Background to the Threat Abatement Plan for the incidental catch (or by-catch) of seabirds during oceanic longline fishing operations

A key threatening process listed under the EPBC act

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Executive Summary

Oceanic longline fishing is a technique used to target pelagic and demersal finfish and shark species. Longline fishing commenced in the southern oceans in the 1950s, and longline fisheries operate in almost all Australian waters today. The impact of longline fishing activities on seabirds was not fully realised until the 1980s when seabird bycatch was first reported and then documented.

The incidental catch (or bycatch) of seabirds during oceanic longline fishing operations was listed as a key threatening process on Schedule 3 of the *Endangered Species Protection Act 1992* on 24 July 1995. The *Endangered Species Protection Act 1992* was incorporated into the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that came into effect on 16 July 2000.

As required under the legislation a *Threat Abatement Plan for the Incidental Catch (or By-catch) of Seabirds During Oceanic Longline Fishing Operations* was prepared and approved by Senator the Hon. Robert Hill on 2 August 1998. The Plan operated for five years, necessitating a review under subsection 279(2) of the EPBC Act.

A revised threat abatement plan (TAP 2005), resulting from that review, has been prepared to coordinate national action to alleviate the destructive impact of longline fishing practices on seabirds in Australian waters. The provisions of the existing TAP will continue to apply until the TAP 2005 is in place.

Substantial progress toward reducing the key threatening process that has been achieved since the first TAP was made. The revised TAP benefits from data collected as part of the first TAP's objectives, and takes into account changes in fishing effort. It aims to recognise and build on the successes of the original TAP toward reducing the key threatening process.

Further work is still required to reduce seabird bycatch in fisheries to levels required for some seabird populations to be considered sustainable. Although information on the level and nature of interactions between seabirds and fishing gear is still lacking in all domestic pelagic tuna fisheries, clearly apparent are significant problems with bycatch of flesh-footed shearwaters in Australian pelagic fisheries. The developing longline fishery for Patagonian toothfish in subantarctic waters also has potential for substantial seabird bycatch.

This document provides background to the draft *Threat Abatement Plan 2005 for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations* which is intended to be brief, succinct and convenient to use. This background document looks at long-line fishing interactions in detail, reporting on the current status (or known status) of seabird bycatch in Australian fisheries, including progress towards the original TAP's objective. The key threatening process of longline fishing is defined and mitigation measures relevant to Australian fisheries and threatened seabirds are described.

Fishing operations are not the only significant threat to seabirds–they face pressure from introduced species and with it predation, habitat destruction and disease. These challenges are beyond the scope of the TAP, which only addresses the most pressing problem of longline fisheries interactions.

1 Interactions Between Seabirds and Longline Fishing Operations

Oceanic longline fishing is a technique used to target pelagic and demersal finfish and shark species. The bycatch of seabirds in fishing operations has significantly contributed to an alarming decline of some species of seabirds over the last 50 years. Some seabird populations have been affected to the point where extinction is threatened.

Longline fishing is one of the greatest threats to seabirds (Alexander et al. 1997; Baker et al 2002; Birdlife International 1995; Croxall 1998; Gales 1998). Non-targeted species such as seabirds are caught (bycatch) during longline fishing when they are attracted to fishing vessels by discarded fish scraps and baits, and then ingest baited hooks during the setting or, less commonly, hauling of the longline. The hooked birds are subsequently pulled under the water by the weight of the line and drowned.

1.1 Recognising the impacts

Longline fishing commenced in the Southern Oceans in the 1950s. Whilst seabird bycatch was first reported from band returns in the early 1980s (Morant et al 1983), the magnitude of the problem was not fully realised until Weimerskirch and Jouventin (1987) documented a dramatic decline in Wandering Albatross populations on the Crozet Islands. These authors proposed that the decline was due to longline and trawl fisheries killing albatrosses at sea. Direct observation of bycatch rates aboard Japanese longline vessels targeting Southern Bluefin Tuna Thunnus maccoyii in Australian and New Zealand waters, confirmed the threat to seabirds from longline fishing operations (Brothers 1991; Murray et al. 1993)

The extent of seabird mortality is generally poorly known for most of the world's longline fisheries (Brothers et al. 1999; Baird 2001). The current worldwide albatross bycatch rate on pelagic longlines is, on average, approximately 0.4 birds observed caught per thousand hooks set (Alexander *et al.* 1997), although rates an order of magnitude higher are also documented (Alexander et al. 1997; Barnes et al. 1997; Brothers et al. 1999). The actual catch rate varies between fishing areas and seasons. When combined with the millions of hooks set each year (Tuck et al 2003), longlining is a significant threat to a number of albatross species.

1.2 Progress in conservation

The incidental catch (or bycatch) of seabirds during oceanic longline fishing operations was listed as a key threatening process on 24 July 1995. As required under Commonwealth legislation (now the Environment Protection and Biodiversity Conservation Act 1999 — EPBC Act), a *Threat Abatement Plan for the Incidental Catch (or By-catch) of Seabirds during Oceanic Longline Fishing Operations* was prepared and approved by the Minister for the Environment on 2 August 1998. The Threat Abatement Plan (TAP) expired in August 2003, necessitating a review under subsection 279(2) of the EPBC Act. The provisions of the current TAP continue to apply to all fisheries managed by the Australian Government until such time as the new TAP is in place.

Substantial progress toward reducing the key threatening process was achieved over the life of the first plan:

- regulations under the Fisheries Management Act 1991 were developed requiring the use of seabird mitigation measures in pelagic tuna fisheries, particularly in fisheries operating below latitude 30^0S where seabird activity and the interaction with longline fishers is considered to be significant;
- various mitigation methods were trialled and developed, particularly underwater setting devices and the use of line weights for pelagic fisheries. These have provided significant data, not only on the mitigation methods being tested, but also on the nature and level of seabird interactions in some important Commonwealth fisheries;
- a number of fisheries recorded incidental catch rates well below 0.05 birds per 1000 hooks, the maximum permissible level set by the plan as a performance indicator; and
- awareness among many fishers has been heightened, leading to considerable cooperation from fisheries in the development of approaches to avoid seabird mortality and improve the sustainability of their industry.

Despite the success of the first plan, further work is required to solve the problem of seabird bycatch in fisheries. Whereas albatross species were once the principal species caught in the Australian Fishing Zone (AFZ), changes in the distribution of fishing effort in eastern Australian waters have since led to significant problems with bycatch of flesh-footed shearwaters in pelagic fisheries operating in these waters, and a similar situation is likely to exist in western Australian waters. Information on the level and nature of interactions between seabirds and fishing gear is still incomplete in all domestic pelagic tuna fisheries and the Southern and Eastern Scalefish and Shark Fishery (Scalefish Hook Sector). There are also developing longline fisheries for Patagonian toothfish in subantarctic waters with potential for seabird bycatch.

The revised Threat Abatement Plan builds on the first plan, focusing on implementing a range of mitigation measures as a key action in reducing seabird bycatch to an acceptable level. Further research on monitoring endangered seabird populations has been addressed in relevant recovery plans (Environment Australia 2001).

1.3 Causes of mortality

Seabird mortality arises from number of different interactions with longline vessels. These interactions are broadly described below.

Birds hooked during line setting and then drowned

This is the most common form of incidental mortality (Murray *et al*. 1993). Brothers (1991) documented this mortality in seabirds on Japanese longline vessels operating in the AFZ. To collect data on mortality arising from this source, birds on hooks are counted when the line is hauled. This data underestimates the rate of bycatch because birds can be hooked and then be eaten by sharks

or fall off the hooks; or longline operators can cut dead birds off the line before they are hauled aboard the vessel and recorded by the observer. These two sources of error are significant, difficult to quantify and serve to reduce the accuracy of bycatch data.

The likelihood of seabirds being caught on longlines depends on the type of fishing activity and the gear used. For example, a number of factors affects whether baited hooks are available to seabirds: the buoyancy of the line and bait, weight on the end of the line, speed of deployment and boat speed, and degree of shielding the line from bird attacks.

Birds hooked during line hauling and killed or released with critical injuries

Huin and Croxall (1996) record seabirds being hooked during line hauling and either escaping or being released alive. Injuries thus sustained may account for the injured birds found dying at breeding colonies by Weimerskirch and Jouventin (1987).

Birds entangled in, or hooked by, gear adjacent to that being targeted

Seabirds can become entangled in longline branch lines or collide with the mainline above the water to the stern of the fishing vessel. Brothers (1995) recorded birds being caught on hooks adjacent to the bait they were attempting to catch.

Birds ingesting discarded fish heads containing hooks

Regurgitated longline hooks have been recorded near albatross nests at South Georgia. It is possible that these hooks come from either birds cut off the line and released during line hauling; or birds that have eaten discarded baits and fish heads containing hooks.

In the south Atlantic Toothfish fishery Brothers (1995) recorded hooks in 23% of discarded heads from the target species, and in 9.4% of the grenadier discarded as fish bycatch.

Mortality of chicks due to death of parent birds

Albatrosses and other seabirds have a high parental investment in raising a chick. It is likely that the death of a breeding adult would also result in the death of their egg or chick. This situation is compounded because the remaining parent is less likely to breed successfully in the years following the death of their mate: there is often a considerable delay before new partnerships are formed and, from those that do form, lower reproductive success has been reported.

Shooting birds

There have been reports of seabirds being shot by crew on longline vessels and recreational fishers (Adams 1992, Tomkins 1985). The rate or incidence of mortality from shooting is not known. The deliberate take of seabirds is illegal under the *Environment Protection and Biodiversity Conservation Act 1999* and equivalent State/Territory legislation.

2 Defining the Key Threatening Process

This section describes the fisheries affected by the actions outlined under the Plan and the seabird species that are threatened by longline fishing.

Descriptions of longlining methods generally follow Alexander *et al.* (1997). Fishery descriptions and assessments of bird interactions for all Australian longline fisheries, obtained from the respective fishery management body and research data where available, are described in detail in the draft *Assessment Report* prepared for Australia's National Plan of Action (AFFA *et al*. 2003). Information on Commonwealth longline fisheries has been summarised from this source and updated, where necessary, from data available from the Australian Fisheries Management Authority website (http://www.afma.gov.au/fisheries/default.php).

2.1 What are longline fishing operations?

Longline fishing involves setting one or more single lines (mainline) containing many individual hooks on branch lines or snoods. The configuration of the longline can vary considerably. The mainline can either be anchored or drifting. It can be oriented vertically or horizontally and the number and type of hooks and the length of the branchlines can vary depending on the target species (Chapman 1990), fishing area and the size of the fishing vessel. Longlines targeting pelagic species can be up to 100 km long and carry 600 to 3500 hooks on 40 m long branchlines (Brothers 1991; Brothers et al. 1999). Demersal longlines have up to 10 000 hooks on 1 m branchlines (Chapman 1990, Brothers 1995).

Longline fishing fleets operate on the High Seas and in the territorial waters of Australia, New Zealand, and southern African and American countries (Tuck et al. 2003). Currently in Australian waters, only domestic vessels use longline gear.

Longlining methods can be divided into two groups: pelagic (midwater set) and bottom set longlines.

Pelagic (Midwater Set) Longlining

Pelagic longlining involves a single longline up to 130 km in length holding between 600 and 3000 branch lines, each about 15 m in length terminating in a baited hook. Hooks are usually suspended 50 to 150 m below the surface of the water from lines suspended by floats (AFMA observer data). This method is mainly used to target various species of tuna and broadbill, and is used by many nations including Australia, Indonesia, Japan, Korea, New Zealand, South Africa, Taiwan and the United States of America.

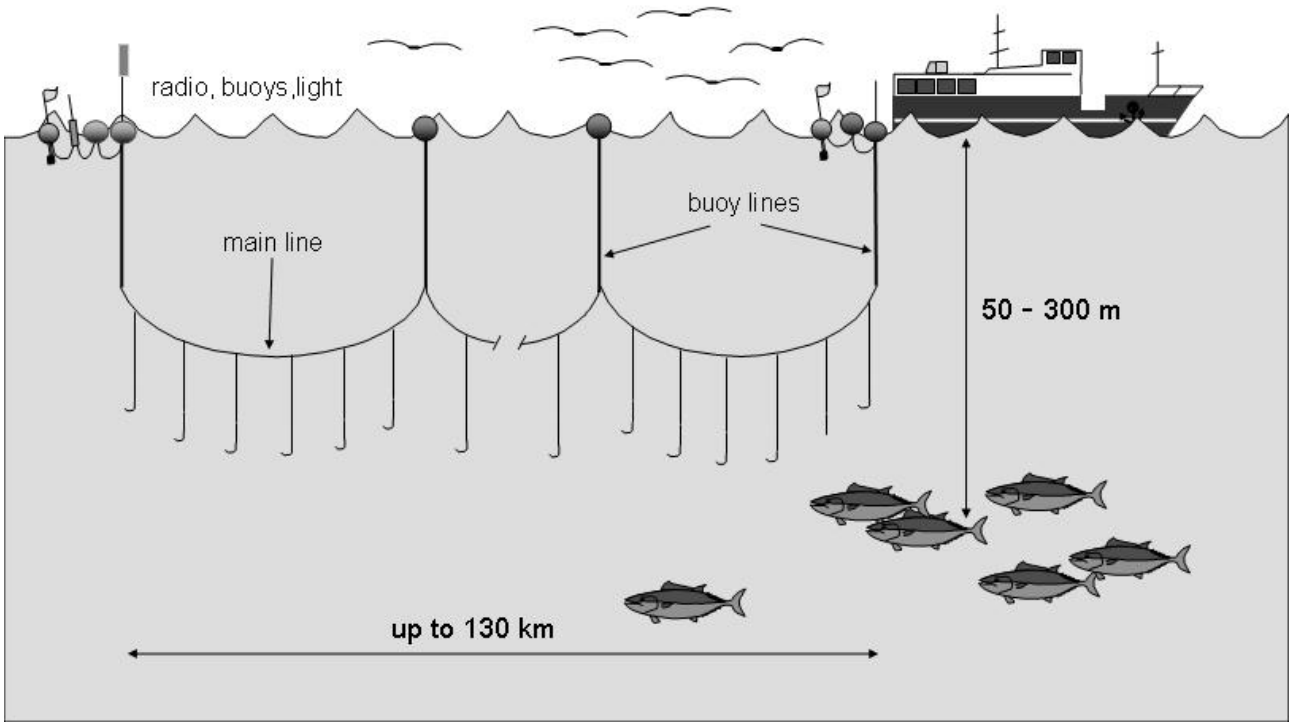


Figure 1 Pelagic tuna longlining fishing configuration.

There are two principal domestic pelagic longline fisheries managed by the Commonwealth—the Eastern Tuna and Billfish Fishery (ETBF) and the Western Tuna and Billfish Fishery (WTBF). These fisheries commenced operations in the AFZ in the 1980s with low effort until 1997, when they expanded rapidly after the Japanese tuna fishery closed. Fishing effort in 2002 and 2003 was 12 million hooks in the ETBF and 6 million hooks in the WTBF. Although there is a large number of licence holders in both fisheries (147 in ETBF, 90 in WTBF), the number of active vessels is significantly less (ETBF— 90; WTBF — 4). Vessels in these fisheries are typically between 18 and 25 m in length, although there is considerable variability within the fleet. The fleet operates largely within 100 nautical miles of shore and is opportunistic depending on weather conditions. Each vessel typically sets between 800 and 1000 hooks, and many vessels use live bait. Vessels fishing for swordfish attach light sticks to their lines to act as lures.

Limited observer data, derived from bycatch mitigation trials conducted off eastern Australia during the period 2000–2003, indicates that bycatch of seabirds is high in the ETBF, particularly during summer. A formal observer program for both fisheries commenced in 2003 and confirmed this conclusion. The main species caught during the trials was the flesh-footed shearwater *Puffinus carneipes*, which comprised 91% of birds killed (Baker and Wise 2005). Observed bycatch rates for flesh-footed shearwaters were 0.378 birds/1000 hooks for night sets, and 0.945 birds/1000 hooks for day sets. Great-winged petrels *Pterodroma macroptera* have also been caught in high numbers during other observer-covered trips in the same region; in waters adjacent to Tasmania shy albatrosses *Thalassarche cauta* were the most common species caught.

From the mid 1980s Japanese longline fishing vessels had access to Australian tuna and billfish stocks under an annual Bilateral Access Agreement between the governments of Australia and Japan. Japan paid an access fee that was used to fund both an observer program and research on

tuna and ecologically related species, including seabirds. Japanese effort declined in the AFZ during the 1990s and ceased in 1997. In 1996 the Japanese pelagic longline fishery consisted of a fleet of about 60 vessels. Japanese vessels are typically larger than Australian vessels (40 to 60 m) and fish further offshore and on the High Seas. The longlines set by Japanese vessels were up to 135 km long and had up to 3500 hooks. Bait was principally squid or mackerel, and live bait was never used. The Japanese tuna longline fleet continues to fish seasonally on the high seas in southern waters adjacent to the AFZ.

Between 1988 and 1996 over nine million hooks were deployed in the presence of an observer (or observed) in this fishery . Bycatch of seabirds was substantial. Analyses of the trends of seabird catch rates in the AFZ by Japanese longliners showed an apparent fall from the 1988 bycatch figure of 0.4 birds/1000 hooks to levels of between 0.1 and 0.2 birds/1000 hooks (Gales *et al*. 1998; Brothers *et al*. 1998a and 1998b; Klaer and Polacheck, 1997). These catch-rates translate to a total mortality of between 1000 and 3500 seabirds per year in the AFZ, depending on the level, area and season of effort. Most of the birds killed were albatrosses, including species recently categorised as threatened (Croxall and Gales 1998).

Demersal (Bottom Set) Longlining

In the AFZ bottom-set longlines are principally used to target ling *Genypterus* spp., toothfish *Dissostichus* spp., and school *Galeorhinus galeus* and gummy shark *Mustelos antarcticus*. Bottom-set longlines may be set in water depths ranging from 100 to 2500 m. There are three methods currently employed: Dropline, Demersal Longline and Trotline.

i. Dropline Fishing

A dropline comprises a series of baited hooks attached by (generally) short snoods to a main line. A buoy is attached at one end of the mainline and a weight is attached to the other end. The mainline extends from the water surface (buoy end of line) to the sea bed (weighted end of line), and because most target species of Australian dropline operations commonly aggregate within 100 metres of the seabed, the hooks are usually attached to the bottom 100 metres of the line (the weighted end), approximately one metre apart. This can be varied for other target species with different behavioural characteristics. Generally between 70 and 100 hooks are attached to a line, and a set consists of up to ten of these lines deployed over a distance of a couple of kilometres. Each line takes approximately 10 to 20 minutes to set, and lines are left to soak for two to four hours. Setting usually occurs before dawn. During setting, the line enters the water vertically and fast so there is minimal likelihood of birds becoming hooked.

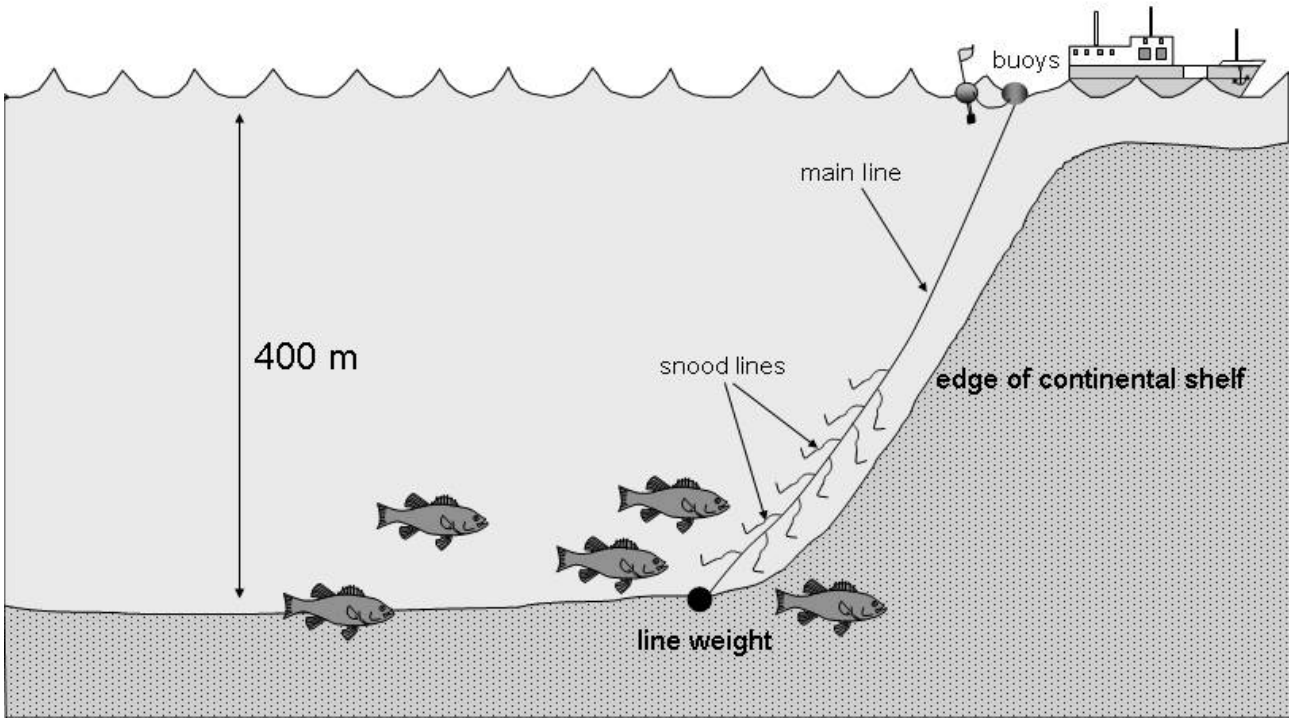


Figure 2 Demersal longline fishing — dropline configuration.

Within Australia droplines are principally used to target blue eye trevalla in the Scalefish Hook Sector of the Southern and Eastern Scalefish and Shark Fishery (SESSF).

ii. Trotline Fishing

A trotline is similar to a dropline, except that several droppers (or trots) are attached to a mainline which is set horizontally at a predetermined depth (usually approximately 30 metres) above the seabed. Each droppers suspended from the mainline has between 20 and 30 baited hooks attached to it by short snoods. To counter the weight of the droppers, the mainline usually has a number of floats attached to it at regular intervals to ensure the droppers are kept taught. Currently trotlines are not widely used in any Australian fishery.

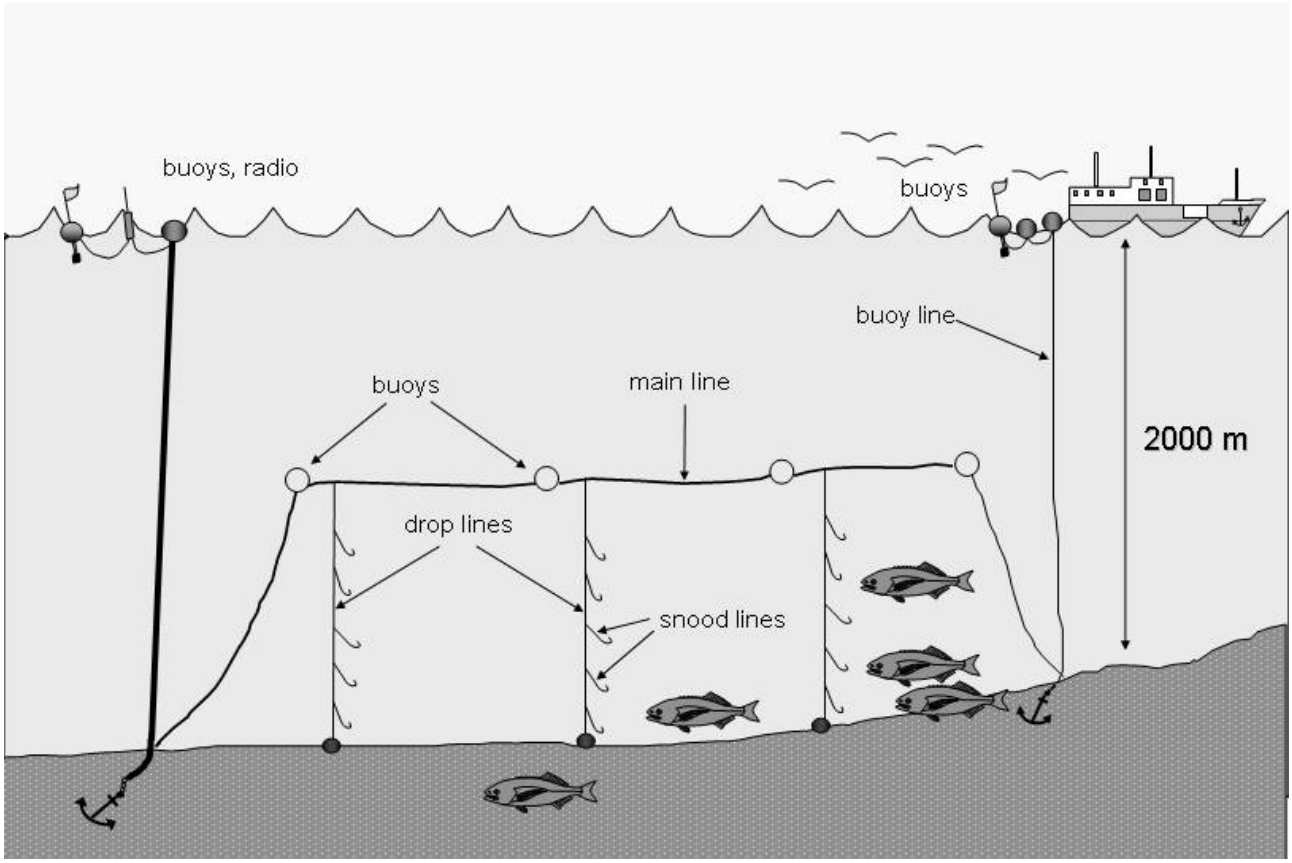


Figure 3 Demersal longline fishing — trotline configuration.

iii. Demersal Longline Fishing

Demersal longlines comprise a series of baited hooks that are attached by (generally) short snoods to a rope mainline, which is anchored to the ocean floor at each end. This method is most often used by fishers to target shark, toothfish or ling. Other scale fish species are also caught, but usually as commercial bycatch in shark fishing operations. A buoy and dahn pole carrying a flag are attached by way of a buoyline to the mainline at each of its ends, for retrieval of the gear. The mainline is hauled from one end by a line hauler, usually over a roller mounted on the vessel gunnels in the mid-section of the boat. Demersal longline vessels can employ up to 20,000 hooks per day, but within the SESSF there is a limit of 2,000 hooks for a single operation.

Automatic longlining or autolining is a form of demersal longlining where some of the line-setting functions such as hook baiting are automated. This allows a great number of hooks to be set and hauled by a single vessel. The most commonly used system is the Mustad autoline system. Autoline vessels can set 1,000 hooks in 10 minutes, and each vessel typically sets up to 15,000 hooks in a day. Autoline gear is currently used in the SESSF fishery and those operating in the Antarctic (which includes subantarctic and high Antarctic fisheries).

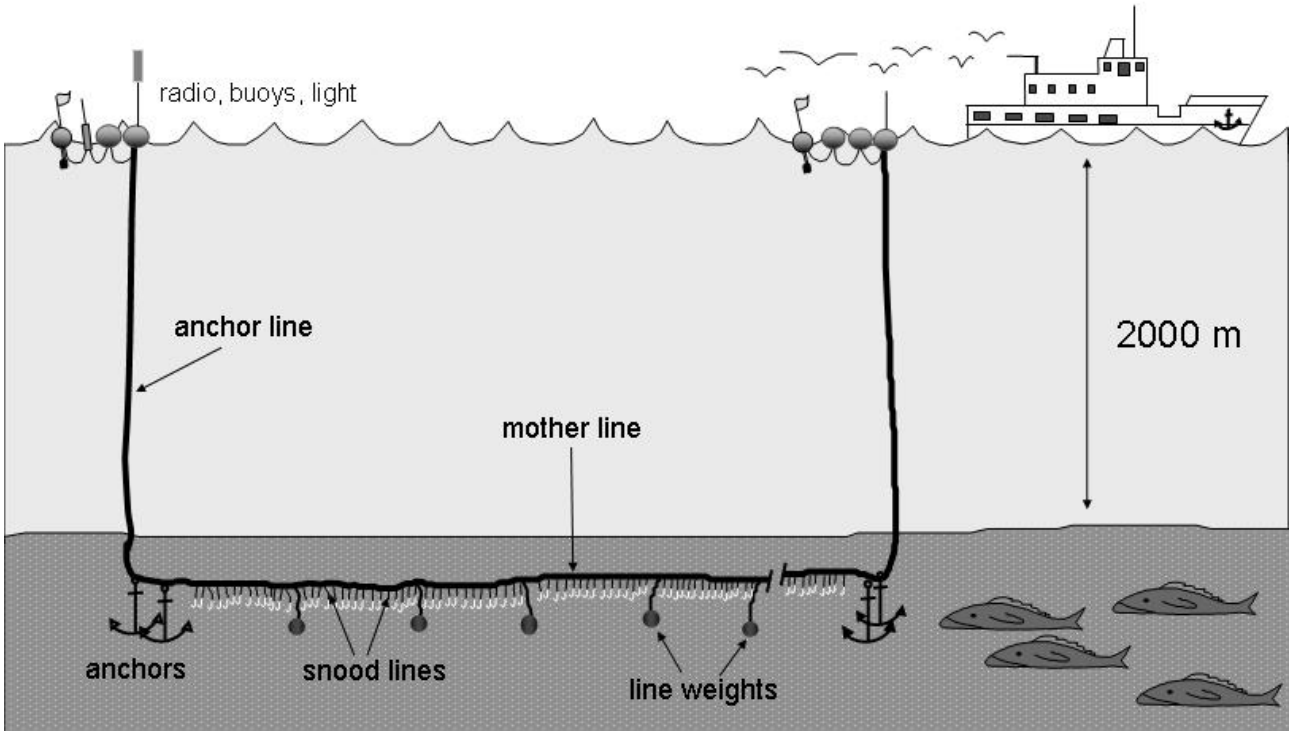


Figure 4 Demersal longline fishing — Mustad configuration.

Antarctic fisheries currently include Heard Island and McDonald Islands (HIMI), and New and Exploratory fisheries within the area of waters covered by the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR). In both the SESSF and Australia's Antarctic fisheries, a range of mitigation measures have been employed, including night setting of lines, use of twin bird scaring lines, coloured snoods, line-weighting or use of integrated weight lines, and seasonal closures. These mitigation measures have resulted in low seabird bycatch, with observers recording less than 0.01 birds/1000 hooks caught during line-setting (> 2 million hooks observed) in the SESSF, and no birds caught (> 3 million hooks) in the HIMI fishery.

The most commonly used system of longline fishing employed in Antarctic demersal fisheries is the Spanish (or double-line) system. This system is usually adopted by Japanese pelagic tuna vessels that have been converted for catching toothfish. The system consists of two parallel lines: (i) a heavy-duty mother-line (~ 20 mm diameter), and (ii) a lightweight (4 to 6 mm) hook-line. The two lines are connected to one another via branch-lines (typically between 15 and 30 m long) that descend from the mother-line at regular intervals (every 50 to100 m). Snoods (up to 1 m long) are attached to the hook-line at spacings 1 to 2 m apart. Each snood hosts a baited hook at the terminal end. Spanish-system vessels deploy buoyant longlines that do not sink without additional weight. Thus, the hook-line is periodically weighted with stones or lead weights (typically where the branch-line joins the hook-line). The mother-line is also occasionally weighted (e.g. every 1500 m) enabling it to sink independently of the hook-line. Line setting follows the same basic procedure used in the autoline system (i.e. heavy grapnels are used to stabilise one end of the mother-line as the vessel steams away, causing the central, baited section of the longline to be pulled out from the stern of the vessel). In Spanish systems, however, both lines must be set simultaneously: typically the mother-

line enters the water on one side of the vessel while the hook-line and snoods enter on the other. The branch-lines straddle the area between the other two lines. Each section of the hook-line between corresponding branch-lines tends to be set in discrete batches or 'baskets.' Hooks are usually baited manually on vessels using the Spanish system.

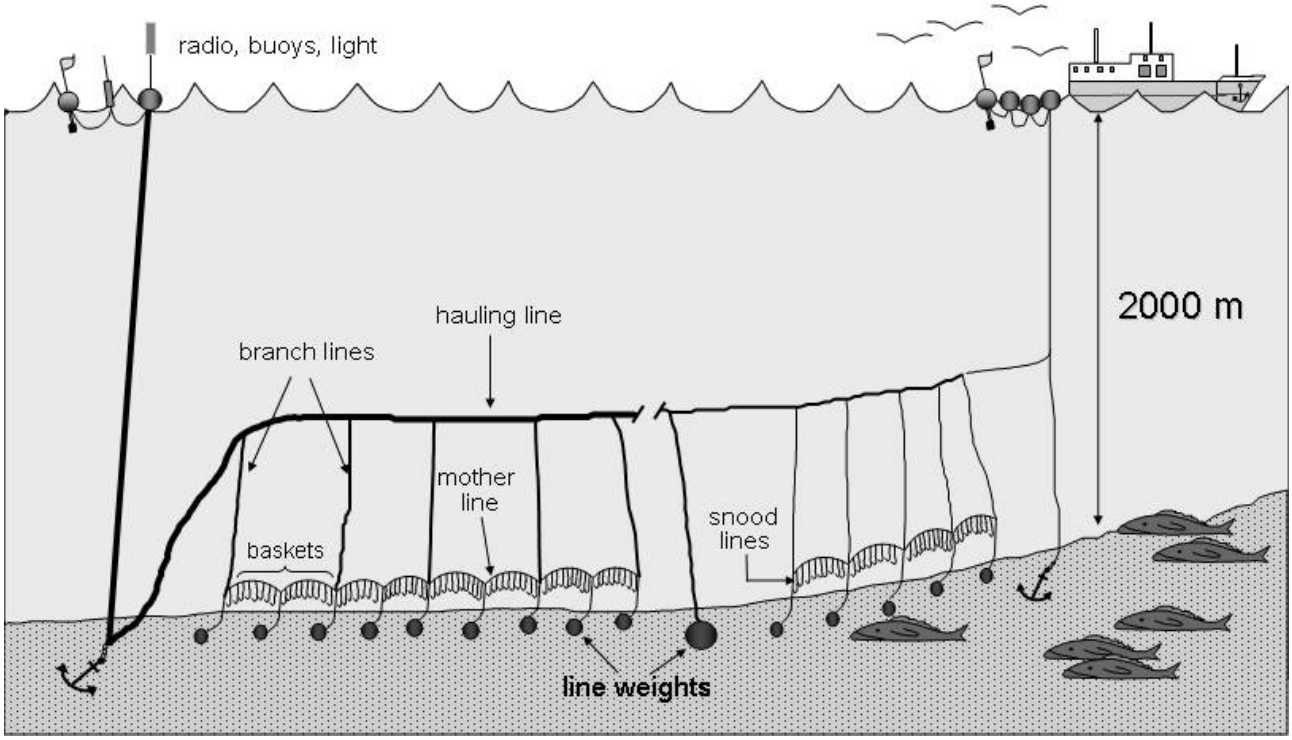


Figure 5 Demersal longline fishing —Spanish double line configuration.

Spanish-system gear has not yet been deployed by Australian vessels operating in domestic fisheries, but its use has been considered. It has several advantages from a fishing perspective—with the heavy-duty mother-line taking most of the weight, gear is less likely to break under the strain caused by the combined effects of fouling on the sea bed, currents, heavy fish catches and line weights. It can therefore be used in rougher conditions and set deeper than the autoline system.

Theoretically, seabird bycatch should be minimal in demersal fisheries, as the aim is to sink the hooked line to the sea floor as rapidly as possible. However, some of the highest seabird bycatch rates ever observed have been recorded in toothfish longline fisheries operating in the subantarctic, with annual estimates of seabirds killed in some fisheries being in the order of tens-of-thousands (SC-CAMLR 2002). This situation, in regulated CCAMLR fisheries, resulted from a combination of fishing in areas with high bird densities and vessels have failing to employ appropriate bycatch mitigation measures. Strict adherence to a suite of mitigation measures in recent years has seen bycatch in most CCAMLR fisheries reduced to extremely low levels (0.002 birds/1000 hooks).

Table 1 summarises the target fish species, fishing areas, fishing seasons, methods and equipment, and effort for oceanic longline fisheries operating in Australian waters. These fisheries vary in their impact on seabirds. Statistically robust data on seabird bycatch are scarce because data often come from observers who are focussed on recording data on fishing operations, not on non-fish bycatch. High relative rates of bycatch are defined as a regularly reported bycatch rate that exceeds 0.1 birds/1000 hooks. Many fisheries have limited or no interactions with seabirds due to their operating method of or location

Table 1: Summary of Longline Types and Target Fish Species Currently Used in the Australian Fishing Zone.

Fishery	*Target Species*	*Fishing Areas (see diagrams)*	*Fishing Seasons*	*Methods and Equipment*	*Effort (hooks/yr in 2004)*	Relative Rate of Seabird Bycatch
ETBF— Domestic Tuna Longline	Yellowfin Tuna *Thunnus albacares*, Big eye Tuna *T. obesus* Albacore *T. alalunga* Southern Bluefin Tuna (SBT) *T. maccoyii*, and Broadbill swordfish *Xiphias gladius*	Predominantly near Continental Shelf but expanding seaward	All year, some seasonality depending on target species. May - Feb SBT.	Pelagic drifting horizontal set longlines 1,000 hooks set/vessel/day 147 licence holders	10.34 million (12.0 million in 2003)	High[3]
WTBF— Domestic Tuna Longline	Yellowfin Tuna *Thunnus albacares*, Big eye Tuna *T. obesus* Albacore *T. alalunga* Southern Bluefin Tuna *T. maccoyii*, and Broadbill swordfish *Xiphias gladius*	Predominantly near Continental Shelf but expanding seaward	All year with some fishery-by-fishery seasonality May - Feb SBT.	Pelagic drifting horizontal set longlines 1,000 hooks set/vessel/day 90 licence holders	1.56 million (6.0 million in 2003)	High[2]
SBT— Domestic Tuna Longline	Southern Bluefin Tuna *T. maccoyii*	Predominantly near Continental Shelf but expanding seaward		Pelagic drifting horizontal set longlines 1,000 hooks set/vessel/day 90 licence holders	Incl. with ETBF	High[3]
SESSF	*Blue eye trevalla (*Hyperoglyphhe antarctica*)* *Ling (*Genypterus *sp)* *Other finfish species*	Commonwealth waters off southern Qld, NSW, Vic, SA and Tas	All year	Vertically set demersal dropline and trotlines Horizontal set demersal longlines 1,700 hooks set/vessel/day 195 licence holders	3.95 million (includes Shark Hook sub fishery)	Low[2]/ Insufficient data

	Blue eye trevalla (*Hyperoglyphhe antarctica*) Ling (*Genypterus* sp)		All year	Automatic demersal longline 10 to 12,000 hooks set/vessel/day 4 licence holders	8.5 million	Low[4]
SESSFF—Shark Hook sub-fishery:	School shark (*Galeorhinus galeus*) Gummy shark (*Mustelos antarcticus*)	Commonwealth waters off Victoria, SA and Tasmania	Permits are issued 1 July to 3 June each year (fishing takes place all year round)	Horizontal set demersal longlines 1,000 to 2,000 hooks set/vessel/day 195 licence holders	Included above under SESSF non-autoline effort	Low[1]
Christmas Is /Cocos — Domestic Tuna Longline	Tuna Thunnus *spp*	*Christmas Is and Cocos (Keeling) Islands, Indian Ocean*	*To be determined*	*Experimental fishery 1,500 hook limit per vessel/day* *6 permit holders*	*< 50,000*	None observed
Norfolk — Demersal longline Dropline Trotline Automatic demersal longline	Bass groper *Polyprion americanus* Blue eye trevalla *(Hyperoglyphhe antarctica)*	Norfolk Island	All year	Exploratory fishery 5 permit holders	nil	None observed
Coral Sea Fishery — Demersal longline Dropline Trotline Automatic demersal longline	tropical snappers (Lethrinidae or Lutjanidae) emperors (Lutjanidae), coral trout (Plectropomus leopardus) jobfish (Lutjanidae, subfamily Etelinae). Individual operators also target other species depending on the specific location and method being used e.g. blue eye trevalla and shark	Australia's Coral Sea Territory, western Pacific Ocean	All year	9 permit holders	390,000	No data
Antarctic Fisheries — Automatic demersal longline	Toothfish *Dissostichus* spp	Heard & McDonald Is, CCAMLR waters	May – Sept at HIMI; summer in high latitudes	1 permit holder	1.6 million	Low[3]

[1] based on anecdotal accounts provided by Tasmanian Parks and Wildlife Service.

[2] based on documented accounts but insufficient data exists to quantify catch rates with accuracy, except for Automatic longline, where bycatch is low.

[3] based on documented accounts able to be quantified with some degree of accuracy.

2.2 Seabird species recorded as longline fishing bycatch in the AFZ

Fourteen species of seabirds were identified as being affected by the key threatening process when it was listed in July 1995. Since the listing, further species have been recorded as bycatch in Australian longline fisheries.

The taxonomy of the albatrosses has also been revised since the listing of the key threatening process, following genetic and morphometric studies by Robertson and Nunn (1998). This review, modified by Croxall, J.P. and Gales, R. (1998), has resulted in an increase in the number of albatross species from 14 species to 24 full species. This assessment has been accepted by Australia for the purposes of conservation management of albatross species. However, readers should be aware that albatross taxonomy is still in a state of flux. Brooke (2004) re-assessed albatross taxonomy and considered there were only 21 species. This view was accepted when the global conservation status of all albatross species was last assessed (BirdLife 2004).

The species known to be affected by longline fishing in the AFZ are listed in tables 2 and 3. These species are typically large seabirds which naturally feed on fish and squid found on or close to the surface. They all exhibit behaviours which make them susceptible to being caught on longlines: they dive for baits and have learned to follow vessels and forage on discards. They are aggressive feeders, and in most cases travel large distances seeking food. The groups most affected are the albatrosses and petrels because of their limited population sizes and low reproduction rates. Gales and Brothers (1995) reported that 75% of the birds killed and retained by Japanese longliners operating in the AFZ during the 1990s were albatrosses. It is likely that other seabirds were also caught but not retained. Recent observer data from domestic pelagic vessels indicates that albatrosses form less than 10% of the species killed, with flesh-footed shearwaters and other petrels dominating the catch (Baker and Wise 2005; AFMA unpublished), most likely reflecting a change in the distribution of fishing effort. There is limited or no data available on bird species taken as bycatch in most demersal longline fisheries within the AFZ, with the exception of Antarctic fisheries and the SESSF.

2.3 Spatial Distribution of Affected Species

The seabird species affected by the key threatening process are principally found in waters south of 25°S (Fraser Island on the east coast and Shark Bay on the west coast) and more commonly south of 30°S. Tables 2 and 3 summarise the distribution of each species based on distribution data presented in Marchant and Higgins (1990).

Other seabird species (found in northern areas where longline fishing operations occur) are not caught as bycatch because they are not attracted to the fishing vessels or the longline baits (AFMA unpublished).

2.4 Conservation Status of Affected Species

The seabird species caught on longlines are highly varied in conservation status. They include endangered species such as the northern royal albatross *Diomedea sanfordi* and prolific species such as the short-tailed shearwater *Puffinus tenuirostris*. The *Environment Protection and Biodiversity Conservation Act 1999* requires the Plan to consider not only endangered and vulnerable seabird species but other seabird species that could become endangered or vulnerable as a result of the key threatening process.

The Threat Abatement Plan is closely linked to recovery plans for threatened seabirds that are caught on longlines. The Plan relies on these recovery plans to collect specific data on population trends in the breeding populations of those threatened species found breeding in Australia. A recovery plan for albatrosses and giant-petrels has been prepared and can be found at http://www.deh.gov.au/biodiversity/threatened/publications/recovery/albatross/

2.5 Longline operations covered by the Plan

The Plan considers all longline operations and makes specific prescriptions where required for particular fishery types, target species, methods, areas and seasons in order to minimise bycatch and mortality of seabirds.

This Plan does not cover bycatch of seabirds in State waters in Australia inside the three nautical mile state boundary. There are a number of Joint Authority arrangements that exist between the Commonwealth and the Northern Territory, Western Australia, New South Wales and Queensland Governments for fisheries. These arrangements mean that some fisheries, particularly shark fisheries that use longline techniques, are managed under State/Territory law out to 200 nm. Given that the EPBC Act applies to Commonwealth waters (which are all waters beyond 3 nm), where fisheries are managed by State agencies in Commonwealth waters, actions prescribed under the Threat Abatement Plan would need to be taken into consideration.

Table 2: Summary of the albatross species affected by pelagic longline fishing bycatch in the AFZ. More detailed information on these species can be found in the Recovery Plan for Albatrosses and Giant-Petrels (http://www.deh.gov.au/biodiversity/threatened/publications/recovery/albatross/)

Previous Taxonomy **Common Name** **Species name**	**Currently Accepted Taxonomy** **Proposed new name** **Species name**	**International conservation status (BirdLife International 2004)**	**Likely incidence in longline bycatch**	**Pelagic distribution in Australia**	**Jurisdiction and location of breeding areas**
Wandering albatross Diomedea exulans exulans	Wandering albatross Diomedea exulans	Vulnerable Listed as a vulnerable species under the EPBC Act	Moderate	Offshore in southern waters from the NSW/Qld border in the east to Fremantle in the west Vagrant to Qld Off Macquarie Island, Heard Island and the McDonald Islands	Australia: Macquarie Island France: Kerguelen Island, Crozet Islands South Africa: Marion Island, Prince Edward Island U.K.: South Georgia
Diomedea exulans antipodensis	Antipodean albatross Diomedea antipodensis	Vulnerable Listed as a vulnerable species under the EPBC Act	Low	Offshore central NSW Extent of range not yet defined	Australia: No sites recorded New Zealand: Antipodes Island, Campbell Island
Diomedea exulans gibsoni	Gibson's albatross Diomedea gibsoni	Vulnerable (Croxall & Gales 1998) Listed as a vulnerable species under the EPBC Act	Moderate	Offshore in southern waters from Coffs Harbour south to Wilsons Promontory Extent of range not yet defined	Australia: No sites recorded New Zealand: Auckland Islands (Adams Island, Disappointment Island, Auckland Island)
Diomedea exulans dabbenena	Tristan albatross Diomedea dabbenena	Endangered Listed as an endangered species under the EPBC Act	Low	One record off Wollongong, NSW	Australia: No sites recorded U.K.: Gough Island, Tristan da Cunha
Amsterdam albatross Diomedea amsterdamensis	Amsterdam albatross Diomedea amsterdamensis	Critically Endangered Listed as an endangered species under the EPBC Act	Low	Vagrant in waters south of Tasmania	Australia: No sites recorded France: Amsterdam Island
Southern royal albatross Diomedea epomophora epomophora	Southern royal albatross Diomedea epomophora	Vulnerable Listed as a vulnerable species under the EPBC Act	Low	Offshore in south-eastern waters from Coffs Harbour in the east to Eyre Peninsula in the west; especially around Tasmania; Vagrant in Western Australian waters	Australia: No sites recorded New Zealand: Campell Island, Enderby Island, Auckland Islands (Adams Island, Auckland Island)

Table 2 continued

Previous Taxonomy **Common Name** **Species name**	**Currently Accepted Taxonomy** **Proposed new name** **Species name**	**International conservation status (BirdLife International 2004)**	**Likely Incidence in Longline Bycatch**	**Pelagic distribution in Australia**	**Jurisdiction and location of breeding areas**
Northern royal albatross Diomedea epomophora sanfordi	Northern royal albatross Diomedea sanfordi	Endangered Listed as an endangered species under the EPBC Act	Low	Offshore in south-eastern waters from Coffs Harbour in the east to Eyre Peninsula in the west; especially around Tasmania	Australia: No sites recorded New Zealand: South Island (Taiaroa Head) Chatham Islands (Big Sister Island, Little Sister Island, Forty-fours Island)
Black-browed albatross Diomedea melanophrys melanophrys	Black-browed albatross Thalassarche melanophrys	Endangered Listed as a vulnerable species under the EPBC Act	High	Offshore in southern waters from the NSW/Qld border in the east to Shark Bay in the west Off Macquarie Island, Heard Island and the McDonald Islands	Australia: Heard Island, McDonald Islands, Macquarie Island (incl. Bishop and Clerk Islets) Chile: Diego Ramirez Island, Ildefonso Isla, Isla Diego de Almagra France: Crozet Islands, Kerguelen Island New Zealand: Bollons Island, Campbell Island, Snares Island U.K.: South Georgia, Falkland Islands
Diomedea melanophrys impavida	Campbell albatross Thalassarche impavida	Vulnerable Listed as a vulnerable species under the EPBC Act	High	Offshore in southern waters from the NSW/Qld border in the east to Ceduna, S.A. (134°E) in the west	Australia: No sites recorded New Zealand: Campbell Island
Buller's albatross Diomedea bulleri bulleri	Buller's albatross Thallassarche bulleri	Vulnerable Listed as a vulnerable species under the EPBC Act	Low	Offshore in south-eastern waters from Coffs Harbour in the east to Eyre Peninsula in the west; around Tasmania	Australia: No sites recorded New Zealand: Snares Island, Solander Island, Little Solander Island
Diomedea bulleri platei	Pacific albatross Thalassarche nov. sp.	Vulnerable (Croxall & Gales 1998) Listed as a vulnerable species under the EPBC Act	Low	Vagrant in south-eastern waters; not yet seen around Tasmania Extent of range not yet defined	Australia: No sites recorded New Zealand: Three Kings Island, Chatham islands (Big Sister Island, Little Sister Island, Forty-fours Island)
Shy albatross Diomedea cauta cauta	Shy albatross Thalassarche cauta	Vulnerable (Croxall & Gales 1998) Listed as a vulnerable species under the EPBC Act	Moderate	Offshore in waters south of Fraser Island in the east to Barrow Island (20°S) in the west Off Macquarie Island	Australia: Tasmania (Albatross Island, Mewstone, Pedra Branca)

Table 2 continued

Previous Taxonomy **Common Name** **Species name**	**Currently Accepted Taxonomy** **Proposed new name** **Species name**	**International conservation status (BirdLife International 2004)**	***Likely Incidence in Longline Bycatch***	***Pelagic distribution in Australia***	***Jurisdiction and location of breeding areas***
Shy albatross Diomedea cauta steadi	White-capped albatross Thalassarche steadi	Vulnerable (Croxall & Gales 1998) Listed as a vulnerable species under the EPBC Act	Moderate	Offshore in south-eastern waters, especially around Tasmania Extent of range not yet defined	Australia: No sites recorded New Zealand: Auckland Islands (Adams Island, Auckland Island, Disappointment Island) Bollons Island
Diomedea cauta salvini	Salvin's albatross *Thalassarche salvini*	Vulnerable Listed as a vulnerable species under the EPBC Act	Low	Offshore in south-eastern waters, especially around Tasmania Extent of range not yet defined	Australia: No sites recorded France: Crozet Islands (Ile des Pingouins) New Zealand: Bounty Island, Snares Island
Diomedea cauta eremita	Chatham albatross *Thalassarche eremita*	Critically Endangered Listed as an endangered species under the EPBC Act	Low	Rare in south-eastern waters around Tasmania Extent of range not yet defined	Australia: No sites recorded New Zealand: Chatham Island
Yellow-nosed albatross *Diomedea chlororhynchos chlororhynchos*	Atlantic yellow-nosed albatross *Thalassarche chlororhynchos*	Endangered	Low	Vagrant in south-eastern waters Extent of range not yet defined	Australia: No sites recorded U.K.: Gough Island, Tristan da Cunha (Tristan da Cunha Island, Nightingale Island, Inaccessible Island, Middle Island, Stoltenhoff Island)
Diomedea chlororhynchos bassi	Indian yellow-nosed albatross *Thalassarche carteri*	Endangered Listed as a vulnerable species under the EPBC Act	Moderate	Offshore in southern waters from NSW/Qld border in the east to Barrow Island (20°S) in the west	Australia: No sites recorded France: Amsterdam Island, St Paul Island Kerguelen Islands, Crozet Islands South Africa: Prince Edward Island
Grey-headed albatross *Diomedea chrysostoma*	Grey-headed albatross *Thalassarche chrysostoma*	Vulnerable Listed as a vulnerable species under the EPBC Act	Moderate	Offshore off Tasmania, Victoria and south-eastern South Australia Off Macquarie Island	Australia: Macquarie Island Chile: Diego Ramirez Island, Isla Iledefonso France: Kerguelen Islands, Crozet Islands South Africa: Marion Is, Prince Edward Is. New Zealand: Campbell Island U.K.: South Georgia

Table 2 continued

Previous Taxonomy **Common Name** **Species name**	**Currently Accepted Taxonomy** **Proposed new name** **Species name**	**International conservation status (BirdLife International 2004)**	***Likely Incidence in Longline Bycatch***	***Pelagic distribution in Australia***	***Jurisdiction and location of breeding areas***
Laysan albatross	Laysan albatross	Vulnerable	Low	One or two sightings at Norfolk Island	No sites recorded in Australia

Diomedea immutabilis	*Phoebastria immutabilis*				**Hawaii:** Hawaiian Leeward Islands **Japan:** Bonin Islands (Mukojima) **Mexico:** Isla Guadalupe, Isla Benedicto, Isla Clarion
Sooty albatross *Phoebetria fusca*	Sooty albatross *Phoebetria fusca*	Endangered Listed as a vulnerable species under the EPBC Act	Low	Offshore in seas south of Australia; off Tasmania Off Macquarie Island	No sites recorded in Australia **France:** Amsterdam Island, St Paul Island, Kerguelen Islands, Crozet Islands **South Africa:** Prince Edward Island, Marion Island **U.K.:** Gough Island, Tristan da Cunha
Light-mantled sooty albatross *Phoebetria palpebrata*	Light-mantled albatross *Phoebetria palpebrata*	Near Threatened	Low	Offshore in seas south of Australia; off Tasmania. Off Macquarie Island, Heard Island and the McDonald Islands	**Australia**: Heard Island, McDonald Islands, Macquarie Island **France:** Kerguelen Islands, Crozet Islands **New Zealand:** Auckland Island Campbell Island Antipodes Island **South Africa:** Prince Edward Island Marion Island **U.K.:** South Georgia

Table 3: Summary of additional seabird species affected by longline fishing by-catch in the AFZ

Common Name *Species name*	*International Conservation Status (BirdLife International 2004)*	*Likely Incidence in longline bycatch*	*Pelagic distribution in Australia*	*Jurisdiction and location of breeding areas*
Southern Giant Petrel *Macronectes giganteus*	Vulnerable	Low	Offshore in southern waters from Fraser Island in the east to Shark Bay in the west Off Macquarie Island, Heard Island and the McDonald Islands	**Australia:** Heard Island, McDonald Islands, Macquarie Island, Australian Antarctic Territory **France**: Crozet Islands, Kerguelen Islands **Norway:** South Sandwich, South Orkney, Bouvet Island **South Africa:** Prince Edward Island, Marion Island **U.K.:** South Georgia
Northern Giant Petrel *Macronectes halli*	Lower Risk - Near Threatened	Low	Offshore in southern waters from Fraser Island in the east to Shark Bay in the west Off Macquarie Island	**Australia:** Macquarie Island **France:** Crozet Islands, Kerguelen Islands **New Zealand:** Antipodes Islands, Auckland Island, Campbell Islands, Chatham Island, Stewart Island **South Africa:** Prince Edward Island, ,Marion Islands
Great-winged Petrel *Pterodroma macroptera*	Not listed	Moderate	Offshore in southern waters from Fraser Island in the east to Geraldton (28°S) in the west	**Australia:** Western Australia (Recherche Arch., Bald Island, Coffin Island, Gull Island, Rabbit Island, Remark Island, Breaksea Island, Eclipse Island, Mistaken Island) **France:** Kerguelen Islands, Crozet Islands **New Zealand:** North Island (north-east coast) **South Africa:** Prince Edward Island, Marion Islands **U.K.:** Gough Island, Tristan da Cunha Islands
White-chinned Petrel Procellaria aequinoctialis	Vulnerable	Moderate	Offshore waters along the southern edge of the mainland and around Tasmania	**Australia**: No sites recorded **France**: Kerguelen Island, Crozet Islands **New Zealand**: Antipodes Island, Campbell Islands, Auckland Islands **South Africa**: Prince Edward Island, Marion Islands **U.K.:** South Georgia
Westland Black Petrel *Procellaria westlandica*	Vulnerable	Low	Oceanic waters off southern NSW coast and east coast of Tasmania	**Australia**: No sites recorded **New Zealand:** South Island (Punakaiki River)

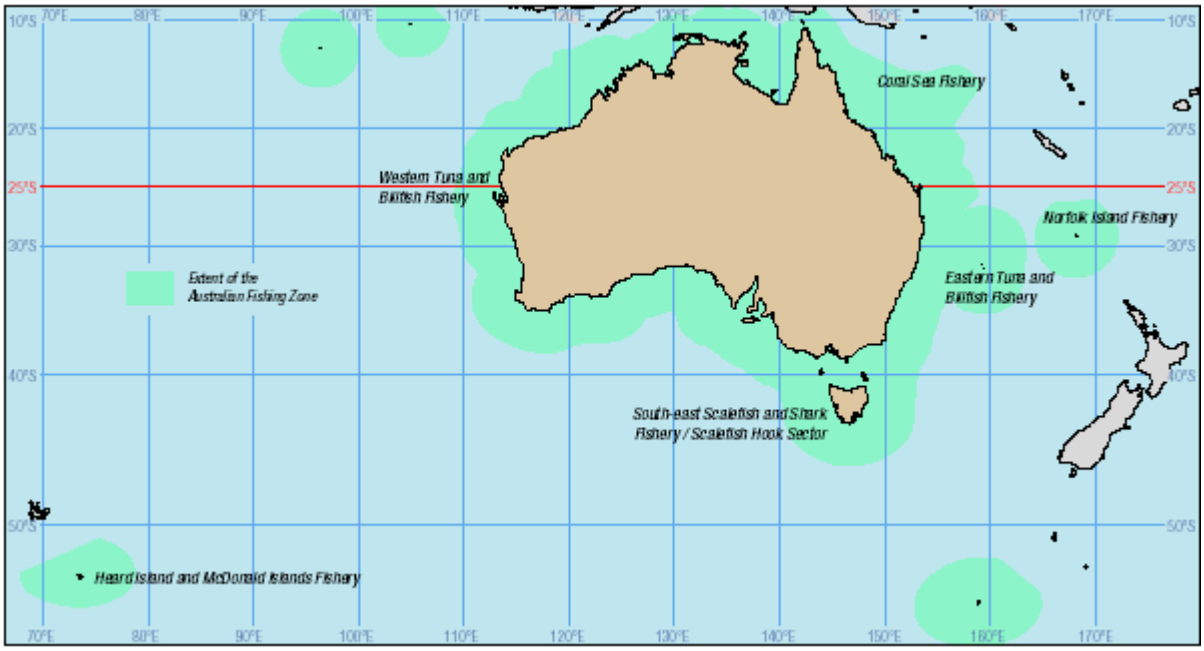
Grey Petrel Procellaria cinerea	Near Threatened	Moderate	Rare visitor to southern waters from Ballina (29°S) in the east to Bunbury (34°S) in the west; Slightly more common around south and west coasts of Tasmania	**Australia**: Macquarie Island **France**: Crozet Islands, Kerguelen Islands, Amsterdam Island **New Zealand:** Campbell Island, Antipodes Islands **South Africa**: Prince Edward Island **U.K.:** Tristan da Cunha Islands
Wedge-tailed shearwater Puffinus pacificus	Not listed	Moderate	Waters off the east coast from Torres Strait in the north to Montagu island in the south; Waters off the west coast from King's Sound in the north to Bunbury (34°S) in the south; Vagrant off northern and southern coasts Off Lord Howe Island Off Norfolk Island	**Australia**: Numerous islands off NSW, QLD and Western Australia, Lord Howe Island, Norfolk Island, North Keeling Island **Other:** extensive distribution throughout the tropical and sub-tropical Pacific and Indian Oceans. Ranges States include Fiji, Japan, Kiribati, Solomon Islands, Marquesas, Marshall Islands, New Zealand, Papua New Guinea, Phoenix, Revillagigedo, Samoa, Seychelles, Tonga, U.S.A (Hawaiian Islands), Vanuatu,
Flesh-footed shearwater Puffinus carneipes	Not listed	High	Coastal in southern waters from Fraser Island in the east to Shark Bay in the west Off Lord Howe Island	**Australia**: Lord Howe Island, South Australia (Smith Island), Western Australia (numerous islands) **France:** St Paul Island **New Zealand:** North Island (north-east and west coasts), Cook Strait
Sooty shearwater Puffinus griseus	Near Threatened	Low	Waters south of the NSW/Qld border in the east and Bunbury (34°S) in the west Off Macquarie Island	**Australia** NSW (Broughton Island, Little Broughton Island, Cabbage Tree Island, Boondelbah Island, Bird Island, Lion Island, Bowen Island, Montagu Island, Tollgate Island), Tasmania (Tasman Island, Hippolyte Rocks, Courts Island, Flat Witch Island, Flat Island, Breaksea Island, Green Island), Macquarie Island **Chile:** Cape Horn **New Zealand:** North Island (north-east coast), South Island (south coast), Cook Strait, Solander Island, Snares Island, Antipodes Island, Auckland Island, Campbell Island, Chatham Island **U.K.:** Falkland Islands

Short-tailed shearwater *Puffinus tenuirostris*	Not listed	Low	Waters south of Fraser Island in the east to Bunbury (34°S) in the west	**Australia:** Numerous islands off NSW, Victoria, Tasmania, South Australia and Western Australia
Southern Skua *Catharacta antarctica*	Not listed	Low	Offshore in southern waters from Fraser Island in the east to Geraldton (28°S) in the west Off Macquarie Island and Heard Island	**Australia:** Macquarie Island, Heard Island **Antarctic Peninsula:** Elephant Island **Argentina:** Cape Horn **France:** Kerguelen Islands, Crozet Islands, Amsterdam Island **New Zealand:** Chatham Island, Auckland Island, Snares Island , Campbell Island, Antipodes Island, Stewart Island **Norway:** Bouvet Island **South Africa:** Prince Edward Island, Marion Islands **U.K.:** South Georgia, Gough Island, Tristan da Cunha Islands, Falkland Islands, South Sandwich Islands, South Shetland Islands, South Orkney

Data derived from Marchant and Higgins (1990), Gales (1998) and Brooke (2004).

Incidence information from Gales and Brothers (1995) and unpublished data held by the Parks and Wildlife Service, Tasmania.

3 Mitigation measures addressing the Key Threatening Process



Australian Fishing Zone (AFZ)

The Threat Abatement Plan applies to all longline fisheries in the Australian Fishing Zone (shaded green) with mitigation measures expected to be mandatory south of 25 degrees soon. The fisheries indicated on the map with text are those where seabirds are most threatened.

Illustration credits: Peter Boyer and Australian Fisheries Management Authority.

The longline fishing practices and equipment described in Section 2 can be modified in a number of ways to reduce the likelihood of seabird bycatch. These modifications are termed mitigation measures. The measures focus on reducing bycatch during the critical period following release of the bait from the stern of the longline vessel until it has sunk out of reach of diving seabirds.

Effective mitigation of the threat relies on measures which:

- reduce seabird access to baits by:
  - ♦ increasing the sink rate of bait;
  - ♦ deterring birds from foraging where baits are being set; and
  - ♦ blocking access to baits
- reduce the chance of a seabird being hooked if it does take a bait
- minimise the attractiveness of longline baits to seabirds
- minimise the congregation of seabirds around vessels

The aim of this action is to develop a package of mitigation measures for each type of longline fishery operation which will minimise the seabird bycatch of that fishery.

The following measures include existing measures that are known to be effective in reducing seabird bycatch and potential measures that are still under development.

Currently, there is limited or no data available on the level of seabird bycatch taken by demersal longline fisheries within the AFZ.

3.1 Existing Practices

A number of mitigation measures are currently used by domestic vessels in the AFZ (Department of Agriculture, Fisheries and Forestry, 2003). Requirements to reduce seabird mortality in pelagic fisheries are prescribed in the TAP and implemented through AFMA fishery management controls. At present all vessels operating south of latitude 30^{o}S must: (i) set lines at night; (ii) use a bird scaring line; (iii) thaw baits; and (iv) not discharge offal during the set. If offal is discharged during the haul, then it must be discharged on the opposite side of the vessel to which hauling occurs. Fishers can apply for exemptions from night setting if they can demonstrate alternate methods which satisfactorily set hooks without catching birds, or if they wish to test or develop new mitigation measures (scientific permits must be issued in the latter case). Some operators are currently trialing underwater-setting devices and line weighting/twin bird-scaring lines and have authority to fish during the day.

3.2 Mitigation measures known to be effective in reducing seabird bycatch

A range of mitigation measures have been developed or proposed to lower seabird bycatch. Each measure has different attributes, costs and levels of potential to successfully reduce seabird catch. Some measures have been consistently successful in a number of longline fisheries, while the effectiveness of other measures has varied between vessels and seabird species. The use of these measures has been extensively described and assessed by Brothers et al. (1999) and Department of Agriculture, Fisheries and Forestry (2003). These measures are briefly described below and summarised in tables 4 and 5.

Night Setting

Most seabirds caught on longlines are active during the day. Fishers can avoid catching birds by setting their lines at night (Harper 1987, Weimerskirch and Wilson 1992). This can result in a 60 to 96% reduction in seabird bycatch (Cherel *et al.* 1996, Alexander *et al.* 1997). This reduction in catch rate decreases around the time of a full moon. The deck lighting on the vessel can attract birds during night setting and should be minimised while ensuring the safety of the crew (Brothers 1991). At present, night setting is mandatory for pelagic fisheries in Australian waters below 30^{0}S.

Line Weighting

Increased line weighting has shown to be important in decreasing seabird bycatch rates in both demersal (Ashford et al. 1995; Barnes et al. 1997) and pelagic (Draft NZ NPOA) longline fisheries as it increases the sink rate of baited hooks so that they are out of reach of seabirds more rapidly. Weights can be added to the branchlines in pelagic longlines and the mainline in demersal longlines to hasten the sinking of baits.

Sink rates of greater than 0.3 metres/second appear to adequately decrease catch rates for demersal longliners (Robertson 2000). Under the existing TAP, line weighting was included as a

measure whereby exemption from night setting could be granted when using sufficiently weighted lines.

In pelagic longlining, 60 gram weights placed on the branchline one metre from the hook can double the sink rate (Draft NZ NPOA). Brothers et al. (2000) found 40 gram weights placed within one metre, or 80 gram weights placed within five metres, of the hook could achieve a sink rate of a baited hook of 0.3 metres/second. In demersal longlining, this sink rate can be attained with four kilogram weights every 40 metres along the mainline (Robertson 2000). The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) currently requires vessels fishing in CCAMLR waters to use 8.5 kilogram weights spaced at 40 metre intervals (CCAMLR 2000) to the mainline in demersal longling operations.

Some pelagic longline fishermen are not prepared to use this method due to concerns about safety risks from the weights. Occasionally, during hauling, if a weighted line breaks free of a fish while under tension, the weight may shoot back to the side of the vessel and strike a fisher. Despite the safety issues, in recent times a number of operators have trialled weighting as a seabird mitigation measures.

There has been substantial work undertaken in recent years to test the use of internally weighted longlines for demersal autolining gear (Graham Robertson, unpublished). The lines are weighted by integrating lead thread into the rope mainlines. Trials of longlines using integrated weight of at least 50 g/m. show the mainline sinks instantly with a linear profile at greater than 0.2 m/s with no external weights attached. This gear has been shown to reduce seabird bycatch substantially whilst not affecting the catch of fish (Graham Robertson, unpublished).

Area Closures

Seabirds congregate at natural feeding grounds and breeding sites at different times. These areas are often rich fishing grounds. Areas of high seabird bycatch can be closed to longline fishing on a temporary, seasonal or permanent basis to minimise the overlap between fishing operations and bird activity. For example, Croxall and Prince (1996) have identified the South Georgia shelf as an area of unacceptably high probability of seabird bycatch during March and May when the resident breeding albatrosses are consistently foraging in the area.

Bird Scaring Lines

Seabirds sit on, or fly low over, the water behind the vessel when diving and attacking baits. A bird line suspended over the water above the area where the baits are being set deters birds from entering this area. The bird line consists of a main cord suspended over the stern of the vessel with a number of streamer cords attached which hang down over the water and move in an unpredictable way deterring seabirds from foraging on the baits. When constructed and set properly, bird lines can reduce mortality by between 30 and 75% (Brothers 1991, Klaer and Polacheck 1995). The bird line is not uniformly effective in deterring all species. Skuas are bold foragers and will avoid the line by foraging near the back of the vessel (Brothers 1993). Bird scaring lines are mandatory in Australian waters below 30^0S under the Fisheries Management Regulations 1992. Above 30^0S lines must be carried as used as necessary.

Bait Casting Machines

One of the main problems with pelagic longlines is the sink rate of the baits. When baits are hand thrown from the vessel during setting they often get caught in the vessel's propeller turbulence which keeps them on the surface of the water. Bait casting machines provide for faster sinking of the bait by throwing the bait clear of the propeller turbulence (Brothers 1993). When used in conjunction with properly configured bird scaring lines, bait casting machines that contain a low arc of throw and facilities to vary the distance and side thrown, can achieve 40 to 80% reductions in seabird bycatch (Brothers 1993).

Offal Discharge

Seabirds are attracted to vessels by offal and discarded fish bycatch. This discharge typically occurs near the point of line hauling. Both the timing and location of discharge can be modified to make the vessel less attractive to birds during line setting and hauling (Cherel *et al.* 1996, Alexander *et al.* 1997). Australian boats and foreign boats in the Australian Fishing Zone must not discharge offal when setting or hauling lines.

Bait Thawing and Swim Bladder Puncturing

Baits are stored frozen on board longline vessels. It is common practice to bait hooks with frozen baits and allow the bait to thaw in the water after setting. Frozen baits set in this manner float for longer than baits which are thawed prior to line setting (Brothers 1995). Reductions in bycatch of 50 to 70% have been suggested from use of thawed baits by Klaer and Polacheck (1995).

Most species of bait fish have swim bladders which are filled with air making them buoyant. These bladders decrease the sink rate of baits and should be punctured (Brothers 1995).

3.3 Mitigation measures requiring further development and testing

Smart Hooks

Seabirds often attack baits without being hooked (Brothers 1991). Smart hooks prevent birds from being caught by retracting the point of the hook until it has reached a safe depth. This measure is in the early stages of development.

Underwater Setting

Underwater setting protects the baits during line setting by enclosing them in a chute or tube until they are outside the diving range of seabirds. This is a potential solution to the threat but also requires the greatest modification to vessels. Successful underwater setting methods must ensure that baits do not float to the surface after they have been set.

Deck Lighting

It is possible that during night setting deck lighting attracts birds and makes bait more visible, but the effect of deck lighting on seabird bycatch is yet to be determined. New vessel designs can consider seabird bycatch when designing lighting for their vessels. The safe operation of the vessel must be considered.

Towed Deterrents

In addition to bird scaring lines described earlier there are a number of towed deterrents that could be used to reduce bird activity around the stern of the vessel during line setting. Buoys and other devices can be towed behind the vessels to disturb birds as they land to feed. This method is being advocated by fishers in North Pacific fisheries but its effectiveness has not been properly determined. Further international activities are underway to determine its efficacy.

Magnetic Deterrents

Seabirds navigate using a geomagnetic compass. There have been some experiments conducted using magnetic fields to disturb the birds' compass to confuse them while in close proximity to the vessel. There has been no success in deterring seabirds using this method in tests (Brothers pers. comm.). The method also has potential Occupational Health and Safety considerations for the crew.

Sound Deterrents

Sound is used to deter birds from airports and crops. A field study using equipment developed jointly by Japan Tuna and Blasting Technologies (a Japanese engineering company), assisted by the Tasmanian Parks and Wildlife Service through 1997 was unsuccessful. Responses by birds to the "scaring sound" were negligible.

Water Cannon

A water cannon is used to prevent birds from entering the area astern of the vessel where the baits are sinking. This method was used by Foreign longliners in the AFZ during winter 1997 with mixed results (AFMA Observer Reports).

Lures and Baits Types

In some fisheries fish or squid baits are replaced with lures which are potentially less attractive to seabirds. This measure shows potential for further development.

Live bait is used in some fisheries which can reduce bycatch rates.

Dyes

To reduce the attractiveness of baits to birds and/or conceal them, baits could be dyed. The impact on fishing efficiency of this measure must be investigated.

Table 4: Analysis of mitigation measures known to reduce seabird bycatch in pelagic longline fisheries

Measure	Stage of Development	Methods of Monitoring Use	Operational Use (Safety implications for crew)	Relative Cost to Fishers in the AFZ	Nature of Cost (fixed or ongoing)	Impact of Catch per Unit Effort	Relative Effectiveness	Impact on bycatch of non–seabird species
Night setting	Developed and tested	Observations	Safe provided lighting is adequate	High for domestic vessels	Ongoing	Reduced bait loss to birds	High	Increased bycatch of other species e.g. sharks
Line weighting	Partially developed	Observations	Caution required	Med	Fixed + Maintenance	Unknown	High (if weight sufficient)	Not known
Area closures	Developed and tested globally, but not for the AFZ	VMS, Aerial, Observations	–	High	Ongoing	Reduced access to stock	High	No bycatch in the closed area
Bird scaring lines	Developed and tested	Aerial, Observations	Safe	Low	Fixed + Maintenance	Reduced bait loss to birds	Med -High	None
Bait thawing and swim bladder puncturing	Developed and partially tested	Observations	Safe	Low	Ongoing	Reduced bait loss to birds Increased setting preparation	Med	Not known
Bait casting machines	Developed and partially tested	Observations	Safe	Med	Fixed + Maintenance	Reduced bait loss to birds Improved bait condition	Med (increased with use of bird scaring line)	None
Offal discharge	Developed and partially tested	Observations	Safe	Low	Fixed	Reduced bait loss to birds	Low	Not known Impacts include artificial food provision

Table 5: Analysis of mitigation measures which have potential to reduce seabird by-catch in pelagic longline fisheries

Measure	Stage of Develop-ment	Methods of Monitoring Use	Operational Use (Safety implications for crew)	Relative Cost to fishers	Nature of Cost (fixed or ongoing)	Impact of Catch per Unit Effort	Relative Effectiveness	Impact on bycatch of non–seabird species
Smart hooks	Not developed	Observations	Safe	Med	Initial equipment cost + replacement of lost equipment	Unknown	Unknown	Unknown
Underwater setting	Being developed outside Australia	Observations	Safe	Low - High dependin g on method	Fixed + Maintenance	Reduced bait loss to birds Improved bait condition	High if baits are set deep enough so as to not resurface in turbulence	Enables fishers to operate day or night and potentially reduces bycatch of other species
Deck lighting	Partially developed	Observations	Safety needs to be considered in planning	Low - Med	Fixed	Reduced bait loss to birds	Low (High in combination with night setting)	Reduced bycatch of species attracted to vessel by lights
Towed deterrents	Used in US fisheries	Observations	Potential gear conflict	Low	Fixed	Unknown	Unknown	Unknown
Magnetic deterrents	Tested	Observations	Unknown	Med	Fixed	Unknown	None	None
Sound deterrents	Limited testing	Observations	Unknown	Med	Fixed	Unknown	Very limited	Very limited
Water cannon	Partially developed	Observations	Wet crew	Med	Fixed	Unknown	Unknown	Unknown
Lures	Not developed	Observations	Safe	Med	Ongoing (considerable savings in bait costs)	Unknown	Unknown	Unknown
Dyes	Not developed	Observations	Safe	Med	Ongoing	Unknown	Unknown	Unknown

4. Glossary

AAD:	Australian Antarctic Division, Department of the Environment and Heritage
ACAP:	Agreement on the Conservation of Albatrosses and Petrels
AFMA:	Australian Fisheries Management Authority
AFZ:	Australian Fishing Zone
BSL:	Bird Scaring Line, also known as a tori pole
CCAMLR:	Convention on the Conservation of Antarctic Marine Living Resources
CCSBT:	Convention for the Conservation of Southern Bluefin Tuna
CI/Cocos:	Christmas Island and Cocos (Keeling) Islands Offshore Tuna Fishery
CMS:	Convention for the Conservation of Migratory Species of Wild Animals
COFI:	FAO Committee on Fisheries
Demersal:	Longlines that are set on the bottom of the ocean
DPIWE:	Department of Primary Industries, Water and Environment
DEH:	Department of Environment and Heritage
EPBC Act:	Environment Protection and Biodiversity Conservation Act 1999
ERS:	Ecologically Related Species Working Group of CCSBT
ETBF:	Eastern Tuna and Billfish Fishery
FAO:	Food and Agriculture Organization of the United Nations
FFC:	Forum Fisheries Committee
FRDC:	Fisheries Research and Development Corporation
SESSF:	Southern and Eastern Scalefish and Shark Fishery (Scalefish Hook Sector)
IMAF:	Incidental Mortality Arising from Fishing—ad hoc Working Group of the Working Group on Fish Stock Assessment of CCAMLR
IOTC:	Indian Ocean Tuna Commission
NHT:	Natural Heritage Trust
Offal:	remains of target fish species, fish bycatch species and unused baits
Pelagic:	Longlines that are set in the water column above the bottom of the ocean
SBT:	Southern Bluefin Tuna or Tuna Fishery
WTBF:	Western Tuna and Billfish Fishery

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