



Australian Government
Department of Agriculture
ABARES

Australian Country Report

Ecologically Related Species in the Australian Southern Bluefin Tuna Fishery 2012–13 and 2013–14

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**Research by the Australian Bureau of Agricultural
and Resource Economics and Sciences**

February 2015



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Cataloguing data

This publication (and any material sourced from it) should be attributed as: Patterson, HM, Hobsbawn, PI & Stobutzki, I 2015, *Australian Country Report: Ecologically related species in the Australian southern bluefin tuna fishery 2012–13 and 2013–14*, report for the CCSBT Ecologically Related Species Working Group, ABARES, Canberra, February. CC BY 3.0

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Acknowledgements

The authors thank Scott Hansen (ABARES), Rupert Summerson (ABARES), Matt Daniel (AFMA), Jonathon Barrington (Australian Antarctic Division), Mat Kertesz (Department of the Environment) and Erin Tomkinson (Department of Agriculture) for their input and comments on this report. Work was funded by Fisheries Resources Research Fund and ABARES.

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Summary

Purpose

This report includes information and data on ecologically related species (ERS) from Australia's southern bluefin tuna (SBT) fishery for the 2012–13 fishing season and, where available, for the 2013–14 fishing season. Data for the 2013–14 fishing season is preliminary and may be updated in future reports.

Catch and effort

Australian SBT catches for the 2013 and 2014 calendar years were 4524 t and 5240 t, respectively. The 2012–13 quota year catch was 4539 t, and the 2013–14 quota year catch was 5420 t. Catches for the 2011–12 quota year exceeded the quota by 34.6 t; Australia voluntarily reduced its 2012–13 TAC by the same amount (34.6 t).

In 2012–13, 25 vessels landed SBT in Australian waters: 92.5 per cent of the catch was taken by five purse seiners off South Australia, with the remainder taken by 19 longliners in the Eastern Tuna and Billfish Fishery (ETBF) and one longliner in the Western Tuna and Billfish Fishery (WTBF).

Observer coverage

In the 2012–13 fishing season, the purse-seine observer coverage was 12.7 per cent of sets, representing 14 sets observed where SBT were retained and one aborted set where fish were reported as too small. In 2013, observers monitored 22.5 per cent of shots where SBT was caught in the ETBF. There was no observer coverage in the WTBF in 2013.

In 2013–14, purse-seine observer coverage was 17.0 per cent of sets, representing 16 sets observed where SBT were retained and one aborted set because of net damage. Longline observer data for 2014 are not yet available.

Interactions with ERS

Details of ERS interactions in the SBT fishery and ETBF and WTBF are provided in the report. Interactions in the ETBF are for only those shots where SBT was taken as SBT is targeted only at certain locations and time periods. Interactions with seabirds, sharks, non-target fish and marine mammals are reported for the ETBF and WTBF where data are available. No ERS interactions were reported for the purse seine SBT fishery.

Mitigation measures

Australia has implemented mitigation measures to address seabird and turtle bycatch in the longline fisheries to ensure the best practice mitigation measures are in place. These measures are provided in detail.

1 Introduction

Three domestic fisheries managed by the Australian Government interact with southern bluefin tuna (SBT; *Thunnus maccoyii*) in varying quantities: the Southern Bluefin Tuna Fishery (SBTF), the Eastern Tuna and Billfish Fishery (ETBF) and the Western Tuna and Billfish Fishery (WTBF). The SBTF targets SBT in the Great Australian Bight using purse seine, with the fishing season running from 1 December to 30 November¹. After capture, the SBT are transferred to grow-out cages and fattened for up to approximately 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*), swordfish (*Xiphias gladius*) and striped marlin (*Tetrapturus audax*). Longlining for SBT occurs primarily in the Australian winter months between May and October in the ETBF. The fishing season in the WTBF begins on 1 February each year, while in the ETBF the fishing season begins on 1 March. Because the three 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 protected species under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999)). The purse seine fishery has very little interaction with ERS as the purse seine fishing method is highly selective. The longline fisheries are multi-species fisheries that, while being relatively selective, catch a range of fish and shark species and have reported interactions with seabirds and, to a lesser extent, marine turtles. A reduction in discarding of species with little commercial value has been a focus of management initiatives. For example, in 2000 the Australian Fisheries Management Authority (AFMA) implemented Bycatch Action Plans for the SBTF, WTBF and ETBF. Since 2008, a bycatch and discarding program has been in place to deal with bycatch issues and develop workplans for each fishery (<http://www.afma.gov.au/managing-our-fisheries/environment-and-sustainability/Bycatch-and-Discarding>).

Australia has made considerable investments to mitigate the rate of seabird, turtle and shark interactions and capture during longline fishing operations. Through government and industry initiatives, the incidence of seabird bycatch during longline operations has declined in recent years (e.g. Hansen et al. 2014). Australia has also completed research on mitigation measures to reduce the capture of sharks and marine turtles in longline fisheries (Ward et al. 2008, 2009).

This report includes information and data on ecologically related species (ERS) from Australia's SBT fishery for the 2012–13 fishing season and, where available, for the 2013–14 fishing season. Data for the 2013–14 fishing season are preliminary and may be updated in future reports.

¹ Various time periods, such as 'calendar years', 'fishing seasons' and Australian 'quota years', can be used when describing Australia's SBTF. 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 SBT began in the early 1950s off New South Wales and South Australia and then later, in 1970, off Western Australia. The catch, then 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-based management plan in the Australian SBTF 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 of quota distribution. Since 1992 there has been a progressive increase in the proportion of SBT taken under farming operations. Currently, about 93 per cent of the Australian SBT 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 arrangement 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 farms for mariculture.

Historically, there has been longlining for SBT off Tasmania and Western Australia, with occasional catches in South Australian waters. There were also some purse seine, trolling and poling operations in the offshore waters of the Australian Fishing Zone (AFZ). Currently, longlining in which SBT is taken occurs primarily off south eastern New South Wales during the winter months (May to October), in core and buffer zones (described below) which move as the SBT migrate.

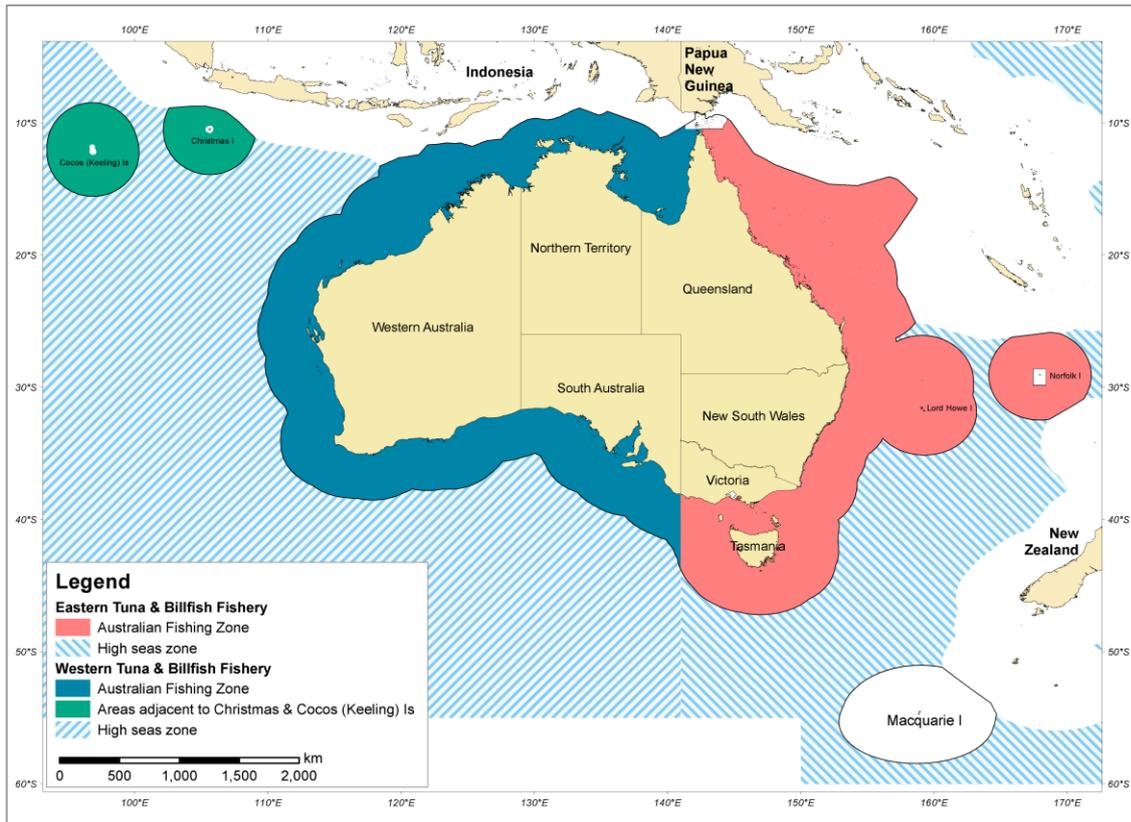
Current fleet size and distribution

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 SBTF encompasses the entire AFZ and extends onto the high seas (Figure 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 purse seine fleet operating out of Port Lincoln, South Australia, and longline fleets operating off eastern and western Australia, which take SBT as a byproduct of fishing for other tuna and billfish species. To longline in these areas, operators are required to have a Boat Statutory Fishing Right in either the ETBF or WTBF, hold uncaught quota for SBT and meet observer requirements. Management measures in terms of gear restrictions and bycatch are managed separately in these fisheries.

The purse seine fleet operating out of Port Lincoln currently (2012–13) takes about 93 per cent of the total SBT commercial catch, fishing in the Great Australian Bight. The SBT are towed back to Port Lincoln, transferred into grow-out pontoons and farmed for a period of time before harvest. In 2012–13 and 2013–14, SBT were also landed by longline in the ETBF off New South Wales and a small amount of SBT was taken by longline off Western Australia in the WTBF.

Figure 2 Area of Australia's Eastern and Western Tuna and Billfish Fisheries



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 (Figure 2). 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 10 days.

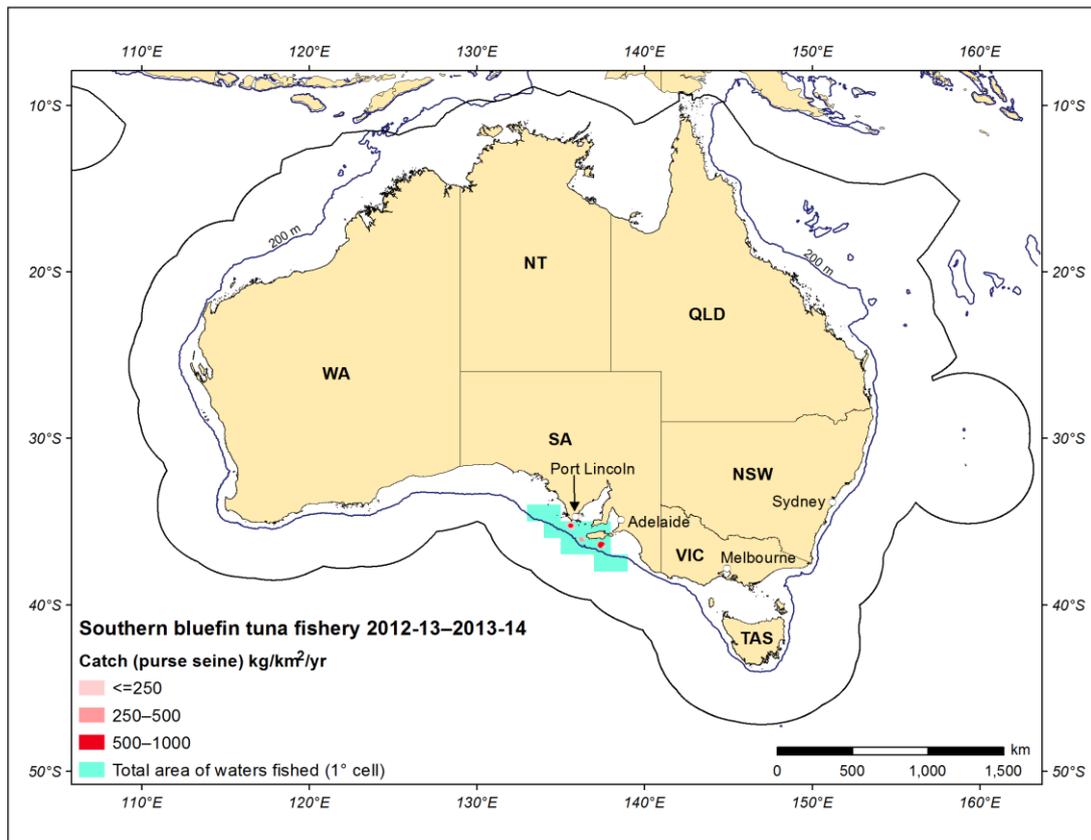
The *Western Tuna and Billfish Management Plan 2005* came into effect on 12 November 2006. The WTBF Plan removes the internal barrier at 34°S, which had previously separated the Southern and the Western Tuna and Billfish Fisheries, and renamed the entire area the 'Western Tuna and Billfish Fishery'. The WTBF Plan provides for a system of individual transferable quota SFRs, 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 TACC for the relevant species.

Distribution of catch and effort

The Australian domestic SBT catches for the 2013 and 2014 calendar years were 4524 t and 5240 t, respectively. The 2012–13 quota year catch was 4539 t, and the 2013–14 quota year catch was 5420 t. Catches for the 2011–12 quota year exceeded the quota by 34 t; Australia voluntarily reduced in 2012–13 TAC by the same amount.

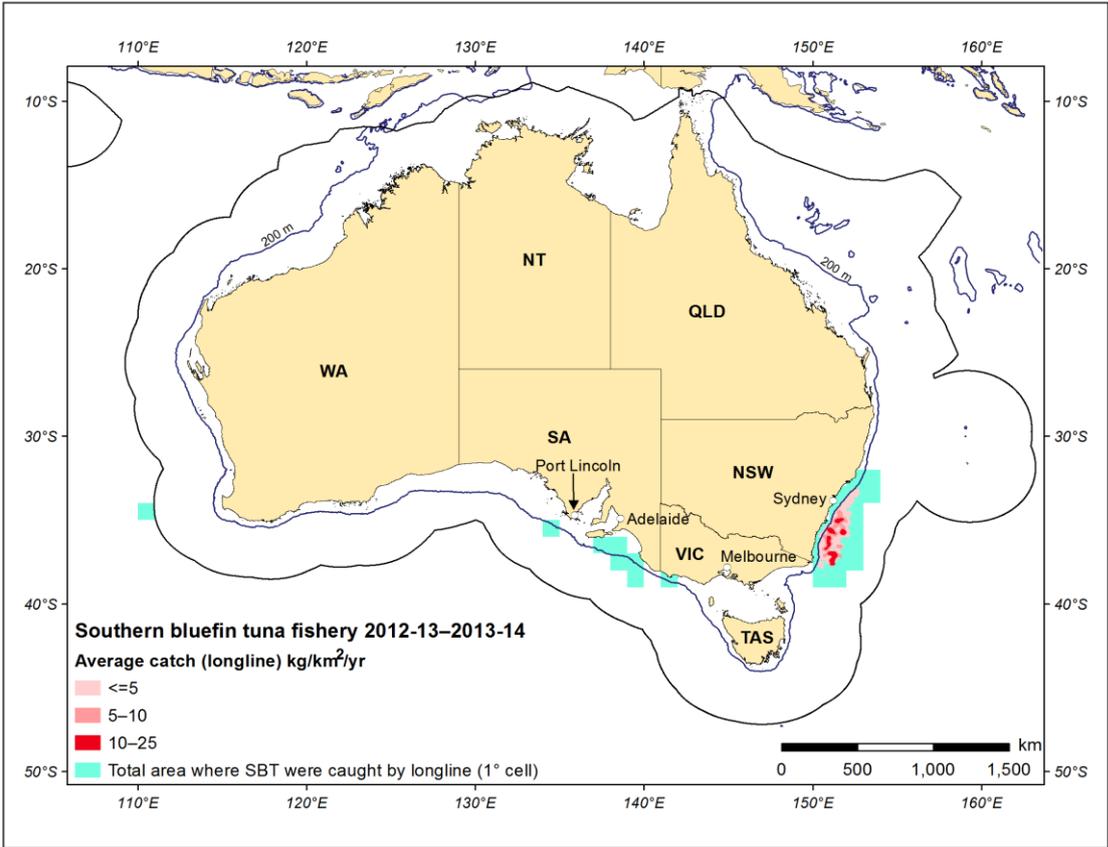
In 2012–13, 25 vessels landed SBT in Australian waters: 92.5 per cent of the catch was taken by five purse seiners off South Australia. The remainder of the catch was taken by 19 longliners in the ETBF and one longliner in the WTBF deploying a total of 292 501 hooks (in 2013) for shots that caught SBT (Figures 3a and 3b²).

Figure 3a Location of SBT catch by purse seine in 2012–13 and 2013–14.



² SBT catch has been filtered so that only operations from a total of five or more vessels over the time period from 2012–13 and 2013–14 are shown. The catch was first aggregated using a kernel density algorithm at a spatial resolution of 25 km square. A neighbourhood analysis was then carried out on the same data and at the same spatial resolution; only the cells where five boats or more operated were then used to make the final map of catch per units of area. The footprint shows grid cells at a spatial resolution of one degree (111 km square) where vessels have reported catch during the time period.

Figure 3b Location of SBT catch by longline in 2012–13 and 2013–14.



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 <http://www.afma.gov.au/services-for-industry/logbooks-and-catch-disposal/current-logbooks-and-catch-disposal-records/>

All of the data provided in logbooks and catch disposal records must be supplied to AFMA within specified time periods. Verification of these data is undertaken through observer programs and, as a minimum, through an annual audit process undertaken by AFMA. In addition, specific reporting forms for protected species under the EPBC Act 1999 (e.g. seabirds, marine mammals etc) are included with the fishery-specific logbooks in all Australian Commonwealth fisheries.

Observer programs

Observer programs for the purse seine and longline fisheries have been in place for a number of years. The observer program began in 2001 in the ETBF and 2003 in the WTBF and SBTF. Approximately 15 observers are currently employed in the AFMA observer program. They are sourced from universities and the maritime industries 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 must complete an AFMA observer training course.

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

In the 2012–13 fishing season, the purse-seine coverage was 12.7 per cent of sets, representing 14 sets observed where SBT were retained and one aborted set where fish were reported as too small, and 13.9 per cent of the estimated SBT catch. In 2013, observers monitored 22.5 per cent of shots where SBT was caught in the ETBF. There was no observer coverage in the WTBF in 2013. Observer data from the longline fisheries are not yet available for 2014.

In the 2013–14 fishing season, observers monitored 17.0 per cent of purse seine sets, representing 16 sets observed where SBT were retained and one aborted set because of was net damage, and 21.9 per cent of the estimated SBT catch.

Vessel Monitoring System

All vessels operating in the SBTF, ETBF and WTBF are required to operate Integrated Computer Vessel Monitoring Systems (ICVMS) while 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 SBT purse seine and tow vessels 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 can be attracted to longline vessels by discharged offal and baits, and on occasion ingest baited hooks during the setting or, less commonly, hauling of longlines. Bait is not used when purse seining, therefore the rate of seabird interactions in this sector is very low.

Oceanic longline fishing is listed as a key threatening process for seabirds under the EPBC Act 1999, requiring the development of a Threat Abatement Plan (TAP) for the Incidental Catch (or bycatch) of Seabirds during Oceanic Longline Fishing Operations (Commonwealth of Australia 2014). The current TAP (2014) requires the ETBF and WTBF 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 southwards of the parallel of 25°S (by 5° latitudinal bands) and season (1 September–30 April; 1 May–31 August).

Australia has implemented permit conditions on fishing operators that are designed to prevent the capture of seabirds. For example, Australian vessel fishing south of 25°S must deploy bird-scaring lines (streamers), known as ‘tori’ lines, to deter seabirds from diving on the line and line weighting to quickly sink the line out of reach of seabirds.

Vessel/crew responses to interactions with seabirds are mandated in the TAP (2014). 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 purse-seine gear in the SBTf. There have been no observed seabird interactions in the purse-seine sector since the 2007–08 fishing season.

Eastern Tuna and Billfish Fishery

The ETBF does interact with seabirds, although the current interaction rate is low. With the implementation of the TAP, 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 reduced the probability of catching albatross but increased the probability of catching 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 (Lawrence et al. 2009).

There were no observed seabird interactions in the Australian ETBF in 2013 (Table 1). Observer data for the ETBF in 2014 is not yet available. Seabird interactions occurring in the ETBF are reported annually to the Western and Central Pacific Fisheries Commission (WCPFC; e.g. Hansen et al. 2014).

Table 1 Observed interactions between seabird species and ETBF vessels (CCSBT statistical area 4) in 2013. Data for 2014 are not yet available. Capture and mortality rates are given as per thousand hooks. Note: data are from shots in the ETBF where SBT were caught. Scientific names are given in Appendix IV.

ETBF (2013)		Observed							Estimate
Species	Total effort (no. hooks)	Total observed effort (no. hooks)	Observer coverage (% no. hooks)	Captures (number)	Capture rate (per 1000 hooks)	Mortalities (number)	Mortality rate (per 1000 hooks)	Live releases	Estimated total mortalities (raised to total effort)
Nil	289 501	65 251	22.5%	0	0.000	0	0.000	0	0.000

Western Tuna and Billfish Fishery

Small amounts SBT were caught in the longlining operations of the WTBF in 2012–13 and 2013–14. However, there was no observer coverage in the WTBF in 2013 and observer data for 2014 are not yet available.

The prevalence of seabirds on the west coast of Australia is considerably less than that of the east coast. In addition to the lower abundance of seabirds, the majority of the fleet in the WTBF targets swordfish and therefore sets 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 (2014).

Non-observed seabird interactions

Southern Bluefin Tuna Fishery

No seabird interactions have been recorded in logbooks for the purse-seine fishery.

Eastern Tuna and Billfish Fishery

Fishers in the ETBF encounter SBT during a limited time of the year when SBT migrate into the ETBF area, typically May to October. In addition, fishing for SBT is permitted only in designated areas. To minimise the risk of non-quota take of SBT by longliners off New South Wales, access to the waters through which SBT migrate has been restricted to only vessels holding SBT quota. This arrangement has resulted in a significant reduction in longline effort in southern areas, and corresponding reductions in seabird and bycatch species interactions. There were no seabird interactions in 2013 or 2014 in shots where SBT was caught recorded in the logbooks.

Western Tuna and Billfish Fishery

Small amounts of SBT were caught in longline operations in the WTBF during the reported fishing seasons (2012–13 and 2013–14). There were no seabird interactions in 2013 or 2014 in shots where SBT was caught recorded in the logbooks. Seabird interactions occurring in the WTBF are reported annually to the Indian Ocean Tuna Commission (IOTC) (e.g. Hobsbawn et al. 2014).

5 Non-target fish

Observed and non-observed fish interactions

Southern Bluefin Tuna Fishery

The purse seine fishery is highly selective and takes few non-target fish. Because purse seine trips often exceed 20 days and there are limited freezer facilities on board the vessels, any non-target fish catch is generally discarded alive. There was no observed non-target catch for the 2012–13 and 2013–14 fishing seasons and no non-target fish catch was reported in logbooks.

Eastern Tuna and Billfish Fishery

Table 2 provides observed non-target catch in the ETBF for 2013. Observer data for 2014 are not yet available. Tables 3a and 3b provide the non-target scalefish catch recorded in logbooks. Again, only non-target fish captured during shots that captured SBT are provided.

Western Tuna and Billfish Fishery

Small amounts of SBT were caught in the longline operations of the WTBF during the recent fishing seasons (2012–13 and 2013–14). However, there was no observer coverage in the WTBF in 2013 and observer data for 2014 are not yet available. Unobserved catch of non-target fish species in the WTBF is provided in Tables 4a and 4b (although there was no non-target fish catch of adequate numbers in 2013) and is also reported annually to the IOTC (e.g. Hobsbawn et al. 2014).

Table 2 Observed interactions between non-target scalefish species and ETBF vessels (CCSBT statistical area 4) in 2013. Observer data for 2014 in the ETBF are not yet available. Capture and mortality rates are given per thousand hooks. Note: data are from shots in the ETBF where SBT were caught and only species where 10 or more individuals were caught are reported. Scientific names are given in Appendix IV.

ETBF		Observed							Estimate
Species	Total effort (no. hooks)	Total observed effort (no. hooks)	Observer coverage (% no. hooks)	Captures (number)	Capture rate (per 1000 hooks)	Mortalities (number)	Mortality rate (per 1000 hooks)	Live releases	Estimated total mortalities (raised to total catch)
Escolar	289 501	65 251	22.5%	54	0.828	29	0.444	24	128.889
Ocean sunfish	289 501	65 251	22.5%	38	0.582	0	0	38	0.000
Oilfish	289 501	65 251	22.5%	19	0.29	10	0.153	9	44.444

Table 3 Unobserved interactions (logbooks) between non-target scalefish species and ETBF vessels (CCSBT statistical area 4) in (a) 2013 and (b) 2014. Capture and mortality rates are given per thousand hooks. Mortalities and mortality rates are based on the number of retained individuals. Releases indicate the number of individuals released, but life status at the time of release is unknown. Note: data are from shots in the ETBF where SBT were caught and only species where 10 or more individuals were caught are reported.

a) Species 2013	Total effort (no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Releases
Escolar	289 501	56	0.193	14	0.048	42
Lancet fish	289 501	71	0.245	0	0.000	71
Mahi mahi	289 501	37	0.128	37	0.128	0
Ocean sunfish	289 501	29	0.100	1	0.003	28
Ray's bream	289 501	54	0.187	54	0.187	0
Rudderfish	289 501	100	0.345	75	0.259	25

b) Species 2014	Total effort (no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Releases
Escolar	230 006	17	0.074	15	0.065	2
Lancet fish	230 006	135	0.587	0	0.000	135
Mahi mahi	230 006	338	1.470	335	1.464	3
Ocean sunfish	230 006	26	0.113	0	0.000	26
Ray's bream	230 006	123	0.538	123	0.538	0
Rudderfish	230 006	79	0.343	58	0.252	21

Table 4 Unobserved interactions (logbooks) between non-target scalefish species and WTBF vessels (CCSBT statistical area 2) in (a) 2013 and (b) 2014. Capture and mortality rates are given per thousand hooks. Mortalities and mortality rates are based on the number of retained individuals. Releases indicate the number of individuals released, but life status at the time of release is unknown. Note: data are from shots in the WTBF where SBT were caught and only species where 10 or more individuals were caught are reported.

a) Species 2013	Total effort (no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Releases
Nil	3000	-	-	-	-	-

b) Species 2014	Total effort (no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Releases
Mahi mahi	12 800	17	1.328	10	0.781	7

Observed and non-observed shark interactions

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 during purse seining 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 other interactions, observed or non-observed, between purse-seine vessels and sharks were recorded in 2013 or 2014.

Eastern Tuna and Billfish Fishery

Shark catch details from observers in the ETBF are provided in Table 5 for 2013. Catches from logbooks are provided in Table 6a and 6b for 2013 and 2014, respectively. Mitigation measures to reduce shark bycatch are in place in the ETBF and WTBF (see section 7). The catch of sharks in the ETBF is reported annually to the WCPFC (e.g. Hansen et al. 2014).

Western Tuna and Billfish Fishery

Small amounts of SBT were caught in the longline operations of the WTBF during the recent fishing seasons (2012–13 and 2013–14). Logbook catches of sharks in 2014 are provided in Table 7 2014; no catches were reported for 2013. The catch of sharks in the WTBF is reported annually to the IOTC (e.g. Hobsbawn et al. 2014).

Table 5 Observed interactions between shark species and ETBF vessels (CCSBT statistical area 4) in 2013. Observer data for 2014 in the ETBF are not yet available. Capture and mortality rates are given per thousand hooks. Note: data are from shots in the ETBF where SBT were caught. Scientific names are given in Appendix IV.

ETBF		Observed							Estimate
Species	Total effort (no. hooks)	Total observed effort (no. hooks)	Observer coverage (% no. hooks)	Captures (number)	Capture rate (per 1000 hooks)	Mortalities (number)	Mortality rate (per 1000 hooks)	Live releases	Estimated total mortalities (raised to total effort)
Blue Shark	289 501	65 251	22.5%	712	10.912	210	3.218	495	2200
Bramble shark	289 501	65 251	22.5%	4	0.061	4	0.061	0	17.778
Longfin mako	289 501	65 251	22.5%	1	0.015	0	0.000	1	0.000
Porbeagle	289 501	65 251	22.5%	1	0.015	1	0.015	0	4.444
Shortfin mako	289 501	65 251	22.5%	10	0.153	6	0.092	4	26.667
Tiger shark	289 501	65 251	22.5%	1	0.015	0	0.000	1	0.000

Table 6 Unobserved interactions (logbooks) between shark species and ETBF vessels (CCSBT statistical area 4) in (a) 2013 and (b) 2014. Capture and mortality rates are given per thousand hooks. Mortalities and mortality rates are based on the number of retained individuals. Releases indicate the number of individuals released, but life status at the time of release is unknown. Note: data are from shots in the ETBF where SBT were caught. Scientific names are given in Appendix IV.

a) Species 2013	Total effort (no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Releases
Blue shark	289 501	3180	10.984	126	0.435	3054
Bronze whaler	289 501	1	0.003	0	0.000	1
Porbeagle	289 501	3	0.010	2	0.007	1
Shark (unidentified)	289 501	2	0.007	0	0.000	2
Shortfin mako	289 501	87	0.301	55	0.190	32
Tiger shark	289 501	4	0.014	0	0.000	4
Thresher shark	289 501	1	0.003	0	0.000	1

Table 6 Continued

b) Species 2014	Total effort (no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Releases
Blue shark	230 006	546	2.374	0	0.000	546
Bronze whaler	230 006	1	0.004	0	0.000	1
Dusky shark	230 006	1	0.004	0	0.000	1
Longfin mako	230 006	1	0.004	0	0.000	1
Oceanic whitetip	230 006	3	0.013	0	0.000	3
Porbeagle	230 006	1	0.004	0	0.000	1
Shortfin mako	230 006	104	0.452	65	0.282	39
Tiger shark	230 006	4	0.017	0	0.000	4
Thresher shark	230 006	2	0.009	1	0.004	1

Table 7 Unobserved interactions (logbooks) between shark species and WTBF vessels (CCSBT statistical area 2) in 2014. Capture and mortality rates are given per thousand hooks. Mortalities and mortality rates are based on the number of retained individuals. Releases indicate the number of individuals released, but life status at the time of release is unknown. Note: data are from shots in the WTBF where SBT were caught. Scientific names are given in Appendix IV.

Species 2014	Total effort (no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Releases
Blue shark	12 800	92	7.188	0	0.0	92
Bronze whaler	12 800	105	8.203	0	0.0	105
Crocodile shark	12 800	7	0.547	0	0.0	7
Shortfin mako	12 800	40	3.125	35	2.734	5
Thresher shark	12 800	1	0.078	0	0.0	1

6 Marine mammals and marine reptiles

The SBTF and the ETBF and WTBF longline fisheries all have a very low incidence of marine mammal and reptile interactions.

Southern Bluefin Tuna Fishery

No interactions with marine mammals or reptiles, observed or non-observed, were recorded in the SBTF in 2012–13 or 2013–14.

Eastern Tuna and Billfish Fishery

There was a single interaction with a marine mammal in the ETBF while fishing for SBT recorded by observers in 2013 (Table 8) and two interactions recorded in logbooks (Table 9). There were no observed interactions with marine reptiles. No interactions were noted in logbooks in 2014. The catch of sharks in the ETBF is reported annually to the WCPFC (e.g. Hansen et al. 2014).

Western Tuna and Billfish Fishery

Small amounts of SBT were caught in the longline operations of the WTBF during the recent fishing seasons (2012–13 and 2013–14). No reptile or mammal interactions were reported in the WTBF in 2013 or 2014. The catch of any bycatch species in the WTBF is reported annually to the IOTC (e.g. Hobsbawn et al. 2014).

Table 8 Observed interactions between mammal species and ETBF vessels (CCSBT statistical area 4) in 2013. Observer data for 2014 in the ETBF are not yet available. Capture and mortality rates are given per thousand hooks. Note: data are from shots in the ETBF where SBT were caught. Scientific names are given in Appendix IV.

ETBF (2013)		Observed							Estimate
Species	Total effort (no. hooks)	Total observed effort (no. hooks)	Observer coverage (% no. hooks)	Captures (number)	Capture rate (per 1000 hooks)	Mortalities (number)	Mortality rate (per 1000 hooks)	Live releases	Estimated total mortalities (raised to total catch)
Australian fur seal	289 501	65 251	22.5%	4	0.061	0	0.000	4	0.000

Table 9 Unobserved interactions (logbooks) between mammal species and ETBF vessels (CCSBT statistical area 4) in 2013. Capture and mortality rates are given per thousand hooks. Note: data are from shots in the ETBF where SBT were caught. na = data not available. Scientific names are given in Appendix IV.

Species	Total effort	Captures	Capture rate	Mortalities	Mortality rate	Releases
Common dolphin	289 501	1	0.003	0	0.000	1
NZ fur seal	289 501	1	0.003	na	na	na

7 Mitigation measures to minimise seabird and other species bycatch

In Australia, the EPBC Act (1999) is the primary legislation that covers environmental issues, including the ecologically sustainable use of marine resources. The EPBC Act requires that:

- all Commonwealth-managed and State/Northern Territory wild capture marine fisheries with an export component be assessed to determine the extent to which management arrangements will ensure each fishery is being managed in an ecologically sustainable way;
- all Commonwealth-managed fisheries are also assessed to determine the impact of actions taken under a fishery management plan on matters of national environmental significance; and
- all Commonwealth-managed fisheries and any State-managed fisheries that operate in Commonwealth waters should also be assessed to determine the impacts of fishing operations on cetaceans, listed threatened species and ecological communities, migratory species, and listed marine species under the EPBC Act.

The assessments consider the impacts of the fishery on target and non-target species caught and the impacts of fishing on the broader marine environment. Initial and subsequent 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 more 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 (2003), and its longline fisheries targeting SBT (2001 and 2003 for the ETBF and WTBF, respectively), which include specific reporting requirements for protected 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 hook sink rates, see Table 10)
- 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 completed ecological risk assessments for each fishery managed by the Commonwealth to quantify impacts on ecologically related species and the broader marine environment (<http://www.afma.gov.au/managing-our-fisheries/environment-and-sustainability/Ecological-Risk-Management/>). Ecological risk management reports for the SBTF, ETBF and WTBF are also available and detail management priorities in those fisheries, based on the results of the assessments. 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 categorise various species as being at high, medium or low risk on the basis of inter alia 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

Seabirds are opportunistic feeders and are attracted to longline vessels, particularly during line setting, but also during line hauling, when the seabirds are at risk of being caught or entangled in the fishing gear. Seabirds are also attracted to discarded offal and are at risk of ingesting discarded hooks still attached to discarded baits. The design of purse-seine nets and the way this fishing gear is deployed, means that the risk of seabird bycatch during purse seine fishing operations is very low.

The adverse impact of longline fishing activities on seabirds was not fully realised until the 1980s. The incidental catch of seabirds during pelagic longline fishing operations was listed as a key threatening process on 24 July 1995. Threat abatement plans for this key threatening process have been in place since 1998 with the current plan, *Threat Abatement Plan 2014 for the incidental catch (or bycatch) of seabirds during longline fishing operations*, made on 14 August 2014 (Commonwealth of Australia 2014). Copies of this plan may be obtained from the Department of the Environment:

<http://www.environment.gov.au/biodiversity/threatened/tap-approved.html>. The ultimate aim of this plan is to achieve zero bycatch of seabirds from longline fishing in Commonwealth fisheries. The plan is subject to review within five years.

Considerable progress has been made under successive threat abatement plans to reduce the impact of pelagic longlining on seabirds. This has been achieved through the combined efforts of the fishing industry, researchers and non-governmental stakeholders working with government to reduce seabird bycatch in longline fisheries in a feasible, effective and efficient way. The prescriptions in this plan recognise this success and seek to further reduce the incidental capture of seabirds.

Over the life of the previous threat abatement plans, substantial progress has been achieved towards reducing the key threatening process. The incidental bycatch rates for several fisheries are well below the 0.01 or 0.05 birds per 1000 hooks, the maximum permissible levels set as a performance indicator under the current and previous plan. The prescriptions in the current plan recognise this success and seek to further reduce the incidental capture of seabirds.

Information on the level and nature of interactions between seabirds and fishing gear has increased significantly since 1995 and there is now extensive information available upon which to base decision-making. Considerable research and development activities have been undertaken into seabird bycatch mitigation measures including at sea trials. This work could not have been achieved without the continued engagement and support of industry. The

prescriptions in this threat abatement plan also draw on best and improving practices in seabird bycatch mitigation for pelagic longline fishing developed under the *Agreement on the Conservation of Albatrosses and Petrels* (ACAP). This international agreement, to which Australia is a Party, aims to achieve and maintain a favourable conservation status for albatrosses and petrels. ACAP has been developed under the auspices of another international agreement, the *Convention on the Conservation of Migratory Species of Wild Animals* (CMS). There is now increased confidence concerning the effectiveness of several mitigation measures, particularly line weighting strategies, use of bird-scaring lines, retention of offal during line setting, and night setting (in certain instances). These mitigation measures form the basis of the prescriptions set out in this threat abatement plan.

Threat abatement plans must specify actions needed to achieve their objective. Under the current plan:

- AFMA will require all pelagic longline tuna fishers operating within either the ETBF or WTBF, or both fisheries, southwards of the parallel of 25 degrees South to:
 - a. employ a line-weighting strategy approved by AFMA that enables the bait to be rapidly taken below the reach of most seabirds;
 - b. employ at least one bird-scaring line constructed to a specified standard approved by AFMA, or use another proven mitigation measure approved by AFMA for use without such a line;
 - c. not discharge offal during line setting; and
 - d. employ, as part of an adaptive management approach to seabird bycatch mitigation, such other mitigation measures as AFMA may stipulate following consultation with the Department of the Environment (including, but not limited to, use of bird exclusion devices and/or managing offal discharge during line hauling, night setting, and area closures).
- AFMA will continue to require domestic and foreign vessels in all longline 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.
- AFMA will implement an appropriate management response if identified circumstances occur, or data analysis indicates that the performance criteria, defined in this threat abatement plan, have not been met in any fishing area, season or fishery, or that independent monitoring has dropped below acceptable levels. Consistent with an adaptive management approach, the management response will be implemented as soon as practical, but no later than within three months of identification of a problem.
- Require that seabird bycatch in all fishing areas and seasons in the ETBF and WTBF is less than 0.05 birds per 1000 hooks.
- Areas within the ETBF or WTBF south of the parallel of 25 degrees South are divided for the purposes of the above bycatch rate criteria into five degree latitudinal bands. Seasons are defined, for the purposes of the criteria, into two: summer 1 September – 30 April, and winter 1 May – 31 August.

Following experiments showing that 40 g weights placed directly at the hook exhibit greater sink rates than the weighting regime of 60 g at 3.5 m from the hook and sea trials showing that there was no significant impact on catch rates of commercial species (Robertson et al. 2013),

AFMA has implemented permit conditions to allow 40 g weights to be used with dead bait. The new conditions were implemented from 1 February (WTBF) and 1 March (ETBF) 2012. Operators are still permitted to use 60 g, 3.5 m from the hook. In addition, 40 g weights at the hook are coated with luminescent plastic which reduces the need to use light sticks. Further trials to investigate the sink rates and commercial impact of using 60 g weights at the hook with live weight are being conducted (see Table 10 for more information).

See Appendix I and II for specific measures required for the ETBF and WTBF in 2014. Specific management arrangements for the ETBF and WTBF detailing all requirements for each fishery can be found in the management arrangements booklets on the AFMA website:

<http://www.afma.gov.au/wp-content/uploads/2010/06/ETBF-management-arrangements-booklet-2014-FINAL.doc>; <http://www.afma.gov.au/wp-content/uploads/2010/06/WTBF-management-arrangements-booklet-2014-.pdf>

A pre-season briefing booklet for the SBTf is also available: <http://www.afma.gov.au/managing-our-fisheries/fisheries-a-to-z-index/southern-bluefin-tuna/>

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). This plan was reviewed and revised in 2012 (Shark plan 2; see section 11). Accordingly, regulations have been put in place in the pelagic longline fisheries 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 (Callorhynchidae), chimaerids (Chimaeridae and Rhinochimaeridae) and sawshark. This limit does not apply to great white sharks and grey nurse sharks, which are no-take protected 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

Note that shortfin makos, longfin makos and porbeagles were listed under the Convention of Migratory Species (CMS) in 2008, which triggered a mandatory legal obligation to list them for protection under Australia's EPBC Act 1999. Listing under the EPBC Act 1999 came into effect on 29 January 2010. As a consequence, in February 2010 all Australian fisheries that interact with these species in Commonwealth waters were assessed under the EPBC Act. The management arrangements for each fishery was reaccredited on the basis that the arrangements in place required all reasonable steps to be taken to ensure that shortfin and longfin makos and porbeagles are not killed or injured as a result of fishing activities. These species may be retained in accredited fisheries if the sharks have come onboard dead. Live caught specimens must be released unharmed and fishers are required to report interactions.

CITES Appendix II listings for sharks and manta rays

The 16th meeting the Conference of Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Bangkok, March 2013) listed a number of shark and manta ray species (oceanic whitetip shark, great, smooth and scalloped hammerhead sharks, porbeagle shark, giant oceanic manta ray and reef manta ray) on Appendix II of CITES (CITES Appendix II lists species that, while not threatened with extinction now, may become so in the future if trade is not regulated). These listings took effect on 14 September 2014. All these species may be encountered by different fishing gears that target tuna and tuna-like species.

The CITES Appendix II listing of shark species does not entail a ban on capture, however the listing does require that any international trade, including any *Introduction from the Sea* (i.e. catch sourced from the High Seas), is informed by a non-detriment finding which determines the harvest is sustainable and that specimens are accompanied by CITES permits for either their import or export.

Non-detriment findings consider, but are not limited to, standard information on species biology and life history characteristics, historical and current range, population structure, status and trends, information on all sources of mortality and management measures in place.

Since 14 September 2014, Australia has had a non-detriment finding in place for the commercial harvest and export, with national harvest levels set for each of the newly-listed shark species. The manta ray species are not included in the non-detriment finding as they are not retained in Australian fisheries for trade. The non-detriment finding is available at:

<http://www.environment.gov.au/biodiversity/wildlife-trade/publications/non-detriment-finding-five-shark-species>

Mitigation measures to minimise sea turtle bycatch

Interactions between sea turtles and pelagic longline fisheries in the AFZ are rare, particularly in areas where SBT I targeted. Guidelines for mitigating the impact of longline fisheries on marine turtles are described under 'Voluntary measures for each fleet', although there is compulsory carriage of line cutters and dehookers. Interactions with the purse seine fishery are negligible and there has been no need to develop mitigation measures for this sector.

In 2009, Australia formally submitted a mitigation plan, *Eastern Tuna and Billfish Fishery Sea Turtle Mitigation Plan*, for review by the Western and Central Pacific Fisheries Commission Scientific Committee and Technical Compliance Committee, and approval by the Commission. The mitigation plan was submitted under CMM 2008-03 (Conservation and Management of Sea Turtles) and was designed to reduce the interaction rate of turtles in pelagic longline fisheries which target swordfish. It took effect 1 January 2010.

Prior to the start of the 2013 fishing season, AFMA revoked the mitigation plan as the trigger limits established were being breached and the plan was not proving effective. Instead, there is now a requirement for vessels targeting swordfish using shallow sets to use large circle hooks when setting less than 8 hooks per bubble. There is also a requirement that at least one de-hooker and one line cutter be carried at all times.

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. In addition, specific limits for some species apply (see the management arrangement booklets noted above for further details).

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.

Level of Compliance

Mitigation measures to minimise seabird bycatch

Australia's level of compliance with measures to minimise seabird bycatch is high based on observer and compliance reports. Australia is continuing to conduct research to develop and domestically implement new and more effective seabird mitigation measures and has promoted their adoption by various RFMOs. Australia is compliant with all relevant resolutions and conservation and management measures in the IOTC and WCPFC.

Mitigation measures to minimise shark bycatch

Australia's level of compliance with measures to minimise shark bycatch is high based on observer and compliance reports. Australia has continued to promote the adoption of shark mitigation measures, such as a ban on wire trace and requiring that sharks be landed with fins attached, in various international meetings. Australia is compliant with all relevant resolutions and conservation and management measures in the IOTC and WCPFC.

Mitigation measures to minimise sea turtle bycatch

Australia's level of compliance with sea turtles mitigation measures is high based on observer and compliance reports. Australia considers that current sea turtle bycatch management and mitigation measure in place in its pelagic longline fisheries, principally the ETBF and WTBF, fulfil Australia's obligations to *FAO Guidelines to Reduce Sea turtle Mortality in Fishing Operations*. In addition, AFMA has provided line cutters and de-hookers to all longline vessels in the ETBF and WTBF, thus ensuring the requirement to carry them is very likely to be met. Australia is compliant with all relevant resolutions and conservation and management measures in the IOTC and WCPFC.

Mitigation measures to minimise fish bycatch

There is a very high level of compliance with the requirement that blue and black marlin be returned to the water (see management arrangement booklets for a complete list of species that cannot be taken), with no logbooks or observer reports noting the retention of these species in 2013 or 2014. In addition, there is a high level of compliance with the State finfish catch restrictions on some species.

Voluntary measures for each fleet

'Industry codes of practice' are in place for a number of fisheries, including the ETBF. These generally 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. 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 recovery plan can be obtained from <http://www.environment.gov.au/coasts/publications/turtle-recovery/index.html>.

A video 'Crossing the line: sea turtle handling guidelines for the longline fishing industry' has been 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, how to help comatose turtles recover and how to release them back into the water. Similarly, AFMA conducted port visits in 2013 and 2014 in the ETBF to provide de-hookers to all boats with instructions on how to use them and on safe handling of marine turtles.

Proportion of fleet using voluntary measures

The proportion of the fleets using the voluntary measures is generally thought to be high. This is based on information such as the generally low seabird bycatch in longline fisheries, as well as observer data reported to AFMA.

Measures under development/testing

Australia has conducted, and is still conducting, a number of scientific trials to further reduce seabird bycatch in longline fisheries, including a variety of line-weighting trials, methods to increase line sink rates and an underwater bait setting machine (Table 10; Robertson & van den Hoff 2010; Robertson et al. 2010a, b; Robertson & Candy 2013; Robertson et al. 2013; Robertson et al. 2015). 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 indicate that weighted lines are among 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 an effective measure for reducing albatross interactions. Recent research has focused on the effects of differing line-weighting regimes (Robertson et al. 2013).

Previous research on wire versus nylon leaders indicates that catch rates of sharks are significantly reduced when nylon leaders are used (Ward et al. 2008); conversely, catch rates of sharks increase when circle hooks are used instead of tuna hooks (Ward et al. 2009).

Despite the relatively 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. Australian research quantified the relative effects of circle and tuna hooks on catches of target and common non-target species (Ward et al. 2009).

Although not designed to compare capture rates of marine 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 (Ward et al. 2009).

Table 10 Mitigation measures to reduce the incidental catch of seabirds under development or testing in Australia

Mitigation measure	Lead agency and collaborators	Results to date	Planned development/testing	Status
Line weighting regimes	AFMA, Australian Antarctic Division (AAD), ETBF operators	Not yet available	Comparing the use of 60 g weights for live baits: <ul style="list-style-type: none"> • directly adjacent to the hook • 0.5 m from the hook • 3.5 m from the hook 	Draft report submitted
Underwater bait setting machine	AAD, Amerro Engineering, ETBF operators	Trials to date indicate albatross & petrel mortality can be prevented with hooks set to 10 m depth. Further data acquisition is scheduled for mid-2014.	<p>Stage 1: R&D; initial operational testing of prototype unit (Mk1)</p> <p>Stage 2: Testing Mk1 unit in ETBF under normal operational fishing</p> <p>Stage 3: At-sea testing and refinement of the performance of Mk1 prototype.</p> <p>Stage 4: Controlled experiment to compare and evaluate the Mk1 prototype underwater setting machine with the conventional method of setting branch lines by hand at the surface.</p> <p>Stage 5: Extensive modification of Mk1 prototype, based on experience from the experiment. Improvements to design and performance, especially concerning maximum depth and cycle time. Extensive operational testing. Construction of new prototype unit (Mk2).</p> <p>Stage 6: Proof-of-concept experiment with Mk2 prototype in the Uruguayan swordfish fishery.</p> <p>Stage 7: Complete scientific paper on effectiveness of underwater setting method in minimising mortality of albatrosses and petrels in pelagic longline fisheries.</p>	<p>Completed</p> <p>Completed</p> <p>Completed</p> <p>Completed</p> <p>Completed</p> <p>Completed</p> <p>Completed</p>

Table 10 Cont. Mitigation measures to reduce the incidental catch of seabirds under development or testing in Australia

Mitigation measure	Lead agency and collaborators	Results to date	Planned development/testing	Status
Methods to increase link sink rates	AAD	Key results to date:	Research is being undertaken to evaluate the factors, including gear, that affect line sink rates.	Ongoing
		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 earlier research the results.	This research includes:	
		2. Use of a line shooter is not necessarily beneficial to achieving faster line sink rates for pelagic longlines; it cannot be regarded as a mitigation measure in all circumstances.	1. Examining the effects of line shooters and propeller turbulence on mainline tension and line sink rates.	Completed
		3. Mainlines 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).	2. Testing the sink rates of frozen versus different stages of thawed baits.	Completed
		4. It is important to avoid setting mainline into propeller turbulence and to avoid slack in the mainline.	3. Following tank testing and initial field work, conducting operational fishing trials 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 tested a faster sinking gear (120 g weight within 2.0 m of the hook and a newly designed 40 g weight at the hook) against the current standard (60 g within 3.5 m of the hook).	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 Plan 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 government, non-government, industry and other stakeholders can discuss current and emerging mitigation strategies.

AFMA staff regularly visit 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 <http://www.afma.gov.au/managing-our-fisheries/environment-and-sustainability/> and <http://www.frdc.com.au/resources/resources> for further information. Media releases and other publications can be found at <http://www.afma.gov.au/resource-centre/media-centre/>.

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 was completed. The program was 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 provided training to vessel owners, skippers, crew and shore managers on their

obligations in relation to bycatch, including reporting requirements and mitigations measures. Objectives under the new discarding plan, which came into effect 1 July 2014, include the development of a best practice handling guide for chondrichthyans and the development of more education courses for crew. The new discarding plan can be found here:

<http://www.afma.gov.au/wp-content/uploads/2010/06/ATB-Bycatch-and-Discarding-Workplan-2014-2016-FINAL.pdf>

Managers

The Australian Government is committed to the ecologically sustainable development of Australian fisheries and all associated international obligations. 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 are sourced from universities and maritime industries 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 WCPFC, 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 undertook ecological risk assessments (ERAs) that looked 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 transition 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

All ERAs for Australian Government-managed fisheries are now publicly available, as are the management reports detailing the response planned to the results of the ERAs:

<http://www.afma.gov.au/managing-our-fisheries/environment-and-sustainability/ecological-risk-management/>

10 Other

Not applicable.

11 Implementation of the IPOA-Seabirds and IPOA-Sharks

Australia endorsed the IPOA-Seabirds, and has undertaken 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 three nautical miles offshore to the extent of Australia's EEZ. To manage these interactions, Australia has put in place the TAP. 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 again in 2014, and applies to all longline fisheries managed by the Australian Government. The TAP (2014) is Australia's key national measure for mitigating the impact of longline fisheries on seabird populations, and is consistent with the IPOA-Seabirds.

Australia's National Plan of Action for Conservation and Management of Sharks (NPOA-Sharks) was released in 2004 according to guidelines as set out in the International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks). The NPOA-Sharks was designed to provide advice and guidance to fisheries managers, conservation managers and the general public on action needed to ensure that Australia's shark populations are managed sustainably into the future.

As part of the review of Australia's NPOA-Sharks, the Australian Government produced the 2009 Shark Assessment Report (SAR) which is the scientific basis for the adoption of the NPOA. The 2009 SAR (Bensley et al. 2010) builds upon the information provided in the 2001 SAR and identifies any significant changes that have occurred in fisheries since the release of the 2001 SAR. The assessment includes the presentation and where possible, analyses of:

- resource information (e.g. harvest methods, catch and effort data, and stock assessments)
- management information (e.g. management frameworks, fishery statistics and markets)
- law and enforcement information.

The second Australian NPOA-Sharks (Shark-plan 2) was released in July 2012 and identifies how Australia will manage and conserve sharks. In addition, an operational strategy was developed in conjunction with state and territory jurisdictions and stakeholders to identify what actions will be pursued in order to meet the objectives of the plan. Shark-plan 2 and the operational strategy can be found here: <http://www.agriculture.gov.au/fisheries/environment/sharks/sharkplan2>

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Appendix I

Mandatory seabird mitigation measures in the ETBF 2014

At all times you must:

- Carry an assembled tori line on board
- Carry either:
 - 1.) 1000 weighted swivels each weighing at least 60 grams; or
 - 2.) 1000 weights each weighting at least 40 grams
- Not discharge offal while setting
- Not discharge offal while hauling. An exemption for small boats may be given by AFMA.

When you are fishing south of 25°S you must:

- Deploy a tori line before commencing a shot
- Use only thawed bait
- Weight longlines with either a minimum of:
 - 1.) 60 g swivels at a distance of no more than 3.5 m from each hook ; or
 - 2.) 98 g swivels at a distance of no more than 4 m from each hook; or
 - 3.) 40 g weights at each hook with dead, non-frozen baits; or
- At all times carry 1000 weighted swivels each weighing at least 60 g or 1000 weights to be used at each hook each weighing at least 40 g
- Not discharge offal while setting
- Not discharge offal while hauling. An exemption for small boats may be given.

When you are fishing north of 25°S you must:

- Carry an assembled tori line onboard
- At all times carry 1000 weighted snoods each weighing at least 60 g or 1000 weights to be used at each hook each weighing at least 40 g.

Your tori line must be:

- At least 100 m long;

- Set up from a position on the boat that allows it to stay above the water for at least 90 m;
- Have streamers attached at least every 3.5 m;
 - o Streamers should be maintained ensuring that their lengths are as close to the water as possible.
- Have a drogue at the end of the line to give sufficient drag to meet the 90 m aerial coverage criteria.

Appendix II

Mandatory seabird mitigation measures in the WTBF 2014

At all times you must:

- Carry an assembled tori line on board
- Carry either:
 - o 1000 weighted swivels each weighing at least 60 grams; or
 - o 1000 weights each weighting at least 40 grams
- Not discharge offal while setting
- Not discharge offal while hauling. An exemption for small boats may be given by AFMA.

When you are longline fishing south of 25°S you must:

- Deploy a tori line before commencing a shot
- Use only thawed bait
- Weight longlines with either a minimum of:
 - 1.) 60 g swivels at a distance of no more than 3.5 m from each hook ; or
 - 2.) 98 g swivels at a distance of no more than 4 m from each hook; or
 - 3.) 40 g weights at each hook.
- At all times carry:
 - o 1000 weighted swivels each weighing at least 60 g; or
 - o 1000 weights each of at least 40 g
- Not discharge offal while setting
- Not discharge offal while hauling. An exemption for small boats may be given by AFMA.

Your tori line must be:

- At least 100 m long;
- Set up from a position on the boat that allows it to stay above the water for at least 90 m;
- Have streamers attached at least every 3.5 m;
 - o Streamers should be maintained ensuring that their lengths are as close to the water as possible; and

- Have a drogue at the end of the line to give sufficient drag to meet the 90 m aerial coverage criteria.

Appendix III

Summary of papers submitted by Australia

CCSBT-ERS/1503/Info3 - Developments in the use of sliding weights in an Australian pelagic longline fishery: voluntary uptake, compliance and methods to minimise lead loss to the environment

There is an increasing voluntary uptake of sliding lead weights in an Australian pelagic longline fishery. Compliance benefits are identified not only in port inspections, but also for self-regulation by crew on fishing vessels, to ensure the sliding lead weights are correctly positioned on branch lines. Information is provided on new methods to minimise loss of sliding lead weights to the environment, and to minimise other environmental impacts.

CCSBT-ERS/1503/Info4 - The development and operational testing of an Underwater Bait Setting System to prevent the mortality of albatrosses and petrels in pelagic longline fisheries

Longline fisheries for tunas and tuna-like species present an existential threat to many populations of albatrosses and petrels worldwide. To prevent this form of mortality we developed a new technology designed to deploy baited hooks underwater beyond the dive depths of seabirds (6 - 10m for the species most commonly caught). The underwater bait setter is a stern-mounted, hydraulically-operated and computer-controlled device that catapults baited hooks underwater in a steel capsule connected to hydraulic winches by Spectra® rope. Baits are flushed from the capsule by water pressure through a spring-loaded bait release door. The chief engineering challenges in the developmental stages were ensuring: 1) bait delivery to target depths with cycle times (time from release to recovery) that were practical for fishing operations; 2) bait retention in the capsule (no drop-outs) on the descent phase of the cycle; 3) baits, upon release at target depth, were not drawn up the water column on the capsule recovery phase (from possible hook-ups and/or suction); and 4) the retention of baits on hooks post-release from the capsule was not affected by the mechanical release underwater. Operational trials with the final version of the capsule yielded satisfactory cycle times to depths of 6 - 10 m. All baits were retained in the capsule on the descent and released as required at target depths (n = 606 deployments). Bait retention on hooks post release from the capsule and retention on hooks hand-set at the surface (the conventional method) were statistically indistinguishable. The underwater bait setter is modular in construction and can be fitted to all types of vessel sterns.

CCSBT-ERS/1503/Info5 - A review of shark bycatch mitigation in tuna longline fisheries

Sharks are a significant component of the catch species in pelagic longline fisheries that generally target tuna and tuna-like species. They may be a target species in some cases, but are more often a byproduct (incidentally caught but retained) or a bycatch (incidentally caught but unwanted and discarded) species. Incidental catch of sharks in pelagic longline fisheries has raised concerns about the status of shark populations and the need for mitigation measures to reduce mortality. Despite these concerns, progress in research and implementation of bycatch mitigation measures for sharks has lagged behind measures for other bycatch species such as seabirds.

A review of the most studied mitigation methods (generally defined as measures that reduce the incidence of sharks being caught on the gear) is undertaken here and is extended to include measures that reduce mortality once the shark is captured and brought to the boat. While not exhaustive, the review identified the following:

1. The three most promising approaches to mitigating mortality of sharks from pelagic longline are hooks type (circle), leader type (monofilament) and best practice handling at the vessel. From a technical viewpoint we suggest that there is often sufficient information in the literature to allow reasonably informed decisions on reducing shark mortality using these approaches. However, a number of issues have hampered studies of mitigation and make it difficult to form a synthesis.
2. Quantifying the *magnitude* of likely reduction in mortality from the introduction of a mitigation approach is critical for determining whether proposed approaches are likely to achieve the overall reductions in fishing mortality required to remove overfishing.
3. There is a need to better understand the barriers to the uptake of measures that have demonstrated technical efficacy. Research (scientific and economic) on the likely costs/benefits of changing gear and fishing practices to mitigate shark mortality is required and should address: changes to target species catch rates, loss of economic byproduct, initial costs of gear, ongoing costs of gear and labour. An additional barrier to uptake of measures relates to operational safety issues from deploying modified gear and implementing best practice handling of sharks.

CCSBT-ERS/1503/Info6 -Enhanced monitoring in the Eastern Tuna and Billfish Fishery

To be provided

Appendix IV

Common and scientific names

Common names	Scientific names
Albatrosses (other)	<i>Diomedeidae</i> spp.
Australian fur seal	<i>Arctocephalus pusillus doriferus</i>
Australian sea lion	<i>Neophoca cinerea</i>
Black marlin	<i>Makaira indica</i>
Black-browed albatross	<i>Thalassarche melanophris</i>
Blacktip sharks	<i>Carcharhinus</i> spp.
Blue marlin	<i>Makaira nigricans</i>
Blue shark	<i>Prionace glauca</i>
Bronze whaler	<i>Carcharhinus brachyurus</i>
Buller's albatross	<i>Thalassarche bulleri</i>
Cape petrel	<i>Daption capense</i>
Common dolphin	<i>Delphinus delphis</i>
Dusky shark	<i>Carcharhinus obscurus</i>
Escolar	<i>Lepidocybium flavobrunneum</i>
Flatback turtle	<i>Natator depressa</i>
Flesh-footed shearwater	<i>Ardenna carneipes</i>
Great hammerhead shark	<i>Sphyrna mokarran</i>
Great-winged petrel	<i>Pterodroma macroptera</i>
Green turtle	<i>Chelonia mydas</i>
Grey-headed albatross	<i>Thalassarche chrysostoma</i>
Hammerhead shark	<i>Sphyrna</i> spp.
Hawksbill turtle	<i>Eretmochelys imbricata</i>
Humpback whale	<i>Megaptera novaeangliae</i>

Lancetfish	<i>Alepisaurus</i> spp.
Leatherback turtle	<i>Dermochelys coriacea</i>
Loggerhead turtle	<i>Carretta carretta</i>
Longnose lancetfish	<i>Alepisaurus ferox</i>
Manta rays	<i>Manta</i> spp.
Mahi mahi	<i>Coryphaena hippurus</i>
Moonfish (opah)	<i>Lampris guttatus</i>
New Zealand fur seal	<i>Arctocephalus forsteri</i>
Ocean sunfish	<i>Mola mola</i>
Oceanic whitetip shark	<i>Carcharhinus longimanus</i>
Oilfish	<i>Ruvettus pretiosus</i>
Pacific (olive) ridley turtle	<i>Lepidochelys olivacea</i>
Petrels, prions and shearwaters	<i>Procellariidae</i> spp.
Porbeagle	<i>Lamna nasus</i>
Ray's bream	<i>Brama brama</i>
Rudderfish	<i>Centrolophus niger</i>
Sailfish	<i>Istiophorus platypterus</i>
Scalloped hammerhead	<i>Sphyrna lewini</i>
Shortbill spearfish	<i>Tetrapturus angustirostris</i>
Shortfin mako	<i>Isurus oxyrinchus</i>
Short-finned pilot whale	<i>Globicephala macrorhynchus</i>
Short-tailed shearwater	<i>Ardenna tenuirostris</i>
Shy albatross	<i>Thalassarche cauta</i>
Silky shark	<i>Carcharhinus falciformis</i>
Smooth hammerhead	<i>Sphyrna zygaena</i>
Sooty shearwater	<i>Ardenna griseus</i>
Southern bluefin tuna	<i>Thunnus maccoyii</i>
Southern royal albatross	<i>Diomedea epomophora</i>
Thresher shark	<i>Alopias vulpinus</i>

Tiger shark	<i>Galeocerdo cuvier</i>
Wahoo	<i>Acanthocybium solandri</i>
Wandering albatross	<i>Diomedea exulans</i>
Wedge-tailed shearwater	<i>Ardenna pacificus</i>
Yellow-nosed albatross	<i>Thalassarche chlororhynchos</i>
