



Australian Government

Department of Agriculture, Fisheries and Forestry
ABARES

Australian Country Report

Ecologically Related Species in the Australian Southern Bluefin Tuna Fishery 2010–11 and 2011–12

Heather M. Patterson, Patricia I. Hobsbawn, Ilona Stobutzki

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

July 2013



© Commonwealth of Australia 2013

This work is copyright. The Copyright Act 1968 permits fair dealing for study, research, news reporting, criticism or review. Selected passages, tables or diagrams may be reproduced for such purposes provided acknowledgment of the source is included. Major extracts or the entire document may not be reproduced by any process without the written permission of the Executive Director, Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES).

The Australian Government acting through ABARES has exercised due care and skill in the preparation and compilation of the information and data set out in this publication. Notwithstanding, ABARES, its employees and advisers disclaim all liability, including liability for negligence, for any loss, damage, injury, expense or cost incurred by any person as a result of accessing, using or relying upon any of the information or data set out in this publication to the maximum extent permitted by law.

Patterson HM, Hobsbawn PI, Stobutzki I 2013, Australian Country Report: Ecologically related species in the Australian Southern Bluefin Tuna Fishery 2010–11 and 2011–12, ABARES report to client prepared for the Commission for the Conservation of Southern Bluefin Tuna, Canberra, July.

Department of Agriculture, Fisheries and Forestry

Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)

Postal address GPO Box 1563 Canberra ACT 2601

Switchboard +61 2 6272 2010

Facsimile +61 2 6272 2001

Email info.abares@daff.gov.au

Web www.daff.gov.au/abares

Acknowledgements

The authors thank Rupert Summerson for creating the maps. In addition, Matt Daniel, Trent Timmiss, Jonathon Barrington, Karen Arthur and Johnathon Davey are thanked for their useful comments and input.

Contents

Summary.....	1
1 Introduction	2
2 Review of SBT Fisheries	3
Fleet size and distribution	3
Distribution of catch and effort	6
3 Fisheries monitoring for each fleet	8
Catch documentation.....	8
Observer programs.....	8
Vessel Monitoring System.....	8
Port monitoring	9
4 Seabirds.....	10
Observed seabird interactions.....	10
Non-observed seabird interactions	12
5 Non-target fish	13
Observed and non-observed fish interactions.....	13
Observed and non-observed shark interactions.....	16
6 Marine mammals and marine reptiles.....	21
7 Mitigation measures to minimise seabird and other species bycatch.....	22
Current measures.....	23
Measures under development/testing	27
8 Public relations and education activities	30
Public relations activities.....	30
Education.....	30
9 Information on other ERS (non-bycatch) such as prey and predator species	32
10 Other	33
11 Implementation of the IPOA-Seabirds and IPOA-Sharks.....	34
References.....	35
Appendix I	37
Mandatory seabird mitigation measures in the ETBF 2013	37
Appendix II.....	39
Mandatory seabird mitigation measures in the WTBF 2013.....	39
Appendix III	40
Summary of papers submitted by Australia	40
Appendix IV	41
Common and scientific names	41

Summary

Purpose

This report includes information and data on ecologically related species (ERS) from Australia's southern bluefin tuna (SBT) fishery for the 2010–11 and 2011–12 SBT fishing seasons.

Catch and effort

Australian SBT catches for the 2011 and 2012 calendar years were 4206 t and 4503 t, respectively. The 2010–11 quota year catch was 3958 t, and the 2011–12 quota year catch was 4543 t. Note that Australia's SBT quota for the 2009–10 and 2010–11 fishing seasons was set at 8030 t total over the two seasons, and fishers were permitted to take up to 5265 t (the quota from the 2008–09 season) in the first of these fishing seasons. Catches for the 2010–11 season exceeded the 8030 t quota by 19.07 t. Australia voluntarily reduced their total allowable catch (TAC) for 2011–12 by 19.07 t. Catches for the 2011–12 quota year exceeded the quota by 34.6 t; Australia has voluntarily reduced its 2012–13 TAC by the same amount (34.6 t).

In 2010–11, 18 vessels landed SBT in Australian waters: 97.8 per cent of the catch was taken by 5 purse seiners off South Australia, with the remainder taken by longliners in the Eastern Tuna and Billfish Fishery (ETBF).

In 2011–12, 16 vessels landed SBT in Australian waters: 98.7 per cent of the catch was taken by 5 purse seiners off South Australia, with the remainder taken by longliners in the ETBF.

No SBT were caught in the Western Tuna and Billfish Fishery (WTBF) in 2010–11 or 2011–12.

Observer coverage

In the 2010–11 fishing season, the purse-seine observer coverage was 19.8 per cent of sets, representing 21 sets observed where SBT were retained. In 2011, observers monitored 24.0 per cent of shots where SBT was caught in the ETBF.

In 2011–12, purse-seine observer coverage was 11.1 per cent of sets, representing 17 sets observed where SBT were retained and two aborted sets where the SBT were reported as too small. In 2012, observers monitored 32.8 per cent of shots where SBT was caught in the ETBF.

Interactions with ERS

Details of ERS interactions in the SBT fishery and ETBF 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 turtles are reported for the ETBF. The SBT purse seine fishery had a single interaction with two sharks. No SBT were caught in the WTBF so no ERS interactions are reported for that 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 recent management initiatives. For example, there are bycatch and discarding. For example, the Australian Fisheries Management Authority (AFMA) implemented a bycatch and discarding program in 2008 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 (Patterson et al. 2013). 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 ERS interactions in Australia's SBT fisheries for the 2010–11 and 2011–12 SBT fishing seasons.

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 99 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.

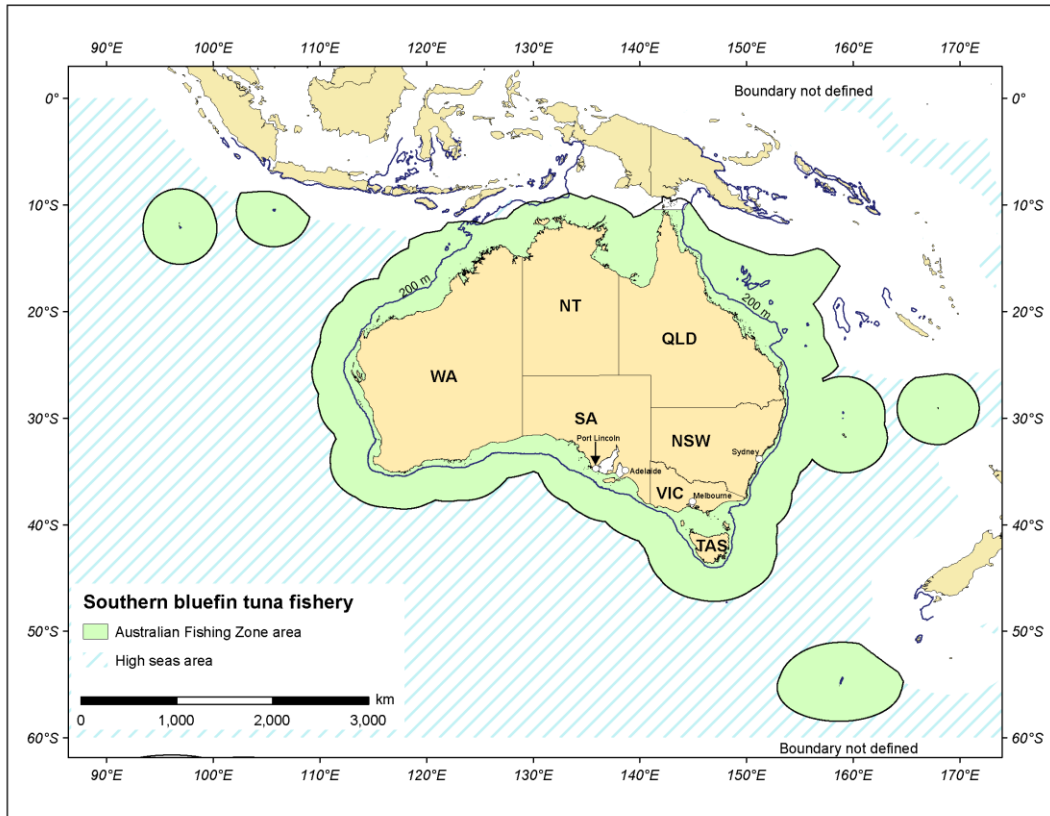
Current fleet size and distribution

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 (2011–12) takes 98.7 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 2010–11 and 2011–12, SBT were also landed by longline in the ETBF off New South Wales. No SBT were taken in the WTBF in 2010–11 or 2011–12.

Figure 1 Area of Australia's Southern Bluefin Tuna Fishery

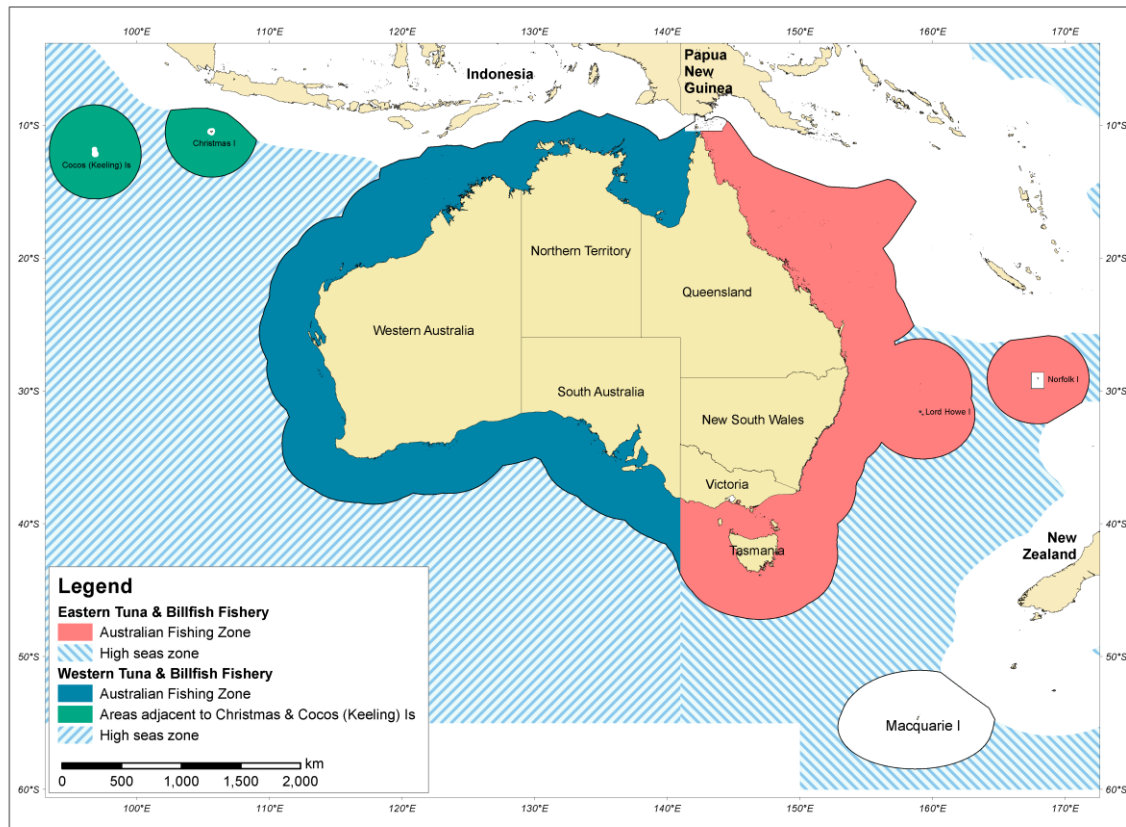


Eastern Tuna and Billfish Fishery

The ETBF extends from Cape York to the Victoria–South Australia border, including waters around Tasmania (Figure 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.

The *Eastern Tuna and Billfish Fishery Management Plan 2010* came into effect on 1 March 2011. The ETBF Plan outlines specific ecosystem requirements, the process for setting total allowable commercial catch (TACC) limits and the provisions for granting of statutory fishing rights (SFRs) in the ETBF. This is the first time that TACCs have been permanently implemented in the ETBF and marks a significant change in management as the fishery moves from input controls based on total allowable effort to output controls with individually transferable quotas operating under a TACC. The species managed under the ETBF Plan include albacore, bigeye tuna, billfish, longtail tuna, northern bluefin tuna, Ray's bream, skipjack tuna and yellowfin tuna.

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 2011 and 2012 calendar years were 4206 t and 4503 t, respectively. Note that Australia's SBT total allowable catch (TAC) for the 2009–10 and 2010–11 fishing seasons was set at 8030 t total over the two seasons, and fishers were permitted to take up to 5265 t (the quota from the 2008–09 season) in the 2009–10 fishing season. Catches for the 2010–11 season exceeded the 8030 t quota by 19.07 t. Australia voluntarily reduced their TAC for 2011–12 by 19.07 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 2010–11, 18 vessels landed SBT in Australian waters: 97.8 per cent of the catch was taken by 5 purse seiners off South Australia, with the remainder taken by longliners in the ETBF deploying a total of 130 573 hooks (in 2011) for shots that caught SBT (Figures 3a and 3b²).

In 2011–12, 16 vessels landed SBT in Australian waters: 98.7 per cent of the catch was taken by 5 purse seiners off South Australia, with the remainder taken by longliners in the ETBF deploying a total of 107 971 hooks (in 2012) for shots that caught SBT (Figures 3a and 3b).

No SBT were caught by longline in the WTBF in 2010–11 or 2011–12.

² SBT catch has been filtered so that only operations from a total of five or more vessels over the time period from 2010–11 and 2011–12 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 3a Location of SBT catch by purse seine in 2010–11 and 2011–12.

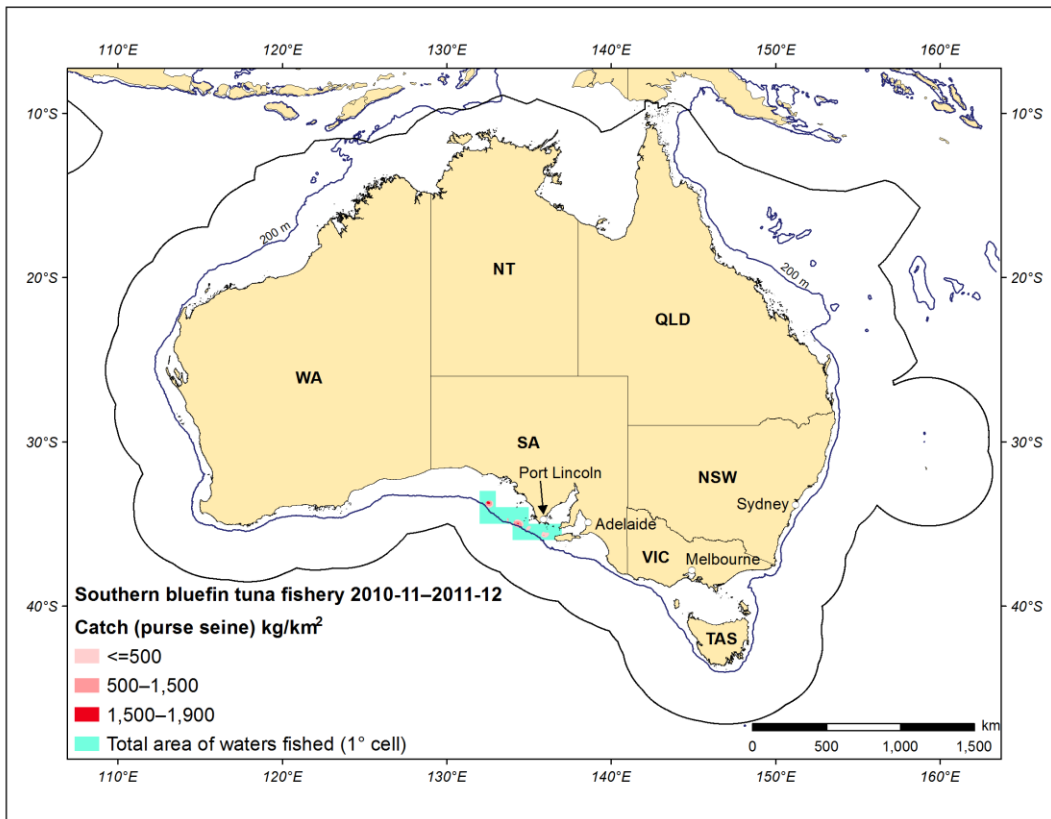
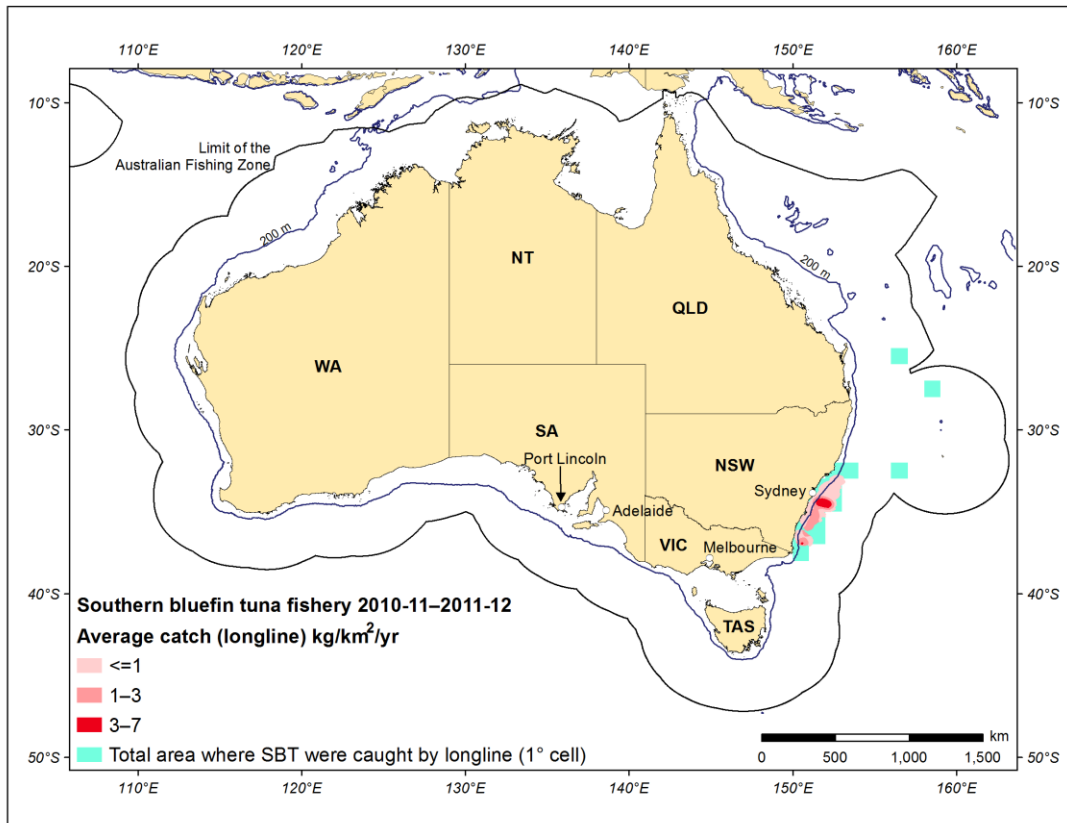


Figure 3b Location of SBT catch by longline in 2010–11 and 2011–12.



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 18 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 2010–11 fishing season, the purse-seine coverage was 19.8 per cent of sets and 12.2 per cent of the estimated SBT catch. In 2011, observers monitored 24.0 per cent of shots where SBT was caught in the ETBF.

In the 2011–12 fishing season, observers monitored 11.1 per cent of purse seine sets and 13.8 per cent of the estimated SBT catch. In 2012, observers monitored 32.8 per cent of shots where SBT was caught in the ETBF.

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 (Anon 2006). The current TAP (2006) 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 (by 5° latitudinal bands) and season (1 September–30 April; 1 May–31 August). The TAP is currently under review.

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 seabird streamers, known as 'tori' lines, to prevent 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 (2006). 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).

Tables 1a and b give the observed interactions with seabirds for the Australian ETBF from 2011 and 2012. Note that interactions have been reported for observed shots in the ETBF where SBT was caught. Seabird interactions occurring in the ETBF are reported annually to the Western and Central Pacific Fisheries Commission (WCPFC; e.g. Patterson et al. 2013).

Table 1 Observed interactions between seabird species and ETBF vessels (CCSBT statistical area 4) in (a) 2011 and (b) 2012. 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. No interactions are reported for the WTBF as there were no SBT caught in the fishery.

a) ETBF (2011)		Observed							Estimate
Species	Total effort (no. hooks)	Total observed effort (no. hooks)	Observer coverage (% no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Live releases	Estimated total mortalities (raised to total effort)
Great crested tern	130 573	31 317	24.0%	1	0.032	1	0.032	0	4.169

b) ETBF (2012)		Observed							Estimate
Species	Total effort (no. hooks)	Total observed effort (no. hooks)	Observer coverage (% no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Live releases	Estimated total mortalities (raised to total effort)
Shy albatross	107 971	35 464	32.8%	1	0.032	0	0.000	1	0.000

Western Tuna and Billfish Fishery

No SBT were caught in the longlining operations of the WTBF in 2010–11 or 2011–12. 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 (2006).

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 September. 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 2011 or 2012 in shots where SBT was caught recorded in the logbooks.

Western Tuna and Billfish Fishery

No SBT were caught in longline operations in the WTBF during the reported fishing seasons (2010–11 and 2011–12). Seabird interactions occurring in the WTBF are reported annually to the Indian Ocean Tuna Commission (IOTC) (e.g. Hobsbawn et al. 2012).

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 is no observed non-target catch for the 2010–11 and 2011–12 fishing seasons and no non-target fish catch was reported in logbooks.

Eastern Tuna and Billfish Fishery

Table 2a and 2b provide observed non-target catch in the ETBF for 2011 and 2012. 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

No SBT were caught in the longline operations of the WTBF during the recent fishing seasons (2010–11 and 2011–12). The catch of non-target fish species in the WTBF is reported annually to the IOTC (e.g. Hobsbawn et al. 2012).

Table 2 Observed interactions between non-target scalefish species and ETBF vessels (CCSBT statistical area 4) in (a) 2011 and (b) 2012. 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. No interactions reported are for the WTBF as there were no SBT caught in the fishery.

a) ETBF (2011)		Observed							Estimate
Species	Total effort (no. hooks)	Total observed effort (no. hooks)	Observer coverage (% no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Live releases	Estimated total mortalities (raised to total catch)
Longnose lancetfish	130 573	31 317	24.0%	15	0.479	6	0.192	9	25.01
Mahi mahi	130 573	31 317	24.0%	13	0.415	13	0.415	0	54.20

b) ETBF (2012)		Observed							Estimate
Species	Total effort (no. hooks)	Total observed effort (no. hooks)	Observer coverage (% no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Live releases	Estimated total mortalities (raised to total catch)
Escolar	107 971	35 464	32.8%	22	0.620	21	0.592	1	63.94
Mahi mahi	107 971	35 464	32.8%	18	0.508	18	0.508	0	54.80

Table 3 Unobserved interactions (logbooks) between non-target scalefish species and ETBF vessels (CCSBT statistical area 4) in (a) 2011 and (b) 2012. 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. No interactions are reported for the WTBF as there were no SBT caught in the fishery.

a) Species	Total effort (no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Releases
Lancetfish	130 573	48	0.368	10	0.0765	38
Mahi mahi	130 573	27	0.207	27	0.207	0
Rudderfish	130 573	21	0.161	21	0.161	0

b) Species	Total effort (no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Releases
Escolar	107 971	16	0.148	0	0.000	16
Lancetfish	107 971	16	0.148	13	0.120	3
Ray's bream	107 971	393	3.640	393	3.640	0

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. In 2010–11, two white sharks (*Carcharodon carcharias*) were caught in a purse seine operation, resulting in the net being dropped and both sharks being released alive. No observer was present for this interaction and it was not noted in the logbooks. As white sharks are a TEP species in Australia, the interaction was reported to the Department of Sustainability, Environment, Water, Population and Communities as required under the Environment Protection and Biodiversity Conservation Act 1999.

No other interactions, observed or non-observed, between purse-seine vessels and sharks were recorded in 2011 or 2012.

Eastern Tuna and Billfish Fishery

Shark catch details from observers in the ETBF are provided in Table 4a and 4b for 2011 and 2012, respectively. Catches from logbooks are provided in Table 5a and bb. 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. Patterson et al. 2013).

Western Tuna and Billfish Fishery

No SBT were caught in the longline operations of the WTBF during the recent fishing seasons (2010–11 and 2011–12). The catch of sharks in the WTBF is reported annually to the IOTC (e.g. Hobsbawn et al. 2012).

Table 4 Observed interactions between shark species and ETBF vessels (CCSBT statistical area 4) in (a) 2011 and (b) 2012. 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. No interactions are reported for the WTBF as there were no SBT caught in the fishery.

a) ETBF (2011)		Observed							Estimate
Species	Total effort (no. hooks)	Total observed effort (no. hooks)	Observer coverage (% no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Live releases	Estimated total mortalities (raised to total effort)
Blue shark	130 573	31 317	24.0%	260	8.302	29	0.926	231	120.913
Dusky shark	130 573	31 317	24.0%	1	0.032	0	0.000	1	0.000
Shortfin mako	130 573	31 317	24.0%	16	0.511	12	0.383	4	50.033
Tiger shark	130 573	31 317	24.0%	1	0.032	0	0.000	1	0.000
Thresher shark	130 573	31 317	24.0%	1	0.032	1	0.032	0	4.169

Table 4 Continued

b) ETBF (2012)		Observed							Estimate
Species	Total effort (no. hooks)	Total observed effort (no. hooks)	Observer coverage (% no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Live releases	Estimated total mortalities (raised to total effort)
Blue shark	107 971	35 464	32.8%	123	3.444	0	0.000	123	0.000
Bronze whaler	107 971	35 464	32.8%	3	0.084	0	0.000	3	0.000
Dusky shark	107 971	35 464	32.8%	3	0.084	0	0.000	3	0.000
Galapagos shark	107 971	35 464	32.8%	1	0.028	1	0.028	0	3.045
Longfin mako	107 971	35 464	32.8%	1	0.028	0	0.000	0	0.000
Oceanic whitetip	107 971	35 464	32.8%	1	0.028	1	0.028	0	3.045
Porbeagle	107 971	35 464	32.8%	1	0.028	0	0.000	1	0.000
Shortfin mako	107 971	35 464	32.8%	32	0.896	25	0.7	7	76.113
Thresher shark	107 971	35 464	32.8%	3	0.084	2	0.056	1	6.089
Tiger shark	107 971	35 464	32.8%	4	0.112	0	0.000	2	0.000

Table 5 Unobserved interactions (logbooks) between shark species and ETBF vessels (CCSBT statistical area 4) in (a) 2011 and (b) 2012. 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. No interactions reported for the WTBF as there were no SBT caught in the fishery.

a) Species	Total effort (no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Releases
Blue shark	130 573	537	4.11	96	0.74	441
Bronze whaler	130 573	32	0.25	0	0.000	32
Dusky shark	130 573	1	0.008	0	0.000	1
Shortfin mako	130 573	69	0.53	58	0.44	11
Thresher	130 573	4	0.031	0	0.000	4
Tiger shark	130 573	1	0.008	0	0.000	1

Table 5 Continued

b) Species	Total effort (no. hooks)	Captures	Capture rate (per 1000 hooks)	Mortalities	Mortality rate (per 1000 hooks)	Releases
Blue shark	107 971	185	1.713	2	0.0185	183
Bronze whaler	107 971	6	0.0555	3	0.0277	3
Dusky shark	107 971	3	0.0277	0	0.000	3
Porbeagle	107 971	1	0.0092	0	0.000	1
Roughskin shark	107 971	1	0.0092	1	0.0092	0
Shortfin mako	107 971	61	0.565	56	0.519	5
Thresher	107 971	3	0.0277	0	0.000	3
Tiger shark	107 971	1	0.0092	0	0.000	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, observed or non-observed, were recorded in the SBTF in 2010–11 or 2011–12.

Eastern Tuna and Billfish Fishery

There were no interactions with marine mammals in ETBF while fishing for SBT in 2010–11 and 2011–12. No observed interactions with reptiles were recorded in the ETBF in 2011 or 2012 and no unobserved interactions were recorded in logbooks in 2011. A single leatherback turtle capture was noted in logbooks in 2012. However, the status of the turtle was not recorded.

Table 6 Unobserved interactions between reptile species and ETBF vessels (CCSBT statistical area 4) in 2012. Capture rate is given per thousand hooks. N/A = data not available. Note: data are from shots in the ETBF where SBT were caught. Scientific names are given in Appendix IV.

Species	Total effort	Captures	Capture rate	Mortalities	Mortality rate	Live releases
Leatherback turtle	130 573	1	0.008	N/A	N/A	N/A

Western Tuna and Billfish Fishery

No SBT were caught in the WTBF in 2010–11 or 2011–2012.

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 7)
- 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

As previously noted, under Commonwealth legislation (now the EPBC Act), a 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 TAP is currently under review. The provisions of the TAP apply to all longline fisheries managed by the Australian Government. The TAP (2006) is now under review.

In the TAP (2006) the following mitigation actions are prescribed:

- 1) AFMA requires all pelagic longline tuna fishers operating within the ETBF and the WTBF 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 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
- 3) 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).

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 5 for more information.

See Appendix I and II for specific measures required for the ETBF and WTBF in 2013. 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/managing-our-fisheries/fisheries-a-to-z-index/eastern-tuna-and-billfish-fishery/>; <http://www.afma.gov.au/managing-our-fisheries/fisheries-a-to-z-index/western-tuna-and-billfish-fishery/notices-and-announcements/>. A pre-season briefing booklet for the SBTF is also available: <http://www.afma.gov.au/wp-content/uploads/2010/06/SBT-Pre-Season-Brief-2011-2012-1.pdf>.

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. Listing under the EPBC Act 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.

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 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 dehooker 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. In recent years, Australia has conducted 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 2011 or 2012. 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 Sustainability, Environment, Water, Populations and Communities. 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 2011 and 2012 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 5; Robertson & van den Hoff 2010; Robertson et al. 2010a, b; Robertson & Candy 2013; Robertson et al. 2013). 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 7 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 	Late-2013
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.	Stage 1: R&D; initial operational testing of prototype unit (Mk1)	Completed
			Stage 2: Testing Mk1 unit in ETBF under normal operational fishing	Completed
			Stage 3: At-sea testing and refinement of the performance of Mk1 prototype.	Completed
			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.	Completed
			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).	Ongoing
			Stage 6: Proof-of-concept experiment with Mk2 prototype in the Uruguayan swordfish fishery.	Mid-2014
			Stage 7: Complete scientific paper on effectiveness of underwater setting method in minimising mortality of albatrosses and petrels in pelagic longline fisheries.	Late 2014

Table 7 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 line 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:	Completed
		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.

This included:

- 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 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 applies to all longline fisheries managed by the Australian Government. The TAP (2006) is Australia's key national measure for mitigating the impact of longline fisheries on seabird populations, and is consistent with the IPOA-Seabirds. The TAP (2006) is currently under review.

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.daff.gov.au/fisheries/environment/sharks/sharkplan2>

References

Anon 2006, Threat Abatement Plan 2006: for the incidental catch (or bycatch) of seabirds during oceanic longline operations. Australian Antarctic Division, Hobart, http://www.antarctica.gov.au/_data/assets/pdf_file/0017/21509/ml_399394109837963_final20threatabatement2007-4-combined6c.pdf

Bensley N, Woodhams J, Patterson HM, Rodgers M, McLoughlin K, Stobutzki I & Begg GA 2009, Shark Assessment Report for the Australian National Plan of Action for the Conservation and Management of Sharks, final report to the Department of Agriculture, Fisheries and Forestry, Bureau of Rural Sciences, Canberra

Hobsbawn P, Phillips K, Begg G 2009, Australia's 2007–08 southern bluefin tuna fishing season. CCSBT-ESC/0909/STB Fisheries—Australia, Commission for the Conservation of Southern Bluefin Tuna, Fourteenth Meeting of the Scientific Committee, 5–11 September, Busan, Korea

Hobsbawn P, Patterson H, Begg G 2010, Australia's 2008–09 southern bluefin tuna fishing season. CCSBT-ESC/1009/STB Fisheries—Australia, Commission for the Conservation of Southern Bluefin Tuna, Fifteenth Meeting of the Scientific Committee, 4–10 September, Taipei, Taiwan

Hobsbawn P, Patterson H, Begg G 2011, Australia's 2009–10 southern bluefin tuna fishing season. CCSBT-ESC/1109/STB Fisheries—Australia, Commission for the Conservation of Southern Bluefin Tuna, Sixteenth Meeting of the Scientific Committee, 19–28 July, Bali, Indonesia

Hobsbawn PI, Patterson HM, Larcombe J 2012, Australian national report to the Scientific Committee of the Indian Ocean Tuna Commission for the 2012, Indian Ocean Tuna Commission, IOTC-2012-SC15-NR-01, Fifteenth Session of the Scientific Committee, 10–15 December 2012, Victoria, Seychelles.

Lawrence E, Giannini F, Bensley N, Crombie J (2009) Estimation of seabird bycatch rates in the Eastern Tuna and Billfish Fishery. Bureau of Rural Sciences, Canberra

Patterson H, Sahlqvist P, Larcombe J (2013) Annual report to the Western and Central Pacific Fisheries Commission, Part 1: Information on fisheries, research and statistics 2012, Australia. WCPFC-SC9-AR/CCM-01, Western and Central Pacific Fisheries Commission, Ninth Regular Session of the Scientific Committee, 6–14 August 2013, Pohnpei, Federated States of Micronesia

Robertson G, van den Hoff (2010) Static water sink rate trials to improve understanding of sink rates estimated at sea, Third meeting of the Seabird Bycatch Working Group, SBWG-3 Doc 31, Agreement on the Conservation of Albatrosses and Petrels, 8–9 April 2010, Mar del Plata, Argentina

Robertson G, Candy SG, Wienecke B (2010a) Effect of line shooter and mainline tension on the sink rates of pelagic longlines and implications for seabird interactions. *Aquatic Conservation: Marine Freshwater Ecosystems* 20, 419–427.

Robertson G, Candy SG, Wienecke B, Lawton K (2010b) Experimental determinations of factors affecting the sink rates of baited hooks to minimize seabird mortality in pelagic longline fisheries. *Aquatic Conservation: Marine Freshwater Ecosystems* 20, 632–643.

Robertson G Candy SC (2013) Does propeller turbulence affect the sink rate of baited hooks and their availability to seabirds in pelagic longline fisheries? *Aquatic Conservation: Marine Freshwater Ecosystems* DOI: 10.1002/aqc.2373.

Robertson G, Candy SC, Hall S (2013) New branch line weighting regimes to reduce the risk of seabird mortality in pelagic longline fisheries without affecting fish catch. *Aquatic Conservation: Marine Freshwater Ecosystems* DOI: 10.1002/aqc.2346.

Ward P, Lawrence E, Darbyshire R, Hindmarsh S (2008) Large-scale experiment shows that nylon leaders reduce shark bycatch and benefit pelagic longline fishers. *Fisheries Research* 90:100–108, doi: 10.1016/j.fishres.2007.09.034

Ward P, Epe S, Kreutz D, Lawrence E, Robins C, Sands A (2009) The effects of circle hooks on bycatch and target catches in Australia's pelagic longline fishery. *Fisheries Research* 97:253–262, doi: 10.1016/j.fishres.2009.02.009

Appendix I

Mandatory seabird mitigation measures in the ETBF 2013

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.
- 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 2013

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 3.5m from each hook ; or
 - 2.) 98 g swivels at a distance of no more than 4m from each hook; or
 - 3.) 40 g weights at each hook.
- At all times carry 1000 weighted swivels each weighing at least 60g
- 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/1308/09 - Draft measures on reducing the incidental bycatch of seabirds in longline fisheries

CCSBT-ERS/1308/10 - Draft measures to mitigate the impact on ecologically related species of fishing for southern bluefin tuna

These two papers are provided to be used by the CCSBT Members at ERSWG and intersessionally to consider possible options for drafting conservation and management measures in respect to ecologically related species and seabirds for consideration by the Commission at CCSBT20.

CCSBT-ERS/1308/11 - Summary of the status of key shark species in tuna regional fisheries management organisations

To date, the CCSBT has not directly undertaken risk assessments for shark species. Given that fishing for SBT using pelagic longline spatially overlaps with fishing for other tuna species, particularly in the Indian Ocean, previous assessments from other RFMOs may be useful in determining which shark species are most at risk by SBT fishing and may provide guidance for the CCSBT in determining what further work on sharks needs to be undertaken. This paper reviews those previous assessments.

CCSBT-ERS/1308/Info/02 - New branch line weighting regimes to reduce risk of seabird mortality in pelagic longline fisheries without affecting fish catch.

1. Experiments were conducted on two new branch line weighting regimes designed to reduce the risk of seabird mortality in the Australian pelagic longline fishery. The experiments compared the sink rates and fish catch rates of the new regimes with that used by the fishing industry.
2. Baited hooks on gear with a 120 g lead weight 2m from the hook reduced the time to reach 2m, 5m and 8m depths by 16%, 58% and 70%, respectively, compared with industry standard gear with 60 g at 3.5 m. Baited hooks with 40 g leads at the hook reduced the time taken to reach 2m, 5m and 8m depth by 33%, 28% and 25%, respectively. The reduction in time with a 60 g lead at the hook to these depths was ~40%.
3. There were no statistically detectable differences in catch rates of target and non-target fish between industry standard branch lines and branch lines with both 120 g leads at 2m and those with 40 g leads at the hook. The results contest the widely-accepted opinion that major branch line modifications, including weight at the hook, reduce fish catch.
4. The regime with a 40 g lead at or very close to (i.e. ≤ 0.5 m) the hook has the most potential for adoption in fisheries due to: (i) improved crew safety; (ii) ease of port-based inspection for compliance purposes; (iii) reduced construction costs; (iv) reduced bin tangles; and (v) ease of deployment. Lead loss from shark bite-offs can be minimized by placing leads on short (≤ 0.5 m) leaders. In areas of moderate to high risk to seabirds, or where the risks are unknown, the use of 60 g leads either at or ≤ 0.5 m from the hook is encouraged.

Appendix IV

Common and scientific names

Common names	Scientific names
Albatrosses (other)	<i>Diomedidae</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 melanophrys</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>
Dusky shark	<i>Carcharhinus obscurus</i>
Escolar	<i>Lepidocybium flavobrunneum</i>
Flatback turtle	<i>Natator depressa</i>
Flesh-footed shearwater	<i>Puffinus carneipes</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>
Mahi mahi	<i>Coryphaena hippurus</i>
Moonfish (opah)	<i>Lampris guttatus</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.
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>Puffinus tenuirostris</i>
Shy albatross	<i>Thalassarche cauta</i>
Silky shark	<i>Carcharhinus falciformis</i>
Smooth hammerhead	<i>Sphyrna zygaena</i>
Sooty shearwater	<i>Puffinus 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>Puffinus pacificus</i>
Yellow-nosed albatross	<i>Thalassarche chlororhynchus</i>

