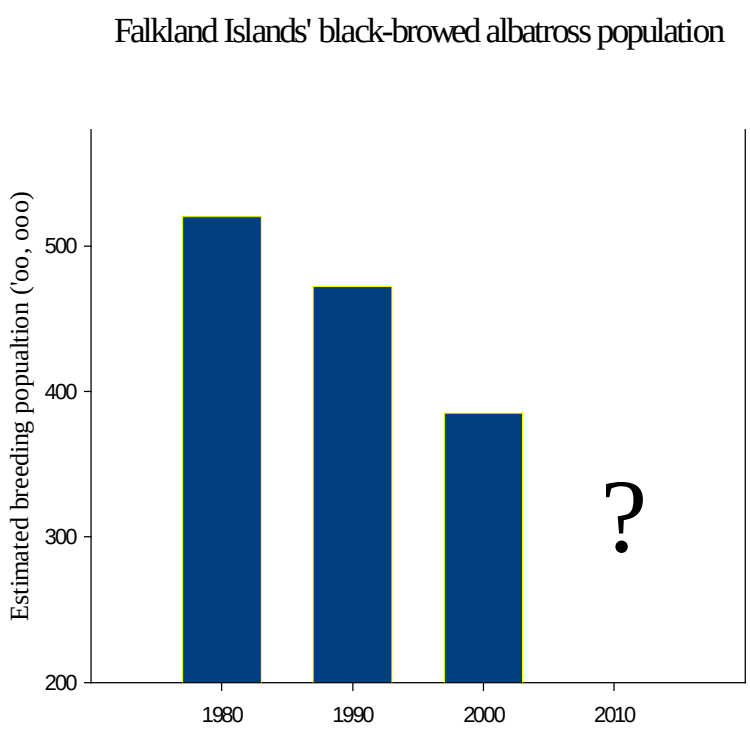
FALKLAND ISLANDS FAO NATIONAL PLAN OF ACTION FOR REDUCING INCIDENTAL CATCH OF SEABIRDS IN LONGLINE FISHERIES



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Structure

This document follows the guidelines provided in FAO International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries to produce a National Plan of Action. The document is divided into two sections:

Part I Review of Longline Incidental Seabird Mortality in the Falkland Islands

Part II Falkland Islands FAO National Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries

Cover: Black-browed albatross population estimates extrapolated by Huin (2001) from Prince (1981), Thompson and Rothery (1991) and various unpubl. reports.

TABLE OF CONTENTS

PART I

REVIEW OF LONGLINE INCIDENTAL SEABIRD MORTALITY IN THE FALKLAND ISLANDS

PART II

FALKLAND ISLANDS NATIONAL PLAN OF ACTION-SEABIRDS

1.0 INTRODUCTION

1.1 Scope and Structure

Incidental mortality of seabirds by pelagic (mid-water) and demersal (bottom) longline fishing has been well documented around the world (Croxall *et al*. 1990, Brothers 1991, Cherel *et al*. 1996, Schiavini *et al*. 1998, Nel *et al*. 2002) and has been linked with a global decline of many species of albatrosses and petrels (Croxall *et al*. 1990, Brothers 1991, Weimerskirch *et al*. 1997, 1999, Robertson and Gales 1998, Nel *et al*. 2002). Of the 53 albatross populations for which the current conservation status is known, 42% are decreasing and longlining remains the most important factor responsible these declines (Gales 1998). The majority of longline deaths are caused by seabirds becoming hooked and drowned while scavenging baits from hooks during line setting operations.

In response to international pressure, in 1997 the United Nations Food and Agricultural Organisation (FAO) Committee of Fisheries (COFI) established a technical working group to draft guidelines on reducing incidental mortality and prepare a draft Plan of Action to implement the mitigation guidelines. In 1999, the resulting International Plan of Action-Seabirds (hereafter IPOA-S, FAO 1999*a*) was produced. IPOA-S is a hortatory document that provides the framework for the development of National Plans of Action–Seabirds (NPOA-S) to reduce the incidental catch of seabirds in longline fisheries, where this occurs. IPOA-S is voluntary and relates to States in the waters of which longline fisheries are being conducted by their own or foreign vessels and to States that conduct longline fisheries on the high seas and in the Exclusive Economic Zones (EEZ) of other States (hereafter, countries).

The clearly stated objective of IPOA-S is to provide international guidance to reduce seabird bycatch in longline fisheries. IPOA-S was developed within the framework of the Code of Conduct for Responsible Fisheries, Articles 7.6.9 and 8.5 (see Appendix I) which state that fisheries should take appropriate measures and use fishing gear and methods that minimise catch of non-target species, both fish and non-fish species, and also minimise negative impacts on associated or dependent species.

This document is divided into two parts:

Part I - Review of Longline Incidental Seabird Mortality in the Falkland Islands

Part I serves as both a review of the scale and management of seabird bycatch (with an emphasis on the Southern Hemisphere) and an assessment and justification of the need for a NPOA-S for the Falkland Islands. As outlined in the technical notes of IPOA-S an assessment should be conducted to 'determine the extent and nature of a country's incidental catch of seabirds in longline fisheries where it occurs.' The purpose of the review is to form the basis of the decision-making process and the resulting Falkland Islands NPOA-S (hereafter FI NPOA-S). To this end, Part I begins with a description of the legislation and policy framework relevant to the development of the FI NPOA-S.

Part II - Falkland Islands National Plan of Action-Seabirds

The FI NPOA-S details a comprehensive strategy to reduce seabird bycatch associated with longliners operating in Falkland Islands waters and Falkland Island flagged vessels operating outside local waters, to levels that will have no deleterious impact on the long-term sustainability of seabird populations, regardless of their provenance. The plan also outlines the steps necessary to enlist the support of industry and other stakeholders to monitor and implement the mitigation measures necessary to maintain seabird bycatch at these low levels in the long-term.

1.2 Definitions

For the purposes of this document the following definitions are applicable:

Bycatch and incidental mortality: refer to the unintentional mortality of seabirds as a direct result of longline fishing practices. The majority of bycatch occurs during line setting when seabirds forage (scavenge) for baits and become hooked and/or entangled and drown as the line sinks. Under certain circumstances the term can also refer to seabirds that are hooked during hauling and are killed or released alive but in condition that is likely to reduce their chance of survival.

Discards: includes all discarded fish species

Falkland Island waters: refers to those parts of the southern Atlantic Ocean under governance of the Falkland Islands Government. These include the Falklands Interim Conservation and Management Zone, which covers a 150nm radius around the islands (FICZ, declared by the United Kingdom in 1986) and the Falklands Outer Conservation Zone (FOCZ, declared by the United Kingdom in 1990), which extends the fishery conservation zone to 200nm in the north, east and south of the islands (Figure 1).

Longlining: refers to fishing methods based on setting a line (mainline) with baited hooks attached on branch lines (snoods). Mainlines vary in length and number of hooks, may be either anchored or drifting and may be orientated vertically or horizontally.

Offal: includes all discharge resulting from processing e.g. visceral matter, fish heads etc.

Pots/Potting: refers to longline fishing methods similar to those described above except that baited hooks are replaced by baited pots.

Seabirds: refers to bird species that habitually obtain their food from the sea beyond the low water mark.

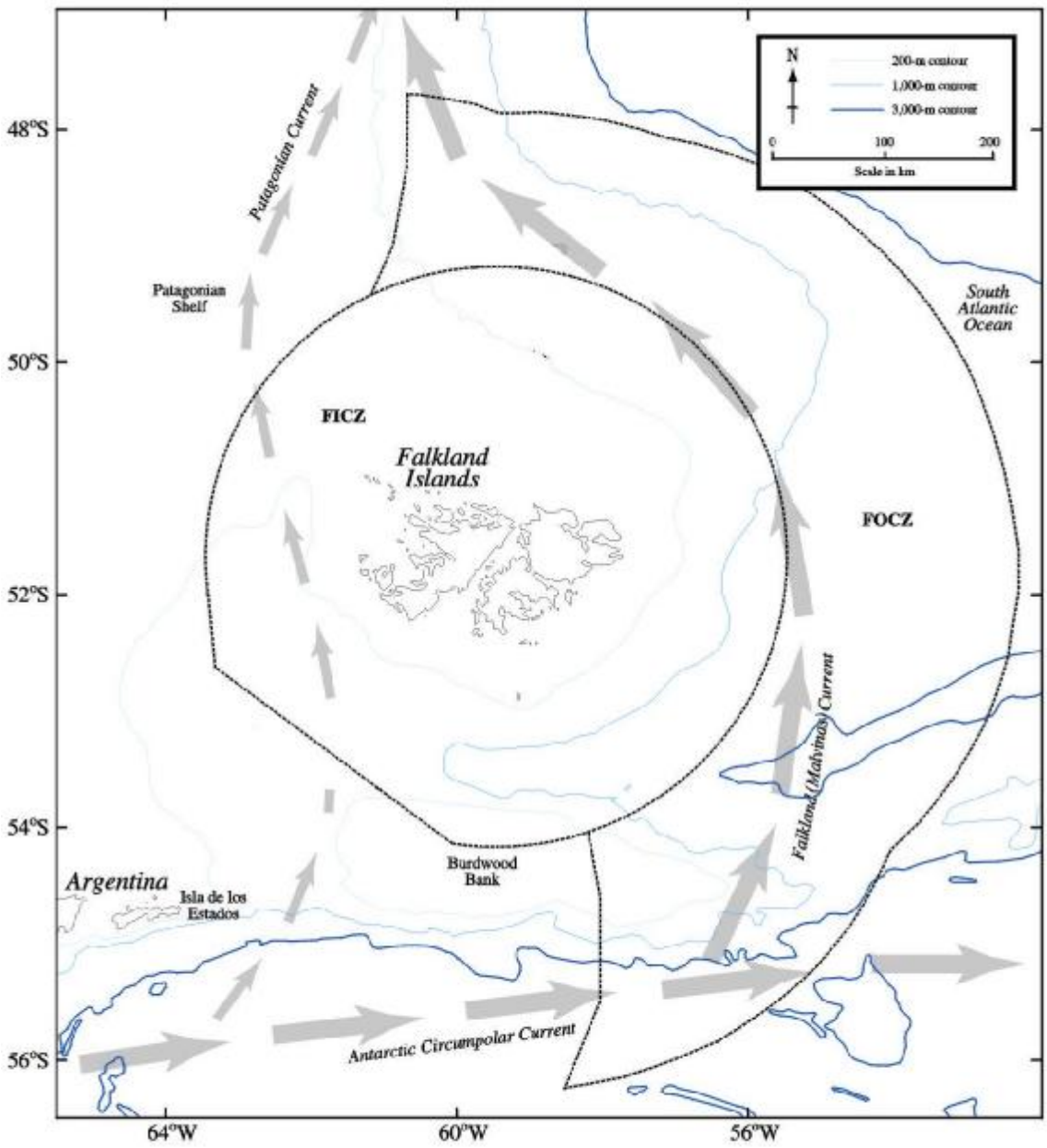

Figure 1 Falkland Islands Interim and Outer Conservation Zones and Regional Currents

PART I REVIEW

REVIEW OF LONGLINE INCIDENTAL SEABIRD MORTALITY IN THE FALKLAND ISLANDS

2.0 LEGISLATIVE/POLICY FRAMEWORK

2.1 Falkland Island Legislation

The Falkland Islands Government in conjunction with the Falkland Islands Fisheries Department, industry and other interested parties is currently reviewing fisheries policy, which will result in the drafting of a new ordinance in 2004.

Currently, the primary ordinance relating to the management of commercial fisheries in Falkland Island waters is the *Fisheries (Conservation and Management) Ordinance 1986.* In its present form, this Act makes no mention of the conservation or management of non-fish taxa, including seabirds and marine mammals, which are susceptible to both direct and indirect mortality associated with longlining. However, current ordinances and licensing provisions give the Director of Fisheries power to impose conditions on vessels fishing in Falkland Island waters and those on the high seas in relation to vessel reporting, carriage of observers, and conservation and mitigation measures to reduce incidental mortality. The *Marine Mammal Ordinance 1992* makes it unlawful for any person to take, wound or kill any marine mammals on land or in the internal waters, territorial sea and fishery waters of the Falkland Islands.

The *High Sea Fishing Ordinance 1995* is the relevant legislation for Falkland Island registered vessels operating on the 'high seas'. This Act also contains no mention of measures or practices for the conservation of non-fish taxa. However, the Director of Fisheries has powers to impose licensing conditions, as mentioned above.

In addition, the *Fishing (CCAMLR) Ordinance 1999* makes provisions for the implementation of conservation and other measures cognisant with the objectives of the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR).

2.2 United Kingdom Overseas Territories

The Falkland Islands is a United Kingdom Overseas Territory. As defined in the 1999 White Paper: Partnership for Progress and Prosperity, the United Kingdom encourages Overseas Territories to have the greatest possible control over their own affairs, but retains international responsibility for the territories, including obligation to ensure that international law is respected. However, locally elected councillors are responsible for the conduct of internal affairs.

Pursuant with the United Kingdom's compliance with the FAO IPOA-S and as a country with locally registered longliners operating in Falkland Island waters, on the high seas, and in the EEZ of other countries, the drafting of FI NPOA-S meets the international commitments of the United Kingdom and the responsibilities of the Falkland Islands under the voluntary Code of Conduct for Responsible Fisheries.

2.3 Primary International Policy Framework

In this section, the IPOA-S is placed in the context of related initiatives and relevant conventions.

Code of Conduct for Responsible Fisheries
Largely to address continuing concern regarding unregulated fishing on the high seas, in some cases involving straddling and highly migratory fish species, which occur within and outside EEZs, in 1991 the FAO-COFI called for the development of new concepts, which would lead to responsible, sustained fisheries. Subsequently, the International Conference on Responsible Fishing, held in 1992 in Cancûn (Mexico) further requested FAO to prepare an international Code of Conduct to address these concerns. In November 1993, the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas was adopted at the Twenty-seventh Session of the FAO Conference. In response to these developments the FAO Governing Bodies recommended the formulation of a global Code of Conduct for Responsible Fisheries which would be consistent with these instruments and, in a non-mandatory manner, establish principles and standards applicable to the conservation, management and development of all fisheries. The Code, which was unanimously adopted in October 1995 by the FAO Conference, provides a necessary framework for national and international efforts to ensure sustainable exploitation of aquatic living resources in harmony with the environment (FAO 1995).

IPOA-S was elaborated within the framework of the Code of Conduct for Responsible Fisheries as envisaged by Article 2 (d) the objective of which is to 'provide guidance which may be used where appropriate in the formulation and implementation of international agreements and other legal instruments, both binding and voluntary (FAO 1995). The Code of Conduct for Responsible Fisheries contains several references to the protection of the marine environment, non-target and dependent species. In addition to those contained in Article 7.6.9 and 8.5 references made in General Principles (Article 6), the Precautionary Approach (Article 7.5) and Management Objectives (Article 7.2.2) (see Appendix I) relate directly to a holistic approach to marine ecosystem management.

Drafting of the International Plan of Action-Seabirds
The issue of the incidental mortality of seabirds in longline fisheries first received official international recognition when the Convention for the Conservation of Antarctic Marine Living resources (CCAMLR) drafted a Conservation Measure in 1990, which was converted into a legally binding measure for signatory countries in 1991. In 1996, the World Conservation Union (IUCN) World Conservation Congress passed a resolution that called for concerted action to reduce seabird mortality. This was followed in 1997 by the COFI establishing a Seabird Technical Working Group (TWG) to draft guidelines on reducing incidental mortality and prepare a draft Plan of Action to implement the mitigation guidelines. The TWG met in Tokyo in 1998 and considered three technical papers (which were combined and published, Brothers *et al*. 1999*a*) as background information on longline fishing, incidental mortality and measures to reduce such mortality. This meeting and subsequent meetings of COFI in 1998 resulted in the production of IPOA-S (FAO 1999*a*).

FAO IPOA-Illegal, Unreported and Unregulated Fishing
As previously stated, the FAO Code of Conduct for Responsible Fisheries (adopted in 1995) provides the general framework, which underpins IPOA-S. The voluntary code "sets out principles and international standards of behaviour for responsible practices with a view to ensuring the effective conservation, management and development of living aquatic resources, with due respect for the ecosystem and biodiversity". Subsequent to the adoption of IPOA-S in 1999, in 2001 FAO adopted the IPOA-IUU (Illegal, Unreported and Unregulated Fishing). The objective of IPOA-IUU is "to prevent, deter and eliminate IUU fishing by providing all States with comprehensive, transparent measures by which to act, including through appropriate regional fisheries management organisations established in accordance

with international law". IPOA-IUU encourages countries to develop legislation and to join regional agreements to control IUU fishing and to develop National Plans of Action (NPOA-IUU). By reducing IUU effort, the development and implementation of such NPOAs should help reduce pressure on fish stocks and also significantly reduce incidental mortality of seabirds since IUU longline fishing, given its disregard of mitigation measures, is recognised as a major cause of bycatch of albatrosses and petrels.

United Nations Convention on the Law of the Sea
The United Nations Convention on the Law of the Sea (UNCLOS 1982) entered into force in 1994. The UK ratified UNCLOS in January 1998 on behalf of UK Overseas Territories, including the Falkland Islands. UNCLOS provided a new framework for the better management of marine resources and a new legal regime that afforded ocean and coastal States rights and responsibilities for the management and use of fishery resources within their EEZs, which embrace some 90 percent of the world's marine fisheries. Article 61 of the agreement is related to the impact of the incidental mortality of seabirds and other non-target species, as it requires coastal States and States fishing on the high seas to consider the effects of fishing on… 'species associated with or dependent upon harvested species with a view to maintaining or restoring populations of such associated or dependent species above levels at which reproduction may become seriously threatened'.

Convention on the Conservation of Migratory Species of Wild Animals
In 1983, the United Nations Environment Programme (UNEP) Convention on the Conservation of Migratory Species of Wild Animals (CMS) agreement came into force to conserve terrestrial, marine and avian migratory species throughout their range. Migratory species are defined by the Convention as those that regularly cross international boundaries, including into international waters. In this context, all seabird species susceptible to longline mortality in Falkland Island waters are considered migratory.

Parties to CMS provide strict protection for endangered migratory species listed in Appendix I, and Appendix II lists migratory species that require or would benefit significantly from international co-operative agreements. Since April 1997 (the fifth meeting of the Conference of Parties to the Convention), all Southern Hemisphere albatross species have been listed in either Appendix I or II.

At the sixth meeting of the Conference of Parties to the Convention the threats posed by fisheries bycatch in general to a wide range of species, and in particular to albatrosses and petrels, were noted and it was requested that relevant Parties develop an Agreement under the Convention, for the conservation of Southern Hemisphere albatrosses and petrels (ACAP 2001). This resulted in the drafting of the Agreement on the Conservation of Albatross and Petrels (ACAP) with the stated objective to achieve and maintain a favourable conservation status for Southern Hemisphere albatrosses and petrels. A major component of ACAP will be the requirement of signatory countries to produce an Action Plan that addresses all threats to relevant albatrosses and petrels, not just the threat posed by longline fishing. One of ACAP's general conservation measures that relates directly to longline fishing is to 'develop and implement measures to prevent, remove, minimize or mitigate the adverse effects of activities that may influence the conservation status of albatrosses and petrels' (Article III 1c).

Unlike IPOA-S, ACAP is a binding agreement that came into force on February 1 2004 after being ratified by five-States (countries). ACAP has been ratified by Australia (Depository State for the Agreement), New Zealand, Ecuador, Spain and South Africa. In September 2002 the Falkland Islands Government Executive Council formally supported the UK ratification of the agreement. ACAP schedules currently have 21 species of albatross and seven species of petrel listed as protected. Three of these species (the White-chinned petrel ***Procellaria aequinoctialis***, Southern giant petrel ***Macronectes giganteus*** and Black-browed albatross (***Thalassarche melanophris***) are identified as breeding in the Falkland Islands.

3.0 LONGLINE SEABIRD MORTALITY

This is not intended as a comprehensive literature review of longline related seabird mortality, but a chronology of events from the identification of the problem and subsequent attempts to quantify its scale to the development of mitigation measures to arrest the resulting decline of many seabird populations. The review is primarily focused on the Southern Hemisphere.

3.1 Identifying and Quantifying Seabird Bycatch

Due to spatial and temporal competition for resources, seabirds and fisheries are inextricably linked throughout the world. The provision of food in the form of factory waste and discards, and in the case of longlining, baited hooks, exacerbates the conflict by attracting seabirds to potentially fatal interactions with fishing vessels. The first evidence of substantial longline related albatross mortality was recorded in the pelagic tuna fishery (*Thunnus* spp.) in the Southern Ocean (Brothers 1991). Since then, a variety of species of seabirds, especially members of the Procellariidae, have been killed in pelagic (mid-water) and demersal (bottom) longline fisheries around the world (e.g. Murray *et al*. 1993, Cherel *et al*. 1996, Schiavini *et al*. 1998, Brothers *et al*. 1999*b*, Nel *et al*. 2002), including the Falkland Islands (Brothers 1995). Albatross species are particularly vulnerable to longline fishing, which has been identified as the primary reason for the recent decline in many populations (Croxall *et al*. 1990, Brothers 1991, Robertson and Gales 1998).

Semi-pelagic longlining for tuna *spp* is generally considered the most dangerous to seabirds as vessels deploy large numbers of hooks on light weighted lines that sink slowly and are vulnerable to foraging seabirds for extended periods (Robertson 1998). While unacceptably high levels of seabird bycatch have also been recorded in demersal longline fisheries (Brothers 1995, FAO 1999*b*, SC-CCAMLR 1995), mitigation measures employed have resulted in a significant reduction in seabird mortality in parts of the Southern Ocean (SC-CCAMLR 1998, 2000, 2002).

Worldwide, a total of 61 seabird species have been recorded as killed by longlining operations on at least one occasion (FAO 1999*b*). Twenty-five of these species are listed as threatened species by the World Conservation Union (Birdlife 2000). In most cases, longline fishing is regarded as the most serious threat to their survival. Of the 61 species identified in the FAO report, 16 have been frequently recorded (>1, 000 records) in Falkland waters by the Seabirds at Sea Team (SAST) over the last three years (White *et al* 2002).

3.2 Reducing Mortality (Mitigation Measures)

The first efforts to develop mitigation measures to reduce the incidental mortality of seabirds in longline fisheries began in the Southern Ocean with the work of Brothers (1991, *in* Melvin and Robertson 2000).

Appendix II provides a brief summary of measures used by vessels using the Spanish system and autoliners. This information is largely based in Brothers *et al.* (1999*a*), which provides a thorough review of current mitigation measures and those under development.

In 1993 CCAMLR established the *ad hoc* Working Group on Incidental Mortality Arising from Longline Fishing (WG-IMALF). (In response to the recent identification of significant trawler related mortality WG-IMALF was renamed as the Working Group on Incidental Mortality Arising from Fishing WG-IMAF). This group advises the Scientific Committee and Commission of CCAMLR concerning appropriate measures to reduce seabird mortality. A suite of mitigation measures to reduce incidental mortality is then enacted through a legally binding Conservation Measure (currently, Conservation Measure 25/02). Other issues related to longline fishing seasons and the use and disposal of potentially entangling materials are covered in other CCAMLR Conservation Measures. As a result of the measures introduced, incidental mortality has been substantially reduced in recent years, especially in South Georgia (Sub-area 48.3) where levels have been reduced from 0.66/1000 hooks in 1993 to 0.0015/1000 hooks in 2002, which represents only six reported mortalities and an estimated bycatch level of 27 birds (SC-CCAMLR 2002)

A reduction in bycatch levels has been achieved for several fisheries around the world but until other fisheries achieve similar results and the activities of IUU vessels can be monitored and their levels of seabird bycatch mitigated, the need for global mitigation remains urgent.

4.0 FALKLAND ISLAND LONGLINING

Longlining for toothfish first commenced around South Georgia in 1988/89 (Dalziell and De Poorter 1993) and then in the southern Indian Ocean around Kerguelen in 1990/91 (Cherel *et al*. 1996). In 1992, experimental longlining commenced within the Falkland Islands Interim Conservation Zone (FICZ), in depths greater than 600m. In 1994, after negligible longlining effort in 1993, experimental fishing re-commenced within the FICZ and in the Falkland Islands Outer Conservation Zone (FOCZ) (Des Clers *et al.* 1996), using the same depth restrictions.

4.1 Fishery Management

Fishing Effort
Since the re-establishment of the fishery in 1994, longlining has been limited to two vessel licences, operating throughout the year, which represents a maximum of up to 24 months fishing effort. The annual average number of hooks set between 1994 and 1997 (3,225,059) was less than half the average number set between 1998 and 2002 (7,144,079) (Figure 2). Fishing effort is typically concentrated in an arc from north-east to south-east of East Falkland Island (Figure 1). A seasonal component of fishing effort is characterised by increased effort in the south in the austral spring and early summer.

Currently, both licences are held by Consolidated Fisheries Ltd. (CFL), which is a consortium comprised of local Falkland Islands fishing companies.

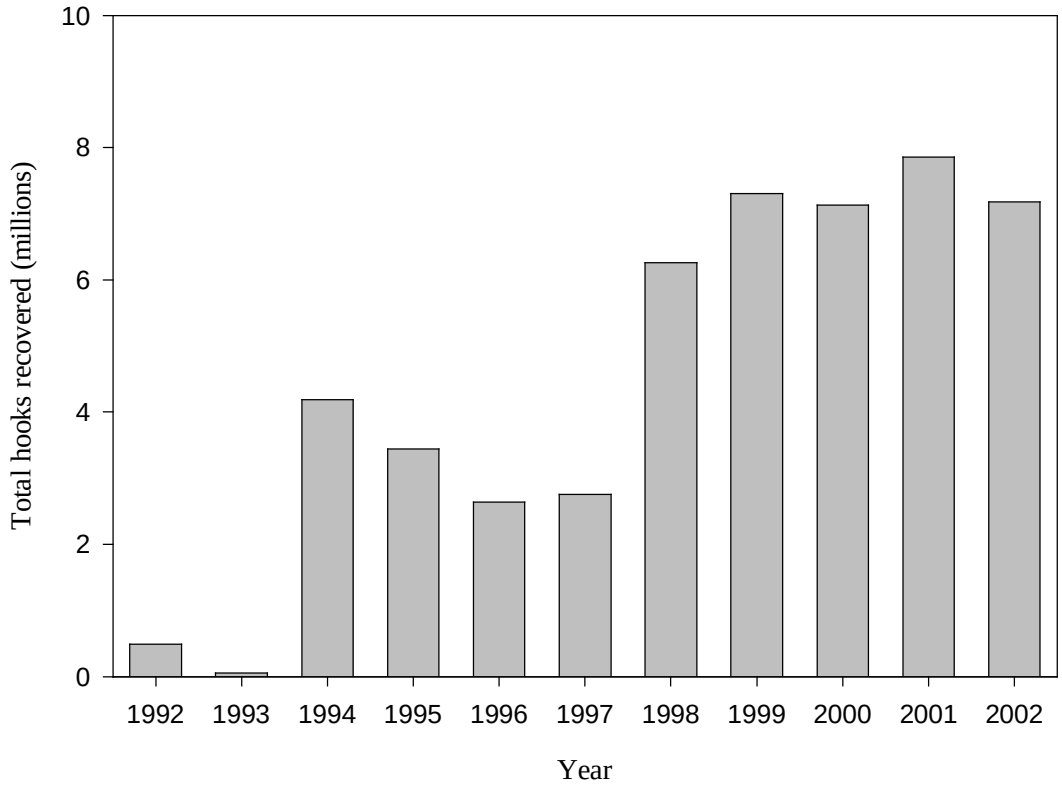

Figure 2 Longline fishing effort in Falkland Island waters between 1992-2002

Longline system/vessels

Currently, both vessels operating in Falkland Island waters utilise the Spanish (double line) system. Typically, the longline consists of an 18mm polyethylene 'mother line' attached by 20m long connecting lines spaced at between 70-90m intervals to a 3mm monofilament 'father line'. Hooks are attached to the 'father line' by 0.75-1.25m long, monofilament snoods spaced at around 1.5m intervals. All hooks are manually baited and are set to rest on the seabed. Baited hooks are placed in setting boxes with their snoods coiled and during line setting they are manually tied to the branchline, which connects the hook line to the mother line. At approximately 35-40m intervals, weights which consist of rocks in string bags are attached to the hook line (see Appendix III, *to be included*). An anchor line at both ends connects the anchors and mother line to the marker buoys and floats on the surface at both ends of the line. The buoys and anchor line are used for retrieval and the lines are hauled over a mounted gunnel positioned around midships.

The Spanish system is ideally suited for demersal longlining in areas with a rough seabed, because the system is designed so that the mother line takes the weight during line hauling and can therefore still be hauled if the hook line is snagged and/or broken. Due to the high level of manual handling required by the double line configuration, and manual baiting, the Spanish system is labour intensive.

Over the last 12 months 4 vessels have fished on the two-longline licences and they have ranged from 45-60m in length and 800-1000 gross registered tonnes. Typically, a Spanish system longliner has around 40+ crew members.

Operational Characteristics
A typical fishing day includes two sets and hauls with an average of around 10,000 hooks per line. Bait used is predominantly squid (*Illex argentinus*), and occasionally sardine (*Sardina* spp) and mackerel (*Scomber* spp). While current regulations do not limit line setting to the night, throughout the year a varying level (which is largely vessel dependent) of effort is made to set lines in the dark. During the winter months when the hours of darkness in high latitudes exceed the daylight hours a higher proportion of lines are set at night. In addition, two of the four vessels that operated in 2001/02 restricted themselves to night setting, at least when observers where present.

One of the four vessels that operated in 2001/02 tested the use of pots (in place of baited hooks) at various times throughout the year. The advantage of pots is obvious: no hooks = no hooked birds. The pots had mixed success and there are several operational constraints on their use. Firstly, current evidence suggests that larger toothfish tend not to enter pots. Secondly, the soak time is critical as toothfish that have been caught can be attacked by crabs and sea lice, which can seriously decrease product value. Thirdly, crabs sometimes take baits, which reduces toothfish catch rates. However, the method has potential to reduce bycatch of non-target seabird species and would benefit from research and development in pot design and handling.

Observer Coverage 2001/02
From July 2001-June 2002 observer coverage was provided by SAST, FIFD and CFL observers. FIFD observers spend approximately 80% of their time onboard conducting seabird observations and 20% working in the factory to collect biological data samples for the stock assessment and management of the toothfish fishery. SAST and CFL observers work solely on quantifying seabird interactions and mortality.

During the 12-month period July 2001 to June 2002, SAST, FIFD and CFL achieved 321 days of observation. During this time 8,164,939 hooks were set by longliners operating within Falkland Island waters. SAST and FIFD personnel observed 1,523,155 (18.6%) hooks being hauled, which represents 37.2% of hooks set with observers onboard (SAST and CFL combined observed 53%, and FIFD 28% of hooks being hauled).

Seabird Interaction/Bycatch
In 2001/02 observers from the three programmes combined, recorded 29 dead birds being hauled (27 of which were black-browed albatross), with a maximum of seven black-browed albatross mortalities recorded on one line in November 2001. Twenty-six of the 29 mortalities (86%) were recorded during the period from late October to mid-January and 3 occurred during winter months. Throughout the year not a single mortality was recorded on lines set during the night.

Management Regime
The ordinances to regulate and manage Falkland Island fisheries are contained in the *Fisheries (Conservation and Management) Ordinance 1986* and *High Sea Fishing Ordinance 1995*. In their current format they do not mention incidental mortality or the conservation of non-fish taxa. However, a current review of Falkland Islands Fishery Policy should result in more inclusive ordinances that address the overall sustainability of the fishery, including addressing important conservation issues such as incidental mortality, conservation of non-fish taxa and their habitat and reducing deleterious impacts on the marine environment.

The current Falkland Islands Fisheries Policy Review, Report 1 Review of Licensing Policy (July 2002) clearly states that where possible under the new ordinances the promulgation of regulations should be preferred to prescriptive clauses in Ordinances. This is likely to result in the detail of future mitigation measures to reduce incidental mortality being contained in longline licensing provisions.

Fishery Patrol Vessels
Falkland Island waters are patrolled by two Fishery Patrol Vessels (FPV) , which represents 16 months patrol effort. The additional 8 months are spent patrolling CCAMLR waters around South Georgia.

Licensing Conditions
Ordinances and licensing provisions give the Director of Fisheries power to impose conditions on vessels fishing in Falkland Island waters and Falkland Island registered vessels operating on the high seas in relation to vessel reporting, carriage of observers, and conservation and mitigation measures to reduce the incidental mortality of seabirds.

Current licensing conditions require the following specific mitigation measures:

- The master shall use his best endeavours to reduce incidental mortality of seabirds, and comply with any reasonable instruction to this effect. A streamer must be deployed during line setting operations. This should be constructed to CCAMLR specifications or to an alternative specification, which has been proved (to the satisfaction of the Director of Fisheries) to be equally efficient.

- Night setting – longlines should be set at night, whenever practicable

- Line weighting – the longline should be adequately weighted to reduce incidental mortality. Weights should be released before line tension occurs. Weights of at least 8.5kg should be attached every 40m, or weights of 6kg should used attached every 20m.

- Bait – only thawed baits should be used

- Offal discharge – the dumping of offal is prohibited while longlines are being set. The dumping of offal during the haul shall be avoided. Discharge of offal shall take place on the opposite side of the vessel to that where longlines are hauled.

Voluntary Mitigation Practices
Two of the four vessels that operated in 2001/02 largely restricted themselves to night setting. Both these vessels had recently been licensed to fish in CCAMLR Sub-area 48.3 (South Georgia) where CCAMLR Conservation Measure (currently 25-02) restricts all line setting to the hours between nautical dusk and nautical dawn. When these vessels fished in Falkland Islands waters they continued to restrict line setting to the night time.

In most cases longliners operating in Falkland Island waters exceeded licensing requirements in 2001/02 by operating with two to three tori lines attached to tori poles positioned on the port and starboard sides of the stern, and one centrally located. While improvements can be made to the length of streamers deployed and the material used, multiple lines appear to be very effective.

5.0 LONGLINE MORTALITY IN THE FALKLAND ISLANDS

Seabird populations of the Falkland Islands (FI) are of international importance (Croxall ***et al***. 1984, Woods and Woods 1997), particularly as the region contains around 70% of the world's breeding black-browed albatross population. A complete census of Falkland Island black-browed albatross breeding populations in 2000/01 identified an estimated reduction of 87,500 breeding pairs over a five-year period. This includes serious declines at the three largest colonies (Steeple Jason –47,300 pairs, Grand Jason –10,100 pairs and Beauchêne –27,500 pairs) (Huin 2001). This decline was largely responsible for the IUCN reclassification of the species from Near Threatened to Vulnerable in 2001, and the subsequent reclassification to Endangered in 2003.

It is difficult to accurately assess the role of longlining in the Falkland Island waters in this decline because prior to May 2001 there was no designated seabird observer program, and hence the historical rate of seabird bycatch in the fishery is unknown. However, as recently as the mid 1990's the level of seabird bycatch in waters around the Falkland Islands has been high including 4.3 birds/line during summer and 0.130 birds/1,000 hooks during winter 1995 (Brothers 1995), with recorded events of up to 90 black-browed albatrosses killed in a single day (Brothers 1996).

In mid 2001, SAST, FIFD and CFL all commenced longliner observer programmes. The three programmes liased closely to achieve compatible data collection protocols. Using methods detailed in Klaer & Polacheck (1995), for multi-stage sampling with unequal size primary and secondary sampling, these data combined suggest that 134 (95% confidence limits 80-188) birds, including 126 (75-177) black-browed albatrosses and eight white chinned petrels (*Procellaria aequinoctialis*) were killed in Falkland Island waters during the 12 month period. This represents a bycatch rate of 0.02 birds/1000 hooks.

Based on a list of 61 seabird species that has been identified as being killed on longlines (Brothers *et al*. 1999*a*), the Falkland Islands has confirmed breeding populations of seven of these species (Table 1).

Table 1 Estimated populations of seabirds that breed in the Falkland Islands and which have been recorded killed on longlines.

Common name	Scientific name	Estimated Falkland Island breeding population (pairs)	Estimated global population
Gentoo penguin	*Pygoscelis papua*	102,000[1]	260,000[3]
Black-browed albatross	*Thalassarche melanophris*	380,000[2]	530,000[4]
Southern giant petrel	*Macronectes giganteus*	7,300[1]	36,000[5]
White-chinned petrel	*Procellaria aequinoctialis*	1,000 – 5,000[1]	5,000,000[6]
Sooty shearwater	*Puffinus griseus*	10,000 – 20,000[1]	>10,000,000[5]
Wilson's storm-petrel	*Oceanites oceanicus*	5,000[1]	>10,000,000[5]
Antarctic skua	*Catharacta antarcticus*	7,000[1]	16,000[7]

[1] Woods and Woods 1997
[2] Huin (2001)
[3] Marchant and Higgins 1990
[4] Submission to IUCN for reclassification
[5] www. oceanwanderers.com
[6] Birdlife International (2000)
[7] Furness (1987)

The current level of longline mortality in Falkland Island waters (around 0.02 birds/1000 hooks) is unlikely to have a significant impact at the population level on any of the species that breed in the Falkland Islands, particularly considering that in 2001/02 mortalities were recorded for only two species (black-browed albatross and white-chinned petrels). However, given the high densities of seabirds that interact with longliners in local waters there is the potential for increased mortality levels and it is vital that the industry investigates improvements to further reduce the potential for seabird bycatch.

Sixteen of the 61 species that have been identified as having been killed on longlines (Brothers *et al*. 1999*a*) have been frequently recorded (>1000 records) in three years of intensive at-sea surveys in Falkland Island waters (White *et al*. 2002, Table 2), and are known to interact directly with longliners operating in local waters.

Table 2 Species identified as having been killed on longliners that have been recorded in Falkland Island waters in at-sea surveys on >1000 occasions (*indicates additional species recorded during setting and hauling on longliners in 2001/02, ^ indicates species that have breeding populations in the Falkland Islands).

Common name	Scientific name
Gentoo penguin^	*Pygoscelis papua*
Wandering albatross	*Diomedea exulans*
Southern royal albatross	*D. epomophora*
Northern Royal albatross	*D. sanfordi*
Black-browed albatross^	*Thalassarche melanophris*
Grey-headed albatross	*T. chrysostoma*
Shy albatross*	*T. cauta agg. (T. cauta* or *T. steadi)*
Light-mantled sooty albatross*	*Phoebetria palpebrata*
Southern giant petrel^	*Macronectes giganteus*
Northern giant petrel	*M. halli*
Antarctic fulmar	*Fulmarus glacialoides*
Cape petrel	*Daption capense*
White-chinned petrel^	*Procellaria aequinoctialis*
Grey petrel*	*P. cinerea*
Great shearwater	*Puffinus gravis*
Sooty shearweater^	*P. griseus*
Manx shearwater*	*P. puffinus*
Wilson's storm-petrel^	*Oceanites oceanicus*
Cormorants^	*Phalacrocorax* spp.
Antarctic skua^	*Catharacta antarcticus*

6.0 SPECIES PROFILES OF SEABIRDS AT RISK IN FALKLAND ISLAND WATERS

A total of eight species of seabird have been reported killed on longlines within Falkland Islands waters. Three of these species breed within the Falklands (black-browed albatross, southern giant petrel, white-chinned petrel) and five are non-breeding visitors (wandering albatross, royal albatross, grey-headed albatross, northern giant petrel and Cape petrel). Species profiles that summarise the available knowledge for these species and other species that breed in the Falkland Islands (Wilson's storm-petrel, sooty shearwater, great shearwater) and species that do not have Falkland Island breeding populations (light-mantled sooty albatross, Antarctic fulmar and grey petrel) but are considered to be potentially vulnerable to longline mortality in Falkland Island waters are provided below.

6.1 Species Reported Killed on Longlines in Falkland Island Waters

6.1.1 Falkland Island Breeding Birds

Black-browed albatross *Thalassarche melanophris*

IUCN Status:	Endangered
Falklands breeding population:	380,000 pairs
World breeding population:	530,000 pairs
Status:	Decreasing
Global level of longline mortality:	High

Black-browed albatross is probably the most widespread species of albatross in the Southern Ocean. Besides the Falklands, significant populations exist on South Georgia and islands off the southern coast of Chile with smaller populations found on Crozet, Kerguelen, Heard, McDonald, Macquarie, Antipodes, and several outer southern Islands of New Zealand. Where sufficient data exists, black-browed albatross populations have been shown to be in decline worldwide.

The Falkland Islands are of international importance for their breeding population of black-browed albatross, supporting approximately 71% of the world population (Huin 2001). Recently censuses of the breeding population have shown a dramatic decline in the population (85,000 pairs over five years). The greatest risk to this species and the cause of this dramatic decline is thought to be fisheries mortality. Falkland Island black-browed albatross have been shown to be genetically distinct at the sub-species level from other populations around the world (Burg and Croxall 2001). As Falkland Island black-browed albatross are largely restricted to the Patagonian Shelf, they should be afforded special consideration in initiatives aimed at reducing incidental mortality.

Densities of black-browed albatross within Falkland Islands waters are highest over Patagonian Shelf waters during the breeding season, September – April (White *et al*. 2002). However, longliners fishing in deeper waters of the FOCZ attract large flocks of black-browed albatrosses, at this time of the year. During the austral winter, a high proportion of the population, including fledglings, migrate northwards (Huin 2002), where they are threatened by longline fishing off the coasts of Brazil, Uruguay and Argentina (see Section 7.0).

Black-browed albatross are typically the dominant scavengers of longline baits, discards and offal associated with fishing vessels in Falkland Island waters and they have been shown to make significantly more feeding attempts on baited hooks than other species. Their level of foraging activity around longliners varies according to time of day (with significantly more attempts on lines set during daylight hours) and the stage of their breeding cycle, with more intensive foraging during the early stages of breeding (egg and young chick stages) (Sullivan and Reid 2002). As a result of these behavioural traits, black-browed albatross are the species most frequently killed by longlines in Falkland Island waters and the wider Patagonian Shelf (e.g. Favero *et al*.2001). The mortality rate for the Falkland Islands in 2001/02 was estimated to be 0.02 birds per 1,000 hooks (Sullivan and Reid 2002), which is considerably lower than the 4.3 birds per line recorded by Brothers (1995). It has been shown that the effective use of recommended mitigation measures (chiefly adequate tori lines, sufficient line weighting and night-time setting) can mitigate black-browed albatross mortality. The observed decrease in mortality rates over recent years is thought to be a direct result of more widespread use of such measures.

Recent work by SAST has identified a significant level of black-browed albatross mortality associated with trawlers fishing within Falkland Islands waters. This problem is likely to extend over much of the Patagonian Shelf, which is widely used by black-browed albatrosses breeding on the Falkland Islands and also supports a large trawling fleet.

Southern giant petrel *Macronectes giganteus*

IUCN Status:	Vulnerable
Falklands breeding population:	7,300 pairs
World breeding population:	36,000 pairs
Status:	Decreasing
Global level of longline mortality:	Moderate

Southern giant petrels are circumpolar in their distribution and typically breed on islands between 40^{o}S-60^{o}S (South Orkneys, South Shetlands, Antarctic Peninsula, South Georgia, Prince Edwards, Macquarie, Heard, islands to the south of Chile and Argentina). The

Falkland Islands support a significant percentage of the world population of southern giant petrel.

Surveys of the at-sea distribution of this species in Falkland Island waters (White *et al*. 2002) have shown that highest numbers occur over Patagonian Shelf waters, particularly in areas occupied by fishing vessels. In addition to those breeding within the Falklands, the population at-sea is likely to be bolstered by females from South Georgia, at least during the early stages of their breeding cycle (Croxall and Wood 2002). The seasonal presence of white phase birds (White *et al*. 2002) indicates that birds that breed on the South Orkneys, South Shetlands and Antarctic Peninsula and South Georgia are present within the Falklands Conservation Zones during the winter.

Although frequently present in large numbers, giant petrels are infrequently the victims of incidental mortality in the Falklands toothfish fishery with only one fatality reported since 1994 (Barton 2002). It appears that this is due to their poor diving ability and that they are often out competed by the more agile black-browed albatross when scavenging on baited hooks. Similarly, a zero mortality rate was recorded over a four-year period of longlining observations at Kerguelen (Weimerskirch *et al*. 2000). However, significant numbers have been reported from the South Georgia and Prince Edward Island fisheries (Moreno *et al*. 1996, Nel *et al*. 2002).

This species would appear to be more vulnerable to secondary hooking during hauling. Although in such cases birds are released alive the long-term implications of secondary hooking could be deleterious.

White-chinned petrel *Procellaria aequinoctialis*

IUCN Status:	Vulnerable
Falklands breeding population:	1-5,000 pairs (rough estimate)
World breeding population:	5,000,000 pairs
Status:	Decreasing
Global level of longline mortality:	Very High

White-chinned petrels have a circumpolar distribution, breeding on South Georgia, Kerguelen, Crozets, Prince Edward, Antipodes, Auckland and Campbell islands. The Falkland Islands support a very small breeding population of this species, 1-5,000 pairs. The number of birds recorded within the Falkland waters during the breeding season (White *et al*. 2002) and satellite tracking studies (Berrow *et al*. 2000) indicate that birds encountered at-sea are likely to include many from the large South Georgian population, which consists of approximately 2 million pairs.

The number of white-chinned petrels recorded in Falkland Island waters is highly seasonal (White *et al*. 2002). Birds are widespread during the summer with highest densities encountered over Patagonian Shelf waters. During the winter, numbers present are far lower with sightings restricted to Patagonian Shelf waters to the west of the Falklands. White-chinned petrels are thought to migrate to more northerly latitudes during the winter where they are likely to face threats from other longline fisheries.

In the Falklands longline fishery in 2001/02, white-chinned petrels were the second most frequently caught species. However, they only accounted for 7% of all mortalities (Sullivan and Reid 2002). Elsewhere, white-chinned petrels are often the most frequently caught species and account for up to 90% of all seabird mortality in those areas (Moreno *et al*. 1996, Weimerskirch *et al*. 1999, Favero *et al*. 2001, Olmos *et al*. 2000*a* and Nel *et al*. 2002).

The lower level of white-chinned petrel mortality recorded within Falklands waters is thought to be directly related to the small breeding population and competition with black-browed albatross. When present, white-chinned petrels are frequently observed making foraging attempts on baited hooks as lines are set. However, competition with the larger, more aggressive black-browed albatross may lead to fewer foraging attempts, and/or to a shift in their foraging attempts to sections of the line further from the stern of the ship, where the line is deeper (Sullivan and Reid 2002).

The effectiveness of night setting to reduce white-chinned petrel mortality has been questioned as several studies have highlighted high numbers of white-chinned petrels killed during night setting operations, nevertheless bycatch of all species was significantly reduced (Ashford *et al.* 1995, Moreno *et al.* 1996, Olmos *et al*. 2000*a*). Other studies in Australian and Kerguelen waters have shown that night setting significantly reduces their mortality (e.g. Gales *et al.* 1998, Weimerskirch *et al.* 2000). In 2001/02 no mortality was recorded on lines set during the hours of darkness (Sullivan and Reid 2002).

6.1.2 Non Falkland Island Breeding Birds

Wandering albatross species *Diomedea exulans* agg.

IUCN Status:	Vulnerable
World breeding population:	8,500 pairs (Biennial)
Status:	Decreasing
Global level of longline mortality:	High

Recently, wandering albatrosses were split into four separate species; wandering, **Tristan** *D. dabbenena*, **Antipodean** *D. antipodensis*, **Gibson's** *D.* gibsoni and **Amsterdam** *D. amsterdamensis* (Roux *et al.* 1983, Nunn *et al*.1996, as adopted by Robertson and Gales 1998). The majority of birds present within Falklands waters are likely to be wandering albatrosses, although the other species are wide-ranging and may occur in the south-west Atlantic.

Wandering albatrosses (*D. exulans*) breed on South Georgia, Crozet, Kerguelen, Marion, Prince Edward, and Macquarie Islands. Direct observations of ringed birds (Croxall *et* al. 1999) and satellite tracking studies (Prince *et al*. 1998) both indicate that the majority of the South Georgian population of wandering albatross are likely to forage within Falklands waters at some time during the year.

At-sea surveys in Falkland Island waters indicate that this species rarely ventures onto the Patagonian Shelf (White *et* al. 2002), rather foraging predominantly in deeper waters over the shelf edge and slope. This means that longliners are the fishing vessels with which wandering albatrosses are most likely to interact. During hauling operations, up to 150 birds have been counted associating with a single vessel with highest numbers recorded during the summer (Sullivan and Reid 2002). However, the number seen during setting operations is usually restricted to a few individuals. Although they are rarely observed feeding from baited hooks during setting, there have been reports of wandering albatross mortality within the Falklands toothfish fishery. Observations during longline setting suggest that wandering albatrosses are most at risk when the sink rate of the line is slowed either by very poor weighting, line snagging or the buoying effect of other species caught during line setting.

During hauling, the ability of wandering albatrosses to swallow large discarded fish and toothfish heads whole makes them vulnerable to ingesting discarded hooks.

Southern royal albatross *D. epomophora* & **Northern royal albatross** *D. sanfordi*

IUCN Status:	Vulnerable &	Endangered (respectively)
World breeding population:	7,870 pairs (Biennial)	5,220 pairs (Biennial)
Status:	Increasing	Decreasing
Global level of longline mortality:	Moderate	Moderate

Royal albatrosses are endemic to New Zealand. Southern royals breed on Campbell, Enderby, Adams and Auckland Islands and Northern royals breed on Chatham Island and Taiaroa Head on the South Island.

The number of royal albatrosses recorded during SAST at-sea surveys (White *et al.* 2002), and satellite tracking studies (Nicholls *et al.* 2002) exhibit the importance of the Patagonian Shelf as a feeding area for these species. The highest densities of both species occur in Falkland Island waters between March and June, although they are present year round in considerable numbers (White *et al*. 2002).

Like wandering albatross, royal albatrosses are often present around longliners during hauling operations but are less evident during line setting, when their numbers are usually restricted to a few individuals. Although they are rarely observed feeding from baited hooks during setting, in the past there have been reports of royal albatross mortality within the Falkland Islands toothfish fishery. From observations of birds during longline setting, it's likely that royal albatrosses are most at risk when the sink rate of the line is slowed by very poor weighting, line snagging or the buoying effect of other species caught during line setting.

During line hauling, the ability of royal albatrosses to swallow large discarded fish and toothfish heads whole makes them vulnerable to ingesting discarded hooks.

Grey-headed albatross *Thalassarche chrysostoma*

IUCN Status:	Vulnerable
World breeding population:	92,000 pairs (Biennial)
Status:	Decreasing
Global level of longline mortality:	High

Grey-headed albatross breed on South Georgia, Diego Ramirez, Crozet, Kerguelen, Marion, Prince Edward, Campbell and Macquarie Island. The nearest breeding colonies of grey-headed albatross to the Falklands are located on South Georgia and Diego Ramirez Island (off southern Chile), which support approximately 54,000 and 10,000 breeding pairs respectively. Satellite tracking studies of breeding birds from South Georgia indicate that they do not forage in Falkland Island waters (Prince *et al*. 1998) and limited tracking from Diego Ramirez indicate that these birds only frequent the southern edge of the Patagonian Shelf (G. Robertson *pers. comm*.). It is therefore likely that those present within Falklands waters are non-breeders from South Georgia.

Significant numbers of grey-headed albatrosses are only present within Falkland Islands waters between May and September (White *et al.* 2002). During this period, grey-headed albatrosses are most frequently encountered over waters deeper than 200 metres. This distribution suggests that they are more likely to interact with longliners than other fishing vessels operating within Falkland Island waters. Consequently, during the winter months, grey-headed albatrosses are frequently the most abundant species of albatross attending longliners within the Falkland Island waters.

Grey-headed albatross are particularly proficient plunge divers and, compared to most species, under some conditions they appear to be relatively undeterred by streamer lines. Therefore, they would appear to be highly vulnerable to longline related mortality in Falkland Island waters during the winter months. Available statistics from the Falkland Islands Fisheries Department (Barton 2002) show that grey-headed albatrosses have been caught in considerable numbers in the past (33 during 1995). This species has been reported to be killed in disproportionately high numbers relative to their abundance in several longline fisheries (Brothers 1995, Ashford *et al*. 1995, Weimerskirch *et al*. 2000).

Northern giant petrel *Macronectes halli*

IUCN Status:	Near threatened
World breeding population:	7-12,000 pairs
Status:	Decreasing
Global level of longline mortality:	Moderate

Northern giant petrels breed at South Georgia, Prince Edward, Crozet, Kerguelen, Macquarie, Campbell and Antipodes Islands and are within Falklands waters year round with the highest densities recorded during the winter (White *et al*. 2002). Satellite tracking from South Georgia suggests that during the breeding season, at least, there could be a marked sex bias towards female birds within Falkland Island waters (Croxall and Wood 2002).

Northern giant petrels are often more abundant around longliners in Falkland Island waters than southern giant petrels (SAST *unpubl. data*). The behaviour of southern and northern giant petrels around longliners is similar and they are therefore thought to be subject to the same risks of mortality. Although frequently present in large numbers, giant petrels are infrequently the victims of incidental mortality in the Falklands toothfish fishery with only one fatality reported since 1994 (Barton 2002). It appears that this is due to their poor diving ability and that they are often out-competed by the more agile black-browed albatross when scavenging on baited hooks. Similarly, a zero mortality rate was recorded over a four-year period of longlining observations at Kerguelen (Weimerskirch *et al*. 2000). However, significant numbers have been reported from the South Georgia and Prince Edward Island fisheries (Moreno *et al*. 1996, Nel *et al*. 2002).

Giant petrels would appear to be more vulnerable to secondary hooking during hauling. Although these birds are released alive the long-term implications of secondary hooking could be deleterious.

Cape petrel *Daption capense*

IUCN Status:	Unclassified
World breeding population:	Several million pairs
Status:	Stable
Global level of longline mortality:	Low

Cape petrels have a circumpolar breeding distribution including Antarctica and adjacent Antarctic and sub-Antarctic islands. The nearest breeding population to the Falklands is located on South Georgia.

Cape petrels are only present within Falklands waters in significant numbers in the non-breeding season, when there is a general northward migration of this species. Throughout the winter, Cape petrels are widely distributed within the Falkland Island waters and typically occur in their highest densities over the Patagonian Shelf (White *et al*. 2002). However, longliners (which operate in deeper waters >600m deep) also attract large flocks of scavenging Cape petrels. During line setting in the winter months Cape petrels make many attempts on baited hooks but low levels of Cape petrel mortality have been recorded in local waters. Individuals that are killed are often hooked in the wing or leg rather than the bill (‘foul hooked’).

Cape petrels are the species most frequently affected by secondary hooking during hauling within the Falkland fishery. Although these birds are released alive the long-term implications of secondary hooking could be deleterious.

6.2 Species Potentially Vulnerable to Longline Mortality in Falkland Island Waters

6.2.1 Falkland Island Breeding Birds

Great shearwater *Puffinus gravis*

IUCN Status:	Unclassified
Falklands breeding population:	Up to 100 pairs
World breeding population:	Several million pairs
Status:	Stable
Global level of longline mortality:	Moderate

It is thought that the Falkland Islands support a very small population of great shearwaters (Woods and Woods 1997) and most of those recorded at-sea probably originate from the large breeding population (several million pairs) found on the Tristan da Cunha group and Gough Island. Their presence within the Falklands Conservation Zones is highly seasonal with highest numbers occurring to the north and east of the Islands between December and April (White *et al*. 2002).

Great shearwaters are proficient divers and at times have been observed foraging on baited longline hooks during setting. To date, no incidental mortality of great shearwaters has been recorded in the Falkland Islands fishery. However, significant levels of mortality have been recorded in other Southern Hemisphere longline fisheries (Neves and Olmos 1998).

Sooty shearwater *P. griseus*

IUCN Status:	Unclassified
Falklands breeding population:	100,000 pairs
World breeding population:	10,000,000+
Status:	Stable
Global level of longline mortality:	Low

The Falklands support a high proportion of the Atlantic breeding population of sooty shearwater, approximately 10-20,000 pairs (Woods and Woods 1997). However, the vast majority of the world population of sooty shearwaters breed on islands around New Zealand.

Like great shearwaters, the majority of the local population migrate northwards in the Austral autumn to over-winter in the North Atlantic. Their presence within Falkland Island waters is therefore highly seasonal, primarily September to March, when they occur in the highest densities over coastal waters and the Patagonian Shelf (White *et al*. 2002). They are regularly recorded around longliners in low numbers in Falkland Island waters.

Sooty shearwaters are proficient divers and have been killed on longlines in the Southern Ocean (Murray *et al*. 1993). In the local fishery they have been observed foraging on baited longline hooks during setting, but to date, no incidental mortality of sooty shearwaters has been recorded in the local longline fishery.

6.2.2 Non-Falkland Island Breeding Birds

Light-mantled sooty albatross *Phoebetria palpebrata*

IUCN Status:	Near threatened
World breeding population:	21,600 pairs (Biennial)
Status:	Decreasing
Global level of longline mortality:	Low

Light-mantled sooty albatrosses breed on islands throughout much of the Southern Ocean; South Georgia, Crozet, Kerguelen, Prince Edward, Marion, Heard, Macquarie, Auckland, Campbell and Antipodes Islands.

The nearest breeding colony of light-mantled sooty albatross to the Falklands is found on South Georgia, where the annual breeding population is approximately 5-7,500 pairs. Throughout the year, light-mantled sooty albatrosses are present in low numbers within the Falkland Island waters (White *et al*. 2002). In Falkland Island waters they are occasionally recorded to associate with longliners but are rarely observed attempting to take baits during line setting and there are no reports of incidental mortality within local waters. However, they are the most adept divers of all albatross species, and longline mortality of this species has been reported in Australia (Gales *et al*. 1998).

Antarctic fulmar *Fulmarus glacialoides*

IUCN Status:	Unclassified
World breeding population:	Several million pairs
Status:	Stable
Global level of longline mortality:	Low

Antarctic fulmars are widely distributed throughout Southern Ocean, breeding on Antarctica and adjacent islands. Like Cape petrels, Antarctic fulmars are primarily winter visitors to Falkland Island waters (White *et al*. 2002). Highest densities of fulmars are generally found over the Patagonian Shelf where they are often associated with trawlers. However, longliners also attract small numbers of scavenging Antarctic fulmars, which exhibit similar behaviour to Cape petrels. There have been no reported mortalities of Antarctic fulmars in the local fishery.

Grey petrel *Procellaria cinerea*

IUCN Status:	Near threatened
World breeding population:	100,000 pairs
Status:	Decreasing
Global level of longline mortality:	High

Grey petrels breed during the winter on cool temperate and sub-Antarctic islands like Tristan da Cunha group, Gough, Prince Edward, Crozet, Kerguelen, Amsterdam, Campbell and Antipodes Islands.

Grey petrels have been recorded in low numbers throughout the year over the deep water areas to the north and east of the Falkland Islands with more sightings during the summer months. There have been reports of significant numbers of grey petrels associating with longliners and making numerous foraging attempts within Falkland Island waters. Their diving ability makes them highly vulnerable to incidental mortality. Although there are no recorded mortalities in the Falkland Island fishery, grey petrels are the most frequently killed species in the New Zealand pelagic longline fisheries (Murray *et al*. 1993).

7.0 REGIONAL LONGLINE MORTALITY

Satellite tracking of breeding black-browed albatross from the Falkland Islands has shown that they forage in different regions of the Patagonian Shelf throughout the year, depending on the stage of their breeding cycle. During the incubation period, birds forage predominantly in the northern reaches of the Patagonian Shelf (on the shelf break east of Peninsula Valdez and north to Rio de la Plata), and during chick rearing both males and females forage locally in areas adjacent to breeding sites (Grémillet *et al.* 2000, Huin 2002).

Longlining over the extent of the Patagonian Shelf and into the waters of northern Argentina, Uruguay and Brazil is directly relevant to the conservation of black-browed albatross from the Falkland Islands. Over 25 million hooks were set by Argentine demersal longliners on the Patagonian Shelf from 1993-95 but only anecdotal estimates of seabird bycatch exists. Therefore, a range of bycatch estimates from CCAMLR waters was applied (0.19-0.67 birds/1000 hooks) to derive an implied mortality of between 3,852-13,514 individuals for the Patagonian Shelf during an 18 month period (Schiavini *et al*. 1998). Subsequent observational data collected from longliners in Argentine waters (1999-2001) showed that of an estimated bycatch rate of 0.18 birds/1000 hook, black-browed albatross comprised 53% of recorded mortalities (Favero *et al.* 2001).

Black-browed albatross was also the most common species killed by pelagic and demersal longliners in Uruguayan waters in 1993/94. In the pelagic fishery the estimated bycatch rate for albatross was 4.7 /1000 hooks (black-browed albatross comprised 120 of 123 albatrosses observed to be caught), and in the smaller demersal fishery 78 black-browed albatross deaths were recorded in a single trip (Stagi *et al*. 1998). More recent bycatch estimates from Uruguay suggest that in 1999 between 666 and 2,345 birds were killed by pelagic longliners, and between 533-1,876 of these were black-browed albatross (Stagi and Vaz-Ferreira 2000). In 1998, 35 demersal longliners operated in southern Brazil, with an estimated seabird bycatch of 2,201 to 6,226 birds, including 127 - 587 black-browed albatross. In the same year 22 pelagic tuna longliners caught between 348 and 7,105 seabirds, including 140-2,842 black-browed albatross (Olmos *et al*. 2000*b*).

Given the extensive foraging range of black-browed albatross on the shelf waters of eastern South America (Huin 2002), and their high level of mortality recorded in these regions, it seems reasonable to assume that longlining (both pelagic and demersal) has played a significant role in the decline in the breeding population of black-browed albatross in the Falkland Islands (Huin 2001).

8.0 SEABIRD PROVENANCE

Seabird bycatch is a global conservation issue and because of the vast distances covered by many of the species affected (*e.g*. Procellariiformes) and the extensive coverage of longline fishing fleets on the world's oceans it must be considered on an appropriately large scale. In the context of the conservation of the Falkland Islands seabirds and given the recent decline of the region's black-browed albatross population, FI NPOA-S is focused largely on reducing mortality of black browed albatross to low levels. However, it is vital that as well as conserving seabirds that breed in Falkland Island waters that FI NPOA-S aims to reduce mortality of all seabirds to low levels, regardless of their provenance. Given the migratory nature of seabird species vulnerable to incidental mortality, all fisheries should be considered as open and dynamic systems. For example, in the non-breeding season South Georgia seabirds migrate to the Indian Ocean and the waters of South American coastal nations, and some species circumnavigate the world. Six species of albatross from New

Zealand migrate to the coastal waters of Peru, Chile, Argentina and Uruguay, where they interact with a range of longline fisheries (Robertson *et al.* 2002). The diversity of seabirds that utilise Falkland Island waters is best emphasised by three years of comprehensive at-sea survey conducted between 1998-2000, in which more than 60 species were recorded, and 21 of these were recorded on more than 1000 occasions (White *et al.* 2002).

9.0 ASSESSMENT OF THE FALKLAND ISLANDS LONGLINE BYCATCH PROBLEM

IPOA-S stipulates that countries with longline fisheries should conduct an assessment of these fisheries to determine if a bycatch problem exists and if so, to determine its extent and nature. If a problem is identified, countries should adopt a National Plan of Action for reducing the incidental catch of seabirds in longline fisheries no later than the FAO Committee of Fisheries (COFI) Session 2001. At this time the United States of America was the only country to have drafted a NPOA (Rivera 2000). In the absence of the provision of specific criteria for assessing what constitutes a bycatch problem in IPOA-S (FAO 1999*a*) it is important to establish the criteria that justify the implementation of a NPOA-S for the Falkland Islands. The key issue that requires the Falkland Islands to adopt a NPOA-S is the declining status of the local black-browed albatross breeding population (see Section 5.0).

9.1 Assessment Criteria

While there is a limited time series of data to determine the impact of longline fisheries in Falkland Island waters on seabird populations, there are strong indications of significant bycatch in the recent past. Although the situation has improved, considerable concerns remain given the declining status of black-browed albatross in particular.

High levels of black-browed albatross and other seabirds mortality were recorded in Falkland Island waters in the mid 1990's, including 4.3 birds/line during summer and 0.130 birds/1,000 hooks during winter 1995 (Brothers 1995), and up to 90 black-browed albatrosses killed in a single day (Brothers 1996). Under the provisions of IPOA-S (FAO 1999*a*) the FIFD conducted an initial assessment for the fishery between 1998-2000 (Brickle and Grzebielec 2001). This assessment was based on data collected from vessel logbooks and records obtained by factory based fisheries observers. During this period 77 mortalities were recorded, predominantly Cape petrels (40) and black-browed albatross (34).

The current level of mortality in the fishery is estimated to be 134 birds in 2001/02. The limited available data from the mid 1990's suggests that the current level of mortality has been achieved by the introduction of mitigation measures and specifically tasked observer programmes. However, article 7.6.9 of the FAO Code of Conduct for Responsible Fisheries states that 'countries should take appropriate measures to minimise waste, discards, catch by lost or abandoned gear, catch of non-target species, both fish and non-fish species, and negative impacts on associated or dependent species, in particular endangered species'. Given the recent decline in the local black-browed albatross breeding population and the subsequent IUCN reclassification of the species from Vulnerable to Endangered, and the criteria applied for assessing a bycatch problem, it is therefore deemed necessary for a NPOA-S to be drafted for the Falkland Island longline toothfish fishery.

PART II

FALKLAND ISLANDS NATIONAL PLAN OF ACTION – SEABIRDS

10.0 SCOPE and PURPOSE

The Falkland Islands National Plan of Action-Seabirds (FI NPOA-S) is the first to be written for a United Kingdom Overseas Territory, and as such, is critically important not only for the Falkland Islands but also for the international conservation commitments of the UK. The plan has been drafted at a time when a rapid decline in the Falkland Islands black-browed albatross breeding population has been identified, and many albatross and petrel populations in the Southern Hemisphere are also in decline, the cause of which is frequently linked to longline mortality.

In August 2002 the Falkland Islands Government supported the UK ratification of the Agreement on the Conservation of Albatrosses and Petrels (ACAP). ACAP is a binding agreement developed in the framework of the Convention on the Conservation of Migratory Species of Wild Animals (CMS) where parties are encouraged to reach agreement for the conservation of wild animals, which periodically cross national jurisdictional boundaries. The overall objective of ACAP is to achieve and maintain a favourable conservation status for Southern Hemisphere albatrosses and petrels, while acknowledging the important role of FAO IPOA-S in the conservation of albatrosses and petrels. FI NPOA-S will act as an important step toward exhibiting the Falkland Islands commitment to reducing longline seabird mortality and will form a significant part of an ACAP Plan of Action that may be required in the future. (ACAP came into force on February 1 2004 after being ratified by 5 countries).

FI NPOA-S relates to longline fishing in Falkland Islands waters and that conducted by Falkland Island registered vessels in other EEZs and on the high seas. The objective of FI NPOA-S is to reduce incidental seabird mortality to a level that will have no deleterious impact on the long-term sustainability of seabird populations. This will be achieved by setting bycatch objectives to reduce seabird mortality to a specific level over the next four years. The primary mechanism for achieving this is the provision of a Seabird Interaction Management Strategy that details a cyclical framework of data collection and research to quantify and reduce (mitigate) seabird bycatch.

While the crew of fishing vessels undoubtedly play a critical role in reducing incidental seabird mortality, the level of importance placed on the issue by government ordinances and policy and the management of fishing companies will largely determine the level of compliance and attitude toward the implementation of mitigation measures at-sea. Pursuant with this principle, the document (Parts I and II) is focused on providing fishing companies with the background knowledge and strategies necessary to achieve significant steps toward reducing seabird mortality to negligible levels within the next four years. When fully implemented FI NPOA-S will facilitate the local fishing industry to position themselves to maximise future marketing opportunities by exhibiting a long-term commitment to the holistic management of the Falkland Islands fisheries.

As such, for FI NPOA-S to achieve the goals stated herein, it is critical that this document is disseminated not only to local fishing companies, but where appropriate, also to senior representatives of their foreign joint partners and all companies involved with longline fishing in Falkland Islands waters.

It is intended that the plan be reviewed four years after implementation, at which time the goals should be revised and the scope and content of the plan reassessed. This is in keeping with the stipulation (FAO 1999*a*, para 18) that 'NPOA-Seabirds States should regularly, at least every four years, assess their implementation for the purpose of identifying cost-effective strategies for increasing the effectiveness of the NPOA-Seabirds'. This 4-year review process is also consistent with the requirements for biennial reporting to FAO-Committee of Fisheries (COFI) on progress with the assessment, development and implementation of NPOA-Seabirds (FAO 1999*a*, para 21).

11.0 OBJECTIVES

General Objective

To further reduce and/or maintain longline mortality to negligible levels (to below 0.01 birds/1000 hooks by 2004/05 and further reduce mortality to below 0.002 birds/1000 hooks by 2006/07) within four years of implementing FI NPOA-S.

Specific Objectives

Through the implementation of strategies and recommendations contained in the FI NPOA-S it should facilitate the achievement of the following objectives:

Attain continuous observer coverage on longliners operating in Falkland Island waters to calculate an annual estimate of incidental mortality;

Where appropriate, provide observer coverage on Falkland Island registered longliners operating outside Falkland Islands waters;

Cognisant with specified bycatch reduction goals, provide strategies necessary to achieve an annual reduction in the incidental mortality of seabirds in Falkland Islands waters;

Where feasible, continue to investigate and develop cost effective and practical mitigation measures to reduce incidental seabird mortality;

Recognising the experience and knowledge of fishermen, encourage their involvement in the modification and development of mitigation measures;

Ensure the dissemination of information and training opportunities for crew and other stakeholders to work towards practical implementation of the FI NPOA-S, and the development of a seabird conservation culture in fishing companies operating in the Falkland Islands;

Facilitate the synergy of FI NPOA-S with the upcoming Falkland Islands Conservation Strategy and Biodiversity Action Plan;

Place high priority on establishing collaborative projects between the Falkland Islands and South American countries with fishing fleets known to be, or suspected of, causing significant incidental mortality of seabirds, particularly black-browed albatross from the Falkland Islands.

12.0 BYCATCH OBJECTIVES

When setting a bycatch reduction goal it is important to consider that a goal based on a mortality rate may be ineffective if a reduction in bycatch is offset by increasing fishing effort causing an actual increase in the rate of incidental mortality. However, due to the relatively constant longlining effort from 1998-2002 (Part I, Figure 2) and given the fact that it is considered highly unlikely that effort will be increased beyond two licences in the next four years (*pers. comm.* J. Barton, Director FIFD) (before the initial review of FI NPOA-S) it is appropriate for FI NPOA-S to set a bycatch rate.

Bycatch rates will be expressed as the number of seabirds killed per 1000 hooks (detailed in Section 16.3). These goals will apply to all seabird species, regardless of their conservation status as reducing the bycatch potential of a vessel/fleet to catch seabirds can only accrue benefit to scheduled species.

12.1 Extrapolation of Bycatch Data

From July 2001 to June 2002 8,164,939 hooks were set in Falkland Islands waters. Of these, 50.1% were set with a specifically tasked seabird observer onboard. The level of bycatch was extrapolated using methods developed by CSIRO for estimating seabird bycatch in the Australian longline tuna fishery (Klaer and Polacheck 1995, 1997). For 2001/02 fishing effort was stratified into five seasonal (temporal), and two location strata (spatial). The season and area of fishing have been identified as critical factors influencing seabird bycatch in many longline fisheries (e.g. Klaer and Polacheck 1998, Brothers *et al*. 1999b), including the Falkland Islands (Sullivan and Reid 2002).

12.1.1 Temporal

As black-browed albatross comprise the majority of recorded bycatch and the stages of their breeding cycle largely determine their abundance and foraging behaviour in Falkland Islands waters, the temporal component of bycatch extrapolations should be based on their breeding cycle (Winter:May-August, Prospecting:September, Eggs:October-December, Young Chick: January-February, Old Chick:March-April).

12.1.2 Spatial

Based on black-browed albatross abundance and mortality in 2001/02, the bycatch level of the longline fishery in Falkland Island waters was divided into two areas; the Burdwood Zone (>53º 15S) and the Falkland Zone (<53º 15S). This stratum should be flexible and it is recommended that annual extrapolations for each fishery reflect fishing effort, seabird abundance and mortality levels.

Any modification of existing strata or inclusion of additional strata that would improve the precision of bycatch estimates should be considered for future calculations.

13.0 REPORTING

It is recommended that an annual review of the FI NPOA-S becomes the mandate of the Fisheries Advisory Committee (FAC), with relevant invited guests. This will ensure that locally elected industry members and relevant government officials continue to have significant input into the monitoring and evolution of the plans.

It is proposed that at this meeting a brief annual summary is also presented that contains, but is not limited to:

- an estimate of seabird mortality within the longline fishery
- an assessment of the level and utility of observer coverage
- an audit of performance against bycatch reduction goals contained in a Seabird Interaction Management Strategy

- a summary of the effectiveness of the Seabird Interaction Management Strategy and any recommended changes to further reduce seabird bycatch
- recommendations for the development and/or changes to mitigation measures

14.0 EDUCATION, TRAINING AND PUBLICITY

The success of FI NPOA-S will depend largely on the education of fishers about the conservation significance of the incidental mortality of seabirds. This process should involve the provision and dissemination of literature to fishing companies that contains generic information on strategies and measures available to reduce mortality levels (e.g. *Longline Fishing: Dollars and Sense*, *Catch Fish Not Birds* and the information sheet produced by FIFD) and also detailed information of local policies and ordinances that relate to the management of seabird bycatch.

As outlined in Part I, the importance placed on reducing seabird mortality by crew-members will depend largely on the emphasis placed on the issue by government ordinances and subsequently by fishing company management. As such, the primary responsibility for the provision of education material and training to crew-members should be the responsibility of the management of fishing companies.

In addition, information on bycatch levels and relevant management strategies (e.g. observer programmes, development and prescription of mitigation measures) should be disseminated, as appropriate, to local and international media.

15.0 DATA COLLECTION (AT-SEA OBSERVER PROGRAMMES)

Currently there are three at-sea observer programmes operating in the Falkland Islands, two of these employ seabird observers and the third is related specifically to fisheries stock assessment.

Falklands Conservation Seabirds at Sea Team (SAST)
SAST employ three specifically tasked seabird observers, two of which work full time on seabird bycatch issues and a third who conducts at-sea surveys around South Georgia and spends a minor proportion of his time investigating seabird mortality onboard fishing vessels.

In 2001/02 SAST observers worked on both longliners and trawlers, and in 2002-2004 they are tasked to investigate, quantify, and where necessary and feasible, develop mitigation measures to reduce seabird mortality caused by trawlers in Falkland Island waters. They will also conduct preliminary investigations into seabird interactions with the large *Illex argentinus* jigging fleet operating in Falkland Island waters from February-June each year.

Falkland Island Fisheries Department (FIFD) Seabird Observers
The FIFD currently employ two seabird observers to investigate and quantify seabird mortality on-board Falkland Island registered vessels when observers are not provided in accordance with alternative observer schemes e.g. Falkland Island registered longliners operating in CCAMLR waters, and foreign flagged longliners operating in Falkland Island waters. The stated objective of the FIFD seabird observer programme is to achieve continuous coverage on all Falkland Island flagged longliners, so the number employed may increase as required. The programme is funded by a specific charge to fishing companies, which is separate to licence fees, and it is intended to continue in the long-term.

Unlike SAST observers, FIFD observers also have an official compliance role which enables them to enforce the implementation of mitigation measures and report on breaches of licensing conditions.

In addition to core seabird observation duties, FIFD observers are also required to spend two days a week in the factory (or the portion of that day required to sample 100 toothfish) to collect biological data for fish stock assessment.

Falkland Island Fisheries Department (FIFD) Fisheries Observers
The FIFD also employ up to six fisheries observers who are tasked with collecting biological fisheries data to meet stock assessment and general fisheries management objectives. As their core duties involve working in the ship's factory, seabird interaction and mortality data collected by Fisheries Observers have traditionally been of limited use in assessing the level of fisheries induced seabird mortality. In the past anecdotal records have highlighted bycatch problems.

16.0 SEABIRD INTERACTION MANAGEMENT STRATEGY

Longlining for Patagonian toothfish in Falkland Island waters has always been limited to two licences, potentially operating for 12 months of the year, which represents a maximum fishing effort of 24 vessel months per year. Given that the allocation of longlining effort in Falkland Islands waters is relatively uniform across a small fleet, a recommendation for the implementation of a specific suite of mitigation measures is both feasible and appropriate.

The IPOA-S states that to reduce seabird bycatch it is essential to reduce the number of encounters between seabirds and baited hooks (FAO 1999*a*). In accordance with this principle, a Seabird Interaction Management Strategy provides detailed recommendations to reduce the frequency of potentially fatal interactions between seabirds and longlines, and establish a cyclical framework of data collection and research to quantify and reduce seabird bycatch to specified reduction goals.

The following section details the five elements of Seabird Interaction Management Strategy (longlining). These elements are not presented in a prioritised order, rather are ordered in logical sequence.

16.1 Data Collection (Observer Coverage)

16.1.1 Objective
At-sea observer programmes are regarded as the most effective means of gathering representative and independent data (FAO 1999*b*). As such, it is important that FI NPOA-S facilitates the establishment, continuation or expansion of an observer programme(s) at an appropriate level to investigate and quantify the nature of seabird interactions within the longline fishery. If incidental mortality is recorded, these data should be analysed to determine the spatial and temporal scale and cause(s) of the problem.

16.1.2 Strategy
In 2002/03 and beyond, FIFD specifically-tasked seabird observers will provide longliner coverage. Occasionally SAST observers may provide coverage if the FIFD require assistance to obtain complete coverage.

It is recommended that to achieve the stated level of continuous coverage in local waters alone, the FIFD longline observer programme requires a third observer, and if in the future locally registered longliners operate in areas without alternative observer programmes, additional observers may be required. Taking into account the additional factory role of FIFD seabird observers, to ensure the most precise annual bycatch estimate, a minimum of 30% of the total number of hooks being hauled should be observed, 100% of daytime, dusk and dawn sets and a representative sample of night time sets.

In 2001/02, FIFD and SAST seabird observers collected compatible data, which included recording species-specific foraging behaviour during daylight line setting operations. It is recommended that FIFD observers continue to collect these data, as it may facilitate a detailed investigation into the environmental and operational variables that affect incidental mortality.

It is important to maintain the on-board retention of carcasses for *post mortem* in Stanley, which provides important data for a range of genetic studies and the collection of age, sex and morphometric data.

16.2 Prescription of Mitigation Measures

16.2.1 Objective
A suite of technical and operational mitigation measures should be developed and implemented to reduce incidental mortality. These may include mandatory (i.e. pursuant with licensing) and voluntary measures and recommended actions to attain best practice management to reduce incidental seabird mortality.

16.2.2 Strategy
It is recommended that current licence conditions are updated to include a more comprehensive suite of both technical and operational mitigation measures so that the Falkland Island fishery can work toward setting new benchmark standards for reducing bycatch. Where possible, this should include research into testing the effectiveness of individual measures and combinations of measures to enable prescriptive recommendations for best practice fishing using the Spanish system (*sensu* Robertson *et al*. 2002).

Current longline licence conditions and recommended prescriptive changes to further reduce seabird mortality in Falkland Island waters are detailed below.

16.2.3 Current Licence Conditions
Current ordinances and licensing provisions allow for conditions to be imposed in relation to reporting, carriage of observers, conservation, and mitigation measures to reduce the incidental mortality of seabirds. Vessels are also required to endeavour to reduce incidental seabird mortality and comply with reasonable instruction to this effect.

Line Weighting
The longline should be adequately weighted to reduce incidental mortality. Weights should be released before line tension occurs. Weights of at least 6kg should be used, spaced at intervals of no more than 20m (i.e. 0.3kg per metre).

Tori Lines
A streamer must be deployed during line setting operations. This should be constructed to CCAMLR specifications or to an alternative specification, which has been proved to be equally efficient. In the future, it is likely that CCAMLR Conservation Measures will require twin tori lines (J. Croxall *pers. comm*.).

Night Setting
Longlines should be set at night, whenever possible.

Bait
Only thawed bait should be used.

Offal Management
The dumping of offal is prohibited while longlines are being set. The dumping of offal during the haul shall be avoided. Discharge of offal shall take place on the opposite side of the vessel to that where longlines are hauled.

16.2.4 Recommended Additions to Licence Conditions
It is recommended that future licence conditions contain the following mitigation measures to reduce bycatch. The following section is divided into technical and operational measures. If in the future a vessel operating a Mustad autolining system is licensed in Falkland Island waters mitigation measures should be altered to suit (See Appendix II for recommended appropriate measures).

Technical Measures

Line Weighting
Currently licence conditions require vessels to use weights of at least 8.5kg spaced at intervals of no more than 40m, or 6kg spaced at intervals of no more than 20m. This recommendation is based on CCAMLR Conservation Measure 25-02. The former weight regime is based on the work of Agnew *et al*. (2000) and is the one currently applied by vessels fishing in CCAMLR Sub-area 48.3 (South Georgia).

Recommended Prescription: The longline should be adequately weighted to reduce incidental mortality. Weights should be released before line tension occurs. Weights of at least 8.5kg mass spaced at intervals no more than 40m or 6kg mass spaced at no more than 20m shall be attached for the entire length of the hook line.

Tori Lines
Although the four vessels that operated in 2001/02 typically exceeded current licensing conditions by deploying two to three tori lines it is recommended that the use of multiple tori lines is added to future licensing conditions.

Recommended Prescription: FIFD should aim to have detailed tori line performance standards in place by 2004/05.

A minimum of two streamer lines (tori lines) will be towed during all line setting operations. The specifications for tori lines may be prescribed by the FIFD in which case they will depend on the latest research and designs proven to be effective in local waters. (Or be consistent with any future twin tori line specifications promulgated by CCAMLR Conservation Measure 25-02). Regardless of the design all streamers must be long enough to reach the sea surface in calm conditions.

Night Setting
There is ample evidence to suggest that night setting is the most effective mitigation measure to reduce albatross bycatch to negligible levels.

Recommended Prescription: It is strongly recommended that whenever practicable longlines should be set at night.

Bait
Current licence condition should be reworded to prevent the use of frozen bait.

Recommended Prescription: All bait must be thawed before use.

Offal Discharge/Hooks
All four vessels that fished in 2001/02 discharged offal on the opposite side of the vessel to the hauling bay. However, improvements can be made to reduce the number of fish heads discharged with hooks *in situ*, and to reduce the number of baited hooks that snap off the line during line hauling and are swallowed by birds scavenging adjacent to the hauling bay.

Recommended Prescriptions: Hooks must be removed from **all** fish (including bycatch species) before they are discharged.

All practical efforts should be made to minimise bait and fish bycatch from being washed or discarded into the sea from the hauling bay.

All possible efforts should be made to reduce the frequency of baited hooks being snapped off the line during hauling and landing in the water adjacent to the hauling bay.

Line Hauling
Although in 2001/02 vessels occasionally deployed a Brickle Curtain (a protective curtain positioned around the hauling bay) to reduce hook-ups it is recommended that future licences require the use of a curtain if a hook-up is recorded, or is deemed by the observer to be likely to occur.

Recommended Prescription: The use of a Brickle Curtain will be deployed when the FIFD observer deems it necessary to prevent/reduce hook-ups (which can cause mortality or morbidity).

Other Recommended Prescriptions:
Firearms are prohibited onboard Falkland Islands registered longliners and foreign flagged vessels operating in Falkland Island waters.

Deck lighting should be kept to the minimum necessary for crew safety during night setting operations.

Potting
To date, the use of pots to catch toothfish in Falkland Island waters (and other areas) has met with limited success.

Operational Measures

Critical Mortality Threshold (Seabirds)
There is considerable evidence for seasonal peaks in longline mortality, particularly in the breeding season (e.g. Murray *et al.* 1993, Brothers *et al.* 1999*b*, Wiemerskirch *et al.* 2000, CCAMLR *various in* Kock 2001, Nel *et al.* 2002,). Falkland Island bycatch data from 2001/02 indicates that mortality events are highly seasonal, with the vast majority of mortality occurring in the black-browed albatross breeding season. Only three mortalities were recorded during the winter (Sullivan and Reid 2002). In addition to the technical mitigation measures recommended, the primary mechanism for managing such seasonal pulses in seabird bycatch is the identification of a Critical Mortality Threshold (CMT). A CMT is a mechanism that stipulates a threshold level of mortality within a specified period that triggers the implementation of an additional mitigation measure (e.g. compulsory night setting) for the subsequent 30-day period. However, the FIFD Director of Fisheries has discretionary power to waive or alter the duration of night setting restrictions under extenuating circumstances (as interpreted by the Director of Fisheries).

In 2001/02 SAST and FIFD observers did not record a single mortality on lines set at night. Similarly, night setting has been shown to reduce seabird mortality in many longline fisheries around the world, both pelagic and demersal (e.g. Gales *et al.* 1998, Ashford and Croxall 1998, Weimerskirch *et al.* 2000). Therefore, current evidence suggests that the most effective way of reducing seabird bycatch to negligible levels would be to enforce compulsory night setting (as defined by CCAMLR Conservation Measure 25/02). However, at high latitudes (with short periods of darkness in the summer) such an option would greatly limit fishing opportunities and potentially the economic feasibility of the fishery (*c.f.* Brothers *et al.* 1998). CMTs are not intended to penalise fisheries in the long-term, but to instigate emergency mitigation measures during critical periods of incidental mortality. CMTs will provide an operational incentive for vessels to maximise the implementation of seabird conservation measures, as failure to do so will result in an operational restriction that limits line setting opportunities.

The extrapolation of bycatch levels for the calculation of the general CMT should be based on the number of mortalities recorded in relation to the proportion of hooks observed per haul. For example, if 50% of hooks of an individual line were observed being hauled and two mortalities are recorded, the estimated level of mortality for the line would be 4-birds.

Vessel Specific CMT
Recommended Prescription: Any vessel(s) that exceeds the bycatch threshold of 10 seabirds in a 14-day period[1] should be limited to setting all lines during night time hours (night setting, i.e. during the hours of darkness between the times of nautical dusk and dawn[2]) for the subsequent 30-day period. However, if all mitigation measures are deployed and fully compliant with licensing conditions, the Director of Fisheries has discretionary power to waive compulsory night setting or to impose night setting restrictions for a shorter time period.

[1] The threshold limit of 10 birds in a 14-day period is based on the highest level of mortality recorded in 2001/02. The 14-day period relates to 14 days consecutive fishing i.e. not including port calls and trans-shipping or other non-fishing days. If the bycatch threshold is exceeded, the observer (or other onboard personnel) should report the incident directly to FIFD within a 48hr period.
[2] The exact times of nautical twilight are set forth in the Nautical Almanac tables for the relevant latitude, local time and date. All times, should be referenced to GMT.

Fleet CMT[3]
The Fleet CMT is intended to prevent vessels from consistently operating at a bycatch level slightly below the *Vessel Specific* CMT threshold, which would result in a cumulative bycatch that could potentially exceed that specified by the *Vessel Specific* CMT.

Recommended Prescription: If the two vessels in combination exceed the fleet bycatch threshold level of 15 seabirds in a 14-day period both vessels should be limited to setting all lines during night time hours for the subsequent 30-day period. However, if all mitigation measures are deployed and fully compliant with licensing conditions, the Director of Fisheries has discretionary power to waive the requirement for compulsory night setting or to impose night setting restrictions for a shorter time period.

16.3 Bycatch Objectives

16.3.1 Objective
Based on Seabird Interaction Management Strategy elements 1 (Data Collection Observer Coverage) and 2 (Prescription of Mitigation Measures) and a thorough knowledge of the operational constraints of the fishery, develop seabird bycatch reduction goals.

16.3.2 Strategy
Based on the 2001/02 estimated level of bycatch for the Falkland Islands (134 mortalities, Co-efficient of variation 20.2%) which represents a bycatch rate of 0.02 birds/1000 hooks, the aim of FI NPOA-S is to reduce the level of bycatch to below 0.01 birds/1000 hooks by 2004/05 and further reduce mortality to below 0.002 birds/1000 hooks by 2006/07. This is the level currently recorded in CCAMLR Sub-area 48.3 (South Georgia, SC-CCAMLR 2002) and is an attainable goal for the Falkland Island fishery.

16.4 Research and Development

16.4.1 Objective
Mitigation Measures[4] –Evaluate the effectiveness of current and emerging mitigation measures under a range of environmental and operational conditions.

Other – identify and prioritise knowledge gaps in seabird ecology that are intrinsically linked with seabird bycatch and would enhance future efforts to quantify and manage its impacts.

16.4.2 Strategy
Mitigation Measures
In the four-year period following the adoption of FI NPOA-S, SAST, FIG and CFL should collaborate and secure funding to conduct research into the effectiveness of a range of mitigation measures in isolation and in concert with each other. In addition, observers should continue to collect foraging behaviour data during line setting operations to further investigate the utility of using the rate of foraging attempts as an index of mortality. If appropriate, foraging behaviour could then be used to investigate the effectiveness of:

[3] The fleet CMT would only apply if, as is the current situation, both longliners were operating under licences held by the same individual and/or company.

[4] Cognisant with prescriptions contained in IPOA-S - Research and Development: NPOA-SEABIRDS should contain plans for research and development, including those aiming: (i) to develop the most practical and effective seabird deterrent device; (ii) to improve other technologies and practices which reduce the incidental capture of seabirds; and (iii) undertake specific research to evaluate the effectiveness of mitigation measures used in the longline fisheries, where this problem occurs.

- different weighting regimes in increasing the sink rate of the hook line

- tori line design and attachment positions to investigate the most effective system that maximises the area protected

- dyed baits in reducing foraging activity during line setting

Other
It is critical that Falkland Conservation's five-yearly census of the Island's black-browed albatross breeding population to assess their conservation status is continued indefinitely.

16.5 Education, Training and Publicity

16.5.1 Objective
Ensure that appropriate educational material and training opportunities on managing incidental mortality are available to management, office staff and crew members.

16.5.2 Strategy
- Convert the FI NPOA-S into a practical set of procedures for use aboard longline vessels

- Dissemination of any other appropriate literature to stakeholders, including fishing company managers and the officers and crew of vessels

- Where appropriate, CFL and FIFD should facilitate onshore training of crew in operational procedures pursuant to the effective implementation of the FI NPOA-S

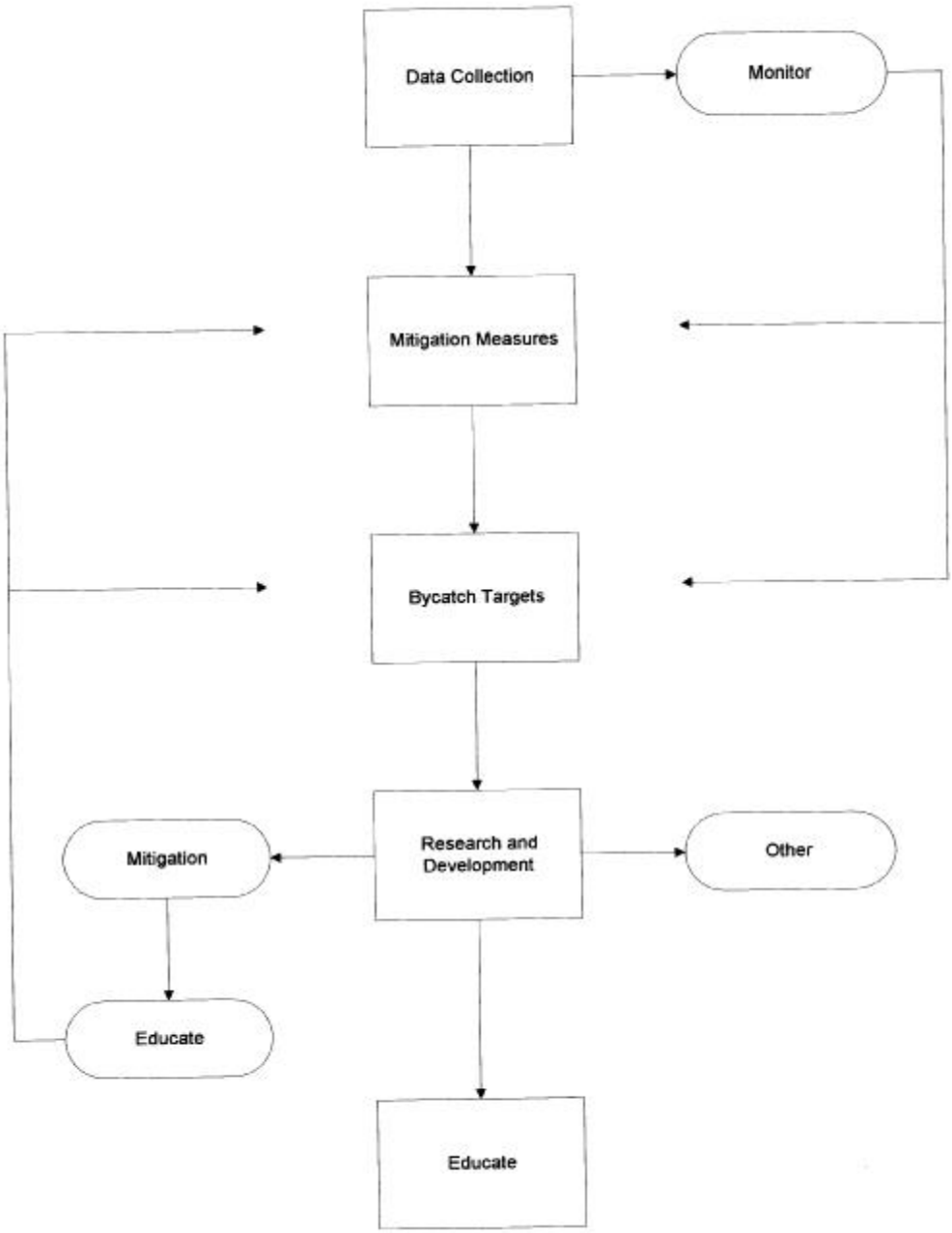

Figure 3 Seabird Interaction Management Strategy

17.0 Exploratory/New Longline Fishing

17.1 Introduction

To date, toothfish is the only species that has been targeted by longlines in Falkland Island waters. Although high levels of incidental mortality were recorded in the mid 1990's, the introduction of mitigation measures has realised a significant reduction in bycatch. Based on historical and recent data, black-browed albatross appear to be the most vulnerable species to longline mortality in Falkland Island waters. As in other areas where black-browed albatross occur, they predominantly forage in relatively shallow shelf waters (Grémillet *et al.* 2000, Huin 2002, White *et al.* 2002), as opposed to deeper oceanic waters. Therefore, their density around toothfish longliners, which are restricted to waters greater than 600m deep, but typically fish in waters >1000m, is likely to be significantly less than would occur around longliners fishing in the more shallow shelf waters surrounding the Falkland Islands.

A longline vessel/fishery targeting a different species is likely to operate in a different region of Falkland Island waters (e.g. shallower shelf waters) to that of toothfish longliners, and would therefore be expected to experience different seabird assemblages and densities, interactions and potentially also levels of mortality.

17.2 Objective

To ensure any exploratory/new longline fisheries operating in Falkland Island waters instigate best practice mitigation measures and other management measures cognisant with licensing conditions to minimise the potential for seabird mortality.

17.3 Strategy

- Prior to the commencement of any exploratory/new longline fishing the FAC should commission a suitably qualified person to conduct a thorough desktop review of potential impacts and best practice mitigation measures. The subsequent report should then be reviewed by the Director of Falkland Islands Fisheries Department prior to imposing licensing conditions. The licence applicant should meet any research and/or production costs incurred in the course of the review.

- It is critical that 100% observer coverage is achieved for all exploratory/new longline operations. This person(s) should have considerable experience as a longline observer.

- If a longline license is awarded for a period of more than six months a detailed Seabird Interaction Management Strategy should be developed and incorporated into FI NPOA-S.

18.0 INTERNATIONAL FISHING

18.1 Introduction

As fishing operations vary greatly depending on the nature of the target species, vessels and fishing area the most appropriate and effective mitigation measures to reduce seabird mortality also vary. It is therefore not possible to recommend a uniform suite of mitigation measures for Falkland Islands registered longliners operating outside Falkland Island waters.

18.2 Recommendations

Falkland Island-registered longliners operating in waters where an international treaty is in place to which the Falkland Islands is a signatory should observe all ordinances and regulations therein.

Where appropriate, FIFD should provide adequate observer coverage to monitor bycatch levels in the EEZ of other countries and on the high seas.

Falkland Island longliners using the demersal Spanish system outside Falkland Islands waters where no management guidelines are in place to reduce seabird mortality, or where guideline are less stringent than those utilised in Falkland Islands waters, should utilise all technical mitigation measures outlined in FI NPOA-S.

Falkland registered longliners operating outside Falkland Islands waters should adopt best practice to reduce seabird mortality and, where possible, adopt mitigation measures outlined in the FI NPOA-S.

19.0 REVIEW PROCESS

The Fisheries Advisory Committee (FAC) should monitor the success of the plan in regard to the implementation of recommendations and the success in reducing seabird bycatch to meet the bycatch reduction goals. Detail of the annual review process is contained in FI NPOA-S: Reporting.

In addition, as required by IPOA-S, FI NPOA-S should be reviewed at four-yearly intervals after its implementation. The FAC should commission an appropriate person(s) to conduct the four-yearly review, which should include, but not be limited to, a review of:

- the scope of the plan
- the purpose of the plan
- the legislative framework
- status of ACAP and other international obligations and their relationship with FI NPOA-S
- an audit of the bycatch reduction goals and an assessment of appropriate new goals
- a review of the conservation status of seabird species potentially impacted by Falkland Island longliners

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APPENDIX I

(Abstracts from) FAO Code of Conduct for Responsible Fisheries (FAO 1995)

Article 6 General Principles

6.5 States and subregional and regional fisheries management organizations should apply a precautionary approach widely to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment, taking account of the best scientific evidence available. The absence of adequate scientific information should not be used as a reason for postponing or failing to take measures to conserve target species, associated or dependent species and non-target species and their environment.

6.6 Selective and environmentally safe fishing gear and practices should be further developed and applied, to the extent practicable, in order to maintain biodiversity and to conserve the population structure and aquatic ecosystems and protect fish quality. Where proper selective and environmentally safe fishing gear and practices exist, they should be recognized and accorded a priority in establishing conservation and management measures for fisheries. States and users of aquatic ecosystems should minimize waste, catch of non-target species, both fish and non-fish species, and impacts on associated or dependent species.

Article 7 Fisheries Management

7.2 Management Objectives

7.2.3 States should assess the impacts of environmental factors on target stocks and species belonging to the same ecosystem or associated with or dependent upon the target stocks, and assess the relationship among the populations in the ecosystem.

7.5 Precautionary approach

7.5.1 States should apply the precautionary approach widely to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment. The absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation and management measures.

7.6 Management Measures

7.6.9 States should take appropriate measures to minimize waste, discards, catch by lost or abandoned gear, catch of non-target species, both fish and non-fish species, and negative impacts on associated or dependent species, in particular endangered species. Where appropriate, such measures may include technical measures related to fish size, mesh size or gear, discards, closed seasons and areas and zones reserved for selected fisheries, particularly artisanal fisheries. Such measures should be applied, where appropriate, to protect juveniles and spawners. States and subregional or regional fisheries management organizations and arrangements should promote, to the extent practicable, the development and use of selective, environmentally safe and cost effective gear and techniques.

Article 8 Fishing Operations

8.5 Fishing gear selectivity

8.5.1 States should require that fishing gear, methods and practices, to the extent practicable, are sufficiently selective so as to minimize waste, discards, catch of non-target species, both fish and non-fish species, and impacts on associated or dependent species and that the intent of related regulations is not circumvented by technical devices. In this regard, fishers should cooperate in the development of selective fishing gear and methods. States should ensure that information on new developments and requirements is made available to all fishers.

APPENDIX II

Mitigation Measures to Reduce Longline Seabird Mortality

There are three primary causes of mortality and morbidity in longline fishing. The first two are caused by birds becoming hooked (or entangled) during line setting and hauling, and the third by the ingestion of hooks, the long term results of which are largely unknown but at the least is likely to reduce longevity. The majority of longline deaths are caused by seabirds becoming hooked and drowned while scavenging baits from hooks during line setting operations. Birds also become hooked during line hauling although in many cases these birds can be released alive, after sustaining injuries that could reduce their chance of survival.

A mitigation measure is defined as a modification either to fishing operations or equipment to reduce the likelihood of seabird mortality. Since the early 1990s there has been two complementary approaches taken toward mitigating the problem. One is based on appealing to fishermen to reduce bait loss by minimising seabird access to baits during line setting and therefore maximise catch and profitability (e.g. Brothers 1991, 1995, Løkkeborg 1998 Løkkeborg and Robertson 2002, Sanchez and Belda 2003) and the second is more directly focused on seabird conservation (e.g. Croxall *et al*. 1990, Brothers 1991, Cherel *et al.* 1996, Schiavini *et al*. 1998, Nel *et al.* 2002). However, it is important to note that the two are not mutually exclusive and by reducing bycatch levels they both achieve seabird conservation objectives.

The following section is largely based on Brothers *et al.* (1999), which provides a detailed summary of mitigation methods currently in use and those under development. It is important to note that there is no 'silver bullet' and without question the most effective means of reducing mortality is to use a combination of mitigation measures in concert.

Spanish System

Night Setting

In most longline fisheries, setting lines at night has been found to be an extremely effective method of mitigation, and can lead to reductions in bird mortality of 60-96%. Generally, night is defined as the period from nautical dusk to nautical dawn. Many species of birds (and particularly albatrosses) find their food visually, and so are less able to detect baits at night. In the Falklands this was found to be extremely effective, with no mortality recorded during night setting in 2001/2002. Several studies have highlighted high numbers of white-chinned petrels killed during night setting operations, nevertheless bycatch of all species was significantly reduced (Ashford *et al.* 1995, Moreno *et al.* 1996, Olmos *et al*. 2000a), whereas other studies in Australian and Kerguelen waters have shown that night setting significantly reduces white-chinned petrel mortality (e.g. Gales *et al.* 1998, Weimerskirch *et al.* 2000).

The advantages of night setting may be negated if bright deck lights are used during line setting. Therefore, it is important to only use the minimum number of lights required for crew safety.

Avoiding line tension

During line setting, it is important that the mainline is set at a speed that is greater than that of the vessel, otherwise the hooks are set under tension, and remain on the surface and accessible to seabirds for a longer period. In the Spanish system, the sink rate of the hook line is also significantly reduced if weights are not pushed from the setting window before line tension pulls the weights from the setting window (Brothers 1995).

Poorly made setting boxes can also create line tension by snagging hooks during line setting. Well-maintained plastic setting boxes with metal sleeves in the hook chute are the most effective way to reduce snags. The performance of hook boxes is further improved if the hooks are on the left hand side rather than the right hand side (due to the angle at which hooks leave the box) (Brothers1995).

Area and season closures

The spatial and temporal characteristics of fishing effort are critical in determining bycatch levels (e.g. Moreno *et al.* 1996, Klaer and Polacheck 1998, Brothers *et al*. 1999*b*, Nel *et al.*2002*)*. In CCAMLR Sub-area 48.3 (South Georgia) seabird mortality has been reduced to negligible levels by a concert of mitigation measures, including restricting longlining to the non-breeding season (May to September) (Conservation Measure 25-02, *in* Kock 2001). A significant reduction in mortality was achieved around the Prince Edward Islands when fishing was prohibited within an 8-mile radius of the islands (Nel *et al*. 2002)

The limitation of seasonal closures is the displacement of fishing effort and potentially incidental mortality into regions with unregulated fishing.

Offal disposal

Due to spatial and temporal competition for resources, seabirds and fisheries are inextricably linked throughout the world. This level of interaction is exacerbated by the provision of discards (e.g. bycatch species, visceral matter, fish heads etc.) by many fisheries. Discards produced by longliners attract seabirds, which subsequently increases their likelihood of scavenging baits during line setting, and therefore their probability of being hooked.

To minimise the attractiveness of longliners to seabirds, ideally vessels should not dispose of any offal. Instead, they should have an onboard meal plant to process all discards, including uneaten bait, fish bycatch, offal and heads etc. If no meal plant is onboard, prior to discharging of waste, all hooks must be removed from fish heads and bycatch species. There is considerable evidence of hooks being recovered form the breeding colonies of Procellariiformes, particularly albatross species, after being regurgitated by adult breeding birds (e.g. Cooper 1995, Huin and Croxall 1996, Nel and Nel 1999)

Vessels without meal plants should never discharge waste during line setting, and preferably, not during hauling as this attracts seabirds, which increases their likelihood of becoming hooked during line hauling. If it is necessary to dispose of offal during line hauling, it must occur on the opposite side of the vessel to line hauling.

An alternative strategy to a meal plant is to store all discards and then discharge a days waste in one event when not setting or hauling.

Bird-scaring line

A bird line (tori line) is a device that is deployed astern during line setting to deter birds from taking baited hooks. Typically, tori lines consist of a series of streamers suspended from a

rope tied to a pole mounted on the stern deck. The higher the pole (attachment point) the greater the area (and number of hooks) astern of the vessel protected.

The bird line is kept in position and covering a distance astern by tension on the seaward end of the bird line. This is either done by drag on the line, or by adding something to the end of the bird line (such as rope of a greater diameter, or a buoy). On demersal longliners, because the baited hooks are set centrally it is feasible to use two or more bird lines at the same time.

Bird lines have been shown to be effective at reducing mortality in a range of pelagic and demersal fisheries (e.g. Brothers *et al.* 1999*b*, Løkkeborg and Robertson 2002, Løkkeborg 2003)

Line weighting

Increasing the weight on lines increases their sink rate during setting, and hence decreases the time that baited hooks remain available to seabirds. There remains an urgent need for research to identify optimum line weighting regimes for autolining and Spanish demersal longliners.

Currently, CCAMLR Conservation Measure XIX stipulates that line weighting consist of 6 kg weights every 20 m, or 8.5 kg weights every 40 m. This requirement is based largely on the work of Agnew *et al*. (2000) who found that there was no significant improvement in bycatch rate by increasing weights attached every 40m from 8.5 kg up to 12.5kg. Nevertheless, the measured catch rates (0.18 birds killed/1000 hooks) recorded using 8.5kg every 40m remained unacceptably high. This is thought to be due to the effect of the ballooning of the line between the attached weights. Therefore, to further reduce catch rates, the spacing between weights would need to be shortened, possibly to the recommended 20m. However, it is currently not possible to assess the effectiveness of this weighting regime as no vessels in CCAMLR, or elsewhere, deploy this system (*sensu* Robertson 2002).

Brickle curtain

During line hauling, many seabirds congregate around the hauling bay to scavenge baits as they surface and those washed overboard. When large numbers of birds gather around the hauling bay they can become hooked as they seize hooks and they often become 'foul hooked' as the line is hauled through a dense congregation of scavenging birds. A Brickle curtain is a device to reduce hauling hook-ups by deterring birds from approaching too close to the hauling bay. The curtain consists of a series of lines hanging seaward from a rope positioned around the hauling bay. Nevertheless, some species such as Black-browed Albatrosses and Cape Petrels can become habituated to the curtain when used over long periods, and it is best used periodically (i.e. when there are high densities of birds around the hauling bay), when it remains very effective.

Acoustic deterrents

Sudden loud noises (such as firing of gas guns, rifles, banging of the hull, or ringing the ship's bell) can frighten birds away from the setting area for short periods (generally up to two minutes). However, birds rapidly habituate to the use of such acoustic deterrents if used regularly. Given the regularity of bird interactions with longlines, acoustic deterrents are thought unlikely to provide effective long-term mitigation.

Water cannons

Shooting water under pressure over the setting area has been trialed in pelagic longline fisheries. It acts by scaring birds from the area the baited hooks enter the water, and hence

acts in a similar manner to a bird line. During trials it was found that water could not be forced far enough away from the vessel for it to be any more effective than a short bird line.

Emerging methods

Emerging methods includes those that have been developed but not yet fully tested, or are still only in the theoretical stage.

Several methods of underwater setting have been suggested and trailed.

Setting chute

Setting chutes are devices that are attached to vessels near their normal stern setting position. These devices consist of a tube (often with a slot along it) deployed from the rear of the vessel, which deliver baited hooks under water. Baited hooks, and possibly, line weights and buoys, slide down the slot and are released underwater. Such devices have been used with mixed success in pelagic longline fisheries and for the autoline method of demersal longline fishing.

A prototype of an underwater setting chute was trialed for the Spanish system in South Georgia in 2000. This consisted of a funnel (for the hooks) and an adjacent chute (for the weights) combined into a single system that was rigidly attached to the stern of the ship, aft of the setting window. Trials resulted in serious line tangling problems and to date no further research has been conducted into development of a chute for the Spanish system. Nevertheless, it may be possible to develop a method to use the device without tangling (since tangling was initially a problem experienced in the development of setting chutes for other longline systems). Any future trials should ensure the chute is gimballed (similarly to the pelagic chute) so that hooks are set at consistent depth rather than riding up and down with the pitch of the vessel.

Mid-ship setting

Some demersal fisheries (e.g. shark fisheries) and some pelagic longliners set the longline from the side of the vessel (approximately where the work deck is on ‘typical’ longliners). Seabird interactions with the baited hooks are negligible on these vessels; this is thought to be due to the bait being sufficiently deep by the time it reaches the stern that it is no longer available to the majority of seabird species. Similarly, it may be possible to have a slotted section added to the side of the hull and leading downwards, similar to a setting chute, but which would not require retrieval when not in use.

Through-the-hull setting

Setting and hauling the line through a hole in the bottom of the hull (moonpool) has frequently been suggested as a mitigation method. It has been suggested that this method would entirely eliminate bird catch. This requires purpose built vessels, and is probably only feasible on a vessel operating an autoline system as opposed to the Spanish system.

A number of Norwegian vessels have been built to haul lines through a hole in the hull, and also to set lines through a chute positioned within the hull. To date vessels have largely been restricted to line hauling through the hull, although vessels that also set through a chute below the waters surface have recently been commissioned (e.g *Vonar* Fishing News International February 2003).

In reality it is unlikely that such developments will be made for the Spanish system.

Artificial baits

Artificial baits in place of fish have been used in pelagic longline fisheries. These have ranged from crude (drawings of fish or squid on the side of a plastic tube full of water) to models of fish or squid. Limited testing of these has indicated the less simplistic designs have been successful, both at catching fish and not catching birds. It is thought that, because the artificial baits are less attractive to birds because they do not have the odour of fish baits. The possibility of similar methods being used in demersal fisheries needs to be investigated.

Dyed Bait

In Hawaiian pelagic longline fisheries, initial studies found dramatic reductions in seabird contacts with baited hooks by dyeing the bait blue. Catch rates of fish were also greater. It was thought this made the baits less visible to the birds and more visible to the fish. Later studies found the use of dyed bait to be less effective, though contact rates were still reduced. It is thought that over time learned behaviour enabled seabirds to alter their visual search cues. Promising results using dyed baits have also been recorded in the pelagic swordfish fishery in Brazil (Neves 2001) and for Japanese tuna longliners operating in the Pacific Ocean (Kiyota 2002).

The use of dyed bait has never been trialed in demersal fisheries, so its effectiveness is unknown. The potential to reduce bycatch is likely to be similar to that for pelagic fisheries, but this would need to be investigated, as would its effect on fish catch rates and its long-term effectiveness as a mitigation device. It has been suggested that due to the typically green shade of ocean waters in higher latitiudes, baits would be more suited if dyed a shade a green.

Hook design

There is some indication that the design of hooks may influence seabird mortality. Smaller hooks may catch smaller birds and larger hooks may sink faster than small ones. There have also been suggestions that the shape may be significant, with birds more likely to be caught on J-shaped hooks than on round ones.

Mitigation measures appropriate for the Autoline of longline fishing.

If in the future a vessel operating an autoline system is licensed to fish in Falkland Island waters (as was the case as recently as 2001) there are a few additional mitigation measures that require consideration. Also methods discussed above are relevant to the autoline system.

Avoiding line tension

To prevent line tension from pulling the hooks to the surface during line setting, it is important that the mainline is set at a speed that is greater than that of the vessel. The use of a line shooter has been shown to increase the initial sink rate of longlines and to reduce (non-significantly) northern fulmar (*Fulmarus glacialis*) mortality compared to the use on no mitigation measures (Løkkeborg and Robertson 2002). However, their effectiveness in reducing mortality remains unclear.

Offal disposal

All comments relevant to the Spanish system are relevant to autolining. One additional issue with offal that is more applicable to autolining is the constant flicking of bait particles and lost bait (more bait is lost off hooks during autolining than for the Spanish system) overboard during line setting. This may act either to distract birds from the baited hooks or act to attract them to the area of the baited hooks and hence more vulnerable.

Line weighting

Increasing the weight on lines increases their sink rate during line setting, and hence decreases the time that baited hooks remain available to seabirds during line setting. The mainline used in the autoline method has a specific gravity that is either neutrally or slightly negatively buoyant, which does not sink rapidly enough to prevent birds from accessing baited hooks during line setting. There is therefore a need to add weights to sink the line more rapidly; however, there remains a need for research to identify optimum line weighting to achieve a sink rate that reduces mortality of all seabird species. Current trials with integrated line weighting (i.e. lead weights manufactured into the autoline) appear promising (G.Robertson *pers.comm*.) and may provide the most effective means of increasing sink rates to an acceptable level.

Setting chute

In general, setting chutes are devices that are attached to the stern of vessels, which deliver baited hooks below the water's surface.

The Mustad setting chute consists of a chute attached to the vessel stern for use in single-line demersal fisheries. The chute consists of a tube, which allows hooks and buoys to travel down and exit underwater, or has a slot in the side for the external deployment of buoys and weights etc. This device is attached at a fixed angle to the stern of the vessel, and releases the hook approximately 1.5 m below the surface of calm sea. This depth is not always adequate to significantly reduce mortality as it is within the diving range of most vulnerable species, particularly white chinned petrels and various shearwater species, which are prone to being hooked because of their diving capabilities. Moreover, rough seas or propeller wash may still bring the line to the surface during setting, despite initial penetration afforded by the tube.

Tests in Norway found use of this device reduced seabird mortality (with predominantly surface seizing Northern Fulmars *Fulmarus glacialis*), though it was not as effective as a bird line (Lokkeborg 1998). Around the Prince Edward Islands the same chute in combination with a bird line lead to significant reductions in seabird mortalities (Ryan and Watkins 2002).

Setting Capsule

The development of a setting chute, which delivers baited hooks to a pre-determined depth below the waters surface in a retrievable capsule has been occurring for several years. The capsule has the advantage over chute systems that it is easily deployed and retrieved on the stern of the vessel and the depth at which it delivers hooks is more flexible. However, unlike the chute it is dependent on both hydraulic and electrical systems. Although it still in development stages it is possible that with some alteration the capsule has application in for sinking weights in demersal longline fisheries.