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Government of the Republic of Maldives
Ministry of Fisheries and Agriculture
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MALDIVES NATIONAL REPORT
SUBMITTED TO THE

INDIAN OCEAN TUNA COMMISSION
SCIENTIFIC COMMITTEE - 2018

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Maldives National Report to the Scientific Committee of the Indian Ocean Tuna Commission, 2018

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INFORMATION ON FISHERIES, RESEARCH AND STATISTICS

In accordance with IOTC Resolution 10/02, 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 2013 final data for the 2012 calendar year must be provided to the Secretariat by 30 June 2013)	NO 15/09/2018
In accordance with IOTC Resolution 10/02, 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 2013, preliminary data for the 2012 calendar year was provided to the Secretariat by 30 June 2013). 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 2013, final data for the 2012 calendar year must be provided to the Secretariat by 30 December 2013).	NO 15/09/2018
If no, please indicate the reason(s) and intended actions: *The data was submitted past the deadline on 15 September 2018. The delay was in part due to technical errors encountered in our Fishery Information System Database. The same was communicated to the Secretariat.*	

Summary

The Maldives tuna fishery comprises of four main components; pole-and-line, handline, longline and troll line. In terms of total landings, livebait pole-and-line is still the most important gear for tunas. The main target species is skipjack tuna (*Katsuwonus pelamis*) and yellowfin tuna (*Thunnus albacares*), but small amounts of juvenile bigeye tuna (*Thunnus obesus*), (about 5-10%) is caught along with yellowfin tuna. Handline fishery is a relatively new gear, which targets large yellowfin tuna (> 70 cm FL) from the surface (<10m). Following termination of joint venture licencing in 2010, a fully Maldivian-flagged longline fishery is now established. Troll fishery is minor and used to target mainly neritic species of kawakawa (*Euthynnus affinis*) and frigate tuna (*Auxis thazard*), but occasionally also caught skipjack and yellowfin tuna.

The pole-and-line and handline fleets operate within about 100 miles although historically, the fleet operated closer, and returned to the home island daily. The foreign licensed longline fleet (1985-2010) operated in the outer waters of the EEZ, beyond 75 miles. With the Longline Regulation, the fishery was limited to 100 miles and beyond and into the high seas. The trolling fleet, still operates in the coastal areas and mostly within the atolls.

Maldives reported a total of 139,000 t of tunas in 2017, comprising of skipjack, yellowfin, bigeye, frigate and kawakawa. Pole-and-line fishery landed 99% of skipjack tuna in 2017 (almost 88,600 t), and was the second most important gear for yellowfin tunas, landing 35% of all yellowfin tuna caught (17,500 t) in 2017. Handline gear almost exclusively lands yellowfin tuna (30,562 t in 2017) which represented 98% of all species landed by the gear. Longline catch of tunas increased by 66% from 2016, landing 1,961 t comprising of 1,269 t of yellowfin tuna and 691 t of bigeye tuna.

Catches of skipjack registered an increase in 2017 relative to 2016. Recent catches have been of the order of 68,000 – 88,000 t, still much less than the catch recorded in 2006. Caches of yellowfin are increasing, due to the growing handline fishery although 2017 reported a slight drop in catch. No specialized vessel is required for handline fishing hence many pole-and-line vessels now carry both sets of gears and switch target fishery and gear depending on fishing opportunities.

Maldives pole-and-line and handline tuna fishery have minimal impact on the ecosystem. Catch and interactions with Endangered, Threatened and Protected (ETP) species and other species of ecological importance is virtually non-existent. Sharks bycatch and turtles are reported from the longline fishery, which has strict measures to report and release those that are caught. In addition, measures to mitigate bird entanglement in the longline gear are mandated by law. Logbooks for all the tuna fisheries have provisions to report catch and interactions of non-targeted and ETP species. Marine Research Centre currently conducts scientific observations of fishing trips that allow verification of logbook reported data.

The national data collection was based on complete enumeration system, which is now replaced by a modern logbook data collection system. The logbooks, introduced in 2010 was revised and now has provisions to record catch and effort, catch of bycatch and non-target as well as Endangered, Threatened and Protected species, and also catch and effort data for bait fishery. Introduction of the logbooks was a significant improvement to accommodate the changing fishing patterns and data requirements. A web-enabled database is now online and allows compilation and processing of catch and effort data. The database is also used to record tuna purchases by the exporters and also help maintain records of active fishing vessel and fishing licenses. Vessel monitoring system covers 100% of the longline vessels and trips and a number of PL and HL vessels. In addition, the observer data collected from pole-and-line and handline fisheries enable verification of fishermen reported data.

A number of donor and local funded programs are being implemented to improve fishery and biological data collection, monitoring and management of the fisheries. The programs are geared towards improving national reporting and compliance to IOTC Conservation and Management Measures and towards understanding and minimising impacts of fisheries on the ecosystem.

1. Background and General Fishery Information

Maldives is a tuna fishing nation with a long tradition dating back hundreds of years. Until the 1980s the tuna fishery was the mainstay of the Maldivian economy, providing employment and a source of protein for its inhabitants. Tuna remains the single most important export commodity from the Maldives earning about 160 million US$ a year. Although spectacular growth and expansion of tourism in the country has declined fisheries' economic importance, tuna fishing continues to be the main economic activity in the outer islands. The fishery sector currently contributed around 2-3% to GDP in recent years.

The most important component of the Maldivian tuna fishery is the livebait pole-and-line fishery. The fishery exploits, in the order of importance, skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), frigate tuna (*Auxis thazard*) and kawakawa (*Euthynnus affinis*). Small amounts of juvenile bigeye tuna (5-10%), are also caught along with yellowfin tuna. Prior to 2013, bigeye tuna was not recorded separately in the catches and so have been estimated from the *Thunnus* catches. Fishing trips, which used to be only single day, have mostly become multi-day operations, especially during times of poor bait and tuna fishing. While the majority of trips are restricted to coastal areas, within about 100 miles from shore, modern vessels have the capacity to venture even further. Fishing effort is thought to be highest around the anchored fish aggregating devices (aFADs) located 12-15 miles range from the coast.

The second most important component of the tuna fishery is the multi-day handline fishery, targeting large yellowfin tuna (>70 cm FL) from the surface (<10m deep) (Adam and Jauharee, 2009, Adam et al., 2015, Ahusan et al., 2016). Handline fishing does not require modifying of the pole-and-line vessel except for addition of handline gear and having facilities for fresh-storage of catch. Ease of conducting the fishery off pole-and-line vessels, the ready availability of ice and the high market price has boosted expansion of the fishery. It is suspected that the growth and expansion of the handline yellowfin tuna fishery is the reason for the recent decline in pole-and-line effort.

Longline fishery has been a minor component in the Maldives tuna fisheries. Maldives used to have a licensed foreign longline fleet operating in the outer EEZ (75 miles and beyond) since 1985 (Anderson, Hafiz and Adam, 1996). During the height of the fishery some 30-40 vessels operated in the Maldivian waters. Reporting and monitoring of the foreign longline fishery was sub-optimal. Due to pressure from the pole-and-line and handline fishermen, licensing for foreign vessels was ended in mid-2010. The Government of Maldives resumed licensing fully local longline vessels and businesses to fish from 75 miles from shore, within the Maldives EEZ, in 2011. The Longline Fishery Regulation (No. 2014/R-388) allowed vessels to target yellowfin and bigeye tuna from 100 miles and beyond and regulated the fishery with a total allowable catch (TAC) based on the fleet development plan submitted to IOTC, a quota system to distribute the TAC, mandatory VMS and logbook reporting of catch and effort.

The troll fishery is the smallest component of the tuna fisheries and targets neritic species of kawakawa and frigate tuna. Importance of the fleet, which landed substantial proportions of the species in the past, significantly declined due to mechanization of the fishing fleet during 1970s and 80s. Trolling activity peaked during the period of transition during the mechanization of the pole and line fleet (1975-1982) (Anderson et al., 1996). More recently, troll activity seems to have picked up due to the wide availability of small crafts, popularity of recreational fishing and availability of markets for the catch. However, it is thought that these operations mostly target non-tuna species such as sailfish (*Istiophorus platypterus*), wahoo (*Acanthocybium solandri*) and other large species.

2. Fleet structure

The fishing fleet has undergone several changes following the mechanization beginning in 1974. The current fleet is a mix wooden hulled and fibre reinforced plastic (FRP) vessels. Vessels are characterized by having long and open-deck at the stern with a high-rise super structure forward of the vessel. Historically, Maldives tuna vessels were gear specific. Pole-and-line fishery was conducted off mechanized tuna vessels (*masdhoni*) while troll fishing was conducted from smaller versions of the pole-and-line tuna vessels, locally called a *vadhu dhoni*. With the introduction of the handline yellowfin tuna fishery in the 1990s, pole-and-line vessels accommodated handline fishery with minor modifications to the vessel and minimal extra costs. Most of the tuna vessels today may switch from pole-and-line to handline or vice versa depending on the catch.

Longline fleet used to be foreign-owned and operated in the outer waters of the Maldives EEZ, beyond 75 miles since 1985 (Anderson, Hafiz and Adam, 1996). Although mandatory catch reporting was provided for in the license agreement, there was poor reporting rates and access to the data proved to be difficult (Adam, 2007). During the height of the fishery some 30-40 vessels operated in the Maldivian waters. In May 2010, the Government of Maldives ceased foreign licensing to allow for a fully local longline fishery.

The Ministry of Fisheries and Agriculture resumed licensing local longline vessels in 2011 to operate from 75 miles from shore. Nineteen Maldivian-owned longline fishing vessels were licensed in the first year. However, these vessels did not start operation until May 2012. The Longline Fishery Regulation (No. 2014/R-388) was enacted in 2014, to allow locally owned vessels and businesses to fish from 100 miles from the archipelagic baseline, targeting yellowfin and bigeye tuna. The fishery is regulated in a way consistent with the fleet development submitted by the Maldives. A total allowable catch is set for every year broken down into equal number of 20 t quota blocks offered at or above a baseline fee. VMS and logbook reporting of catch and effort data is made mandatory under MCS programme jointly being implemented by Coast Guard and Maldives Customs. In 2017, 44 longline vessels were licensed to operate (Table 1).

Table 1: Number of vessels operating in Maldives EEZ and on high seas, flagged to Maldives (2012-2017).

Year	Vessel type	Length Range (LoA, meters)							
		< 07.5	> 07.5 < 12.5	> 12.5 < 17.5	> 17.5 < 22.5	> 22.5 < 27.5	> 27.5 < 32.5	> 32.5 < 37.5	> 37.5
2013	Engine row boat	4	--	--	--	--	--	--	--
2013	Longline vessel	--	1	5	2	--	--	--	7
2013	Mechanized masdhoni	--	23	117	141	224	68	11	--
2013	Mechanized vadhu dhoani	1	6	--	--	--	--	--	--
2014	Engine row boat	2	2	1	1	1	3	--	--
2014	Longline vessel	7	34	10	9	2	--	--	9
2014	Mechanized masdhoni	--	--	132	163	277	94	12	--
2014	Mechanized vadhu dhoani	1	2	1	2	--	--	--	--
2015	Mechanized masdhoni	11	50	161	182	302	108	14	1
2015	Longline vessels	-	-	9	17	2	-	-	-
2016	Mechanized masdhoni	9	43	116	155	273	93	16	-
2016	Longline vessel	-	-	14	21	3	-	-	4
2017	Mechanized masdhoni	-	66	140	170	320	104	17	1
2017	Longline vessel	-	1	13	23	3	-	-	4

3. Catch and effort (by species and gear)

Total tuna catches reached an all-time high of over 167,000 t in 2006 (Figures 1a and 1b). This was followed by a 53% decline in catch until 2010. Total tuna catches have since been recovering with 2017 recording a 37% increase from 2010. Catches of skipjack and yellowfin tuna in the recent five years

(2013-2017) have increased steadily by 19% and 8% respectively. In contrast, nominal catches of frigate and kawakawa declined by 39% and 84% respectively.

Reported national tuna landings in 2017 were around 139,000 t. Of these close to 64% was skipjack tuna and 35% was yellowfin tuna. The remaining 1% constituted bigeye tuna, frigate and kawakawa. Historically juvenile bigeye tuna caught in pole-and-line fishery was estimated, in part due to the low numbers in the *Thunnus* catches (YFT+BET). Earlier estimates by Anderson, 1996 showed the bigeye component to be between 3-4% while more recent analysis of tag release data has shown that the estimates of bigeye tuna caught in the pole-and-line fishery may be 3 times more, particularly in the south (Adam et al., 2014).

Pole and line tuna fishery landed nearly all of skipjack tuna in 2017 (88,600 t), representing 99% of all skipjack tuna landed. Yellowfin tuna is the second most important species in the tuna fishery. Catches have increased dramatically over the years, thanks to rapid growth of the handline yellowfin fishery that targets surface dwelling schools of the large yellowfin (> 100 cm FL) (Ahusan et al. 2016). Catches of yellowfin tuna were close to 50,000 t in 2017, slightly less than the previous year. Close to 62% of the yellowfin catch was from the handline fishery. Both pole-and-line and handline fisheries operate quite close to the atolls, although there is a difference in the predominant fishing regions of the two fisheries. Most of the pole-and-line catch is taken from the south of the country while the handline catch is mainly taken from the north and central atolls.

The small-scale trolling fleet targets kawakawa (*Euthynnus affinis*) and frigate tuna (*Auxis thazard*) in the coastal areas and atoll lagoons. The main trolling fleet effectively died in the late 1980s due to improved socio-economic changes. These days catch of kawakawa and frigate is mainly from pole-and-line vessels (Ahusan and Adam, 2011a and b, Ahusan 2016). Combined average catch of both species was 502 t in 2017 by all gears.

Longline fleet used to be foreign-owned and operated in the EEZ, beyond 75 miles under licensed and joint venture arrangements. Licensing scheme for foreign vessels was scrapped in March 2010. However, in 2011 Maldives re-started a longline fishery exclusively for Maldivian-owned vessels. In 2017, 44 vessels were given licenses for longline operations.

Except or longline fishery, effort is measured in number of fishing days. This was the most natural and easiest since fishing takes place on day-trips leaving early in the morning and returning by evening. In the past, the uniform fleet structure and use of essentially pole-and-line method for most of the tuna catches makes the choice for unit of effort satisfactory. However, with increasing efficiency of vessels (size, engine horse power, fish hold and bait capacity, and other operational factors) the day of fishing should be standardized to use the CPUE data (Kolody and Adam., 2011; Sharma et al. 2014, Medley et al. 2018). Total recorded days of fishing have been declining largely due to changes in structure and operational aspects of the fleet. Reduction in pole-and-line effort has been the most prominent due to a combination of factors; increase in vessels size, decline in catch and shift towards handline fishery. Handline effort has been relatively stable in the recent years.

Catch and effort by gear and species for the recent five years is presented in Table2. Maps of catch by species and effort from different gears for 2017 is presented in Figures 2a, 2b, 2c and 2d. Maps of catch by species and effort from different gears (average for 2013-2017) is presented in Figures 3a, 3b, 3c and 3d.

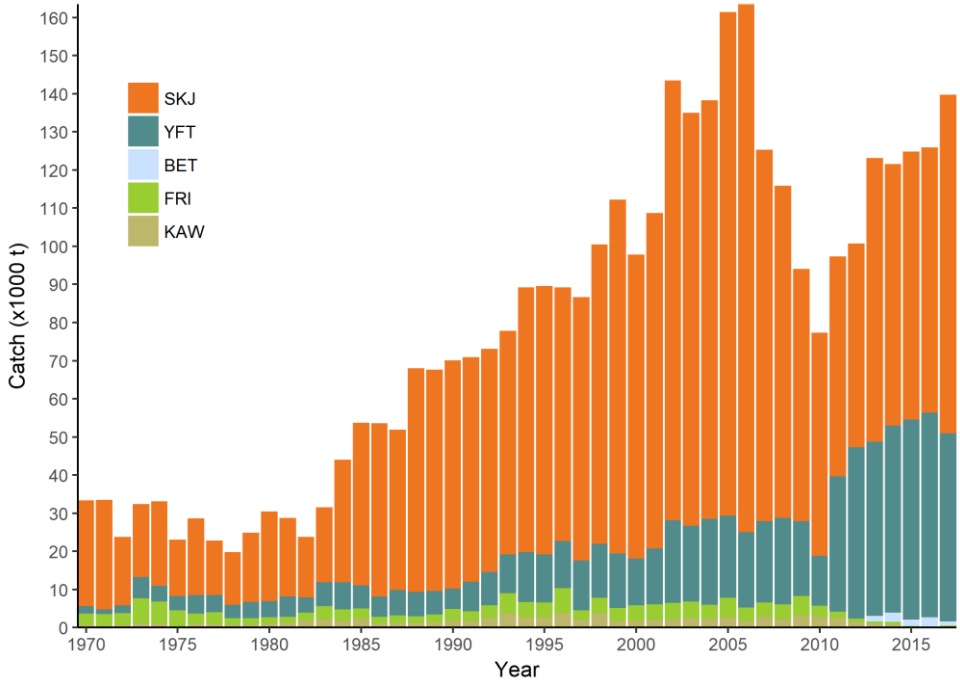


Figure 1a: Historical tuna catch for the national fleet by species (1970-2017). Note that bigeye tuna began to be recorded separately in 2013.

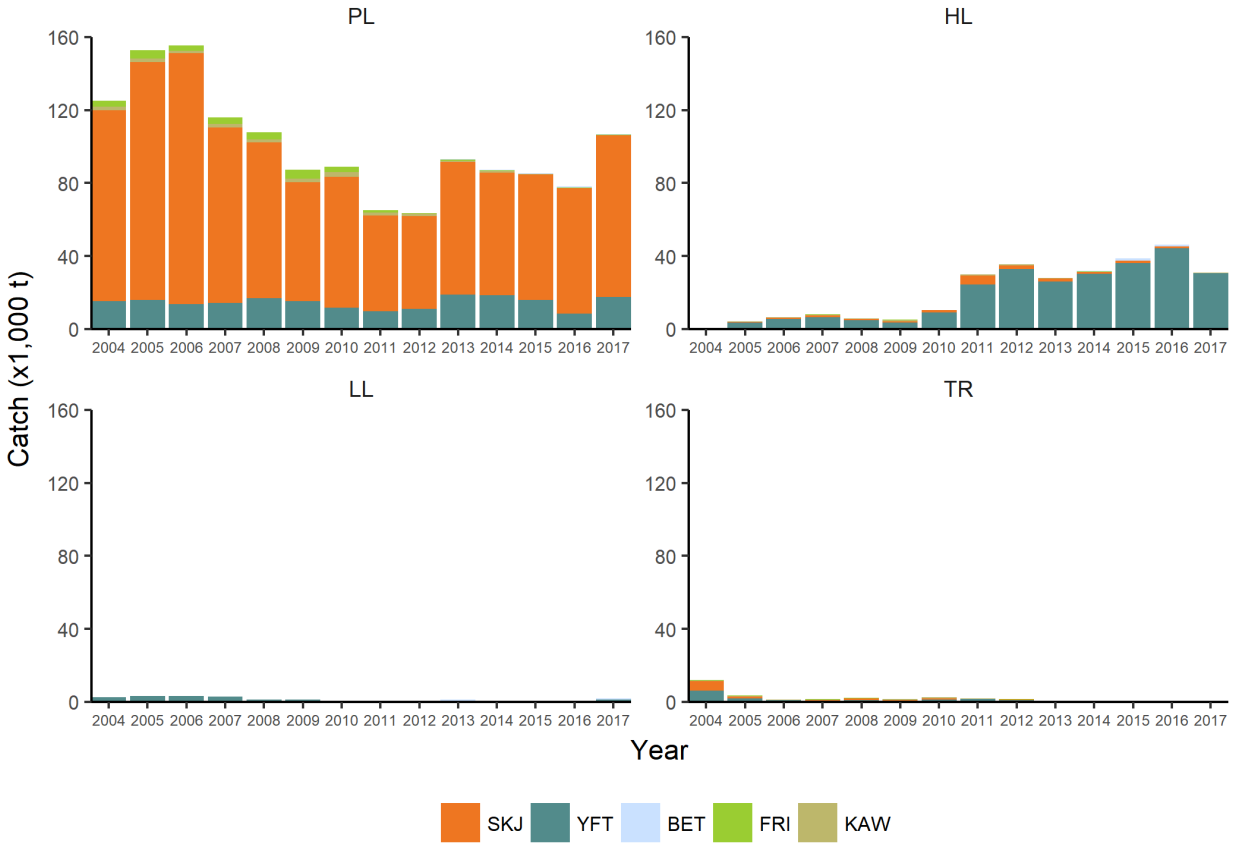


Figure 2b: Catch for the national fleet by gear (2004-2017). Note that bigeye tuna began to be recorded separately in 2013.

Table 2. Annual catch (t) and effort by gear (days fished) of the fishing fleet. for the period, 2011-2017.

Year	Gear	Effort (days)	SKJ (t)	YFT (t)	BET (t)	KAW (t)	FRI (t)
2013	PL	63,247	72,583	18,878	344	760	478
	HL	43,196	1,584	26,085	116	179	70
	LL	1,501	0	239	1059	0	0
	TR	12,300	255	387	0	66	18
2014	PL	36,144	67,301	18,481	304	741	578
	HL	24,860	1,015	30,246	525	103	50
	LL	na	0	183	0	0	0
	TR	4,778	181	181	3	45	22
2015	PL	22,877	68,965	15,796	184	180	96
	HL	24,045	1,057	36,299	1,433	19	8
	LL	na	0	89	122	0	0
	TR	1,960	252	231	2	23	14
2016	PL	29,061	68,711	8,550	781	26	124
	HL	31,291	866	44,384	1,066	2	16
	LL	na	1	286	361	0	0
	TR	929	9	44	9	2	4
2017	PL	25,042	88,617	17,500	269	142	334
	HL	24,321	198	30,562	113	9	1
	LL	na	1	1,269	691	0	0
	TR	199	9	28	0.3	8	8

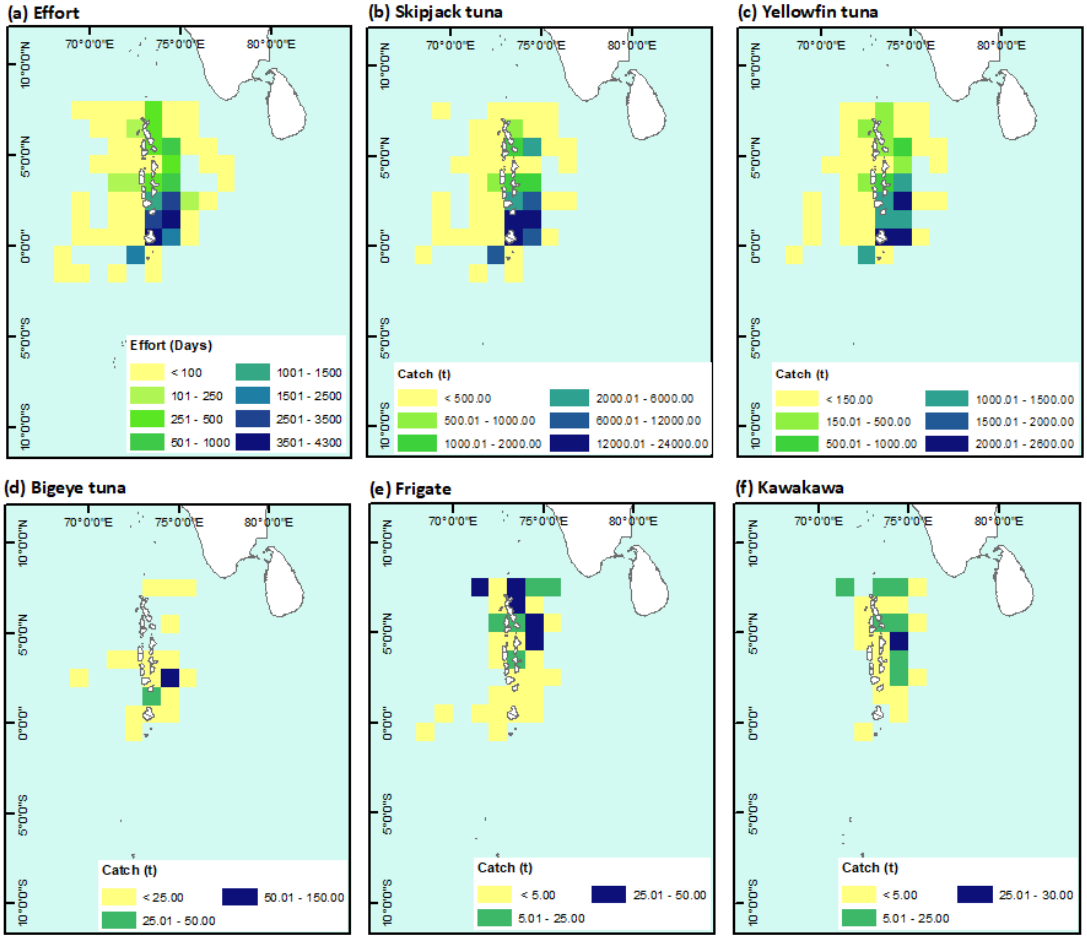


Figure 2a. Map of distribution of fishing effort and catch by species for pole and line gear for 2017.

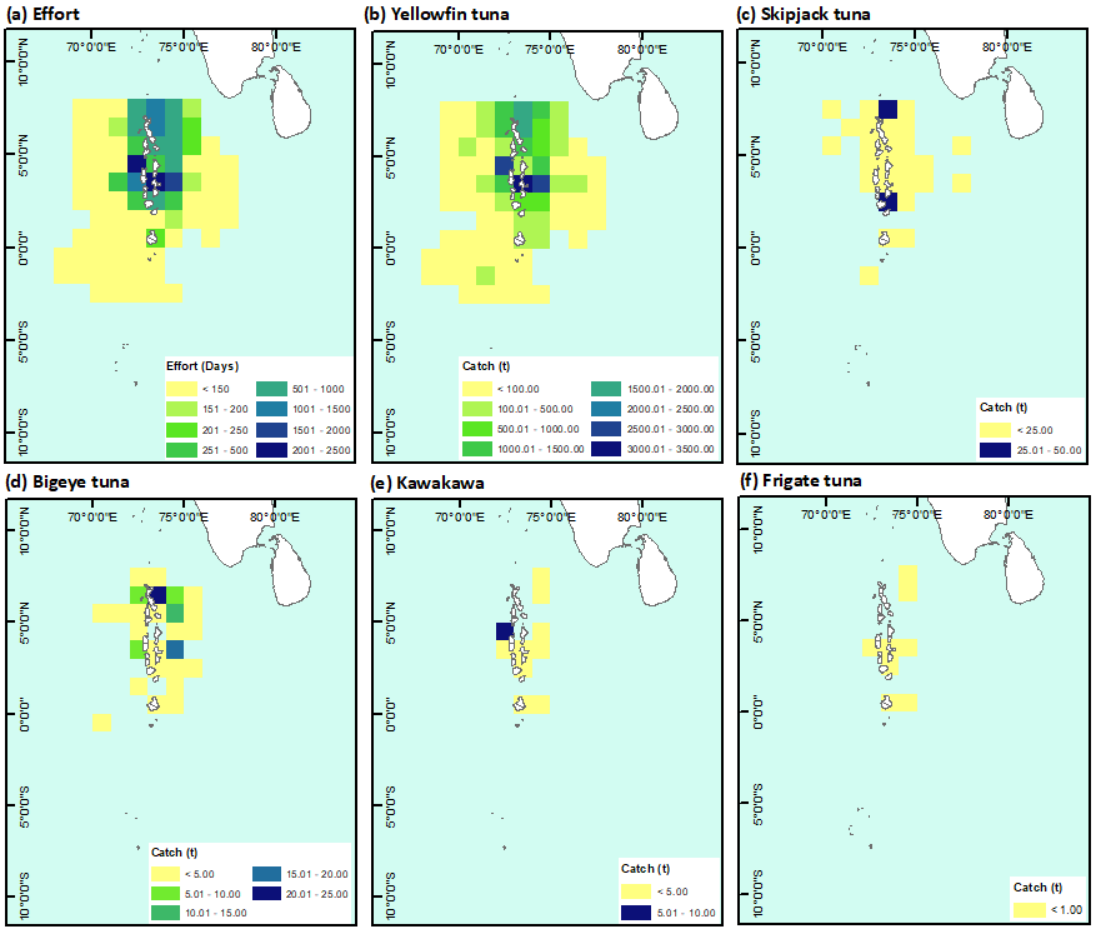
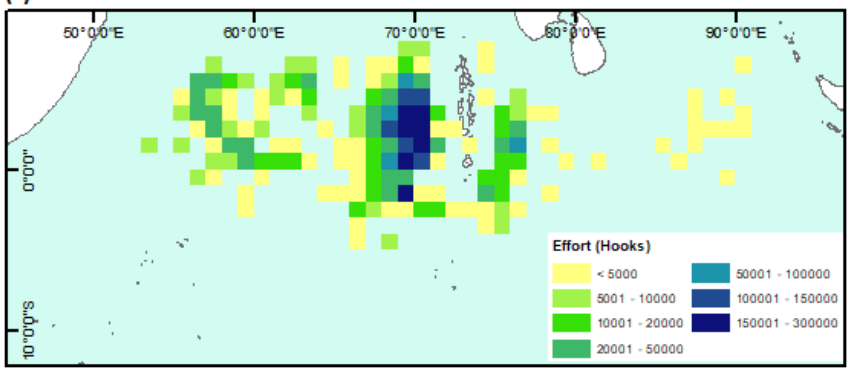
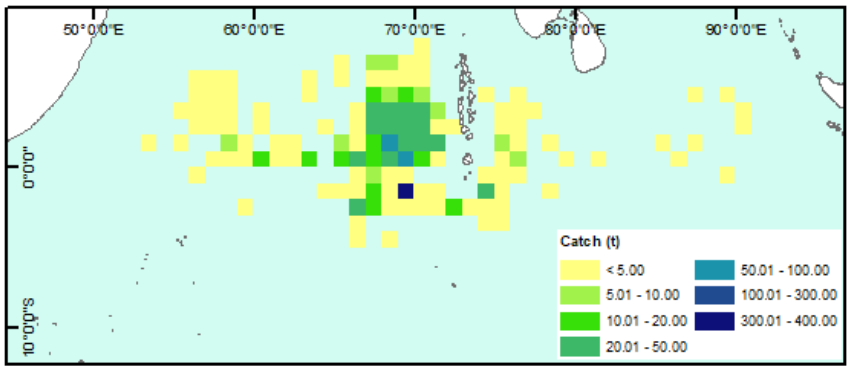


Figure 2b. Map of distribution of fishing effort and catch by species for handline gear for 2017.

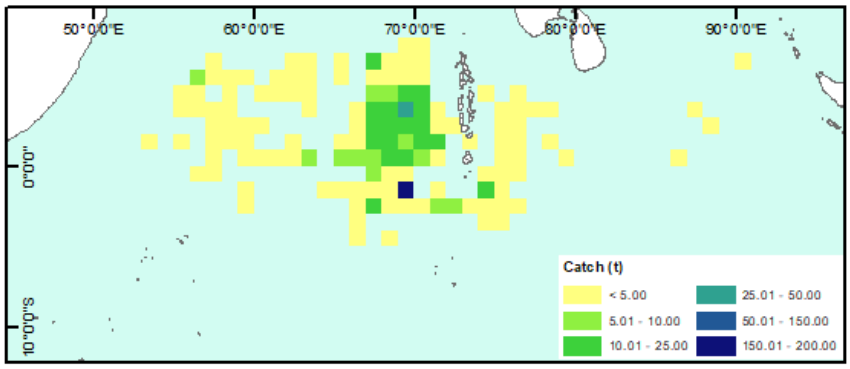
(a) Effort



(b) Yellowfin tuna



(c) Bigeye tuna



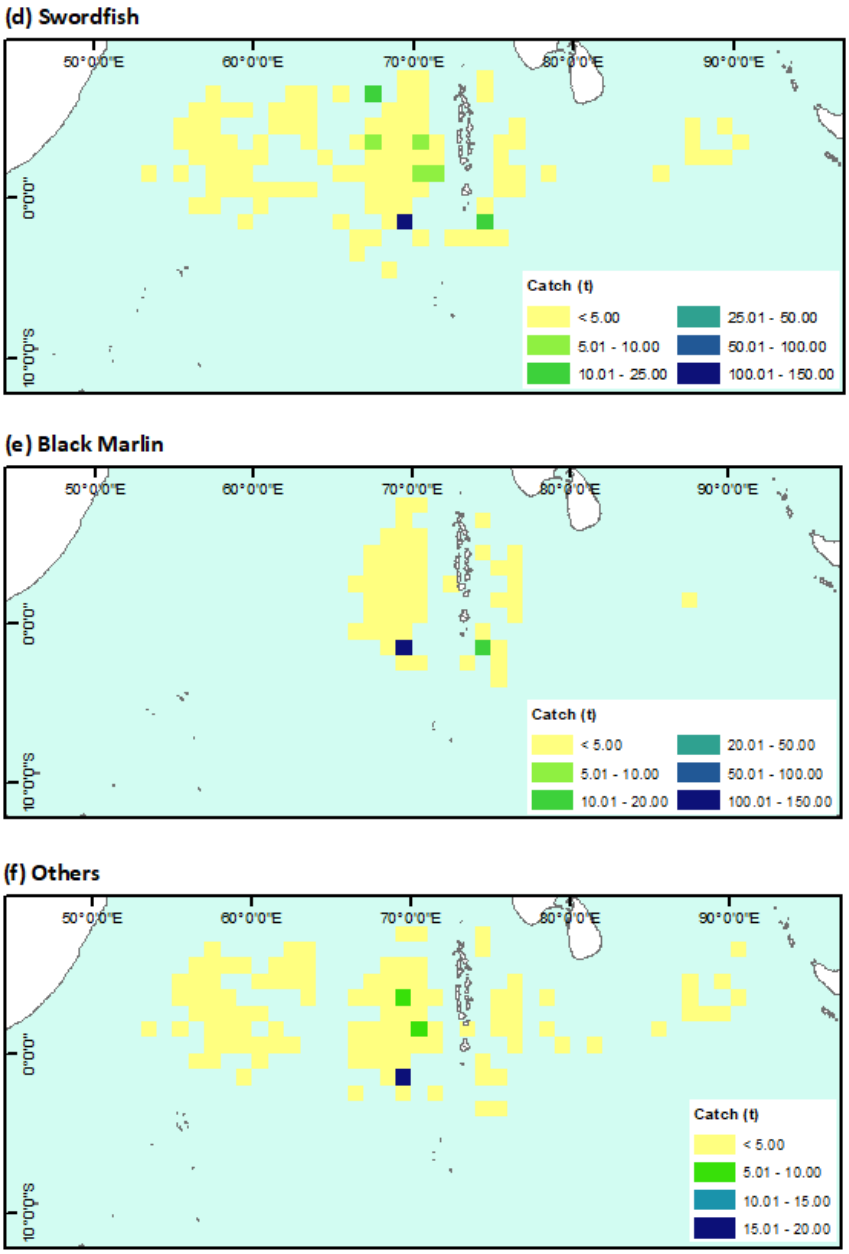


Figure 2c. Map of distribution of fishing effort and catch by species for logline gear for 2017.

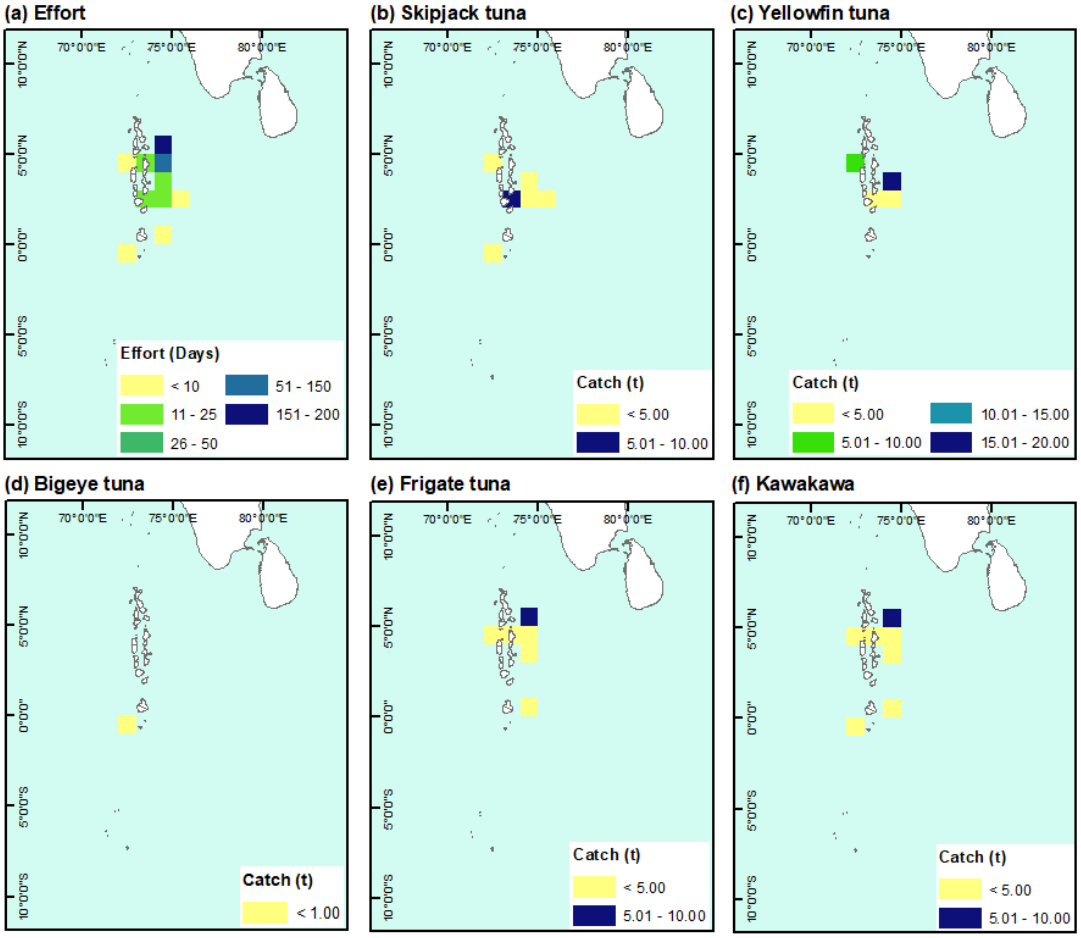


Figure 2d. Map of distribution of fishing effort and catch by species for trolling gear for 2017.

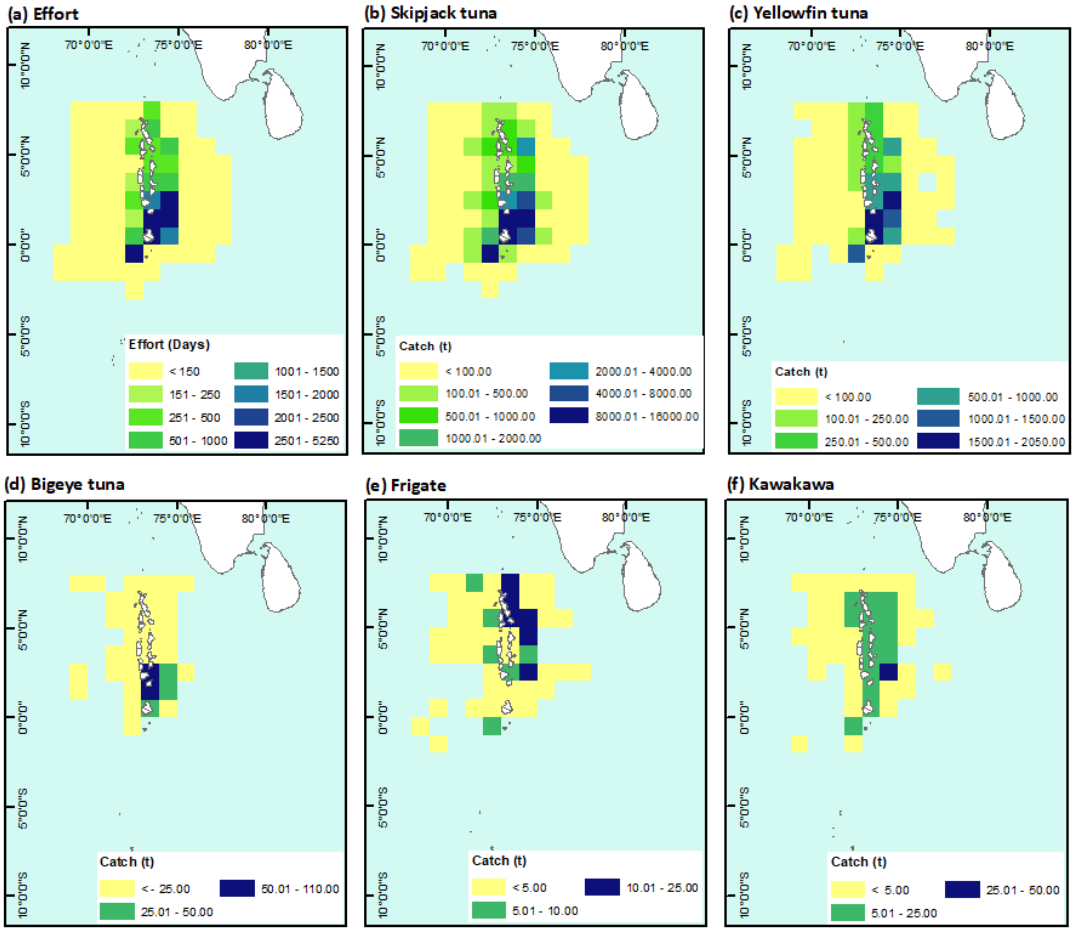


Figure 3a. Map of distribution of fishing effort and catch by species for pone and line gear (average of the 5 previous years, 2013-2017).

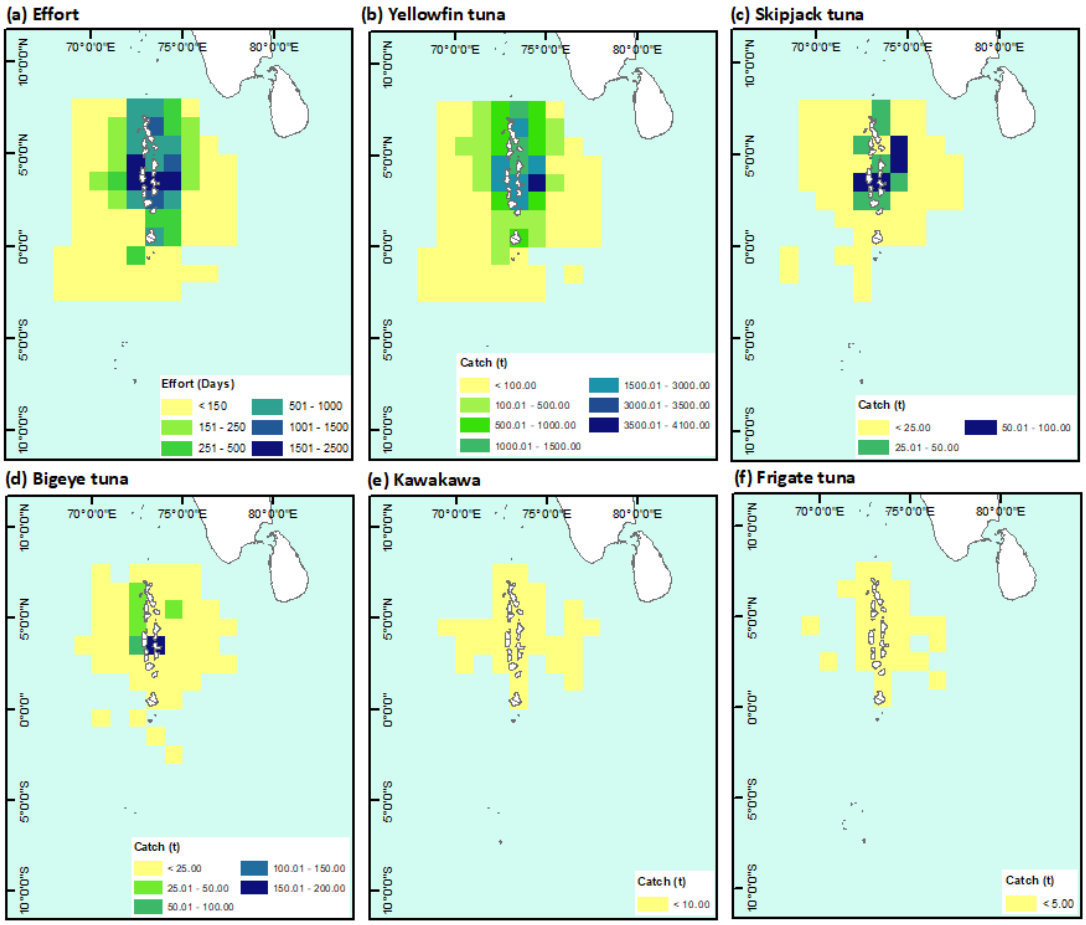
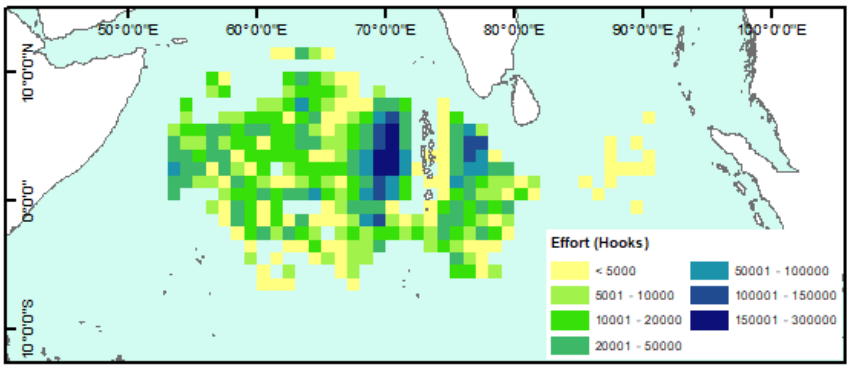
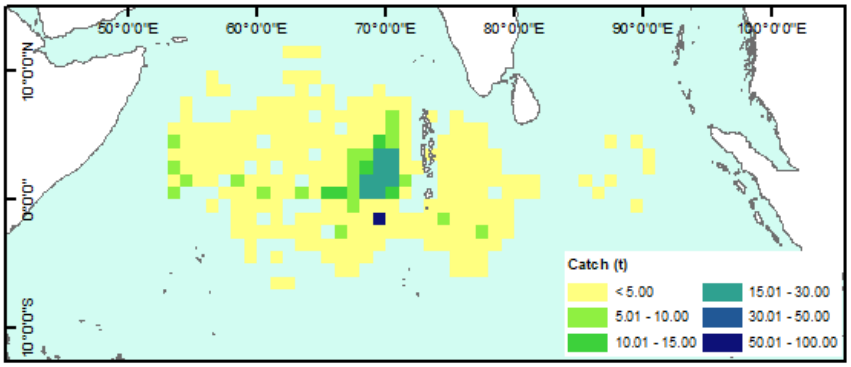


Figure 3b. Map of distribution of fishing effort and catch by species for handline gear (average of the 5 previous years, 2013-2017).

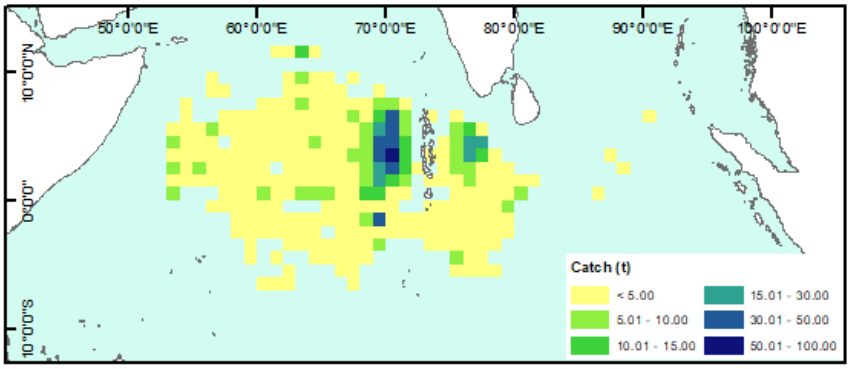
(a) Effort



(b) Yellowfin tuna



(b) Bigeye tuna



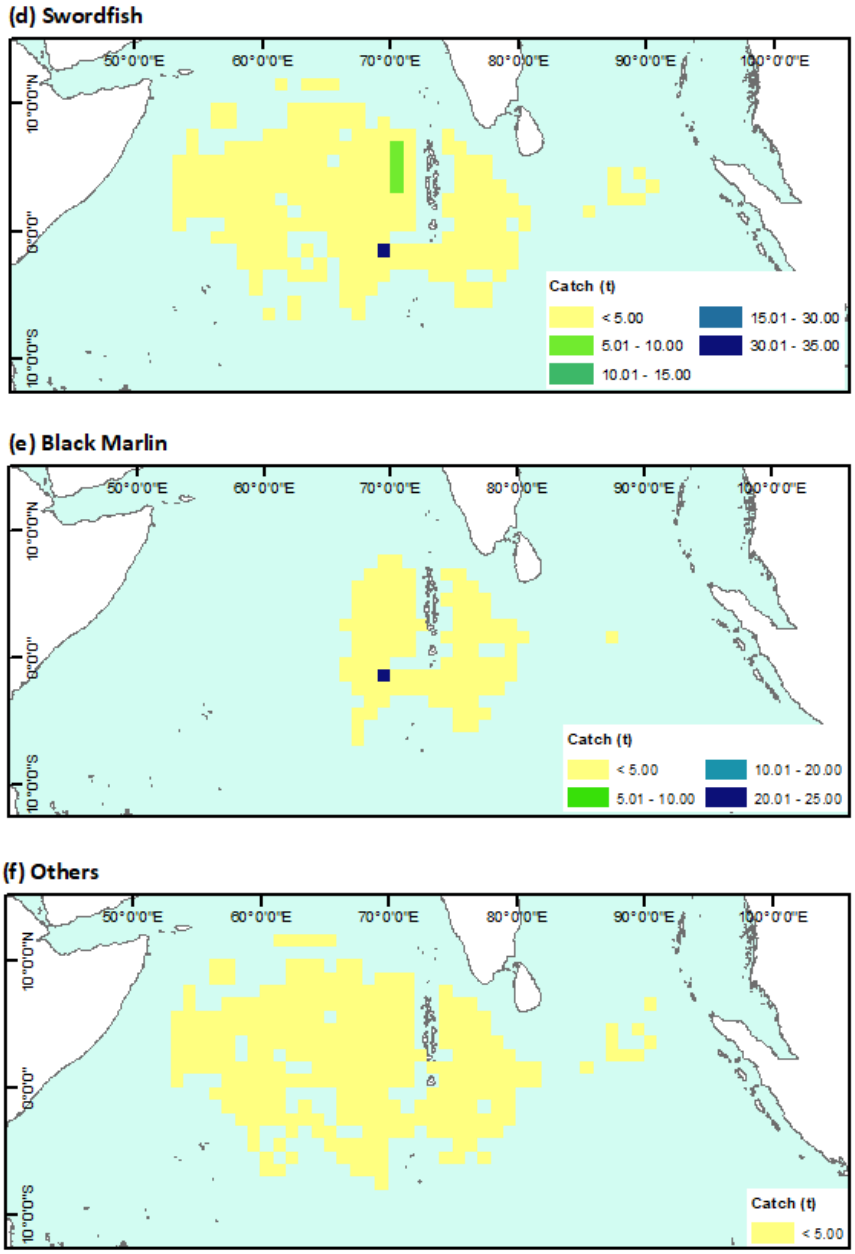


Figure 3c. Map of distribution of fishing effort and catch by species for longline gear (average of the 5 previous years, 2013-2017).

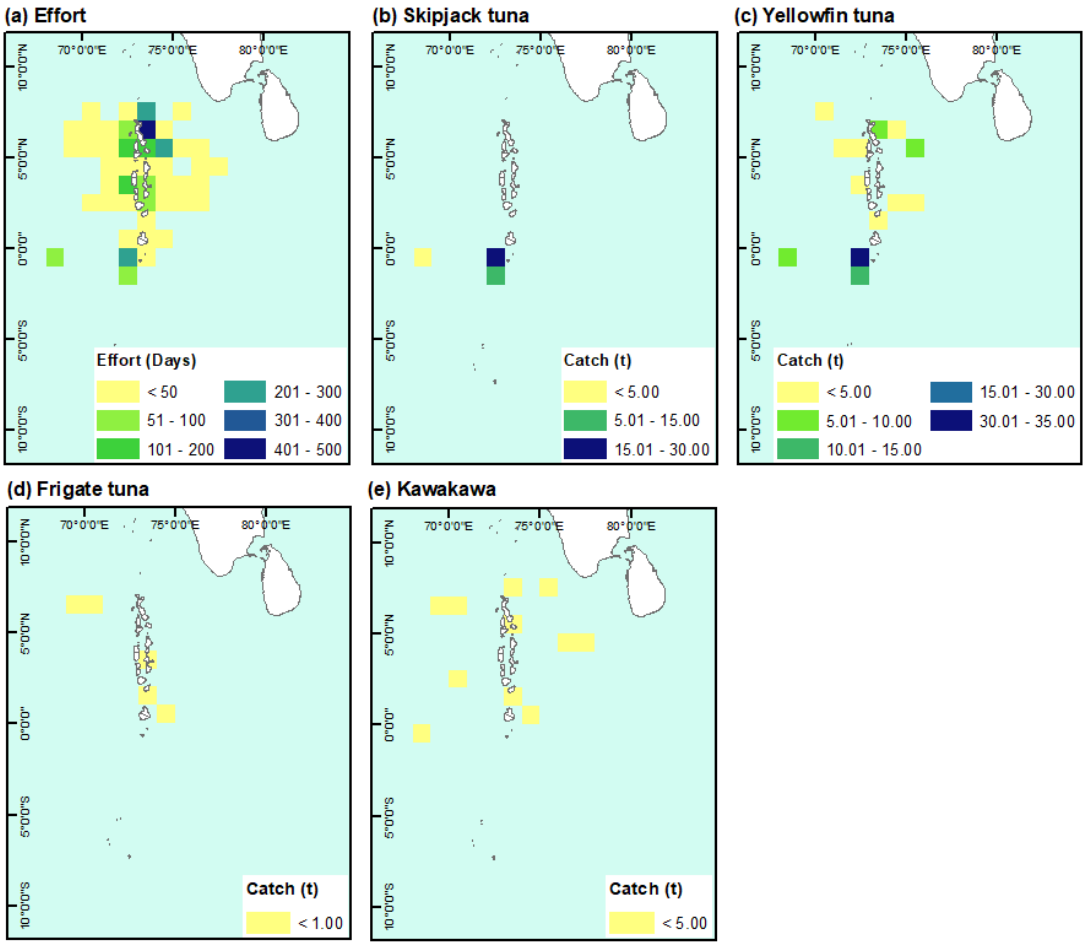


Figure 3d. Map of distribution of fishing effort and catch by species for trolling gear (average of the 5 previous years, 2013-2017).

4. Recreational fishery

Big game fishing is popular among tourists and it is now common practice to have an outfit in almost every resort. Common target species are sail fish (*Makaira* spp.) and dolphin fish (*Coryphaena hippurus*), but also large yellowfin and skipjack tuna. Dogtooth tuna (*Gymosarda unicolor*) are often caught on the troll lines operated off the outer atoll reef. Casting using poppers, rod and reel is also popular game fishing activity targeting mainly large jacks, snappers and other similar fish off the reef and seamounts. The fishery is mostly a catch and release fishery.

There are no institutionalized mechanisms for recording catch from the recreational fishery. Unlike in other countries, Maldives does not have fishing clubs where recreational fisheries are data recorded. Recently, the Ministry and Marine Research Centre, has initiated efforts to monitor the recreational fishery.

Reef fishing logbooks have been recently introduced and are being enforced slowly. Although not reef associated species, the logbook has provisions to report billfish catch and effort. In addition, MoFA is currently in the process of improving the fishery statistics of billfish and to introduce a data collection system for the billfish fishery. These activities are expected to improve the data on billfish landings in the Maldives and follows the Scientific Committee's request (Paragraph 79 - 81, IOTC–2012–SC15–R[E], 2012).

5. Ecosystem and bycatch issues

Maldives has a highly selective form of fishing with virtually no by-catch and no discards. Miller et al, 2017, observed 161 pole-and-line fishing events and reported a figure of 0.65% of total tuna catch by weight. The pole-and-line method alone contributes more than 70% of the total tuna landings. Similarly handline and troll fishing methods are also highly selective with almost no bycatch and discards. Ali (2016) noted that currently less than 1% of tuna is caught from longline which contributes catches of non-target, associated and dependent species (such as sharks etc.)

Livebait is critical for the tuna pole-and-line fishery and is considered as retained species. The species exploited by tuna fleet are characterized by short generation times and high intrinsic rates of population growth. These are species that are not easily overexploited. Maldives has recently intensified monitoring and conducted a review of the livebait fishery. It has also produced a management plan for the livebait fishery.

5.1. Sharks

Shark fishing is banned in Maldives waters, since March of 2010. However, shark bycatch is inevitable in the longline fishery which operates from 100nm and beyond into high seas. Provisions are in place in the "Longline Fishery Regulation (2014/R-388)" to minimise bycatch of sharks and other ecologically important species, in adherence to relevant IOTC Conservation and Management Measures. The Regulation prohibits use of sharks caught in the fishery and ensures that that all live sharks caught are released and reported. The Regulation has further provisions to retain the dead shark by-catch for subsequent confiscation at the port. However, as Maldives is yet to make the required arrangements, all sharks caught in the longline fishery are released or discarded at sea. This information is reported through the mandatory logbooks and are regularly to the IOTC Working Party on Ecosystem and Bycatch (WPEB).

NPOA-Sharks: Maldives' National Plan of Action on the Conservation and Management of Sharks (NPOA-Sharks) was formulated and presented to the stakeholders in April 2014. It was subsequently endorsed by the Ministry of Fisheries and Agriculture on April 2015. With the aim to ensure the implementation and observation of the shark fishery ban, the NPOA-Sharks addresses six key areas: mitigating the impacts of shark fishery ban; improving data collection and handling of shark by-catch; improving scientific research on shark populations; raising awareness on life-history characteristics of

sharks; improving coordination, consultation and monitoring of shark ban; and cooperating on international agreements pertaining to sharks and with relevant RFMOs on research and management of shark species.

Shark interactions in tuna longline fishery: Logbooks for tuna longline fishery currently record shark bycatch as species-complexes; mako sharks, thresher sharks, hammerhead sharks, oceanic white tip and other sharks (Figures 4a and 4b). Due to the shark fishery ban, sharks caught in the longline fleet, is not retained (Table 3). Table 4 lists the numbers of sharks by species/groups, released/discarded by the national fleet in the IOTC area of competence.

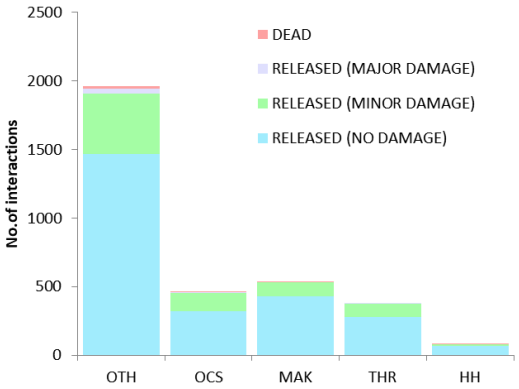


Figure 3a: Interactions of sharks in the Maldives longline fishery - 2016

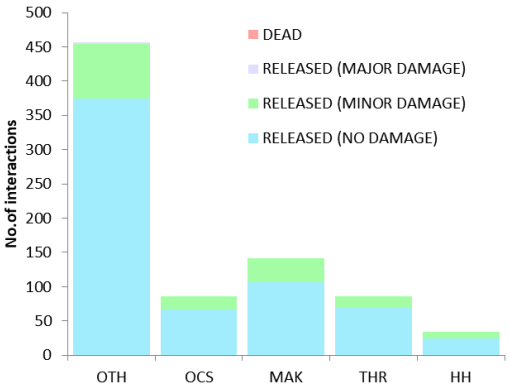


Figure 4b: Interactions of sharks in the Maldives longline fishery – 2017

Table 3: Total number and weight of sharks, by species, retained by the national fleet in the IOTC area of competence.

Not Applicable: Maldives imposes a fishery ban on sharks and therefore does not retain sharks caught in any of the fisheries.

Table 4: Total number of sharks, by species/group, released/discarded by the national fleet in the IOTC area of competence. HH: Heamerhead sharks (Sphyrnidae), THR: Threasher sharks (Alopiidae), MAK: Mako sharks (Lamnidae), OCS: Oceanic whitetip shark (Carchahinidae), OTH: Other sharks).

Year	Fleet	HH	THR	MAK	OCS	OTH
2014	LL	14	822	875	1525	1763
2015	LL	14	44	72	221	264
2016	LL	78	374	534	464	1964
2017	LL	34	86	141	86	457
	HL	2	4	0	0	0

5.2. Seabirds

The interaction with seabirds is minimal in handline, pole-and-line, troll fisheries and longline fisheries. New logbook data collection system allows the fishermen to report such interactions and one incident was reported for the longline fishery in 2017. "Longline Fishery Regulation" mandates longline fishing vessels to implement at sea, bird mitigation measures in adherence to IOTC Resolution nos: 10/06 and the new 12/06.

5.3. Marine Turtles

Maldives imposed a 10 year moratorium on catching or harming of turtles in 1995. The moratorium was renewed in 2005 extending further 10 years with a ban on egg-harvesting from 14 turtle nesting islands (Ali & Shimal, 2016). With the termination of the second ten-year moratorium in 2016, a new legislation on marine turtles under the Environment Protection and Preservation Act (4/93) came into effect in April 2016, declaring all species of marine turtles as protected and prohibits harvest of turtle eggs throughout the Maldivian archipelago. Maldives is also a signatory to the IOSEA Marine Turtles MoU, signed on April 2010.

Longline Fishery Regulation describes turtle mitigation measures during longline fishing operations, including release of live turtles and having de-hookers and line cutters on vessels. Maldives has collaborated with the Bay of Bengal Large Marine Ecosystem Project (BoBLME) to raise awareness on the issue of derelict fishing gear on marine turtles in the central Indian Ocean. A paper studying the impacts of derelict fishing gear on turtles particularly oliveridley turtles (*Lepidochelys olivacea*) was presented by the Maldives at the IOTC WPEB of 2014. Figure 5 presents turtle interactions from the longline fishery, reported in logbooks, from 2014-17.

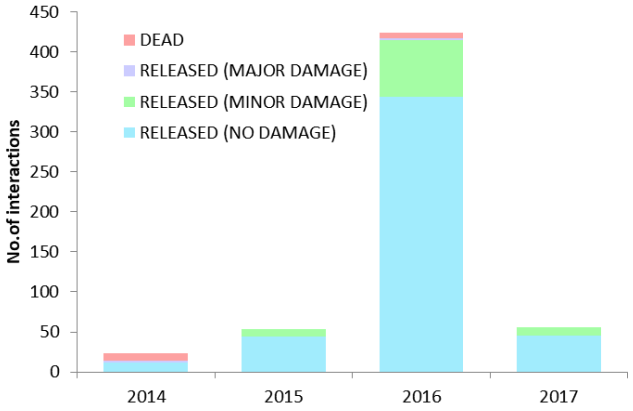


Figure 5: Interactions of marine turtles in the longline fishery 2014-2017

5.4. Other ecologically important species

Whale sharks and dolphins are protected under fisheries regulation. Even though handline fishermen target yellowfin tuna from dolphin associated schools, the interactions are minimal and there has been no reported dolphin catches or interactions (Table5).

Table 5. Reported annual bycatch of special interest species (seabirds, marine turtles and marine mammals) as reported in LL, HL/PL logbooks. Note that prior to 2014, logbooks did not report bycatch of these groups.

Year	Fishery	Seabirds	Marine Turtles	Marine Mammals
2011		NA	NA	0
2012		NA	NA	0
2013		NA	NA	0
2014	LL	NA	24	0
2015	LL	0	53	0
2016	LL	0	0	0
2017	LL	1	56	0

6. National data collection and processing systems

Data collection and reporting system of Maldives was based on total enumeration of the catch, requiring conversion factors for estimating weight. Vessels reported catch by species and effort data (number of

days fished) to their respective island offices where the vessels are registered. The data were then aggregated by vessel and month providing catch by species/species groups and effort in number of days fished.

Complication on separating catch by gear occurred due to the prominence attached to vessel type rather than gear (Adam et al. 2012). For historical reasons it was assumed the 'pole-and-line vessels' would always use pole-and-line gear and so the vessel type is assigned to presumed gear type in the monthly aggregated forms.

6.1. Logbook data collection and verification

Following successful establishment of logbooks as anticipated the enumerated system of data reporting was ceased from 1 January 2017. The enumerated system of data reporting was slowly being phased out by the logbook system that began in 2010. The enumerated system of data reporting was operated in conjunction with the logbook system for a period of 7 years to build awareness and sensitizing the fishers on the need for a log book system.

Logbooks were first introduced in 2010 and went through two revisions, with the recent most revision in 2012 and the new logbooks being introduced in January 2013. The logbook data has allowed Maldives to report data by the required spatial resolution improving compliance with the data reporting requirements.

A web-enabled fishery information system, "*Keyolhu"* is now fully functional and all catch data are recorded and analysed through the system. This is a major improvement to the old database for data recording. The system is one stop shop for vessel registration, issuing fishing licenses & fish processing licenses, data entry of fish purchase (by the commercial companies) and logbook data to provide a comprehensive system of compilation and reporting. The system is also designed to computerize the process of issuance of catch certificates required for the exports of all frozen, fresh or canned tuna from the Maldives.

Logbook data could be verified through different mechanisms. The observer data collected by the Marine Research Centre, with donor funding, will allow verification of all aspects of logbook reported data. Further, landings data, obtained through the tuna exporting companies is used to verify and used in situations of non-reporting. Further, the Fisheries Information System, *Keyolhu*, allows near real-time tracking of landings and purchases as well as licensing.

6.2. Vessel Monitoring System

Maldives implements a VMS system on 100% of the longline vessels and a number of PL/HL vessels. At the time of writing, 121 vessels are equipped with VLDs (Figure 6). The World Bank funded Sustainable Fisheries Resources Development Project committed resources to expand the VMS coverage.

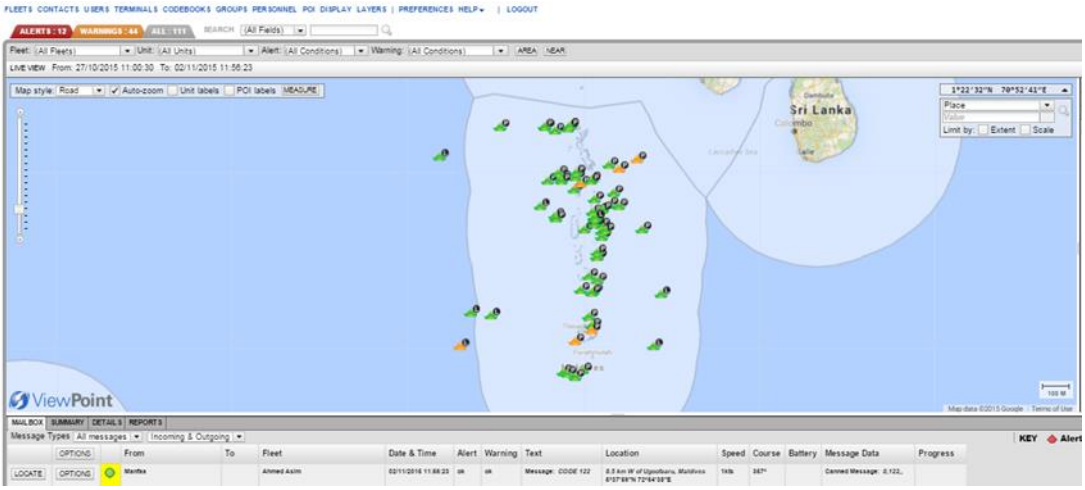


Figure 6. Screen capture of the Maldives VMS System. Currently 121 vessels have VLDs, continuously monitored by the Fishery Management Division, of the Ministry of Fisheries and Agriculture

6.3. Observer Programme

The Observer program was established in 2015, but had to be suspended for various reasons. The program has proven to be costly and due to high staff turn-over, it has been problematic to train and deploy observers on board fishing vessels. To overcome these difficulties the focus is now to shift to an electronic observer system to comply with the requirements of the relevant resolutions of the IOTC. A World Bank funded project is being developed and is expected to start this year.

The bycatch sampling program that started in 2014 continues to date with monitoring of handline large yellowfin tuna trips in addition to PL trips. To date, data has been collected from more than 100 fishing trips from 2015 to 2017. The objective of the programme is take part on regular fishing trips to observe and collect data from the fishing trips, including biological and operational data. A sampling protocol is established for the observer on sampling and recording on database of both the catch and bycatch, including the livebait fishery. These observations are consistent with the IOTC observer requirements and one observer report was submitted in 2017. As stated, it has been difficult to train and place observers on-board vessels, and therefore, the bycatch sampling program fails to meet the required observer coverage.

Table 6. Annual observer coverage for the tuna fleets.

Maldives is working towards an e-observer programme to address the challenges in placing observers on-board vessels. 1 pole-and-line trip observer report was submitted in 2017.

6.4. Port sampling programme

A systematic port-sampling programme to monitor artisanal landings is not in place yet. However, size sampling of catch landed at the ports are conducted regularly through samplers at the three main PL tuna landing ports, fishermen samplers, and scientific observer and MRC staff. Furthermore, MRC implements a program to self-report fishery information and size samples by contracting fishermen samplers from the artisanal fleet. It should also be noted that under the implementation of EU – IUU instruments, fresh fish collectors (fish buyers) are required to record the details of catch and report to the Ministry which is being used as part of the issuing of catch certificate and to corroborate with the fishermen reported logbooks.

All fish processing and purchasing facilities are required to obtain a processing license to process fish for the export market as stipulated by the Licensing Regulation. Changes have been made to the license conditions and data reporting requirements to make it mandatory for all licensed fish processing facilities to record and report size frequency data. This will ensure that Maldives complies with length frequency

data reporting requirements to the IOTC in the future. Table 7 provides a summary of the size data for the year 2017.

Table 7: Number of individuals measured, by species and gear for 2017.

Gear	SKJ	YFT	BET	KAW	FRI	Total
PL	19,360	14,038	286	654	2,514	36,852
HL	0	3,476	0	0	0	3,476
LL	0	99	0	0	0	99
Total	19,360	17,613	286	654	2,514	40,427

6.5. Unloading/Transhipment

This section is not applicable to Maldives as at-sea transhipments are banned in Maldivian waters and Maldivian-flagged vessels do not tranship at sea in the IOTC Convention Area.

7. National research programs

Table 8 provides a summary of the major research program being implemented. They are primarily geared towards improving national reporting and compliance to IOTC Conservation and Management Measures. The newly implemented Fishery Information System (FIS) continues to be tweaked and debugged to improve performance. The integrated web-enabled database enables to maintain records of landings, fishing vessel registries, fishing license and help to compile the various logbooks (HL/PL and LL). The system is also capable to produce summaries that would facilitate reporting data to IOTC

Table 8: Summary table for national research programs currently underway.

Project title	Period	Countries involved	Budget total	Funding source	Objectives	Short description
Maldives yellowfin and SKJ CPUE standardization	Ongoing Starting from September 2016	Maldives	US$ 15,500	IPNLF & World Wise Foods	To improve and extend analyses of SKJ CPUE and develop PL/HL YFT CPUE for IOTC Working parties	The project aims to make use of disparate data and information on operational aspects of the fishery to develop a standardized CPUE series for possible use in stock assessment of tropical tunas, particularly yellowfin and skipjack
Behavior and fishery dynamics of tuna around anchored FADs of the Maldives	36 moths, (starting date: October 2016)	Maldives, France (French IRD) UK	US$ 500,000	IPNLF, Marks & Spencer (UK), MARBEC (IRD, France). MRC/MoFA		Research is linked to a PhD (staff of MRC/MoFA). One key objective is to explore possibilities of using presence/absence data of tunas around anchored FADs as a means to estimated abundance proxies independent of the fisheries.
Development of Fishery Information System (FIS) web-enabled database	2012-2019	Maldives	US$ 81,000	IPNLF, Sainsbury & Marks & Spencer (UK)	To develop an integrated database to compile fishery information + develop an app to compile logbook via PDA (e-logbook)	This brand-new database was developed to accommodate logbook data collection currently in place. It also allows to monitor vessel registry and issue fishing license. *Keyolhu* (e-logbook) would replace paper logbooks
Bycatch sampling Programme	2014-2020	Maldives	US$ 100,000	IPNLF	To observe and sample bycatch in pole-and-line	Observers take part on regular fishing trips to observe and measure the total catch,

					fishery	including species composition of tuna catch. A sampling protocol has been established for observations, sampling, and recording on database of both the catch and bycatch including the livebait fishery, valid to meet IOTC observer criteria. Data collection encompasses the PL and HL fisheries.
Sustainable Fisheries Resources Development Project – Tuna Sampling Programme	2017-2020	Maldives	US$ 70,000	World Bank	To increase the size sampling effort in the Maldives	Port-samplers are based in 3 major landing sites in the Maldives, where size sampling takes 5 days a week. Samplers are based in major tuna landing ports. Additionally, fishermen samplers recruited from the artisanal fleet report fishery and size data regularly.

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

Table 9 below summarises the progress on recommendations of the Scientific Committee and Specific Resolutions relevant to the work of the Scientific Committee.

Table 9: Scientific requirements contained in Resolutions of the Commission, adopted between 2005 and 2018.

Res. 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	Logbook data collection system has been established in 2010; logbooks revised in 2013 based on the new requirements of Res 13/03. Each fishing vessel should have a logbook on board to record catch and effort and reporting of catch and effort data is mandatory. For the first time, in 2013 Maldives reported the catch and effort data by IOTC requirements of 1x1 geographic gird. A new web-enabled database to compile the data in new format is complete and came into operation in 2016.
15/02	Mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties	Paragraphs 1- 7	Maldives has been regularly providing total catch/effort and size data for the stock assessment work of the working party meetings. Maldives submitted the 2015 catch and effort and size frequency data by June 30, 2016. Longline data was also submitted to IOTC by June 30, 2016. The data recording and reporting requirements have been amended this year and it is now mandatory for licensed fish processing facilities to record and report size frequency data to the Ministry.
15/05	On the conservation for striped marlin, black marlin and blue marlin	Paragraph 4	Catches of black marlin in the Maldives are from dropline and to a lesser degree from trolling within coastal areas outside of the atolls. Black marline may also be caught in LL bycatch which are reported. Logbook for the PL/HL has provisions to record marlins which may be caught as bycatch in the fisheries. There is ongoing effort at MoFA to improve the fishery statistics of billfishes.
13/04	On the conservation of cetaceans	Paragraphs 7– 9	Maldives is part of the International Whaling Commission's Indian Ocean Sanctuary established in 1979. Furthermore, all whales and dolphins are protected by law in the Maldives and their interactions with the fisheries are minimal. The

Res. No.	Resolution	Scientific requirement	CPC progress
			observer & bycatch sampling programme records all interactions with cetaceans during fishing trips. Reports from the observer program will present all, if any, interactions with cetaceans.
13/05	On the conservation of whale sharks (*Rhincodon typus*)	Paragraphs 7– 9	Whale sharks are protected in the Maldives. None of fisheries of the Maldives are known to harm the whale sharks. Maldivian flagged vessels only recently started fishing on high seas. These vessels are only longline vessels and are unlikely to encounter any interaction that is worthy of reporting for fishery purpose. The logbooks do have a field for recording such unusual encounters if any. An observer scheme is now in place to verify any such interactions.
13/06	On a scientific and management framework on the conservation of shark species caught in association with IOTC managed fisheries	Paragraphs 5-6	All species of sharks are protected in the Maldives and actively targeting sharks inside Maldivian waters is prohibited. The main types of fishery in Maldives are the pole and line and the handline tuna fishery. Observations suggest that interaction with sharks is minimal in these fisheries and any shark that is caught is released live or with minimal harm. The Regulation on longline fishing in Maldives stipulates that all live sharks must be released immediately should they be caught in the longlines and any dead sharks must be landed at an inspection site for verification. Shark interactions are recorded in detail in the log books of all fisheries targeting tunas (PL, HL and LL) and information on shark interactions has been reported to the IOTC as required. Under the recently formulated shark NPOA, review and analysis of longline bycatch is given a priority. LL shark bycatch data form 2015 has been provided to IOTC.
12/09	On the conservation of thresher sharks (family Alopiidae) caught in association with fisheries in the IOTC area of competence	Paragraphs 4-8	Shark fishing is prohibited in Maldivian waters. See section on Resolution 13/06 for details. An observer scheme is now established and the information on shark interactions will be verified through these observer schemes.
12/06	On reducing the incidental bycatch of seabirds in longline fisheries.	Paragraphs 4-8	The Appendix 2 of "Longline Fishery Regulation" gives 6 ways to mitigate the bycatch of seabirds as per the relevant IOTC resolutions. Implementation of one of these mitigation measures is mandatory. Interactions with seabirds should also be reported as per the IOTC requirements through the logbooks. Most recent data and findings were presented in the 12th meeting of the Working Party on Bycatch.
12/04	On the conservation of marine turtles	Paragraphs 3, 4, 6–10	Maldives is signatory to the Indian Ocean – Southeast Asian (IOSEA) Marine Turtle Memorandum of Understanding. A second 10-year Turtle Moratorium is in force from 2008-2018 that includes banning of hunting, taking, or harming turtles, including harvesting of eggs. Appendix 2 of Regulation on Longline Fishing in the Maldives describes turtle mitigation measures during longline fishing operations, including release of live turtles having de-hookers and line cutters on vessels as per the relevant IOTC resolutions.
11/04	On a regional observer scheme	Paragraphs 9	The Observer program that was established in 2015 is defunct due to various reasons. The program has proven to be costly and due to high staff turn-over, it has been problematic to train and deploy observers on board fishing vessels. To overcome these difficulties the focus is now to shift to an electronic observer system to comply with the requirements of the relevant resolutions of the IOTC. A

Res. No.	Resolution	Scientific requirement	CPC progress
			World Bank funded project is being developed and is expected to be trialled next year. The initial focus will be to assess the effectiveness and feasibility of the use of such systems in Maldivian fishing vessels. However, MRC has deployed scientific observers on over 100 fishing trips. The information collected by the observers are consistent with the IOTC requirements and has proven to be very useful to validate the information provided in the fisheries log books.
05/05	Concerning the conservation of sharks caught in association with fisheries managed by IOTC	Paragraphs 1–12	Shark fishing is prohibited in Maldives waters (the entire EEZ). The ban is effective from May 2010. The only fishery likely to catch shark would be longline fishery. Currently there 28 active longline vessels (targeting BET/YFT) operating between 100nm to 200nm of Maldives EEZ. The Regulation on Longline Fishing in Maldivian waters requires shark by-catch to be released alive if possible and landed otherwise to an inspection port.

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