	2	3	1	2	3	1	2
E. superba	8	27	20	52	55	87	41	26
S. superba & *T. macrura*	—	—	4	2	—	—	—	—
T. macrura	1	2	9	8	3	1	—	—

Between the currents towards the north and the south the cyclonic eddies are formed, therefore, the isotherms and the isohalines bend far laterally, and the whaling grounds in the Antarctic waters is located near the cyclonic eddies, that is, whaling grounds are formed in the center of the water boundary forming cyclonic eddies as Ruud (1929) and Uda (1954) describe. It seems that the krill *T. macrura* is concentrated by the water current on such areas.

As above mentioned, in 1957 the area where *T. macrura* occurred was covered on the waters from 135°W to 100°W longitude, and the greatest concentration was observed at the adjacent waters of 110°W longitude. Generally speaking in the area were *T. macrura* had been dominaratly appeared the temperature and salinity were approximately 0°C and 33.60‰ respectively in our observations. So *T. macrura* may distribute relatively high temperature and salinity and may be the food of baleen whales of which are distributed off comparatively warmer waters in the Antarctic.

SUMMARY

An Antarctic *Thysanoëssa, T. macrura* is found as a stable food of baleen whales. Considering dominant appearances of *T. macrura* in stomachs of whales, it must bear significance for the Antarctic whales in the certain Antarctic area.

T. macrura is considered to distribute relatively higher temperature and salinity than *Euphausia superba.*

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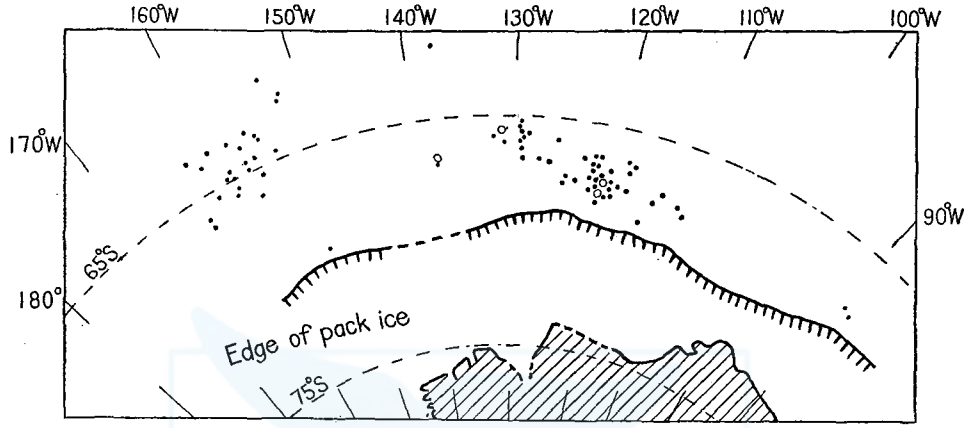

Fig. 4. Occurrences uf *T. macrura* in the collected samples in the Antarctic waters in 1956.

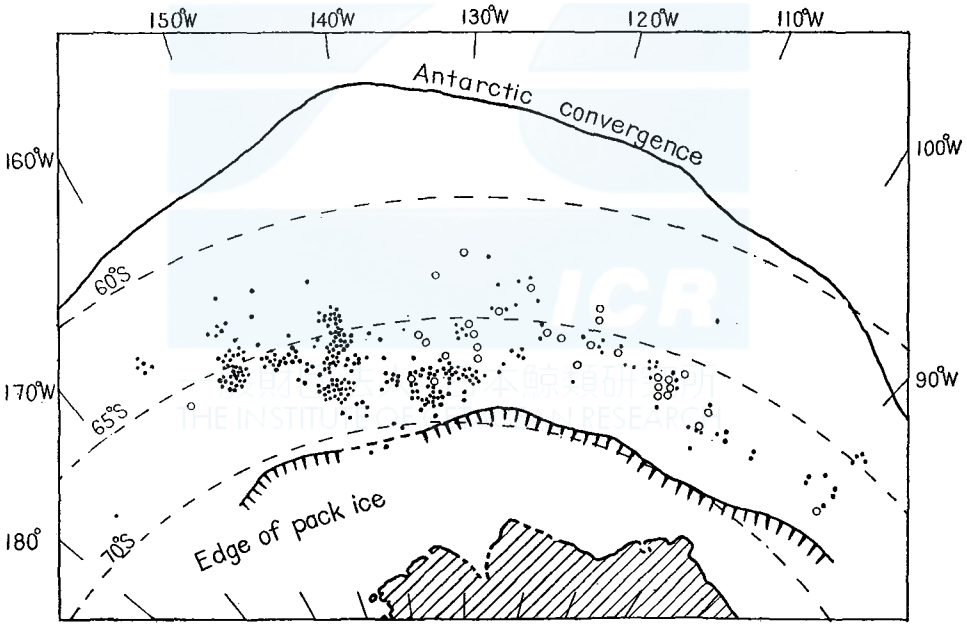

Fig. 5. Occurrences of *T. macrura* in the collected samples in the Antarctic waters in 1957.