

PRELIMINARY RESULTS OF RESEARCH ACTIVITIES OF RV *EVRIKA* IN THE SCOTIA SEA IN JANUARY-MARCH 1988

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Abstract

In 1987/88 a multi-disciplinary survey was conducted of the Scotia Sea and adjacent waters, accompanied by regular trawlings with an Isaac-Kidd trawl. The waters off South Georgia in particular were surveyed twice. Research activities are part of the program implemented in areas of the Atlantic Sector of the Southern Ocean identified for monitoring by CCAMLR. During the observation season the zonal drift of waters of the Antarctic Circumpolar Current and Second Frontal Zone became stronger, causing the krill to drift eastwards. Krill concentrations were observed in the waters to the southeast of South Georgia where relatively small crustaceans of less than 35 mm dominated. In the east Scotia Sea a higher abundance of primary production was registered. The analysis of data on phytoplankton, zooplankton and krill (biological parameters) is now under way.

Résumé

En 1987/88 une étude multidisciplinaire dans la mer de Scotia et des eaux voisines ainsi que des opérations régulières de chalutage, à l'aide d'un chalut de type Isaacs-Kidd, furent effectuées. Les eaux au large de la Géorgie du Sud en particulier furent prospectées à deux reprises. Les activités de recherche font partie du programme poursuivi dans les zones désignées pour la surveillance par la CCAMLR du secteur atlantique de l'océan Austral. Pendant la saison d'observation, la dérive zonale des eaux du courant circumpolaire antarctique et de la seconde zone frontale s'amplifia, provoquant la dérive du krill vers l'est. Des concentrations de krill furent observées au sud-est de la Géorgie du Sud. Des crustacés relativement petits, d'une taille inférieure à 35 mm, y prédominaient. Dans la partie est de la mer de Scotia, une abondance plus élevée de production primaire fut observée. L'analyse des données sur le phytoplancton, le zooplancton et le krill (paramètres biologiques) est maintenant en cours.

Резюме

В 1987/88 г. В море Скотия и прилегающих водах проводилась многоотраслевая съемка, сопровождавшаяся регулярными тралениями с помощью трала Айзакса-Кидда. Съемка в этой акватории, в частности в водах вокруг Южной Гергии, проводилась дважды. Эта научно-исследовательская деятельность является частью программы работ, проводимой в атлантическом секторе Южного океана на выделенных АНТКОМом участках

мониторинга. За период проведения наблюдений зональное перемещение вод Антарктического циркумполярного течения и второй фронтальной зоны усилилось, что вызвало перемещение криля к востоку. Концентрации криля наблюдались в водах к юго-востоку от Южной Георгии. Здесь доминировали относительно небольшие рачки размером до 35 мм. В восточной части моря Скотия был отмечен повышенный уровень первичной продукции. Анализ данных по фитопланктону, зоопланктону и крилю (биологические параметры) продолжается.

Resumen

En 1987/88 se realizó una prospección multidisciplinaria del mar de Scotia y aguas adyacentes, acompañada de arrastres periódicos con el arrastre Isaacs-Kidd. En particular se prospeccionaron dos veces las aguas a la altura de Georgia del Sur. Las actividades de investigación forman parte del programa que se está realizando en aquellas zonas que fueron identificadas para seguimiento por la CCAMLR, en el sector atlántico del océano Austral. Durante la temporada de observación, la deriva zonal de las aguas de la Corriente Circumpolar Antártica y de la Segunda Zona Frontal se hizo más fuerte causando un desplazamiento del krill hacia el este. Se observaron concentraciones de krill en aguas al sureste de Georgia del Sur. Allí predominaban crustáceos relativamente pequeños de un tamaño menor de 35 mm. Al este del mar de Scotia se registró una mayor abundancia de la producción primaria. Actualmente se está realizando el análisis de datos sobre fitoplancton, zooplancton y krill (parámetros biológicos).

During the survey the location of the Second Frontal Zone was similar to long-term averages. On the whole, surface water dynamics in the Scotia Sea contributed to the drift of krill to South Georgia and the formation of its stable concentrations (see Figure 3). Waters from the Weddell Sea penetrated the eastern part of the area from the east and were characterized by surface temperatures ranging from 1.0°C to 1.4°C, the minimum temperature being -1.2° and -1.4°C. The temperature of the warm deepwater "core" dropped to 0.8°-1.2°C and high silicon content at the surface (40-50 μ g at/l) were characteristic for these waters. Many icebergs were sighted in the area.

Closed water circulation was found around the archipelago off the South Orkney Islands. To the north of the archipelago the dynamic relief was rather smoothed, hence there were no required conditions for the formation of abundant krill concentrations. At the same time circulation patterns were registered off Elephant Island, which facilitated krill concentration.

The highest concentrations of chlorophyll-a (112 mg/m²) were recorded in the waters off South Georgia which corresponded with the high dynamic activity of waters in the area during the observation period. Feeding so-called "green krill" was in catches. Low chlorophyll-a concentrations were recorded in the south-east Scotia Sea (see Figure 4).

In most of the surveyed area, primary production in the photosynthetic layer made 0.1-0.2 gC/m²/day (see Figure 5). Photosynthesis intensity fluctuated. The waters north of South Georgia, in the east Scotia Sea and off Elephant Island were characterized by high assimilation values. In the photic layer, bacterioplankton production fluctuated between 1.4 g C/m²/day, and it ranged from a fraction of a percent to several percent of the primary production being in a reverse proportion to photosynthesis production values.

As compared with previous seasons, specific features were typical for spatial and qualitative distribution of krill. High krill concentrations were found off South Georgia and south of the island towards the Second Frontal Zone (see Figure 6). Small crustaceans of 29-35 mm prevailed in catches (see Figure 7).

In February, off South Orkney Islands, concentrations occurred only in the small area south of Coronation Island. When the western drift of the Atlantic Circumpolar Current became weaker in March, more abundant concentrations were sighted to the north-west of Coronation Island over the area of 560 m² northward in the so-called "shadow" area (as related to the main direction of water movement) (see Figure 8a).

In April rather dense concentrations formed off the South Georgia (see Figure 9). Mature crustaceans distributed over the eastern part of the surveyed area in the Scotia Sea, were in prespawning and spawning condition. Spawning krill concentrations were dominant in the waters north of the Second Frontal Zone. Near islands, they were found in the areas over high sea depths outside shelf zones.

In the Weddell Sea the spawning came to an end by the time of the survey.

In May the proportion of post-spawning crustaceans increased near the Elephant and Coronation Islands indicating the end of krill spawning in those areas. Due to the stronger Antarctic Circumpolar Current drift westward to the Scotia Sea in 1988, most krill concentrations apparently to extended eastward of 30°W, outside the area surveyed.

The analysis of samples, mass collections of phyto- and zooplankton, euphausiid larvae and, in particular, krill biological samples, in particular, are under way. Their results will be available later.



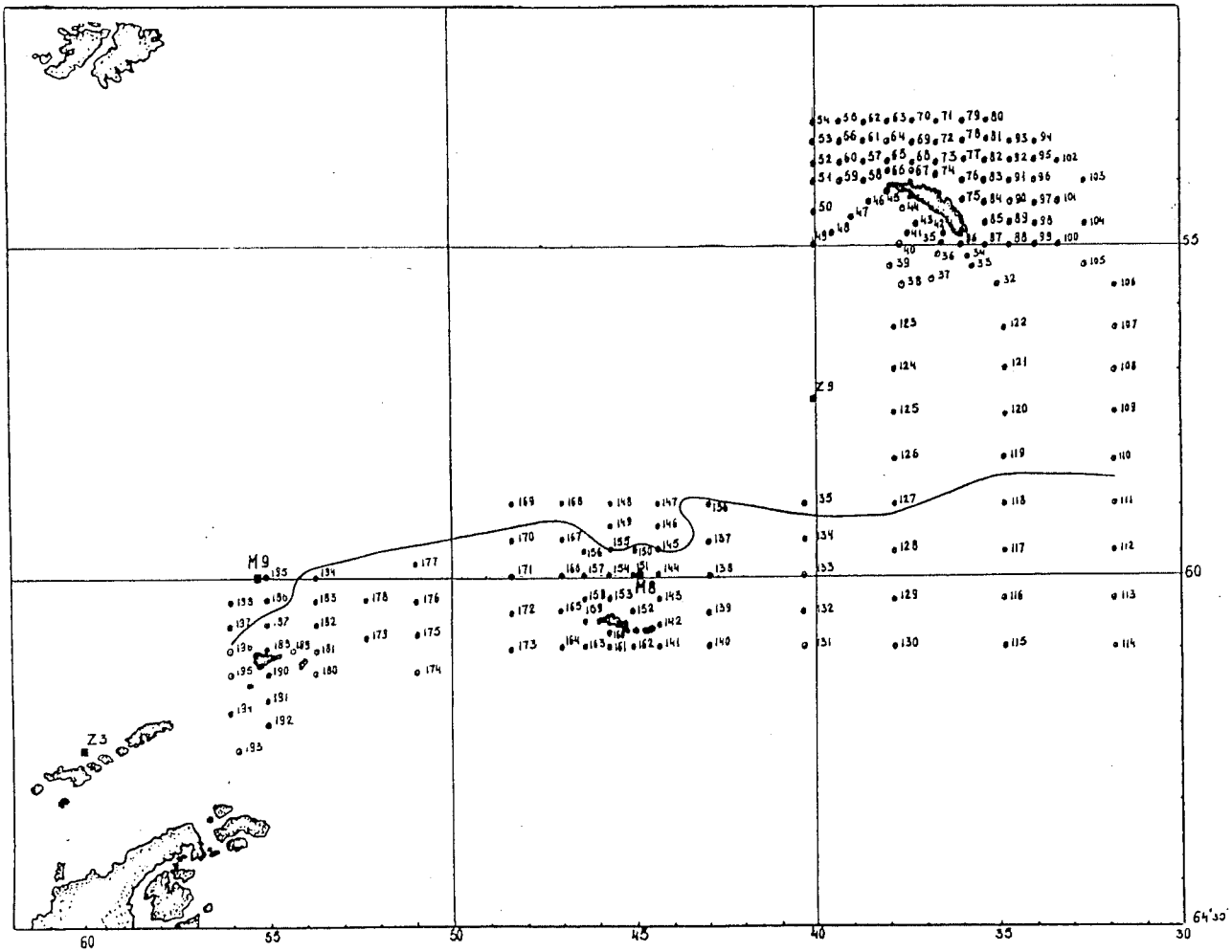


Figure 1: Network of survey stations (20 January-9 March 1988).
 Key: — Second Frontal Zone
 M8, M9, Z3, Z9 - control points for estimation of meridional and zonal air drift.

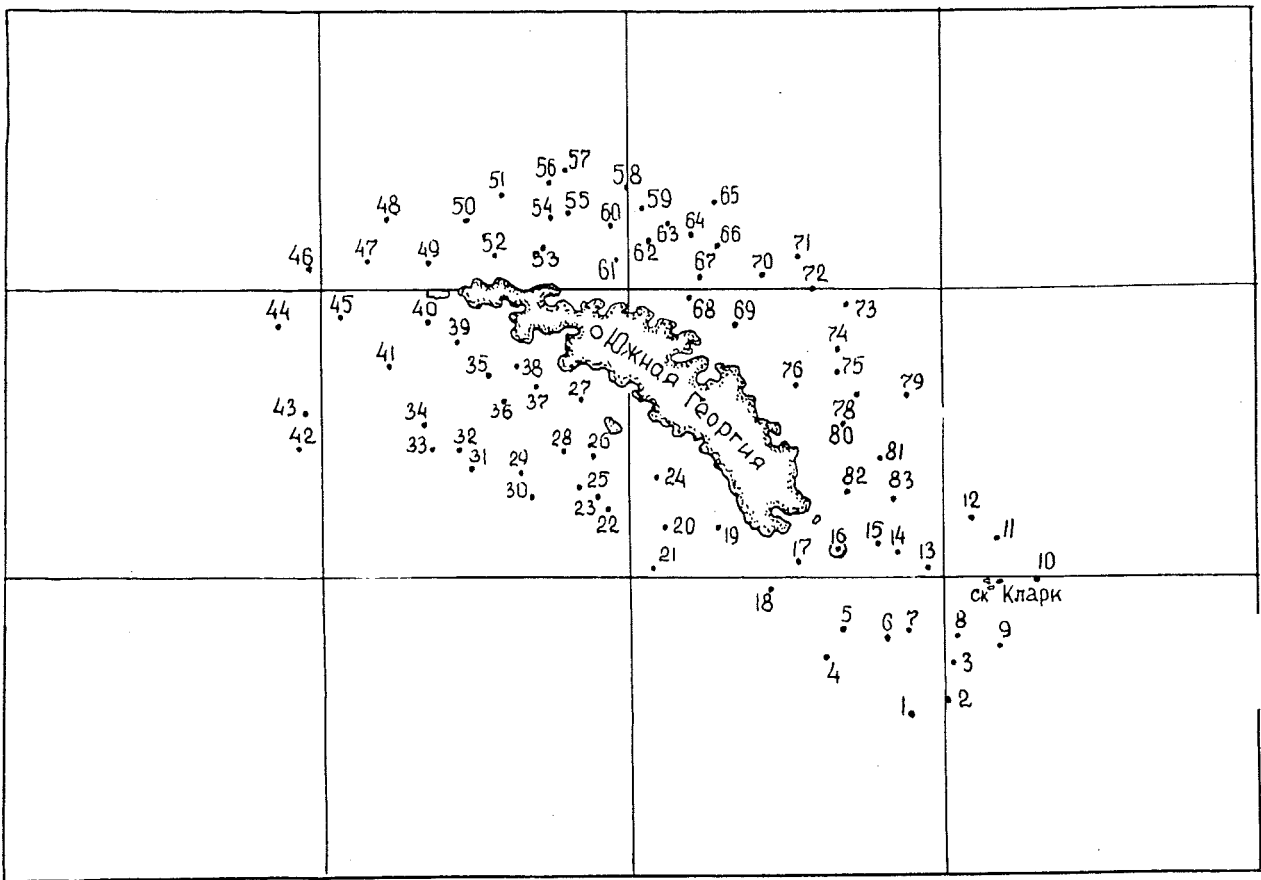


Figure 2: Network of survey stations (30 March-9 April 1988) off South Georgia.

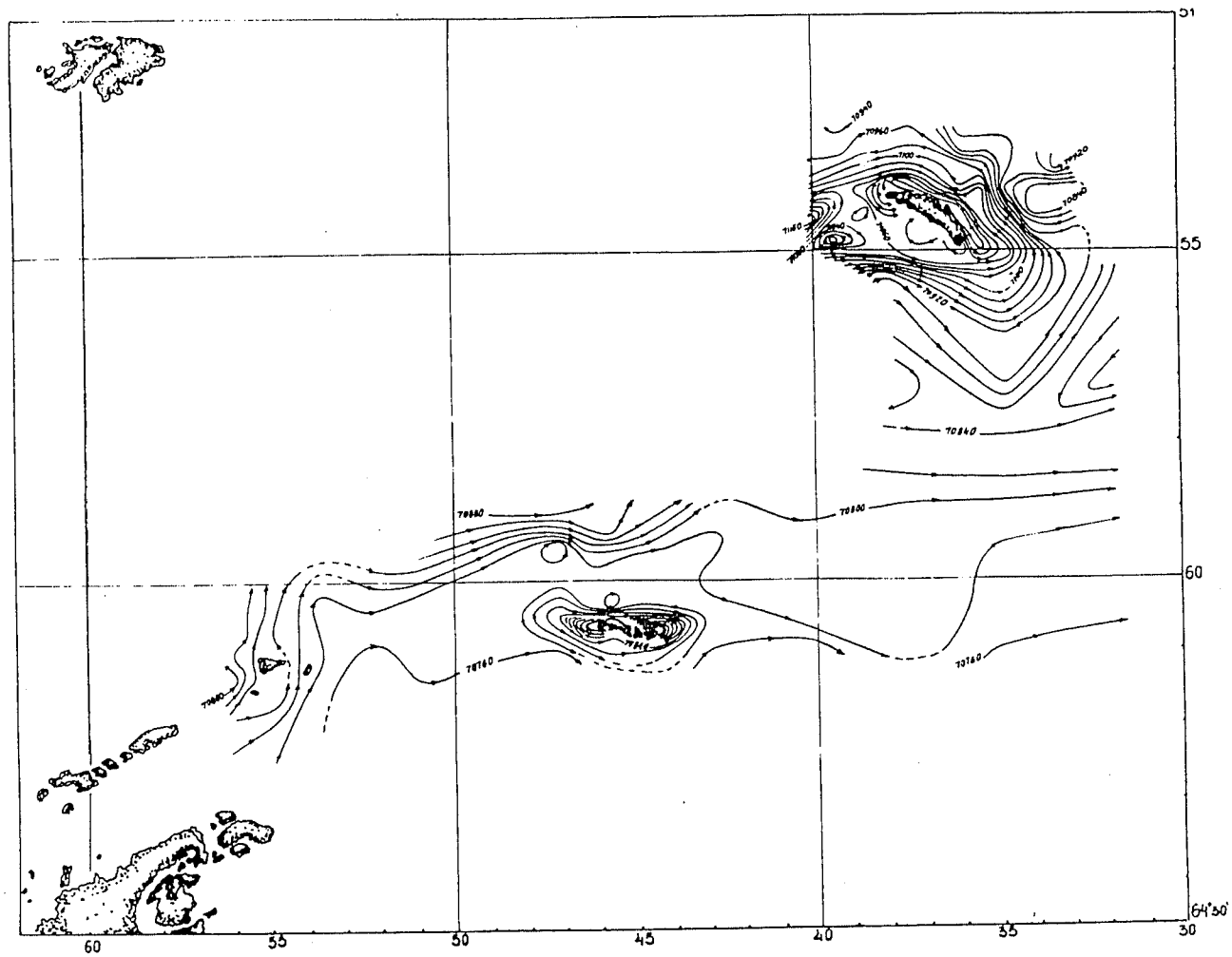


Figure 3: Geostrophic circulation on the surface in relation to 1 000 decibar (20 January-9 March 1988).

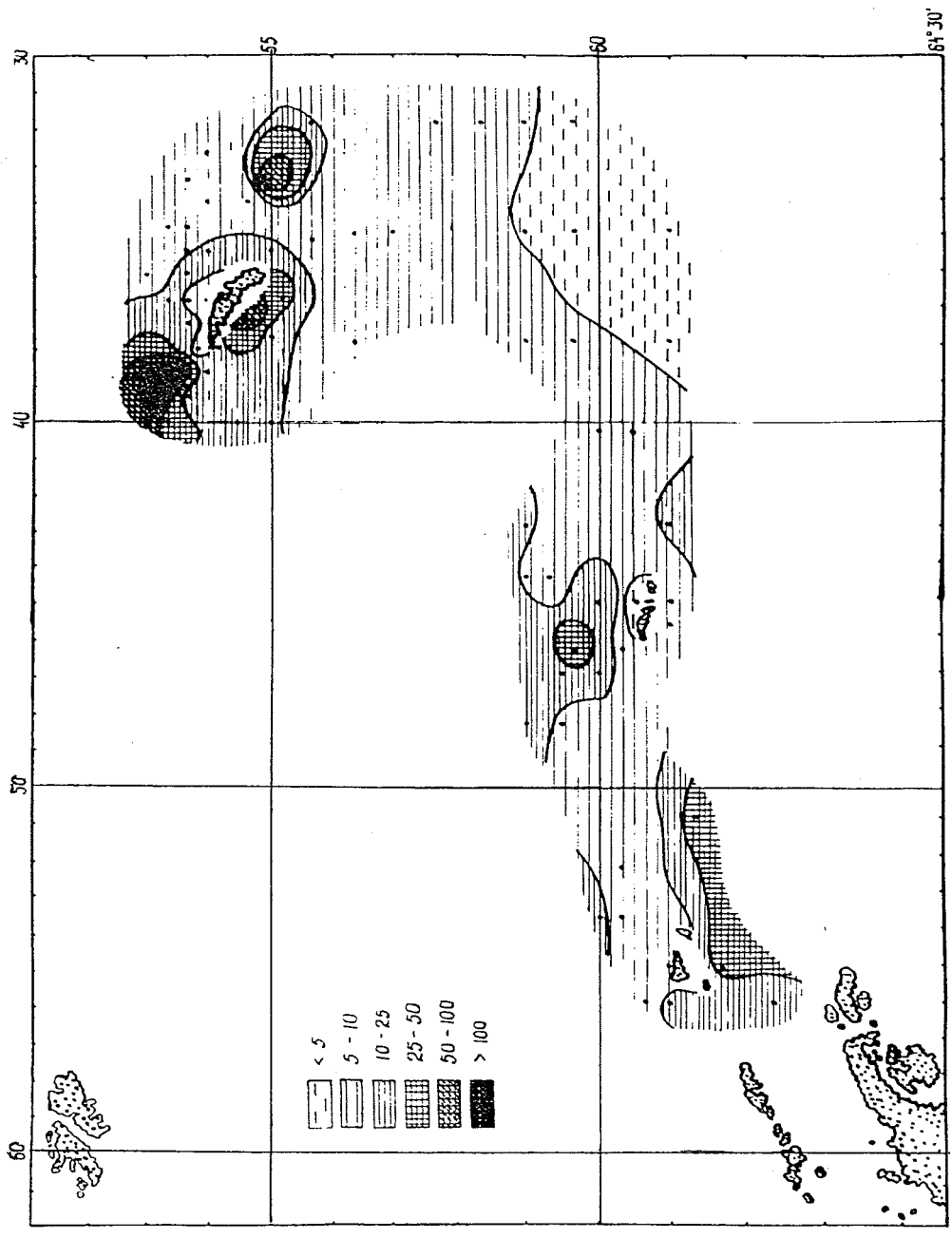


Figure 4: Distribution of chlorophyll-a (mg/m²) in the photic layer.

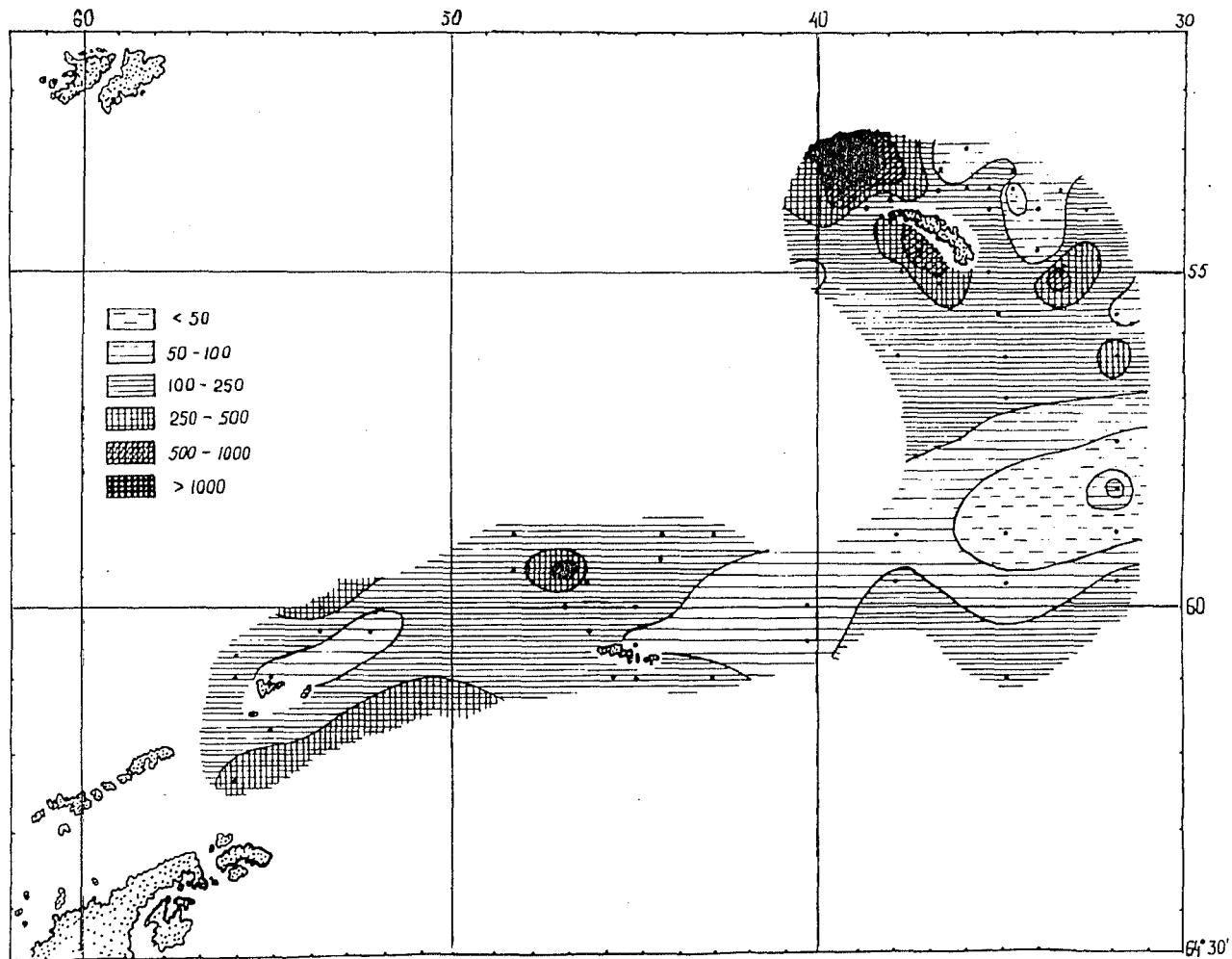


Figure 5: Distribution of primary production ($\text{mg C/m}^2/\text{d}^{-1}$) in the photosynthetic layer.

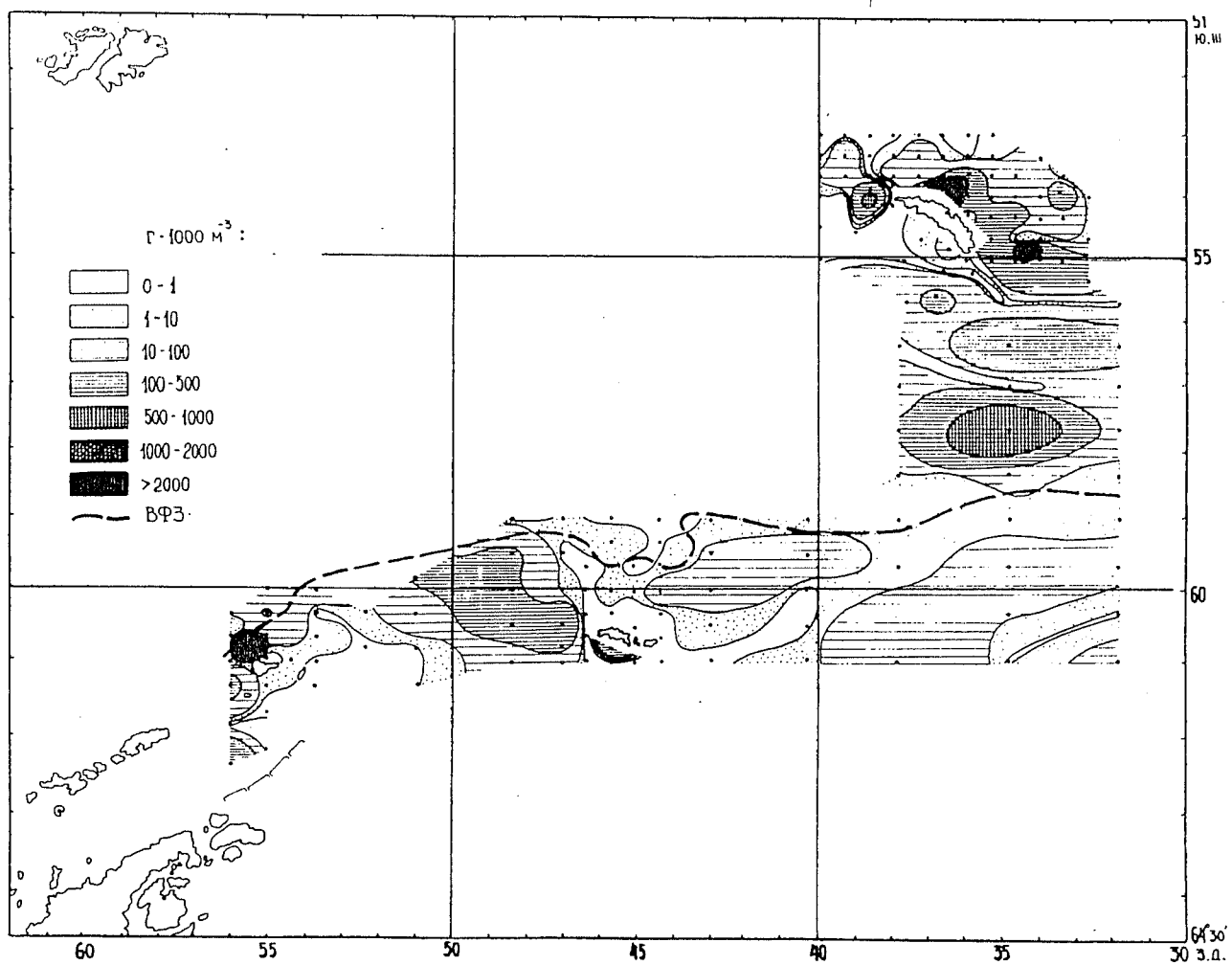


Figure 6: Distribution of *Euphausia superba* ($\text{g}/1000 \text{ m}^3$) in the layer of 0-100 m (20 January-9 March 1988).

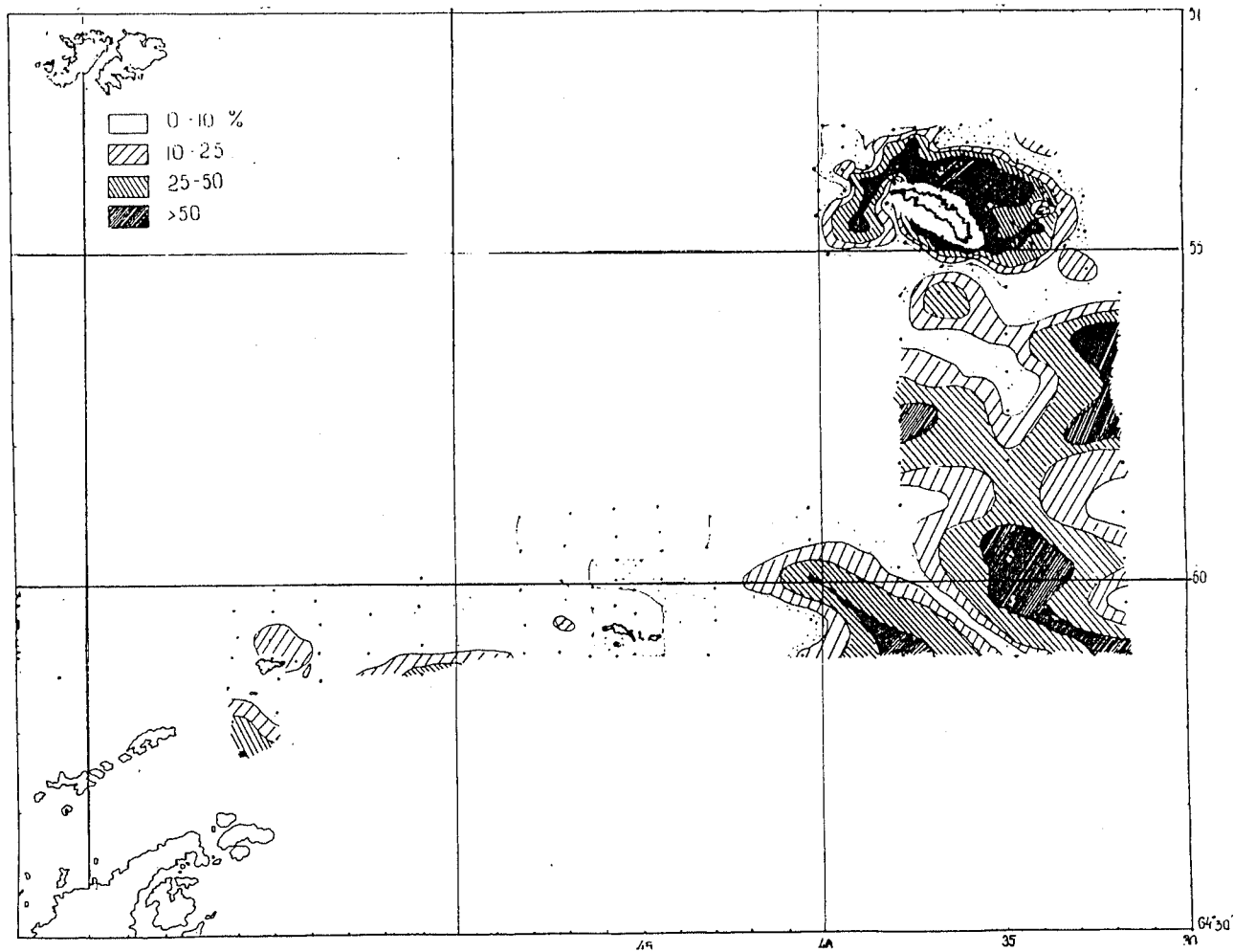


Figure 7: Distribution of crustaceans of 29-36 mm long presented as percentage to the catch size (survey data).

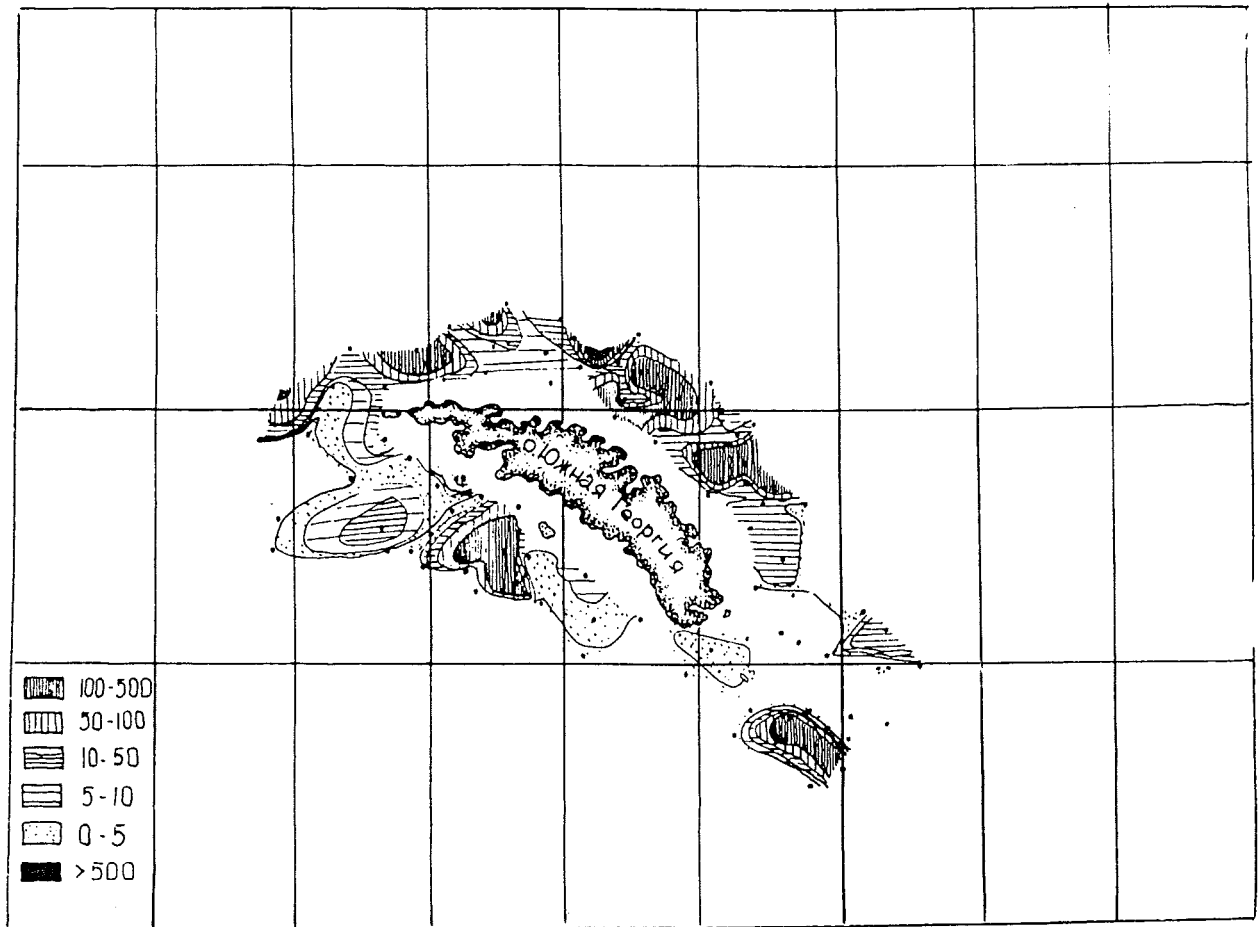


Figure 8: Krill concentrations off South Shetland Islands (a) and South Orkney Islands (b) - March 1988.

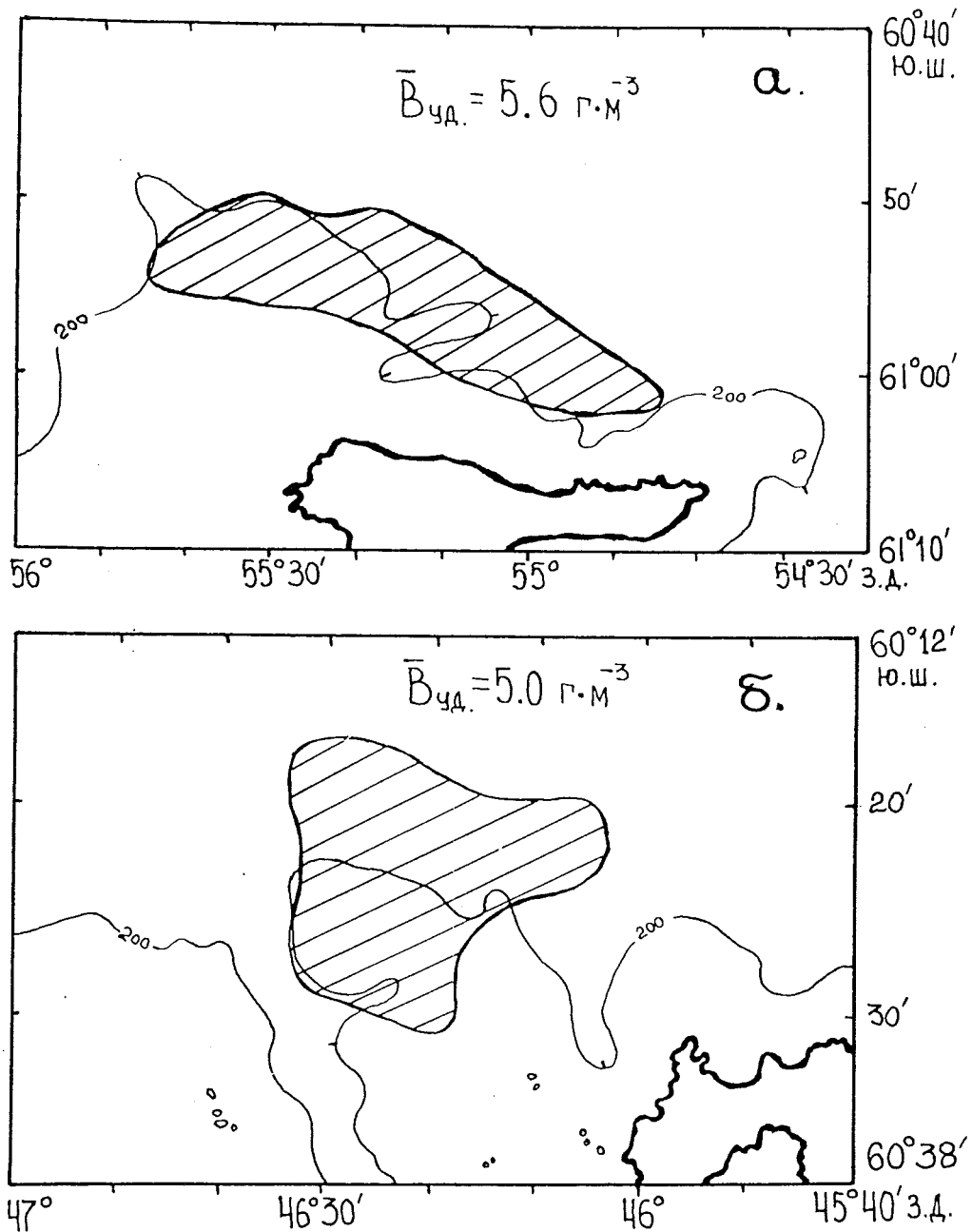


Figure 9: Distribution of *Euphausia superba* off South Georgia (g/m^2) from 30 March to 9 April 1988.

Légendes des figures

- Figure 1 Réseau des stations de recherche (20 janvier - 9 mars 1988)
Clé: - Seconde zone frontale;
M8, M9, Z3, Z9 - points de contrôle pour l'estimation du courant aérien méridional et zonal.
- Figure 2 Réseau des stations de recherche (30 mars - 9 avril 1988) au large de la Géorgie du Sud.
- Figure 3 Circulation géostrophique en surface sur une base de 1 000 décibar (20 janvier - 9 mars 1988).
- Figure 4 Répartition de chlorophylle A (mg/m^2) dans la couche photique.
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- Figure 8 Concentrations de krill au large des îles Shetland du Sud (a) et des îles Orcades du Sud (b) - mars 1988.
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Обозначение: - Вторая фронтальная зона;
M8, M9, Z3, Z9 - Контрольные точки для оценки меридионального и зонального перемещения воздуха.
- Рисунок 2 Сеть океанографических станций по сбору проб (30 марта - 9 апреля 1988 г.) около Южной Георгии.
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- Рисунок 7 Распределение рачков длиной 29-36 мм, в процентном отношении к улову (данные съемки)

Рисунок 8 Концентрации криля в районе Южных Шетландских островов (а) и Южных Оркнейских островов (b) - март 1988 г.

Рисунок 9 Распределение *Euphausia superba* вокруг Южной Георгии (г/м²) с 30 марта по 9 апреля 1988 г.

Leyenda de la Figura

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- Figura 8 Concentraciones de krill a la altura de las islas Shetland del Sur (a) y las islas Orcadas del Sur (b) - marzo de 1988.
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