Mem. Natl Inst. Polar Res., Spec. Issue, **40**, 194–196, 1986

A PROPOSAL FOR STOCK BIOMASS ESTIMATE OF *EUPHAUSIA SUPERBA* DANA BY THE ENVIRONMENTAL INDEX $\bar{Q}_{200}$ IN COMPARISON WITH HAMPTON'S METHOD (EXTENDED ABSTRACT)

Mikio NAGANOBU

Ocean Research Institute, University of Tokyo, 15–1, Minamidai 1-chome, Nakano-ku, Tokyo 164

Acoustic survey using an echo integrator is considered to be an effective means to estimate the stock biomass of *Euphausia superba*. However, when we estimate the stock biomass with this equipment, the following two limitations must be taken into account (NAGANOBU and HIRANO, 1983):

1) Echo sounder itself cannot distinguish the species of living organisms. Therefore, the range of geographical distribution of *E. superba* must be known beforehand.

2) To extend densities measured by the echo integrator to all areas where *E. superba* is thought to be distributed has practical difficulties on account of the vastness of the area.

NAGANOBU and HIRANO (1982) proposed the following method to estimate the stock biomass of *E. superba*: The distribution density of *E. superba* is acquired from the value measured by the echo sounder, while estimating the distribution range of *E. superba* by using the isolines of the environmental index $\bar{Q}_{200}$ which corresponds well to the distribution of *E. superba*, and the distribution density is extended to areas where the echo sounder is not applicable.

HAMPTON (1983) estimated the stock biomass of *E. superba* using the value measured with the echo integrator by estimating the mean density of *E. superba* by "block", and then extending it to "geographic range of the krill". However, it seems that the terms "block" and "geographic range of the krill" used by HAMPTON are qualitative and not precise.

For instance, the width of the latitudinal intervals is 5° in "block" in the Indian Ocean Sector. But this divides and averages the distribution pattern of *E. superba* too mechanically, and the range of estimate of the stock biomass is thought to be too wide. Moreover, the "geographic range of the krill" which is based on MACKINTOSH (1973) is taken from an idealized model of the oceanic structure. Because of poor knowledge of the distribution of *E. superba* the echo integrator is not used effectively in spite of the minute values measued by it.

Figure 1 shows the isolines below 0.0°C of the environmental index $\bar{Q}_{200}$ $\left[1/200 \int_0^{200} (\text{temperature})\, dz\right]$ to express characteristically the environment of the area in which *E. superba* is concentrated. The difference of environment among the Atlantic Ocean, Indian Ocean, and Pacific Ocean Sector can be clearly seen. The distribu-

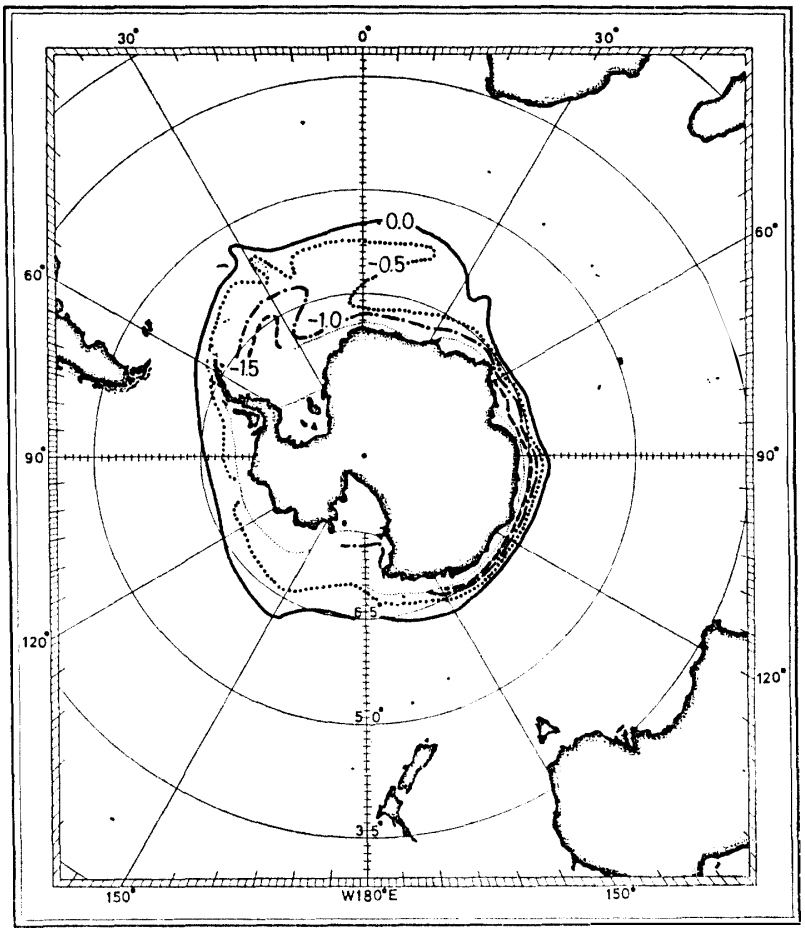

Fig. 1. Isolines below 0.0°C of the environmental index $\overline{Q}_{200}\left[1/200\int_0^{200}(\text{temperature})\,dz\right]$ *express environmental characteristics of* E. superba *concentrated area.*

tion of *E. superba* corresponds to these environmental differences.

The proposal therefore is to gain the stock biomass of *E. superba* by plotting the distribution density from the values measured by the echo integrator under 0.0°C isolines of $\overline{Q}_{200}$. Using the environmental index $\overline{Q}_{200}$ which divides the range from the viewpoint of the environmental ecology, we would obtain a more accurate estimate of the stock biomass of *E. superba* than that attempted by HAMPTON. Thus, I propose that the stock biomass of *E. superba* should be estimated using the environmental index $\overline{Q}_{200}$ together with the way of HAMPTON.

References

HAMPTON, I. (1983): Preliminary report on the FIBEX acoustic work to estimate the abundance of *Euphausia superba*. Mem. Natl Inst. Polar Res., Spec. Issue, **27**, 165–175.

MACKINTOSH, N. A. (1973): Distribution of post-larval krill in the Antarctic. Discovery Rep., **36**, 95–156.

NAGANOBU, N. and HIRANO, T. (1982): Geographical distribution of the Antarctic krill, *Euphausia superba* DANA, and its environmental structure (extended abstract). Mem. Natl Inst. Polar Res., Spec. Issue., **23**, 1–4.

NAGANOBU, M. and HIRANO, T. (1983): Kagaku gyotan ni yoru *E. superba* shigenryô no mitsumori ni okeru kankyô shisû $\overline{Q}_{200}$ no igi. Dai-6-kai Kyokuiki Seibutsu Shinpojiumu Puroguramu·Kôen Yôshi (Program Abstr. 6th Symp. Polar Biol.). Tokyo, Natl Inst. Polar Res., 34–35.

(Received April 24, 1985; Revised manuscript received July 11, 1985)