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Australian National Report

To the Scientific Committee of the Indian Ocean Tuna Commission for 2018

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In accordance with IOTC Resolution 15/02, final scientific data for the previous year was provided to the Secretariat by 30 June of the current year, for all fleets other than longline (e.g. for a National report submitted to the Secretariat in 2017, final data for the 2016 calendar year must be provided to the Secretariat by 30 June 2017).	YES 30/06/2018
In accordance with IOTC Resolution 15/02, provisional longline data for the previous year was provided to the Secretariat by 30 June of the current year (e.g. for a National report submitted to the Secretariat in 2017, preliminary data for the 2006 calendar year was provided to the Secretariat by 30 June 2017). REMINDER: Final longline data for the previous year is due to the Secretariat by 30 Dec of the current year (e.g. for a National report submitted to the Secretariat in 2017, final data for the 2006 calendar year must be provided to the Secretariat by 30 December 2017).	YES 30/06/2018

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Summary

Pelagic longline and purse seine are the two main fishing methods used by Australian vessels to target tuna and billfish in the Indian Ocean Tuna Commission (IOTC) Area of Competence. The number of active longliners and levels of fishing effort have remained low since 2001 due to reduced profitability, primarily as a result of lower fish prices and higher operating costs. In 2017, three Australian longliners from the Western Tuna and Billfish Fishery and seven longliners from the Eastern Tuna and Billfish Fishery operated in the IOTC Area of Competence. They caught 18.6 t of albacore (*Thunnus alalunga*), 59.3 t of bigeye tuna (*Thunnus obesus*), 65.3 t of yellowfin tuna (*Thunnus albacares*), 155.8 t of swordfish (*Xiphius gladius*) and 1.5 t of striped marlin (*Kajikia audax*). These catches represent approximately 12 per cent of the peak catches taken by Australian vessels fishing in the IOTC Area of Competence in 2001, for these five species combined. In 2017, 1.8 t of shark was landed by the Australian longline fleet operating in the IOTC Area of Competence and 10 184 sharks were discarded/released. In addition, 11.7 per cent of hooks deployed in the WTBF were observed with electronic monitoring in the 2017 calendar year. The catch of southern bluefin tuna (*Thunnus maccoyii*) in the purse seine fishery was 3951 t in 2017. There was no skipjack tuna (*Katsuwonus pelamis*) caught by purse seine fishing.

1 Background/general fishery information

Australian fisheries targeting tuna and billfish in the Indian Ocean Tuna Commission (IOTC) Area of Competence are the pelagic longline fisheries – Western Tuna and Billfish Fishery (WTBF) and Eastern Tuna and Billfish Fishery (ETBF) (Appendix A) – and the purse seine fisheries – Southern Bluefin Tuna Fishery (SBTF) and the Eastern and Western Skipjack Fisheries (SJF). These five fisheries are managed by the Australian Government through the Australian Fisheries Management Authority (AFMA). Other methods such as handline, dropline, trolling and gillnetting capture small amounts of tuna and related species in multi-purpose fisheries, which are managed by the Australian Government and Australian State Governments (e.g. Western Australia). Catches from the SBTF are included in this report, although this information is reported separately to the Commission for the Conservation of Southern Bluefin Tuna.

2 Fleet structure

Longline fleet

The number of Australian longline vessels operating in the IOTC Area of Competence has declined substantially since 2000 (61 vessels) with only ten vessels operating in 2017 (Table 1). The main factor influencing the decline in fishing effort is reduced profitability, caused by lower export prices and higher operating costs, particularly fuel costs.

Historically, most of these vessels have operated in the WTBF (Appendix A) with very little longline effort taking place in the area of the ETBF between 141°E and 150°E. In 2017, three vessels from the WTBF and seven from the ETBF fished in the IOTC Area of Competence. In recent years, the Australian longline fleet has fished mainly within Australia's Exclusive Economic Zone (EEZ) between 20°S and 35°S; 98.2 per cent of total effort in 2017.

Most Australian longline vessels range in length from 20 to 35 m and are less than 230 gross registered tonnes. Ice, ice slurry or brine spray systems are used to chill the catch. The majority of the fishing trips undertaken by Australian longline operators are less than 15 days in length (56 trips undertaken in the WTBF in 2017). Vessels fishing on the high seas undertake longer voyages of up to 62 days.

Purse seine fleet

The purse seine fleet has fluctuated from 5–14 vessels since 1998 (Table 1). The purse seine vessels vary in length from 20 to 45 m and target southern bluefin tuna (SBT; *Thunnus maccoyii*) for farm cage grow-out. There were six active SBT vessels in 2017.

Table 1 Number of Commonwealth and Western Australian longline and purse seine vessels reporting one or more fishing trips in the IOTC Area of Competence from 1998 to 2017. For the purse seine fleet, the numbers in brackets represent the number of active SBT purse seine vessels from the total number of purse seiners. The number of vessels >24 metres in length (all methods combined) for each year is also indicated.

	Number of vessels		
Calendar Year	**Longline**	**Purse seine**	**> 24 m**
1998	37	5 (5)	n/a
1999	49	7 (7)	n/a
2000	61	8 (8)	n/a
2001	45	13 (8)	n/a
2002	44	9 (7)	25
2003	36	7 (7)	21
2004	22	7 (6)	17
2005	6	8 (8)	11
2006	4	14 (7)	10
2007	3	11 (6)	9
2008	5	10 (7)	8
2009	4	10 (8)	13
2010	4	9 (7)	13
2011	2	5 (5)	7
2012	4	5 (5)	8
2013	4	5 (5)	11
2014	4	6 (6)	9
2015	7	6 (6)	9
2016	7	7 (7)	10
2017	10	6 (6)	11

n/a = data not available

3 Catch and effort by species and gear

Longline fleet

Australian longline fishing activity and associated catches of tunas and billfishes in the eastern Indian Ocean increased rapidly between 1998 and 2001, especially off Australia's western coast, south of latitude 20°S. Catch and effort for all species then declined and have remained relatively low since 2005, with some annual variation (Figure 1). Swordfish (*Xiphius gladius*) has been the main target species since 1999 (peak catch of 2136 t in 2001) with smaller amounts of albacore (*Thunnus alalunga;* peak catch of 94 t in 2001), bigeye tuna (*Thunnus obesus;* peak catch of 436 t in 2000), yellowfin tuna (*Thunnus albacares;* peak catch of 558 t in 2001) and striped marlin (*Kajikia audax;* peak catch of 23 t in 1999) landed each year.

Overall catch of the main target species in the fishery remained approximately the same in 2017 compared to 2016, whereas longline effort increased from 429 288 hooks in 2016 to 532 396 hooks in 2017 in the IOTC area. The swordfish catch increased from 133.8 t in 2016 to 155.8 t in 2017 (Table 2a). Bigeye catch decreased from 69.4 t in 2016 to 59.3 t in 2017. Yellowfin tuna catch decreased slightly from 65.8 t in 2016 to 65.3 t in 2017 (Table 2a). The total catch in 2017 decreased slightly compared to 2016. There was a slight decrease in catch of the 'not elsewhere indicated' (NEI) category, both of which were significantly higher than in previous years. This was once again due to the higher longline catch of southern bluefin tuna in the IOTC area. Figure 2a and Figure 2b map the footprint of Australian tuna fishing effort in the IOTC area of competence for 2017 and for 2013–17. Due to confidentiality restrictions that prevent the disclosure of fishing activity by fewer than five vessels, fine-scale effort distribution cannot be reported in the WTBF or ETBF. Figures 3a and 3b indicate the distribution of the catch in the IOTC Area of Competence. However, the longline catch from the WTBF and ETBF could not be mapped for 2017 due to confidentiality.

Figure 1 Australian annual catch of primary species in the longline sector of the WTBF, 1986 to 2017

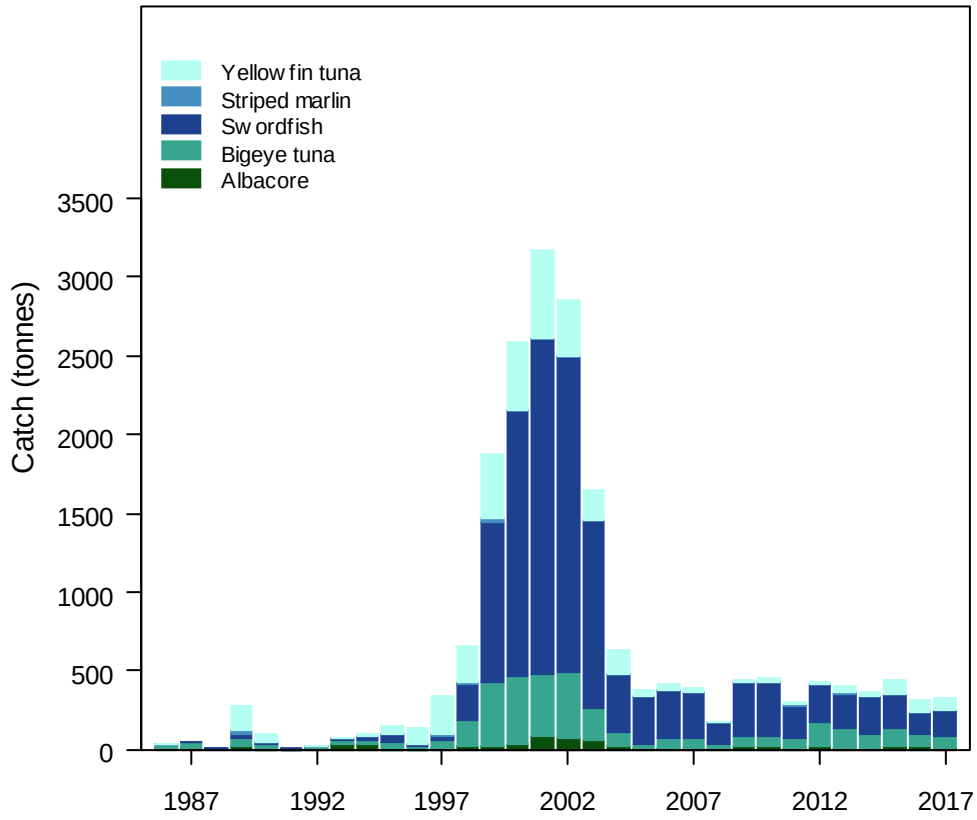


Figure 2a Fishing footprint (shown as 1 degree cells) in the Western Tuna and Billfish Fishery and Eastern Tuna and Billfish Fishery (longline) and in the Southern Bluefin Tuna Fishery (purse seine) for 2017

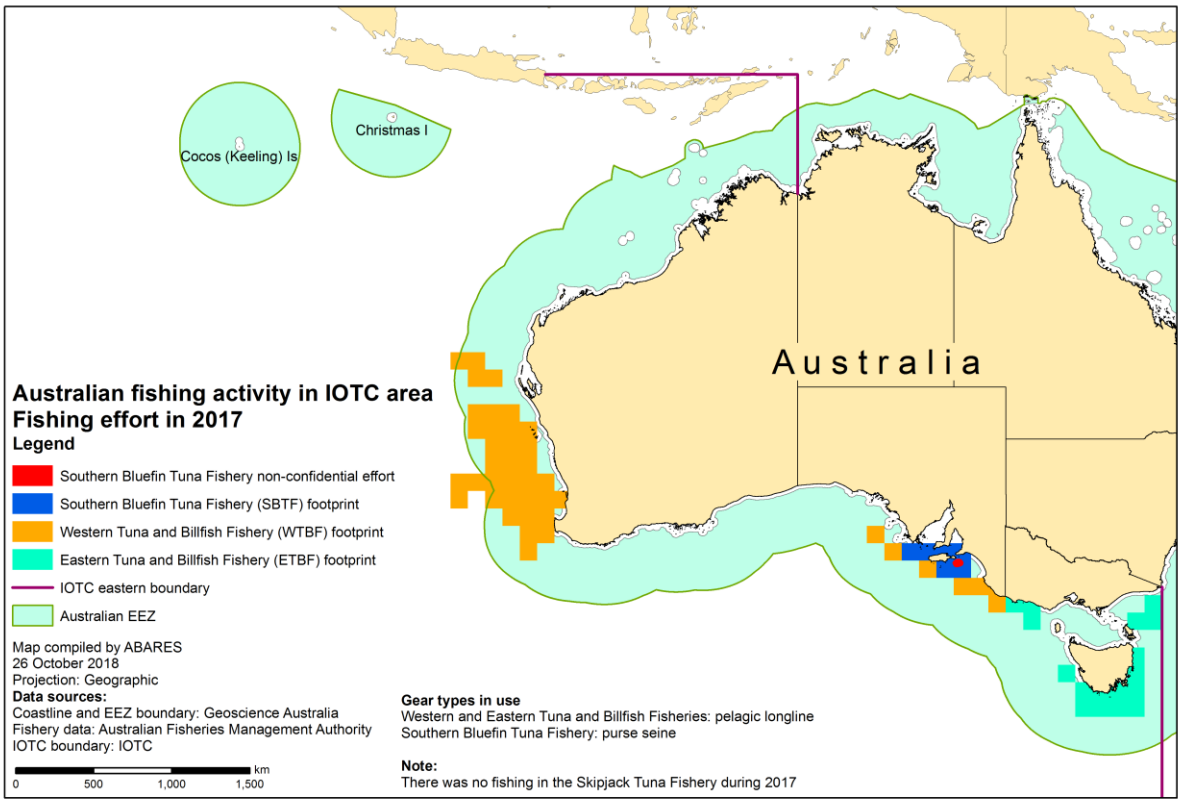


Figure 2b Aggregate fishing footprint (shown as 1 degree cells) in the Western Tuna and Billfish Fishery and Eastern Tuna and Billfish Fishery (longline) and in the Southern Bluefin Tuna Fishery (purse seine) for 2013 to 2017

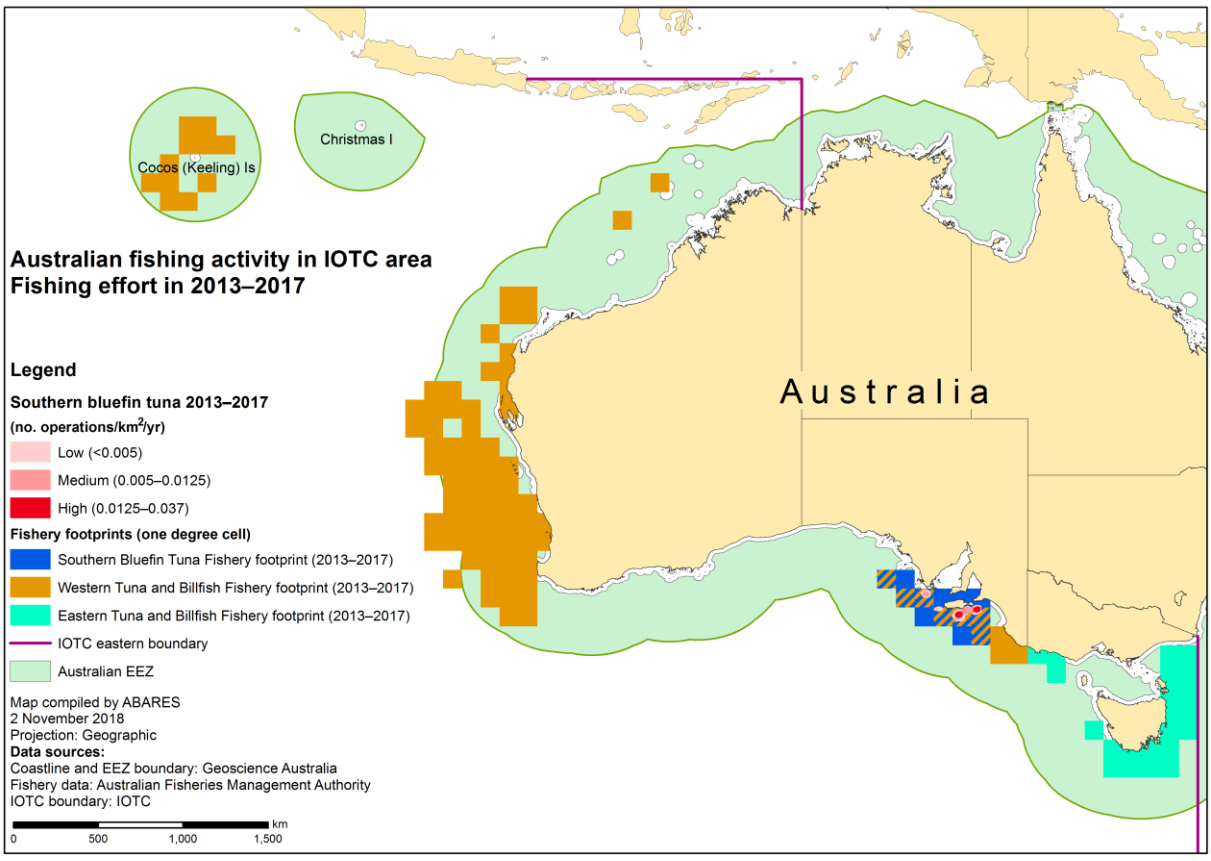


Figure 3a Distribution of catch in the Southern Bluefin Tuna Fishery (purse seine) for 2017. Note that due to the low effort in the longline fisheries, confidentiality rules prohibit the depiction of the 2017 WTBF and ETBF data

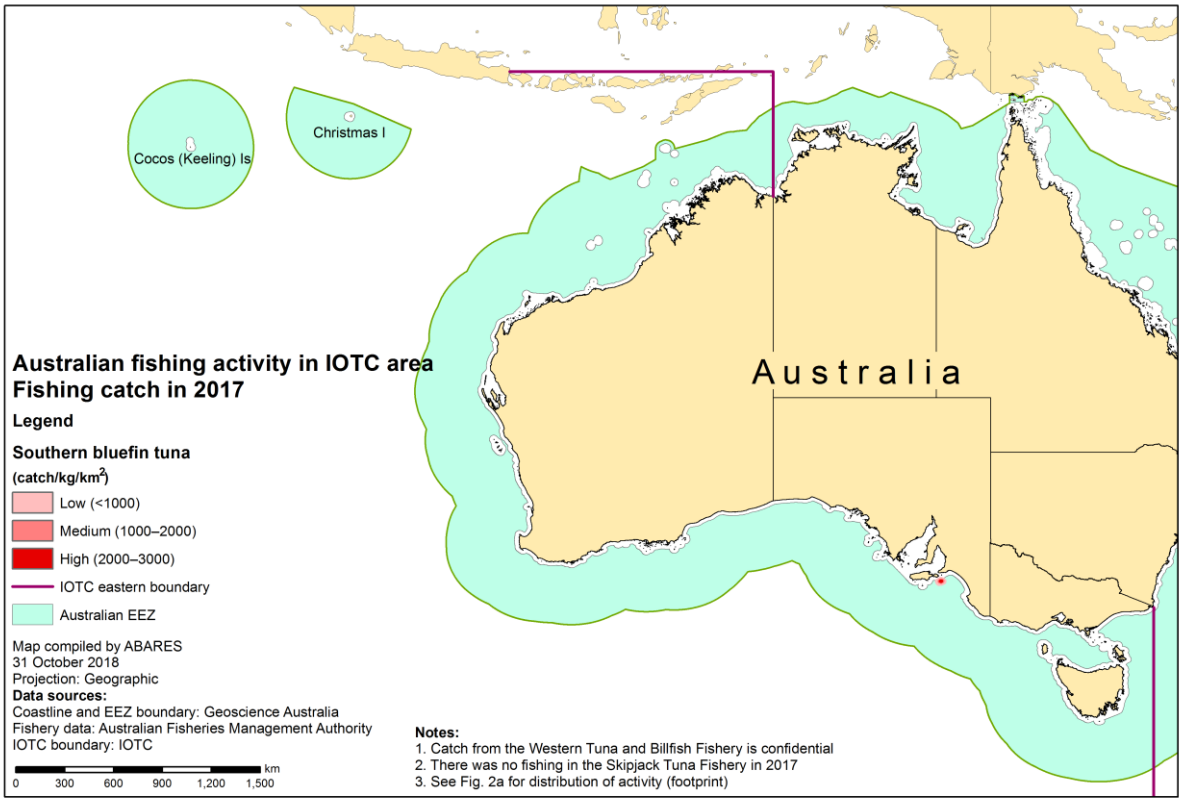
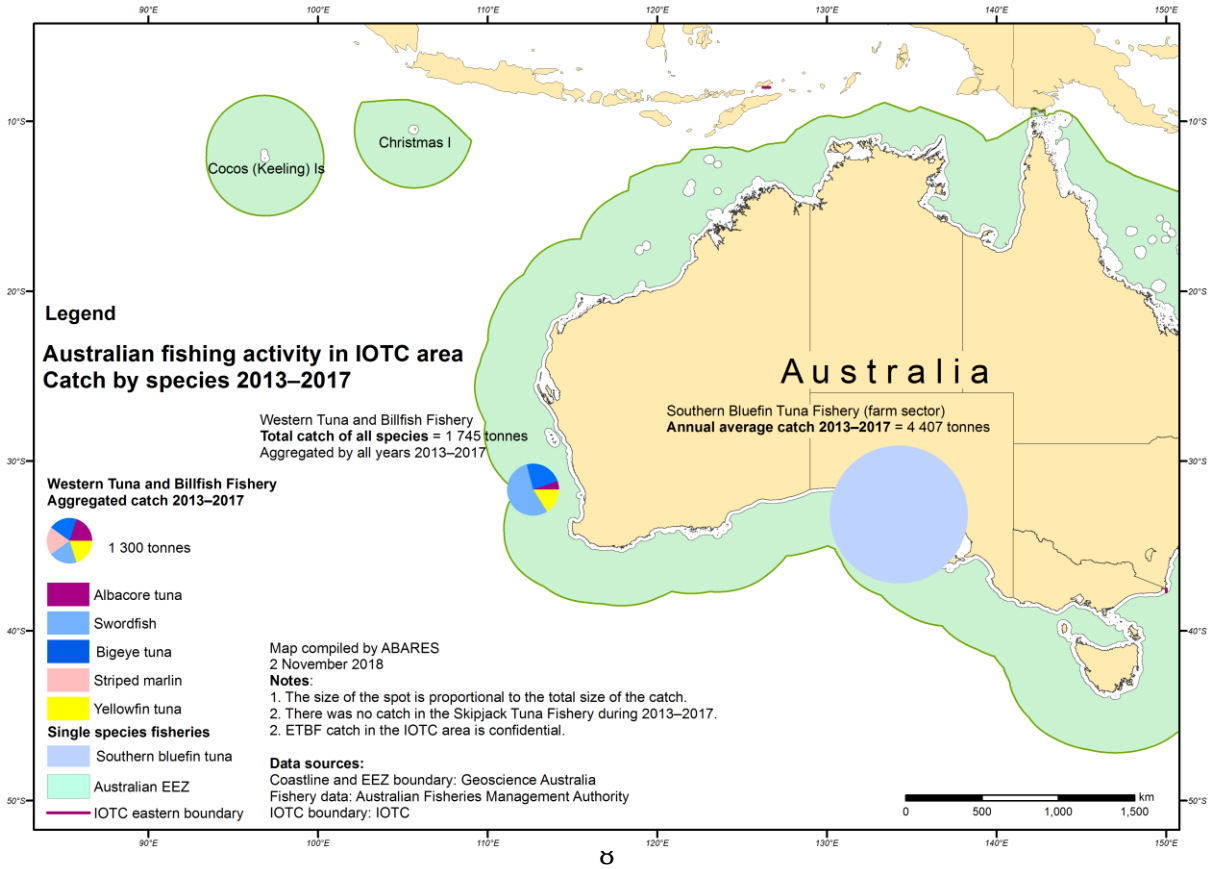


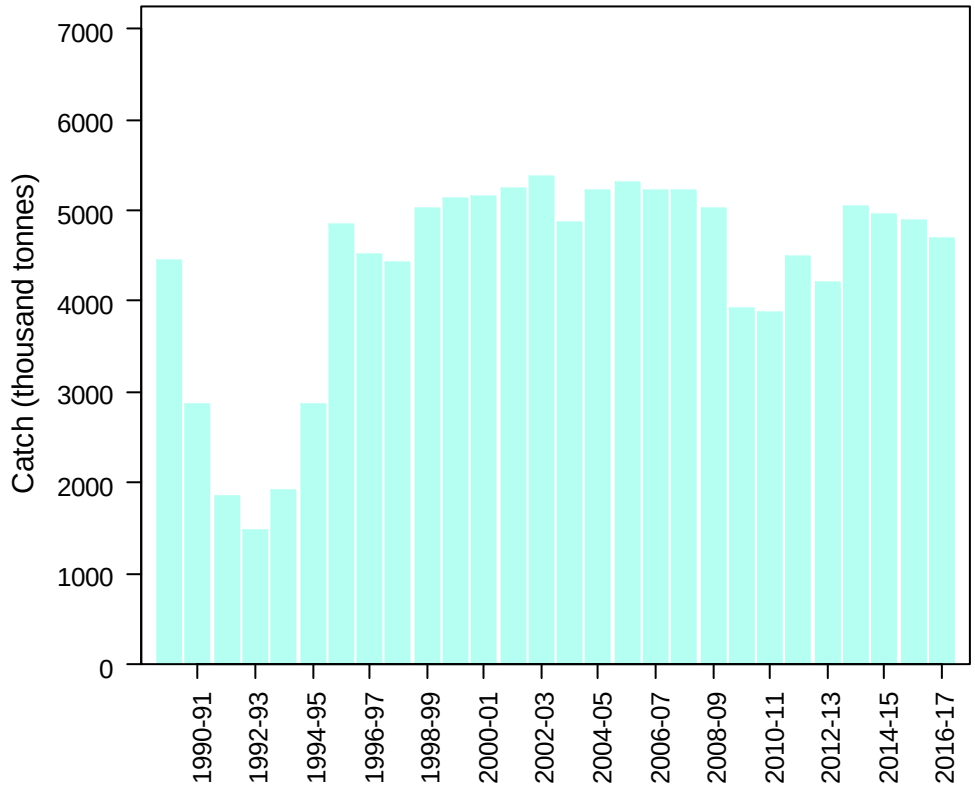
Figure 3b Distribution of catch in the Western Tuna and Billfish Fishery (WTBF; longline), Eastern Tuna and Billfish Fishery (ETBF; longline) and in the Southern Bluefin Tuna Fishery (purse seine) for 2013 to 2017



Purse seine fleet

Purse seine fishing by Australian vessels in the IOTC Area of Competence targets SBT in the Great Australian Bight for grow-out in farm cages at Port Lincoln, South Australia. Effort in the purse-seine sector decreased from 124 sets in 2015–16 to 109 sets in the 2016–17 season (Table 2b). The actual catch of SBT taken in the purse seine fishery (derived from catch disposal data) for the 2015–16 fishing season (1 December 2015 to 30 November 2016) was 4896 t (Table 2b; Figure 4). In 2017, the actual catch was 4571 t, while for the 2016–17 fishing season (1 December 2016 to 30 November 2017), the actual catch taken was 4683 t. Distribution of the catch in the SBTF is shown for 2017 in Figure 3a and for 2013–17 in Figure 3b. In some previous fishing seasons, purse seine vessels have also targeted skipjack tuna (*Katsuwonus pelamis*) late in the SBT season. However, there was no skipjack catch in 2017.

Figure 4 Fishing season catches of southern bluefin tuna in the purse seine sector of the SBTF, 1989–90 to 2016–17



Multi-purpose fleets

The multi-purpose fisheries (dropline, gillnet, minor line, trawl and troll) typically target different species (e.g. Spanish mackerel) compared to the longline fishery. In 2017, total tuna catch for gillnet, troll, trawl and line (mainly handline) from state-managed Western Australian fisheries increased from 2016 (Tables 2c, 2d). In the Commonwealth-managed WTB, SBT and ETB Fisheries, eight vessels (four trolling vessels, one pole-and-line vessel, one dropline vessel and two vessels using handline) operated in the IOTC Area of Competence in 2017. These vessels caught 13.3 t of longtail tuna, 1.5 t of southern bluefin tuna, 0.2 t of albacore, <0.1 t of bigeye tuna and 1.1 t of skipjack tuna.

Table 2a Total numbers of Australian longline vessels, hooks set and total catch (tonnes live weight) of the five main tuna and billfish species taken by those vessels operating in the IOTC Area of Competence from 1998 to 2017

Calendar year	Vessel number	Hooks set (thousands)	Albacore	Bigeye tuna	Yellowfin tuna	Swordfish	Striped marlin	NEI[a]	Total catch
1998	37	1807	25.1	161.1	231.3	238.3	8.8	196.7	1031.4
1999	49	4031	29.2	411.6	406.2	1013.7	22.6	154.1	2586.0
2000	61	6246	30.9	436.2	429.1	1690.5	1.7	42.5	2726.5
2001	45	6175	93.9	386.0	557.5	2135.7	0.0	118.5	4702.4
2002	44	5956	72.1	419.5	355.2	2004.8	0.7	14.2	2866.3
2003	36	4000	65.7	205.5	191.3	1184.0	0.2	100.7	2526.3
2004	22	1593	26.6	90.9	152.3	370.0	0.4	46.9	1300.7
2005	6	773	7.3	31.3	35.9	301.4	4.1	12.3	380.6
2006	4	718	10.6	58.7	37.3	311.2	4.5	14.1	436.4
2007	3	738	12.1	69.1	29.3	281.2	1.6	15.3	404.1
2008	5	237	10.3	26.6	1.2	142.2	0.5	10.5	191.0
2009	4	529	19.9	61.7	11.7	349.3	0.3	11.3	454.3
2010	4	622	18.7	65.3	21.9	349.4	0.5	4.8	460.5
2011	2	360	5.8	50.0	14.1	189.9	0.7	1.4	261.9
2012	4	672	13.1	167.4	23.0	209.3	2.5	1.6	417.3
2013	4	610	14.6	90.6	40.5	203.5	2.0	1.0	352.2
2014	4	449	16.6	75.3	19.0	211.6	0.6	5.4	328.6
2015	7	430	19.3	94.3	72.6	200.6	1.5	3.9	392.3
2016	7	429	30.1	69.4	65.8	133.8	0.9	135.1	435.2
2017	10	532	18.6	59.3	65.3	155.8	1.5	126.4	426.9

[a] NEI denotes species that are 'not elsewhere indicated'

Table 2b Purse seine effort and catch (tonnes live weight) of southern bluefin tuna (by fishing season) and skipjack tuna (by calendar year) by Australian vessels fishing in the IOTC Area of Competence

Southern bluefin tuna								Skipjack tuna
Fishing season	Search hours	No. of sets	Estimated catch [a]	Actual catch	Calendar year	Estimated catch	Actual catch	Estimated catch
1994–95	526	104	2179	2009	1995	n/a	1840	n/a
1995–96	631	89	2859	3442	1996	n/a	3121	n/a
1996–97	769	118	3134	2505	1997	n/a	2998	n/a
1997–98	671	143	3916	3629	1998	3290	3584	n/a
1998–99	972	129	4418	4991	1999	5120	5325	n/a
1999–00	764	107	4746	5131	2000	4616	5132	n/a
2000–01	799	129	5100	5162	2001	5319	4767	1039
2001–02	1309	159	5400	5234	2002	4920	4683	1144
2002–03	1276	150	5188	5375	2003	5587	5792	<1
2003–04	1202	160	5299	4874	2004	5178	4834	30
2004–05	1168	139	5225	5215	2005	5330	5210	<1
2005–06	1304	156	5463	5302	2006	5852	5629	446
2006–07	1459	160	5091	5230	2007	4822	4809	4
2007–08	1217	134	4530	5211	2008	4431	5010	877
2008–09	1156	139	4348	5015	2009	4316	4884	855
2009–10	417	78	3323	3931	2010	3660	4039	0[b]
2010–11	835	106	3840	3872	2011	3909	4114	0[b]
2011–12	1150	156	4328	4485	2012	4423	4444	<1
2012–13	1021	110	4039	4198	2013	4210	4561	<1
2013–14	752	101	4381	5039	2014	3649	4168	0
2014–15	1016	154	4789	4950	2015	4789	5252	<1
2015–16	906	124	4826	4896	2016	5012	5222	0
2016–17	852	109	4036	4683	2017	3951	4571	0

[a] Note that estimated catch is derived from logbook data while actual catch is derived from catch disposal data; [b] Note that there was has been effort in the Skipjack Tuna Fishery since 2008–109
[c] Note that the catch data provided for 2017–18 are preliminary as the SBTF season does not conclude until 30 November 2018
n/a = data not available

Table 2c Numbers of fishing vessels and catch of tuna and tuna-like species (tonnes live weight) in Western Australian state fisheries by method

Year	Dropline		Gillnet		Line[a]		Trawl		Troll	
	Catch (t)	Vessels	Catch (t)	Vessels	Catch (t)	Vessels	Catch (t)	Vessels	Catch (t)	Vessels
2004	0.6	7	2. 7	9	36.8	46	3 .4	14	435.1	34
2005	0.04	6	2.6	8	46.3	30	5.0	4	310.4	22
2006	n/a	n/a	0.9	6	10.6[b]	30	23.4	10	283.6	18
2007	0.1	5	1.2	8	23.6	24	n/a	n/a	317.8	18
2008	n/a	n/a	5.0	9	12.6	22	n/a	n/a	333.6	26
2009	n/a	n/a	1.3	7	12.0	18	n/a	n/a	285.6	16
2010	n/a	n/a	0.8	6	27.1	13	n/a	n/a	269.4	15
2011	n/a	n/a	1.1	6	14.7	14	n/a	n/a	285.5	17
2012	n/a	n/a	1.5	6	16.4	17	n/a	n/a	316.4	17
2013	n/a	n/a	0.2	6	11.9	16	n/a	n/a	300.5	25
2014	n/a	n/a	0.3	6	41.6	18	n/a	n/a	299.6	26
2015	n/a	n/a	0.4	7	36.3	18	n/a	n/a	285.1	27
2016	n/a	n/a	0.6	7	15.6	12	n/a	n/a	282.4	28
2017	n/a	n/a	0.4	8	13.8	15	<0.5	<3	287.9	19

[a] Line consists mainly of handline

[b] Total includes dropline catches for this year as individual method data could not be presented because of state jurisdictional confidentiality reasons (i.e. <5 active vessels using each method)

n/a = data not available

Table 2d Catch of tuna and tuna-like species in Western Australian state fisheries, by species and method, for 2016 and 2017

Year	Species		Live weight (kg)			
	Common name	**Scientific name**	**Gillnet**	**Line[a]**	**Trolling**	**Total**
2016	Australia bonito	*Sarda australis*	<500	<500	6 645	6 902
	mackerel, grey	*Scomberomorus semifasciatus*	<500	<1000	13 591	14 108
	mackerel, shark	*Grammatorcynus bicarinatus*	n/a	<500	<500	45
	mackerel, Spanish	*Scomberomorus commerson*	n/a	14 116	261 450	275 896
	mackerel, spotted	*Scomberomorus munroi*	n/a	n/a	2	2
	mackerels, general	Scombridae	<500		<500	12
	tuna, bigeye	*Thunnus obesus*	n/a	<500	n/a	<500
	tuna, northern bluefin	*Thunnus orientalis*	n/a	n/a	n/a	n/a
	tuna, longtail	*Thunnus tonggol*	<500	<500	<500	203
	tuna, mackerel	*Euthynnus affinis*	n/a	n/a	n/a	n/a
	tuna, other	*S*combridae	<500	<500	<500	554
	tuna, skipjack	*Katsuwonus pelamis*	n/a	<500	<500	25
	tuna, yellowfin	*Thunnus albacares*	<500	129	260	543
	wahoo	*Acanthocybium solandri*	n/a	n/a	254	254
	TOTAL		**614**	**15 551**	**282 417**	**298 582**

Table 2d (cont.) Catalog of tuna and tuna-like species in Western Australian state fisheries, by method and species, for 2016 and 2017

Year	Species		Live weight (kg)				
	Common name	**Scientific name**	**Gillnet**	**Line**[a]	**Trolling**	**Trawl**	**Total**
2017	Australia bonito	*Sarda australis*	<500	116	834	n/a	962
	mackerel, grey	*Scomberomorus semifasciatus*	n/a	>1 000	10 925	n/a	15 957
	Mackerel, school	*Scomberomorus queenslandicus*	n/a	n/a	<1 000	n/a	518
	mackerel, shark	*Grammatorcynus bicarinatus*	n/a	n/a	26	n/a	26
	mackerel, Spanish	*Scomberomorus commerson*	<500	8 054	274 942	n/a	283 011
	mackerel, spotted	*Scomberomorus munroi*	n/a	n/a	<500	n/a	15
	mackerels, general	Scombridae	n/a	<500	<500	n/a	11
	tuna, bigeye	*Thunnus obesus*	n/a	64	n/a	n/a	64
	tuna, northern bluefin	*Thunnus orientalis*	n/a	n/a	n/a	n/a	n/a
	tuna, longtail	*Thunnus tonggol*	n/a	<500	235	n/a	277
	tuna, mackerel	*Euthynnus affinis*	n/a	<500	<500	<500	58
	tuna, other	Scombridae	<500	78	<500	n/a	178
	tuna, skipjack	*Katsuwonus pelamis*	<500	<500	<500	n/a	72
	tuna, yellowfin	*Thunnus albacares*	<500	435	243	n/a	966
	wahoo	*Acanthocybium solandri*	n/a	n/a	<500	n/a	22
	TOTAL		**423**	**13 847**	**287 867**	**<500**	**302 136**

[a] Line consists mainly of handline

n/a = data not available

4 Recreational fishery

Recreational fishing is undertaken in Australian states and the Northern Territory. The Western Australian recreational gamefish fishery targets sailfish (*Istiophorus platypterus*), black marlin (*Makaira indica*) and yellowfin tuna, with blue marlin (*Makaira mazara*) and striped marlin caught on occasions. There is a daily bag limit of one billfish (sailfish and marlins combined) in Western Australia but the majority of sailfish and marlins are tagged and released alive. There is also a combined daily bag limit of two fish for yellowfin tuna and SBT. In South Australia, Victoria and Tasmania, gamefishers mainly target albacore, skipjack tuna and SBT. Daily bag limits or possession limits also apply in those states. Recreational fishing surveys have been undertaken in Western Australia (Ryan et al. 2015, 2017) and South Australia (Giri & Hall 2015) in 2013–14, and in Tasmania in 2012–13 (Lyle et al. 2014). However, these surveys have used different methodologies, have large estimation errors, and were generally focussed on species other than tunas. Therefore, estimates of total recreational catch for tuna and tuna-like species within the IOTC area in Australian waters remain uncertain.

5 Ecosystem and bycatch issues

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

- all Commonwealth 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 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 fisheries and any State/Northern Territory-managed fisheries that operate in Commonwealth waters must 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 WTBF, ETBF, SJF and SBTF, and continue to guide the development of improved management arrangements to reduce the ecological impacts of Australian tuna and billfish fisheries (see http://environment.gov.au/marine/fisheries/commonwealth-managed-fisheries).

Measures to reduce the ecological impacts of these fisheries rely initially on the analysis of fishery-dependent and -independent data collected through observer programs, logbooks, electronic monitoring and targeted research activities. As data are collected and the impacts of fishing operations on ecologically related species 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 and maintained observer and/or electronic monitoring programs in the WTBF, ETBF, SJF and SBTF, which include specific reporting requirements for threatened, endangered and protected (TEP) species
- initiated a range of at-sea programs to trial strategies to reduce the incidental mortality of seabirds caught during longlining operations (e.g. increasing line sink rates)
- 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 ecologically related species (see below).

AFMA has carried out an Ecological Risk Assessment (ERA) for each of its fisheries. AFMA's Ecological Risk Management (ERM) process responds to the ERAs for major fisheries managed by the Australian Government and develops a framework for future risk assessments as additional information becomes available. The ERA/ERM framework aims to inform government

agencies and stakeholders of priorities for research, data collection, monitoring and management, and ensure there is a high level of confidence in verifiable results.

The ERAs rely on existing biological and catch information and consider five ecosystem components: target species, byproduct and bycatch species, TEP species, habitats, and communities. The assessments categorise various species as being at high, medium or low relative risk on the basis of a range of factors, including their susceptibility to capture by the various fishing methods, their distribution, and the ability for populations to recover from fisheries impacts. The aim of the ERA process is to help prioritise research, data collection and monitoring needs and management actions for fisheries, and ensure that they are managed both sustainably and efficiently. There are three levels at which an ERA may be conducted: Level 1 (Scoping); Level 2 (Productivity and Susceptibility Assessment); Sustainability Assessment for Fishing Effects (previously Level 3) and Level 3 (fully quantitative assessments).

AFMA, in conjunction with the Commonwealth Scientific and Industrial Research Organisation (CSIRO), has completed ERAs for the WTBF (Webb et al. 2007a, AFMA 2009e, Zhou et al. 2009, AFMA 2010b), ETBF (Webb et al. 2007b, AFMA 2009a), SBTF (Hobday et al. 2007, AFMA 2009b, Zhou et al. 2009) and SJF (Daley et al. 2007, Zhou et al. 2009, AFMA 2010a). These reports are available at: (http://www.afma.gov.au/sustainability-environment/ecological-risk-management-strategies/). ERAs are currently being reviewed and updated.

Western Tuna and Billfish Fishery

The ERA examined 187 species in the WTBF (38 chondrichthyans and 149 teleosts), none of which were classified as at risk of potential overfishing, based on the Level 3 analysis (Zhou et al. 2009). However, an increase in fishing effort could potentially move some species into a higher risk category, particularly sharks that are more vulnerable to fishing pressure. Therefore, a priority action identified in the WTBF ERM report (AFMA 2010b) is to monitor the catch and interaction level with sharks. Management of shark interactions in this fishery will be reviewed if the landed amount of any one species exceeds 50 t within a year (AFMA 2010b). Given the connectivity of highly migratory fish stocks beyond the EEZ, the ERM response may need to take into account broader Indian Ocean issues in the future.

A summary of priority issues for managing the ecological effects of fishing in the WTBF, arising from the three levels of ERA, is described in AFMA (2010b), and available at: http://www.afma.gov.au/sustainability-environment/ecological-risk-management-strategies/

Eastern Tuna and Billfish Fishery

AFMA, in conjunction with the CSIRO, has undertaken three levels of ecological risk assessment (ERA) for the ETBF (Webb et al. 2007b, AFMA 2009c, Zhou et al. 2009). A total of 390 species were initially assessed in the ERA process (Webb et al. 2007b). After a Level 3 assessment for fish species only, three shark species (crocodile shark, longfin mako and pelagic thresher) were identified as being at high risk due to the effects of fishing in the ETBF (Zhou et al. 2007). The priority of the management response is to reduce interactions with TEP species (AFMA 2009a). The ETBF ERM report also aims to decrease the capture and mortality of sharks.

A summary of priority issues for managing the ecological effects of fishing in the ETBF, arising from the three levels of ecological risk assessment is described in AFMA (2009a), and available at: http://afma.gov.au/environment/eco_based/eras/docs/ETBF_ERM_May09.pdf.

Southern Bluefin Tuna Fishery

The Level 2 assessment indicated that only two species, of the 193 assessed, were considered to be at high risk: SBT and white shark (Hobday et al. 2007). A Level 3 assessment was also conducted on 83 non-target species (6 chondrichthyans and 77 teleosts) to determine the impact of SBT fishing on these species (AFMA 2009d). It was determined that the risk to these non-target species was low (Zhou et al. 2009).

A summary of priority issues for managing the ecological effects of fishing in the SBTF arising from the three levels of ERA, including monitoring interactions with threatened species, is described in AFMA (2009b), and available at: http://www.afma.gov.au/wp-content/uploads/2010/06/sbt_erm.pdf

Skipjack Tuna Fishery

For the Level 2 assessment 328 species were assessed. After the residual risk assessment was applied, 25 species, mostly TEP species, were deemed to be at high risk. However, after the Level 3 assessment no species was assessed as high risk (Daley et al. 2007, Zhou et al. 2009, AFMA 2010a). It should be noted that the Skipjack Tuna Fishery has been inactive since 2009, hence there has been no ecological risk from the fishery during that period.

Ecological risk management for the SJTF is designed to achieve an adequate level of monitoring to establish the level of interaction that may occur if effort increases and to quantify the effect that the fishery is having on the species identified as being at high risk from the effects of fishing (AFMA 2010a).

Bycatch and discard work plan

In response to bycatch issues, AFMA formulated a Bycatch and Discard Work Plan for both the WTBF and ETBF (AFMA 2008). The work plan outlines a series of measures to improve the monitoring of, and reduce fishery impacts on, the bycatch species identified in the ERA process as being at high risk from fishing operations. AFMA has reviewed the Bycatch and Discard Workplan, which commenced in 2008, and an updated plan for 2014–2016 commenced in 2014 (AFMA 2014) and can be found at: https://www.afma.gov.au/sites/g/files/net5531/f/uploads/2014/11/Bycatch-and-Discarding-Workplan-ATBF-2014-2016-8.pdf. In the future, AFMA may integrate the Bycatch and Discard Plan into the development of a more comprehensive and holistic Fishery Management Strategy for the WTBF.

Sharks

NPOA-Sharks

Australia's National Plan of Action for Conservation and Management of Sharks (NPOA-Sharks), first released in 2004, was reviewed and revised in July 2012 (Shark-plan 2) (DAFF 2012). It is currently under review again. Consistent with the International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks), Shark-plan 2 incorporates scientific information and issues identified in the 2009 Shark Assessment Report (Bensley et al. 2010). An updated Shark Assessment Report was recently released (Woodhams & Harte 2018) and can be found here: http://agriculture.gov.au/abares/research-topics/fisheries/fisheries-research/shark-assessment-report-2018#download-the-full-report.

Shark-plan 2 aims to coordinate action on shark conservation and management by prioritising issues and identifying actions to address them. A copy of Shark-plan 2 can be found at: http://www.agriculture.gov.au/fisheries/environment/sharks/sharkplan-2

Shark catch and finning regulation

The Australian Commonwealth prohibits the possession or landing of fins separate from shark carcasses. There is a landing limit of 20 sharks per longline vessel per fishing trip, and a ban on wire traces in order to decrease the likelihood of retaining shark. Longline vessels undertaking single jurisdiction high seas trips may apply for a permit to retain 100 sharks per fishing trip, of which only 80 can be blue sharks.

Shortfin mako, longfin mako and porbeagle sharks were listed under the Convention on Migratory Species (CMS) in 2008, which triggered a mandatory legal obligation to list them for protection under the 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 were 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. Australia requires all tuna longline vessels to carry line cutters and de-hookers to ensure the safe release of shark and turtle species in the water, which may help improve their chances of survival.

A number of species for which Australia is a range state were added to Appendix I and/or II of the Convention on the Conservation of Migratory Species (CMS) at its 11th Conference of Parties in November 2014. Following the completion of our domestic processes, the following species were included in the list of migratory species under the *Environment Protection and Biodiversity Conservation Act 1999*:

- *Anoxypristis cuspidata* (narrow sawfish)
- *Pristis clavata* (dwarf sawfish)
- *Pristis zijsron* (green sawfish)
- *Pristis pristis* (largetooth sawfish)
- *Carcharhinus falciformis* (silky shark)
- *Manta alfredi* (reef manta ray)
- *Mobula eregoodootenkee* (pygmy devil ray)
- *Mobula japanica* (Japanese devil ray)
- *Mobula thurstoni* (bentfin devil ray)

As listed migratory species, it is now an offence to kill, injure, take, trade, keep or move these species in Commonwealth waters. Any interactions with the above species in Commonwealth waters will also need to be reported, as is currently the case with other protected species such as dugongs and whale sharks. Further information on reporting requirements can be found at:

http://www.environment.gov.au/biodiversity/threatened/listed-species-and-ecological-communities-notification

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix II listing of the oceanic white tip, porbeagle and the smooth, scalloped and great hammerhead sharks, and the giant and reef manta rays, came into effect on 14 September 2014. Silky shark, thresher sharks, and mobula rays were added to Appendix II of CITES at its 17th Meeting of the Conference of the Parties (CoP17) in 2016. The listings of mobula rays came into effect on 2 January 2017. Silky shark and thresher shark listings came into effect on 4 October 2017.

CITES Appendix II designates species that may not be threatened with extinction, but require trade to be regulated to ensure their ongoing survival in the wild. International trade in the listed species from each CITES Party must be underpinned by an assessment of sustainability, known as a non-detriment finding. A Non Detriment Finding (NDF) was produced for three hammerhead shark species (scalloped, great and smooth) which allows export from Australian commercial fisheries subject to national harvest limits (https://www.environment.gov.au/biodiversity/wildlife-trade/publications/non-detriment-finding-five-shark-species). The NDF was underpinned by research on population levels and sustainable catch limits and available information on the relevant shark species. In 2017, the Department undertook an analysis of relevant available information on these species and decided that the precautionary harvest levels set in the 2014 NDF will remain in place until additional information becomes available.

Interactions

Western Tuna and Billfish Fishery

Total interactions by the Commonwealth Australian longline fleet with shark species in the IOTC Area of Competence are provided in Tables 3a, 3b and 4. In 2017, 50 individual sharks were landed (Table 3a) weighing 1.8 t (Table 3b), while 10 184 individuals were discarded/released (Table 4). No information is currently available from logbooks on the life status of discarded/released sharks, other than those considered to be threatened species under the EPBC Act. In 2017, e-monitoring data recorded 358 sharks captured in the WTBF, mainly crocodile sharks and blue sharks. Of these sharks, 7 were dead, 114 were released alive and the life status of 237 was undetermined.

Eastern Tuna and Billfish Fishery

As very little effort from the ETBF has occurred in the IOTC Area of Competence in recent years, a full description of shark interactions is not provided here, but can be found in Australia's national report to the Western and Central Pacific Fisheries Commission (WCPFC; Patterson et al. 2018).

Southern Bluefin Tuna Fishery

No interactions with sharks were reported by observers in the IOTC Area of Competence relevant to the SBTF in 2017. All interactions with ecologically related species are reported to the Commission for the Conservation of Southern Bluefin Tuna (CCSBT; Patterson et al. 2017).

Minor line fisheries

Other fisheries in Western Australia use a variety of minor line gear types (e.g. Tables 2c, 2d) which take small incidental catches of tuna and tuna-like species. No data is available on the interaction of these minor line fisheries with sharks. However, given the nature of the fishing and the small catches in these fisheries, they likely have negligible impacts on shark populations.

Table 3a Total number of sharks, by species, retained by Australian longline vessels in the IOTC Area of Competence from 2008 to 2017 (source: AFMA logbook data)

Common name	Scientific name	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Blacktip shark	*Carcharhinus* spp.	0	0	0	0	0	0	0	0	0	0
Blue shark	*Prionace glauca*	309	366	148	2	2	0	0	0	0	2
Bronze whaler	*Carcharhinus brachyurus*	0	0	0	0	1	0	0	0	0	0
Cookie-cutter shark	*Isistius brasiliensis*	0	0	0	0	0	0	0	0	0	0
Crocodile shark	*Pseudocarcharias kamoharai*	0	51	105	0	16	20	0	10	0	0
Dusky shark	*Carcharhinus obscurus*	0	0	0	0	0	0	0	0	0	0
Hammerhead	*Sphyrna* spp.	0	0	0	13	0	3	0	0	0	0
Oceanic whitetip	*Carcharhinus longimanus*	24	11	7	11	10	1	0	0	0	0
Porbeagle	*Lamna nasus*	9	0	3	0	0	0	0	0	0	28
Roughskin shark	*Centroscymnus* spp.; *Deania* spp.	0	0	0	0	0	0	0	0	0	0
Sandbar shark	*Carcharhinus plumbeus*	0	0	0	0	0	0	0	0	0	0
Scalloped hammerhead	*Sphyrna lewini*	0	0	0	0	0	0	0	0	0	0
Shortfin mako	*Isurus oxyrinchus*	8	16	20	43	6	34	73	0	92	20
Longfin mako	*Isurus paucus*	0	0	0	0	0	0	0	0	0	0
Silky shark	*Carcharhinus falciformis*	0	1	0	0	0	0	0	0	0	0
Smooth hammerhead	*Sphyrna zygaena*	0	0	0	0	0	0	0	0	0	0
Thresher shark	*Alopias vulpinus*	0	1	1	0	0	0	0	0	0	0
Tiger shark	*Galeocerdo cuvier*	2	0	0	0	0	0	0	0	0	0
Shark - other	-	0	0	0	0	0	0	0	0	0	0
TOTAL		**352**	**446**	**284**	**69**	**35**	**58**	**73**	**10**	**92**	**50**

Table 3b Total weight (tonnes trunked weight) of shark species retained by Australian longline vessels in the IOTC Area of Competence from 2008 to 2017 (source: AFMA logbook data)

Common name	Scientific name	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Blacktip shark	*Carcharhinus* spp.	0	0	0	0	0	0	0	0	0	0
Blue shark	*Prionace glauca*	9.2	10.2	3.9	0.04	0.05	0	0	0	0	0.1
Bronze whaler	*Carcharhinus brachyurus*	0	0	0	0	0.02	0	0	0	0	0
Cookie-cutter shark	*Isistius brasiliensis*	0	0	0	0	0	0	0	0	0	0
Crocodile shark	*Pseudocarcharias kamoharai*	0	0.1	0.3	0	0.03	0.04	0	0.03	0	0
Dusky shark	*Carcharhinus obscurus*	0	0	0	0	0	0	0	0	0	0
Hammerhead	*Sphyrna* spp.	0	0	0	0.2	0	0.04	0	0	0	0
Oceanic whitetip	*Carcharhinus longimanus*	0.7	0.3	0.1	0.2	0.3	0.02	0	0	0	0
Porbeagle	*Lamna nasus*	0.2	0	0.05	0	0	0	0	0	0	0.8
Roughskin shark	*Centroscymnus* spp.; *Deania* spp.	0	0	0	0	0	0	0	0	0	0
Sandbar shark	*Carcharhinus plumbeus*	0	0	0	0	0	0	0	0	0	0
Scalloped hammerhead	*Sphyrna lewini*	0	0	0	0	0	0	0	0	0	0
Shortfin mako	*Isurus oxyrinchus*	0.2	0.2	0.4	0.6	0.1	0.5	1.5	0	2.2	0.9
Longfin mako	*Isurus paucus*	0	0	0	0	0	0	0	0	0	0
Silky shark	*Carcharhinus falciformis*	0	0.04	0	0	0	0	0	0	0	0
Smooth hammerhead	*Sphyrna zygaena*	0	0	0	0	0	0	0	0	0	0
Thresher shark	*Alopias vulpinus*	0	0.04	0.03	0	0	0	0	0	0	0
Tiger shark	*Galeocerdo cuvier*	0	0	0	0	0	0	0	0	0	0
Shark - other	-	0	0	0	0	0	0	0	0	0	0
TOTAL		**10.3**	**10.9**	**4.8**	**1.1**	**0.5**	**0.6**	**1.5**	**0.03**	**2.2**	**1.8**

Table 4 Total number of sharks, by species, released/discarded by Australian longline vessels in the IOTC Area of Competence from 2008 to 2017 (source: AFMA logbook data)

Common name	Scientific name	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Blacktip shark	*Carcharhinus* spp.	0	0	0	0	0	0	0	0	0	0
Blue shark	*Prionace glauca*	4 044	8 596	7 073	5 148	5 315	3 333	3 273	2 315	3 309	6 013
Bronze whaler	*Carcharhinus brachyurus*	3	2	0	1	39	27	106	11	12	63
Cookie-cutter shark	*Isistius brasiliensis*	0	0	0	0	0	0	1	1	1	3
Crocodile shark	*Pseudocarcharias kamoharai*	900	4 651	5 861	7 167	4 880	2 118	2 911	2 716	2 378	3 299
Dusky shark	*Carcharhinus obscurus*	0	0	0	0	1	0	11	0	111	86
Hammerhead	*Sphyrna* spp.	32	3	2	6	96	7	39	91	45	74
Oceanic whitetip	*Carcharhinus longimanus*	19	66	171	51	131	12	14	11	36	34
Porbeagle	*Lamna nasus*	0	0	0	0	0	0	7	3	0	129
Roughskin shark	*Centroscymnus* spp.; *Deania* spp.	0	0	0	0	0	0	0	0	0	0
Sandbar shark	*Carcharhinus plumbeus*	0	0	0	0	1	2	0	0	0	0
Scalloped hammerhead	*Sphyrna lewini*	0	0	0	0	0	0	0	0	0	0
Shortfin mako	*Isurus oxyrinchus*	50	575	756	525	758	290	238	361	333	425
Longfin mako	*Isurus paucus*	0	0	0	0	3	1	0	0	0	0
Silky shark	*Carcharhinus falciformis*	0	0	0	0	0	0	0	0	0	0
Smooth hammerhead	*Sphyrna zygaena*	0	0	0	0	0	0	0	0	0	0
Thresher shark	*Alopias vulpinus*	4	1	1	4	14	84	19	32	18	26
Tiger shark	*Galeocerdo cuvier*	0	0	0	0	1	1	2	8	4	31
Shark - other	-	0	0	0	0	132	0	0	4	0	1
TOTAL		**5 052**	**13 894**	**13 864**	**12 902**	**11 371**	**5 875**	**6 621**	**5 553**	**6 247**	**10 184**

Seabirds

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 low.

Threat Abatement Plan

The adverse impact of longline fishing activities on seabirds was not fully realised until the 1980s. The incidental catch (or bycatch) of seabirds during oceanic 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 for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations 2018*, released recently (Commonwealth of Australia 2018). The ultimate aim of this plan is to achieve zero bycatch of seabirds from longline fishing in Commonwealth fisheries, especially threatened albatross and petrel species. The plan is subject to review within five years. Copies of this plan may be obtained from the Australian Antarctic Division of the Department of the Environment and Energy: http://www.antarctica.gov.au/science/southern-ocean-ecosystems-environmental-change-and-conservation/southern-ocean-fisheries/seabird-bycatch/threat-abatement-plan-seabirds

Considerable progress has been made under successive threat abatement plans to reduce the impact of pelagic longlining on seabirds (Commonwealth of Australia 2014). The incidental bycatch rates for several fisheries are well below 0.01 or 0.05 birds per 1000 hooks, which are the maximum permissible levels set as performance criteria for different fisheries under the current plan, and which apply to individual fishing seasons and fishing areas, as relevant. This reduction in bycatch rates 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 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 and Energy (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.

NPOA-Seabirds

Australia has developed a National Plan of Action to minimise the incidental catch of seabirds in Australian capture fisheries (NPOA-Seabirds) to address the potential risk posed to seabirds by all fishing methods (http://www.agriculture.gov.au/SiteCollectionDocuments/fisheries/environment/bycatch/npoa-seabirds.pdf). NPOA-Seabirds applies to all commercial, recreational and Indigenous capture fisheries within Australian jurisdiction, as well as to fishing undertaken by Australian-flagged fishing vessels on the high seas including areas governed by regional fisheries and conservation bodies. The goal of the NPOA–Seabirds is to minimise and, where practicable, eliminate the incidental catch of seabirds in capture fisheries. To achieve this, NPOA-Seabirds seeks to identify and understand all sources of seabird mortality from fishing practices, including trawl, gillnet and purse seine fishing, with a view to developing an appropriate response to mitigate the effects of these practices on seabird species. The NPOA-Seabirds complements the FAO's best practice technical guidelines for member countries to use

when drafting NPOAs, which recommends fishing methods apart from longline (particularly gillnet and trawl) be assessed for risk, and mitigation methods be developed and prescribed when drafting an NPOA.

Recovery Plan

A *National Recovery Plan for threatened albatrosses and giant petrels* in Australia has been in place since 2001, with the current recovery plan adopted in 2011. A copy of the current recovery plan may be obtained from the Department of the Environment and Energy: http://www.environment.gov.au/biodiversity/threatened/publications/recovery/albatrosses-and-giant-petrels.html. The recovery plan's objective is to ensure the long-term survival and recovery of albatross and giant petrel populations breeding and foraging in Australian jurisdiction. The recovery plan sets out a coordinated conservation strategy for albatrosses and giant petrels listed as threatened under the EPBC Act. It considers threats to albatrosses and giant petrels both at terrestrial breeding sites and at-sea in their foraging habitat. The recovery plans also collects specific data on population trends of those threatened species found breeding in Australia. A five-year review of the recovery plan was completed in early 2016.

Mitigation measures

The mitigation measures required in the WTBF are detailed in Appendix B and include the use of weighted lines and tori lines when fishing south of 25°S, where all ten vessels fished in 2017; 100 per cent of vessels used these methods in 2017. This requirement is the same in the ETBF. Of the sets done in the IOTC area in 2017, 85.9 per cent were at night.

Interactions

Western Tuna and Billfish Fishery

The abundance of seabirds on the west coast of Australia and the level of fishing effort for tuna-like species are considerably lower than on the east coast. In addition, the majority of the fleet in the WTBF targets swordfish and operates at night, which reduces the risk of interactions with many species of seabirds vulnerable to bycatch. While observer data are only available for recent years, when fishing activity has been very low, the data indicate that seabird interactions are near zero and well below the limit of 0.05 seabirds per 1000 hooks in each fishing area prescribed by the threat abatement plan. In 2017, there were four observed (using electronic monitoring, hereafter referred to as 'observed') interactions with a seabirds (one albatross which was dead; raised mortality estimate is 8.5 and three birds from the petrels, prions and shearwaters family, all released alive; Tables 5 and 6) and 14 interactions recorded in logbooks (eight flesh footed shearwaters and one Wilsons storm petrel which were alive; and, two albatrosses, one shy albatross, one wandering albatross and one flesh footed shearwater which were dead).

Eastern Tuna and Billfish Fishery

With the implementation of the original threat abatement plan in 1998, a large proportion of the ETBF longline fleet began to set their lines during the night to avoid interactions with albatross species. In doing so, they dramatically reduced the catch of albatross but increased the catch of shearwaters. Through a number of at-sea trials and the subsequent significant improvements to mitigation measures, the total catch of all seabirds in the fishery has been considerably reduced to a level below the 0.05 seabirds per 1000 hooks set in each fishing area, despite the widespread return to day setting. As very little effort from the ETBF has occurred in the IOTC Area of Competence in recent years, a full description of seabird interactions is not provided

here, but can be found in Australia's national report to the Western and Central Pacific Fisheries Commission (WCPFC; Patterson et al. 2018).

Southern Bluefin Tuna Fishery

There are very few incidences of seabirds interacting with purse seine fishing vessels or gear in the SBTF recorded by observers. Observers did not report any seabird interactions in the purse seine sector in 2015–16 or 2016–17. All interactions with ecologically related species are reported to the CCSBT (e.g. Patterson et al. 2017).

Table 5 Observed seabird interaction data for the Australian WTBF longline fleet, 2017

Fishery		Observed					
Area	Total effort	Total observed effort	Observer coverage	Captures (number)	Mortalities (number)	Live releases (number)	Mortality estimate (number)[3]
WTBF[1]	417,997	48,795	11.7%	1	1	0	8.5
WTBF[2]	417,997	48,795	11.7%	3	0	1	0

1 = Unspecified albatross; 2 = Prions, petrels and shearwaters (Family Procellariidae); 3 = Raised estimate of mortality

Marine turtles

Recovery plan

A Recovery Plan for Marine Turtles in Australia was developed, with an overall objective to reduce the detrimental impacts on Australian populations of marine turtles and hence promote their recovery in the wild. A copy of the plan can be obtained from: http://www.environment.gov.au/coasts/publications/turtle-recovery/index.html.

Interactions

Western Tuna and Billfish Fishery

In the WTBF, four turtle interactions were observed in 2017, and were all released alive. Eighteen turtle interactions were recorded in logbooks (5 loggerhead and 13 leatherback), all were released alive.

Eastern Tuna and Billfish Fishery

A full description of sea turtle interactions in the ETBF can be found in Australia's national report to the WCPFC (Patterson et al. 2018).

Southern Bluefin Tuna Fishery

Observers did not report any turtle interactions in the purse seine sector in 2015–16 or 2016–17. All interactions with ecologically related species are reported to the CCSBT (Patterson et al. 2017).

Table 6 Observed annual estimated captures of species of special interest (seabirds, turtles and marine mammals) for the Australian longline fleet, in the IOTC Area of Competence, for 2008 to 2017 (source: AFMA electronic monitoring data)

Group	Common name	Scientific name	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Seabirds	Yellow-nosed albatross	*Thalassarche chlororhynchos*	0	1	0	0	0	0	0	0	0	0
	Albatrosses	Diomedeidae - undifferentiated	0	0	0	0	0	0	0	0	1	1
	Flesh footed shearwater	*Puffinus carneipes*	0	1	0	0	0	0	0	0	0	0
	Petrels, prions and shearwaters	Procellariidae – undifferentiated	0	0	0	0	0	0	0	0	0	3
Turtles	Loggerhead turtle	*Caretta caretta*	2	1	0	0	0	0	0	0	0	1
	Hawksbill turtle	*Eretmochelys imbricata*	0	2	0	0	0	0	1	0	0	0
	Leatherback turtle	*Dermochelys coriacea*	2	4	1	0	1	0	1	0	1	2
	Green turtle	*Chelonia mydas*	0	0	0	0	0	0	0	0	0	0
	Olive Ridley turtle	*Lepidochelys olivacea*	0	0	0	0	0	0	0	0	0	0
	Sea turtles	Cheloniidae - undifferentiated	0	0	0	0	0	0	0	0	0	1
Mammals	Australian fur seal	*Arctocephalus pusillus doriferus*	0	0	2	0	0	0	0	0	0	0

6 National data collection and processing systems

Logbooks

Catch and effort data continues to be collected in daily fishing logbooks for the Australian longline and purse seine vessels operating in the IOTC Area of Competence. AFMA distributes, collects and processes these logbooks. Logbooks have been in place for purse seiners in the SBTF and SJF since the 1960s. Logbooks for Australian longline fisheries first began in 1986. The current Longline Daily Fishing Log, AL06 has existed since 2007. Electronic logbooks have been implemented for the ETBF and the WTBF.

Disposal of catch is monitored using catch disposal record forms for the WTBF and ETBF longline, and the SJF and SBT purse seine fisheries.

Vessel monitoring system

A Vessel Monitoring System (VMS) has been required on all boats in all Commonwealth managed-fisheries since 1 July 2007, including the WTBF, ETBF, SJF and SBTF. Compliance with VMS requirements has increased markedly since 2008, and from 1 November 2011, any vessel operator with a VMS that stops reporting could be ordered to return to port.

Observer program

Western Tuna and Billfish Fishery

In 2007, an ongoing observer program was implemented in the WTBF with a target level of observer coverage set at 5 per cent. In 2017, observer coverage was 11.7 per cent of hooks set (48 795 hooks; Table 7). This figure only reflects e-monitoring.

Eastern Tuna and Billfish Fishery

Seven longline vessels in the ETBF fished in the IOTC Area of Competence in 2017. As with the WTBF, these vessels were subject to compulsory e-monitoring. Observer coverage rates in the ETBF are reported to the WCPFC (Patterson et al. 2018).

Southern Bluefin Tuna Fishery

The ongoing target observer coverage for the SBT purse seine fleet operating out of Port Lincoln is 10 per cent of the total catch and effort for the fishery. During the 2016–17 quota year, Australian observers spent 58 days at sea. They observed purse seine activities for 11 days and tow activities for 18 days. The observers monitored 20 purse seine sets where fish were retained, and two sets that were aborted and one set where fish were released, representing 18.3 per cent coverage for sets where fish were retained. This equates to approximately 16.8 per cent of the total catch.

Regional observer scheme

In March 2010, the IOTC passed Resolution 10/04 on a regional observer scheme, which was superseded by Resolution 11/04, which specifies:

2. *In order to improve the collection of scientific data, at least 5% of the number of operations/sets for each gear type by the fleet of each CPC while fishing in the IOTC Area of*

Competence of 24 meters overall length and over, and under 24 meters if they fish outside their Exclusive Economic Zone (EEZ) shall be covered by this observer scheme. For vessels under 24 meters if they fish outside their EEZ, the above mentioned coverage should be achieved progressively by January 2013.

3. *When purse seiners are carrying an observer as stated in paragraph 1, this observer shall also monitor the catches at unloading to identify the composition of bigeye tuna catches. The requirement for the observer to monitor catches at unloading is not applicable to CPCs already having a sampling scheme, with at least the coverage set out in paragraph 2.*

Resolution 11/04 also sets out the following tasks for observers:

a) *Record and report fishing activities, verify positions of the vessel; b) Observe and estimate catches as far as possible with a view to identifying catch composition and monitoring discards, by-catches and size frequency; c) Record the gear type, mesh size and attachments employed by the master; d) Collect information to enable the cross-checking of entries made to the logbooks (species composition and quantities, live and processed weight and location, where available); and e) Carry out such scientific work (for example, collecting samples), as requested by the IOTC Scientific Committee.*

AFMA has recruited and trained observers since its establishment in 1992. Approximately 15 observers are currently employed in the AFMA observer program. They are sourced from universities and maritime industries from around Australia and must be able to live and work at sea, have demonstrated experience in collecting biological data at sea, and experience in fisheries research methodologies and collection of associated scientific data. Observers must also hold marine radio operators certificate of proficiency (or similar qualifications and/or experience), a sea safety certificate and medical certificate, and have completed an AFMA observer training course.

Recently, AFMA has introduced electronic monitoring (e-monitoring) to its longline fisheries. E-monitoring of the WTBF and ETBF became compulsory from 1 July 2015 for vessels operating within the Australian Exclusive Economic Zone. As a minimum, e-monitoring information from 10 per cent of the hauls is reviewed and used to acquit information provided in logbooks.

In 2017, a total of 532 396 longline hooks were deployed in the IOTC Area of Competence by Australian vessels. Figure 5 depicts the spatial distribution of the longline e-monitoring coverage in the IOTC Area of Competence. Note that the observer coverage of the SBTF is not included on the map as the operations are generally confined to a small spatial area in the Great Australian Bight and this information is reported to the CCSBT.

Unloading/transhipment

This section is not applicable to Australia as Australian-flagged vessels were not authorised to tranship at sea in the IOTC Area of Competence in 2017.

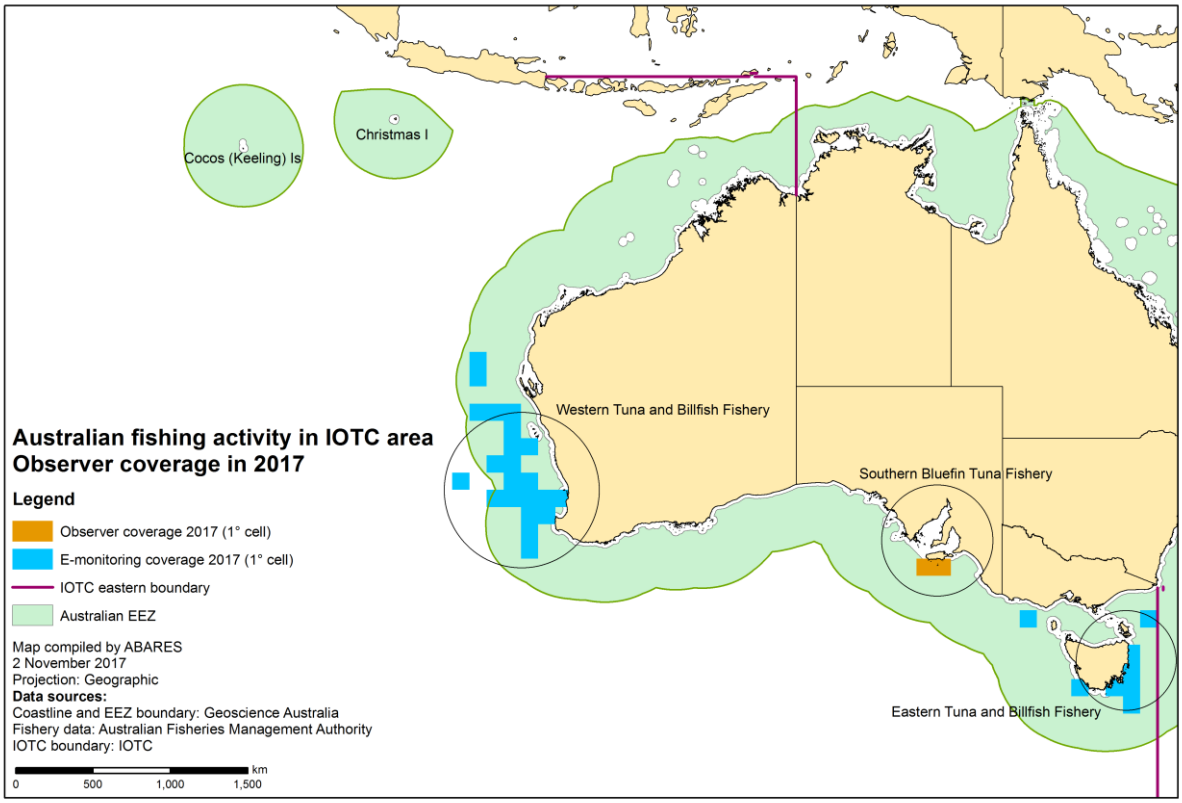
Table 7 Observer coverage, by hooks in the WTBF longline sector and by sets in the purse seine sector, in the IOTC Area of Competence for 2006 to 2017 (calendar year). The purse seine coverage noted here refers only to fishing for southern bluefin tuna (SBT).

Year	Longline Hooks Observed	Percentage Coverage (Hooks)	SBT Season	Purse Seine Sets Observed	Percentage Coverage (Sets)
2006	n/a	n/a	2006–07	9	5.6
2007	n/a	1.42	2007–08	16	11.8
2008	n/a	n/a	2008–09	11	7.9
2009	44 790	8.46	2009–10	7	9.0
2010	15 330	2.45	2010–11	21	19.8
2011	6 232	1.7	2011–12	17	11.1
2012	119 757	17.8	2012–13	14	12.7
2013	0	0.0	2013–14	16	17.0
2014	41 066	9.1	2014–15	14	9.1
2015[a]	30 435	7.1	2015–16	25	18.9
2016[b]	36 038	10.2	2016–17	20	18.3
2017	48 795	11.7	2017–18	na	na

na = data not available

a Note that observer coverage in 2015 includes both human observers and data obtained from electronic monitoring systems. b Note that since 1 July 2015 all coverage is by electronic monitoring.

Figure 5 Spatial distribution of 2017 observer coverage in the longline fishery in the IOTC Area of Competence



Port sampling program

A fish size monitoring program for the WTBF has been conducted since 1999. When possible, a contractor collects weights and lengths for target species from processors in Western Australia. Details on the fish measured in 2017 as part of the port sampling program in the IOTC Area of Competence are given in Table 8.

Table 8 Number of individuals measured, by species, in the WTBF and SBTF in 2017. All species were caught with pelagic longline in the WTBF, with the exception of southern bluefin tuna, which were taken with purse seine in the SBTF

Common name	Scientific name	Number measured
Albacore tuna	*Thunnus alalunga*	854
Bigeye tuna	*Thunnus obesus*	1847
Striped marlin	*Kajikia audax*	19
Swordfish	*Xiphias gladius*	2115
Yellowfin tuna	*Thunnus albacares*	1347
Southern bluefin tuna	*Thunnus maccoyii*	2092
Total		**8274**

7 National research programs

Australia undertakes research projects and programs that are applicable to IOTC fisheries. Details of recent projects are provided below in Table 9.

Table 9 Summary table of current or recent national research programs

Project title	Period	Countries Involved	Funding source	Objectives	Short description
Assessment of the vulnerability of sea turtles to IOTC tuna fisheries	2018	Australia	Australia, IOTC	To undertake a Productivity-Susceptibility Analysis (PSA) of the vulnerability of sea turtles to IOTC tuna fisheries	Results revealed that no sea turtle sub-populations were classified as low vulnerability to longline, purse seine or gillnet fisheries – all were classified as either medium or high vulnerability. Sea turtles were found to be more vulnerable to gillnet and longline fisheries than purse seine fishing, due mostly to the large spatial area and depth distribution of longline fishing, and the assumed high post-capture mortality of sea turtles in gillnet fisheries. Within these fisheries, the species identified to be most vulnerable to fishing were green turtles, loggerhead turtles and hawksbill turtles, particularly in the Arabian Sea and Bay of Bengal.
Evaluation of electronic monitoring (EM) systems for longline fisheries	2017-	Australia	Australia	To assess the ability of (EM) systems to collect fisheries-dependent data from longline fisheries, and improve the reporting of data in commercial logbooks	This project is evaluating the ability of EM systems to collect regional observer programme minimum standard data fields, and improve the reporting of retained catch, discards, and interactions with protected species in commercial fisheries logbooks.

Population Structure of IOTC species and sharks of interest in the Indian Ocean	2017-2019	CSIRO (Australia), AZTI (Spain), IRD (France), RCFMC-TRIF (Indonesia)	EU	To determine the connectivity of IOTC species and sharks of interest throughout their distribution and their effective population size	This project will use next generation sequencing technologies and otolith micro-chemistry to evaluate the degree of connectivity among populations of IOTC species and sharks of interest throughout the Indian Ocean.
Investigate oceanographic and environmental factors impacting on the Eastern Tuna and Billfish Fishery (ETBF)	2018-2020	Australia	Australia	To improve the Australian Fisheries Management Authority and participating countries' understanding of environmental impacts upon a) the ETBF and other national fisheries and b) ETBF interactions with other fisheries (domestic and international), and ensure such impacts can be taken account of when developing or amending management arrangements.	This project will collate fisheries, environmental and biological data for Australia and participating regional countries with the aim of developing habitat models for five key tuna and billfish species.

8 Implementation of Scientific Committee recommendations and resolutions of the IOTC relevant to the SC

Australia is compliant with IOTC resolutions relevant to the Scientific Committee. Table 10 details the resolutions and how they have been implemented.

Table 10 Scientific requirements contained in the Resolutions of the Commission, adopted between 2011 and 2017

No.	Resolution	Scientific requirement	CPC progress
15/01	On the recording of catch and effort by fishing vessels in the IOTC area of competence	Paragraphs 1–10	- Catch and effort data prescribed in the Resolution are collected in daily fishing logbooks for the Australian longline and purse seine vessels operating in the IOTC area of competence. - Catch and effort data are also recorded in daily fishing logbooks for relevant fisheries managed by Western Australia that operate in the IOTC area of competence. - Disposal of catch is monitored using catch disposal record forms for the WTBF and ETBF longline, and the SJF and SBT purse seine fisheries. -Australia has submitted templates of its official logbooks to record data in accordance with Annex I, II and III to the IOTC Executive Secretary for publishing on the IOTC website. - Data submitted by 30 June each year.
15/02	Mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs)	Paragraphs 1–7	- Data submitted including: -Total catch data -Catch and effort data -Size data - Data submitted by 20 June each year.
18/05	On management measures for the conservation of the billfishes: Striped marlin, black marlin, blue marlin and Indo-Pacific sailfish	Paragraphs 7–9	- Catch and effort data prescribed in Resolution 15/01 are collected in daily fishing logbooks for the Australian longline and purse seine vessels operating in the IOTC area of competence. - Catch and effort data are also recorded in daily fishing logbooks for relevant fisheries managed by Western Australia that operate in the IOTC area of competence.

No.	Resolution	Scientific requirement	CPC progress
			- Commercial fisheries in Australia are not permitted to keep black or blue marlin - Catch of striped marlin in the WTBF is very low (~1 t in 2017)
13/04	On the conservation of cetaceans	Paragraphs 7–9	- Resolution 13/04 has been implemented through conditions on boat statutory fishing rights in the WTBF and permit conditions in the SJF. - The setting of purse seines around cetaceans is prohibited and concession holders are required to report all interactions with cetaceans through their daily catch and effort logbooks. This information is also collected by observers if on board. - All cetacean species are protected by Australian law (EPBC Act).
13/05	On the conservation of whale sharks (*Rhincodon typus*)	7–9	- Resolution 13/05 has been implemented through conditions on boat statutory fishing rights in the WTBF and permit conditions in the SJF. - The setting of purse seines around whale sharks is prohibited and concession holders are required to report all interactions with cetaceans through their daily catch and effort logbooks. This information is also collected by observers if on board. - Whale sharks are protected by Australian law (EPBC Act).
13/06	On a scientific and management framework on the conservation of shark species caught in association with IOTC managed fisheries	5–6	-The retention, transhipment, landing or storage of oceanic whitetip sharks, whole or parts of, is prohibited in the WTBF and ETBF. - Australia continues to collect data, including on ocean whitetip sharks, through Australia's scientific observer program.
12/09	On the conservation of thresher sharks (family Alopiidae) caught in association with fisheries in the IOTC area of competence	Paragraphs 4–8	- Australia provides data on interactions with thresher sharks to the IOTC. - In 2011, Australia implemented new permit conditions to prohibit licence holders from retaining, transhipping, landing, storing or selling thresher sharks in the IOTC Area of Competence. - Commercial interactions with thresher sharks in 2015 have been reported to the IOTC as required. Captured thresher sharks were released as required. - The results from recreational tuna catch surveys indicated that interactions with thresher sharks by recreational fishers are also extremely rare.

No.	Resolution	Scientific requirement	CPC progress
12/06	On reducing the incidental bycatch of seabirds in longline fisheries.	Paragraph 3–7	- Australia has conducted research on methods to reduce seabird bycatch and reported the results to the IOTC (e.g. Robertson & Ashworth 2010; Robertson et al. 2010; Robertson & Candy 2013; Robertson et al. 2013). - In 2014, Australia implemented a revised Threat Abatement Plan for seabirds to minimise seabird interactions in pelagic longline operations. Under the 2014 plan, longline vessels are required to maintain the bycatch rate of 0.05 seabirds per 1000 hooks set in all fishing areas and fishing seasons. - Consistent with the objectives of the plan and with Resolution 12/06, Australia requires that all longline vessels fishing south of 25°S employ an approved line-weighting strategy and a bird-scaring line or another approved method; longline vessels in all other areas must use at least one mitigation method. - Australia reports on seabird interactions and mitigation measures in its national report.
12/04	On the conservation of marine turtles	Paragraphs, 3, 4, 6–10	- Australian vessels are required to record and report interactions with marine turtles; this information is reported to the IOTC. - Research using circle hooks has been undertaken and reported to IOTC (Ward & Hall 2009). - Australia is a signatory member of Indian Ocean South-East Asia Marine Turtle Memorandum of Understanding and has committed to implement conservation and management measures to protect sea turtle habitat and nesting sites. - Australia requires the operators of all longline vessels to carry line cutters and de-hookers to facilitate the appropriate handling and prompt release of marine turtles that are caught or entangled.
11/04	On a regional observer scheme	Paragraph 9	- Australia provides information on observer coverage including the number of vessels monitored and the coverage rates by gear type. Australia has had observers for a number of years and aims to achieve 5 per cent observer coverage each year.
17/05	On the conservation of sharks caught in association with fisheries managed by the IOTC	Paragraphs 6, 9, 11	- Data submitted to meet the data reporting requirements outlined in the resolution. - Landing requirements are in place: sharks must be landed with fins attached naturally or by other means; landing of shark livers only (i.e. without the carcass) is not permitted. - The use of wire leaders is not permitted.

No.	Resolution	Scientific requirement	CPC progress
			- In the Australian EEZ, a longline shark trip limit of 20 sharks per vessels per trip applies, as well as a 15 kg trip limit for gulper sharks. - Good handling practices are encouraged to return sharks to the sea alive and vigorous. - Research pertaining to the conservation of sharks has been conducted by Australia and reported to the IOTC (e.g. Hindmarsh 2007; Ward et al. 2007; Ward & Hall 2009; Patterson et al. 2014). - A shark bycatch mitigation guide was produced and distributed to encourage practical solutions that can be used by fishers (Patterson & Tudman 2009). - Under Australia's *Environment Protection and Biodiversity Conservation Act 1999*, licence holders must take measures to avoid the catch of porbeagle shark (*Lamna nasus*), shortfin (*Isurus oxyrinchus*) and longfin (*Isurus paucus*) makos and any live animals must be returned to the water alive.
18/02	On management measures for the conservation of blue shark caught in association with IOTC fisheries	Paragraphs 2–5	- Data submitted to meet the data reporting requirements outlined in the resolution. - In the Australian EEZ, a longline shark trip limit of 20 sharks per vessels per trip applies. Longline vessels undertaking single jurisdiction high seas trips may apply for a permit to retain 100 sharks per fishing trip, of which only 80 can be blue sharks. - Research pertaining to the conservation of sharks has been conducted by Australia and reported to the IOTC (e.g. Hindmarsh 2007; Ward et al. 2007; Ward & Hall 2009; Patterson et al. 2014).
18/07	On measures applicable in case of non-fulfilment of reporting obligations in the IOTC	Paragraphs 1, 4	-Australia is compliant with data reporting requirements and has implemented reporting obligations in their IOTC fisheries. -Australia has reported on the implementation of electronic monitoring in its longline fisheries. This will improve the accuracy of the data recorded in logbooks, including data on shark interactions. -Such data will be reported in the implementation report and in the annual data submission to the IOTC. -Australia reports zero catches as part of the annual data submission

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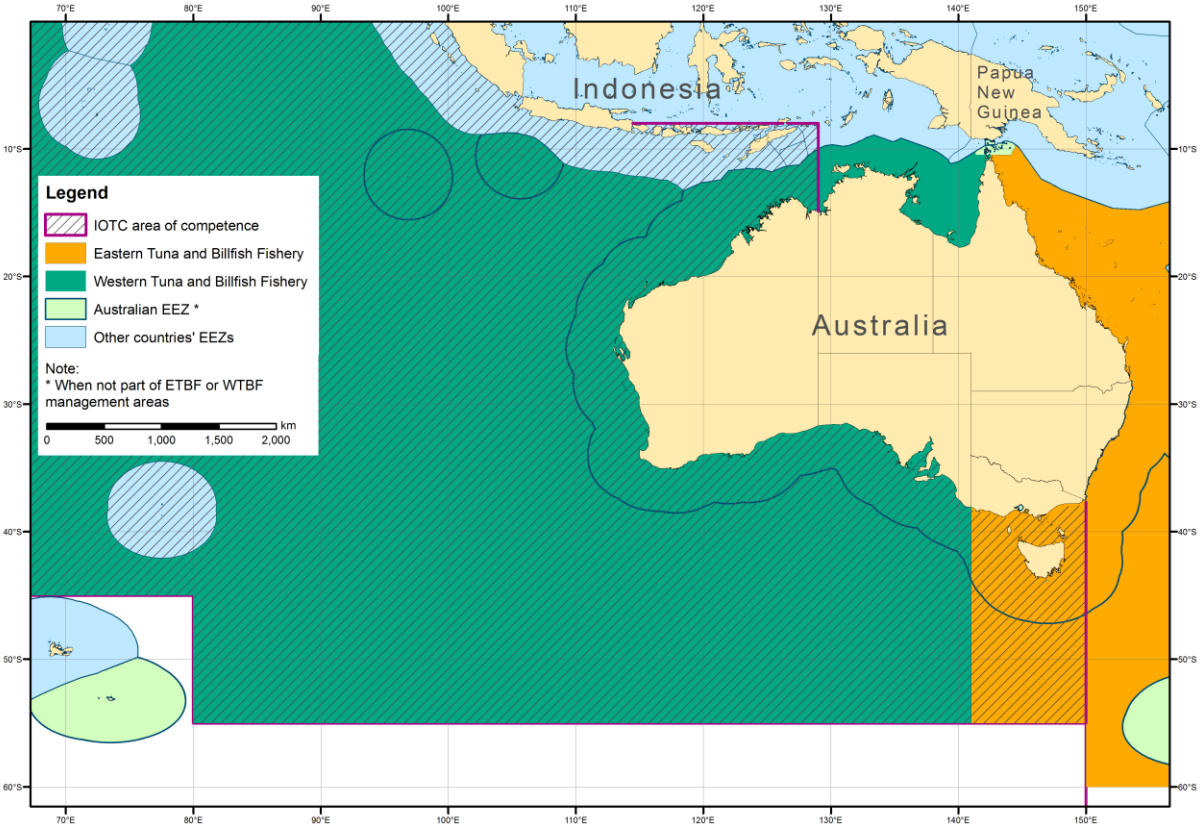
Appendix A Fishery boundaries

Locations of the ETBF and the WTBF in relation to the IOTC Area of Competence. The Western Skipjack Fishery and the Eastern Skipjack Fishery use the same boundary line as the WTBF and ETBF.



Appendix B Mandatory mitigation measures in the WTBF 2018–19

(Source: AFMA website: https://www.afma.gov.au/sites/g/files/net5531/f/uploads/2014/02/2018-WTBF-Management-Arrangements-booklet-Final-copy.pdf)

Seabirds

At all times you must:

- Carry an assembled tori line on board
- Not discharge offal while setting

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

- Deploy a tori line before commencing all shots that take place between nautical dawn and nautical dusk
- A tori line if not required to be deployed when performing fishing operations between the hours of nautical dusk and nautical dawn, providing the vessel uses minimum deck lighting (where minimum deck lighting is a lighting level which does not pose a risk to safety and navigation)
- Use only thawed bait
- Weight longlines with either a minimum of:
    - 60 g swivels at a distance of no more than 3.5 m from each hook ; or
    - 98 g swivels at a distance of no more than 4 m from each hook; or
    - 40 g weights immediately adjacent to the hook, or no more than 0.5 m from the hook, with dead, non-frozen baits attached to the hooks; or
    - 'Smart tuna hooks' with a cap and weighing at least 38 g may be deployed directly at the hook as an alternative.

Tori line specifications:

- 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
    - 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.

Turtles

Circle hooks

Large circle hooks must be used if less than eight hooks per bubble are set.

De-hooking device

At all times you must carry on board a minimum of one de-hooking device, with the following specifications:

- The device must enable the hook to be secured and the barb shielded so that the barb does not re-engage with the fish while the hook is being removed;
- The device must be blunt with all edges rounded;
- Where more than one size of hook is to be carried, a de-hooking device (or devices) must be carried that can be used with all hooks on the boat; and
- The shaft of the device must be a minimum of 1.5 metres in length.

Line-cutting device

At all times you must carry on board a minimum of one line cutting device. The line cutting device must be constructed and used in accordance with the following specifications:

- The device must be constructed to allow the line to be cut as close to the hook as possible;
- The blade of the device must be enclosed in a blunt rounded (arc-shaped) cover with the hook exposed on the inside of the arc; and
- The shaft of the device must be a minimum of 1.5 metres in length.