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Republic of Maldives**

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**MALDIVES NATIONAL REPORT
SUBMITTED TO THE
INDIAN OCEAN TUNA COMMISSION
SCIENTIFIC COMMITTEE - 2017**

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Maldives National Report to the Scientific Committee of the Indian Ocean Tuna Commission, 2015

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INFORMATION ON FISHERIES, RESEARCH AND STATISTICS

<p>In accordance with IOTC Resolution 15/02, final scientific data for the previous year was provided to the Secretariat by 30 June of the current year, for all fleets other than longline [e.g. for a National report submitted to the Secretariat in 2013 final data for the 2012 calendar year must be provided to the Secretariat by 30 June 2013)</p>	<p>NO</p> <p>23/07/2017</p> <p>The data was submitted to the IOTC after the deadline due to difficulties in compiling and analyzing the catch and effort data following the migration of the database used to record catch and effort information. A new database has been developed to address the difficulties in extracting the data and it is expected that with the new database infrastructure the information provided by the Maldives to the IOTC will further improve in the future and improve timeliness of the data of submission</p>
<p>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).</p> <p>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).</p>	<p>YES</p> <p>30/06/2017</p>
<p>If no, please indicate the reason(s) and intended actions: (sse above)</p>	

Executive Summary

The Maldivian tuna fishery comprises of four main components; pole-and-line, handline, longline and troll line. The most important is still the traditional livebait pole-and-line tuna fishery. The main target species is skipjack tuna (*Katsuwonus pelamis*), but small amounts of juvenile yellowfin tuna (*Thunnus albacares*) are also caught in the fishery of which about 5-10% is bigeye tuna (*Thunnus obesus*). Handline fishery is still expanding 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 targets mainly neritic species of kawakawa (*Euthynnus affinis*) and frigate tuna (*Auxis thazard*), but occasionally also catches skipjack and yellowfin tuna.

Total tuna catches for the 5 species of tunas (skipjack tuna, yellowfin tuna, bigeye tuna, frigate tuna and kawakawa) caught in the Maldives was at about 126,000 t. These catches came from pole and line, handline, longline and trolling gear. Pole and line catch, dominated by skipjack tuna, was at 69,500 t while the handline catch, which targets surface dwelling schools of large yellowfin tuna, was at 53,000 t. Landings from the longline fleet observed an increase from the previous year to 1,300 t. The catch from trolling fleet continues to be on the decline with a mere 64 t being reported in 2015

Skipjack tuna registered a slight decrease in catch in 2016 relative to 2015 (~1%). Catches for the most recent five years ranged between 50 and 75,000 t, with an average of 67,000 t. catches have been of the order of 50,000 – 75,000 t. Catches of yellowfin are steadily increasing, due to the growing handline fishery. Most recent five years' catch averaged at 49,000 t with a range of 44 – 53,700 t. Bigeye tuna landings increased by ~42% to 2,400 t in 2016. The growth was driven by the increased contribution from longline and pole and line.

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 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. A web-enabled database is now online to allow compilation and processing of catch and effort data. The web-enabled database is also used to record tuna purchases by the exporters. The database will 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 pole and line and handline vessels. In addition, the observer data collected from pole-and-line and handline fisheries enable verification of fishermen reported data. Beginning 2018, electronic observer systems will be installed on licensed fishing vessels on a rotational basis to cover 5% of the trips.

A number of research programs funded by the Government and NGOs are currently being implemented. 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. Research activities relevant to fisheries managed by IOTC include work on understanding the behaviour of tunas around Anchored FADs, understanding the socio-economic dimensions in tuna fisheries of the coastal states in the context of IOTC rights-based management and allocation issues, bycatch sampling, and continued development of the Fishery Information System.

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 140 million US\$ in 2014 (Basic Fishery Statistics, MoFA 2014). 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 many of the outer islands. The fishery sector currently contributes around 1-2% to GDP (National Bureau of Statistics, 2017).

The most important component of the Maldivian tuna fishery is the livebait pole-and-line fishery targeting skipjack (*Katsuwonus pelamis*). Small amounts (~15-17%) of juvenile yellowfin (*Thunnus albacares*) and bigeye tuna (*Thunnus obesus*) are also caught in the fishery of which about 5-10% is bigeye tuna. In the past bigeye tuna was not recorded separately in the domestic catches and so have been estimated from the *Thunnus* catches. The proportion of bigeye in pole-and-line catches were revised recently (Adam et al., 2014). The fishery is generally conducted in coastal areas within 60-70 miles from the atoll boundary. Fishing effort is considered to be highest around the anchored fish aggregating devices (aFADs) located 12-15 miles range from the coast.

A second 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 significant modifying of the vessel except for addition of the handline gear and having facilities for fresh-storage of this high-valued catch. The growth and expansion of the handline yellowfin tuna fishery appears to be the reason for the declining effort trend of the pole-and-line component. Recent years have shown increase in catches of yellowfin tuna, to offset reduced catches of skipjack. Recorded catches in yellowfin tuna by all gears in 2016 were about 53,000 t which is an increase of about 2.8% relative to 2015. Skipjack catches were about 70,000 t in 2016, roughly the same as that of 2015.

Two minor components of the tuna fishery are longline and troll fisheries. Maldives used to have licensed foreign longline fleet operating in the outer EEZ (beyond 100 miles from shore). 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 finally brought to an end in mid-2010. Until November 2011, there was no longline fishing in Maldivian waters. Maldivian vessel started operation during 2012. With an increase in interest from locals to buy vessels and based on Maldives' commitment to conservation and management measures of the IOTC, the Government decided to impose a total allowable catch (TAC) for the fishery and a quota system to distribute the TAC among the longline companies. This TAC was based on the fleet development plan submitted by the Maldives to the IOTC and the TAC for 2016 was set 13,500 t. A total of, 1,820 t of TAC has been purchased during the quota period of 2016. The quota period for longline TAC is from the beginning of June to end of May of the following year. The longline fishery is highly regulated with mandatory VMS, strict licensing and reporting of catches of all catch and bycatch varieties via logbooks. The fishery is restricted to the outer EEZ – from 100 miles and beyond by law.

The trolling component targets coastal species of kawakawa (*Euthynnus affinis*) and frigate tuna (*Auxis thazard*) (Ahusan and Adam, 2011a, Ahusan and Adam, 2011b). The trolling fleet which landed substantial proportions of both species in the past, died off due to mechanization of the fishing fleet during 1970s and 80s.

2. Fleet structure

The fishing fleet has undergone several changes following the mechanization beginning in 1974. The current fleet is a mix of 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. Two rows of the FRP ice-boxes are commonly placed on the open deck of wooden vessels, a characteristic of handline

fishing vessels targeting yellowfin tuna. It is also becoming popular to have insulated fish holds to keep fish in ice or slurry.

Pole-and-line and handline fishing is conducted from identical vessels and switching from handline to pole-and-line or vice versa is done without major modification to the vessel. Vessels have multiple bait-wells for carrying live, bait required for handline and pole-and-line which differ in size and species composition. The most important visible feature of the handline vessels are the large ice-boxes (0.5 –1.8 t capacity) placed on open fishing platform. Often they are placed in pairs on either side of the engine hatch (2, 4, or 6 numbers are common). Newly built vessels have insulated fish holds that negate the use of ice-boxes and frees up deck space.

Longline fleet used to be foreign-owned and operated within the EEZ, beyond 100 miles under licensed and joint venture arrangements. Following the cessation of longline foreign licensing in May 2010, the Ministry has undertaken considerable work to establish a Maldivian longline fleet. Nineteen Maldivian-owned longline fishing vessels were licensed in the first year the scheme was established in November 2011. However, these vessels did not start operation until May 2012. Furthermore, there was a growing interest from fisheries industry to bring in new vessels for longline operation. To promote a sustainable and transparent approach in developing local longline fleet, the Government of the Maldives decided to implement a quota based approach for management of this fishery. As such it was decided to adhere to the fleet development plan submitted by the Maldives to IOTC, and cap the total output of the fishery by introducing a quota system for Maldivian longline vessel.

Table 1: Number of vessels operating in the IOTC area of competence, by type for last 4 years (2012-2016).

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
2012	Engine row boat	10	--	--	--	--	--	--	--
2012	Longline vessel	--	--	3	--	--	--	--	--
2012	Mechanized masdhoni	1	50	121	151	223	84	12	--
2012	Mechanized vadhu dhoani	3	6	--	--	--	--	--	--
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

3. Catch and effort (by species and gear)

Reported national tuna landings in 2016 were around 12,000 t. Of these 55% was skipjack tuna and close to 43% was yellowfin tuna. A small quantity of bigeye tuna is caught along with yellowfin component in the pole-and-line fishery. Earlier estimates by Anderson, 1996 showed this bigeye component may be 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 (Adam et al., 2014). Bigeye tuna is also caught by the longline fishery operating within the Maldives EEZ, the catch of which in was 624 t in 2016.

Total tuna catches reached an all-time high of over 167,000 t in 2006. This was followed by a 62% decline in catch until 2010. Total tuna catches have since been recovering with 2016 recording a 23% increase in catch from 2010. A reason for the decline in total catches is the sharp decrease of skipjack catch over the period. Skipjack catches dropped from a record high of 138,000 MT in 2006 to 53,400 MT in 2012.

Skipjack tuna registered a slight decrease in catch in 2016 relative to 2015 (~1%). Catches for the most recent five years ranged between 50 and 75,000 t, with an average of 67,000 t. Pole and line, the main gear for skipjack tuna, contributed 98% of the landings followed by handline and trolling. Pole and line caught skipjack tuna has remained somewhat stable over the last four years.

Yellowfin tuna is the second most important species in the tuna fishery. Catches of the species has increased steadily 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 increased to 53,700 t in 2016, the highest recorded so far, with the growth being driven largely by the handline fishery. Most recent five years' catch averaged at 49,000 t with a range of 44 – 53,700 t.

Slightly more than 80% of the yellowfin catch was from the handline fishery targeted for export, an increase from about 70% in 2015. Both pole-and-line and handline fisheries operate quite close to the atolls, albeit minor differences in the predominant fishing regions. Pole and line effort is higher in the southern atolls, in contrast to handline effort which has a higher central to northern distribution.

Bigeye tuna landings increased by ~42% to 2,400 t in 2016, from 1700 t in the previous year. The growth was mainly driven by increased contribution from longline and pole and line gears. While longline targets deep swimming large individuals, pole and line catches juveniles from surface swimming schools along with yellowfin tuna.

Catches of neritic species (frigate tuna: *Euthynnus affinis* and kawakawa: *Auxis thazard*), from all gears have seen substantial declines with 2009 recording the highest catch in recent years. From 5200 t (frigate) and 3000 t (kawakawa) in 2009, catch has plummeted to a mere 141 t and 29 t for frigate and kawakawa respectively. Ahusan and Adam (2015) argue that these declines are primarily due to under-reporting and decline in effort towards both species due to the low economic value attached to the catch.

The small-scale trolling fleet targets frigate and kawakawa tuna in the coastal areas and atoll lagoons. The main trolling fleet effectively died in the late 1980s due to improved socio-economic changes. Current catch of the species is mainly from pole-and-line gear (Ahusan and Adam, 2011a and b, Ahusan 2016). Combined average catch of both species was about 600 t in the recent five years. Historical catch, catch by species and gear and effort by gear and its catch are presented in Figure 1, Figure 2, and Table 2.

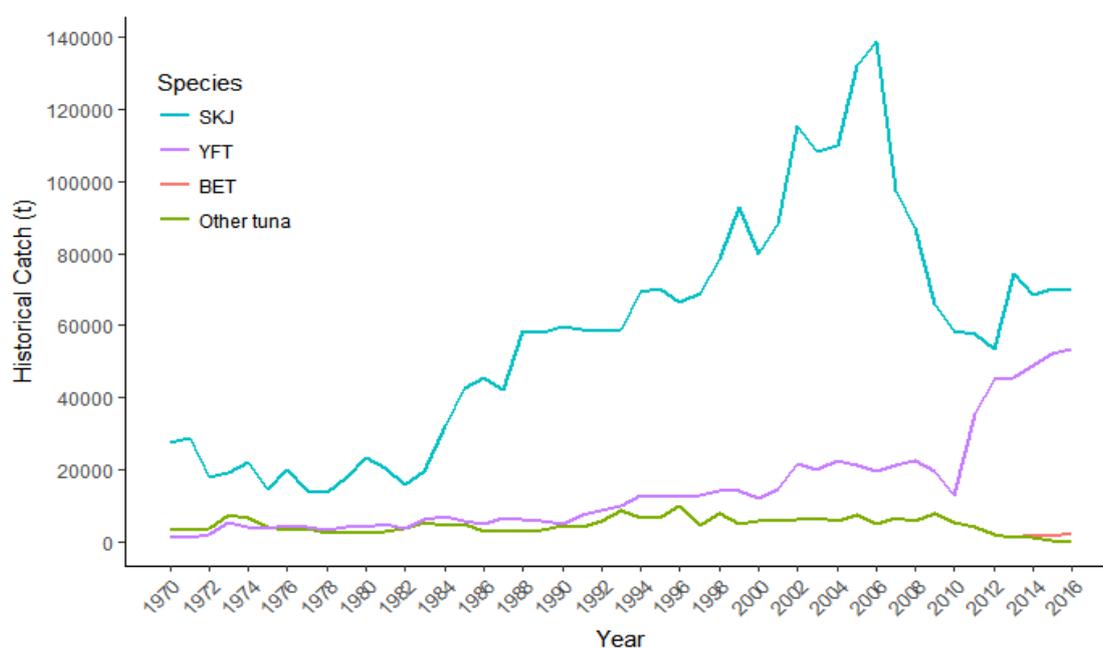


Figure 1: Historical annual catch for the national fleet by species (1970-2016). Other tunas include frigate and kawakawa.



Figure 2: Catch trends by gear for each species for the last 10 years (2007-2016). There was no longline fishery for 2010 and 2011. Note BET began to be separately from 2013 onwards.

Table 2. Annual catch (t) and their effort by gear (days fished) in IOTC area of competence for the 2012-2016. Note the fishing effort for 2014-16 was estimated. Note that BET began to be reported separately from 2013 onwards.

Year	Gear	SKJ	YFT	BET	KAW	FRI	Effort (days)
2012	HL	1,981	32,969	-	376	309	51,875
	LL	-	113	-	-	-	42
	PL	51,134	10,896	-	1,012	481	79,005
	TR	276	999	-	197	31	16,334
2013	HL	1,584	26,085	116	179	70	43,196
	LL	-	239	1,059	-	-	1,501
	PL	72,583	18,878	345	760	478	63,247
	TR	255	387	-	66	18	12,300
2014	HL	1,015	30,246	524	103	50	40,000
	LL	-	183	1502	-	-	na
	PL	67,301	18,481	304	741	578	60,000
	TR	181	181	3	45	22	10,000
2015	HL	1,057	36,299	1,433	19	8	40,072
	LL	-	89	122	-	-	na
	PL	68,965	15,796	184	180	96	58,500
	TR	252	231	2	23	14	4,096
2016	HL	866	44,384	1,065	1.8	15.66	40,000

	LL	2	726	624	-	-	na
	PL	69,711	8,550	781	26	123	58,000
	TR	8	43	8	2	3	652

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 Indo-Pacific sailfish (*Istiophorus platypterus*) 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. An institutionalized mechanism to record catch from the recreational fishery does not exist at the moment.

Reef fishing logbooks have been recently introduced and 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 is in compliance with 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, 2016, Miller et al. 2017). 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 less than 1% of tuna is caught from longline which contributes catches of non-target, associated and dependent species (such as sharks etc.).

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 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 in the Maldives as protected species for an indefinite period of time and prohibits the harvest of turtle eggs throughout the Maldivian archipelago. Maldives became a signatory to the IOSEA MoU in April 2010.

Livebait is critical for the tuna pole-and-line fishery and is considered a 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 of this fishery and conducted a review of the livebait fishery. A management plan for the livebait fishery was produced in 2013.

5.1. Sharks

Shark fishing is banned within Maldives waters including the EEZ. The ban is effective from March of 2010. However, with the introduction of longline fishing from 100 miles and beyond and into the high seas, sharks are being caught as bycatch in the fishery. Provisions are in place in the "Longline Fishery Regulation" to minimise the bycatch of sharks in adherence to IOTC Resolutions 05/05 and 12/09.

NPOA-Sharks: Maldives' National Plan of Action on the Conservation and Management of Sharks (NPOA-Sharks) was formulated and endorsed by the Ministry of Fisheries and Agriculture on April 2015. With the aim to ensure the implementation and observation of the total shark fishery ban, the NPOA-Sharks

addresses six key areas; i) mitigation of the impacts of shark fishery ban, ii) improvement of data collection and better handling of sharks caught in the longline fishery, iii) improve research on shark populations, iv) raise awareness on life-history characteristics, v) improve coordination, consultation and monitoring of shark ban and vi) cooperate on international agreements pertaining to sharks and with relevant RFMOs on research and management of shark species.

Shark interactions in tuna longline fishery: The shark fishery ban prohibits usage of any shark species caught from the EEZ of the Maldives. The “Longline Fishery Regulation” has provisions to retain the dead shark by-catch for subsequent confiscation. However, as the institutional arrangements to monitor and handle the sharks bycatch from the fishery is currently lacking, all dead shark bycatch are discarded at sea.

Logbooks for tuna longline fishery currently record the shark interactions as species-complexes; mako sharks, thresher sharks, hammerhead sharks, oceanic white tip shark and other sharks. An analysis of shark interactions by species-complexes in the longline fishery in 2014-15 was presented at the IOTC WPEB of 2016 (Figure 3 and Figure 4). Interactions with sharks in tuna longline fishery by species complexes for 2016 are presented in Figure 4.

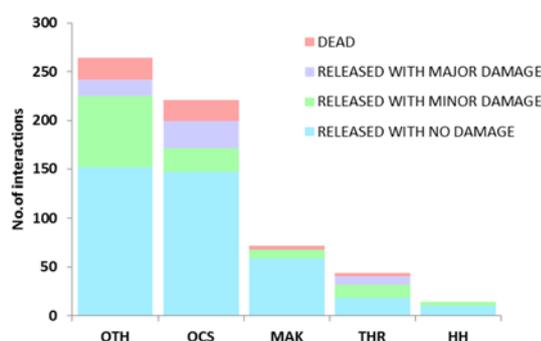


Figure 3. Interactions of sharks in the Maldives longline fishery - 2015

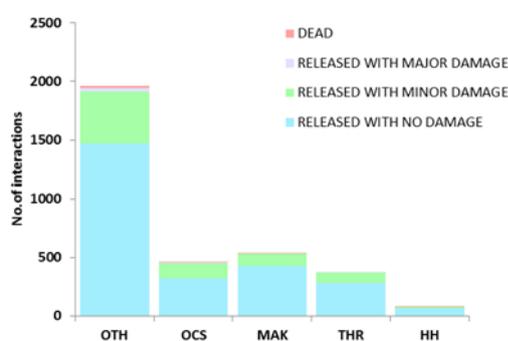


Figure 4. Interactions of sharks in the Maldives longline fishery - 2016

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 interaction and currently there is none reported. “Longline Fishery Regulation” mandates longline fishing vessels to implement seabird mitigation measures in adherence to IOTC Resolutions 10/06 and 12/06.

5.3. Marine Turtles

Maldives is signatory to the Indian Ocean – Southeast Asian (IOSEA) Marine Turtle Memorandum of Understanding. With the end of the second 10-year Turtle Moratorium (2006-2016) that includes banning of hunting, taking, or harming turtles, including harvesting of eggs from 14 islands known for turtle nesting in January 2016, a new legislation on marine turtles came into force under the Environment Preservation and Protection Act (Law no. 04/93), where all marine turtles have now been declared as protected species and a nation-wide ban on turtle egg harvesting is also declared.

Longline Fishery Regulation on Fishing and Export of Large Yellowfin Tuna describes turtle mitigation measures during longline fishing operations, including release of live turtles and having de-hookers and line cutters on vessels. Maldives 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 drifting FADs and ghost nets, particularly on oliveridley turtles (*Lepidochelys olivacea*) was presented by the Maldives at the IOTC WPEB of 2014. Ali (2016) presented an analysis of marine turtle interactions in tuna longline fishery at IOTC WPEB 2016.

Marine turtle interactions in longline fishery for 2016, was noted to be considerably higher than the previous years (Figure 5). This sudden increase in turtle interactions for 2016 could be due to spatial change in fishing operations or due to improved reporting. In all the years, the majority of the turtles were released without any harm.

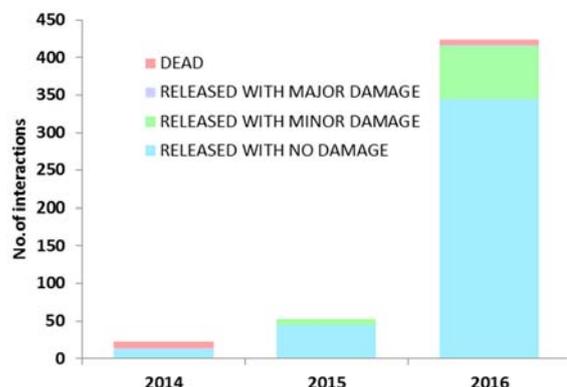


Figure 5: Interactions of marine turtles in the Maldives longline fishery 2014-2016.

5.4. Other ecologically related species

Whale sharks and dolphins are protected under fisheries regulation. Even though handline fishermen target yellowfin tuna from dolphin associated schools, the interaction is minimal and there has been no reported dolphin catches or interactions (Table 3).

Table 3. Reported annual bycatch of species of special interest (seabirds, marine turtles and marine mammals) as reported in LL, HL/PL logbooks. All turtle interactions were reported from LL. Most of the turtles were released alive with no harm.

	Seabirds	Marine Turtles	Marine Mammals
2011	NA	NA	0
2012	NA	NA	0
2013	NA	NA	0
2014	NA	23	0
2015	0	53	0
2016	15	424	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 of the catch. Vessels report catch by species and effort data (number of days fished) to their respective island council offices where the vessels are registered. There, the data are aggregated by vessel by month providing catch by species in number along with the 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 is 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.

Fishing 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 operational factors) the day of fishing should be standardized to use the CPUE data (Kolody and Adam., 2011; Sharma et al. 2014). 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.

6.1. Logbook data collection and verification

The enumerated system of data reporting through island councils still exist. The system is slowly being replaced by a logbook system starting from 2010. The logbooks introduced in 2010 were revised in 2012 and the new versions introduced in January 2013. Following successful establishment of logbooks the enumerated system of data reporting will be ceased from 1 January 2018. The logbook data has allowed Maldives to report data by the required 1 x 1 degree resolution helping to comply with data reporting requirements.

A web-enabled fishery information system (Figure 6) 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 currently handles vessel registration, issuing fishing & 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. Further modules are now being developed for the FIS to allow for data analysis and compliance related functions of the Ministry.

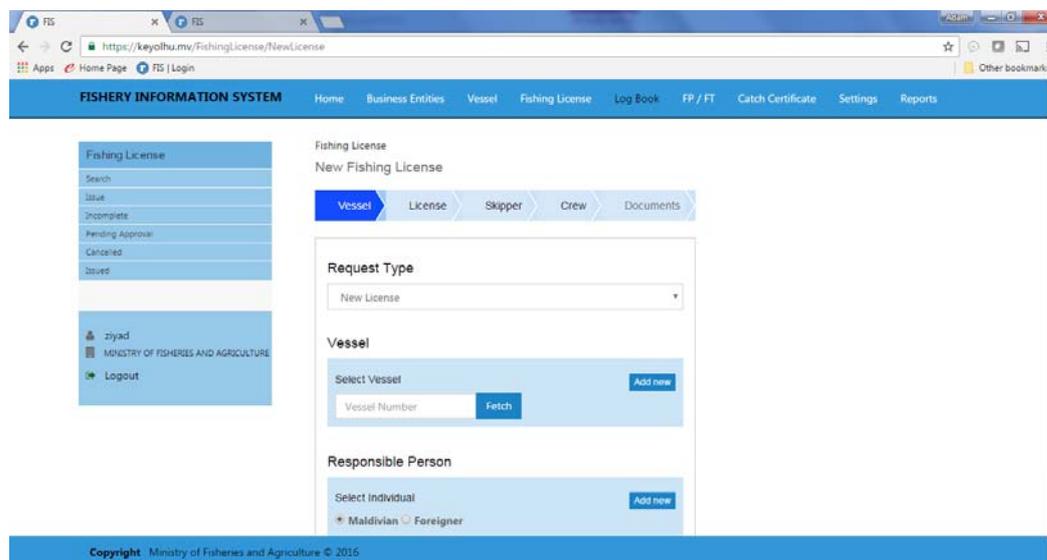


Figure 6. Screen capture of the updated Fisheries Information System (FIS) showing the Fishing License Module.

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 allows near real-time tracking of landings and purchases as well as licensing.

6.2. Vessel Monitoring System

Maldives implements a VMS system for its fishing fleet. All longline fishing vessels with a valid fishing license are strictly monitored via VMS. The implementation of VMS the remaining licensed fishing fleet

is loosely enforced pending major overhaul to the VMS under a World Bank project. At the time of writing, 130 vessels are equipped with VLDs (Figure 7).

A project funded by the World Bank is now being implemented in the Maldives and under the component to improve monitoring, control and surveillance capacity for the fishing fleet, a new VMS will be setup. This will allow fishing vessels to report catch while out at sea, further enhancing the catch reporting system in place. It is expected that installation of vessel tracking units will start in 2018.

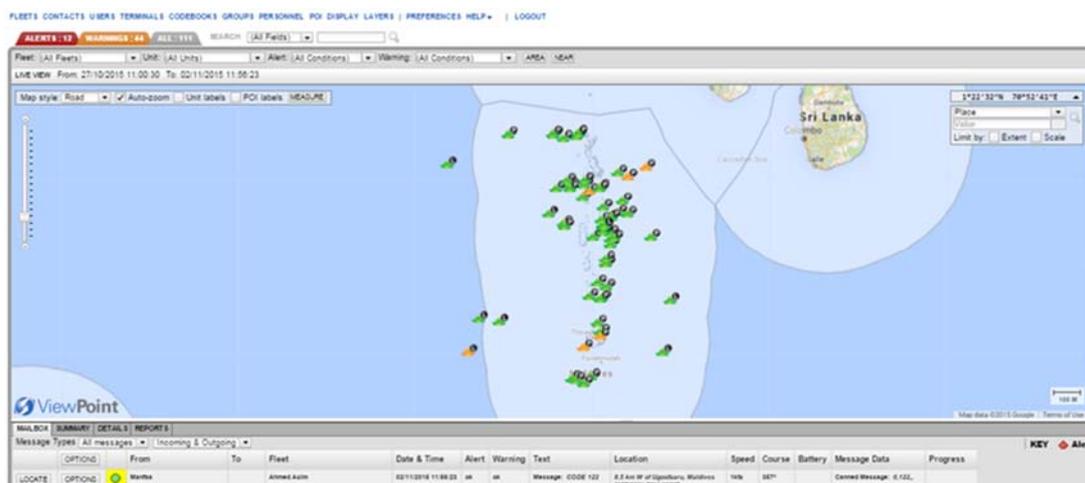


Figure 7. Screen capture of the Maldives VMS System. Currently 149 vessels have VLDs, monitored round the clock by the Fishery Management Division, of the Ministry of Fisheries and Agriculture

6.3. Observer Programme

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 Worldbank funded project has now commenced and electronic observer systems will be installed on licensed fishing vessels on a rotational basis to cover 5% of the total fishing trips as required by the relevant IOTC resolutions. Installation of E-observer systems will start in 2018.

Furthermore, Marine Research Centre conducts regular scientific observation on pole-and-line and handline tuna fishing trips. These observations are consistent with the IOTC observer requirements. To date, observer data has been collected from over 100 fishing trips in 2015 and 2016 and the information collected can be used to verify the logbook data provided by the fishermen.

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, a scientific observer and MRC staff. Data collection by fishermen data collection officers will begin towards the end of 2017. This data collection programme is expected to yield important information on 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. Table 4 provides a summary of the size data for the year 2016.

Table 4: Number of individuals measured, by species and gear for 2016.

Gear	SKJ	YFT	BET	KAW	FRI	Total
PL	19,317	17,398	1,503	1,706	2,805	42,729
HL	0	2,147	0	0	0	2,147
LL	0	38	42	0	0	80
Total	19,317	19,583	1,545	1,706	2,805	44,956

6.5. Unloading/Transshipment

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

7. National research programs

Table 5 provides a summary of the major research program being implemented. They are geared towards improving national reporting and compliance to IOTC conservation and management measures and more recently, towards scientific capacity building in the Maldives.

Two projects that started in 2016 are research on tuna behaviour around Maldives' anchored FAD-array and research on capturing social and economic dimension of the tuna fishery in the coastal states with a view support ongoing resource allocation negotiations in the IOTC. MRC/MoFA staff have been selected as PhD candidates and both have started their work (University of Montpellier, France and University of Dalhousie, Canada, respectively).

Table 5: Summary table for national research programs.

Project title	Period	Countries involved	Budget total	Funding source	Objectives	Short description
Maldives Catch and effort data standardization (extension)	Oct 2017 – Dec 2018	Maldives	US\$ 10,500	IPNLF & Marks & Spencer UK	To continue improving Maldives CPUE work; build technical capacity at MRC/ MoFA	The project aims to continue working on standardization of CPUE series of YFT and SKJ with the aim of contributing to improve stock assessment
FAD Research in the Maldives - Using Maldives Anchored Fish Aggregating Devices as Research Platforms	36 months, (starting date: October 2016)	Maldives, France (French IRD) UK	US\$ 500,000	IPNLF, Marks & Spencer (UK), MARBEC (IRD, France). MRC/MoFA	Understanding dwell time of associated fish around Maldives FAD array; Using flux of fish within FAD array attempt obtain fishery-independent estimate of CPUE; understand local vs. IO-wide management	Research is linked to PhD (staff of MRC/MoFA). The PhD is being supervised by academicians at MARBEC/IRD. The student is registered in University of Montpellier.
Development of Fishery Information System (FIS) web-enabled database	2012-2018	Maldives	US\$ 125,000	IPNLF and its members	To develop an integrated database and supporting infrastructure for electronic logbook systems.	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.

						A trial on use of notepads for electronic recording of logbook is ongoing.
Bycatch sampling Programme	2014-2018	Maldives	US\$ 100,000	IPNLF and its members	To observe and sample bycatch in pole-and-line and handline fishery	Observers take part on regular fishing trips to observe and measure the total catch, 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.
Strengthening the Port Sampling Programme	2017-2022	Maldives	US\$ 330,000	–WB Project: “Sustainable Fishery Development Project”	To increase the size sampling effort in the Maldives. Observe landings and strengthen data capture.	A total of 16 samplers are employed in 3 major landings sites and on fishing vessel (by supporting fishermen-field officers who are active fishermen on vessels). The target is also to capture small-scale fishery targeting neritics.
Understanding socio-economic dimension in tuna fisheries of the coastal states in the context of IOTC rights-based management and allocation issues	2017-2012	Maldives	US\$ 150,000	IPNLF and its members	To conduct research on ways of objectively capturing social and economic dimension with a view of supporting the ongoing IOTC allocation work	A Maldivian candidate (staff of MoFA) has been registered at University of Dalhouse for a PhD Program.

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

The Table 6 below summarises the progress Maldives has made to recommendations of the Scientific Committee and Specific Resolutions relevant to the work of the Scientific Committee.

Table 6: Summary response on the progress made to recommendation of the SC and specific Resolutions relevant to the work of the Scientific Committee.

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. A new web-enabled

Res. No.	Resolution	Scientific requirement	CPC progress
			<p>database to compile the data in new format is complete and came into operation in 2016.</p> <p>An electronic catch reporting tool (mobile application) is now being trialled and is expected to be fully rolled out next year. It is expected that catch reporting will be made mandatory for all licensed fishing vessels through this application in the future.</p>
15/02	Mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties	Paragraphs 1- 7	<p>Maldives has been regularly providing total catch/effort and size data for the stock assessment work of the working party meetings. Maldives submitted the 2016 catch and effort data on 23rd July 2017. Size frequency data and longline data were submitted by June 30, 2016.</p> <p>An electronic catch reporting tool (mobile application) is now being trialled and is expected to be fully rolled out next year. It is expected that catch reporting will be made mandatory for all licensed fishing vessels through this application in the future.</p>
15/05	On the conservation for striped marlin, black marlin and blue marlin	Paragraph 4	<p>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 which are reported through the logbooks.</p> <p>Logbook for the PL/HL has provisions to record billfishes which may be caught as bycatch in the fisheries. There is ongoing effort at MoFA to improve the fishery statistics of billfishes.</p>
13/04	On the conservation of cetaceans	Paragraphs 7– 9	<p>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 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.</p>
13/05	On the conservation of whale sharks (<i>Rhincodon typus</i>)	Paragraphs 7– 9	<p>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 their operations are unlikely to interact with whale sharks. Logbooks for all fisheries have provisions to record encounters if any. An observer scheme is now in place to verify any such interactions.</p>
13/06	On a scientific and management framework on the conservation of shark species caught in association with IOTC managed fisheries	Paragraphs 5-6	<p>All species of sharks are protected in the Maldives and actively targeting sharks inside Maldivian waters is prohibited.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>Under the recently formulated shark NPOA, review and analysis of longline bycatch is given a priority. LL shark</p>

Res. No.	Resolution	Scientific requirement	CPC progress
			bycatch data for the previous year 2015 was 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.
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	<p>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 Worldbank funded project is now being implemented and installations of E-observer systems will begin in 2018.</p> <p>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.</p>
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 100 miles and beyond. The Regulation on Longline Fishing requires shark by-catch to be released alive if possible and landed otherwise to an inspection port.

9. References

- Adam, M.S., A.R. Jauharee and K. Miller (2015). Review of Yellowfin Tuna Fisheries in the Maldives, Paper submitted to IOTC Working Party on Tropical Tunas (IOTC-2015-WPTT-17-17), October 23-29, 2015, Montpellier, France, 15pp.
- Adam, M.S. A.R. Jauharee, and M. Ahusan (2014). Notes on Yellowfin/Bigeye Tuna Ratio and Size Distribution in the Maldivian Tuna Fishery. Paper submitted to WPPT16, IOTC–2014–WPTT16–26. 11 pp.

- Adam, M.S., H. Sinan, S. Rasheed, R. Abdulla (2012). Notes of the presence of 'Other Marine Fish' in the Maldives Pole-and-line catch. Paper submitted to 14th Session of the Working Party on Tropical Tuna, Mauritius, 24-29 October 2012, IOTC-2012-WPTT14-INF04. 13 pp.
- Adam, M.S and A.R Jauharee (2009). Handline yellowfin tuna fishery of the Maldives. Working paper submitted to WPTT 2009, Mombasa, Kenya. 14 pp.
- Ahusan, M., I. Nadhee, and M Shiham Adam (2016). Length Distribution of Yellowfin Tuna from the Maldives Pole-and-line and Handline Tuna, Paper submitted to IOTC-WPTT18, October 4-10, Seychelles. 6 pp.
- Ahusan, M & M. S. Adam (2015). Further Investigations into the decline in neritic tuna (*Euthynnus affinis* and *Auxis thazard*) catches from 2010 to 2013 in the Maldives. Paper presented at the 5th Working Party on Neritic Tunas. IOTC-2015-WPNT05-11. May 26-29, 2015. Zanzibar, Tanzania. 6 pp.
- Ahusan, M & M. S. Adam (2011a). Kawakawa (*Euthynnus affinis*) fishery in Maldives. Paper presented at the 1st Working Party on Neritic Tunas Meeting. IOTC-2011-WPNT-01. November, 14th – 16th, 2011. Chennai, India. 10 pp.
- Ahusan, M & M. S. Adam. (2011b). Frigate tuna (*Auxisthazard*) fishery in Maldives. Paper presented at the 1st Working Party on Neritic Tunas Meeting. IOTC-2011-WPNT-01. November, 14th – 16th, 2011. Chennai. 10 pp.
- Ali, K (2016). Status of the Shark Fishery Ban in the Maldives and the Implementation of the National Plan of Action on Sharks - An Update with Notes on Turtles and Seabirds. Paper submitted to ITOC-WPEB12-2016, September 12-16, Seychelles. 15 pp.
- Ali, K and Shimal, M. (2016). Review of the Status of Marine Turtles in the Maldives. Marine Research Centre. Ministry of Fisheries and Agriculture, Male', Rep. of Maldives. 27 pp.
- Kolody, D & Adam, M.S. 2011. Maldives Skipjack Pole and Line Fishery Catch Rate Standardization 2004 – 2010. Thirteenth Session of the Indian Ocean Tuna Commission Working Party on Tropical Tunas.
- Miller, K, Nadheeh I, Jauharee AR, Anderson RC, Adam MS (2017) Bycatch in the Maldivian pole-and-line tuna fishery. PLoS ONE 12(5): e0177391. <https://doi.org/10.1371/journal.pone.0177391>
- Miller, K, R. Jauharee, I. Nadheeh, and M. Shiham Adam (2016). Interactions with Endangered, Threatened and Protected (ETP) species in the Maldivian pole-and-line tuna fishery, IPNLF Technical Report #7. IPNLF, London. 28 pp.
- Sharma, R, Geehan, and M. S. Adam (2014). Maldives skipjack pole and line fishery catch rate standardization 2004–2012: Reconstructing historic CPUE until 1985. Working Paper submitted to WOPTT16, Bali, Indonesia, IOTC-2014-WPTT16-42. 33 pp.
- National Bureau of Statistics. 2017. GDP Revision – October 2016. Website: <http://statisticsmaldives.gov.mv/gdp-revision-october-2016/>. Accessed, October 4, 2017.

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