Australian Government
Bureau of Rural Sciences

Australian Country Report:

Ecologically Related Species in the Australian Southern Bluefin Tuna Fishery 2007–08

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Executive Summary

Purpose

This report includes information and data on ecologically related species (ERS) from Australia's southern bluefin tuna (SBT) fisheries for the 2006–07 and 2007–08 SBT fishing seasons, with some preliminary results for 2008–09.

Catch and effort

The Australian domestic SBT catches for the 2006, 2007 and 2008 calendar years were 5635 t, 4813 t and 5051 t, respectively. The 2006–07 quota year catch was 5234 t, and the 2007–08 quota year catch also 5234 t.

In 2006–07, 14 vessels landed SBT in Australian waters: 99.9% of the catch was taken by 8 purse seiners off South Australia, and the remainder by 6 longliners in the Eastern Tuna and Billfish Fishery (ETBF).

In 2007–08, 22 vessels landed SBT: 99.6% of the catch was taken by 7 purse seiners and the remainder by 15 longliners in the ETBF.

No SBT were caught by longline in the Western Tuna and Billfish Fishery (WTBF) in 2006–07, 2007–08 or 2008–09.

Observer coverage

In 2006–07, observers monitored 5.6% of purse seine sets. In 2006, observers monitored 30.2% of longline sets in the ETBF during the months and in the areas of the SBT migration, and 2% of longline sets in the WTBF.

In 2007–08, purse-seine coverage was 11.8% of sets. In 2007, a coverage level of 22.1% of hook effort was achieved in the ETBF during the months and in the areas of the SBT migration. Observers monitored 17.4% of operations in the WTBF in 2007.

In 2008–09, observers monitored 7.9% of purse seine sets. In 2008, observers monitored 47.9% of hooks in the ETBF during the months and areas of the SBT migration, and 16.7% of operations in the WTBF. Results for 2008–09 are preliminary.

Interactions with ERS

No interactions with ERS were observed in the SBT purse seine fishery in 2007–08 or 2008–09. One white-faced storm petrel was found on deck a purse seiner and released alive in 2006–07.

Details of interactions between ERS and the ETBF longline fishery are provided. The number of interactions with seabirds has decreased since 2004. The number of interactions with non-target fish, and sea turtles and marine mammals, has also decreased since 2004.

Mitigation measures

Australia is developing and testing a range of mitigation measures including line-weighting trials, methods to increase line sink rates, an underwater bait setting machine and circle hooks.

Contents

1. INTRODUCTION

Three fisheries managed by the Australian Government catch southern bluefin tuna (SBT; *Thunnus maccoyii*) in varying quantities: the Southern Bluefin Tuna Fishery (SBT Fishery), Eastern Tuna and Billfish Fishery (ETBF) and the Western Tuna and Billfish Fishery (WTBF). The SBT fishery targets juvenile SBT in the Great Australian Bight using purse seine, with the fishing season from 1 December to 30 November.[1] After capture, the juvenile SBT are transferred to grow-out cages and fattened for up to 6 months before being harvested. The ETBF and WTBF are longline fisheries primarily targeting yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*), albacore (*Thunnus alalunga*), broadbill swordfish (*Xiphias gladius*) and striped marlin (*Tetrapturus audax*). Longlining for SBT occurs primarily in the austral winter months between May and October, and the fishing seasons of these two fisheries are defined by the Australian financial year, 1 July to 30 June. Because the fisheries have distinct characteristics and management plans, they are separated within this report.

Australia separates its Ecologically Related Species (ERS), or non-target catch, into byproduct and bycatch (including threatened, endangered and protected [TEP] species). The longline fisheries are multi-species fisheries that, while being relatively selective, catch a range of fish and shark species and interact with a number of species of seabird and to a lesser extent sea turtles. Much of the non-target catch in these fisheries is considered to be byproduct (e.g. mahi mahi *Coryphaena* spp., black oilfish *Ruvettus pretiosus*) and is sold commercially. A reduction in the discarding of species with little commercial value has been a focus of recent management initiatives. In contrast to the longline fisheries, the SBT Fishery has very little interaction with ERS as the purse seine is highly selective.

Australia as a whole has made considerable investments to mitigate the rate of both seabird interaction and capture during longline fishing operations. Through government and industry initiatives, the incidence of seabird bycatch has declined in recent years. Australia has also recently completed research on mitigation measures to reduce the capture of sharks and sea turtles in longline fisheries (Ward et al. 2008, 2009).

This report includes information and data on ERS from Australia's SBT fisheries for the 2006–07 and 2007–08 SBT fishing seasons, with some preliminary results for 2008–09.

[1]Various time periods, such as 'calendar years', 'fishing seasons' and 'quota years', can be used when describing Australia's SBT fishery. Unless otherwise indicated, we have used fishing seasons in this report, but note that fishing seasons of the various fishery components often span quota years.

2. REVIEW OF SBT FISHERIES

Fleet size and distribution

Historical fleet size and distribution

Fishing for southern bluefin tuna (SBT) began in the early 1950s off New South Wales (NSW) and South Australia (SA) and then later, in 1970, off Western Australia (WA). The catch, used primarily for canning, peaked at 21 500 t in 1982.

Progressively over the mid to late 1980s, the Australian catch focused on supplying the Japanese sashimi market. The introduction of an individual transferable quota (ITQ)-based management plan in 1984, based on an Australian total allowable catch (TAC) of 14 500 t, resulted in the redistribution of quota ownership. In the late 1980s the Australian quota was reduced to 5265 t, which led to further restructuring. Since 1992 there has been a progressive increase in the proportion of SBT taken under farming operations. Currently, over 99% of the Australian quota is captured using the purse-seine method.

From 1990 to 1994, approximately half the Australian quota was taken by Australia-Japan joint venture longliners. With the termination of the joint venture arrangements in 1995, Australian catches again focused on the surface fishery with poling operations supplying the fresh chilled sashimi market and purse seiners providing SBT to ranches for mariculture.

In the past there has been longlining for SBT off NSW, Tasmania and WA, with occasional catches in SA waters. There were also some purse seine, trolling and poling operations in the offshore waters of the Australian Fishing Zone (AFZ). Currently, longlining for SBT occurs primarily off south eastern NSW during the winter months (May to October).

To minimise the risk of non-quota take of SBT by longliners off NSW and WA, access to the waters through which SBT migrate has been restricted to vessels holding SBT quota since 2000 in NSW and 2001 in WA. This arrangement has resulted in a significant reduction in longline effort in southern areas, and corresponding reductions in seabird and other species bycatch interactions.

Current fleet size and distribution

Southern Bluefin Tuna Fishery

All SBT caught commercially in Australia is taken under the *Southern Bluefin Tuna Fishery Management Plan 1995* and is required to be covered by quota. The area of the SBT Fishery encompasses the entire AFZ and extends onto the high seas (Fig. 1). The AFZ is defined consistently with Australia's Exclusive Economic Zone (EEZ) and extends out to 200 nautical miles from the coast. There are two main components for the fishery: the surface fleet operating out of Port Lincoln, SA, which takes juvenile SBT, and longline fleets operating off eastern and western Australia, which usually take a broad size range of SBT as an incidental catch of fishing for other tuna or billfish species. To longline in these areas, operators are required to have a fishing permit in either the Eastern Tuna and Billfish Fishery (ETBF) or Western Tuna and Billfish Fishery (WTBF), and management measures for gear restrictions and bycatch are managed through these separate fisheries.

The surface fleet in Port Lincoln takes about 99% of the total SBT commercial catch, capturing juvenile SBT (age 1–5) in the Great Australian Bight. Juvenile SBT are towed back to Port Lincoln, transferred into grow-out pontoons and ranched for up to 6 months before harvest. In recent years (2006–07 to 2008–09), SBT have also been landed by the ETBF from waters off NSW, while no SBT have been caught in the WTBF.

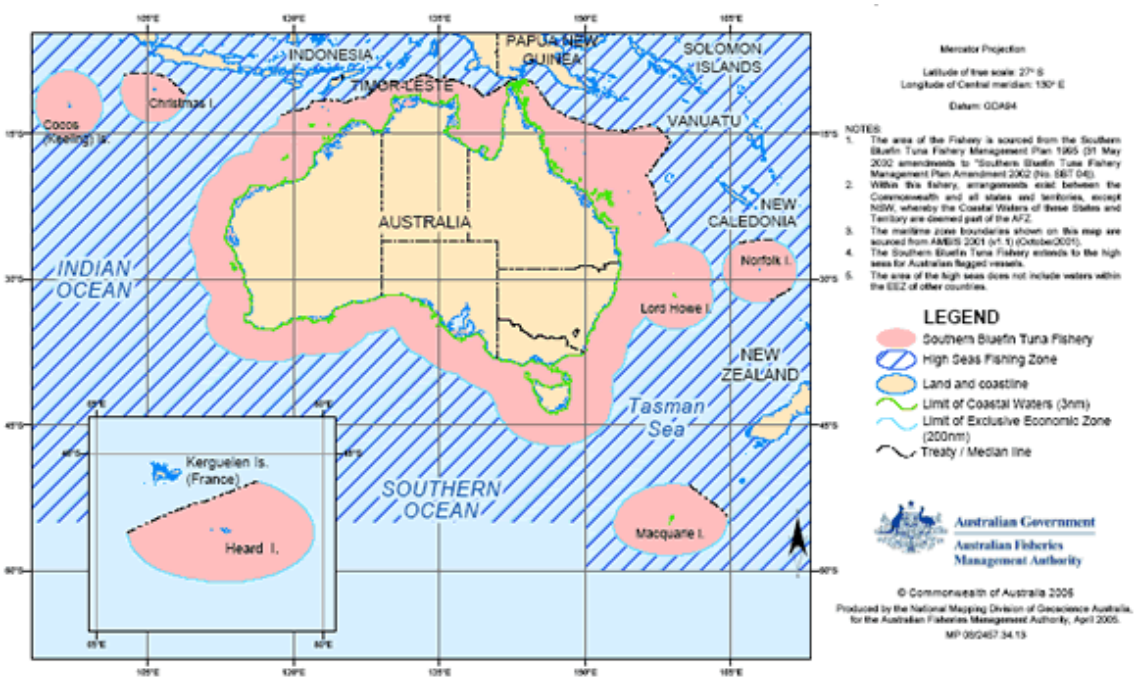

Fig. 1. Area of Australia's Southern Bluefin Tuna Fishery

Eastern Tuna and Billfish Fishery

The ETBF extends from Cape York to the Victoria–South Australia border, including waters around Tasmania (Fig. 2). Domestic longline vessels are mostly 15–25 m long and use monofilament gear. Fishing practices vary with target species, location and season. Vessels usually conduct one longline operation per day or night, depending on the target species. A typical longline set will comprise about 1200 hooks. Fishers commonly operate around 107 days per year. Most trips are between 2 and 15 days, but occasionally trips extend up to 30 days. Typical fishing trips range from 40–300 nautical miles from port, though in the past some vessels journeyed out to 1000 nautical miles or further to fish.

In late 2005, the *Eastern Tuna and Billfish Fishery Management Plan* was approved for implementation (implementation expected 1 November 2009). The target species to be managed under the Plan include albacore tuna, bigeye tuna, billfish, longtail tuna, northern bluefin tuna, Rays bream, skipjack tuna and yellowfin tuna. The catch of the target species will be managed by controlling the total fishing effort expended in the fishery in a season through a Total Allowable Effort: that is, the number of hooks that can be set each year. Rights to the fishery will be determined on an annual basis.

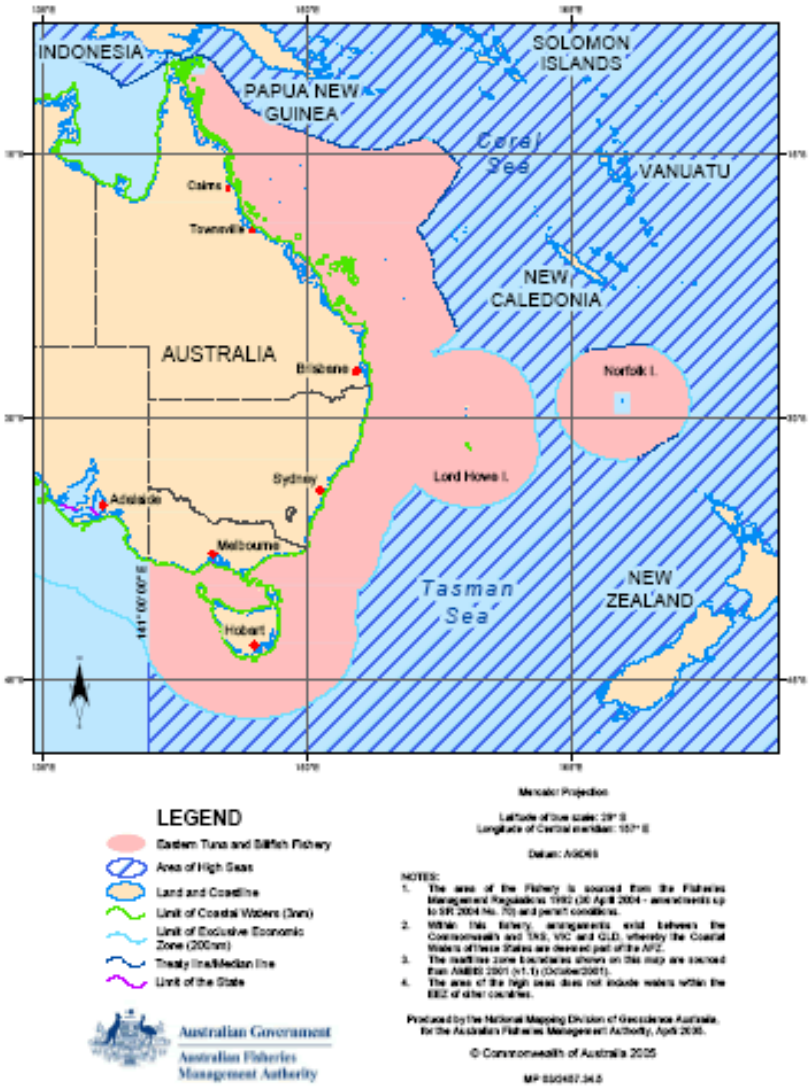

Fig. 2. Area of Australia's Eastern Tuna and Billfish Fishery

Western Tuna and Billfish Fishery

The WTBF encompasses the area of the AFZ off the northern, western and southern coastline westward from Cape York Peninsula (142°30'E) off Queensland to 141°E at the Victoria–South Australia boarder (Fig. 3). The fishery includes waters seaward of territorial waters (outside 12 nautical miles from the coast) adjacent to Christmas and Cocos (Keeling) Islands and high seas areas throughout the Indian Ocean, consistent with the area of competency of the Indian Ocean Tuna Commission. Most longline vessels in the fishery are 15–25 m long and set 1000–1500 hooks on monofilament lines, with an average of one set per day. Vessels fish throughout the year with an average trip of 4 to 6 days.

As with the ETBF's Management Plan, the *Western Tuna and Billfish Management Plan* was approved for implementation in late 2005. The Plan removes the internal barrier at 34°S, which had previously separated the Southern and the Western Tuna and Billfish Fisheries, and renamed the entire area the 'Western Tuna and Billfish Fishery'. The Plan provided for a system of individual transferable quota statutory fishing rights (SFR), with the quota species including bigeye tuna, yellowfin tuna, striped marlin and broadbill swordfish. For one fishing season, each SFR entitles an equal share to the TAC for the relevant species.

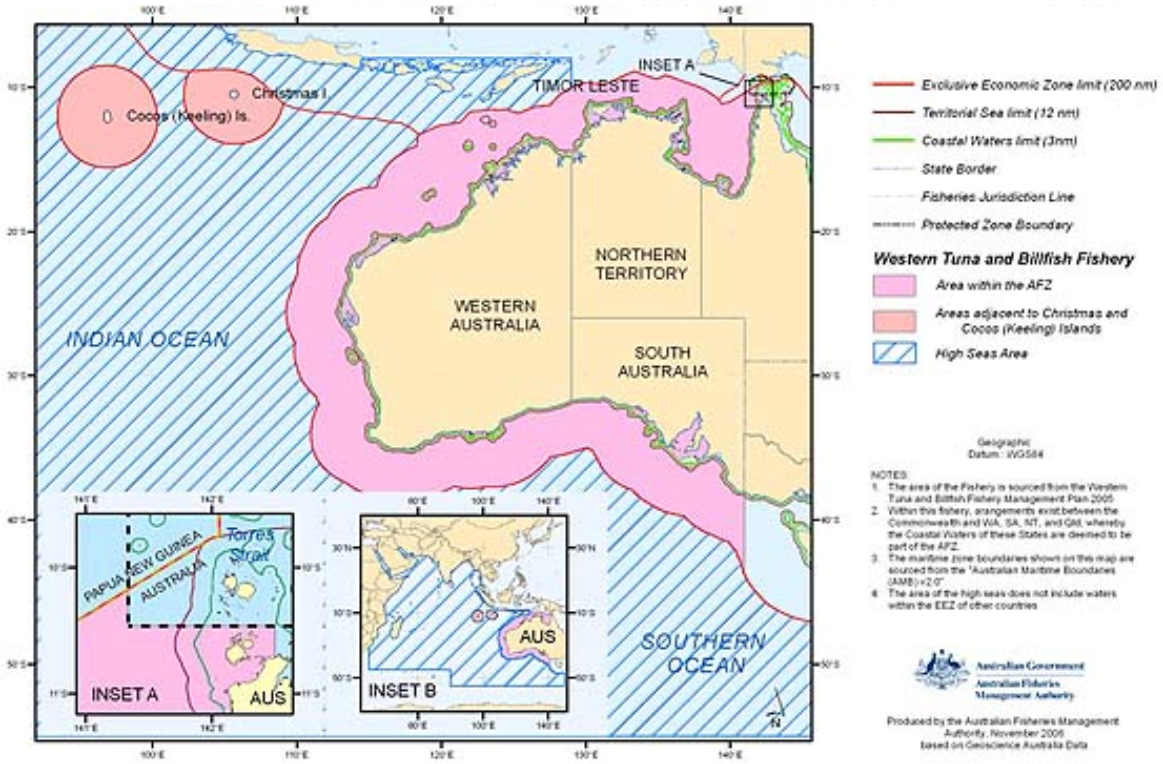

Fig. 3. Area of Australia's Western Tuna and Billfish Fishery

Distribution of catch and effort

The Australian domestic SBT catches for the 2006, 2007 and 2008 calendar years were 5635 t, 4813 t and 5051 t, respectively. The 2006–07 quota year catch was 5234 t, and the 2007–08 quota year catch also 5234 t.

In 2006–07, 14 commercial fishing vessels landed SBT in Australian waters (Hobsbawn et al. 2008). A total of 99.9% of the catch (5230 t) was taken by 8 purse seiners fishing in the juvenile habitat (age 2–5 SBT) in the Great Australian Bight off SA (Fig. 4). The remaining 4 t were taken by 6 longliners in the area of the fishery for older juveniles and adults in deeper waters off NSW (Fig. 4) (Hobsbawn et al. 2008).

In 2007–08, 22 commercial fishing vessels landed SBT. A total of 99.6% of the catch (5211 t) was taken by purse seine with the remaining 23 t taken by longline: 7 purse seiners fished off SA, while 15 domestic longliners reported landing from deeper waters off NSW (Fig. 4).

No SBT were caught by longline in the Western Tuna and Billfish Fishery (WTBF) in 2006–07, 2007–08 or 2008–09.

Australian longliners generally target more than one species in the fishing season and the targeted effort (number of hooks targeting SBT) is not distinguishable from logbooks.

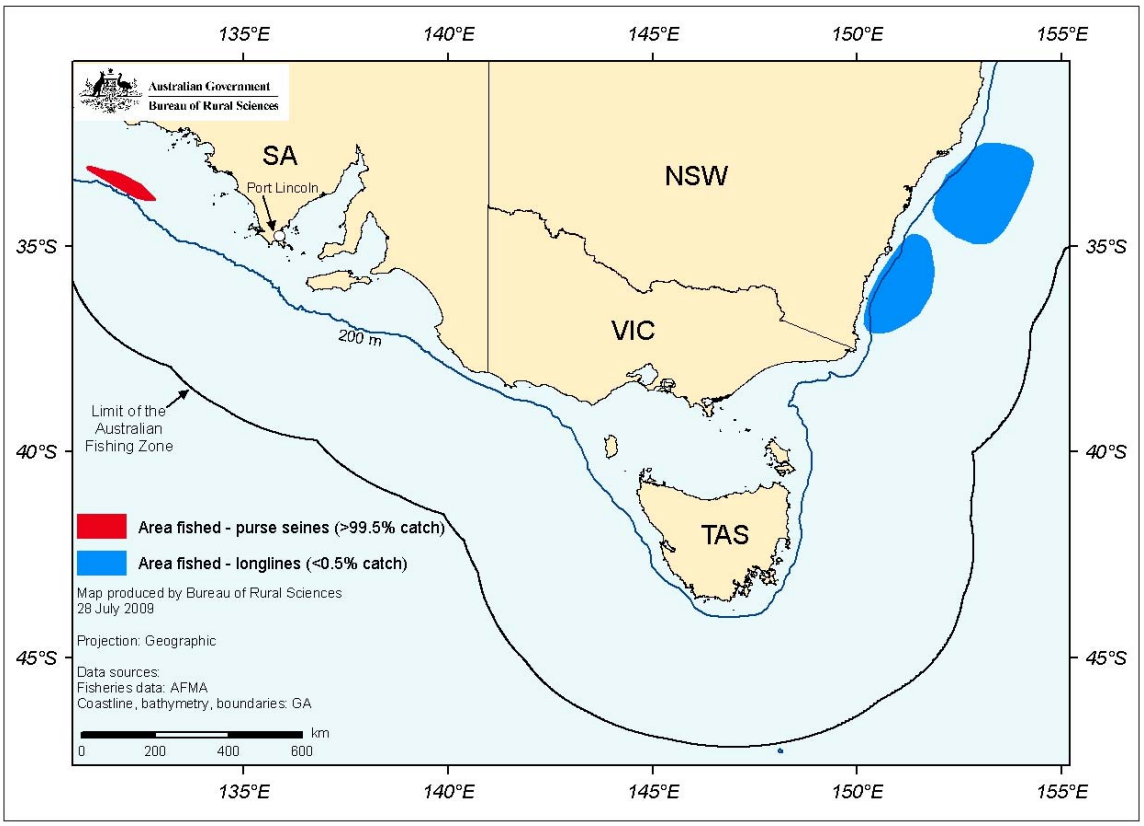

Fig. 4. Location of SBT catch (proportion of total commercial catch) in 2006–07, 2007–08 and 2008–09

3. Fisheries monitoring for each fleet

Catch documentation

There are a series of compulsory fishery-specific logbooks and associated catch disposal records that are required by law to be completed by Australian fishers. Current fishery-specific logbooks and catch disposal records can be downloaded from www.afma.gov.au/industry/logbooks/current.htm. All of the data provided on logbooks and catch disposal records must be supplied to the Australian Fisheries Management Authority (AFMA) within specified time periods. Verification of these data is undertaken through observer programs and, as a minimum, through an annual audit process by AFMA.

In addition to detailed catch and effort information, specific reporting forms for threatened, endangered or protected (TEP) species are included with the fishery-specific logbooks in all Australian Commonwealth fisheries (www.afma.gov.au/industry/logbooks/current.htm).

AFMA has recently implemented a system of 'prior reporting' in the ETBF. Operators are required to inform AFMA of their impending arrival in port to alert authorities that they have catch on board their vessel.

Observer programs

Observer programs for the purse seine and longline sectors have been in place for a number of years. The program began in September 2001 in the ETBF and April 2003 in the SBT Fishery. Approximately 30 observers are currently employed in the AFMA observer program. They are sourced from universities and the maritime industries from around Australia and require the ability

to live and work at sea, have demonstrated experience in collecting biological data at sea, and have experience in fisheries research methodologies and collection of associated scientific data. Observers also hold marine radio operators certificate of proficiency (or similar qualifications and/or experience), a sea safety certificate and medical certificate, and have completed an AFMA observer training course.

The observer reports include details of daily fishing operations, the mitigation measures employed and any non-target interactions. In terms of ERS species, the number (and weight where appropriate) of each species caught, the life status (alive, dead, injured) and whether it was retained or discarded is recorded for each shot observed. AFMA's observer program aims to monitor 10% of SBT fishing activities and employs international (and domestic) observers in compliance with CCSBT observer standards.

In the 2006–07 quota year, observers monitored 5.6% of purse seine sets and 5.6% of the estimated SBT catch (Hobsbawn & Hender 2007). In 2006, observers also monitored 30.2% of longline sets in the ETBF during the months and in the areas of the SBT migration through that fishery (defined as the SBT core and buffer zones, updated on a fortnightly basis from a habitat preference model based on sea surface temperature, www.afma.gov.au/fisheries/tuna/etbf/mgt/zones.htm). Observers monitored 2% of longline sets in the WTBF, but only 3 vessels operated in the fishery.

In 2007–08, the purse-seine coverage was 11.8% of sets (Hobsbawn et al. 2008). In 2007, a coverage level of 22.1% of hook effort was achieved in the longline ETBF south of 30°S from May to September (the months in which SBT are usually caught). A coverage of 17.4% of operations was achieved in the WTBF in the 2007 calendar year.

In the 2008–09 quota year, observers monitored 7.9% of purse seine sets where fish were retained, and 15.3% of the estimated SBT catch. In the 2008 calendar year, observers monitored 47.9% of hooks in the ETBF during the months and in the areas of the SBT migration through that fishery. Observers monitored 16.7% of operations in the WTBF in 2008, though only one vessels operated in the fishery during this period. Note that observer coverage levels for 2008–09 are preliminary.

Vessel Monitoring System

All Australian longline vessels, including those that catch SBT, are required to operate Integrated Computer Vessel Monitoring Systems (ICVMS) whilst fishing and transiting to and from fishing grounds. This allows real-time vessel position and activity reporting to a central Vessel Monitoring Systems (VMS) operations area at AFMA.

Australian purse seine and tow vessels catching and towing SBT for the Australian farm fishery off Port Lincoln are required to report their locations and catch details on a daily basis. This may be done by ICVMS, or at sea by satellite phone, mobile phone or fax.

Port monitoring

Australian fisheries officers conduct random inspections of landings at key SBT ports, as well as at-sea boardings and inspection of vessels taking SBT in the longline and purse seine fisheries.

Compliance risk assessments for all sectors taking SBT are completed annually. Likewise, a specific compliance operational plan is developed and implemented on an annual basis for each fishery.

4. Seabirds

Seabirds are attracted to longline vessels by discarded offal and baits, and on occasion ingest baited hooks during the setting or, less commonly, hauling of longlines. Because baited hooks are not used when purse seining, the rate of seabird interactons in this sector is very low.

Oceanic longline fishing is listed as a key threatening process for seabirds under the *Environmental Protection and Biodiversity Conservation Act (1999)* (EPBC Act 1999), requiring the development of a *Threat Abatement Plan (TAP) 2006 for the Incidental Catch (or bycatch) of Seabirds during Oceanic Longline Fishing Operations* (or 'TAP') (Anon 2006). The current TAP (2006) requires the ETBF to reduce the bycatch of seabirds in oceanic longline operations and maintain a bycatch rate of less than 0.05 seabirds per 1000 hooks in all fishing areas (by 5° latitudinal bands) and season (1 September–30 April; 1 May–31 August).

AFMA has implemented fishing permit conditions that are designed to avoid the capture of seabirds. Conditions to fish south of 25°S include the mandatory use of seabird streamers or 'tori' lines to prevent seabirds from diving on line, and weighted swivels to sink the line out of reach of seabirds.

Vessel/crew responses to interactions with seabirds are mandated in the TAP, and AFMA and the fishing industry have proven the current TAP is capable of minimising interactions and dealing with the occurrence of any unusual issues.

Consistent with the objectives and prescriptions of the TAP, Australia has implemented conditions aimed at reducing seabird mortality through requirements on fishing permits. These are detailed in Section 7 of this report.

Observed seabird interactions

Southern Bluefin Tuna Fishery

There are very few recorded incidences of seabirds interacting with fishing vessels or gear in the SBT Fishery. There were no observed seabird interactions in the purse-seine sector in 2007–08 or 2008–09. In 2006–07, one white-faced storm petrel was discovered on the aft deck of a tow vessel. It was captured and later released.

Eastern Tuna and Billfish Fishery

Of the Commonwealth fisheries that interact with SBT, the only one with a substantive seabird interaction rate is the ETBF. With the implementation of the original TAP in 1998, a large proportion of the longline fleet on the east coast began to set their lines during the night to avoid interactions with albatross species. In doing so, they dramatically reduced the catch of albatross but increased the catch of shearwaters. Through a number of at-sea trials with a variety of mitigation measures, the catch of all seabirds has been reduced to a level under the 0.05 seabirds per 1000 hooks set as the performance indicator under the TAP (Table 1).

Table 1. Estimates of annual mean seabird interactions (gear contact) in 20–40°S, based on observed interactions. Lower and upper confidence bounds represent the 2.5 and 97.5 percentiles of bootstrap estimates (Lawrence et al. 2009)

Year	Mean rate (seabirds per 1000 hooks)	Lower confidence bound	Upper confidence bound
2002	0.1555	0.0911	0.2198
2003	0.1175	0.0726	0.1623
2004	0.0694	0.0322	0.1065
2005	0.0219	0.0088	0.0350
2006	0.0487	0.0242	0.0732
2007	0.0261	0.0020	0.0501

In 2006 and 2008, a number of seabird interactions were recorded in a relatively small part of the fishery. In both years, fishing in the area of high seabird interactions was restricted to night setting and mitigation measures were reviewed. The captures in the winter season of 2008 resulted in a seabird interaction rate of 0.06 seabirds per 1000 hooks in the area 30–35°S, in excess of the TAP performance limit. In response to this higher bycatch, the fishery has remained closed to daylight setting in this area. Commencing in August 2008, further research is being conducted on alternative line weighting and other mitigation methods that might allow a return to day setting.

Table 2 gives the observed interactions (where contact has been made with fishing gear) of seabirds for the Australian ETBF from 2004–08, as reported to the Western and Central Pacific Fisheries Commission (WCPFC) (Sands & Wilson 2009). Note that interactions have been reported for all observed shots in the ETBF, not only those shots in which SBT were caught.

Table 2. Observed interactions (gear contact) between seabirds species and ETBF vessels in the WCPFC Convention Area, 2004–08 (note: data are from all observed shots in the ETBF, not only those in which SBT were captured)

Seabird common name	*Longline catch (number)*					
	2004	2005	2006	2007	2008	TOTAL
Black-browed albatross	1	0	1	2	2	6
Buller's albatross	0	0	1	0	1	2
Grey-headed albatross	0	1	0	0	0	1
Shy albatross	1	0	2	0	1	4
Southern royal albatross	1	0	0	0	0	1
Wandering albatross	7	1	1	3	2	14
Albatrosses (other)	0	1	0	0	3	4
Flesh-footed shearwater	4	2	1	0	0	7
Short-tailed shearwater	4	0	0	0	0	4
Wedge-tailed shearwater	1	1	0	0	0	2
Petrels, prions and shearwaters	0	1	0	0	0	1
Cape petrel	0	4	0	3	0	7
Great-winged petrel	0	1	0	0	0	1
Great skua	0	0	0	3	0	3
TOTAL	**19**	**12**	**6**	**11**	**9**	**57**

Western Tuna and Billfish Fishery

No SBT were caught in the WTBF during the recent fishing seasons (2006–07, 2007–08, 2008–09). The prevalence of seabirds on the west coast of Australia is considerably less than that on the east coast. In addition to the lower abundance of seabirds, the majority of the fleet in the WTBF targets broadbill swordfish and therefore operates at night. While observer data are only available for recent years, when fishing activity has been very low, the data indicate that seabird interactions are below the limit of 0.05 seabirds per 1000 hooks prescribed by the TAP.

5. Non-target fish

Southern Bluefin Tuna Fishery

The purse seine fishery is highly selective and takes few non-target fish. There was no observed catch of non-target fish species in 2007–08. In 2006–07, a small amount of the byproduct species skipjack tuna (*Katsuwonus pelamis*) was caught and discarded. In 2008–09, observers reported a small catch of skipjack tuna and leatherjackets (Monacanthidae). Because the purse seine trips often exceed 20 days and there are limited freezer facilities on board, any non-target fish catch is generally discarded.

Eastern Tuna and Billfish Fishery

Table 3 provides commercial logbook records of non-target fish catch (including SBT) for the ETBF from 2004 to 2008 (Sands & Wilson 2009). Data in Table 3 were obtained from all shots regardless of whether SBT was captured or not. Less than 300 t of SBT was caught in the ETBF during this period.

Western Tuna and Billfish Fishery

No SBT were caught in the WTBF during the recent fishing seasons (2006–07, 2007–08 and 2008–09). The catch of non-target fish species in the WTBF is reported annually to the Indian Ocean Tuna Commission (IOTC) (Hobsbawn & Wilson 2008).

Sharks

Southern Bluefin Tuna Fishery

Bycatch of sharks during pole-and-line and purse seine fishing (including farm operations) for SBT is minimal. Sharks taken incidentally are able to be released before the net is retrieved and fish are transferred to tow cages. Sharks are known to interact with tow cages containing SBT being towed back to farms, and divers work to release these sharks alive. No interactions between purse-seiners sharks were observed in the SBT Fishery in 2006–07, 2007–08 or 2008–09.

Eastern and Western Tuna and Billfish Fishery

In 2000, a retention limit of 20 sharks per trip was imposed in both the WTBF and ETBF. Any sharks caught in excess of 20 are no longer classified as byproduct but become bycatch and must be discarded whether alive or dead. To reduce the capture of sharks in these fisheries, the use of wire tracers was banned in the WTBF and ETBF in 2001 and 2005 respectively (see Ward et al. 2008 for further details). Reported catches of sharks in the ETBF for 2004–08 are given in Table 3. No SBT were caught in the WTBF in 2006–07, 2007–08 or 2008–09.

Table 3. Retained non-target fish catches by ETBF vessels in the WCPFC convention area, 2004–08. Data are from commercial logbooks and include shots with 0 t SBT

Common name	*Longline catch (t)*					
	2004	2005	2006	2007	2008	TOTAL
Scalefish						
Black oilfish	79.0	84.4	64.0	101.1	75.3	403.8
Mahi mahi	304.5	189.1	117.6	101.8	148.7	861.7
Indo-Pacific sailfish	1.3	2.6	2.3	2.0	0.0	8.2
Moonfish	9.5	11.1	97.8	112.8	58.6	289.8
Northern bluefin tuna	10.3	13.0	5.5	3.8	2.7	35.3
Ocean sunfish	0.0	0.0	1.7	0.0	0.0	1.7
Oilfish	3.9	7.9	6.8	2.5	0.0	21.1
Ray's bream	6.3	29.1	6.9	60.4	39.0	141.7
Rudderfish	195.5	154.4	125.0	146.7	166.9	788.5
Shortbilled spearfish	16.9	13.5	25.8	13.0	10.6	79.8
Southern bluefin tuna	***213.7***	***37.3***	***6.3***	***6.9***	***20.8***	***285.0***
Wahoo	12.3	12.4	43.7	32.7	25.9	127.0
SUBTOTAL	853.2	554.8	503.4	583.7	548.5	3043.6
Sharks						
Blacktip sharks	6.0	3.2	3.9	2.6	0.0	15.7
Blue shark	21.9	10.6	10.3	9.0	5.7	57.5
Bronze whaler	30.4	20.0	15.2	10.8	7.5	83.9
Dusky shark	3.2	0.0	2.3	0.0	2.1	7.6
Hammerhead shark	1.5	0.0	6.9	2.4	2.5	13.3
Oceanic whitetip shark	8.6	5.9	4.4	3.7	2.0	24.6
Scalloped hammerhead	8.5	4.5	0.0	0.0	0.0	13.0
Shortfin mako	73.2	63.9	43.5	35.7	49.2	265.5
Silky shark	0.0	0.0	2.3	1.7	0.0	4.0
Smooth hammerhead	0.0	2.0	0.0	0.0	0.0	2.0
Thresher shark	1.2	1.4	0.0	0.0	0.0	2.6
Tiger shark	8.5	6.2	4.5	2.8	2.6	24.6
SUBTOTAL	163	117.7	93.3	68.7	71.6	514.3
TOTAL	**1016.2**	**672.5**	**596.7**	**652.4**	**620.1**	**3557.9**

6. Marine mammals and marine reptiles

The longline fisheries and, in particular, the SBT purse seine sector all have a very low incidence of marine mammal and reptile interactions compared with other fisheries both within Australia and throughout the world.

Southern Bluefin Tuna Fishery

No marine mammal or sea turtle interactions were observed in the SBT Fishery in 2006–07, 2007–08 or 2008–09.

Eastern Tuna and Billfish Fishery

Table 4 gives interactions (contact with gear) in the ETBF the last 5 years for observed annual estimated catches in the WCPFC convention area (Sands & Wilson 2009).

Table 4. Observed interactions (gear contact) between sea turtles, marine mammals and ETBF vessels in the WCPFC Convention Area, 2004–08 (note: data are from all observed shots in the ETBF, not only those in which SBT were captured)

Common name	**Longline catch (number)**					
	2004	2005	2006	2007	2008	TOTAL
Sea turtles						
Green turtle	0	6	1	5	1	13
Hawksbill turtle	1	0	0	1	0	2
Leatherback turtle	9	8	8	3	3	31
Loggerhead turtle	1	1	2	2	2	8
Pacific (or Olive) Ridley turtle	1	3	0	0	2	6
Turtles (other)	0	0	1	0	2	3
SUBTOTAL	12	18	12	11	10	63
Cetaceans						
Common dolphin	1	0	0	0	0	1
Humpback whale	0	1	0	0	0	1
Short-finned pilot whale	1	0	0	1	0	2
SUBTOTAL	2	1	0	1	0	4
Pinnipeds						
Australian fur seal	0	0	1	0	2	3
Australian sea lion	0	0	0	0	2	2
SUBTOTAL	0	0	1	0	4	5
TOTAL	**14**	**19**	**13**	**12**	**14**	**72**

Western Tuna and Billfish Fishery

No SBT were caught in the WTBF in the past several fishing seasons (2006–07 to 2008–09).

7. Mitigation measures to minimise seabird and other species bycatch

In December 1998, Australia's Oceans Policy established principles and actions to pursue ecologically sustainable development in Australian fisheries. The policy commitment included a requirement under the EPBC Act (1999) to prepare strategic assessment reports for all Commonwealth fisheries and those Commonwealth or State fisheries with an export component to ensure that they are managed in an ecologically sustainable manner. The reports consider the impacts of the fishery on target and non-target species caught and the impacts of fishing on the broader marine environment. Strategic assessments have been completed for the SBT Fishery, ETBF and WTBF (see http://environment.gov.au/coasts/fisheries/commonwealth/index.html), and continue to guide the development of improved management arrangements to reduce the ecological impacts of Australian fisheries catching SBT.

Measures to reduce the ecological impacts of fisheries catching SBT rely initially on the analysis of fishery-dependent and -independent data collected through observer programs, logbooks and targeted research activities. As data are collected and the impacts of SBT fishing operations on ERS become clearer, strategies to reduce these impacts continue to be developed and refined.

In this context, Australia has:

- Continued to use catch and effort logbooks to collect data on the catch of target and non-target species
- Introduced observer programs in the SBT surface fishery, and its longline fisheries targeting SBT, which include specific reporting requirements for TEP species
- Initiated a range of at-sea programs to trial strategies to reduce the incidental mortality of seabirds caught during longlining operations (e.g. by increasing line sink rates, see Table 5)
- Introduced detailed strategies to reduce bycatch and impacts on ecologically related species, performance measures to monitor progress, and reporting and review targets to assess the effectiveness of these strategies, and refine them where necessary. An important part of these strategies is the development of fishing industry codes of practice to reduce impacts on ERS (see below)

AFMA has commenced an ecological risk assessment for each of its fisheries (www.afma.gov.au/environment/eco_based/eras/reports.htm) with an aim of quantifying impacts on ecologically related species and the marine environment. The purpose of AFMA's ecological risk management is to undertake ecological risk assessments for major fisheries managed by the Australian Government and to develop a framework for future risk assessments as additional information becomes available. The results of the framework will help inform fisheries management agencies of priorities for research, data collection, monitoring and management, and ensure there is a high level of confidence in verifiable results.

The ecological risk assessments rely on existing biological and catch information and consider five ecosystem components: target species, by-product and bycatch species, TEP species, habitats, and communities. The assessments will categorise various species as being at high, medium or low risk on the basis of *inter alia* their susceptibility to capture by the various fishing methods, their distribution, and the ability for species populations to recover.

Current measures

Mandatory measures for each fleet

Mitigation measures to minimise seabird bycatch

The incidental catch (or bycatch) of seabirds during oceanic longline fishing operations was listed as a key threatening process on 24 July 1995. Under Commonwealth legislation (now the EPBC Act 1999), the *Threat Abatement Plan (TAP) 2006 for the Incidental Catch (or bycatch) of Seabirds during Oceanic Longline Fishing Operations* (TAP) was prepared and approved by the Minister for the Environment on 2 August 1998. A review of the TAP was carried out under subsection 279(2) of the EPBC Act and a new TAP was approved in 2006 (Anon 2006). The provisions of the 2006 TAP apply to all longline fisheries managed by the Australian Government.

In the 2006 TAP the following mitigation actions are prescribed:

1. AFMA will require all pelagic longline tuna fishers operating within the ETBF south of latitude 25°S to adopt one of two options:
    a. a line-weighting strategy that enables the bait to be rapidly taken below the reach of most seabirds; or
    b. set all hooks during the night
    c. in both options, vessels will also employ at least one seabird scaring (‘tori’) line constructed to a specified standard, not use bait that is still frozen and retain all offal during line setting
2. AFMA will require all pelagic longline tuna fishers operating within the WTBF south of latitude 30°S to set all hooks during the night. In addition, vessels will also employ at least one seabird scaring line constructed to a specified standard, not use bait that is still frozen and retain all offal during line setting
3. AFMA will require domestic and foreign longline vessels in all demersal fisheries operating within Australian jurisdiction to adopt proven mitigation measures that ensure the performance criteria for each fishery are achieved in all areas and seasons
4. AFMA will implement an appropriate management response if data analysis indicates that the criteria defined in the 2006 TAP have not been met in any area, season and fishery, or that observer coverage has dropped below the performance criteria for each fishery (Anon 2006).

Mitigation measures to minimise shark bycatch

Australia has developed a National Plan of Action for the Conservation and Management of Sharks (Shark-plan 2004) in line with the FAO International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks). Accordingly, regulations have been put in place in the longline sector to minimise shark bycatch and prevent indiscriminate finning.

The regulations applying to the ETBF and WTBF are:

- A ban on the use of wire leaders
- A limit of 20 sharks per trip, excluding school shark, gummy shark, elephantfish (Callorhinchidae), chimaerids (Chimaeridae and Rhinochimaeridae) and sawshark. This limit does not apply to great white sharks and grey nurse sharks, which are no-take TEP species
- Fishing permit holders are prohibited from carrying, retaining, or landing all shark dorsal, pectoral, caudal, pelvic and anal fins that are not attached to their carcass

- Fishing permit holders are prohibited from carrying, retaining and landing livers obtained from sharks unless the individual carcasses from which the livers were obtained are also landed

Mitigation measures to minimise sea turtle bycatch

Interactions between sea turtles and pelagic longline fisheries in the AFZ are rare. Guidelines for mitigating the impact of longline fisheries on sea turtles are described under 'Voluntary measures for each fleet'. Interactions with the purse seine fishery are negligible and there has been no need to develop mitigation measures for this sector.

Mitigation measures to minimise fish bycatch

Effective from 27 July 1998, the commercial take of blue and black marlin was banned under the *Fisheries Management Act 1991*. Regulations specified that blue and black marlin must be returned to the water irrespective of life status.

Compliance monitoring system

AFMA's observer program currently places observers on domestic and, if required, foreign vessels fishing within the AFZ and some adjacent areas under international arrangements. Observers are trained in specialised sampling techniques including environmental observations, and are briefed to educate fishers on their responsibilities to complete logbooks and other data sources, and to use mitigation strategies to reduce impacts on ERS.

AFMA has a responsibility to enforce the provisions of the *Fisheries Management Act 1991* and the *Torres Strait Fisheries Act 1984* through the detection and investigation of illegal activities by both domestic and foreign fishing boats in the AFZ and Commonwealth-managed fisheries. The Australian Customs and Border Protection Services also patrol waters in the AFZ as part of the Australian Government's anti-illegal fishing strategy.

Voluntary measures for each fleet

'Industry codes of practice' are in place for a number of fisheries. These include voluntary bycatch mitigation measures together with handling and release guidelines for seabirds, including:

- Puncturing of swim bladders of thawed baits to increase sinking rates
- Gear selection that minimises the probability of seabird bycatch
- Promoting safe handling and release of seabirds caught alive on longlines

AFMA has run a 'seabird bycatch education program' in the ETBF to teach fishers about fishing practices designed to minimise seabird bycatch, effective line weighting, and correctly assembling/deploying tori lines.

A recovery plan for sea turtles in Australia has been developed by the Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA). The overall objective of the plan is to reduce the detrimental impacts on Australian populations of marine turtles and hence promote their recovery in the wild. A copy of the Plan can be obtained from www.environment.gov.au.

A video 'Crossing the line: sea turtle handling guidelines for the longline fishing industry' was recently produced by the Fisheries Research and Development Corporation to help the Australian longline fishing industry minimise its impact on sea turtle populations. It shows how to use de-

hooking devices on deck and on turtles still in the water, how to safely bring turtles aboard and handle them on deck, help comatose turtles recover and how to release them back into the water. It also explains how to tag, measure and identify the different species of turtle.

Circle hooks are not currently mandatory in Australia's pelagic longline fisheries. AFMA will be considering the impact of such a measure in light of potential implications that such an action may have upon other bycatch species, primarily sharks, in 2009.

Measures under development/testing

Australia has conducted a number of scientific trials to reduce seabird bycatch, including a variety of line-weighting trials, methods to increase line sink rates and an underwater bait setting machine (Table 5). Scientific studies have been conducted to investigate the most appropriate minimum sink rate of line, differences in the sink rates of live and dead baits, the sink rates of different stages of thawed bait and a variety of weighted branchline arrangements.

Results have been variable but have indicated that weighted lines is amongst the most effective mitigation measures for all seabirds and can be complemented by other measures, such as offal management and use of tori lines. Night setting is also very effective at reducing albatross bycatch.

Operators are also encouraged to develop and experiment with mitigation measures to suit their own situations and vessels.

Recent research on wire and nylon leaders indicated that catch rates of sharks are reduced when nylon leaders are used (Table 5; Ward et al. 2008); conversely, catch rates of sharks increase when circle hooks rather than tuna hooks are used (Table 5; Ward et al. 2009).

Despite the comparatively rare occurrence of interactions between pelagic longliners and sea turtles within the AFZ, the Australian Government has recognised the potential for these interactions to threaten the survivability of the species. Recent research quantified the relative effects of circle and tuna hooks on catches of target and common non-target species (Table 5). Although not designed to compare capture rates of sea turtles on circle and tuna hooks (owing to the rarity of sea turtle interactions in Australian longline fisheries), results demonstrated that higher catch rates of target species were attained when circle hooks were used (Table 5; Ward et al. 2009).

Table 5. Mitigation measures to reduce the incidental catch of non-target species under development/testing in Australia

Mitigation measure	Lead agency and collaborators	Results to date	Planned development/testing	Expected completion
Seabirds				
Underwater bait setting machine	Australian Antarctic Division (AAD), Amerro Engineering (AE) and ETBF Operators	na	Stage 1: Oct 2006–Jul 2009: R&D; initial operational testing of prototype unit (Mk1) (AE; AAD) Stage 2: Aug 2009: Testing Mk1 unit in ETBF under normal operational fishing Stage 3: Build Mk2 version of underwater setting machine; scheduled late 2009 Stage 4: Undertake normal (ie commercial) operational fishing trials of Mk2 machine under 100% observer coverage; scheduled 2010 Stage 5: Scheduled for spring 2010. Conduct a controlled experiment on a chartered fishing vessel (the vessel will not be catching fish) to compare and evaluate the underwater setting machine with other setting methods, including stern and side setting, to determine the most seabird-friendly method of setting longlines in pelagic longline fisheries	Ongoing
Weighting regimes	AFMA and ETBF operators	na	Trialing different weighting regimes, (38 g, 60 g swivel) for use with double tori lines	Completed
New tori line design	**AFMA/SEANET and ETBF operators**	**A new tori line has been designed and distributed to all ETBF and WTBF operators**	**Design consists of a 100 m backbone from which paired and double-paired streamers form a curtain to the water**	**Ongoing**

Table 5 (cont'd). Mitigation measures to reduce the incidental catch of non-target species under development/testing in Australia

Mitigation measure	Lead agency and collaborator	Results to date	Planned development/testing	Expected completion
Seabirds (cont'd)				
Methods to increase line sink rates	**AAD**	**Key results to date:** **1. Provided bait is thawed sufficiently to be placed on a hook, further thawing of baits does not significantly alter branch line sink rates, contrary to the results of earlier preliminary research** **2. Use of a line shooter is not necessarily beneficial to achieving faster line sink rates for pelagic longlines, and it cannot be regarded as a mitigation measure in all circumstances. Lines set by a line shooter that produces more than a minimal amount of slack line, such as during "deep setting", sink more slowly than tauter set lines, due to the slack line being buoyed by propeller turbulence. It is important to avoid setting line into propeller turbulence and to avoid excessive slack line**	**A range of research is being undertaken to evaluate the factors, including gear, that affect line sink rates. Research includes examining the effects of line shooters and propeller turbulence on mainline tension and line sink rates; and the sink rates of frozen versus different stages of thawed baits. Following tank testing and initial field work, operational fishing trials are to commence in the ETBF to examine the effects on catch rates of target and non-target species by adding more weight to branch lines and moving the weight closer to the hook. The trials will test a faster sinking gear (120 g weight within 2.0 m of the hook) against the current standard (60 g within 3.5 m of the hook)**	**Ongoing**

Table 5 (cont'd). Mitigation measures to reduce the incidental catch of non-target species under development/testing in Australia

Mitigation measure	Lead agency and collaborator	Results to date	Planned development/testing	Expected completion
Sharks				
The effects of wire-leaders on longline catch rates	BRS and AFMA	Large numbers of animals are lost when they bite through nylon leaders. There is uncertainty over the species composition of that component of the catch and their fate (Ward et al. 2008)	Observers monitored 177 longline fishing operations in 2005–06, involving equal numbers of wire and nylon monofilament leaders. Results indicated reduced shark catch rates and elevated bigeye tuna catch rates on the nylon compared with wire leaders	Completed
Sea turtles				
The effects of circle hooks on longline catch rates	**BRS, Belldi Consultancy and AFMA**	**Not designed to investigate the efficacy of circle hooks in reducing sea turtle bycatch: turtle interactions quite rare in Australian longline fisheries. Four turtles were caught: 3 on circle hooks and 1 on a tuna hook. Scalefish and shark catches were considerably higher on circle compared with tuna hooks (Ward et al. 2009)**	**Observers monitored 16 trips on longliners from 2005–08, testing the effects of circle hooks on longline catches**	**Completed**

8. Public relations and education activities

Public relations activities

All mitigation strategies in place or being trialled by Australia to reduce impacts of SBT fishing on ERS include a level of education and extension to increase their effectiveness. Specific activities to educate fishers on ERS issues are included in the TAP, National Plans of Action for Sharks, and Bycatch Action Plans for both the tuna purse seine and longline fisheries. AFMA's Resource Assessment Groups and Management Advisory Committees are valuable forums in which industry, government, non-government and other stakeholders can discuss current and emerging mitigation strategies.

In addition, observers are briefed to educate fishers on their responsibilities to complete logbooks and other data sources, and to use mitigation strategies to reduce impacts on ERS. This information is passed onto vessel masters and crews during observer trips and while in port. Staff from AFMA are regular visitors to key SBT fishing ports and engage in education and extension activities during these visits. AFMA also provides education materials in the form of brochures, fact sheets, communication post cards, media releases and other written material for extension to fishers and the general public. A large amount of material is made available through the websites of AFMA and the Fisheries Research and Development Corporation (FRDC). Industry representatives are continuing to refine existing codes of practice to reduce the environmental impacts of Australian tuna fisheries.

Communication (media releases, published material, video, public presentations)

AFMA provides education materials in the form of booklets, posters, media releases, educational videos and other written material for further education of vessel skippers and crews. Industry and the general public are able to subscribe to AFMA for electronic media releases and be informed of upcoming extension activities in their local area. A large amount of material is made available through the websites of AFMA and the FRDC: see www.afma.gov.au/environment/default.htm and www.frdc.com.au/shop/ for further information. Media releases and other publications are archived at www.afma.gov.au/information/default.htm.

Education

Training of fishers

Specific activities to educate fishers on ERS issues are included in the TAP, National Plans of Action for sharks and Bycatch Action Plans for both the tuna purse seine and longline fisheries, and in the Ecological Risk Assessment project.

In addition, Australian observers are briefed to educate fishers on their responsibilities to complete logbooks and other data submission obligations, and in the requirements for, and use of, mitigation strategies to manage impacts on ERS. This information is passed onto vessel skippers and crews during observer trips and while in port.

A series of voluntary training workshops for ETBF operators about bycatch handling, reporting and mitigation is underway. The program is a key initiative under the Australian Tuna and Billfish Longline Fisheries Bycatch and Discarding Workplan, which came into effect on 1 November 2008. Through the program, on-shore workshop sessions and on-board demonstrations will provide training to vessel owners, skippers, crew and shore managers on their obligations in relation to bycatch.

This includes:

- Logbook reporting requirements
- Handling practices
- Mitigation measures—in particular, the importance of using tori lines and other deterrent methods to reduce seabird interactions.

Managers

The Australian Government is committed to the ecologically sustainable development of Australian fisheries and all associated international commitments. On-the-job and specific training is provided to meet this commitment.

Observers

AFMA has recruited and trained scientific observers since its establishment in 1992. Observers complete an AFMA training course before deployment, and are briefed to educate fishers on their responsibilities to complete logbooks and other data sources, and to use mitigation strategies to reduce impacts on ERS. Observers are sourced from universities and maritime industries from around Australia and require the ability to live and work at sea, have demonstrated experience in collecting biological data at sea, and have experience in fisheries research methodologies and collection of associated scientific data.

Information exchange

Australia is committed to its data exchange obligations, and information exchange in general, and actively encourages open and transparent regional approaches in line with the revised requirements for CCSBT member's annual report to ERSWG, and the Recommendation to Mitigate the Impact on Ecologically Related Species of Fishing for Southern Bluefin Tuna, adopted at the 15th meeting of the Commission in October 2008.

Australia's commitment is also evident in the priority given to meeting data exchange obligations to the Western and Central Pacific Fisheries Commission (WCPFC), Indian Ocean Tuna Commission (IOTC) and the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).

9. Information on other ERS (non-bycatch) such as prey and predator species

In 2001 AFMA initiated the project Ecological Risk Assessment for Commonwealth Fisheries (ERACF). This project is undertaking ecological risk assessments (ERAs) that look at the impact, both direct and indirect, of fisheries activities on all aspects of the marine ecosystem, which includes prey and predator species. This work forms part of a move to ecosystem-based fisheries management by AFMA.

The ERA framework details a process for assessing and progressively addressing the impacts that fisheries' activities have on five aspects of the marine ecosystem, including:

- Target species
- Bycatch and byproduct species
- Threatened, endangered and protected (TEP) species

- Habitats
- Communities

A number of ERAs for Australian Government-managed fisheries are now publicly available, with the remainder scheduled for release in the near future (www.afma.gov.au/environment/eco_based/eras/reports.htm). The ERAs assist fisheries managers to prioritise research, and guide data collection, monitoring and future management decisions.

10. Other

Not applicable.

11. Implementation of the IPOA-Seabirds and IPOA-Sharks

Australia endorsed the IPOA-Seabirds, and agreed to undertake a national assessment of longline fisheries to determine seabird bycatch rates. The Australian longline fisheries that principally interact with seabirds operate in Commonwealth waters, which generally refers to waters from 3 nautical miles offshore to the extent of Australia's EEZ. To manage these interactions, Australia has put in place the *Threat Abatement Plan (TAP) 2006 for the Incidental Catch (or bycatch) of Seabirds during Oceanic Longline Fishing Operations*. The TAP is a legislative instrument that directs mandatory seabird bycatch management measures. It was first introduced in 1998 and was revised in 2006, and applies to all longline fisheries managed by the Australian Government. The 2006 TAP is Australia's key national measure for mitigating the impact of longline fisheries on seabird populations, and is consistent with the IPOA-Seabirds.

Australia produced a Shark-plan in 2004. The Australian Government Department of Agriculture, Fisheries and Forestry has responsibility for overseeing the implementation and review of the Shark-plan. The Shark-plan was developed by a Shark Advisory Group comprising representatives from the:

- Relevant Australian Government and state and territory agencies
- Commercial fishing industry
- Recreational fishing groups
- Indigenous groups
- Scientific agencies
- Conservation groups

The Shark-plan was supported by the findings of the Shark-plan Assessment Report, completed in 2001.

The Shark-plan recognises that while Australia is not a major shark fishing nation, sharks are an important part of the total quantity of Australia's wild fish production and that Australian vessels regularly take sharks as target and non-target catch.

In addition to commercial fishing, sharks may be captured by recreational fishers, shark control devices for bather protection and the aquarium trade. Sharks are also of cultural and spiritual significance to Australian Indigenous people.

Sharks are valued for their ecological role in the marine ecosystem, in which they are apex predators. Legislation in some states and the Commonwealth provides for the listing and protection of threatened shark species. Currently there are nine shark species that are protected in Australian waters.

The Shark-plan aims to address shark conservation and management issues through six key themes:

- Reviewing existing conservation and management measures
- Improving conservation and management measures
- Changes to data collection and handling
- Research and development
- Education or awareness raising
- Improved coordination and consultation.

The Shark-plan will be reviewed during 2009 and 2010.

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