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South African National Report to the Scientific Committee of the Indian Ocean Tuna Commission, 2017

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INFORMATION ON FISHERIES, RESEARCH AND STATISTICS

In accordance with IOTC Resolution 15/02, final scientific data for the previous year was provided to the IOTC Secretariat by 30 June of the current year, **for all fleets other than longline** [e.g. for a National Report submitted to the IOTC Secretariat in 2017, final data for the 2015 calendar year must be provided to the Secretariat by 30 June 2017)	YES 30/06/2017
In accordance with IOTC Resolution 15/02, provisional **longline data** for the previous year was provided to the IOTC Secretariat by 30 June of the current year [e.g. for a National Report submitted to the IOTC Secretariat in 2017, preliminary data for the 2016 calendar year was provided to the IOTC Secretariat by 30 June 2017). **REMINDER:** Final longline data for the previous year is due to the IOTC Secretariat by 30 Dec of the current year [e.g. for a National Report submitted to the IOTC Secretariat in 2017, final data for the 2016 calendar year must be provided to the Secretariat by 30 December 2017).	YES 30/06/2017
If no, please indicate the reason(s) and intended actions:	

EXECUTIVE SUMMARY

South Africa has two large pelagic commercial fishing sectors in the Indian Ocean – the Large Pelagic Longline and the Tuna Pole-Line (baitboat) sectors. In 2016, only two Tuna Pole-Line vessels fished in the Indian Ocean with a combined fishing effort of 25 days. Negligible catches of albacore (*Thunnus alalunga*) and snoek (*Thrysites atun*) were made by these two vessels. The South African-flagged large pelagic longline vessels have traditionally used swordfish (*Xiphias gladius*) targeting methods, whilst the Japanese-flagged vessels that operate under joint-ventures and fish under South African rights holders target tropical tunas with effort focused in the Indian Ocean. In 2016, 19 longline vessels were active in the IOTC area of competence, which is the equal to that in 2015. However, a single Japanese foreign-flagged vessel that was permitted to fish in South African waters opted not to do so. This significantly decreased the number of hooks set and proportion of effort observed in the IOTC area due to foreign-flagged vessels requiring 100% observer coverage. Given this effort decrease, annual catches decreased in the IOTC area of competence from 2015 to 2016 for some of the major species. Swordfish catches decreased by 24%, followed by yellowfin (21%) and bigeye (20%). Increases in catches for the same period were observed for the following species: albacore (8%), southern bluefin tuna (66%), shortfin mako (87%) and blue shark (33%). The observed increase in shark catches, particularly shortfin mako, can be attributed to the fishery straddling the IOTC/ICCAT boundary line. As such, a slight movement eastward by the fishery resulted in a higher proportion of fish being caught in the IOTC region. Research into the stock origin and intermixing of tuna, swordfish and large pelagic shark populations at the boundary between the Atlantic and Indian Oceans is a priority in South Africa.

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1. BACKGROUND/GENERAL FISHERY INFORMATION

1.1. Large Pelagic Longline fishery

The South African Large Pelagic Longline fishery was commercialized in 2005, with the issuing of 18 swordfish-directed and 26 tuna-directed fishing rights valid for 10 years. The fishery was restricted to 50 permits (one permit per vessel) through a Total Applied Effort (TAE) control. The Large Pelagic Longline fishery was initially split into swordfish and tuna-directed sub-sectors due to the drastic declines in swordfish catch and CPUE experienced during the period of the experimental fishery from 1997 to 2005. South Africa amended its Large Pelagic Longline fishery policy in 2008 after only 9 swordfish-directed longline vessels operated in 2006, resulting in the lowest annual catch since 2001.

The current local longline vessels have gear configured to catch swordfish, but catch composition is split between swordfish and tropical tunas (bigeye and yellowfin tunas). The general method and gear used to target swordfish involves setting lines at night (to reduce seabird mortality) with squid bait using buoy - and branch lines of 20 m length. Depending on the vessel size, 700 – 1500 hooks are set per line. Stainless steel hooks are prohibited and as of 2017 wire traces are also prohibited. In addition, there is a precautionary upper catch limit (PUCL) of 2000 t for sharks. The larger vessels that target tropical tuna are able to fish further offshore and differ in their methodology. These vessels set up to 3000 hooks per set with a combination of fish and squid bait, using deeper branch lines and varying hook numbers per basket to influence the setting depth. The smaller longline vessels carry ice whereas the larger vessels have freezers. Fish are dressed at sea and no further at-sea processing is conducted. Swordfish are targeted in the north east of the South African EEZ and beyond in the Mozambique Channel, whereas tropical tunas are caught along the entire continental shelf edge.

South Africa submitted a bigeye tuna fishing plan (CoC 07/13) to the Commission meeting of the IOTC, thereby notifying the Commission of South Africa's intention to exceed 1000 t of bigeye tuna in future as the fishery develops. Prior to 2002 most of longline fishing effort was concentrated in the Atlantic Ocean. Fishing effort started increasing in the Indian Ocean from 2001 with the development of ice and processing facilities at Richards Bay, which is situated on the east coast of South Africa. The targeting and catching of tropical bigeye and yellowfin tunas has proven more successful in the Indian Ocean, resulting in a sizeable amount of the longline fishing effort being concentrated in the Indian Ocean. This fishery is now the most important South African tuna fishery operating in the Indian Ocean in terms of tonnage landed.

In 2005 the shark longline sector was split into a demersal shark longline component, which predominantly targets soupfin (*Galeorhinus galeus*) and hound sharks (*Mustelus mustelus*), and a pelagic shark longline component (seven vessels), which predominantly targets shortfin mako and blue sharks. The latter catches tunas and swordfish as bycatch. This fishery was split as a precursor to phase out the targeting of pelagic sharks due to the concern over the local stock status of some species. The pelagic shark fishery operated under exemptions from 2005 until March 2011, when South Africa incorporated the pelagic shark fishery into the tuna/swordfish longline fishery. Six of the seven shark exemption holders were issued with tuna/swordfish rights in March 2011. These vessels are undergoing a phase-out period to reduce shark targeting and focus on tuna and/or swordfish catches. Pelagic sharks are now considered as bycatch in the tuna and swordfish longline fishery.

In 2014 the decision was taken to no longer refer to the fleet as two different fishing strategies, tuna-directed and swordfish-directed, since the fishing behaviour of the local fleet has been shifting from exclusive swordfish targeting to include tunas and sharks. The fishery is now referred to as the Large Pelagic Longline fishery and includes vessels that target tunas, swordfish and sharks as by-catch. The 10-year long-term rights granted in 2005 expired in February 2015, and 15-year rights have subsequently been allocated by South Africa's

Department of Agriculture, Forestry and Fisheries. For the current long-term fishing rights period, the South African longline fleet will be restricted to 70 vessels, with no more 50 vessels exceeding 24 m LOA operating in the IOTC region at any given time. The fishery is allowing an interim period for foreign vessels to charter in this sub-sector to expedite skills development and as a means of acquiring suitable vessels. Foreign vessel owners in the tuna-directed sub-sector are encouraged to reflag their vessels.

Foreign vessels, mainly from Japan and Chinese-Taipei, fished in South African waters through the issuing of bi-lateral agreements in the 1970s, and re-negotiated these agreements in the 1990s until 2002 (Sauer *et al*., 2003). Joint-venture agreements with Japan have been underway since 1995, whereby these foreign-flagged vessels are permitted to fish under a South African Rights Holder. The vessel is required to adhere to South African legislation, including but not limited to, the Marine Living Resources Act (Act No. 18 of 1998) and Regulations promulgated thereunder, including Large Pelagic Longline sector specific policy. Importantly, each foreign vessel is required to carry an observer onboard every trip. The catch, and observer coverage from these vessels accrues to South Africa.

1.2.Pole and Line fishery, commercial linefishery

Fishing for tunas using rod and reel and/or pole and line dates back to the 1970s in South Africa when they were caught in minimal quantities as bycatch in other fisheries. Interest sparked in 1979 when yellowfin tuna (*Thunnus albacares*) became available close inshore off Cape Point (Shannon, 1968). Operators from other sectors converted their vessels to ice vessels to fish for yellowfin using pole and line or purse-seine nets, resulting in catches of over 4 500 t (Penney and Punt, 1993). By 1980 the yellowfin tuna was no longer available close inshore, resulting in these vessels targeting albacore (*Thunnus alalunga*) instead on the south-west and west coasts of South Africa. Albacore catches peaked at 6000 t in 1989, although these catches were under-reported and were probably closer to 10 000 t (Penney and Punt, 1993). The sector has continued to exploit juveniles and sub-adult albacore of between 2 and 3 years old (average of 86 cm FL) and larger yellowfin tuna (average of 133 cm FL). Catches of albacore have remained relatively stable over the last decade, averaging approximately 3 500 t per year. Yellowfin tuna are periodically available inshore with a frequency of 5 to 7 years and the fleet harvests this species opportunistically. In 2014 and 2015 yellowtail were available to the fishery around the Cape of Good Hope region which might have resulted in lower catches in the IOTC region.

The sector operates along the south-west and west coasts of South Africa in the Atlantic Ocean where albacore is available close inshore from October to May, but vessels make forays into the Indian Ocean depending on target species distribution. Traditionally the South African fleet has been characterized into three different categories (1) Skiboats, (2) Pole and Line and (3) Freezer vessels (Leslie et al. 2004). Skiboats are less than 25 GRT and are mostly confined to day trips within a range of 50 nm. Pole and Line boats, which represent the bulk of the fleet, are mainly older displacement-type vessels converted from other fisheries. These vessels can undertake multiday trips of limited duration and range, as the catch is kept on ice. Freezer vessels are mainly vessels up to 30 m and 230 GRT. Due to their large size and freezing facilities, these vessels can stay out at sea for long periods and reach the farthest fishing grounds (West *et al.*, 2013). In more recent years, improvements in navigational gear, the use of live bait and sonar equipment has improved the performance of these vessels (West *et al*., 2013).

This sector is effort controlled, limiting the number of vessels and crew. Prior to 2006, the pole and line fishery was managed under the bracket of commercial linefishing. During the long-term rights allocation process in 2006, the commercial linefishery was divided into three separate sectors consisting of the traditional linefishery (452 vessels and 3 450 crew), the hake-handline sector (130 vessels and 785 crew) and the pole and line fishery (200 vessels and 3 600 crew) (Mann, 2013). Of the 200 vessels and 3 600 crew allocation available for 8 years, only 198 vessels and 2961 crew were allocated in 2006 (TAC/TAE, 2015). The reallocation of long-term rights in 2013 saw 130 rights (136 vessels) granted and 15% of the available effort reserved for possible allocation for appeals. Subsequent to the finalisation of the 2015 Appeals process, 34 new rights (41 vessels, 25 repeat and 15 unique) were added, resulting in a total vessel number of 151 (164 rights). This reduction was in response to the 2013 ICCAT albacore stock assessment outcome of large uncertainty around the estimates of albacore stock status in the south Atlantic. ICCAT has issued South Africa with a 4 400 t per annum albacore allocation for the period 2014 to 2016 (ICCAT, 2013), 90% of which is caught by the Tuna-Pole Line sector. The Tuna Pole-Line TAE for the 2017 fishing season was maintained at 165 vessels.

Since vessels are small and the nature of the operation requires the vessel to maximise on crew (who work in pairs to catch and haul albacore), scientific observers are currently not accommodated on the vessel and instead monitor catches in port during offloading.

In 2014, after 6 years of experimental fishing, live-bait purse-seining was incorporated in the sector, allowing a limited number of vessels to cast a net and all vessels to hold live-bait. The live-bait are mostly anchovy (*Engraulis encrasicolus*) with sardine (*Sardinops sagax*) considered as accidental catch and are stored alive in tanks for up to 3 months. The vessels are authorised to use purse-seine nets that do not exceed 210 m in length and 35 m in depth.

In 2016 only two Pole and Line vessels fished in the Indian Ocean. This fishery is largely based in Cape Town and the fleet operates in the Atlantic Ocean along the west coast as far north as Namibia and as far west as Valdivia and Vema seamounts. The fleet has access to near shore albacore and yellowfin tuna in these areas.

South Africa also has a boat-based commercial Linefishery which opportunistically catches yellowfin tuna and eastern little tuna (*Euthynnus affinis*) (Everett, 2014), in addition to king mackerel and shark species in the Indian Ocean using rod and reel when other linefish species such as yellowtail (*Seriola lalandi*), snoek (*Thyrsites atun*), kob (*Argyrosomus spp*), geelbek (*Atractoscion aequidens*) and slinger (*Chrysoblephus puniceus*) are not available. These catches usually only contribute a negligible percentage of the total catch of the Linefishery due to the multispecies nature of this fishery.

2. Fleet structure

South Africa has two commercial fishing sectors which either target, or catch as bycatch, tuna and tuna-like species in the Indian Ocean – the Large Pelagic Longline and the Tuna Pole-line. The Tuna Pole-line sector, which operates mainly in the Atlantic Ocean from September – May each year, only occasionally crosses over into the Indian Ocean in search of yellowfin tuna. In 2016, only two Tuna Pole-Line vessels fished in the Indian Ocean with a combined fishing effort of 25 days. These vessels are relatively small (< 24m), have a limited range and the duration of trips is short (< 16 days).

In contrast, 19 longline vessels (16 domestic, 3 foreign-flagged) were active in the IOTC area of competence, which is equal to that in 2015. However, a single Japanese foreign-flagged vessel that was permitted to fish in South African waters, and did so in 2015, opted not to in 2016.

South Africa currently has a commercial linefishery (artisanal) that is regulated through a TAE of 370 permits, and a recreational skiboat fishery open access (a recreational permit can be purchased).

South Africa submitted a Fleet Development Plan (FDP) in 2007 and is yet to provide information on the implementation of the initial FDP and to consult with stakeholders to provide an updated FDP.

Table 1. Number of vessels operating in the IOTC area of competence, by gear type and size, for the period 2010 - 2016.

<table>
<tr><th rowspan="2">Fishing Sector</th><th colspan="3">Fleet Structure in 2016</th><th colspan="3">Fleet Structure 2010 - 2015</th></tr>
<tr><th>No. Active Permits</th><th>Vessel size range (m)</th><th>Trip duration (days)</th><th>No. Active Permits</th><th>Vessel size range (m)</th><th>Trip duration (days)</th></tr>
<tr><td>Large Pelagic Longline</td><td>19</td><td>20 - 49</td><td>4 - 93</td><td>2015: 19
2014: 15
2013: 22
2012: 24
2011: 29
2010: 21</td><td>2015: 20 - 49
2014: 20 - 49
2013: 20 - 50
2012: 22 - 50
2011: 22 - 50
2010: 21 - 50</td><td>7 - 90</td></tr>
<tr><td>Pole & Line</td><td>2</td><td>16 – 19</td><td>4 – 15</td><td>2015: 3
2014: 0
2013: 0
2012: 6
2011: 6
2010: 2</td><td>2015: 16 - 19
2014: N/A
2013: N/A
2012: 14 - 20
2011: 13 - 22
2010: 13</td><td>2 - 14</td></tr>
<tr><td>Commercial Linefishery</td><td>370</td><td>4 - 10</td><td>1 - 2</td><td></td><td></td><td></td></tr>
<tr><td>Recreational Linefishery</td><td>Unknown</td><td>4 - 10</td><td>1</td><td></td><td></td><td></td></tr>
</table>

3. CATCH AND EFFORT (BY SPECIES AND GEAR)

The decrease in the number of hooks set in the IOTC area of competence resulted in significant decrease in annual catches from 2015 to 2016 for some of the major species (Table 2a). Swordfish catches decreased by 24%, followed by yellowfin (21%) and bigeye (20%). Increases in catches for the same period were observed for the following species: albacore (8%), southern bluefin tuna (66%), shortfin mako (87%) and blue shark (33%). The observed increase in shark catches, particularly shortfin mako, can be attributed to the fishery straddling the IOTC/ICCAT boundary line. As such, a slight movement eastward by the fishery results in a higher proportion of fish being caught in the IOTC region. This is accompanied by a reciprocal decrease in catch in the ICCAT area of competence. It is recommended that total South African catch be referred to for reference when assessing fisheries which straddle the IOTC/ICCAT boundary line to avoid emphasizing erroneous statistics that are clearly an artefact of this management boundary. Skipjack catches continue to be negligible (< 0.1 metric tons) and the catch of all other species (NEI) also declined from 2015 to 2016. In 2016, only two Tuna Pole-Line vessels fished in the Indian Ocean with a combined fishing effort of 25 days. Negligible catches of albacore (*Thunnus alalunga*) and snoek (*Thrysites atun*) were caught by these two vessels in the IOTC area of competence (Table 2b).

Table 2a. Annual Large Pelagic fishery catch (tons round weight excluding sharks and NEI) and effort (number of hooks) of primary species in the IOTC area of competence for the period 2010 - 2016. NEI indicates all other catch.

Year	Total number of hooks	Bigeye tuna	Yellowfin tuna	Albacore	Southern bluefin tuna	Swordfish	Skipjack	Shortfin mako	Blue shark	NEI
2010	44 52 420	794.9	1207.3	60.3	7.8	467.6	0.7	41.9	90.9	98.8
2011	5 235 123	781.2	1063.2	254.7	60.2	488.2	3.0	341.1	193.8	180.5
2012	3 816 271	759.2	590.1	161.7	109.1	395.1	2.6	221.3	171.7	136.4
2013	3 872 846	590.4	1029.4	177.5	53.3	305.0	3.6	304.4	169.8	101.6
2014	1 828 671	339.2	383.0	28.2	15.3	102.8	0.8	249.3	102.9	38.2
2015	1 614 724	256.0	422.1	18.5	10.7	122.7	0.3	290.6	128.9	47.4
2016	1 284 756	203.6	331.5	19.9	17.8	93.4	0.1	543.6	171.7	28.7

Table 2b. Annual catch and effort (number of days) of primary species from the Tuna Pole-Line in the IOTC area of competence for the period 2010 - 2016. NEI indicates all other catch.

Year	Total number of catch days	Albacore	Yellowfin tuna	Skipjack	Bigeye tuna	Snoek	Yellowtail	NEI
2010	3	3.5	0	0	0	0	0	0.26
2011	25	45.7	0.69	0.002	0	0.02	0.88	0.85
2012	31	15.3	0.16	0.04	0.12	0.32	0.01	0.09
2013	2	0.06	0.01	0.01	0	0	0	0
2014	0	0	0	0	0	0	0	0
2015	3	0.13	0.11	0	0	0	0	0
2016	25	5.78	0	0	0	6.52	0	0

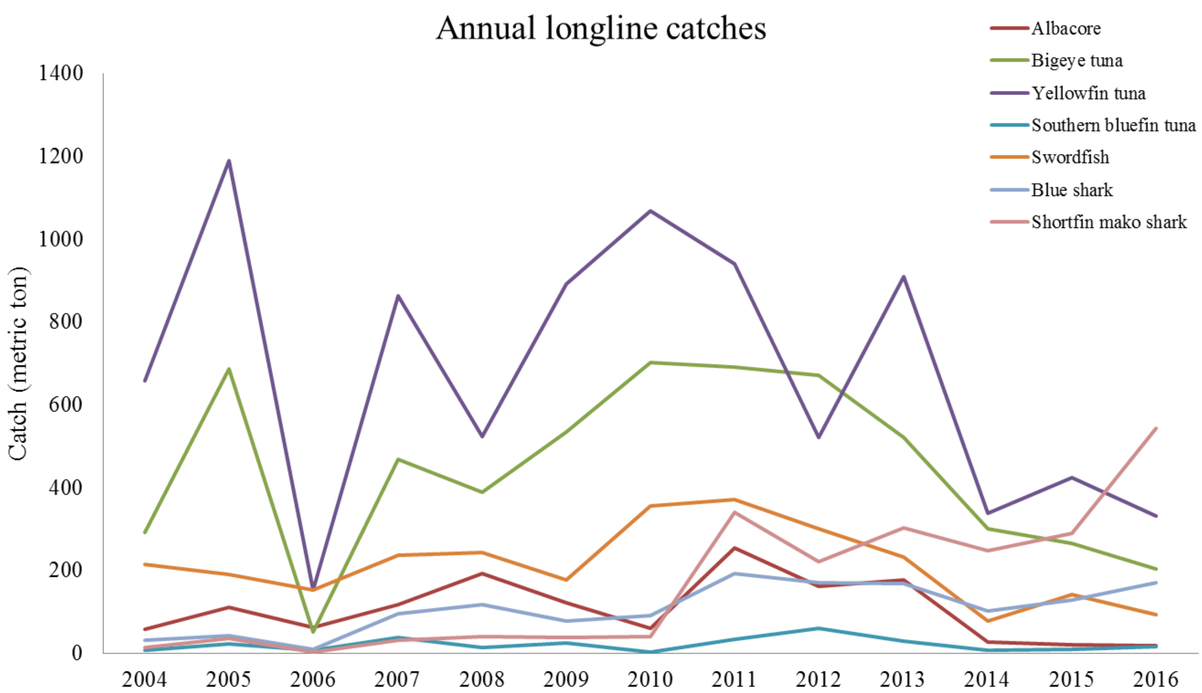

Figure 1a. Historical annual catch for the South African Large Pelagic Longline fleet for the IOTC area of competence of the period 2004 – 2016.

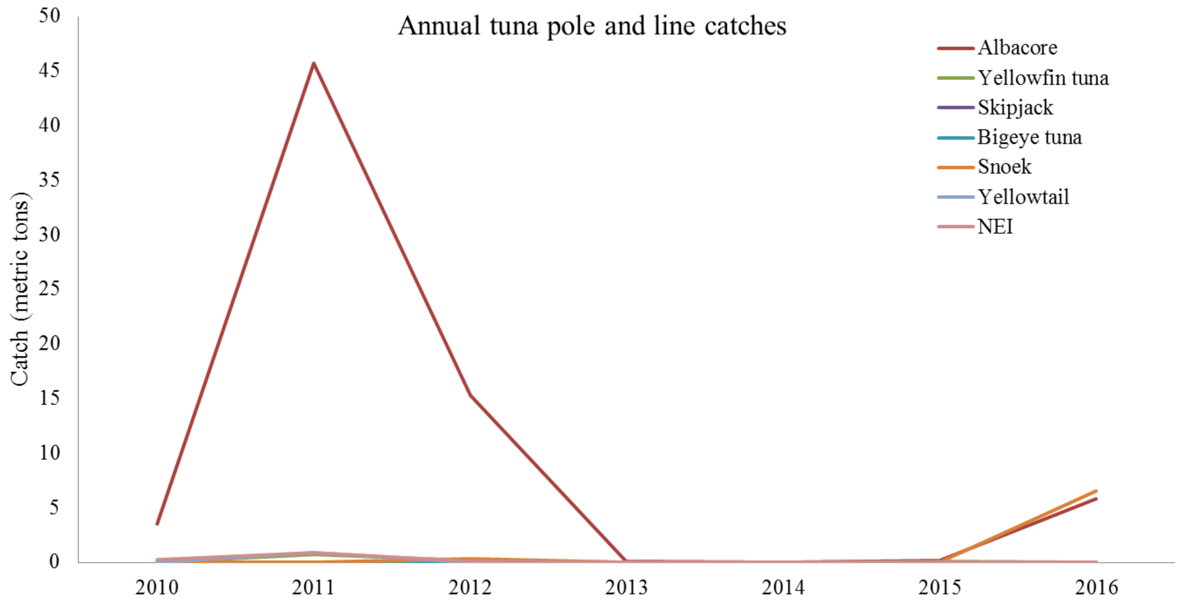

Figure 1b. Historical annual catch for the South African Tuna Pole-Line fleet for the IOTC area of competence for the period 2010 – 2016. .

There are seemingly two areas of concentrated longline effort by the national fleet in the IOTC area of competence (Figure 2): the Agulhas Bank (~ 20-25 degrees longitude) and offshore of Richards Bay (~32 degrees longitude). The spatial distribution of species-specific catches is illustrated in Figure 3a. While most species have high catches in both the Agulhas Bank and Richards Bay areas, mako sharks are predominantly caught in the former which forms the IOTC/ICCAT boundary. Swordfish have the widest distribution in the IOTC area of competence, with high catches on the western boundary (IOTC/ICCAT) and to the east on the boundary of South African and Mozambique.

The annual national fleet longline effort for the period 2008 to 2016 is illustrated in Figure 3b. While the distribution is relatively evenly spread along the South African coast, there is a definitive trend of effort moving nearshore. A vast amount of effort was further offshore in the past (2008 – 2013), particularly on the border of Mozambique. The current effort has subsequently decreased, and has been focused closer to the mainland or on the Agulhas Bank.

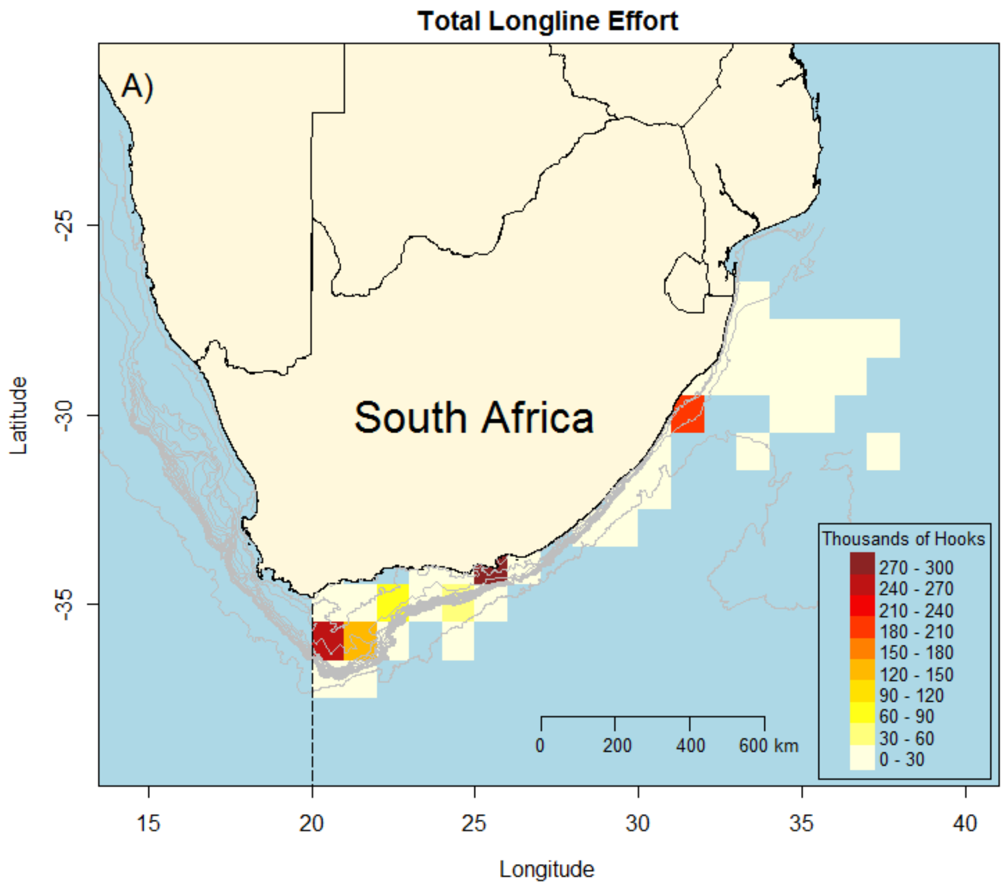

Figure 2a. Map of the distribution of effort of the South African Large Pelagic Longline fishing fleet in the IOTC area of competence for 2016.

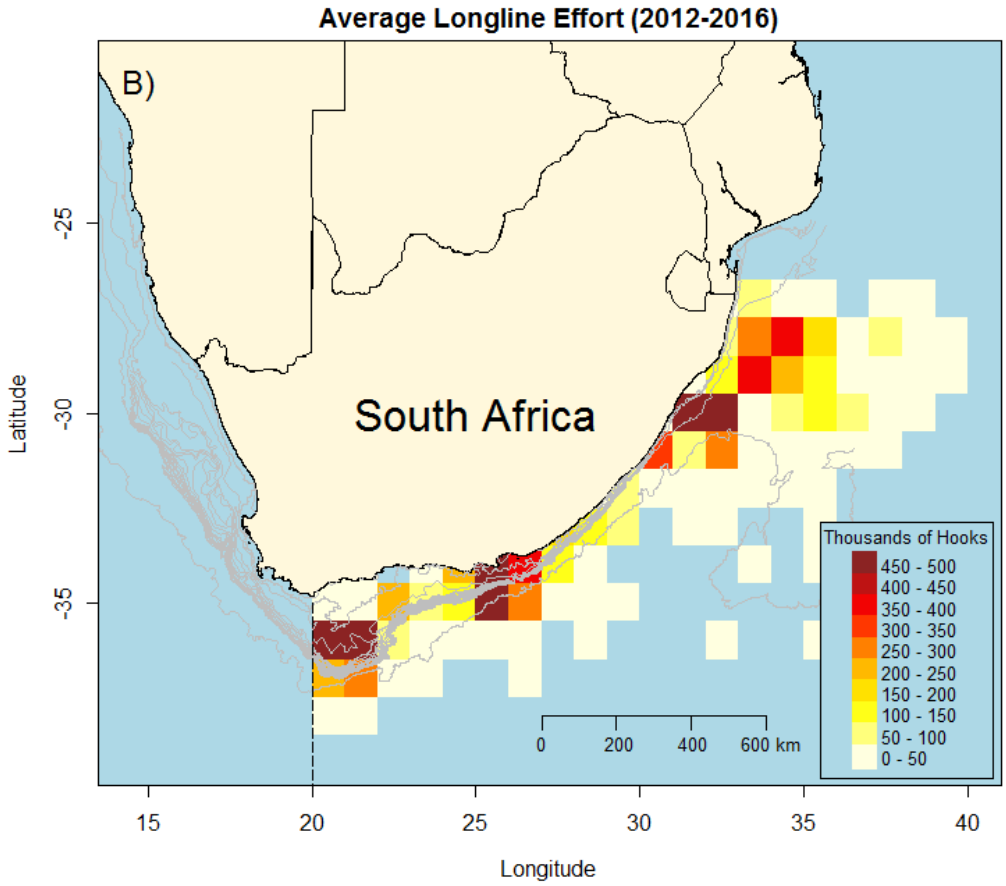

Figure 2b. Map of the distribution of average effort of the South African Large Pelagic Longline fishing fleet in the IOTC area of competence for the last 5 years (2012 – 2016).

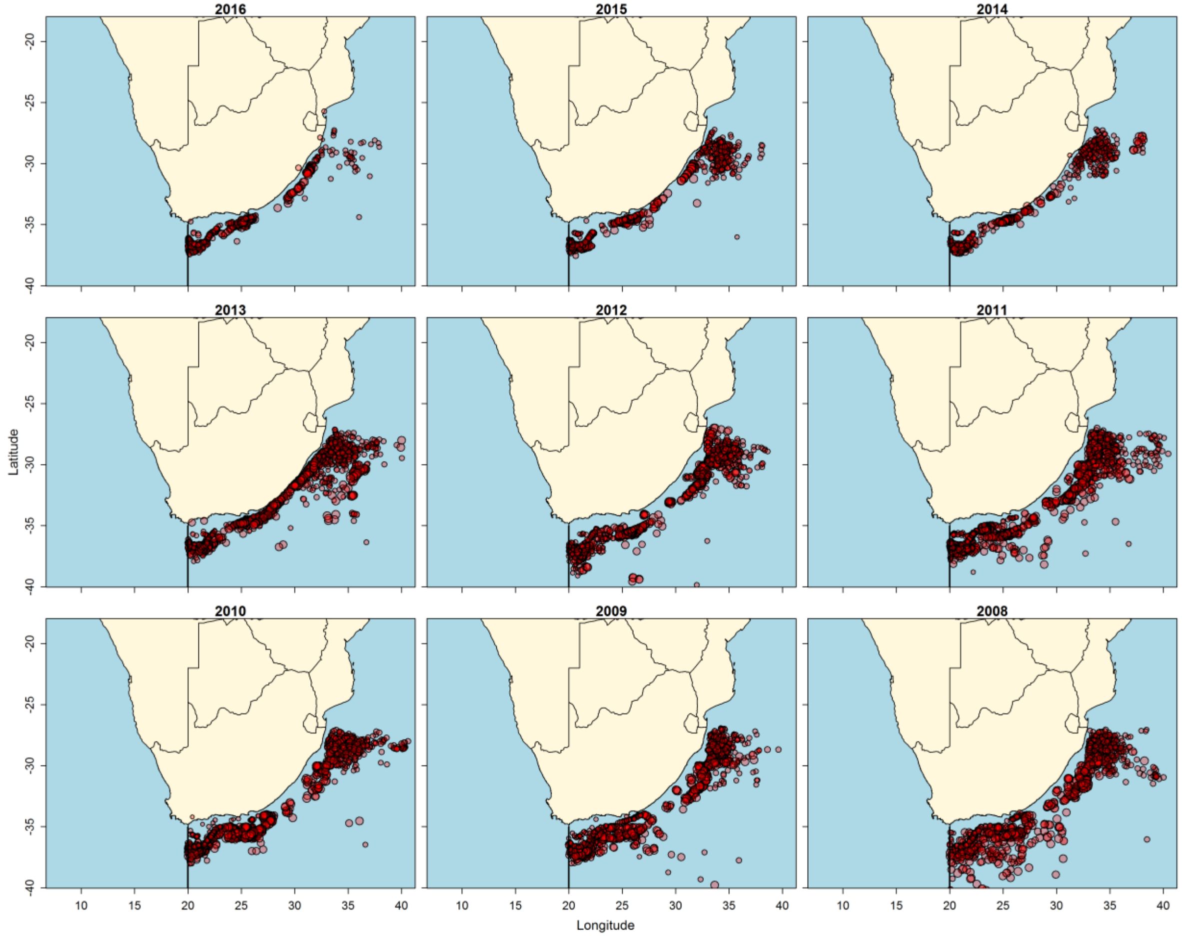

Figure 2c. Map of annual distribution of pelagic longline relative effort for the period 2008 - 2016 in the IOTC area of competence. The black line indicates the IOTC/ICCAT boundary

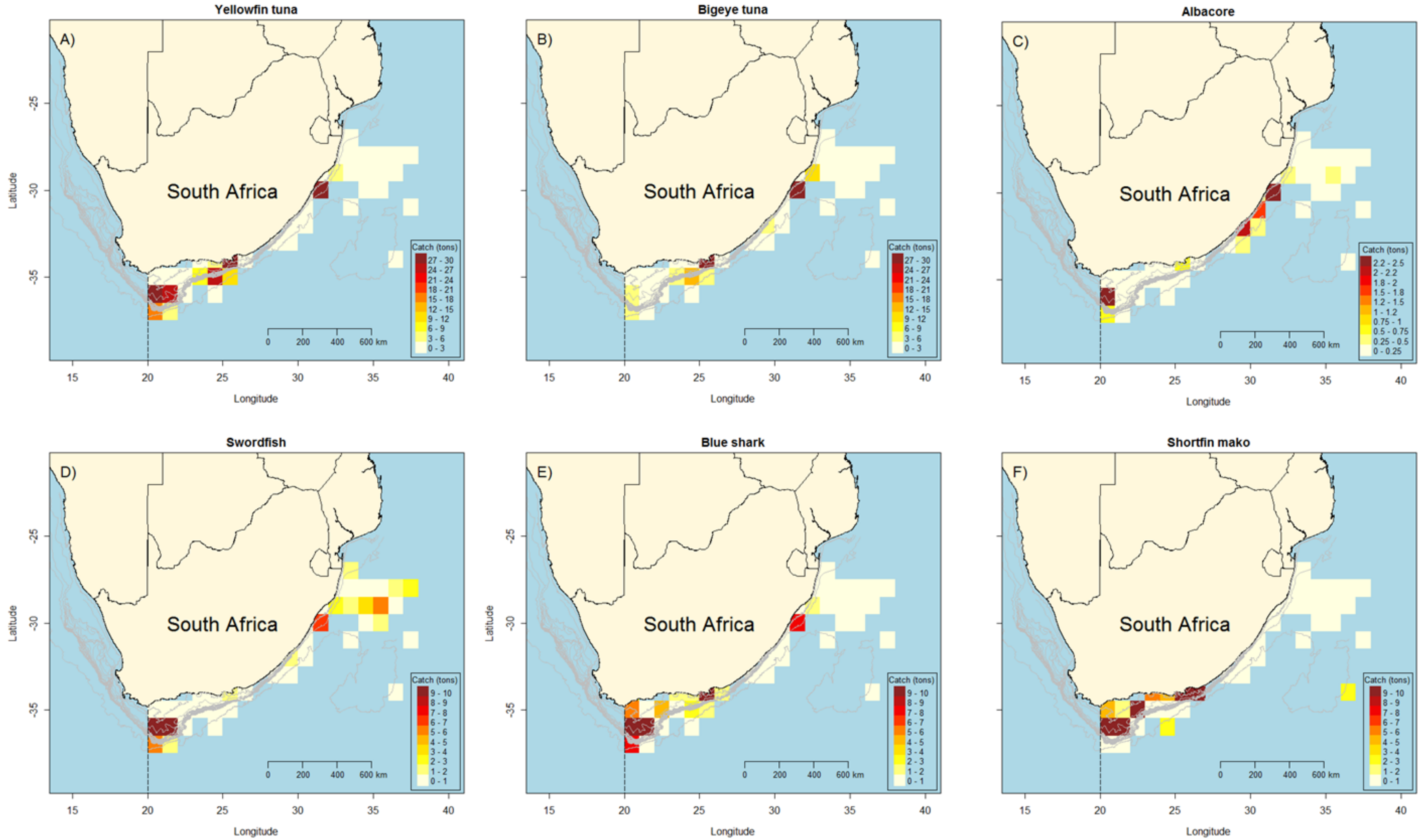

Figure 3a. Map of distribution of fishing catch (metric tons), for a) yellowfin tuna, b) bigeye tuna, c) albacore, d) swordfish, e) blue shark and f) shortfin mako shark for pelagic longline in South Africa, in the IOTC area of competence in 2016.

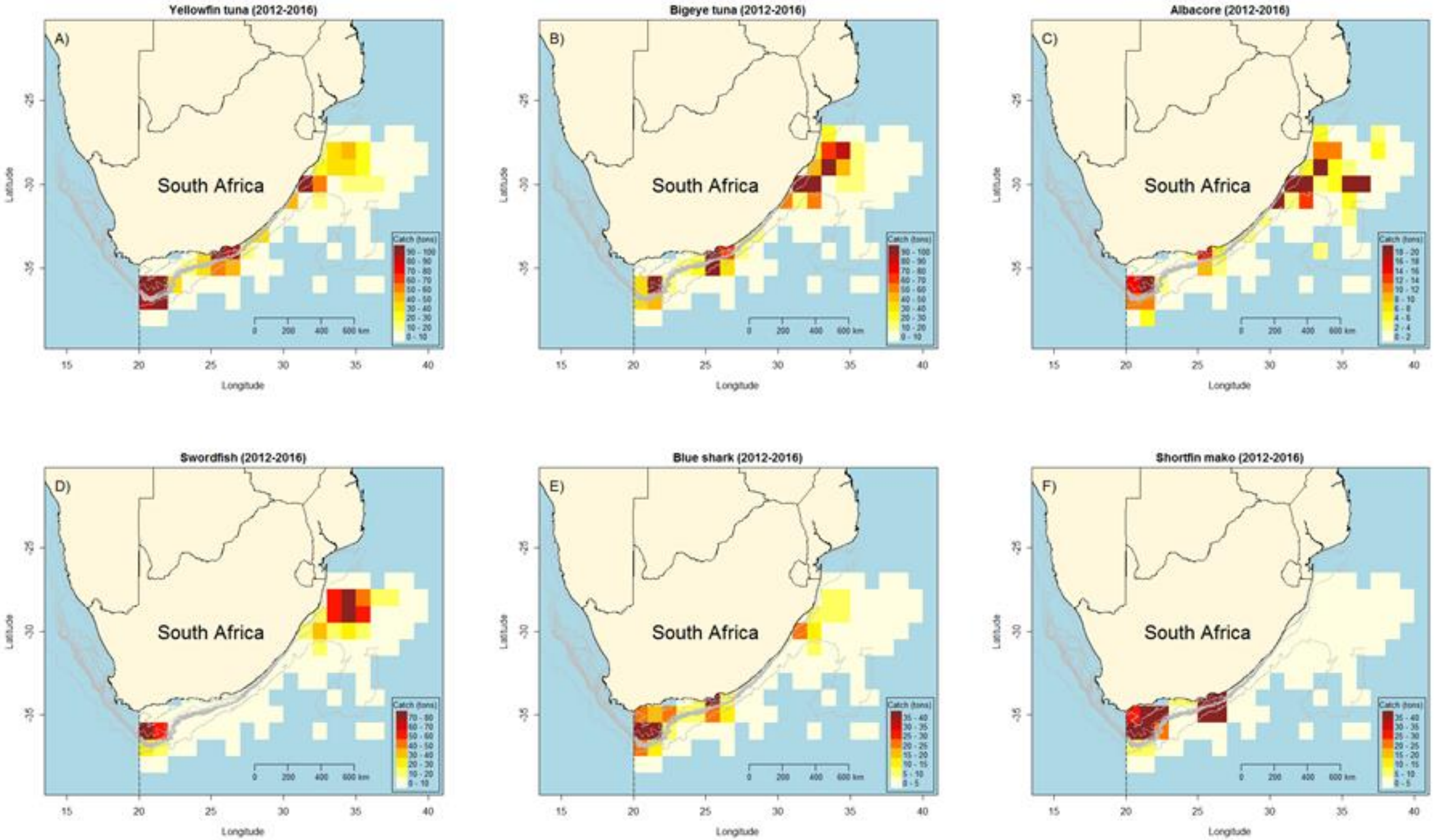

Figure 3b. Map of distribution of average fishing catch (metric tons), for a) yellowfin tuna, b) bigeye tuna, c) albacore, d) swordfish, e) blue shark and f) shortfin mako shark for pelagic longline in South Africa, in the IOTC area of competence for the last 5 years (2012 – 2016).

4. RECREATIONAL FISHERY

The boat-based recreational fishery, including informal charter and sport fisheries using rod and reel and spear guns, also targets albacore, yellowfin, skipjack and bigeye tuna, and marlins (blue marlin *Makaira nigricans* and black marlin *Makaira indica*), from small fishing vessels (on average 4 – 10 m in length). All recreational fishers are required to purchase a permit and are restricted to a bag-limit of 10 tuna, 5 swordfish and 5 billfish per day, with the sale of catch prohibited. There are further minimum weight restrictions of 3.2 kg for yellowfin and bigeye, 6.4 kg for southern bluefin and 25 kg for swordfish caught. As there are no reporting requirements for this fishery catch and effort data are not consistently available. The angling associations have regular tuna and billfish competitions every year where they promote research (e.g. tagging), catch-and-release and responsible fishing. Most recreational fishing takes place in nearshore waters during holiday and relatively few anglers are equipped to target tuna.

The impact of the recreational fishing sector on South African large pelagic resources has resulted in a number of data collection initiatives being implemented. These are largely driven by NGOs, Government Research Institutes and Universities. One such initiative FishforLife (http://fishforlife.co.za/) is a citizen science initiative aimed at gathering relevant fisheries data in the recreational fishing sector via their online portal CatchReport (http://www.catchreport.co.za/).

5. ECOSYSTEM AND BYCATCH ISSUES

The World Wildlife Fund South Africa (WWF-SA) Responsible Fisheries Programme, now the WWF Sustainable Fisheries, has worked since 2007 to facilitate the implementation of an Ecosystem Approach to Fisheries management (EAF) in Southern Africa. An Ecological Risk Assessment (ERA) was conducted in 2007 to identify the issues (e.g. ecological wellbeing, human wellbeing and ability to achieve) in the pelagic longline, shark longline and Tuna Pole-Line fisheries (Petersen, 2007). The Performance Report identified the gaps amongst research, management, compliance and industry and has been used – and has continued relevance – as a tool to guide work plans and the implementation of EAF considerations in permit conditions.

5.1.Sharks

The National Plan of Action (NPOA) for sharks was finalised and launched at the 2013 ICCAT Commission meeting held in Cape Town, South Africa. Shark-related issues discussed in the NPOA-Sharks have been categorised into clusters with proposed actions by the responsible unit within a time frame (NPOA-Sharks, 2013). A task-team of relevant stakeholders is required to achieve the tasks set out in the NPOA-Sharks.

The permit conditions are amended regularly to include shark mitigation measures. As of 2017, the use of wire traces has been banned in the South African Large Pelagic Longline fishery.

In addition, a precautionary upper catch limit (PUCL) of 2000 t dressed weight of Chondrichthyans was enforced in 2012. Foreign-flagged fleets may not land Chondrichthyans that exceed 10% of the total dressed weight of tuna species per season. South African-flagged vessels are limited by the following PUCL. When the PUCL has been reached the entire fishery will close.

Retention of all requiem sharks (*Carcharhinus*) should be prohibited, and such sharks should be released by cutting the line as close to the jaw as possible once the shark is alongside.

Table 3. Total number and dressed weight (metric tons) of sharks retained by the South African national fleet in the IOTC area of competence for the period 2010 - 2016. 'Requiem sharks' is a total of bronze whaler (*Carcharhinus brachyurus*), dusky (*Carcharhinus obscurus*) and silky (*C. falciformus*).

Year	Blue shark no.	Blue shark tons	Shortfin mako shark no.	Shortfin mako shark tons	Requiem sharks no.	Requiem sharks tons
2010	4 424	90.9	2 066	41.9	5	0.09
2011	10 844	193.8	14 734	341.1	325	15.21
2012	11 021	171.7	8 184	221.3	456	16.80
2013	11 588	169.8	11 620	304.4	38	1.72
2014	7 544	102.9	8 720	249.3	24	1.36
2015	10 609	128.9	10 856	290.6	281	15.8
2016	15 636	171.7	20 117	543.6	206	9.7

Thresher sharks belonging to the genus *Alopias*, hammerhead sharks (belonging to genus *Sphyrna*), manta- and mobulid rays shall not be retained on board any vessel and all releases of these species are noted on the logbooks.

Shark fins must be naturally attached to the body when landed.

The trade of shark and ray products, including fins, fillets, gill rakers and other products should be carefully monitored to ensure CITES Appendix II listed species are not traded without the necessary permits.

The total number of sharks, by species, released/discarded by the national fleet in the IOTC area of competence for the period 2009 to 2016 is provided in Tables 4a – 4h. These tables quantify the state of released individuals from 2011 onwards.

Table 4a: Total number of sharks, by species, released/discarded by the national fleet in the IOTC area of competence in 2009.

	Discarded
Mobula spp.	2
Manta spp.	6
Pelagic stingray *Pteroplatytrygon violacea*	445
Blue shark *Prionace glauca*	494
Bronze whaler shark *Carcharhinus brachyurus*	11
Crocodile shark *Pseudocarcharias kamoharai*	55
Hammerhead shark *Sphyrna* spp	8
Shortfin mako shark *Isurus oxyrinchus*	416
Thresher shark *Alopias spp*	110
Big eye Thresher *Alopias superciliosus*	14
Shark unidentified	13
Ray and skate unidentified	17

Table 4b: Total number of sharks, by species, released/discarded by the national fleet in the IOTC area of competence in 2010.

	Discarded
Mobula spp.	1
Pelagic stingray *Pteroplatytrygon violacea*	188
Blue shark *Prionace glauca*	207
Bronze whaler shark *Carcharhinus brachyurus*	4
Crocodile shark *Pseudocarcharias kamoharai*	24
Dusky shark *Carcharhinus obscurus*	2
Hammerhead shark *Sphyrna* spp	7
Shortfin mako shark *Isurus oxyrinchus*	339
Thresher shark *Alopias spp*	133
Big eye Thresher *Alopias superciliosus*	10
Shark unidentified	11

Table 4c: Total number of sharks, by species, released/discarded by the national fleet in the IOTC area of competence in 2011.

	Alive and in good health	Alive, condition unknown	Alive, life-threatening injuries, unlikely to survive	Alive, minor injuries, stressed, high probability of survival	Dead	Unknown	Total
Bigeye thresher *Alopias superciliosus*	7	36		2	5		50
Blue shark *Prionace glauca*	70	287	3	79	68		507
Bronze whaler shark *Carcharhinus brachyurus*					3		3
Crocodile shark *Pseudocarcharias kamoharai*	6	25		8	3		42
Dusky shark *Carcharhinus obscurus*		7	1	1	5		14
Hammerhead sharks *Sphyrna* spp		11			4		15
Longfin mako *Isurus paucus*	1		1				2
Manta and *Mobula* spp		1					1
Oceanic whitetip shark *Carcharhinus longimanus*	1	3			1		5
Pelagic stingray *Pteroplatytrygon violacea*	62	230	12	80	69		453
Porbeagle shark *Lamna nasus*		2		3			5
Skates and rays unidentified		4					4
Shortfin mako shark *Isurus oxyrinchus*	118	202	8	183	141	1	653
Silky shark *Carcharhinus falciformis*					1		1
Smooth hammerhead shark *Sphyrna zygaena*	1	26			9		36
Thresher shark *Alopias vulpinus*	21	119		1	11	2	154
Tope shark *Galeorhinus galeus*				1	2		3

Table 4d: Total number of sharks, by species, released/discarded by the national fleet in the IOTC area of competence in 2012.

	Alive and in good health	Alive condition unknown	Alive, life-threatening injuries, unlikely to survive	Alive, minor injuries, stressed, high probability of survival	Discard reason unknown	Discard, dead	Discard dead, depredated	Discard, dead, finned	Discard, dead, no commercial value	Discard, dead, undersized	Total
Bigeye thresher *Alopias superciliosus*	5	21				3					29
Blue shark *Prionace glauca*	38	80	13	98	8	4	4	10		15	270
Bronze whaler shark *Carcharhinus brachyurus*				1							1
Crocodile shark *Pseudocarcharias kamoharai*	6		1	26				1			34
Dusky shark *Carcharhinus obscurus*	1	3		2	1	3					10
Great hammerhead shark *Sphyrna mokarran*		2									2
Manta and *Mobula* spp		4									4
Pelagic stingray *Pteroplatytrygon violacea*	53	3		97		2			2		157
Pelagic thresher shark *Alopias pelagicus*		2									2
Porbeagle shark *Lamna nasus*				6							6
Scalloped hammerhead shark *Sphyrna lewini*		4				2					6
Shortfin mako shark *Isurus oxyrinchus*	44	52	7	133	5	13	7	7		27	295
Smooth hammerhead shark *Sphyrna zygaena*	3	14		3		3	1				24
Thresher shark *Alopias vulpinus*	15	23		6		4	1	2			51
Tiger shark *Galeocerdo cuvier*		1									1

Table 4e: Total number of sharks, by species, released/discarded by the national fleet in the IOTC area of competence in 2013.

	Alive and in good health	Alive condition unknown	Alive, life-threatening injuries, unlikely to survive	Alive, minor injuries, stressed, high probability of survival	Discard reason unknown	Discard, dead	Discard, dead depredated	Discard, dead, finned	Discard, dead, no commercial value	Discard, dead, undersized	Total
Bigeye thresher *Alopias superciliosus*		2	1	8	1				1		13
Blue shark *Prionace glauca*	39	59	47	53	3	12	19			34	266
Crocodile shark *P.kamoharai*	7	4	2	16							29
Dusky shark *Carcharhinus obscurus*				1		1				1	3
Great hammerhead shark *Sphyrna mokarran*	6		2		3	3					14
Manta and *Mobula* spp	2	2									4
Oceanic whitetip shark *Carcharhinus longimanus*	1	2		2							5
Pelagic stingray *Pteroplatytrygon violacea*	34	16	6	27					2		85
Pelagic thresher shark *Alopias pelagicus*		3		1							4
Porbeagle shark *Lamna nasus*	1	8			1			1	1		12
Scalloped hammerhead shark *Sphyrna lewini*				2							2
Shortfin mako shark *Isurus oxyrinchus*	30	31	17	42	3	10	10	6	1	17	157
Silky shark *Carcharhinus falciformis*	3	2	1	1							7
Smooth hammerhead shark *Sphyrna zygaena*				1	1						2
Thresher shark *Alopias sp*	12	20	3	12	14						61
Tiger shark *Galeocerdo cuvier*				1							1

Table 4f: Total number of sharks, by species, released/discarded by the national fleet in the IOTC area of competence in 2014.

	Alive and in good health condition	Alive conditions not determined	Alive, life threatening injuries unlikely to survive	Alive, minor injuries / stressed high probability of survival	Discard reason unknown	Discard, dead	Discard, dead, depredated	Discard, dead, no commercial value	Discard, dead, undersize	Total
Bigeye thresher *Alopias superciliosus*	2			5		1				8
Blue shark *Prionace glauca*	73	26	20	98	2	47	27		35	328
Bronze whaler shark *Carcharhinus brachyurus*				2		1				3
Crocodile shark *Pseudocarcharias kamoharai*	5			7		1		1		14
Hammerhead sharks *Sphyrna* spp	1			1						2
Manta and *Mobula* spp				2						2
Pelagic stingray *Pteroplatytrygon violacea*	10	8	3	27		5		2		55
Pelagic thresher *Alopias pelagicus*			2	7						9
Shortfin mako *Isurus oxyrinchus*	24	13	2	64		13	5		25	148
Silky shark *Carcharhinus falciformis*						1				1
Thresher shark *Alopias* spp	18	7		6		5				36

Table 4g: Total number of sharks, by species, released/discarded by the national fleet in the IOTC area of competence in 2015.

	Alive and in good health condition	Alive conditions not determined	Alive, life threatening injuries unlikely to survive	Alive, minor injuries / stressed high probability of survival	Discard reason unknown	Discard, dead	Discard, dead, depredated	Discard, dead, no commercial value	Discard, dead, undersize	Total
Bigeye thresher *Alopias superciliosus*	6									6
Blue shark *Prionace glauca*	144	12	70	64	1	34	18	2	20	365
Bronze whaler shark *Carcharhinus brachyurus*	8		1	4		5				18
Crocodile shark *Pseudocarcharias kamoharai*	3		1	2		2				8
Hammerhead sharks *Sphyrna* spp	10		2	4		5				21
Oceanic whitetip shark *Carcharhinus longimanus*	2					3				5
Pelagic stingray *Pteroplatytrygon violacea*	73		5	8		7		20		113
Scalloped hammerhead shark *Sphyrna lewini*	6					1				7
Shortfin mako *Isurus oxyrinchus*	54	1	19	33	1	25	14		15	162
Silky shark *Carcharhinus falciformis*	9	5				19	1			34
Smooth hammerhead shark *Sphyrna zygaena*	1			1		1				3
Thresher shark *Alopias* spp	33	3	4	9		5				54
Tiger shark *Galeocerdo cuvier*	2									2

Table 4h: Total number of sharks, by species, released/discarded by the national fleet in the IOTC area of competence in 2016.

	Alive and in good health condition	Alive conditions not determined	Alive, life threatening injuries unlikely to survive	Alive, minor injuries / stressed high probability of survival	Discard reason unknown	Discard, dead	Discard, dead, depredated	Discard, dead, no commercial value	Discard, dead, undersize	Total
Bigeye thresher *Alopias superciliosus*		25	4						6	35
Blue shark *Prionace glauca*	22	160	48	23	1	13			29	296
Bronze whaler shark *Carcharhinus brachyurus*		3							1	4
Crocodile shark *Pseudocarcharias kamoharai*	3	10	13							26
Pelagic stingray *Pteroplatytrygon violacea*	9	50	4				3			66
Scalloped hammerhead shark *Sphyrna lewini*	1	2								3
Shortfin mako *Isurus oxyrinchus*	9	42	9	2	16	4			8	90
Thresher shark *Alopias* spp		25	4						6	35
Tiger shark *Galeocerdo cuvier*		4								4

5.2.Seabirds

South Africa has been collecting data on seabird interaction with its longline fishery since 1998. South Africa published its NPOA for seabirds in 2008 (NPOA-Seabirds, 2008). The NPOA-Seabirds specifies a maximum mortality rate of 0.05 birds/1000 hooks, and lays out bycatch mitigation measures for use in longline fishing.

South Africa has introduced a number of bird mitigation measures through permit conditions since the start of its fishery, including the compulsory flying of tori-lines, no daylight setting, and the use of thawed bait to improve sink rates, in the tuna fishery. South Africa does not consider the use of line shooters or offal discard management to be useful in reducing seabird incidental mortality. Furthermore, South Africa (with the Albatross Task Force of BirdLife South Africa) developed a management plan in 2008 to reduce seabird by-catch in its longline fishery. This plan includes two seabird bycatch limits per vessel per year. The first limit stipulates that once a vessel reaches 25 birds killed in a year, it must adopt additional mitigation measures; it has to fly a second tori line and it has to place additional weights on to each branchline. If the vessel reaches the second limit of 50 seabird mortalities, the Department will review compliance with mitigation measures before deciding whether to permit further fishing by that vessel.

Table 4i: Summary of amendments to seabird bycatch mitigation measures in South African permit conditions for Foreign-flagged and South African within the South African EEZ.

Mitigation measure	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Foreign-flagged vessels	-	-	-	-			
Night setting only	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bird-scaring line	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Line weighting (achieving 0.3 $m.s^{-1}$)	No	No	No	No	No	No	No
Line weighting (60 g < 2m of hook)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Thawed bait before setting	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reduced lighting	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Offal management	No	No	No	No	No	No	No
25 bird bycatch limit per year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
South African vessels	-	-	-	-	-	-	-
Night setting only	No	No	No	No	No	No	No
Bird-scaring line	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Line weighting (achieving 0.3 $m.s^{-1}$)	No	No	No	No	No	No	No
Line weighting (60 g < 2m of hook)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Thawed bait before setting	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reduced lighting	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Offal management	No	No	No	No	No	No	No
25 bird bycatch limit per year	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Since the implementation of seabird mitigation measures and the stringent monitoring thereof, seabird mortality has been reduced by more than an order of magnitude. For South Africa's entire coastline, the seabird mortality rate has declined from a maximum of 1.85 seabirds/1000 hooks^{-1} in 2011 to 0.38, 0.37 and 0.37 for 2012, 2013 and 2014, respectively. In 2016, seabird mortalities were the lowest achieved to date with only 35 seabird interactions observed (Table 5). This equates to a catch rate of 0.051 seabirds/1000 hooks^{-1}, which is a vast improvement. The absence of an observer programme to monitor the local pelagic longline vessels has made it challenging to obtain reliable and accurate data on all seabird encounters in the fleet. That said, the implementation of mitigation measures remains high priority. All South African vessels, or vessels operating under a bi-lateral agreement with South Africa, are required to employ a combination of bird scaring lines, line weighting and night setting as bird bycatch mitigation measures.

1. How many vessels operated south of 25˚S in the period covered by this report?
   - 100% of vessels operations reported in 2016 were south of 25˚S.

2. How many of those vessels used bird scaring lines (as a proportion of total effort)?
   - 100% of vessels flew tori lines. This is a mandatory regulation in South African waters.

3. How many of those vessels used line weighting (as a proportion of total effort)?
   - 100% of vessels employed line weighting.

4. How many of those vessels used night setting (as a proportion of total effort)?
   - 100% of vessels employed night setting. This is a mandatory regulation in South African waters.

5.3.Marine Turtles

The South African government has worked closely with WWF to educate skippers on release procedures for turtles. Skippers are provided with guidelines/instructions in their permit conditions on how to safely handle and release caught turtles. The use of circle hooks is encouraged as stated in the permit conditions, as well as the release of turtles using a de-hooker. As of 2014, skippers were required to record interactions with turtles, including the fate of the turtle, in the catch statistic logbooks on board the vessel. Although the absence of an observer programme to monitor the local pelagic longline vessels has made it challenging to obtain reliable and accurate data on all turtle encounters in the fleet, there is high awareness among skippers on handling protocols and release mortalities are thought to be low. In 2016, 5 turtle interactions were recorded, all of which were released alive (Table 5).

5.4.Other ecologically related species (e.g. marine mammals, whale sharks)

South Africa encourages vessels to take cognizance of sustainable fishing practices and impacts of tuna longline operations on the ecosystem. A specific concern is the impact of lost "strops" (cords used to hang fish during freezing) during discharge procedures. Marine animals subsequently become entangled in these strops, resulting in mutilation and potential mortality of entangled animals. In order to solve this problem the Permit Holder is to ensure that "strops" used during freezing and discharge do not exceed the stipulated 80 mm stretched length. In 2016, a single interaction with a bottlenose dolphin was recorded (Table 5).

Table 5. Observed annual catch of seabirds, marine turtles and marine mammals in the national pelagic longline fleet from 2010 - 2016 in the IOTC area of competence.

	2010		2011		2012		2013		2014		2015		2016	
	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Seabirds														
Atlantic yellow-nosed albatross *Thalassarche chlororhynchos*			187	42	12	5	8	2	34		14	4	4	2
Black-browed albatross *Thalassarche melanophris*	8		64	62	4	1	10		4	2	4	2		
Grey-headed albatross *Thalassarche chrysostoma*		1		99	4									
Indian yellow-nosed albatross *Thalassarche carteri*	29	1	1950	34	11		80	1	26		14	2		
Shy albatross *Thalassarche cauta*	3	22	350	814	4	7	1	11	1	6	1	1		
Albatross unidentified	3	15	387	465	1		6	4	2	1		1		
Cape gannet *Morus capensis*	12		180		1		5		19		4			
White-chinned petrel *Procellaria aequinoctialis*	4	52	319	8326	9	66	9	131	16	78	6	38	3	25
Petrel unidentified		1	172	2870		1							1	
Cape petrel *Daption capense*			32											
Great skua *Stercorarius skua*			11											
Marine turtles														
Leatherback turtle *Dermochelys coriacea*	3		227		1		1		2		5	1		
Loggerhead turtle *Caretta*	2		202		1				2		5		3	
Green turtle *Chelonia mydas*			32		1		1							
Hawksbill turtle *Eretmochelys imbricata*					1									
Turtle unidentified	3		154				3				2		2	
Marine mammals														
Common dolphin *Delphinus* spp	1													
Dolphin unidentified											1		1	

6. NATIONAL DATA COLLECTION AND PROCESSING SYSTEMS

6.1. Logsheet data collection and verification (including date commenced and status of implementation)

Vessels in the Large Pelagic Longline fishery and Tuna Pole-Line fishery have been required to complete daily logs of catches since 1997 and 1985, respectively. The data are verified by comparing logs of catches with landing declarations that are overseen by South African Fisheries Compliance Officers and Fisheries Monitors. Rights Holders are required to submit these logsheets on a monthly basis.

6.2. Vessel Monitoring System (including date commenced and status of implementation)

The Vessel Monitoring System (VMS) was implemented in 1998 for Large Pelagic Longline vessels and was subsequently followed by the Tuna Pole-Line vessels. All longline and pole-line vessels are required to have a functional VMS system on board that transmits directly to the Department's VMS OPS Room. It is the Permit Holder's responsibility to ensure that the VMS transmits data continuously and uninterruptedly prior to and throughout the duration of the trip.

6.3. Observer programme (including date commenced and status; number of observers, include percentage coverage by gear type)

The observer program was established in 1998, at the start of the experimental phase of the pelagic longline fishery, and a minimum 20% observer coverage was stipulated. The Offshore Resources Observer Programme (OROP) began in March 2002 and to date it still requires 100% observer coverage on foreign-flagged vessels. Up until March 2011, 11- 20% observer coverage was achieved on local vessels per year based on the total effort (number of hooks) deployed. The observer programme contract expired in March 2011. Since then the continuation of the observer coverage has been ensured by introducing measures within the fishing regulations that prescribe a minimum coverage per vessel and an overall coverage by fleet in order to meet the 5% observer coverage as specified by IOTC on the domestic longline vessels, whilst re-establishing the national observer programme by developing the specifications for the tender process. The observer programme for joint-venture (Japanese-flagged) vessels has continued with 100% of fishing trips observed.

There were 4 observers actively observing on the three Japanese foreign-flagged joint-venture vessels in 2016 in the IOTC region, with a combined total of 300 observer days. There are no observers stationed on pole-line vessels; however, increased inspections and sampling of pole-line vessels is conducted during offloading in port by South Africa Fisheries Compliance Officers and Fisheries Monitors.

Table 6. The number of hooks observed (local and foreign-flagged joint-venture vessels) per year from 2010 to 2015 in the IOTC region.

Year	Total number of hooks set on vessels that carried an observer	Percentage hooks observed on vessel that carried an observer	Percentage hooks observed of total hooks set in IOTC region (of which foreign-flagged coverage)
2010	2 297 122		
2011	3 126 357	48.4	29 (100%)
2012	2 615 568	37.5	26 (100%)
2013	2 235 366	43.7	25 (100%)
2014	1 263 727	43.0	30 (100%)
2015	1 037 222	62.5	64 (100%)
2016	680 000	52.9	28 (100%)

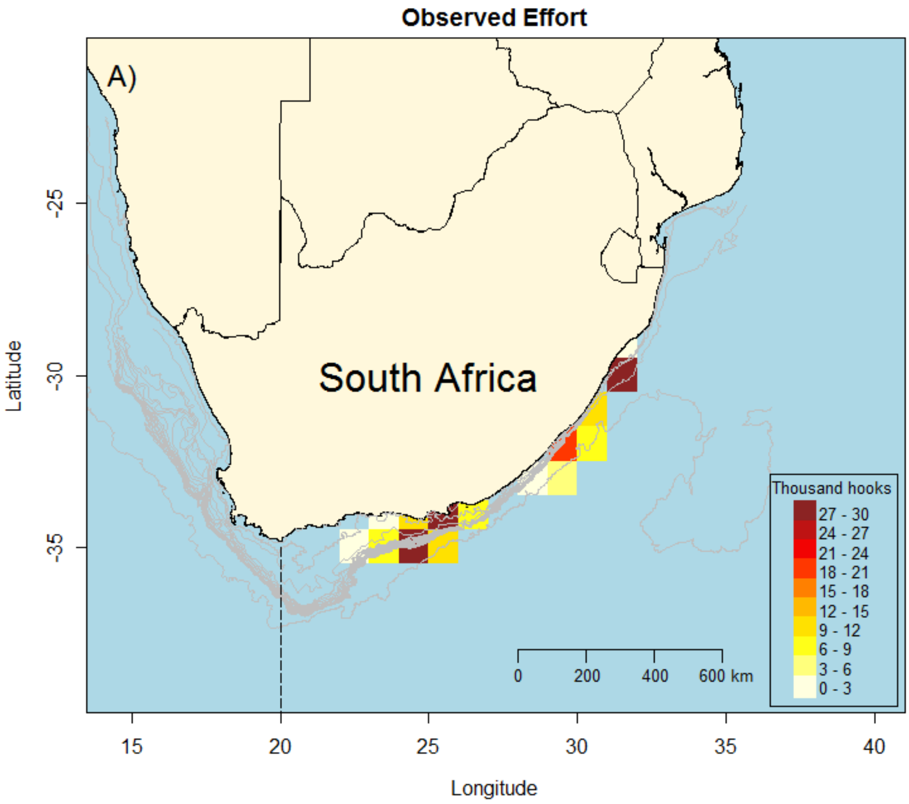

Figure 4. Map showing the spatial distribution of observer effort coverage for the IOTC area of competence in 2016.

The observers collect all operational, catch (retained and discard), effort and length frequency data, and will collect biological material when required. The observers record data on the following forms:

- Form 1: Vessel and trip information sheet (IOTC Form I-GEN)
- Form 2D: Pelagic longline gear and operation information (IOTC Form 2-LL)
- Form 3D: Fishing effort pelagic long-line (IOTC Form 4-LL)
- Form 4: Marine mammal, sea turtle, and seabird incidental take form
- Form 6: Depredation
- Form 7: Fish biological sampling

6.4. Port sampling programme [including date commenced and status of implementation]

Port sampling for tuna, swordfish and related species began in 1973 in the IOTC region.

The collection of albacore length frequency data through port sampling of Pole and Line vessels has been undertaken by employees of the Department of Agriculture, Forestry and Fisheries since 2011. The skippers are encouraged to collect yellowfin tuna length frequency measurements onboard Pole and Line vessels prior to dressing the catch. All length frequency data on the pelagic longline vessels are collected at sea by observers prior to the fish being dressed.

6.4. Unloading/Transhipment [including date commenced and status of implementation]

Unloading or discharging of fish from a longline vessel can only be undertaken in the presence of a monitor or a South African Fisheries Control Officer. Transhipment of fish is not permitted at sea. Transhipments of fish in port requires pre-authorisation. Tuna Pole-Line discharges in port are monitored. These measures have been in place since 1998.

Table 7. Number of individuals measured by observers on pelagic longline vessels in the IOTC area of competence for the period 2012 - 2016.

English name	Scientific name	2012	2013	2014	2015	2016
Albacore	*Thunnus alalunga*	6002	4211	1037	311	324
Atlantic pomfret	*Brama*	15	3	571	45	89
Atlantic sailfish	*Istiophorus albicans*			2		
Bigeye tuna	*Thunnus obesus*	8138	4812	3134	3046	1948
Big-scale pomfret	*Taractichthys longipinnis*	7				
Black marlin	*Makaira indica*	16	15	12	26	19
Blue marlin	*Makaira nigricans*	7	9	6	12	16
Blue shark	*Prionace glauca*	2199	1572	967	1142	514
Brilliant pomfret	*Eumegistus illustris*			1		
Butterfly kingfish	*Gasterochisma melampus*	7				
Common dolphinfish	*Coryphaena hippurus*	101	227	35	83	40
Copper shark	*Carcharhinus brachyurus*			1	4	9
Crocodile shark	*Pseudocarcharias kamoharai*			7	1	
Dorado	*Salminus brasiliensis*				9	
Escolar	*Lepidocybium flavobrunneum*	1978	1547	844	747	353
Indo-Pacific sailfish	*Istiophorus platypterus*	8	7	4	3	
Long snouted lancetfish	*Alepisaurus ferox*			8		
Longfin mako	*Isurus paucus*		4			
Mako sharks	*Isurus* spp	62	6	68		
Moonfish	*Mene maculate*		1			
Ocean sunfish	*Mola*		2	2	2	
Oceanic whitetip shark	*Carcharhinus longimanus*				1	
Oilfish	*Ruvettus pretiosus*	2452	772	545	418	140
Opah	*Lampris guttatus*	231	524	124	51	13
Pelagic stingray	*Dasyatis violacea*				3	
Pomfrets, ocean breams nei	*Bramidae*	1507	1656	127	133	307
Porbeagle	*Lamna nasus*		1	6		
Rudderfish/Black ruff	*Centrolophus niger*	2		15		
Shortbill spearfish	*Tetrapturus angustirostris*	1	8		7	3
Shortfin mako	*Isurus oxyrinchus*	664	625	303	517	368
Silky shark	*Carcharhinus falciformis*			1	7	
Skipjack tuna	*Katsuwonus pelamis*	826	253	113	38	8
Southern bluefin tuna	*Thunnus maccoyii*	411	161	35	66	132
Striped marlin	*Tetrapturus audax*		6	1	2	6
Swordfish	*Xiphias gladius*	672	339	114	239	83
Wahoo	*Acanthocybium solandri*	23	173	18	17	7
Yellowfin tuna	*Thunnus albacares*	12741	12912	7666	8814	1871

7. NATIONAL RESEARCH PROGRAMS

The management boundary that separates the ICCAT from the IOTC region at 20° east divides the South African pelagic marine environment in two approximately equal zones. As such, studies which take place in the ICCAT area of competence have bearing on IOTC stocks and will likely be implemented in the IOTC region in the future, if not already. Given the ecological flexibility of this management boundary, research from the ICCAT area of competence is also listed below.

7.1.Current research projects

7.1.1. Stock Assessment software

South African government scientists (DAFF), in collaboration with CPC scientists from NOAA, are leading the development and implementation of the new, open-source modeling framework JABBA (Just Another Bayesian Biomass Assessment). JABBA is a generalized Bayesian State-Space Surplus Production Model (SPM) and represents the next generation of biomass dynamic modeling. The motivation for developing JABBA was to provide a unified approach to SPM-based assessments that is reproducible, well-documented, and easily implemented for a variety of fisheries. By hosting JABBA in the open-source platform GitHub, the JABBA-Project provides a means for fisheries scientists to share, document, and improve assessment procedures in a standardized manner, greatly reducing time spent constructing redundant models, and democratizing modelling approaches across nations. Hosting such tools in a globally-accessible repository also increases transparency in the assessment workflow; enables rapid, continuous modification of the code not limited to a single developer; and acts as an archive of model improvements over time. JABBA originates from a continuous development process of a Bayesian State-Space SPM software that has been applied and tested that has been applied in the 2017 IOTC Indian Ocean Blue Shark Assessment (Winker 2017), Mediterranean albacore assessment (ICCAT, 2017a; Winker and Parker 2017), the 2017 North and South Atlantic shortfin mako shark assessments (ICCAT, 2017b; Winker et al. 2017a; Winker and Parker 2017a; Winker and Carvalho 2017) and the 2017 ICCAT South Atlantic swordfish assessment (ICCAT, 2017c; Winker and Parker 2017b). Given the positive feedback during the assessments meetings and recommendations to use JABBA for final assessment advice for South Atlantic swordfish and in futures, South Africa encourages full documentation and future research on JABBA. A JABBA manuscript is currently in the process of being finalized to be submitted for publication.

7.1.2. CPUE standardization

In 2016, South Africa has made significant progress in developing standardized CPUE indices by applying a General Additive Mixed Modelling approach for Tuna Pole-Line and longline catch and effort data. For the IOTC region, South African CPCs presented standardized CPUE indices for swordfish (da Silva et al. 2017). In addition, South African CPCs presented standardized CPUE indices in the ICCAT region for albacore (Winker et al. 2017b) and yellowfin tuna (Parker et al. 2017a) from the Tuna Pole-Line fleet as well as swordfish (Parker et al. 2017b), shortfin mako (Winker et al. 2017c) and bigeye tuna (Parker et al. 2017c) from the longline fleet. The suitability of these standardized indices for use in stock assessments were reviewed during the 2017 Albacore Intersessional meeting ICCAT, 2017a), the 2017 Tropical Tuna Intersessional meeting (ICCAT, in press), the 2017 Shortfin Mako Stock Assessment ICCAT, 2017b) and the 2017 Swordfish Stock Assessment (ICCAT, 2017c), respectively. As a result, the South African swordfish CPUE index was used in final South Atlantic swordfish assessment model and the Tuna Pole-Line albacore CPUE index was considered as input for the South Atlantic albacore assessment. Yellowfin tuna and bigeye tuna CPUE indices were not deemed suitable as direct stock assessment inputs due to the small spatial representation of the catch area and high variability, respectively. Similarly, it was suggested that shortfin mako CPUE index should currently not be included in stock assessment models because the majority of available catch and effort records occur in an area that straddles the ICCAT/IOTC 20 degree boundary, which is a known juvenile aggregation area that is associated with high uncertainty regarding regional assignment of this boundary stock. South Africa seeks to further improve the standardization of CPUE indices for the Tuna Pole-Line fleet and tuna/swordfish longline fleet for contribution in future stock assessment sessions of tunas, swordfish and sharks.

7.1.3. Biology and Ecology

The management boundary that separates the ICCAT from the IOTC at 20° East divides the South African pelagic marine environment in two approximately equal zones. Stocks of pelagic species with large ranges and a widespread larval disposal often straddle this boundary, which has implications for South Africa’s research, reporting and assessment regimes. Biologically meaningful stock boundaries need to be investigated and considered for each species. The level of intermixing, the degree of reproductive isolation and a biologically and genetically defined boundary needs to be determined and considered when South African catch data is included in regional stock assessments. Studies that aid in resolving stock boundary issues are encouraged and much welcomed in South Africa.

7.1.3.1. Movement of juvenile shortfin mako sharks (*Isurus oxyrinchus*) and blue sharks (*Prionace glauca*) around the Agulhas Bank shelf edge. This PhD project aims to investigate the horizontal and vertical movement shortfin mako blue sharks around the Agulhas Bank shelf. Furthermore, this project aims to investigate the hypothesis that the Agulhas shelf acts as a nursery ground for shortfin mako sharks. To date 19 shortfin mako and 8 blue sharks have been tagged with PSAT and SPOT tags in collaboration with DAFF, DEA (Department of Environmental affairs) and SWIOFP (South West Indian Fishery Project). One of the key research priorities involves investigating the movement of large pelagic sharks and fish between the Indian and Atlantic Ocean.

7.1.3.2. Albacore has been studied mainly in the North Atlantic and the North Pacific, and little is known about this species in the southern regions and tropics. In the Pacific and Atlantic oceans there is a clear separation of southern and northern stocks associated with the oceanic gyres. The Indian Ocean population, is thought to comprise of a single stock, distributed from 5°N to 45°S, but this link between Indian Ocean and South Atlantic stocks needs to be investigated. In South African waters, mainly juveniles are caught but the links with the adult populations are still not completely understood. South Africa is a collaborator on the GERMON project led by Institut français de recherche pour l'exploitation de la mer (IFREMER) and Institut de recherche pour le développement (IRD) to better understand the stock structure of albacore between the Indian and Atlantic Oceans. Genetic, morphological and biological sampling was concluded in July 2014 and the data are currently in preparation for publication.

7.1.3.3. Genetic stock structure and estimation of abundance of swordfish (*Xiphias gladius*) in South Africa". This study examined the stock structure of swordfish around South Africa and developed the initial CPUE standardization process currently used to estimate indices for swordfish for both IOTC and ICCAT. South Africa straddles two ocean basins, the Indian and Atlantic Ocean and currently the jurisdictions of the IOTC and ICCAT are separated by a management boundary at 20°E. This study examined the origin of SA caught swordfish. Eleven microsatellite loci were included in this study of the fine scale population structure of swordfish caught relatively close inshore. Despite the poor quality of the DNA samples, muscle material of 267 swordfish caught in 2005 around the entire range of South Africa's coastline was utilised. A posterior predictive map of admixture proportions produced a potential admixture zone between 14°E and 27°E. There is evidence of gene flow and migration in this area in both directions, though the evidence for weak differentiation suggests that the Indian Ocean and Atlantic Ocean contain separate stocks and that swordfish stocks coexist around South Africa but return to their ocean of origin to reproduce. Due to passive drift of larvae and active dispersal of adults that have wide environmental parameter limits that extend across this area, swordfish would be prone to admixture and genetic homogenisation. The MSc student has graduated and the research has been concluded.

7.1.3.4. The heavy metal contamination of commercially important large pelagic species (blue shark (*Prionace glauca*), shortfin mako (*Isurus oxyrinchus*) and yellowfin tuna *Thunnus albacares*) has been investigated by a PhD student in the Meat science, Processing & Product Development research team (Department of Animal Sciences) at Stellenbosch University. Levels of Mercury in South African caught mako sharks are a cause for concern as the maximum allowable limit was exceeded in 100% of samples. The findings have been published.

7.1.3.5. "World without borders- genetic population structure of a highly migratory marine predator, the blue shark (*Prionace glauca*)". This study proved insights into the genetic population structure of blue sharks, by sampling the least mobile component of the populations, i.e., the young-of-year and small juveniles (<2 year; *N* = 348 individuals), at three reported nursery areas, namely, western Iberia, Azores, and South Africa. Samples were collected in two different time periods (2002–2008 and 2012– 2015) and were screened at 12 nuclear microsatellites and at a 899-bp fragment of the mitochondrial control region. Results show temporally stable genetic homogeneity among three Atlantic nurseries at both nuclear and mitochondrial markers, sug- gesting basin-wide panmixia. In addition, comparison of mtDNA CR sequences from Atlantic and Indo-Pacific locations also indicated genetic homogeneity and unrestricted female-mediated gene flow between ocean basins. These results are discussed in light of the species' life history and ecology, but suggest that blue shark populations may be connected by gene flow at the global scale. The implications of the present findings to the management of this important fisheries resource are also discussed. The findings have been published.

7.1.3.6. The Department, with the assistance of NGOs (e.g. Birdlife SA), assesses the impact of longline fisheries on seabirds, turtles and sharks and to investigate various mitigation and management measures. A National Plan of Action for seabirds (NPOA-seabirds) was published in 2008, which aimed to reduce seabird mortalities below 0.05 seabirds.1000 hooks-1. Good collaboration with the fishing industry, researchers and managers, continual refining of mitigation measures, the implementation of stringent management measures through permit conditions, and close monitoring through the observer programme has resulted in decreased seabird mortalities and the mortality rate in 2012 was less than 0.05 seabirds per thousand hooks, reaching the goal identified in NPOA-seabirds.

7.1.3.7. Distribution patterns and population structure of the blue shark (*Prionace glauca*) in the Atlantic and Indian Oceans." The blue shark (*Prionace glauca*) is the most frequently captured shark in pelagic oceanic fisheries, especially pelagic longlines targeting swordfish and/or tunas. As part of cooperative scientific efforts for fisheries and biological data collection, information from fishery observers, scientific projects and surveys, and from recreational fisheries from several nations in the Atlantic and Indian Oceans was compiled. Data sets included information on location, size and sex, in a total of 478,220 blue shark records collected between 1966 and 2014. Sizes ranged from 36 to 394 cm fork length. Considerable variability was observed in the size distribution by region and season in both oceans. Larger blue sharks tend to occur in equatorial and tropical regions, and smaller specimens in higher latitudes in temperate waters. Differences in sex ratios were also detected spatially and seasonally. Nursery areas in the Atlantic seem to occur in the temperate south-east off South Africa and Namibia, in the south-west off southern Brazil and Uruguay, and in the north-east off the Iberian Peninsula and the Azores. Parturition may occur in the tropical north-east off West Africa. In the Indian Ocean, nursery areas also seem to occur in temperate waters, especially in the south-west Indian Ocean off South Africa, and in the south-east off south-western Australia. The distributional patterns presented in this study provide a better understanding of how blue sharks segregate by size and sex, spatially and temporally, and improve the scientific advice to help adopt more informed and efficient management and conservation measures for this cosmopolitan species. This project was a global initiative and was conducted by several CPCs with data and input provided by SA. This project was published.

7.2.Previous research projects

7.2.1. South Africa's involvement in the South West Indian Ocean Fisheries Programme (SWIOFP) through Component 4: Assessment and sustainable utilization of large pelagic resources has provided momentum to our research programme. The primary focus is to understand the distribution and movement of swordfish, bigeye and yellowfin tuna within the SWIO region, to which end 15 pop-up satellite archival tags (PSATs) were provided for deployment on swordfish, yellowfin and bigeye tunas as well as hook monitors and time depth recorders for deployment of an instrumented longline.

7.2.2. The Department's national research cruise in 2011 was a momentous achievement during which 11 swordfish were successfully PSAT tagged in the South West Indian Ocean (SWIO) region with SWIOFP tags. Swordfish have proven to be very sensitive to handling and South Africa is the first country to achieve PSAT tagging of swordfish in this region. Tags have been programmed for either 90 or 180 days. Of the 11 tags, 4 remained on the swordfish for more than 2 months. The results of this study were presented at the IOTC Working Party for Billfish in 2012 (Document number IOTC-2012-WPB10-16). South Africa aims to conduct further research on the movement of large pelagic species between the Indian and Atlantic Oceans by placing more satellite (PSAT and SPOT) tags on animals. Coupled with movement data, genetic studies on the differences between swordfish from the two Ocean basins are currently being explored. There are no formal scientific programmes for billfish in South Africa (*Rec 06-09*).

7.2.3. South Africa has collected instrumented longline data (Time Depth Recorders and Hook Timers) from 29 sets (of between 259 – 300 hooks per set) obtained on the dedicated research cruises on the Ellen Khuzwayo research vessel, though more data is required for analysis for a target and bycatch study.

7.2.4. Two bigeye tuna (*Thunnus obesus*) and one southern bluefin tuna (*Thunnus maccoyii*) were successfully PSAT tagged on research cruise on the RV Ellen Khuzwayo in August 2015. These fish were tagged at 36S, 19E with tags setup to pop off after 90 (2 tags) and 180 days (1 tag). Data from these tags will reveal horizontal movement patterns between the Atlantic and Indian Oceans. Additional sampling is subject to the availability of funding.

7.2.5. Aspects of the biology and fishery of the blue shark (*Prionace glauca*) in South African waters". This project examined the blue shark fishery in South Africa as well as examining aspects of their biology. Spatio-temporal analyses on nominal CPUE, as well as a standardised CPUE series revealed seasonality in blue shark abundance with a high abundance during summer and autumn off the west coast of South Africa. Annual standardised CPUE revealed that blue shark abundance has remained relatively stable from 1998 to 2008, contradictory to previous findings. The findings from this study suggested that the blue sharks from South Africa are not being overfished, corroborating the findings of the 2008 ICCAT stock assessment. This study resulted in an MSc thesis, publication and IOTC document.

7.2.6. "The current status and management of South Africa's chondrichthyan fisheries". The impact of all South African fisheries on chondrichthyans was investigated. In South Africa's diverse fishery sectors, which include artisanal as well as highly industrialised fisheries, 99 (49%) of 204 chondrichthyan species that occur in southern Africa are targeted regularly or taken as bycatch. A total reported dressed catch for 2010, 2011 and 2012 was estimated to be 3 375 t, 3 241 t and 2 527 t, respectively. Two thirds of reported catch were bycatch. Regulations aimed at limiting chondrichthyan catches, coupled with species-specific permit conditions, currently exist in the following fisheries: demersal shark longline, pelagic longline, recreational line and beach-seine and gillnet. Limited management measures are currently in place for chondrichthyans captured in other South African fisheries. This research has been published.

7.2.7. "First documented southern transatlantic migration of a blue shark *Prionace glauca* tagged off South Africa". This project aimed to describe the first documented recapture of a South African-tagged juvenile blue shark off Uruguay lending weight to the hypothesis of a single blue shark population in the South Atlantic. Furthermore, this project aimed to identify a nursery area off Cape Town. The presence of neonate blue sharks with umbilical scars and females with post-parturition scars, as well as the high frequency of small juveniles in research longline catches, confirm the existence of a parturition and nursery area off South Africa. The final positions of three tagged sharks suggest that large-scale movement patterns in the South Atlantic are a mirror image of movements in the North Atlantic, with sharks using the north-westerly Benguela Drift to migrate into the tropics and ultimately across into South American waters. The confirmed existence of a parturition and nursery area off the south coast of South Africa and the movement of sharks into both adjacent ocean basins suggest that the southern African blue sharks are part of a single stock that straddles the South Atlantic and Indian oceans, and possibly the entire Southern Hemisphere. This project was published.

8. Implementation of Scientific Committee Recommendations and Resolutions of the IOTC relevant to the SC.

Table 9. Scientific requirements contained in Resolutions of the Commission, adopted between 2005 and 2016.

No.	Resolution	Scientific requirement	CPC progress
16/01	On an Interim Plan for Rebuilding the Indian Ocean Yellowfin tuna Stock in the IOTC area of competence	Paragraphs 1-9	South Africa does not allow the use of purse seine vessels gillnets or supply vessels to target Large Pelagics in its EEZ. Furthermore, longline catches of Yellowfin reported for 2014 were, and remain far below 5000 MT as of 2017.
15/03	On the vessel monitoring system (VMS) programme	Paragraphs 1-8	All longline and Tuna Pole-Line vessels shall be fitted with a functional vessel monitoring system (VMS). The permit holder shall ensure the VMS is fully functional and continues to transmit to the Department's Operations room. Whilst at sea, the VMS shall report without interruption.
15/01	On the recording of catch and effort by fishing vessels in the IOTC area of competence	Paragraphs 1–10	All longline and Tuna Pole-Line vessels are required to complete a logbook of catch and effort and submit this on a monthly basis to the Department.
15/02	Mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs)	Paragraphs 1–7	South Africa submits nominal catch data and catch and effort data for surface and longline fisheries. Size data are collected through the observer program and port sampling. Fleet characteristics are submitted annually.
15/05	On conservation measures for striped marlin, black marlin and blue marlin	Paragraph 4	Marlin species (striped, blue and black) are caught in minimal quantities and are considered secondary species. Marlins less than 120 cm LJFL may not be retained. No discarding of dead marlins is permitted.
13/04	On the conservation of cetaceans	Paragraphs 7-9	There have been minimal encounters (i.e. incidental captures) with cetaceans by the longline vessels. South Africa will endeavour to have all skippers and onboard observers collect data on all encounters with cetaceans.
13/05	On the conservation of whale sharks (*Rhincodon typus*)	Paragraphs 7-9	There have been no recorded encounters (i.e. incidental captures) with whale sharks by the longline vessels. South Africa will endeavour to have all skippers and onboard observers collect data on all encounters with whale sharks.
13/06	On a scientific and management framework on the conservation of shark species caught in association with IOTC managed fisheries	Paragraphs 5-6	South Africa's NPOA-Sharks (2013) has grouped issues facing each fishery into clusters with proposed actions, responsibilities, priorities and timeframes (Pg 19-30 of the NPOA-Sharks, 2013)
12/09	On the conservation of thresher sharks caught in association with fisheries in the IOTC area of competence	Paragraphs 4-8	Thresher sharks are not permitted to be retained.
12/06	On reducing the incidental bycatch of seabirds in longline fisheries.	Paragraphs 3-7	The start and completion of line setting has to be conducted at night, defined by the period between nautical dusk and nautical dawn.

No.	Resolution	Scientific requirement	CPC progress
			Vessels have to fly a bird-scaring line (tori line) during the setting of each longline. • Instruction on the method of tori line construction and deployment is provided to each vessel to ensure that correct specifications and procedures are followed. Deck lighting is to be kept to a minimum. The beams of deck lights have to be directed towards the deck. All bait has to be appropriately thawed, and where necessary, the swim bladder punctured to ensure rapid sinking of the bait. All birds caught have to be brought onboard and, with the use of the release instructions provided, live birds are to be released. • The release instructions clearly outline the procedures to follow to ensure that a seabird has a good chance of survival after release. The NPOA-Seabirds was gazetted in 2008. The NPOA-SEABIRDS (2008) specifies a maximum bycatch rate of 0.05 birds/1000 hooks. Within this plan an initial seabird bycatch limit of 25 birds killed per year is set per vessel. Once the vessel reaches this limit then: • a second tori line has to be flown and, • branch lines (snoods) have to be weighted by placing 60 g weights within 2 m of the hook to ensure optimal sinking rates. Where multiple weights are used then the first weight should be within 2 m of the hook and the last weight within 3 m of the hook. If a vessel reaches 50 birds killed in a year then the vessel has to stop fishing immediately. If the vessel has complied with all mitigation measures 100% of the time then it will be allowed to fish on condition that a trained onboard observer has to be present to investigate the nature of the high seabird mortality and that instructions given by the observer will be followed.
12/04	On the conservation of marine turtles	Paragraphs 3,4,6-10	The use of circle hooks is encouraged as stated in the permit conditions. The South African government has worked closely with WWF to educate skippers on release procedures for turtles. According to the handling and release instructions provided to vessels in their permit conditions, vessels are required, amongst others, to:

No.	Resolution	Scientific requirement	CPC progress
			• Remove the hook using a long-handled de-hooker on turtles too large to bring onboard and a de-hooker on turtles brought onboard. • Use a line-cutter when a de-hooker is not possible and to cut the line as close to the hook as possible. • Use net to bring the turtle onboard and to avoid pulling on the line. • Handle the turtle with gentle care. Release the turtle headfirst and away from fishing gear once it has recovered onboard. Trained observers are present on all foreign-flagged longline vessels and they record all interactions with marine turtles during the fishing operation. Since 2013, all vessels have been required to record interactions with marine turtles in their logbooks, and each vessel has been given a species guide to aid identification of turtles to species level.
11/04	On a regional observer scheme	Paragraph 9	100% observer coverage is achieved on foreign flagged vessels. The observer programme for domestic vessels expired in 2011 and the Department is currently in the process of re-establishing the programme which would require at least 5% coverage of domestic longline (at-sea observer coverage) and Tuna Pole-Line (port observer coverage) fishing trips. It is envisaged that by March 2018, the observer programme will be in place.
05/05	Concerning the conservation of sharks caught in association with fisheries managed by IOTC	Paragraphs 1-12	South Africa has provided all its historic shark data to IOTC. The fins and trunks of all sharks caught must remain attached to the trunk naturally. A precautionary upper catch limit (PUCL) for sharks is set at 2000 t dressed weight for the entire South African longline fishery. Furthermore, the use of wire traces has been banned from the Large Pelagic Longline fishery as of 2017. Joint venture vessels are restricted to a 10% shark by-catch limit. Thresher sharks belonging to the genus *Alopias*, hammerhead sharks (belonging to genus *Sphyrna*), oceanic whitetip and silky sharks shall not be retained on board the vessel.

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