

# Interactions between Cetaceans and Fisheries in the Southern Ocean – Progress Report 2008

by

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## Abstract

Depredation by killer whales (*Orcinus orca*) and Sperm whales (*Physeter macrocephalus*) has been a significant problem in longline fisheries in the Southern Ocean for more than 10 years and until recently there was no apparent solution. Modifications to longline gear have been trialed by three different countries participating in the longline fishery for Patagonian toothfish (*Dissostichus eleginoides*) in waters adjacent to the Southern Ocean and have been found to bear the potential of reducing depredation substantially. These modifications involve the use of net sleeves, weights at the end of vertical lines, and clusters of 10 hooks fixed 30 cm above the weight, it is likely that this method will be introduced in longline fishing in the Southern Ocean from the season 2007/08 onwards.

## Introduction

Fisheries interactions with cetaceans can be either biological or operational. Biological interactions are indirect and involve competition for the same food resource fish (Dayton et al., 1995; Earle, 1996; Trites et al., 1997; Kaschner, 2004). Operational interactions (depredation) are direct and are caused by cetaceans removing fish from fishing gear (Anonymous, 2006a; Estes et al., 2006). Depredation has become a global phenomenon in the past three decades (e.g. Northridge and Hoffman, 1999; Karpouzli and Leaper, 2004; Kock et al., 2006; Dalla Rosa and Secchi, 2007; Sigler et al., 2007).

In the Southern Ocean (FAO Areas 48, 58 and 88) and slope areas adjacent to it, depredation occurs primarily on longline gear used by commercial fisheries targeting Patagonian toothfish (*Dissostichus eleginoides*). Very few cases have been reported as being fatal for a cetacean (review in Kock et al., 2006).

The two cetacean species primarily involved in fisheries interactions in the Southern Ocean are Type C (Pitman and Ensor, 2003) killer whales (*Orcinus orca*) and sperm whales (*Physeter macrocephalus*) while Type A and Type B killer whales prey predominantly on minke whales and pinnipeds respectively (Branch and Williams, 2006). A photographic catalogue developed over the last 5 – 8 years in areas, such as South Georgia, Crozet Islands and Kerguelen Islands, has allowed the identification of a large number of killer whales that are regularly present in the vicinity of fishing vessels (Clark et al., 2006; Roche et al., 2007).

Depredation may cause considerable loss (up to 40 to 50% of the fish caught during one longline set) to fishermen around some Sub-Antarctic islands, such as South Georgia, the Prince Edward Islands and Crozet Islands (Purves et al., 2004, 2006; Roche et al., 2007) while in others, such as Heard and McDonald Islands, depredation by killer whales appears to be non-existent (Morrice, 2004). The Scientific Committee of CCAMLR suggested in October 2005 that a system to quantify the interactions between marine mammals (including cetaceans) and the longline fishery be developed in a systematic fashion. This should include direct observations of fish being removed from the line and indirect observations of depredated fish, lost hooks and broken gear, as well as systematic reporting of the presence of killer whales and sperm whales SC-CAMLR,

2005). Information collected until 2005/06 has been provided by Purves et al. (2004) and Kock et al. (2006).

We report here on recent developments inside and outside CCAMLR waters which have the potential to reduce depredation by cetaceans in longline fisheries substantially.

## Results

### Depredation mitigation methods

One paper was submitted to CCAMLR in 2006 and three in 2007 which dealt with cetacean – fishery interactions in the Southern Ocean. Some ancillary information was available from reports of scientific observers onboard longliners held by the CCAMLR secretariat:

#### 2006

Brandão and Butterworth (2006) estimated depredation by cetaceans in the EEZ around the Prince Edward Islands *ad hoc* from 2000 to 2006 to be 33.1 – 66.7% of the total amount of Patagonian toothfish removed. Depredation was assumed to be a learning process: depredation increased from 2000 to 2003 and then declined again in recent years although no quantitative estimate was provided (Anonymous, 2006b).

#### 2007

A modification to the longline gear with net sleeves, weights at the end of the vertical lines, and clusters of 10 hooks fixed 30 cm above the weight was introduced to the Chilean longline fishery along the Chilean coast of Tierra del Fuego (Moreno et al., 2007) (Figure 1). Although initially developed to deter birds from the line (bird mortality was reduced to zero after its introduction) the new system was also found to reduce depredation by killer and sperm whales by up to two thirds (Moreno et al., 2007).

A similar exclusion device to reduce depredation was introduced in the Uruguayan longline fishery from 40° to 50°S in 2006/07 (Pin and Rojas, 2007). Using the

exclusion device reduced the incidence of depredation from 71% of the sets to 27% and the catch rates increased from 15.53 to 23.03kg/hour.

Zaytsev (2007) described the use of a mammal exclusion device in longline operations of a Russian vessel in FAO Subareas 41.3.2 and 41.3.1 (waters off southwest Atlantic) in 2006/07 to reduce cetacean depredation. The exclusion device is a protection (cone) net and slides down over the hooks and catch as soon as the line is hauled. The design is shown in Figure 2. In addition, bunches of kapron (artificial fibre) filaments were fastened to the outside of the net.

Trials using cone nets in longlining have also been conducted by the UK in the South Georgia longline fishery in 2006/07 (Anon., 2007; scientific observer report from the vessel *Jacqueline* to CCAMLR). Initial results were promising, and the UK intends to proceed with further, more extensive trials in the 2007/08 season.

An 'Orca Acoustic Sphere Device' suspended from the side of the vessel which was used on the Spanish longliner *Viking Bay* to deter killer whales has been reported by the UK observer. The device was only successful in deterring cetaceans on the first day. From the second day onward the deterrent had no obvious effect with killer whales being observed as close to the vessel as when no device had been used. Pingers attached at intervals along the longline also had no effect on depredation levels (scientific observer report from the *Viking Bay* to CCAMLR).

Cetacean Interactions with fisheries around South Georgia.

Observers on board longline vessels fishing for toothfish around South Georgia are required to record whenever cetaceans are seen near the vessel during hauling. Initial results from analysis of these data have been published previously (Purves et al., 2002), the following is a brief update from the work done since then.

Interactions have been most common to the north east of the island and around Shag Rocks to the west (~~Figure 3:Figure 3~~), these areas also happen to be the most productive in terms of CPUE for toothfish and as a result are the most heavily fished.

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Sperm whales are the most commonly sighted, being seen on between 12% and 23% of all lines since 2001, killer whale interactions are fewer but more consistent, varying between about 3% and 5% (~~Figure 4~~Figure 4).

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The fishery operates for 4 months from May through to the end of August. Analysis of these months shows that most of the activity occurs at the start of the fishery in May with interactions dropping off, sometimes by as much as half, after that (Figure 5).

By using photos taken by observers it has been possible to build up an ID guide to the cetaceans around South Georgia. To date it has been possible to identify 65 individual sperm whales and 30 individual killer whales by their markings on their dorsal and tail fins. These guides are given to observers and have helped to track individual animals throughout the season as well as from year to year within their respective groups, this will help build up a pattern of their social behaviour and may make it possible to see if some vessels are being targeted by particular animals. A sample from the guide is shown in ~~Figure 6~~Figure 6.

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## Discussion

Depredation was substantial in areas, such as the Prince Edward Islands with 2 out of 3 fish taken off the line by cetaceans. However, the CCAMLR Working Group on Fish Stock Assessment was unable to make any strong assertions on levels of removals due to the anecdotal kind of data collection except for South Georgia where information is collected in a systematic fashion since 2001. The Working Group recommended that protocols be developed within the CCAMLR Scheme of International Scientific Observation in collaboration with the Scientific Committee of the IWC to the extent that the level of depredation in the toothfish fisheries in various subareas of the CCAMLR Convention Area can be estimated.

In their review on mitigating interaction of cetaceans with longline gear Gilman et al. (2006) concentrated primarily on how the visual and sound performance of longline vessels can be improved:

1. Fleet communication to enable vessels to avoid temporally and spatially unpredictable and sporadic hotspots of aggregations of cetaceans,

2. Underwater acoustic masking devices to conceal the sound of the vessel, gear and setting and hauling activities,
3. Quieter vessels to reduce cetaceans' ability to target longline vessels,
4. Encasement of caught fish to reduce cetacean access to or interest in the catch,
5. Use of bait and gear with an unpleasant smell or taste to reduce the attractiveness of gear, bait and catch for cetaceans,
6. Use of pre-recorded fishing vessel sounds played from stations throughout a fleet's fishing grounds to distract cetaceans from actual fishing vessels,
7. Use of acoustic devices to mask returning cetacean echolocation signals, and
8. Use of tethered sonobuoys to track cetaceans and enable fleet avoidance.

Other methods which have been used with limited success in other areas, such as the Gulf of Alaska, were

9. Use of dummy buoys,
10. Long distance movements of fishing vessels (>60 nautical miles),
11. Temporary cessation of fishing activities,
12. Change of target species, and
13. Use of pot gear instead of longlines (Dahlheimer, 2006).

The use of acoustic deterrents may mediate the problem with orcas (Mate and Harvey, 1987; Richardson et al., 1995; Jefferson and Curry, 1996; Morton and Symonds, 2002). Their utility with respect to sperm whales which appear to be more resistant to acoustic deterrents, however, remains doubtful (André, 1997). The most successful method to reduce depredation at South Georgia until the end of the 2006/07 season had proven to be cutting the line and buoying it off when cetaceans are present and moving away to haul another line, returning to the first line when cetaceans have left the area. However, the method of encasing the catch developed in the fishery on Patagonian toothfish off Chile appears to be a much more successful method to deter cetaceans from the catch. The important development appears to be the net sleeve to protect fish from predation. Depredation by sperm whales in the Chilean industrial fishery off Tierra del Fuego fell from 5% in the early 2000's (Hucke – Gaete et al., 2004) to 0.36% in 2006/07 (Moreno et al., 2007). Furthermore, sperm whales after attending fishing vessels for one week unsuccessfully disappeared from the fishing ground (Moreno et al., 2007).

It is currently unknown to what extent the method has spread around South America into the South Atlantic. A similar exclusion device has been developed in the Uruguayan fishery at about the same time (Pin and Rojas, 2007). A similar device has also been used by Russian longliners in the South Atlantic in the same season (Zaytsev, 2007). Depredation became negligible after the protection net had been introduced which indicates that the method is equally successful to the Chilean and Uruguayan development in deterring cetaceans. It is more than likely that the method will be introduced in the Southern Ocean when longlining starts again in April 2008.

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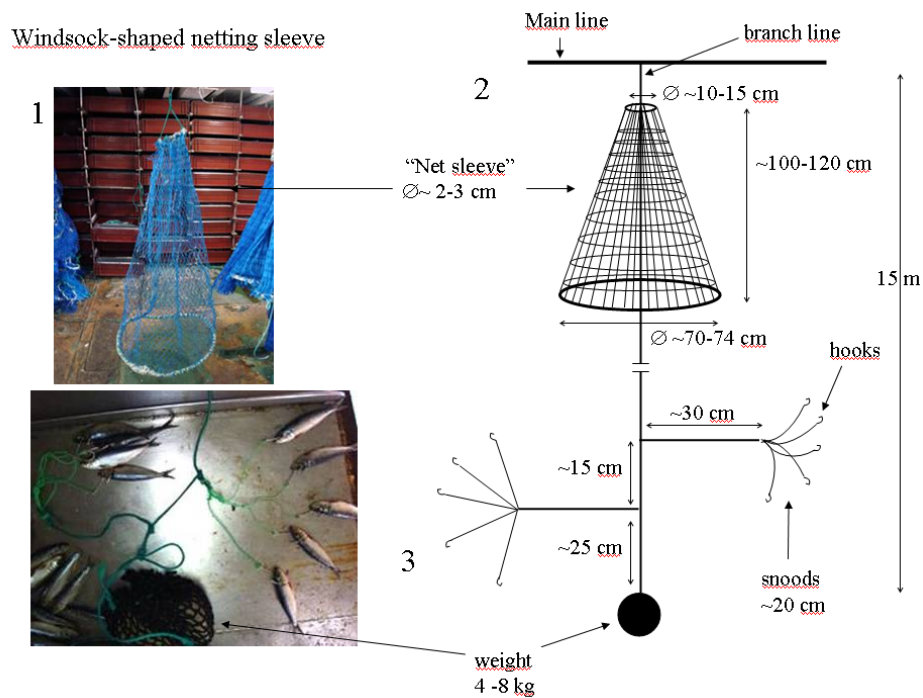


Figure 1: Cetacean exclusion device used in the Chilean longline fishery on the southern Chilean slope and off Tierra del Fuego

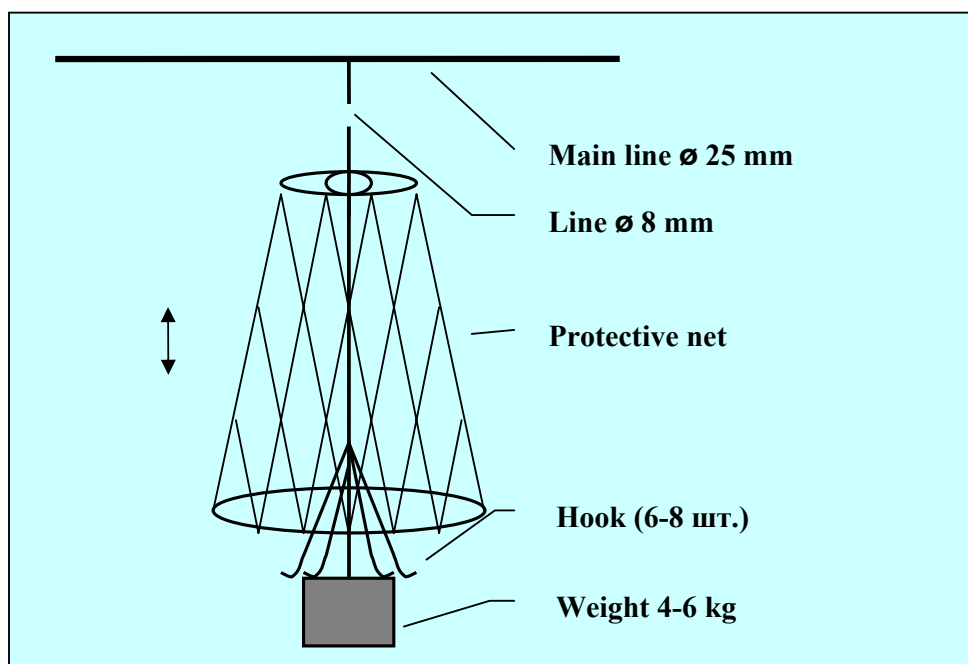


Figure 2: Cetacean exclusion device in a Russian long liner fishing off the Patagonian shelf (WG-FSA-07/11)

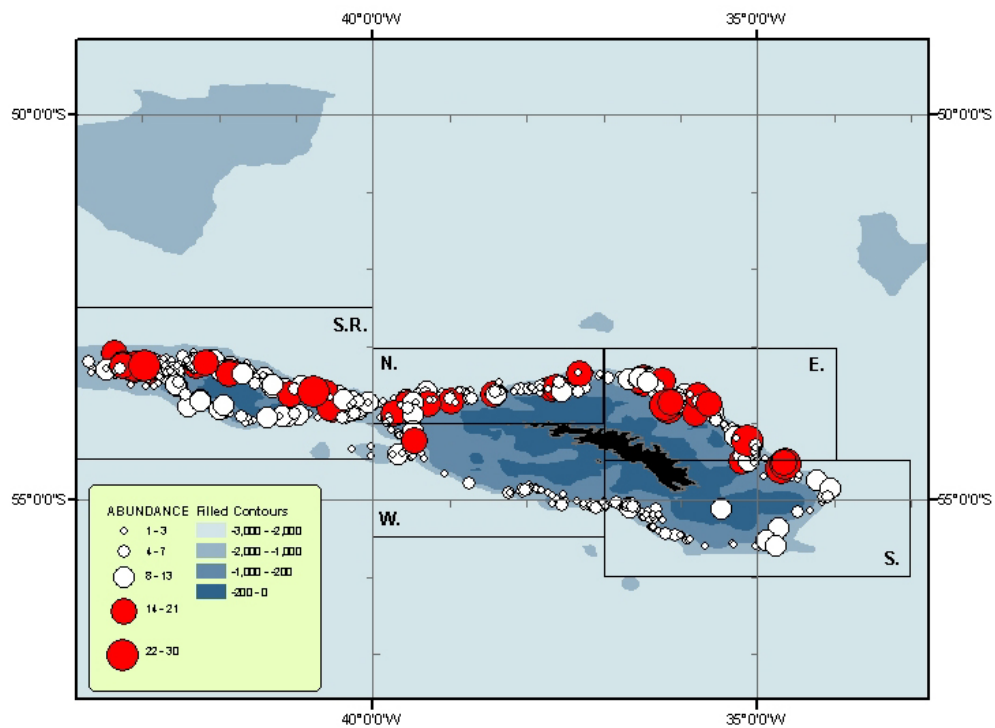


Figure 3: Location and abundance of cetacean interactions around South Georgia

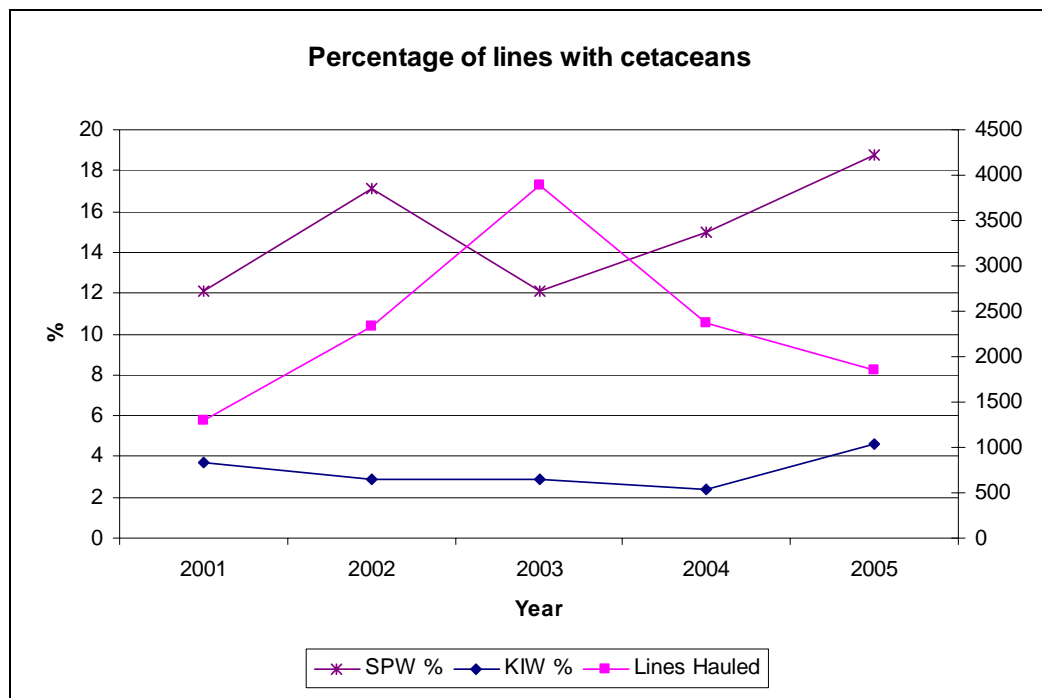


Figure 4: Cetacean interactions since 2001

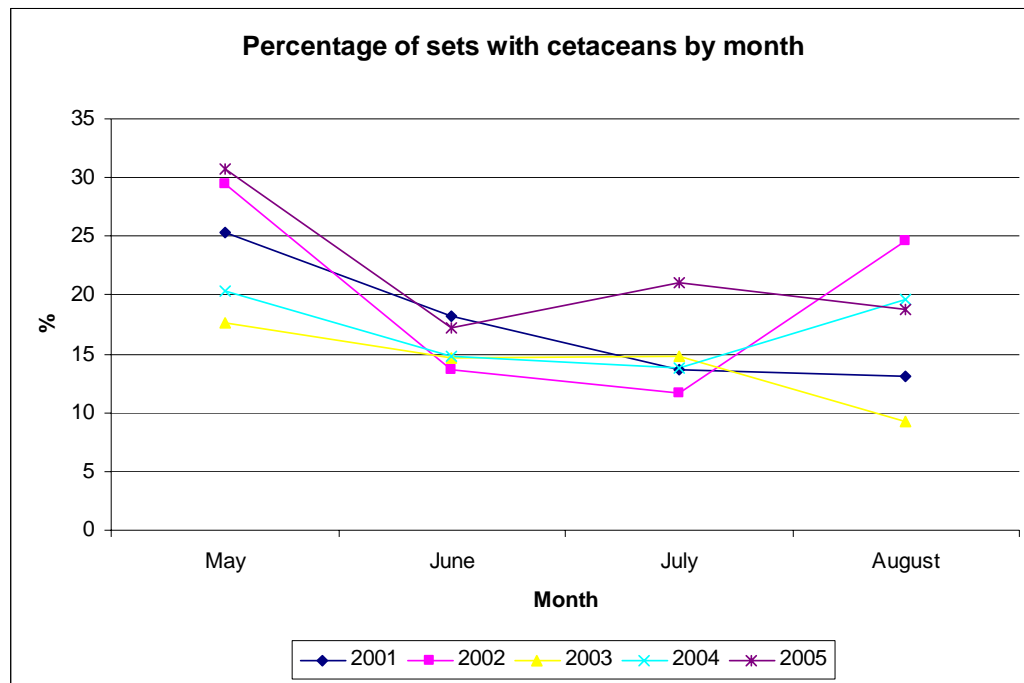


Figure 5: Level of interactions by month.

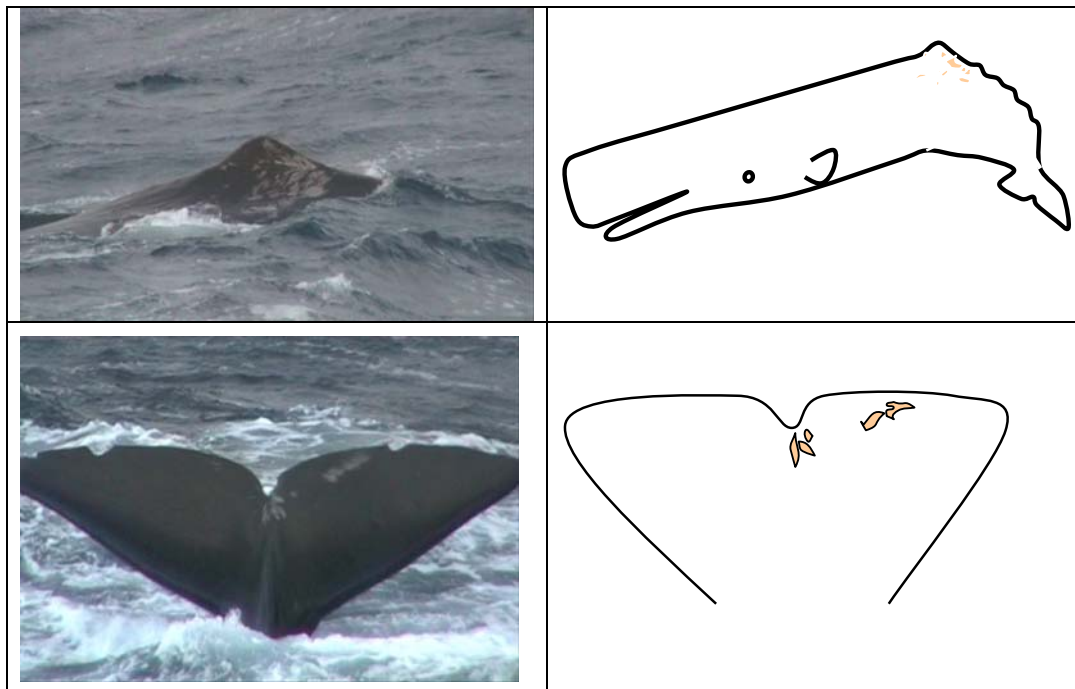


Figure 6: Example from South Georgia cetacean ID guide

