CCAMLR Science, Vol. 3 (1996): 101-110

POTENTIAL INTERACTIONS BETWEEN WANDERING ALBATROSSES AND LONGLINE FISHERIES FOR PATAGONIAN TOOTHFISH AT SOUTH GEORGIA

J.P. Croxall and P.A. Prince
British Antarctic Survey
Natural Environment Research Council
High Cross, Madingley Road
Cambridge CB3 0ET
United Kingdom

Abstract

We examine the extent of overlap between South Georgia wandering albatrosses (*Diomedea exulans*) and local longline fishing for Patagonian toothfish (*Dissostichus eleginoides*), using satellite-tracking data and precise haul locations, respectively. We conclude that *D. exulans* breeding at South Georgia have a relatively low potential risk of interaction with longline fisheries around South Georgia between December and February (incubation period) and between late May and October (main chick-rearing period). However during the chick-brooding period, from March through mid-May, adult birds of both sexes spend most of their time at sea over the South Georgia continental shelf in areas very similar to where the longline fishery operates and are therefore at serious risk from these fisheries at this time. Until fishing methods which do not catch albatrosses are in comprehensive use, we recommend that the South Georgia longline fishery for *D. eleginoides* should be managed in such a way as to avoid fishing between the end of February and mid-May.

Résumé

Nous examinons l'importance du chevauchement, en Géorgie du Sud, des secteurs fréquentés par les grands albatros (*Diomedea exulans*) et des lieux de pêche à la palangre de légine australe (*Dissostichus eleginoides*), à partir de données de suivi par satellite et d'informations précises sur la position des poses. Nous estimons que pour *D. exulans* se reproduisant en Géorgie du Sud, le risque d'interaction avec les opérations de pêche à la palangre autour de la Géorgie du Sud de décembre à février (période d'incubation) et de fin mai à octobre (période principale d'élevage des jeunes) est assez faible. Pendant la période de couvaison des jeunes, cependant, à savoir de mars à mi-mai, les oiseaux adultes des deux sexes passent la plupart de leur temps en mer sur le plateau continental de la Géorgie du Sud, dans des secteurs très similaires à ceux où se déroulent les opérations de pêche à la palangre. Ces oiseaux courent alors le risque d'être touchés par ces opérations de pêche. Jusqu'à ce que soient mises en œuvre des méthodes de pêche qui préviennent la capture des albatros, nous recommandons de réglementer la pêcherie à la palangre de *D. eleginoides* de manière à éviter toute pêche entre fin février et mi-mai.

Резюме

Исследуется степень частичного совмещения района обитания странствующих альбатросов Южной Георгии (*Diomedea exulans*) и локального ярусного промысла патагонского клыкача (*Dissostichus eleginoides)* при помощи данных спутникового слежения в случае альбатросов и точных координат выборок ярусов в случае клыкача. Делается вывод, что у вида *D. exulans*, размножающегося на Южной Георгии, потенциальный риск взаимодействия с ярусным промыслом в районе Южной Георгии в период с декабря по февраль (инкубационный период) и в период с конца мая по октябрь (период выращивания птенцов) сравнительно низок. Тем не менее в ходе периода высиживания птенцов (с марта по середину мая) взрослые птицы обоего пола проводят большое количество времени в море над континентальным шельфом Южной Георгиии в районах, схожих с районами ведения ярусного промысла, и, следовательно, подвергаются существенному риску в результате этого промысла в данный период времени. До тех пор, пока не будут широко применяться промысловые методы, при которых прилов альбатросов нулевой,

рекомендуется, чтобы управление ярусным промыслом *D. eleginoides* в районе Южной Георгии осуществлялось таким образом, чтобы промысел в период с конца февраля по середину мая не проводился.

Resumen

Se hizo un estudio del área de superposición entre la población de albatros errantes (*Diomedea exulans*) de Georgia del Sur y las operaciones locales de pesca de palangre dirigida al bacalao de profundidad (*Dissostichus eleginoides*), utilizando los datos de rastreo vía satélite y de la ubicación precisa de los lances, respectivamente. Se concluyó que el potencial de interacción de los ejemplares de *D. exulans* que se reproducen en Georgia del Sur, con las pesquerías de palangre que se realizan en los alrededores de dicha isla, es relativamente bajo entre diciembre y febrero (período de incubación) y entre fines de mayo y octubre (el período principal de cría de los polluelos). Sin embargo, durante el período de incubación que se extiende de marzo a mediados de mayo, las aves adultas de ambos sexos pasan la mayor parte del tiempo en el mar, sobre la plataforma continental de Georgia del Sur, en áreas muy similares a donde se efectúan las operaciones de pesca de palangre. Por lo tanto, estas pesquerías representan un alto riesgo para estas aves durante este período. Hasta que la utilización de los métodos de pesca que evitan la captura de albatros no se haga extensiva, se recomienda ordenar la pesquería de palangre de *D. eleginoides* de manera tal que evite la pesca entre fines de febrero y mediados de mayo.

Keywords: incidental mortality, CCAMLR, fishery management, Patagonian toothfish, satellite-tracking, South Georgia, wandering albatross

INTRODUCTION

Over the last 20 years wandering albatross (*Diomedea exulans*) populations have declined at all breeding colonies for which sufficient data exists (Weimerskirch and Jouventin, 1987; Croxall et al., 1990; de la Mare and Kerry, 1994), to the extent that the species is now classified as globally threatened (Collar et al., 1994).

A major factor in the population declines is mortality associated with longline fishing, especially fisheries for southern bluefin tuna (*Thunnus maccoyi*) (Croxall and Prince, 1990; Croxall et al., 1990; Brothers, 1991; Gales, 1993; Murray et al., 1993). More recently, however, the use of longline techniques has become widespread in other Southern Hemisphere fisheries, notably those for Patagonian toothfish (*Dissostichus eleginoides*). These fisheries are also known frequently to catch albatrosses (Ashford et al., 1994; Schiavini et al., in press), but few quantitative data concerning these interactions are currently available. Within the Southern Ocean to the south of the Antarctic Polar Front, where fisheries are managed by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), considerable effort has been made to modify fishing methods in order to try to reduce the number of albatrosses killed (e.g. CCAMLR, 1994). However, these efforts are still only partially successful (Ashford et al., 1995; CCAMLR, 1995); ensuring the comprehensive use of appropriate methods by fishing vessels may take a considerable time. Therefore it may be timely to see if there are other approaches that can be used to assess the magnitude and significance of potential interactions between albatrosses and fisheries and thereby contribute to solutions to the current problem.

In this paper we try to assess the overlap in at-sea distribution between *D. exulans* breeding at South Georgia and vessels fishing for *D. eleginoides* in the surrounding waters in order to identify any times of the year when the potential for albatross mortality associated with longline fishing might be particularly serious.

METHODS

To examine foraging ranges of *D. exulans* we used data from satellite-tracking studies, carried out at Bird Island, South Georgia, as described in Prince et al. (1992). From studies during incubation and chick-rearing periods (December-October), fairly evenly distributed between August 1990 and September 1994, we have a total of 9 518 location uplinks from 45 birds (27 males, 18 females) tracked for a total of 784 days. For the brood-guard period (mid-March to mid-May) we have a total of 1 063 uplinks from 11 birds (7 males, 4 females), tracked for a total of 91 days during 1991 and 1992.

The accuracy of locational information is similar to that described by Prince et al. (1992). That is, about 40% of locations are accurate to within 1 km. The remaining 60% are of unspecified accuracy but, when viewed in conjunction with adjacent data of specified accuracy, are very unlikely to be inaccurate by more than ±10 km. For present purposes we treat all position fixes equally and use the proportion of fixes in an area as an index of time spent in that area.

To assess the distribution of vessels fishing for *D. eleginoides* around South Georgia, we use the data reported to CCAMLR on the location of hauls (catches). Fishing for *D. eleginoides* around South Georgia started in 1976/77. Longline techniques were first introduced in 1988/89. To compare with the albatross data we have used, with permission of the parties concerned, CCAMLR data for the years 1990/91 to 1993/94. Up to 1992/93 the fishery was open year-round and fishing took place in most months of the year with between 1 and 12 vessels operating at any time. In 1993/94 the fishery was restricted to the period 15 December 1993 to 15 September 1994 and involved a total of five vessels, only one operating at a time. From these periods we have data on a total of 1 976 haul locations from 21 vessels.

RESULTS

The distribution at sea of foraging *D. exulans* of both sexes during the incubation and chick-rearing periods is shown in Figure 1. Excluding the brood-guard period (see below), about 25% of all location uplinks were from the area of the South Georgia shelf and shelf-slope. However most (c. 75%) of these uplinks related to birds in transit to or from their breeding site at Bird Island. Therefore, during the post-brood chick-rearing period (mid-May through October) most active foraging (as opposed to relatively direct travelling to and from the breeding site) was associated with the Patagonian Shelf, particularly slope areas over depths of c. 1 000 m, and with seamounts around the Falkland/Malvinas Islands and Tierra del Fuego. The distribution of sexes was much as illustrated in Prince et al. (1992); females favoured the more northerly areas, while males showed a more southerly bias, they alone foraging around southern Argentina and Chile, into the Drake Passage and south to the Antarctic Peninsula.

The distribution of foraging *D. exulans* during the brood-guard period (mid-March through mid-May; Figures 2 and 3) is completely different. At this time of year, when chicks need frequent feeding and one parent remains at the nest brooding or guarding the young chick, the foraging range of both sexes was mainly closely associated with the South Georgia continental shelf. For males (Figure 2), 74% of their uplink locations were over the shelf or shelf-slope within the area of operation of the *D. eleginoides* fishery. Females (Figure 3) foraged significantly further afield, but 56% of their uplinks were over the South Georgia shelf, most of the remainder being in one or two specific areas around the Falkland/Malvinas Islands.

The location of longline fishing hauls for *D. eleginoides* around South Georgia in the 1991 to 1994 seasons is shown in Figure 4. This fishery operates mainly over the edge of the continental shelf at depths of around 1 000 m and deeper.

DISCUSSION

For most of their breeding season (which lasts almost one complete year) *D. exulans* appear to have limited vulnerability to longline fishing around South Georgia. Their principal, and considerable, vulnerability to this type of fishing is in the waters of, or near, the Patagonian Shelf and southern South America. At South Georgia, birds are primarily at risk during their regular transits across the shelf-slope to and from their breeding colonies. These transits are usually fairly brief (1 day), especially in relation to the very long foraging trips during the incubation (averaging 10-12 days) and post-brooding (averaging 6-7 days) chick-rearing periods. Therefore, although some 25% of uplinks are in areas coextensive with those used by the local longline fishery, birds only spend about 10% of their time in this area, even during the post-brooding chick-rearing period.

In contrast, during the brood-guard period (when foraging trips last 2-3 days, on average) the foraging ranges of breeding adults are greatly restricted, chiefly to the vicinity of South Georgia. Thus birds of both sexes are foraging mainly in the same general, and often specific, areas as those where longline fishing for *D. eleginoides* typically takes place. This extensive overlap between albatrosses and longline fishing vessels is of considerable concern. There are obviously high risks of *D. exulans* interacting with and becoming

victims of longline fishing vessels. In addition, injury to or death of one parent at this time will certainly cause the young chick to die. Furthermore, body reserves of the surviving partner may be reduced to atypically low levels (with potential prejudice to future survival and reproductive performance) by the artificial extension of its brood-guard shift caused by the loss of its partner.

The restriction of foraging activities to the vicinity of breeding colonies during the brooding period is characteristic of *D. exulans* generally (see Weimerskirch et al., 1993), so the particular potential problems we report may occur anywhere a longline fishery operates near a breeding site. Given that existing provisions to reduce mortality of albatrosses associated with longline fishing in the Southern Ocean (e.g. setting of lines at night, use of tori poles and streamers) are, as yet, neither sufficiently widely used nor adequately effective (see CCAMLR, 1994, 1995), restricting the timing of longline fishing in the vicinity of albatross colonies could make a substantial contribution to reducing albatross mortality at a particularly critical time of year.

For *D. exulans* at South Georgia the brooding period lasts on average from 11 March to 12 April (range 27 February to 11 May) (Tickell, 1968). Therefore, if the local longline fishery for *D. eleginoides* were closed from the end of February until mid-May, the time of the most serious potential mortality of *D. exulans* would be avoided. We recommend that the authorities responsible for the management of this fishery consider carefully this option, at least until such time as longline fishing methods that do not cause albatross mortality are in comprehensive use.

ACKNOWLEDGEMENTS

We thank Drs G. Parkes and D.J. Agnew for assistance in acquiring data on the *D. eleginoides* fishery at South Georgia, and Argentina, Bulgaria, Chile, Republic of Korea, Russia and Ukraine for permission to use these data. We are grateful to Drs A.G. Wood and P.N. Trathan for preparation of maps and Drs F. Mehlum and G. Robertson for many helpful comments on the manuscript, which was typed by J. Leland. We also thank numerous field staff from Bird Island for their assistance in the research on satellite tracking of *D. exulans* in recent years.

REFERENCES

Ashford, J.R., J.P. Croxall, P.S. Rubilar and C.A. Moreno. 1994. Seabird interactions with longlining operations for *Dissostichus eleginoides* at the South Sandwich Islands and South Georgia. *CCAMLR Science*, 1: 143-153.

Ashford, J.R. J.P. Croxall, P.S. Rubilar and C.A. Moreno. 1995. Seabird interactions with longlining operations for *Dissostichus eleginoides* around South Georgia, April-May 1994. *CCAMLR Science*, 2: 111-121.

Brothers, N. 1991. Albatross mortality and associated bait loss in the Japanese longline fishery in the Southern Ocean. *Biological Conservation*, 55: 255-268.

CCAMLR. 1994. *Report of the Thirteenth Meeting of the Commission (CCAMLR-XIII)*. CCAMLR, Hobart, Australia.

CCAMLR. 1995. *Report of the Fourteenth Meeting of the Commission (CCAMLR-XIV)*. CCAMLR, Hobart, Australia.

Collar, N.J., M.J. Crosby and A.J. Stattersfield. 1994. *Birds to Watch 2. The World List of Threatened Birds*. BirdLife Conservation Series No. 4. BirdLife International, Cambridge.

Croxall, J.P. and P.A. Prince. 1990. Recoveries of wandering albatrosses *Diomedea exulans* ringed at South Georgia, 1958-1986. *Ringing and Migration*, 11: 43-51.

Croxall, J.P., P. Rothery, S.P.C. Pickering and P.A. Prince. 1990. Reproductive performance recruitment and survival of wandering albatrosses *Diomedea exulans* at Bird Island, South Georgia. *Journal of Animal Ecology*, 59: 773-794.

de la Mare, W.K. and K.R. Kerry. 1994. Population dynamics of the wandering albatross (*Diomedea exulans*) on Macquarie Island and the effects of mortality from longline fishing. *Polar Biology*, 14: 231-241.

Gales, R. 1993. *Co-operative Mechanisms for the Conservation of Albatross*. Australian Nature Conservation Agency: 132 pp.

Murray, T.E., J.A. Bartle, S.R. Kalish and P.R. Taylor. 1993. Incidental capture of seabirds by Japanese southern bluefin tuna

longline vessels in New Zealand waters 1988-1992. *Bird Conservation International*, 3: 181-210.

Prince, P.A., A.G. Wood, T.R. Barton and J.P. Croxall. 1992. Satellite-tracking wandering albatrosses *Diomedea exulans* in the South Atlantic. *Antarctic Science*, 4: 31-36.

Schiavini, A., E. Frere, P. Gandini, N. Garcia and E. Crespo. In press. Albatrosses off Patagonia (Argentina) and offshore fisheries. In: Robertson, G. (Ed.). *Albatross Biology and Conservation*. Surrey Beatty and Sons, Chipping Norton, Australia.

Tickell, W.L.N. 1968. The biology of the great albatrosses *Diomedea exulans* and *D. epomophora*. *Antarctic Research Series*, 12: 1-55.

Weimerskirch, H. and P. Jouventin. 1987. Population dynamics of the wandering albatross, *Diomedea exulans*, of the Crozet Islands: causes and consequences of the population decline. *Oikos*, 49: 315-322.

Weimerskirch, H., M. Salamolard, F. Sarrazin and P. Jouventin. 1993. Foraging strategy of wandering albatrosses through the breeding season: a study using satellite telemetry. *Auk*, 110: 325-342.

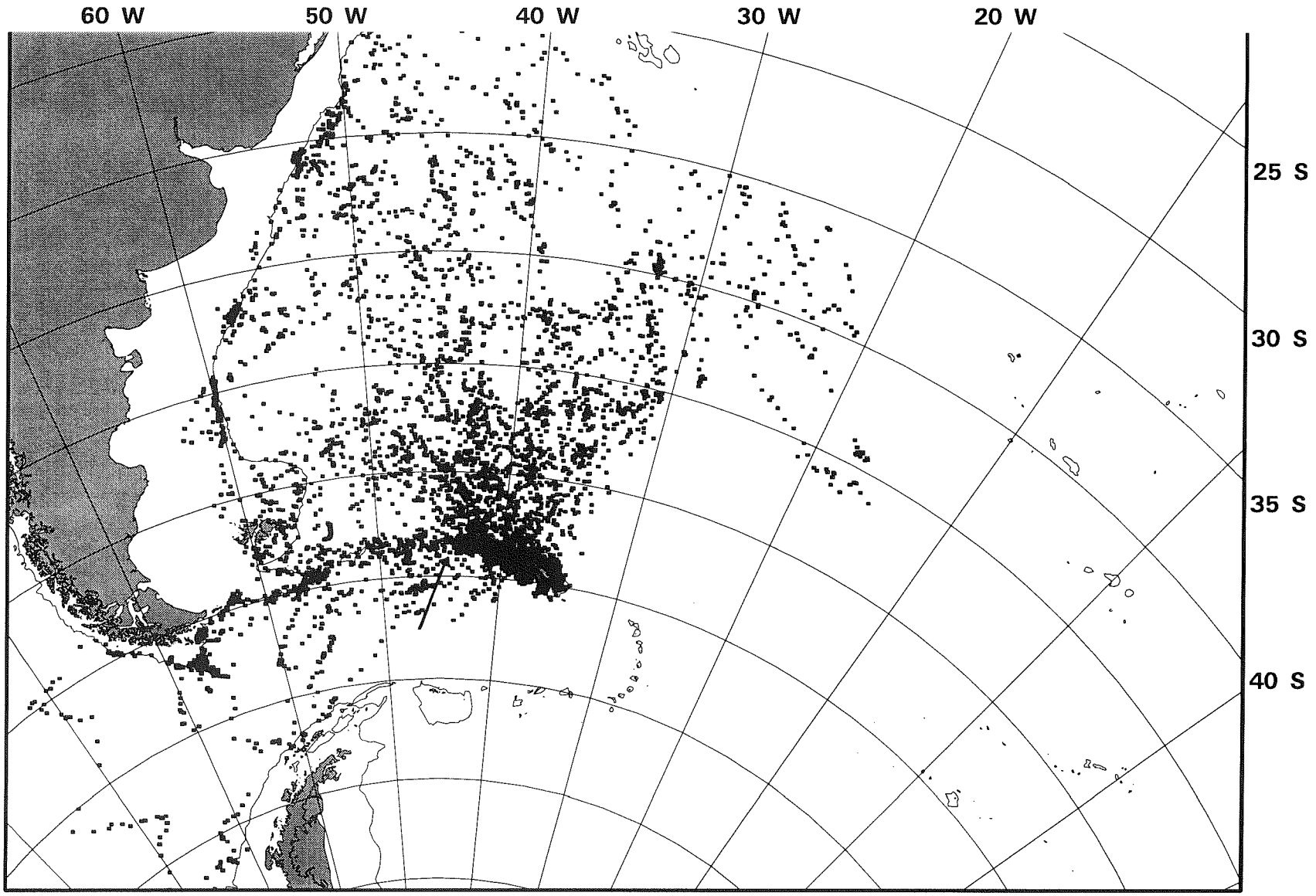

Figure 1: Distribution of *D. exulans* of both sexes satellite-tracked from South Georgia, 1990-1994. Arrow indicates the location of Bird Island.

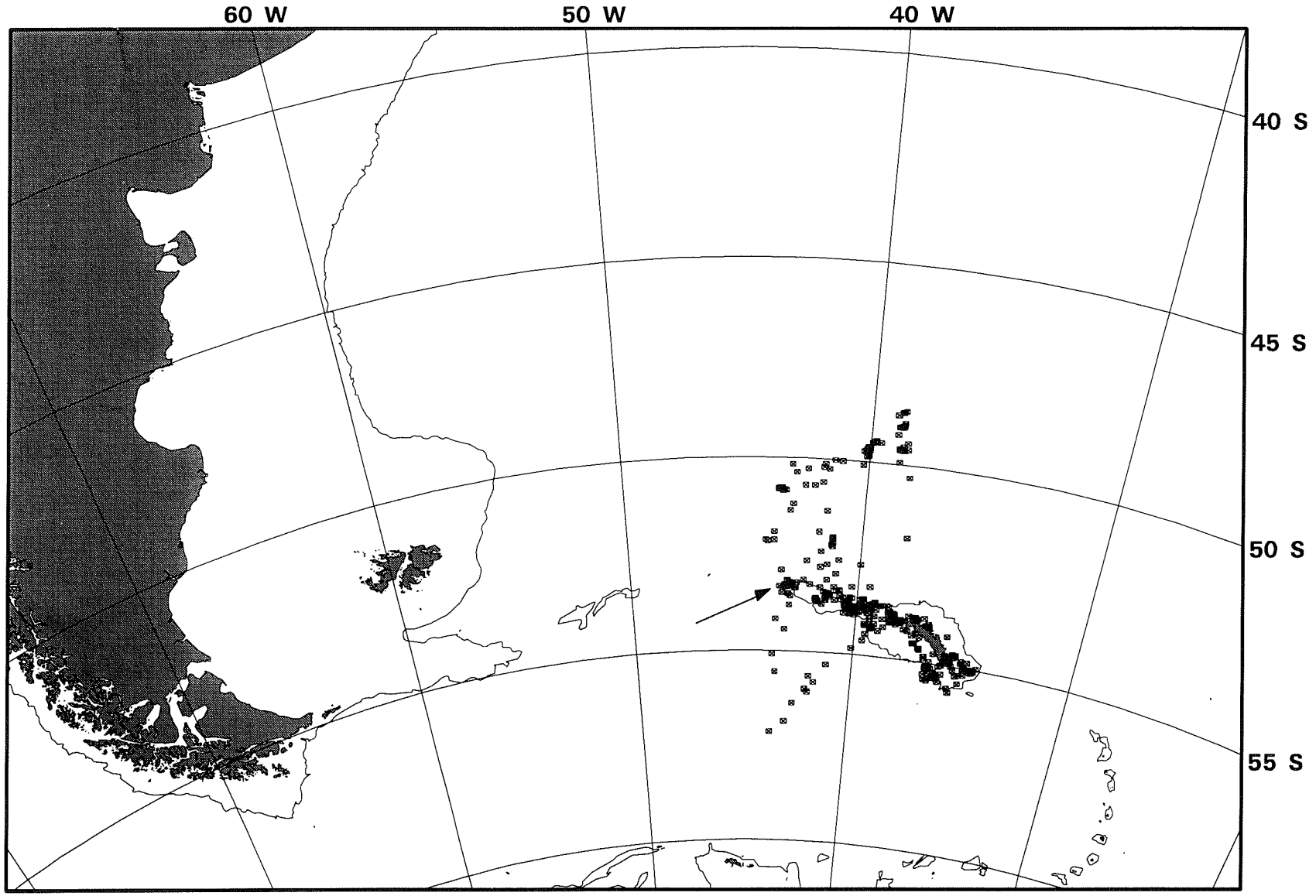

Figure 2: Distribution of male *D. exulans* satellite-tracked from South Georgia during the brood-guard period. Arrow indicates the location of Bird Island.

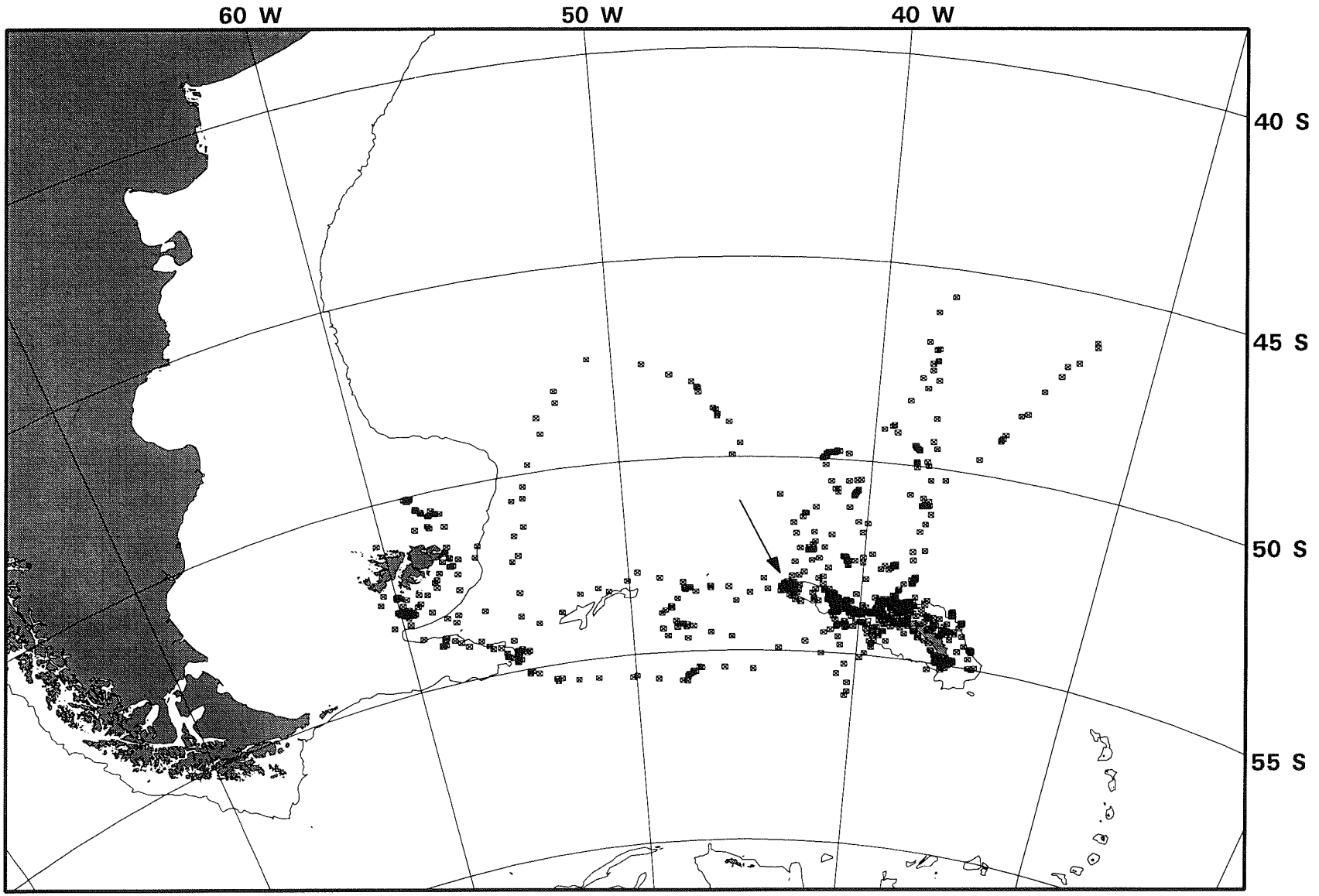

Figure 3: Distribution of female *D. exulans* satellite-tracked from South Georgia during the brood-guard period. Arrow indicates the location of Bird Island.

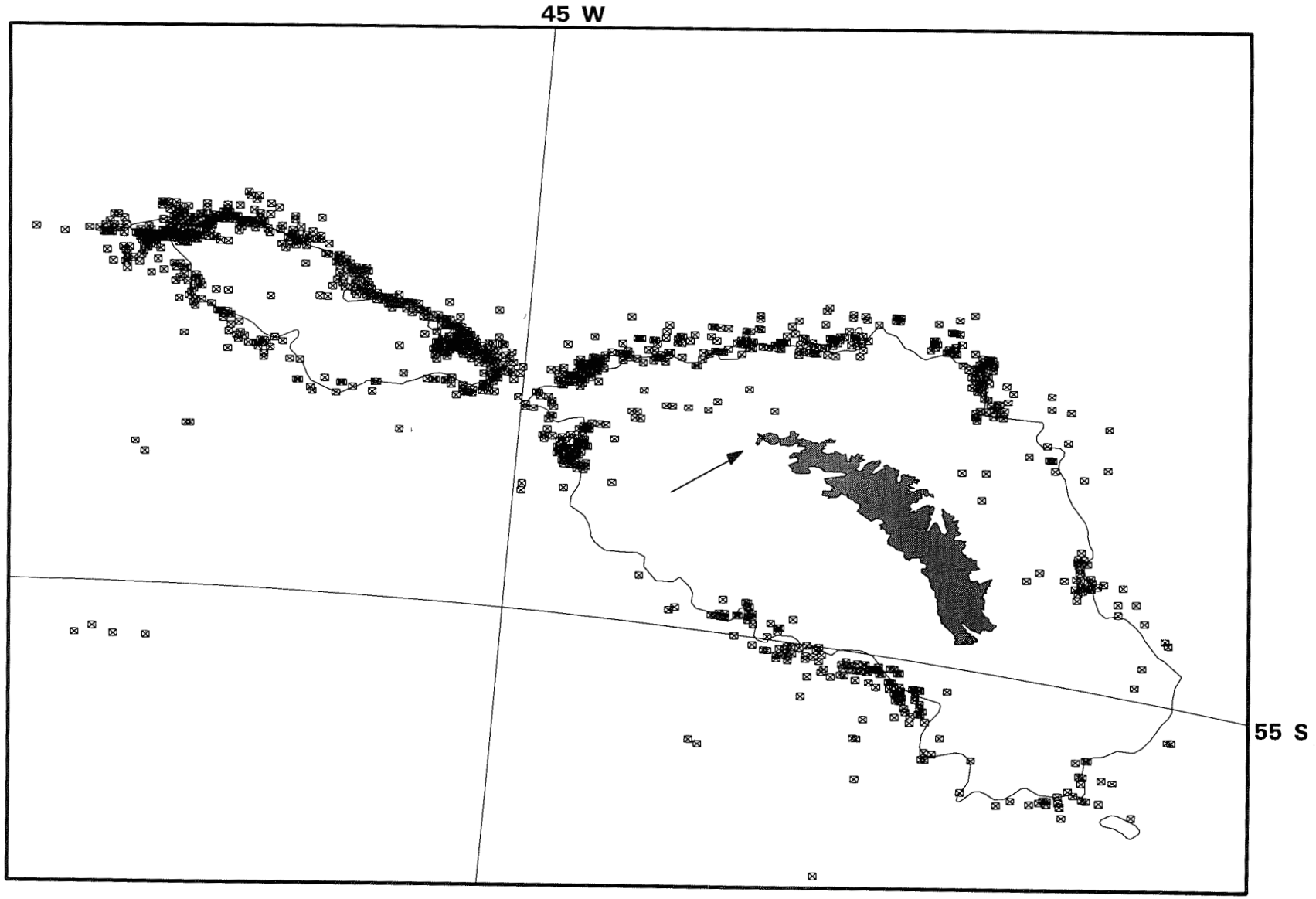

Figure 4: Distribution of *D. eleginoides* longline hauls around South Georgia during the 1991 to 1994 seasons. Arrow indicates the location of Bird Island. Bathymetric contour is 1 000 m.

Liste des figures

Figure 1: Répartition de *D. exulans* des deux sexes, d'après un suivi par satellite de la Géorgie du Sud, 1990-1994. La flèche indique la position de l'île Bird.

Figure 2: Répartition des mâles de *D. exulans*, d'après un suivi par satellite de la Géorgie du Sud effectué pendant la période de couvaison/de garde. La flèche indique la position de l'île Bird.

Figure 3: Répartition des femelles de *D. exulans*, d'après un suivi par satellite de la Géorgie du Sud effectué pendant la période de couvaison/de garde. La flèche indique la position de l'île Bird.

Figure 4: Répartition de poses effectuées autour de la Géorgie du Sud lors de la pêche à la palangre de *D. eleginoides* pendant les saisons 1991-1994. La flèche indique la position de l'île Bird. L'isobathe indiquée estcelle de 1 000 m.

Список рисунков

Рисунок 1: Распределение обоего пола *D. exulans* Южной Георгии, определенное при помощи спутникового слежения, 1990-1994 гг. Стрелкой указано расположение острова Берд.

Рисунок 2: Распределение самцов *D. exulans* Южной Георгии, определенное при помощи спутникового слежения в период высиживания птенцов/охраны. Стрелкой указано расположение острова Берд.

Рисунок 3: Распределение самок *D. exulans* Южной Георгии, определенное при помощи спутникового слежения в период высиживания птенцов/охраны. Стрелкой указано расположение острова Берд.

Рисунок 4: Распределение ярусных уловов *D. eleginoides* в районе Южной Георгии в период с 1991-1994 гг. Стрелкой указано расположение острова Берд. Батиметрические контуры - 1 000 м.

Lista de las figuras

Figura 1: Distribución de la población de *D. exulans* de ambos sexos, obtenida del rastreo por satélite en Georgia del Sur desde 1990 hasta 1994. La flecha indica la ubicación de la Isla de los Pájaros.

Figura 2: Distribución de los machos de *D. exulans* obtenida del rastreo por satélite en Georgia del Sur desde el período de incubación hasta la guardería. La flecha indica la ubicación de la Isla de los Pájaros.

Figura 3: Distribución de las hembras de *D. exulans* obtenida del rastreo por satélite en Georgia del Sur desde el período de incubación hasta la guardería. La flecha indica la ubicación de la Isla de los Pájaros.

Figura 4: Distribución de los lances de la pesquería de palangre de *D. eleginoides* alrededor de Georgia del Sur durante las temporadas de pesca de 1991 a 1994. La flecha indica la ubicación de la Isla de los Pájaros. El contorno batimétrico corresponde a 1 000 m.