

## SEABIRD INTERACTIONS WITH TRAWL AND LONGLINE FISHERIES FOR *DISSOSTICHUS ELEGINOIDES* AND *CHAMPSOCEPHALUS GUNNARI*

R. Williams  
Australian Antarctic Division  
Channel Highway, Kingston  
Tasmania 7050, Australia

D. Capdeville  
Centre d'Etudes Biologiques de Chizé  
79360 Villiers-en-Bois, France

### Abstract

The behaviour of seabirds and the rate of incidental mortality were observed during commercial trawling operations for Patagonian toothfish (*Dissostichus eleginoides*) in the 1994/95 season near Macquarie Island and Kerguelen Island. Longlining for *D. eleginoides* and trawling for mackerel icesh ( *Champscephalus gunnari* ) were also observed at Kerguelen. Many seabirds were constantly observed near the vessels, especially giant petrels (*Macronectes halli* and *M. giganteus*), black-browed albatrosses (*Diomedea melanophris*) and Dominican gulls (*Larus dominicanus*). White-chinned petrels (*Procellaria aequinoctialis*) were common only at Kerguelen. Bird mortality during trawling was zero at Macquarie Island and very low at Kerguelen; most was associated with a single vessel using a netsonde cable while targetting *C. gunnari*. Most mortality associated with both longliners and trawlers was of white-chinned petrels, with a lesser mortality of albatross species. Mortality rates associated with longlining in the Kerguelen region were lower than those reported for the South Georgia area, probably because the birds at the former site are distracted from the longlines by the discharge of offal from the side of the vessel opposite to where the longline is set.

### Résumé

Le comportement des oiseaux de mer et le taux de mortalité accidentelle ont été observés dans les chalutages industriels de légine australe (*Dissostichus eleginoides*) pendant la saison 1994/95 aux alentours des îles Macquarie et Kerguelen. De plus, à Kerguelen, les opérations de pêche à la palangre de *D. eleginoides* et les chalutages de poissons des glaces (*Champscephalus gunnari*) ont également été observés. De nombreux oiseaux de mer étaient constamment présents autour des navires, en particulier les pétrels géants (*Macronectes halli* et *M. giganteus*), les albatros à sourcils noirs (*Diomedea melanophris*) et les goélands dominicains (*Larus dominicanus*). Les pétrels à menton blanc (*Procellaria aequinoctialis*) n'étaient fréquemment rencontrés qu'à Kerguelen. Pendant les chalutages, la mortalité des oiseaux était nulle à l'île Macquarie et très faible à Kerguelen où elle était causée presque exclusivement par un navire qui utilisait un câble électro-porteur de contrôle des chaluts pendant la pêche de *C. gunnari*. La plupart des cas de mortalité associés aux palangriers et aux chalutiers concernaient des pétrels à menton blanc et, à moindre mesure, des espèces d'albatros. Les taux de mortalité associés à la pêche à la palangre dans la région de Kerguelen étaient plus faibles que ceux déclarés à proximité de la Géorgie du Sud et ce, vraisemblablement, parce que les oiseaux, dans la région de Kerguelen, étaient détournés des palangres par le rejet de déchets de poissons par le navire, du bord opposé à celui de la pose de la palangre.

### Резюме

В течение сезона 1994/95 г. у о-ва Макуори и о-ва Кергелен было подвергнуто наблюдению поведение морских птиц и уровень их побочной смертности в ходе тралового промысла патагонского клыкача (*Dissostichus eleginoides*). На Кергелене также подвергались наблюдению ярусный промысел *D. eleginoides* и траловый промысел ледяной рыбы (*Champscephalus gunnari*). Вблизи судов постоянно наблюдалось большое количество морских птиц, особенно гигантских буревестников (*Macronectes halli* и *M. giganteus*), чернобровых альбатросов (*Diomedea melanophris*) и доминиканских чаек (*Larus dominicanus*). Белогорлые буревестники (*Procellaria aequinoctialis*) встречались только на Кергелене. В

ходе траловых работ у о-ва Макуори смертность птиц была нулевой, а у Кергелена - очень низкой; в основном эта смертность была связана с применением одним судном кабельного нетзонда при целевом промысле *C. gunnari*. В большинстве случаев смертность как на ярусоловах, так и на траулерах была связана с белогорлыми буревестниками, а в меньшей степени - различными видами альбатросса. Смертность при ярусном промысле в районе Кергелена была меньше, чем в районе Южной Георгии, вероятно в связи с тем, что у Южной Георгии птицы отвлекаются от ярусов сбросом отходов переработки с борта, противоположного тому, с которого устанавливается ярус.

#### Resumen

Se observó el comportamiento de las aves marinas y la tasa de mortalidad incidental durante las operaciones pesqueras comerciales de arrastre del bacalao de profundidad (*Dissostichus eleginoides*) en la temporada 1994/95 cerca de las islas Macquarie y Kerguelén. También se observó la pesca de palangre de *D. eleginoides* y de arrastre de draco rayado (*Champscephalus gunnari*) en Kerguelén. Se observaron muchas aves constantemente cerca de los barcos, especialmente petreles gigantes (*Macronectes halli* y *M. giganteus*), albatros de ceja negra (*Diomedea melanophris*) y gaviotas dominicanas (*Larus dominicanus*). Los petreles de mentón blanco (*Procellaria aequinoctialis*) solamente fueron avistados con frecuencia en Kerguelén. La mortalidad de las aves durante los arrastres fue cero en la isla Macquarie y muy baja en Kerguelén; la mayor parte asociada con un solo barco que utilizó un cable de control de la red para la búsqueda del objetivo *C. gunnari*. La mayor parte de la mortalidad asociada con palangreros y arrastreros fue de petreles de mentón blanco, con una mortalidad más baja de albatros. Las tasas de mortalidad asociadas con la pesca de palangre en la región de Kerguelén fueron más bajas que aquellas notificadas para el área de Georgia del Sur, probablemente porque en la región de Kerguelén las aves fueron atraídas a la descarga de desechos efectuada desde el lado opuesto al del calado del palangre.

Keywords: *Dissostichus eleginoides*, *Champscephalus gunnari*, CCAMLR, Kerguelen, Macquarie, seabird mortality

#### INTRODUCTION

The Southern Ocean fishery for Patagonian toothfish (*Dissostichus eleginoides*) began around the Kerguelen Islands in 1984/85 and South Georgia in 1986/87. Since then it has expanded rapidly both within and outside the CCAMLR area, and in recent years the *D. eleginoides* fishery has been the most important one within the CCAMLR area (CCAMLR, 1995). Reported catches have averaged 2 830 tonnes per season, all taken by longliners, in Subarea 48.3 (South Georgia) over the five seasons 1990/91 to 1994/95 and 4 800 tonnes from Division 58.5.1 (Kerguelen) during the same period with catches taken by a mixture of longlining (12%) and trawling (88%). A trawl fishery for this species started in the 1994/95 season near Macquarie Island (54°30'S, 159°45'E) which is outside the CCAMLR area, north of Subarea 88.1. A total of 450 tonnes was caught in that season.

The high mortality of seabirds, mainly albatrosses and giant petrels, associated with the longline fishery for *D. eleginoides* in the vicinity of South Georgia (Subarea 48.3) is well established

(Croxall et al., 1990). By-catch rates of up to 0.457 birds per 1 000 hooks have been observed (SC-CAMLR, 1995a). These other fisheries, as is the case at South Georgia, occur in the vicinity of islands where there are large populations of seabirds, particularly albatrosses and petrels, which are vulnerable to injury or death from fishing operations. Whereas the South Georgia fishery is conducted entirely using longlines, the Kerguelen and Macquarie catches are taken mostly by trawling, and where longlines are used in the Kerguelen fishery, techniques are somewhat different from those used at South Georgia. The interaction of seabirds with fishing vessels was closely monitored during the 1994/95 season in both the Kerguelen and Macquarie fisheries, and this paper summarizes these observations.

#### METHODS

Three types of fishing vessels operated over the Kerguelen Plateau in Division 58.5.1 during the 1994/95 season with two principal species targeted:

- three 54-metre-long Ukrainian longliners fishing for *D. eleginoides*;
- three Ukrainian trawlers (83 m, 84 m and 102 m in length) fishing for *D. eleginoides* and mackerel icefish (*Champsocephalus gunnari*); and
- two French trawlers (78 m and 87 m in length) fishing for *D. eleginoides*.

The longliners fished using the method described by Duhamel (1992) and Cherel et al. (1995), in which setting and hauling of the lines of 2 400 hooks takes place both by day and night. Fish waste (heads, guts and tails of *D. eleginoides*) was discharged during line setting from the opposite side of the vessel to distract the birds and reduce incidental mortality. The trawlers were factory freezer trawlers of which one, *Mys Ostrovsoko*, still used a netsonde cable.

The incidence of bird by-catch was recorded by fisheries inspectors on each vessel in the zone. The information consisted either of individual observations gathered during the normal work of the observer, or of observations connected with the quantification of by-catch of non-commercial fish species. Special attention was also paid to the netsonde cable during observations aboard *Mys Ostrovsoko*.

At Macquarie Island, only one vessel was fishing. This was the 85-metre-long Australian factory freezer trawler *Austral Leader*. This was fishing for *D. eleginoides* 3 to 5 n miles to the west of the island at depths between 600 and 1 000 m. A scientific observer was aboard for the duration of the principal voyage to the island, during which 350 tonnes of *D. eleginoides* were caught. All phases of the trawling operation were closely observed during the voyage, and the behaviour of the seabirds around the vessel was noted.

Behavioural techniques used by the birds to seize food are described according to Harper et al. (1985).

## RESULTS

### Longliners

During longline fishing in the Kerguelen area, birds attracted by baits were caught on hooks and drowned during the setting of the longline. The species most affected was the white-chinned petrel (*Procellaria aequinoctialis*), presumably because of its tendency to dive for the baits.

Incidental mortality occurred despite measures to divert the birds away from the longlines during setting, i.e. discharging factory waste from the side of the ship opposite to where the lines were set (Table 1). A detailed analysis of 42 longline sets observed throughout their entire deployment shows a mean by-catch of 0.28 birds per deployment (0.12 birds/1 000 hooks) in November/December, which is less than the 0.50 birds per deployment (0.21 birds/1 000 hooks) observed in February by Duhamel (1991). This difference could be connected with the more active searching for food by the birds in February when their chicks have developed beyond the brood stage (Le Petitcorps, pers. comm.). The mean capture rate of 0.02 birds per longline set (0.008 birds/1 000 hooks) with waste disposal from the opposite side of the ship compared with 1.19 birds per longline set (0.496 birds/1 000 hooks) without waste disposal during setting (Cherel et al., 1995) demonstrates the potential of this method of waste disposal to minimise incidental mortality in this fishery, although more data are necessary before simple interannual or seasonal variability can be discounted. In considering this method, the CCAMLR Working Group on Fish Stock Assessment (WG-FSA) noted that the use of offal to distract seabirds may be

Table 1: Incidental mortality observed on the longliner *Primorets* during the 1994/95 season. The fishery targetted *D. eleginoides*.

Dates	17 November 1994 to 2 January 1995	10 January 1995 to 6 March 1995
Observer	Capdeville	Castano
Total longline sets	205	232
Mortality observed:		
white-chinned petrel	7	10
black-browed albatross	3	2
grey-headed albatross	2	1
wandering albatross	0	1

useful in this particular fishery because the number of hooks set is relatively low (2 400) and setting times are therefore very short (SC-CAMLR, 1995b - paragraph 8.58).

#### Trawlers

*Austral Leader* fished in the vicinity of Macquarie Island from 1 January to 12 February 1995 with only two short breaks of less than one day each. The vessel made an average of five hauls per day (a total of 198 hauls) in the depth range 600 to 1 000 m between the island and the western edge of the Macquarie Ridge, less than 5 n miles from the island. Most hauls were of three to four hours duration on the bottom and covered 12 to 15 miles, essentially along the same track. The vessel did not use a netsonde cable.

No mortality or injury to seabirds was observed on the voyage. Birds were never caught in the net itself, which is not surprising as the fishing depth was well below the birds' diving depth, and they would be alert and fast enough to avoid the net during hauling. No bird was seen to collide with any of the trawl gear or the ship itself. Observations covered all phases of the trawling operation, i.e. setting, towing and hauling. The behaviour of the birds can be summarised as follows:

- After the first few hauls, the number of birds attending the ship was fairly constant. There were usually about 150 giant petrels (both *M. halli* and *M. giganteus*), 50 black-browed albatrosses (*Diomedea melanophris*), 50 Dominican gulls (*Larus dominicanus*) and 4 grey-headed albatrosses (*D. chrysostoma*) regularly following the ship or sitting on the water close by. Skuas (*Catharacta antarctica*) were first seen around the ship four weeks after fishing started and up to four birds were seen from then until the end of fishing. Two shy albatrosses (*D. cauta*) followed the ship for the final two weeks of fishing. Other species, such as the wandering albatross (*Diomedea exulans*) and Cape petrel (*Daption capense*), followed the ship occasionally. Species such as the light-mantled sooty albatross (*Phoebastria palpebrata*), sooty shearwater (*Puffinus griseus*) and prions (*Pachyptila* spp.) were occasionally seen from the ship, but did not seem to take any notice of it. Nearly all of these species are common around the island, and most breed there (Marchant and Higgins, 1990).

- Early in the voyage, the birds were observed near the ship at all times, either sitting in large groups on the water close to the ship or flying across the stern area. After the first two weeks of fishing, they seem to have learnt that food was available only about the time the net was hauled. For the remainder of the voyage, most birds stayed close to the ship only from the time hauling commenced until the factory stopped discharging waste from fish processing.
- When the net reached the surface during hauling, birds would attempt to pick food from its meshes. The giant petrels and albatrosses would sit either beside or above the net and reach for morsels, whereas the Dominican gulls would swoop from above to grasp food. This behaviour only lasted two or three minutes as the net was quickly hauled aboard. There was a similar period when the net was being set, but this was shorter because the net, with its heavy ground gear, sank quickly.
- The major interaction came when the factory began discharging waste from a chute on the starboard side about 10 m forward of the stern. A few birds (usually less than 20 black-browed albatrosses and giant petrels) would sit near the chute and attempt to scavenge from the surface or surface dive for food. Most of the larger items such as fish heads and tails sank too quickly for them, but they often picked up lighter items such as pieces of liver and guts. They were more successful later in the voyage when the factory waste was macerated, producing many more smaller pieces. Most feeding, however, took place well behind the stern. A large group of birds would sit behind the propeller wash, about 80 m astern of the ship. From there birds would move forward and attempt to seize food, and then drop back relative to the ship as it moved forward. Alternatively, birds flying around the ship would approach the propeller wash area from the side, landing on the water to seize food, although Dominican gulls would often attempt to seize food with their bills while still on the wing. Frequently, small melees of birds fighting over food scraps would form in the ship's wake and be left behind by the ship. The above behaviour meant that birds rarely came closer than 5 m to the fishing gear, except when they were attempting to take morsels from the net during hauling and setting.

At Kerguelen there was much greater fishing effort than at Macquarie Island and some bird by-catch was observed, although it was much less than with the longliners (Table 2). Mortality directly attributable to the trawl gear mostly affected diving birds such as white-chinned petrels when they were trying to seize items lost from the trawl. They were either caught in the meshes of the top of the net (Duhamel, 1991) or in the bag of the net, equally during setting or retrieval. All but one of the birds were killed in the *C. gunnari* fishery. The relatively small size of this fish (24 to 40 cm total length during the 1994/95 season) makes it much more easy to ingest than *D. eleginoides* and, therefore, more attractive to birds. As with the longline fishery, the capture of birds was only observed after the end of the brood stage of the chicks.

In the case of *Mys Ostrovsoko*, it is difficult to determine the relative contributions of the trawl and the netsonde cable to bird mortality (Table 3). Birds definitely killed by the netsonde cable were found between this cable and the headline of the net. The cause of death of birds found in the bag of the net could be either collision with the netsonde cable or diving into the net. The estimate of mortality caused by the cable is therefore a minimum because some birds could be injured or killed by collision with the cable and fall in the water, ending up in the net. The mean mortality rate, including all species and causes of mortality, is 0.48 birds per day. Observation of bird behaviour during the setting and hauling of trawls by *Mys Ostrovsoko* showed that the birds were capable of seeing the netsonde cable under some conditions, judging by the frequent observation of avoidance reactions. Mortality unequivocally caused by the netsonde cable was only observed during four trawls in particular meteorological conditions. For two trawls, the ship's speed relative to the wind was nil, i.e. the ship was moving in the same direction and at the same speed as the wind. In the other two cases, a strong wind was blowing at right angles to the direction in which the ship was travelling.

## DISCUSSION

These observations in the vicinity of Kerguelen and Macquarie Islands in sub-Antarctic waters demonstrate that there is little or no mortality of birds arising from trawling at either location, even though the species composition of birds following the ships, and in some cases the species fished, are different. At Macquarie Island, where the target

species is *D. eleginoides* and white-chinned petrels are uncommon, there was no mortality. Most of the activity around the vessel by albatrosses, giant petrels and Dominican gulls was in attempting to seize waste from the fish factory and, to a lesser extent, from the net when at the surface. Similarly at Kerguelen, only one white-chinned petrel, a common species around the island, was observed killed in the *D. eleginoides* fishery, which accounted for 54% of the trawls (Table 2). In the remainder of the trawls, which were targeting *C. gunnari*, the bird mortality was higher at 0.027 birds per trawl, although this is still a low figure. Most of this mortality was observed on the one vessel with a netsonde cable where at least seven of the total of 17 bird deaths, including all of the albatross deaths observed, were caused by the cable (Table 3). Trawling in the *C. gunnari* fishery, provided no netsonde cable is used, poses problems only for diving birds, principally white-chinned petrels. Fine mincing of offal before discharge may make fishing vessels less attractive to birds and so further reduce the possibility of incidental mortality.

By contrast, longlining appears to be responsible for some incidental mortality at Kerguelen, although the practice of discharging offal from the side of the vessel opposite to that from which the longline is set appears to reduce the extent of the problem when compared to the South Georgia fishery. Although 72% of the birds killed in the longline fishery were white-chinned petrels, the impact of this mortality is tempered by the size of the population at Kerguelen (100 000 to 300 000 breeding pairs (Weimerskirch et al., 1989). The impact of fishing mortality on the smaller populations of grey-headed and black-browed albatrosses (7 900 and 3 115 to 3 225 breeding pairs respectively) will be proportionately greater. The global decline of the black-browed albatross population observed during the last 20 years (Woehler, in press) underlines the importance of quantifying the mortality due to fishing operations in order to establish if this is likely to affect albatross populations.

## REFERENCES

- CCAMLR. 1995. *Statistical Bulletin, Vol. 7 (1985-1994)*. CCAMLR, Hobart, Australia.
- Cherel, Y., H. Weimerskirch and G. Duhamel. 1995. Interactions between longline vessels

Table 2: Incidental mortality observed on trawlers fishing in the Kerguelen and Macquarie Island areas during the 1994/95 season.

Dates	1 Jan 1995 to 11 Feb 1995	14 Sept 1994 to 24 Oct 1994	6 Nov 1994 to 15 Nov 1994	31 Mar 1995 to 20 May 1995	3 May 1995 to 15 May 1995	16 Nov 1994 to 30 Dec 1994	6 Jan 1995 to 29 Jan 1995	2 Feb 1995 to 9 Mar 1995	16 Mar 1995 to 26 Mar 1995
Ship	<i>Austral Leader</i>	<i>Kerguelen de Tremarec</i>	<i>Mys Ostrovskogo</i>	<i>Kerguelen de Tremarec</i>	<i>Austral</i>	<i>Mys Ostrovskogo</i>	<i>Chatyr Dag</i>	<i>Mys Ostrovskogo</i>	<i>Vozrozhdenie</i>
Area	Macquarie	Kerguelen	Kerguelen	Kerguelen	Kerguelen	Kerguelen	Kerguelen	Kerguelen	Kerguelen
Season	Summer	Spring	Spring	Autumn	Autumn	Summer	Summer	Summer	Autumn
Scientific observer	Williams	Castano	Capdeville	Le Guilcher	Castano	Castano	Capdeville	Capdeville	Le Guilcher
Target species	<i>D. eleginoides</i>	<i>D. eleginoides</i>	<i>D. eleginoides</i>	<i>D. eleginoides</i>	<i>D. eleginoides</i>	<i>C. gunnari</i>	<i>C. gunnari</i>	<i>C. gunnari</i>	<i>C. gunnari</i>
Total number of trawls	198	146	33	205	180	204	76	149	42
Mortality observed:									
white-chinned petrel	0	1	0	0	0	1	1	13	3
black-browed albatross	0	0	0	0	0	0	0	3	1
grey-headed albatross	0	0	0	0	0	0	0	1	0

Table 3: Apparent causes of incidental mortality associated with the trawler *Mys Ostrovskogo*, 2 February to 9 March 1995. Target species was *C. gunnari* and 149 trawls were observed.

Species	Number Caught in the Meshes and/or the Bag of the Trawl	Cases of Collision with Netsonde Cable
White-chinned petrel	10	3
Black-browed albatross	0	3
Grey-headed albatross	0	1

- and seabirds in Kerguelen waters and a method to reduce seabird mortality. *Biological Conservation*, 75: 63-70.
- Croxall, J.P., P. Rothery, S.P.C. Pickering and P.A. Prince. 1990. Reproductive performance, recruitment and survival of the wandering albatross, *Diomedea exulans*, at Bird Island, South Georgia. *Journal of Animal Ecology*, 59: 775-796.
- Duhamel, G. 1991. Incidental mortality arising from fisheries activities around Kerguelen Island (Division 58.5.1). Document SC-CAMLR-X/BG/14. CCAMLR, Hobart, Australia.
- Duhamel, G. 1992. Exploratory longline fishing around the Kerguelen Islands (Division 58.5.1). Description of the fishing effort, catchability and target size of *Dissostichus eleginoides*. Document WG-FSA-92/31 Rev. 1. CCAMLR, Hobart, Australia.
- Harper, P.C., J.P. Croxall and J. Cooper. 1985. A guide to foraging methods used by marine birds in Antarctic and sub-Antarctic seas. *BIOMASS Handbook*, 24: 1-22.
- Marchant, S. and P.J. Higgins (Eds). 1990. *Handbook of Australian and New Zealand Birds. Volume 1: Ratites to Ducks. Part A, Ratites to Petrels*. Oxford University Press, Melbourne: 735 pp.
- SC-CAMLR. 1995a. *Report of the Fourteenth Meeting of the Scientific Committee (SC-CAMLR-XIV)*. CCAMLR, Hobart, Australia.
- SC-CAMLR. 1995b. Report of the Working Group on Fish Stock Assessment. In: *Report of the Fourteenth Meeting of the Scientific Committee (SC-CAMLR-XIV)*, Annex 5. CCAMLR, Hobart, Australia.
- Weimerskirch, H., R. Zotier and P. Jouventin. 1989. The avifauna of the Kerguelen Islands. *Emu*, 89: 15-29.
- Woehler, E.R. In press. Concurrent decreases in five species of Southern Ocean seabirds in Prydz Bay. *Polar Biology*, 16.

## Liste des tableaux

- Tableau 1: Mortalité accidentelle observée sur le palangrier *Primorets* pendant la saison 1994/95. *D. eleginoides* constituait l'espèce visée.
- Tableau 2: Mortalité accidentelle observée sur les chalutiers pêchant dans les régions des îles Kerguelen et Macquarie pendant la saison 1994/95.
- Tableau 3: Causes apparentes de la mortalité accidentelle associée au chalutier *Mys Ostrovskogo*, du 2 février au 9 mars 1995. *C. gunnari* constituait l'espèce visée et 149 chalutages ont été observés.

## Список таблиц

- Таблица 1: Побочная смертность, наблюдавшаяся на ярусолове *Приморец* в сезон 1994/95 г. Объект лова - *D. eleginoides*.
- Таблица 2: Побочная смертность, наблюдавшаяся на траулерах, работавших в районах Кергелена и о-ва Макуори в течение сезона 1994/95 г.
- Таблица 3: Видимые причины побочной смертности, связанной с траулером *Мыс Островского*, с 2 февраля по 9 марта 1995 г. Объект лова - *C. gunnari*. оличество наблюдавшихся тралений - 149.

## Lista de las tablas

- Tabla 1: Mortalidad incidental observada en el palangrero *Primorets* durante la temporada 1994/95. El objetivo de la pesca fue *D. eleginoides*.
- Table 2: Mortalidad incidental observada en los arrastreros que pescaron en las áreas de las islas Kerguelén y Macquarie durante la temporada 1994/95.
- Table 3: Posibles causas aparentes de la mortalidad incidental asociada con el arrastrero *Mys Ostrovskogo*, del 2 de febrero al 9 de marzo de 1995. La especie objetivo fue *C. gunnari* y se observaron 149 arrastres.

