DRAFT: EXECUTIVE SUMMARY: MARINE TURTLES

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
iotc ctoi

Status of marine turtles in the Indian Ocean

TABLE 1. Marine turtles: IUCN threat status for all marine turtle species reported as caught in fisheries within the IOTC area of competence

Common name	Scientific name	IUCN threat status[1]
Flatback turtle	*Natator depressus*	Data deficient
Green turtle	*Chelonia mydas*	Endangered
Hawksbill turtle	*Eretmochelys imbricata*	Critically Endangered
Leatherback turtle	*Dermochelys coriacea*	Vulnerable
Loggerhead turtle	*Caretta caretta*	Endangered
Olive Ridley turtle	*Lepidochelys olivacea*	Vulnerable

Sources: Marine Turtle Specialist Group 1996, Red List Standards & Petitions Subcommittee 1996, Sarti Martinez (Marine Turtle Specialist Group) 2000, Seminoff 2004, Abreu-Grobois & Plotkin 2008, Mortimer et al. 2008, IUCN 2014

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No assessment has been undertaken by the IOTC WPEB for marine turtles due to the lack of data being submitted by CPCs. However, the current International Union for Conservation of Nature (IUCN) threat status for each of the marine turtle species reported as caught in IOTC fisheries to date is provided in Table 1. It is important to note that a number of international global environmental accords (e.g. Convention on Migratory Species (CMS), Convention on Biological Diversity (CBD)), as well as numerous fisheries agreements obligate States to provide protection for these species. While the status of marine turtles is affected by a range of factors such as degradation of nesting beaches and targeted harvesting of eggs and turtles, the level of mortality of marine turtles due to capture by gillnets is likely to be substantial as shown by the Ecological Risk Assessment undertaken in 2012/13, and an order of magnitude higher than longline and purse seine gears for which mitigation measures are in place.

Outlook. Resolution 12/04 *On the conservation of marine turtles* includes an annual evaluation requirement (para. 17) by the Scientific Committee. However, given the lack of reporting of marine turtle interactions by CPCs to date, such an evaluation cannot not be undertaken. Unless IOTC CPCs become compliant with the data collection and reporting requirements for marine turtles, the WPEB and the SC will continue to be unable to address this issue. Notwithstanding this, it is acknowledged that the impact on marine turtle populations from fishing for tuna and tuna-like species may increase if fishing pressure increases, or if the status of the marine turtle populations worsens due to other factors such as an increase in fishing pressure from other fisheries or anthropological or climatic impacts. The following should be noted:

- The available evidence indicates considerable risk to marine turtles in the Indian Ocean.
- The primary source of data that drive the ability of the WPEB to determination a status for the Indian Ocean, total interactions by fishing vessels, is highly uncertain and should be addressed as a matter of priority.
- Current reported interactions are known to be a severe underestimate: 39 interactions reported in 2010 by 3 CPCs.
- The Ecological Risk Assessment conducted by Nel et al. (2013) concluded that, from the limited data received on longlining and purse seining, the former posed the greater apparent risk to marine turtles. The ERA estimated that ~3,500 marine turtles are caught by longliners annually, followed by ~250 turtles p.a. in purse seine operations. Two separate approaches to estimate gillnet impacts on marine turtles, based on very limited data, calculated that 52,425 turtles p.a. or 11,400–47,500 turtles p.a. are caught in gillnets (with a mean of the two methods being 29,488 turtles p.a.). Anecdotal/published studies reported values of >5000–16,000 marine turtles p.a. for each of India, Sri Lanka and Madagascar. Of these reports, green turtles are under the greatest pressure from gillnet fishing, constituting 50–88% of catches for

[1] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

Madagascar. Loggerhead, hawksbill and olive Ridley turtles are caught in varying proportions depending on the region.

- Maintaining or increasing fishing effort in the Indian Ocean without appropriate mitigation measures in place, will likely result in further declines in biomass.
- That appropriate mechanisms are developed by the Compliance Committee to ensure CPCs comply with their data collection and reporting requirements for marine turtles.

APPENDIX I

SUPPORTING INFORMATION

(Information collated from reports of the Working Party on Ecosystems and Bycatch and other sources as cited)

CONSERVATION AND MANAGEMENT MEASURES

Marine turtles in the Indian Ocean are currently subject to a number of Conservation and Management Measures adopted by the Commission:

- Resolution 13/03 on the recording of catch and effort by fishing vessels in the IOTC area of competence
- Resolution 12/04 *On the conservation of marine turtles* recognizes the threatened status of the populations of the six marine turtle species found in the Indian Ocean and that some tuna fishing operations carried out in the Indian Ocean can adversely impact marine turtles. This resolution makes mandatory the collection and provision of data on marine turtle interactions and the use of best handling practices to ensure the best chances of survival for any marine turtles returned to the sea after capture.
- Resolution 11/04 *on a Regional Observer Scheme* requires data on marine turtle interactions to be recorded by observers and reported to the IOTC within 150 days. The Regional Observer Scheme (ROS) started on 1st July 2010, and aims to collect scientific observer data on catch and bycatch on, at least, 5% of the fishing operations of vessel over 24 m and vessel under 24 m fishing outside their EEZ. The requirement under Resolution 11/04 in conjunction with the reporting requirements under Resolution 12/04, means that all CPCs should be reporting marine turtle interactions as part of their annual report to the Scientific Committee.

Extracts from Resolutions 11/04 and 12//04

RESOLUTION 11/04 ON A REGIONAL OBSERVER SCHEME

Para. 10. Observers shall:

b) Observe and estimate catches as far as possible with a view to identifying catch composition and monitoring discards, by-catches and size frequency;

RESOLUTION 12/04 ON MARINE TURTLES

Para. 3. CPCs shall collect (including through logbooks and observer programs) and provide to the IOTC Secretariat no later than 30 June of the following year in accordance with Resolution 10/02 (or any subsequent revision), all data on their vessels' interactions with marine turtles. The data shall include the level of logbook or observer coverage and an estimation of total mortality of marine turtles incidentally caught in their fisheries.

Para. 7. CPCs with gillnet vessels that fish for species covered by the IOTC Agreement shall:

a) require that operators of such vessels record all incidents involving marine turtles during fishing operations in their logbooks[1] and report such incidents to the appropriate authorities of the CPC.

Para. 8. CPCs with longline vessels that fish for species covered by the IOTC Agreement shall:

…

c) require that operators of such vessels record all incidents involving marine turtles during fishing operations in their logbooks[1] and report such incidents to the appropriate authorities of the CPC

Para. 9. CPCs with purse seine vessels that fish for species covered by the IOTC Agreement shall:

…

c) require that operators of such vessels record all incidents involving marine turtles during fishing operations in their logbooks[1] and report such incidents to the appropriate authorities of the CPC

[1] This information should include where possible, details on species, location of capture, conditions, actions taken on board and location of release.

INDICATORS

Biology and ecology

Six species of marine turtles inhabit the Indian Ocean and likely interact with the fisheries for tuna and tuna-like species. The following section outlines some key aspects of their biology, distribution and historical exploitation.

Flatback turtle

The flatback turtle (*Natator depressus*) gets its name from its relatively flat, smooth shell, unlike other marine turtles which have a high domed shell. Flatback turtles have the smallest migratory range of any marine turtle species and this restricted range means that the flatback turtle is vulnerable to habitat loss, especially breeding sites. Table 2 outlines some of the key life history traits of flatback turtles.

TABLE 2. Biology of the flatback turtle (*Natator depressus*)

Parameter	Description
Range and stock structure	Flatback turtles are found in northern coastal areas, from Western Australia's Kimberley region to the Torres Strait extending as far south as the Tropic of Capricorn. Feeding grounds also extend to the Indonesian Archipelago and the Papua New Guinea Coast. Flatback turtles have the smallest migratory range of any marine turtle species, though they do make long reproductive migrations of up to 1300 km. Although flatback turtles do occur in open seas, they are common in inshore waters and bays where they feed on the soft-bottomed seabed.It is carnivorous, feeding mostly on soft-bodied prey such as sea cucumbers, soft corals, jellyfish, molluscs and prawns.
Longevity	unknown
Maturity (50%)	unknown
Spawning season	Many females nest every 1 to 5 years, one to four times a season (mean = 2.8), laying clutches of between 50 and 60 eggs. The flatback turtle nests exclusively along the northern coast of Australia.
Size (length and weight)	The flatback turtle is a medium-sized marine turtle, growing to up to one meter long and weighing up to 90 kg.

Sources: Mortimer 1984, FAO 1990; Limpus 2007

Green turtle

The green turtle (*Chelonia mydas*) is the largest of all the hard-shelled marine turtles and is one of the most widely distributed and commonest of the marine turtle species in the Indian Ocean. The Indian Ocean hosts some of the largest nesting populations of green turtles in the world, particularly on oceanic islands in the southwest Indian Ocean and on islands in South East Asia. Many of these populations are now recovering after intense exploitation in the last century greatly reduced the populations; some populations are still declining.

During the 19th and 20th centuries intense exploitation of green turtles provided onboard red meat for sustained cruises of sailing vessels before the time of refrigeration, as well as meat and calipee (i.e. yellow glutinous/cartilage part of the turtle found next to the lower shell) for an international market. Several nesting populations in the Indian Ocean were devastated as a result. Table 3 outlines some of the key life history traits of green turtles.

TABLE 3. Biology of the green turtle (*Chelonia mydas*)

Parameter	Description
Range and stock structure	Globally distributed and generally found in tropical and subtropical waters along continental coasts and islands between 30°N and 30°S. Green turtles primarily use three types of habitat: open beaches (for nesting), convergence zones in the open ocean (oceanic stage juveniles), and benthic feeding grounds in coastal areas (neritic stage juveniles and adults). Adults migrate from foraging areas to mainland or island nesting beaches and may travel hundreds or thousands of kilometers each way. After emerging from the nest, hatchlings swim offshore, where they are believed to caught up in major oceanic current systems and live for several years, feeding close to the surface on a variety of pelagic plants and animals. Once the juveniles reach a certain age/size range, they leave the pelagic habitat and travel to nearshore foraging grounds. Adult green turtles are unique among marine turtles in that they are herbivorous, feeding on seagrasses and algae.
Longevity	unknown
Maturity (50%)	Exact age is unknown, it is believed that sexual maturity is reached between 25 and 30+ years
Spawning season	Females return to their natal beaches (i.e. the same beaches where they were born) every 2 to 4 years to nest, laying several clutches of about 125 eggs at roughly 14-day intervals several times in a season. Nesting seasons can change throughout the year (i.e. winter vs summer) according to the nesting site locations in the Indian Ocean.
Size (length and weight)	The largest of all the hard-shelled marine turtles, growing up to 1.2 m long and weighing 130–160 kg.

Sources: Mortimer 1984, FAO 1990, Dalleau et al. 2012

Hawksbill turtle

The hawksbill turtle (*Eretmochelys imbricata*) is small to medium-sized compared to other marine turtle species and is although generally not found in large concentrations, are widely distributed in the Indian Ocean. The keratinous (horn-like) scutes of the hawksbill are known as "tortoise shell," and they were sought after for manufacture of diverse articles in both the Orient and Europe. In modern times hawksbill turtles are solitary nesters (although some scientists postulate that before their populations were devastated they may have nested on some beaches in concentrations) and thus, determining population trends or estimates on nesting beaches is difficult. Decades long protection programs in some places, particularly at several beaches in the Indian Ocean, have resulted in population recovery. Table 4 outlines some of the key life history traits of hawksbill turtles.

TABLE 4. Biology of the hawksbill turtle (*Eretmochelys imbricata*)

Parameter	Description
Range and stock structure	Circumtropical, typically occurring from 30°N to 30°S latitude. Adult hawksbill turtles are capable of migrating long distances between nesting beaches and foraging areas, which are generally shorter to migrations of green and loggerhead turtles. Hawksbill turtles use different habitats at different stages of their life cycle, but are most commonly associated with coral reefs. Post-hatchlings (oceanic stage juveniles) are believed to occupy the pelagic environment. After a few years in the pelagic zone, small juveniles recruit to coastal foraging grounds. This shift in habitat also involves a shift in feeding strategies, from feeding primarily at the surface to feeding below the surface primarily on animals associated with coral reef environments. Their narrow, pointed beaks allow them to prey selectively on soft-bodied animals like sponges and soft corals.
Longevity	unknown
Maturity (50%)	unknown
Spawning season	Female hawksbill turtles return to their natal beaches every 2–3 years to nest. A female may lay 3-5, or more, nests in a season, which contain an average of 130 eggs. The largest nesting populations of hawksbill turtles in or around the Indian Ocean (which are among the largest in the world) occur in the Seychelles, Indonesia and Australia. Nesting generally takes place during the warmest months of the year.
Size (length and weight)	In the Indian Ocean, adults weigh 45 to 70 kg, but can grow to as large as 90 kg.

Sources: Mortimer 1984, FAO 1990

Leatherback turtle

The leatherback turtle (*Dermochelys coriacea*) is the largest turtle and the most widely distributed living reptile in the world. The leatherback turtle is the only marine turtle that lacks a hard shell: there are no large external keratinous scutes and the underlying bony shell is composed of a mosaic of hundreds of tiny bones. Table 5 outlines some of the key life history traits of leatherback turtles.

TABLE 5. Biology of the leatherback turtle (*Dermochelys coriacea*)

Parameter	Description
Range and stock structure	The leatherback turtle is the most wide ranging marine turtle species, and regularly migrates enormous distances, e.g. between the Indian and south Atlantic Oceans. They are commonly found in pelagic areas, but they also forage in coastal waters in certain areas. The distribution and developmental habitats of juvenile leatherback turtles are poorly understood. While the leatherback turtle is not as common in the Indian Ocean as other species, important nesting populations are found in and around the Indian Ocean, including in Indonesia, South Africa, South Mozambique, Sri Lanka and India's Andaman and Nicobar Islands. Adults are capable of tolerating water temperatures well below tropical and subtropical conditions, and special physiological adaptations allow them to maintain body temperature above cool water temperatures. They specialise on soft bodied invertebrates found in the water column, particularly jelly fish and other sorts of "jellies."
Longevity	unknown
Maturity (50%)	Exact age is unknown, it is believed that sexual maturity is reached at around 15 years
Spawning season	Females lay clutches of approximately 100 eggs on sandy, tropical beaches. They nest 6–8 times during a nesting season.
Size (length and weight)	Mature males and females can grow to 2 m and weigh almost 900 kg.

Sources: FAO 1990, Nel 2012

Loggerhead turtle

The loggerhead turtle (*Caretta caretta*) is globally distributed and the species is known to be heavily impacted by longline fisheries worldwide. The hatchlings and juveniles are pelagic, living in the open ocean and have the ability to undertake long trans-hemispheric migrations from the south to the north Indian Ocean. Adults forage in coastal areas or near shallow sea mounts. Key nesting sites in the Indian Ocean are found in Oman, South Africa and West Australia. Table 6 outlines some of the key life history traits of loggerhead turtles.

TABLE 6. Biology of the loggerhead turtle (*Caretta caretta*)

Parameter	Description
Range and stock structure	Circumglobal, occurring throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. Studies in the Atlantic and Pacific Oceans show that loggerhead turtles can spend decades living on the high seas, crossing from one side of an ocean basin to another before taking up residence on benthic coastal waters. Adults are capable of migrating long distances between nesting beaches and foraging areas and late stage juveniles have also been shown to undertake extensive migrations. Their enormous heads and powerful jaws enable them to crush large marine molluscs, on which they specialise.
Longevity	unknown
Maturity (50%)	Exact age is unknown, it is believed that sexual maturity is reached between 12 and 30 years. Age at maturity was estimated at 21.6 years in Tongaland, South Africa, through tagging studies.
Spawning season	Many females nest every 2 to 3 year, three to four times a season, laying clutches of approximately 40 to 190 eggs. Loggerhead turtles nest in relatively few countries in the Indian Ocean and the number of nesting females is generally small, except on Masirah Island (Sultanate of Oman) which supports one of only two loggerhead turtles nesting beaches in the world that have greater than 10,000 females nesting per year.
Size (length and weight)	Mature males and females may grow to over one meter long and weigh around 110 kg or more.

Sources: FAO 1990, Lewison et al., 2004, Dalleau et al. 2013, Hamann et al. 2013

Olive Ridley turtle

The olive Ridley turtle (*Lepidochelys olivacea*) is considered the most abundant marine turtle in the world, with an estimated 800,000 nesting females annually. The olive Ridley turtle has one of the most extraordinary nesting habits in the natural world. Large groups of turtles gather off shore of nesting beaches. Then, all at once, vast numbers of turtles come ashore and nest in what is known as an "arribada". During these arribadas, hundreds to thousands of females come ashore to lay their eggs. In the northern Indian Ocean, arribadas occur on three different beaches along the coast of Orissa, India. Gahirmatha used to be one of the largest arribada nesting sites in the world. However, arribada nesting events have been less frequent there in recent years and the average size of nesting females has been smaller, indicative of a declining population. Declines in solitary nesting of olive Ridley turtles have been recorded in Bangladesh, Myanmar, Malaysia, and Pakistan. In particular, the number of nests in Terengganu, Malaysia has declined from thousands of nests to just a few dozen per year. Solitary nesting also occurs extensively throughout this species' range. Despite the enormous numbers of olive Ridley turtles that nest in Orissa, this species is not generally common throughout much of the Indian Ocean. Table 7 outlines some of the key life history traits of olive Ridley turtles.

TABLE 7. Biology of the olive Ridley turtle (*Lepidochelys olivacea*)

Parameter	Description
Range and stock structure	The olive Ridley turtle is globally distributed in the tropical regions of the South Atlantic, Pacific, and Indian Oceans. It is mainly a pelagic species, but it has been known to inhabit coastal areas, including bays and estuaries. Olive Ridley turtles often migrate great distances between feeding and breeding grounds. They have an annual migration from pelagic foraging, to coastal breeding and nesting grounds, back to pelagic foraging. They can dive to depths of about 150 m to forage.
Longevity	unknown
Maturity (50%)	Reach sexual maturity in around 15 years, a young age compared to some other marine turtle species.
Spawning season	Many females nest every year, once or twice a season, laying clutches of approximately 100 eggs. Arribadas occur at the beginning of each year in Indian, from January to March.
Size (length and weight)	Adults are relatively small, weighing on average around 45 kg. As with other species of marine turtles, their size and morphology varies from region to region.

Sources: Mortimer 1984, FAO 1990

Availability of information on the interactions between marine turtles and fisheries for tuna and tuna-like species in the Indian Ocean

The IOTC has implemented data collection measures using onboard observers to better understand the nature and extent of the interactions between fisheries for tuna and tuna-like species in the Indian Ocean and marine turtles. Subsequently, IOTC members have implemented a number of national observer programmes that are providing information on the levels of marine turtle bycatch. Observer data from all fleets and gears remains very low with only Australia, China, the EU, Japan, the Republic of Korea and South Africa reporting levels of marine turtle interactions to date (Table 8). Data from other sources and in other regions indicate that threats to marine turtles are highest from gillnets and longline gear, and to a lesser extent purse-seine gear.

TABLE 8. Members and Cooperating non-Contracting Parties reporting of marine turtle interactions for the years 2008–2013 to the IOTC.

CPCs		2008	2009	2010	2011	2012	2013	Remarks
Australia		4	7	1	0	0	0	Nil interaction reported.
Belize		0	0	0				Interactions not reported 2011-2013. No observer deployment.
China				0	0	0	0	Nil interaction reported. No observer deployment.
Taiwan,China		32	84	4	4	14	7	Non-raised observer data
Comoros								
European Union*	LL			7	25	15	15	For longline fleets: EU,France: 8, EU,Portugal: 7,
	PS	250 (SD=157)	250 (SD=157)	250 (SD=157)	250 (SD=157)	50	47	Average number of interactions estimated annually from observer data for the European and French(OT) purse seine fleets. On average, 77% of the marine turtle are released alive.
Eritrea								
Guinea								
India								
Indonesia		51 & 71						51 & 71 turtles caught between 2005 and 2012 during 2 observers programs (non-raised observer data)
Iran, Islamic Republic of					2	24		Non-raised observer data
Japan				14		0	2	Non-raised observer data (21 observed trips, 2010-2014)
Kenya								
Korea, Republic of			36	0		0	1	Non-raised observer data
Madagascar								
Malaysia						0		Nil interaction reported
Maldives, Republic of				0	0	0	93	
Mauritius						0		Nil interaction reported
Mozambique						0		Nil interaction reported
Oman, Sultanate of								
Pakistan								
Philippines		0	0	0		0		Nil interaction reported
Seychelles								
Sierra Leone								
Somalia								
Sri Lanka							25[2]	Non-raised sample data
Sudan								
Tanzania								
Thailand								
United Kingdom (OT)								No active fleet
Vanuatu				0				
Yemen								
Cooperating Non-Contracting Parties								

[2] IOTC-2014-WPEB10-27

Djibouti							
Senegal							No activity since 2007
South Africa	15	13	24	14	4	95	Includes data on foreign fleets

Green = CPC reported level of marine turtle interactions; Red = CPC did not report level marine turtle interactions

Purse seine

European Union observers (covering on average 5% of the operations annually from 2003 to 2007) reported 74 marine turtles caught by EU,France and EU,Spain purse seiners over the period 2003–2007[3]. The most common species reported was olive Ridley, green and hawksbill turtles, and these were mostly caught on log (natural Fish Aggregation Devices – FAD) sets and returned to the sea alive (although there is no systematic information on survivorship after release). Mortality levels of marine turtles due to entanglement in drifting FADs set by the fishery are still unknown and need to be assessed. The EU has indicated that its purse-seine fleet is making progress towards improved FAD designs aimed at reducing the incidence of entanglement of marine turtles, including the use of biodegradable materials. EU,France has indicated that it is already deploying FADs that are likely to reduce the entangled of marine turtles in both the Atlantic and Indian Oceans, while EU,Spain has indicated that it will conduct experiments in the Atlantic Ocean on several FADs designs aimed at reducing the incidence of entanglement of marine turtles, before recommending a final FAD design to replace current FADs. Data collected through observer programs from 1995 to 2011 on purse seine fishing operations suggested that the purse-seine fishery has a low impact on marine turtles with an estimated 240 (SD=157) individuals incidentally captured annually[4]. This study suggested that drifting FADs, considered a critical conservation issue for this fishery, may play a key role in the aggregation of juvenile turtles and could be improved by avoiding entangling devices such as nets. Nevertheless, initial results suggest that this is not the main source of incidental captures of marine turtles in this fishery.

Longline

There is limited information on the interactions of longline fleets in the IOTC with marine turtles and and it is not known if this fishing activity represents a serious threat, as is the case in most other regions of the world.

The South African longline fleets have reported that marine turtle bycatch mainly comprises predominantly leatherback turtles, with lesser amounts of loggerhead, hawksbill and green turtles[5]. Estimated average catch rates of marine turtles ranged from 0.005 to 0.3 marine turtles per 1000 hooks and varied by location, season and year. The highest catch rate reported in one trip was 1.7 marine turtles per 1000 hooks in oceanic waters. Over the period 1997 to 2000, the Programme Palangre Réunionnais[6] examined marine turtle bycatch on 5,885 longline sets in the vicinity of Reunion Island (19-25° S, 48-54° E). The fishery caught 47 leatherback, 30 hawksbill, 16 green and 25 unidentified marine turtles, equating to an average catch rate of less than 0.02 marine turtles per 1000 hooks over the 4 year study period.

The Fishery Survey of India (FSI) carried out a survey covering the whole Indian EEZ using four longline vessels from 2005 to 2009. During this period around 800,000 hooks were deployed in the Arabian Sea, in the Bay of Bengal and in the waters of Andaman and Nicobar. In total 87 marine turtles (79 olive Ridley, 4 green and 2 hawksbill turtles) were caught. Catch rates were: 0.302 marine turtles per 1000 hooks in the Bay of Bengal area, 0.068 marine turtles per 1000 hooks in the Arabian Sea and 0.008 marine turtles per 1000 hooks in the Andaman and Nicobar waters. The highest occurrence of incidental catches in the Bay of Bengal area is probably due to the large abundance of olive Ridley turtles whose main nesting ground in the Indian Ocean is on the east coast of India, in the Orissa region.

Gillnets

Due to the nature of this gear, the incidental catch of marine turtles is thought to be relatively high compared to that of purse-seine and longline gears, however, quantitative data for this gear type are almost non-existent. While the IOTC currently has virtually no information on interactions between marine turtles and gillnets, the IOSEA database indicates that the coastal mesh net fisheries occur in about 90% of IOSEA Signatory States in the Indian Ocean, and the fishery is considered to have a moderate to relatively high impact on marine turtles in about half of those IOSEA member States. Given the widespread abundance of mesh net fisheries in the Indian Ocean, there is clearly an urgent need for careful, systematic information to be collected and report on this gear type and its impacts on marine turtles.

Other data sources

[3] IOTC-2008-WPEB-08
[4] Bourjea et al. 2014
[5] IOTC-2006-WPBy-15
[6] Poisson F. and Taquet M. (2001) L'espadon: de la recherche à l'exploitation durable. Programme palangre réunionnais, rapport final, 248 p. available in the website www.ifremer.fr/drvreunion

The IOTC and the Indian Ocean – South-East Asian Marine Turtle Memorandum of Understanding (IOSEA), an agreement under the Convention on Migratory Species, are actively collecting a range of information on fisheries and marine turtle interactions. The IOSEA database covers information from a wider range of fisheries and gears than those held by the IOTC. The IOSEA Online Reporting Facility[7] compiles information through IOSEA National Reports on potential marine turtle fisheries interactions, as well as various mitigation measures put in place by its Signatory States and collaborating organisations. For example, members provide information on fishing effort and perceived impacts of fisheries that may interact with marine turtles, including longlines, purse seines, FADs, and gillnets. While the information is incomplete for some countries and is generally descriptive rather than quantitative, it has begun to provide a general overview of potential fisheries interactions as well as their extent. No information is available for China, Taiwan,China, Japan, Rep. of Korea (among others) which are not yet signatories to IOSEA. Information is also provided on such mitigation measures as appropriate handling techniques, gear modifications, spatial/temporal closures etc. IOSEA is collecting all of the above information with a view to providing a regional assessment of member States' compliance with the FAO Guidelines on reducing fisheries interactions with marine turtles.

ASSESSMENT

A number of comprehensive assessments of the status of Indian Ocean marine turtles are available, in addition to the IUCN threat status:

- Hawksbill turtle – Marine Turtle Specialist Group 2008 IUCN Red List status assessment[8].
- Loggerhead turtle – 2009 status review under the U.S. endangered species act[9].
- Loggerhead turtle – 2013 Assessment of the conservation status of the loggerhead turtle in the Indian Ocean and South-East Asia. IOSEA Species Assessment: Volume II.
- Leatherback turtle – Assessment of the conservation status of the leatherback turtle in the Indian Ocean and South-East Asia (IOSEA Marine Turtle MoU, 2006)[10].
- Leatherback turtle – 2012 Assessment of the conservation status of the leatherback turtle in the Indian Ocean and South-East Asia – 2012 update. IOSEA Marine Turtle MoU Secretariat report

LITERATURE CITED

Abreu-Grobois A, Plotkin P (IUCN SSC Marine Turtle Specialist Group) (2008) *Lepidochelys olivacea*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Downloaded on 09 November 2012

Bourjea J, Clermont S, Delgado A, Murua H, Ruiz J, Ciccione S, Chavance P (2014) Marine turtle interactions with purse-seine fishery in the Atlantic and Indian Oceans: Lessons for management. Biological Conservation 178: 74-87

Dalleau M, Ciccione S, Mortimer JA, Garnier J, Benhamou S, Bourjea J (2012) Nesting phenology of Marine Turtles: Insights from a Regional Comparative Analysis on Green Turtle (Chelonia mydas). PLoS ONE 7(10): e46920. doi:10.1371/journal.pone.0046920

FAO Species Catalogue (1990) Vol.11: Sea turtles of the world. An annotated and illustrated catalogue of sea turtle species known to date.FAO fisheries synopsis no.125, vol.11. Rome, FAO. 1990. 81p

Hamann M, Kamrowski RL, Bodine T (2013) Assessment of the conservation status of the loggerhead turtle in the Indian Ocean and South-East Asia. IOSEA Species Assessment: Volume II. 64 p

Lewison RL, Freeman SA, Larry B (2004) Quantifying the effects of fisheries on protected species: the impact of pelagic longlines on loggerhead and leatherback sea turtles. Ecology Letter, 7(3): 221–231. DOI: 10.1111/j.1461-0248.2004.00573.x

Limpus CJ (2007) A biological review of Australian marine turtle species. 5. Flatback turtle, *Natator depressus* (Garman). Series: A Biological review of Australian marine turtle species. Vol5. 1-54p

Marine Turtle Specialist Group (1996) *Caretta caretta*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Downloaded on 09 November 2012

Mortimer JA (1984) Marine Turtles in the Republic of the Seychelles: Status and Management. IUCN

Mortimer JA, Donnelly M (IUCN SSC Marine Turtle Specialist Group) (2008) *Eretmochelys imbricata*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Downloaded on 09 November 2012

Nel R (2012) Assessment of the conservation status of the leatherback turtle in the Indian Ocean and South-East Asia – 2012 update. IOSEA Marine Turtle MoU Secretariat report, Bangkok, Thailand. 41 p

[7](www.ioseaturtles.org/report.php)
[8]http://www.iucnredlist.org/documents/attach/8005.pdf
[9]http://www.nmfs.noaa.gov/pr/pdfs/statusreviews/loggerheadturtle2009.pdf
[10]http://www.ioseaturtles.org/content.php?page=Leatherback%20Assessment

Red List Standards & Petitions Subcommittee (1996) *Natator depressus*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Downloaded on 09 November 2012

Sarti Martinez AL (Marine Turtle Specialist Group) (2000) *Dermochelys coriacea*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Downloaded on 09 November 2012

Seminoff JA (Southwest Fisheries Science Center, U.S.) (2004) *Chelonia mydas*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Downloaded on 09 November 2012