

## KRILL BIOMASS ASSESSMENT IN STATISTICAL AREA 48 FROM THE RV ATLANTNIRO DATA - AUTUMN 1989/90

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### Abstract

A krill biomass census survey was carried out at two fishing grounds in the South Sandwich and South Orkney Islands areas during a cruise by RV *AtlantNIRO* in March/April 1990. The survey was conducted in the upper 100 m layer using a modified Isaacs-Kidd trawl. Trawling speed was 3.2 to 3.6 knots. The total krill stock on the poorly studied site off the South Sandwich Islands was assessed at 3.8 million tonnes, most of which was concentrated in the waters of the Weddell Sea. In contrast to this site, the one off the South Orkney Islands is well-established in terms of both research and commercial harvesting. The overall krill stock here was estimated to be 1.1 million tonnes. Most of this stock was concentrated in the south-western part of the Coronation Island shelf.

### Résumé

En mars/avril 1990, une campagne d'évaluation de la biomasse du krill s'est déroulée, à bord du navire de recherche *AtlantNIRO*, sur deux lieux de pêche des régions des îles Sandwich du Sud et des Orcades du Sud. La campagne a été menée dans la couche des 100 m supérieurs à l'aide d'un chalut Isaacs-Kidd modifié. La vitesse de chalutage était de 3,2 à 3,6 nœuds. Le stock total de krill du site - d'ailleurs insuffisamment étudié - au large des îles Sandwich du Sud a été estimé à 3,8 millions de tonnes, la plupart étant concentrée dans les eaux de la mer de Weddell. Par contre, le site au large des îles Orcades du Sud est bien établi, tant en matière de recherche que d'exploitation commerciale. Là, le stock global est estimé à 1,1 million de tonnes. Ce stock était en grande partie concentré dans la section sud-ouest du plateau de l'île du Couronnement.

### Резюме

Учетная съемка биомассы криля была произведена на двух участках в районе Южных Сандвичевых и Южных Оркнейских островов во время рейса НИС *АтлантНИРО* в марте-апреле 1990 г. Учет криля проводился модифицированным тралом Айзекса-Кидда в верхнем 100-метровом слое. Скорость траления составила 3,2-3,6 узлов. Общий запас криля на малоизученном участке Южных Сандвичевых островов составил 3,8 млн. тонн. Основная доля этого запаса была сосредоточена в водах моря Уэдделла. В отличие от первого участка, участок у Южных Оркнейских островов является традиционным как в плане научных исследований, так и промысла криля. Общий запас криля на этом участке был оценен в 1,1 млн. тонн. Основная часть этого запаса была сосредоточена в юго-западной части шельфа о. Коронейшн.

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## Resumen

En un crucero a bordo del BI *AtlantNIRO* se llevó a cabo una prospección de censo en dos caladeros de pesca de las islas Sandwich y Orcadas del Sur durante los meses de marzo y abril de 1990. Esta se realizó en la capa superior de los 100 m y se hizo con un arrastre Isaacs-Kidd modificado. La velocidad del arrastre era de 3.2 a 3.6 nudos. La población total de krill en esta zona relativamente poco estudiada de las islas Sandwich del Sur, se calculó en unas 3.8 millones de toneladas, estando la mayoría concentrada en las aguas del mar de Weddell. En cambio, en la zona de las Orcadas del Sur, tanto la investigación como la pesca comercial hace tiempo que están bien establecidas. Allí, la población total se estimó en 1.1 millones de toneladas. La mayoría de la población se concentró en la zona sudoeste de la plataforma de la isla Coronación.

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In the interests of rational use of Antarctic krill (*Euphasia superba* Dana) it is essential to carry out constant monitoring of the state of its stock both in traditional fishing grounds and in the other inadequately studied areas of its distribution. In this connection, an attempt was made to estimate krill biomass as part of the sixth cruise of RV *AtlantNIRO* to the Atlantic sector of the Southern Ocean.

The biomass assessment was carried out in the central (inadequately studied) and western (traditional fishing ground) area of the Antarctic in autumn 1990 (from 13 March to 8 April in the South Sandwich Islands study area and from 12 to 10 April in the South Orkney study area). The first study area, a vast expanse surrounding the South Sandwich Islands consisting of two parts; the northern (55° to 60°S; 32° to 18°W) and southern (60° to 67°S; 20° to 18°W), was affected by different types of Antarctic waters during the observation period, i.e. the Antarctic Circumpolar Current (ACC) and the Weddell Sea waters. The second study area was only subject to the influence of the waters of the northern periphery of the Weddell Sea eddy (Fedulov *et al.*, in press).

Krill was taken with an Isaacs-Kidd net, modified by Aseev-Samyshev (6 m<sup>2</sup>; 6 mm mesh), in the upper 100 m layer using the double oblique hauling method (0-100-0 m) at a towing speed of 3.2 to 3.6 knots. Trawling depth was controlled by a trawl probe "Igla" attached to the top beam of the metal trawl rigging. The volume of filtered water was controlled by the flowmeter "General Oceanics" (model 2030). Distance between hauls during the first survey was 60 miles by latitude and longitude and during the second survey it was 30 miles by latitude and 40 miles by longitude. Krill density (specific biomass) was calculated using the formula:

$$K = \frac{m}{w}$$

where **k** = density, mg/m<sup>3</sup>

**m** = catch, mg

**w** = swept water volume, m<sup>3</sup> (according to flowmeter readings);

Values of krill density obtained from various stations were interpolated to draw density isolines along selected intervals (Figures 1 and 2) and the area of layers having equal density was determined. Biomass in the 0 to 100 m layer was calculated in respect of each swarm. Overall biomass was determined as the sum of biomass by layer. Table 1 gives mean weighted (mg/m<sup>3</sup>) and absolute (thousands of tonnes) biomass.

The extent to which krill avoid fishing gear during investigations was not considered since currently there is no methodology for working out this phenomenon.

Extensive areas of low specific biomass were typical of krill distribution both in the South Sandwich (Figure 1) and South Orkney (Figure 2) Island areas. Minimum values for mean weighted biomass (not including areas of high biomass density) did not exceed 30 mg/m<sup>3</sup> in the ACC and Weddell Sea waters of the South Sandwich Island study area and 50 mg/m<sup>3</sup> in the South Orkneys study area. The areas of high biomass density in the above waters coincided with dynamic elements such as meanders, mesoscale circulations and parts of the Frontal Zone between the waters of the ACC and the Weddell Sea. Maximum values for specific biomass (up to 2 443 mg/m<sup>3</sup>) were recorded in the frontal zone area in the anticyclonic meander to the west of the South Sandwich Islands. Mean value of weighted biomass in the South Sandwich Islands study area was 145.9 mg/m<sup>3</sup> in the Weddell Sea waters and 24.9 mg/m<sup>3</sup> in the ACC and 202.7 mg/m<sup>3</sup> in the South Orkney Islands study area (Table 1).

The figure of 3.8 million tonnes for the total krill stock in the South Sandwich Islands study area, with the bulk of the stock concentrated in the Weddell Sea waters, suggests that the Weddell Sea waters are more abundant in krill than the ACC. Unfortunately, it is impossible to be more accurate in estimating krill biomass in the South Sandwich Islands area since no similar studies have been carried out there before. The only available data are from Japanese investigations conducted in January 1984-85 as part of the SIBEX II Program (Endo *et al.*, 1986). The Japanese estimates of specific biomass (mean value 193 mg/m<sup>3</sup>, maximum value 1 233 mg/m<sup>3</sup>; sampling gear is KYMT trawl of 9 m<sup>2</sup> with mesh size 3.4 mm) are close to ours. Bearing this in mind, as well as the paucity of data and the limitations involved in such a comparison, a relative similarity may point to an agreement between the krill stock size estimated in autumn 1990 in the South Sandwich Islands area and the long-term value.

In the South Orkney Islands area, where research and commercial exploitation of krill resources have been long established, the total stock was 1.1 million tonnes. Most of the stock was concentrated in the south-west part of the Coronation Island shelf, an area to which krill had been transported and then accumulated due to favourable circulation conditions, and where the commercial fishing fleet had been operating over an area of about 600 km<sup>2</sup>. The specific biomass reached its greatest level here (on average up to 6 000 mg/m<sup>3</sup>). It is worth noting that the similarity of krill biomass assessments over the years, despite intensive commercial exploitation, may indicate a continued relative stability of the krill stock in the area.

#### REFERENCES

- ENDO, Y., T. IMASEKI and Y. KOMAKI. 1986. Biomass and population structure of Antarctic krill (*Euphausia superba* Dana) collected during SIBEX II Cruise of RV *Kaiyo Maru*. *Mem. National Institute of Polar Research*, Special Issue 44: 107-117.
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- SUSHIN, V.A., L.G. MAKLYGIN and S.M. KASATKINA. 1990. *Summary Results of Krill Integrated Studies in Statistical Area 48 Carried Out in Research Cruises of RV Argus and RV Evrika in 1984-1988*. WG-Krill-90/23. Hobart, Australia: CCAMLR. (In Russian).

Table 1: Krill biomass in the 0 to 100 m layer in various areas of the Atlantic sector of the Southern Ocean, autumn 1990.

Study Area	Water Masses	Area (km <sup>2</sup> )	Mean Weighted Biomass mg/m <sup>3</sup>	Total Biomass (000 tonnes)
South Sandwich Islands	Weddell Sea			
	Northern Area	221 048.3	145.9 1 254.5* 22.7**	3 226.6
	Southern Area	69 343.4	22.9	159.1
	Antarctic Circumpolar Current	169 717.9	24.9	423.8
	Total:	460 109.6		3 809.5
South Orkney Islands	Weddell Sea	54 926.2	202.7 3 296.7* 43.7**	1 113.4

\* Area of high biomass density (0.5 mg/m<sup>3</sup>)

\*\* Total area but excluding areas of high biomass density

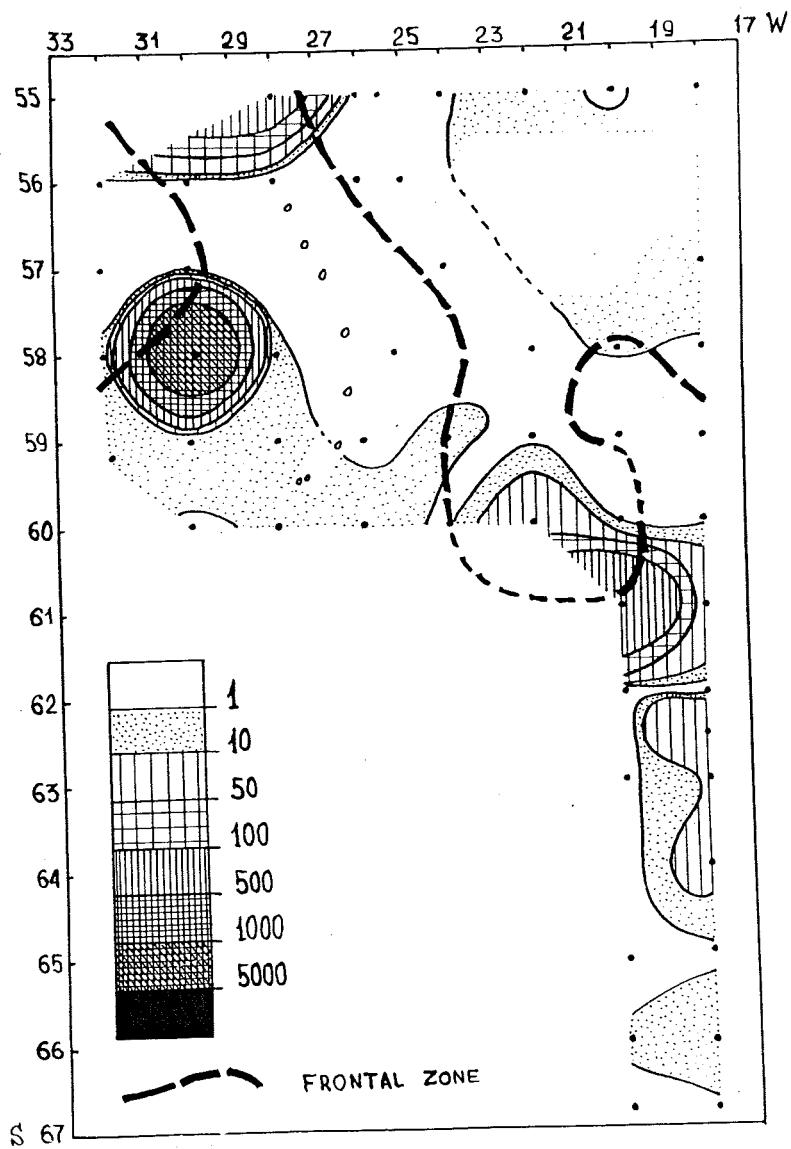


Figure 1: Distribution of *E. superba* (mg/m<sup>3</sup>) in the 0 to 100 m layer based on trawl data from the South Sandwich Island study area in March/April 1990.

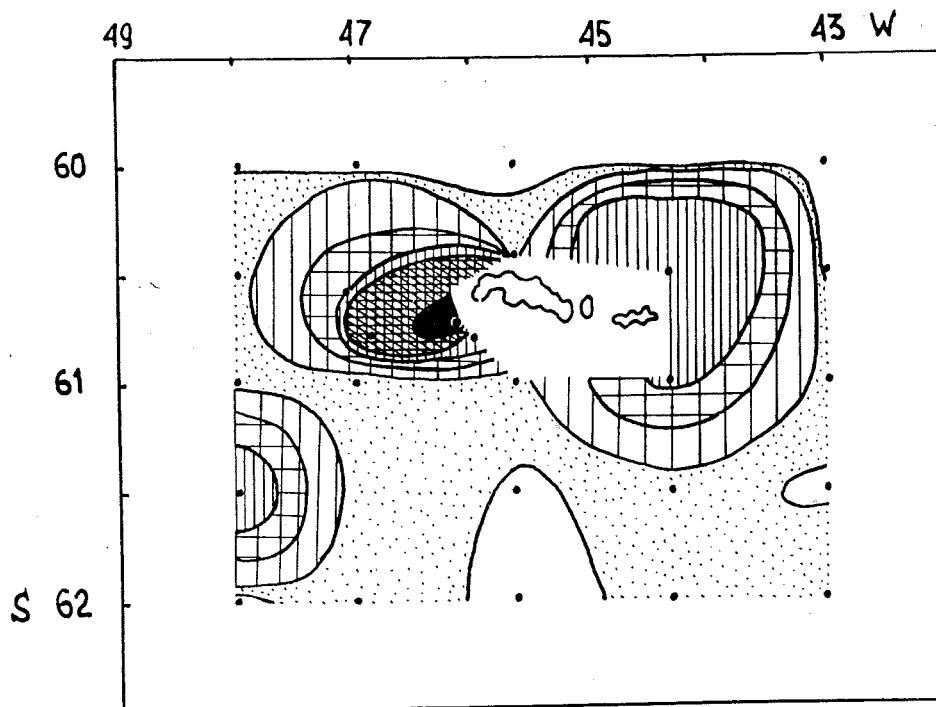


Figure 2: Distribution of *E. superba* ( $\text{mg}/\text{m}^3$ ) in the 0 to 100 m layer based on trawl data from the South Orkney Island study area in April 1990. (See Figure 1 for key).

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Figure 2: Répartition d'*E. superba* (mg/m<sup>3</sup>) dans la couche de 0 à 100 m, à partir de données provenant de chalutages de l'aire étudiée des îles Orcades du Sud en avril 1990 (cf. explications à la figure 1).

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Figura 2: Distribución de *E. superba* (mg/m<sup>3</sup>) en la capa de los 0-100 m, basada en los datos de los arrastres realizados en la zona de estudio de la isla Orcadas del Sur en abril 1990. (Las claves son igual que las de la Figura 1).