



IOTC / IOSEA reports give insights into Indian Ocean fisheries-turtle interactions

Introduction

The Indian Ocean Tuna Commission (IOTC) is the main regional fisheries management organisation mandated to manage tuna and tuna-like species in the Indian Ocean and adjacent seas. While its primary objective is to assure the conservation and optimum utilisation of fish stocks, the IOTC has paid increasing attention in recent years to the impacts of its fisheries on other marine species, such as marine turtles, seabirds and sharks. IOSEA and IOTC have developed a good working relationship, which has included collaboration in the production of regular status reports on marine turtles, the development of turtle ID cards for fishermen and, most recently, co-funding of the production of a region-wide Ecological Risk Assessment (ERA) for marine turtles.

Membership of IOTC is open to coastal countries and to countries or regional economic integration organisations that are fishing for tuna in the Indian Ocean. There is a substantial overlap in the respective memberships of IOTC and IOSEA. Indeed, twenty-three of the 31 IOTC Contracting Parties and two Cooperating Non-Contracting Parties (collectively known as CPCs) are also signatories to IOSEA. Many are also members of the Convention on Migratory Species, the parent organisation of IOSEA. This might help to explain, in part, why IOTC has been receptive to substantive discussions about fisheries interactions with non-target migratory species.

The annual meeting of the IOTC Scientific Committee includes on its agenda a presentation and review of national reports submitted by CPCs.¹ These reports cover such topics as: background/general fishery information, fleet structure, catch and effort by species and gear, recreational fishery, ecosystem and bycatch issues, national data collection and processing systems, national research programmes, and implementation of IOTC recommendations and resolutions relevant to the Scientific Committee.

These reports are a rich source of information on fisheries potentially interacting with marine turtles in the Indian Ocean, as well as on monitoring programmes and bycatch mitigation measures that may have been implemented by IOTC members. They include, for example, data on the size and coverage of longline and purse seine fleets, as well as trends in fishing effort and shifts in the geographic distribution of fishing fleets. Such information could eventually be useful in helping to identify areas where marine turtles may be more or less prone to interactions with fisheries. The reports also contain information that may be used to assess the extent of compliance with various IOTC resolutions and recommendations pertaining to mitigation of marine turtle bycatch.

Incidentally, the reports also contain some data on the incidence of turtle bycatch, however this aspect is generally incomplete and based on very limited observation and reporting. Indeed, the IOTC Scientific Committee has expressed concern in the past “that the lack of data from Contracting Parties and cooperating non-contracting Parties (CPCs) on the interactions and mortality of marine turtles from fisheries under the mandate of the IOTC undermines the ability to estimate levels of turtle bycatch and consequently IOTC’s capacity to respond and manage adverse effects of fishing on marine turtles”.

Until now, the IOTC national reports have never been analysed systematically from the standpoint of assessing their potential contribution to the understanding of marine turtle bycatch in the Indian Ocean and of the efficacy of bycatch mitigation measures undertaken by IOTC members. The following analysis does just that, by compiling and summarising information from all of the national reports submitted to the 15th Scientific Committee meeting held in Seychelles in December 2012.

IOTC frame of reference for mitigation of marine turtle bycatch

IOTC Resolution 12/04 (adopted in April 2012) requires IOTC Contracting Parties and Cooperating non-Contracting Parties to take various measures in order to mitigate the impact of their

¹ Available at: http://www.iotc.org/English/meetings/sc/doc_meeting_SC15.php. The designation of geographical entities in this report does not imply the expression of any opinion concerning the legal status of any country, territory or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

fisheries on the six species of marine turtles that are present in the Indian Ocean. The requirements of CPCs with regard to fishing vessels registered on the IOTC Record of Fishing Vessels can be summarised as follows:

- To require fishermen to bring aboard, if practicable, any captured marine turtle that is comatose or inactive, and foster its recovery before safely returning it to the water; and to release marine turtles observed entangled in fishing gear;
- To ensure that fishermen are aware of and use proper mitigation, identification, handling and de-hooking techniques and keep on board all necessary equipment for the release of marine turtles. More specifically, CPCs are to ensure that longline vessel operators carry line-cutters and de-hookers; that purse seine vessel operators avoid encirclement of marine turtles and use dip nets to handle them; and they are encouraged to adopt designs for Fish Aggregating Devices (FADs) that reduce the incidence of entanglement of marine turtles; and
- To collect, and provide to the IOTC Secretariat, all data on their vessels' interactions with marine turtles, through the use of a logbook system and an observer programme.

CPCs are also requested to undertake research trials with a view to improving mitigation methods in several areas that have shown potential (e.g. use of circle hooks and whole finfish bait, alternative gear design and handling techniques) and to report the results of these trials to the Scientific Committee. Furthermore, CPCs are encouraged to collaborate with IOSEA, to apply the *FAO Guidelines to Reduce Sea Turtle Mortality in Fishing Operations*, and to support developing countries in their implementation of these guidelines.

In fact, the provisions of Resolution 12/04 are broadly shared by its predecessor from 2009, Resolution 09/06, with the introduction of some additional elements. For instance, the new resolution clarifies that it applies to all fishing vessels on the IOTC Record of Fishing Vessels, and reinforces the need for CPCs to report annually to the IOTC Secretariat all interactions and mortality of marine turtles in fisheries under the IOTC mandate. As noted above, the latest resolution also calls for the development of improved FAD designs to reduce the incidence of entanglement of marine turtles; and its provisions on safe handling of accidentally captured marine turtles now apply to all species, not only hard shelled turtles. Similarly, IOTC Recommendation 05/08, dating back to 2005, also included specific guidelines in relation to safe handling, purse seine and longline operations, and data collection.

Thus, while it might seem reasonable to excuse IOTC CPCs for any incompleteness in their reports submitted in December 2012 – given that much of their content relates to a resolution adopted earlier that same year – CPCs have in fact been encouraged to improve and report on their implementation of marine turtle bycatch mitigation measures as long ago as 2005.

Methodology

Available 2012 IOTC national reports were reviewed in order to identify actions taken so far by CPCs in accordance with IOTC Resolution 12/04, regarding marine turtle interactions with tuna fisheries operating in the IOTC convention area. In total, 24 reports were reviewed, corresponding to all IOTC CPCs, except: Eritrea, Guinea, Pakistan, Sierra Leone, United Republic of Tanzania, Vanuatu and Yemen, which did not submit a report to the IOTC Secretariat; Belize and Sudan, whose submitted reports were not available on the IOTC website; and Senegal, which has not conducted any fishing activities in the IOTC area of competence since 2007. Incidentally, the reports of Comoros and Philippines were found to provide very little information regarding their implementation of the provisions of IOTC Resolution 12/04.

All of the relevant information gleaned from the IOTC national reports is summarised in a large Excel spreadsheet (Annex 1: available online at http://ioseaturtles.org/pom_detail.php?id=127). In due course, consideration may be given to transforming the contents of the spreadsheet into an online database, to make it easier to search for particular topics of interest.

Supplementary information from IOSEA national reports submitted to the IOSEA Secretariat by countries that are members of both IOSEA and the IOTC has allowed for further enrichment of the analysis. For instance, IOSEA reports often provide complementary information concerning small-scale fisheries operating in the IOTC convention area but not targeting tuna, such as shrimp trawling and pole-and-line fisheries; occurrence of illegal fishing; subjective assessments of the degree of

interaction of each fishery with marine turtles; details of results of ongoing research trials; eventual use, monitoring and recovery of FADs; details of existing net retention and recycling schemes; and national regulations on spatial and temporal control of fishing etc. This complementary information is mentioned in various places in the text, and is summarised for each country in Annex 2.

I. Fleet structure and trends in fishing effort

Out of the 24 reports reviewed, 21 CPCs reported having a longline fishery operating in the IOTC area. It is not possible, from the limited information currently available, to draw any conclusion about the overall impact of this fishery on marine turtles in the Indian Ocean. However, a report by Varghese et al (2010) submitted to the IOTC Working Party on Ecosystems and Bycatch in 2010 is particularly informative in its description of the impact on marine turtles of the longline fishery in Indian waters.

As far as purse seine is concerned, this gear type is reportedly used in nine CPCs. This fishing technique could have a direct as well as an indirect impact on marine turtles, since it is often used in combination with FADs. These can entangle turtles if they are not designed with “turtle-friendly” configuration and materials. A recent study based on a long-term dataset indicates that the rate of turtle mortality in the EU Indian Ocean purse seine fishery is actually rather low. However, that study did not consider FADs that are not observed, lost or abandoned, and which may go on to become “ghost nets” that trap turtles and other marine species indefinitely.

Other fishing techniques – trawling, gillnets, ringnets, troll lines (with or without FAD), hand lines or harpoons – are used in the majority of the IOTC member countries, often as secondary / artisanal fisheries. The degree of their so-far-unquantified interaction with marine turtles should not be underestimated. For instance, shrimp trawl and gill net fisheries are often cited in IOSEA reports for having a relatively high impact on marine turtles.

Many of the IOTC reports provide interesting information on national trends in fishing effort, in terms of current fleet size and recent growth/contraction trends. Longline fishing effort, measured in terms of vessel numbers, has reportedly declined in recent years in 11 countries – substantially so in some cases (e.g. Australia, EU-Portugal, Japan, Republic of Korea) – while effort has apparently undergone a moderate increase in six countries (EU-Spain, Indonesia, Kenya, South Africa and Sri Lanka). For all of the CPCs involved in purse seining, effort in this fishery is reported to have declined in recent years. Reasons provided by CPCs to account for these declining trends include increased piracy in parts of the IOTC area, as well as higher operational costs associated with a general decrease in the target fish stock. Fishing effort of six CPCs was reported to have shifted geographically in recent years (mostly in 2011), suggesting a possible adaptation of the fisheries to those negative conditions.

It would be interesting to investigate more thoroughly the implications of these trends for marine turtle conservation. For instance, are smaller fleet sizes necessarily resulting in less turtle bycatch? Are the reported shifts in the geographic distribution of fishing effort positive, negative or inconsequential for marine turtle populations, in terms of the frequency of fisheries interactions with turtles? These and other questions could be explored more thoroughly if access to more detailed information on fishing effort and turtle distribution (including migration patterns) were made available.

II. Monitoring activities

Observer programme

Seventeen CPCs declared the existence of an observer programme designed for their fisheries. Although, unsurprisingly, none was reported to be specific to turtles, all of them include marine turtles in their scope. However, eight of the 17 concerned CPCs – namely China, Comoros, Kenya, Mauritius, Philippines, Republic of Korea, Sri Lanka and Thailand – reportedly did not implement their programme in the year 2011, either due to piracy issues, lack of resources or decline in fishing effort; and the Islamic Republic of Iran also mentioned having some issues regarding the implementation of its observer programme.

Furthermore, one general reservation that may be stated regarding the implementation of existing national observer programmes is that data, sometimes still in the process of analysis, are currently unavailable for some key countries (e.g. China's data for the years 2007, 2008 and 2009 are still to be recovered; and Japanese data for 2010 are under analysis). Moreover, it is important to note that observer coverage of the national programmes is very uneven across countries (e.g. 1.3% for Spain, 1.7% for Australia, 5% for Japan, between 9 and 13% for France, 16% for EU-Portugal, and a "target" of 30% for Madagascar). This lack of uniformity and relatively low coverage rate for some national fisheries makes it difficult to draw meaningful conclusions from the available observer data.

More positively, many of the countries that have yet to implement an observer programme have stated their intention to do so, or are in the process of developing one (namely India, Malaysia, Maldives, and Oman). Moreover, South Africa is developing a new phase of its observer programme and Seychelles has just started to administer its newly designed programme in early 2013.

The IOTC national reports offer some insights into the integrity of the programmes that are already operational. Only 9 countries (Australia, Comoros, Islamic Republic of Iran, Kenya, Madagascar, Mauritius, EU-Portugal, Republic of Korea, Seychelles) mention training of their observers – while Sri Lanka, whose programme is under development, has requested assistance from the IOTC Secretariat. Of these countries, only three (Australia, China and Republic of Korea) provide additional information that might allow for a cursory indication of observer competence. For the latter, observers are reportedly recruited from among graduates of science colleges/universities. In the case of the Islamic Republic of Iran, the observers are crew members trained for the purpose of its programme. In general, the available information is insufficient to give confidence about the ability of observers, trained or otherwise, to correctly identify and handle incidentally caught turtles. Kenya's national report to IOSEA mentions the incapacity of its observers to deal with faulty TEDs.

Logbook system and port sampling programme

All CPCs had implemented a national logbook system in the year 2011, except for Comoros, Philippines, United Kingdom (which no longer issues commercial licences) and Thailand (under development). In some cases, the onboard filling of logsheets by vessel operators is a licensing or unloading requirement, in China and Mauritius, respectively.

However, available data seem to be scarce even for several of those countries that have been implementing their logbook system in recent years. In most cases this situation is due to insufficient raw data, either because coverage of the programme was very limited (Indonesia, Japan), because of implementation delays (Malaysia) or, more commonly, because data were not correctly reported by cooperating vessels: Islamic Republic of Iran, Madagascar, Seychelles (for its recreational fishery), and Sri Lanka. But the limitation of available data is also, in the case of France, due to incomplete processing of recovered data because of unexpected technical and administrative problems.

CPCs seem aware of this issue and, to address it, several of them have recently reviewed their logsheets in accordance with IOTC requirements (India, Madagascar, Mozambique, Seychelles, and Republic of Korea). Additionally, Australia and France have implemented an electronic logbook system in 2013 and the Maldives and Korea are on the path to doing it.

With the exceptions of Japan, Madagascar, Maldives, Mozambique, Philippines, EU-Portugal, Republic of Korea, Seychelles and United Kingdom/BIOT, all CPCs implemented a port sampling programme in 2011, involving the collection of data such as catch, number of trips, days per trip, and operations by fishing ground. However, very little information was provided in CPC 2012 reports on the level of coverage of the programmes, and Oman declared having sometimes recorded some inaccurate data. In general, it is unclear whether any of these port sampling programmes might provide an opportunity to glean more information about the extent of marine turtle bycatch.

Reporting of turtle bycatch

According to the IOTC 2012 national reports, 14 CPCs currently apply a system of turtle bycatch monitoring to a portion of their fisheries. Such activities are organised either as part of their main observer programme (Australia), logbook system (China), other research projects carried out by specialized institutes (EU countries), or by NGOs (Seychelles). On the other hand, seven countries (Comoros, Kenya, Madagascar, Mauritius, Oman, Philippines, and Thailand) did not provide any data in their IOTC reports, suggesting no existing monitoring activities. The United Kingdom (BIOT) and

Maldives declared no turtle bycatch in their waters due to the nature of their fisheries in 2011, without specifying whether monitoring had been implemented for that year or not.

Among the CPCs reporting on levels of turtle bycatch, Australia, China, Mozambique and Spain reported no interaction of their national fisheries with marine turtles in 2011, in the IOTC area. The number of incidentally caught turtles averaged about 12 in countries reporting incidental catch events in their territorial waters for that year (10 for Portugal, 14 for Japan, and 12 for South Africa).

Additional information is available from a study (Clermont et al 2012) that analysed European Union purse seine fishery interactions with marine turtles in the Indian Ocean over a 15 year period. Based on available observer data, the average annual bycatch of marine turtles in fishing sets of EU purse seines operating in the Indian Ocean was estimated to be in the order of 250 animals. About 3/4 of these by-caught turtles were released alive, suggesting that the number of marine turtles killed in the EU purse seine fishery is in the order of 60 individuals per year. This finding is consistent with studies in other ocean basins showing very low rates of turtle mortality in purse seine operations. However, it is worthwhile noting that observations on sets do not take into account the phenomenon of “ghost fishing” occurring on floating devices (some of them being lost by owners) that do not end up in a fishing set.

In general, the levels of marine turtle bycatch recorded in CPC reports should be considered with great caution. The extent of monitoring and/or reporting of turtle bycatch in the IOTC area appears to be uneven among CPCs. Firstly, reporting of bycatch is not necessarily a requirement for all fisheries of a given CPC (for example, Japan clarifies that its observers are limited to longliners) and, in general, smaller vessels that cannot accommodate observers are usually excluded on practical grounds. India reports a sizeable longline fleet of some 294 vessels, but bycatch monitoring is undertaken on only four governmental tuna longline survey vessels. Under these circumstances, meaningful extrapolations are problematic.

Secondly, it is often difficult to differentiate between *effectiveness of bycatch monitoring/reporting* and *actual levels of bycatch* where the quality of bycatch monitoring and reporting appears to vary greatly among CPCs. It is impossible to discern from the available reports whether the lack of mention of any bycatch (or a very low value) is a reflection of little or no “actual” turtle bycatch, poor reporting by vessel operators, and/or inadequate monitoring/reporting by authorities. For example, in Malaysia, although longline operators “were informed to record any interaction with turtles”, very few reports of bycatch appear to have been recorded. In contrast, some countries have submitted extensive documentation to various IOTC working groups which gives confidence that their estimates of low bycatch, in some fisheries, are scientifically justified.

Very few CPCs provide information on the fate of by-caught turtles in their IOTC, IOSEA or other reports. Some reports suggest that a high percentage of turtles may be released alive. For example, the study by Clermont et al (2012) indicates that 86% of the nearly 600 turtles caught in the EU purse seine fishery between 2003 and 2010 were released alive. A similarly high value, 88%, was reported for one of Australia’s eastern longline fisheries, based on a much smaller sample size (22 animals). The basis of Sri Lanka’s estimation that “over 95% of the turtles incidentally caught are returned safe to the sea” is not clear from its report submitted to IOTC. Other research conducted in Sri Lanka in late 1999/2000 suggests otherwise, at least in some localities (Marine Turtle By-Catch in Sri Lanka, 2002. Turtle Conservation Project.)

III. Turtle mitigation measures

Generally speaking, most CPCs have a general legal instrument in place that deals with protection of marine turtles from fishing activities, such as a ban on catching of turtles, spatial and temporal control of fishing, or marine protected areas that complement marine turtle conservation efforts.

Regulation of legal fisheries

Training of fishermen

IOTC Resolution 12/04 requires that all CPCs “ensure that fishermen are aware of” turtle mitigation methods. Regarding that provision, 13 countries so far (Australia, Comoros, France, India, Indonesia, Islamic Republic of Iran, Kenya, Mozambique, EU-Portugal, Republic of Korea, South

Africa, Sri Lanka and Thailand) have developed programmes, in one form or another, intended to educate vessel operators about fishing techniques to avoid marine turtle bycatch and appropriate handling of by-caught turtles. However, there is little information available to judge the scope and effectiveness of these programmes, which seem to greatly vary from one CPC to another. Genuine training (e.g. through workshops, that go beyond simply handing out reading material) appears to have been provided in very few countries. Indonesia’s mention of training of crews in collaboration with WWF is noteworthy. China, France and the Republic of Korea report having produced and distributed identification cards intended to help fishermen accurately record turtle bycatch.

Use of mitigation techniques

Eleven CPCs reported having a legal framework requiring fishermen to help recover captured marine turtles and to release them at sea (Australia, China, Portugal, Indonesia, Madagascar, Maldives, Mauritius, Mozambique, Seychelles, South Africa, and Thailand). In addition, nine CPCs have adopted regulations that require fishermen to carry onboard line cutters and de-hookers (Australia, China, India, Maldives, Mauritius, Mozambique, EU-Portugal, Republic of Korea, and South Africa). Furthermore, monitoring and recovery of FADs is reportedly carried out in four countries (Comoros, Indonesia, Madagascar and Malaysia).

However, while most of the CPCs have provided information on their legal framework for mitigation of turtle bycatch (either to IOTC or to IOSEA), the extent to which these national regulations are effectively monitored and enforced is ambiguous. Although most of the CPCs have adopted regulations requiring fishermen to “*keep on board* all necessary equipment for the release of marine turtles” (IOTC resolution 12/04, para. 6), it is less clear whether vessel operators effectively “*use proper mitigation, identification, handling and de-hooking techniques*”. Similarly, no information is provided on whether fisheries have effectively adapted their fishing practices in accordance with IOTC Resolution 12/04, which encourages the use of whole finfish bait for longliners and avoidance of marine turtle encirclement by purse seiners.

While it is beyond the intended scope of IOTC reporting, some CPCs mention there – or in their reports to IOSEA – their programmes requiring the use of Turtle Excluder Devices (e.g. Australia, India, Kenya, Madagascar, Malaysia, Mozambique, Philippines). However, in most cases, little or no information is provided on their effective use by fishing fleets.

National Plans of Action

Only three countries (Australia, Kenya and Malaysia) report having a national plan for marine turtle conservation in place, and those plans are, in some cases, overdue for review. It is known from other sources that a number of countries – including France, Indonesia and India – are in the process of developing their national plans. Although not directly related to bycatch mitigation, a few CPCs (e.g. France, Malaysia, and Oman) report having opened turtle conservation centres for educational purposes, and many other countries are known to have similar centres.

Illegal fishing

The national reports submitted to IOSEA provide supplementary information about the perceived impact of illegal fishing on marine turtles in the IOTC convention area. Indeed, 13 IOSEA members have reported such activities in their territories, potentially affecting marine turtle populations. Apart from poaching directly targeted at marine turtles (e.g. harpooning in Kenya and Seychelles, and illegal inshore fishing in the United Kingdom/BIOT), accidental harming of turtles commonly occurs in some CPCs (e.g. through the illegal use of explosive for fishing in Indonesia).

IOSEA national reports also document the fact that non-reported bycatch of turtles in illegal fisheries occurs in many CPCs, significant examples of which are the large-meshed bottom gill-net fishery intended to catch stingrays in Malaysia, illegal purse seine fishery in Mozambique, set gill net fishery in Philippines, as well as the use of FADs in commercial ski-boat line-fishery to attract pelagic fish in South Africa. Aside from IOTC, it is urgent that countries take necessary measures to address these issues by enforcing their domestic regulations more effectively in order to improve the scope and impact of their legislation.

Incidentally, no mention is made in the reports of IOTC CPCs of the ramifications of IUU fishing, in terms of the potential extent of bycatch of non-target species, including marine turtles.

IV. Research initiated by governments

IOTC Resolution 12/04 calls on CPCs to undertake research on a variety of mitigation techniques and to report the results of trials to the Scientific Committee. Until now, only a small number of countries have reported activities undertaken in this regard. However, it is known from IOSEA reports that Australia is currently quantifying the ecological and economic value of short soak time for gillnets, developing and trialling set mesh nets with break-away panels, and has reported a reduction of marine turtle interactions with its longline fishery as a result of the use of circle hooks. The impact of such hooks is also being investigated by Malaysia, Philippines, and Republic of Korea. Similarly, EU-Portugal has undertaken research trials on the use of whole finfish bait; and alternative FADs are being designed in France and Madagascar, and trialled in Mozambique. South Africa reportedly introduced on an experimental basis grids that exclude turtles.

It is likely that more research is being conducted than is being reported, either through IOTC or IOSEA channels. Given the value and cost-effectiveness of sharing the results of successful – and even unsuccessful – research trials, more attention should be paid to documenting the work that has been undertaken.

V. Quality of data provided

Overall, the IOTC national reports reveal considerable variability, in terms of the regulation, practical application and enforcement of turtle mitigation measures. Some countries, such as Australia, India, Indonesia, Malaysia and Sri Lanka, are apparently more active in this area, whereas data relative to turtle mitigation efforts were found to be scarce or sometimes inexistent in the IOTC reports of Comoros, Indonesia, Japan, Oman, Philippines, and EU-Spain. Yet, most if not all of these countries are thought to be confronted with turtle-bycatch issues.

Generally speaking, the level of detail in the national reports is often insufficient to distinguish between the mere existence of a regulation (for instance, a requirement for vessels to carry line cutters and de-hookers on board, for appropriate handling of turtles) and effective implementation of that regulation. The latter implies a certain degree of training of crews (repeated occasionally, as crews can change), periodic feedback, and monitoring of compliance. Going forward, logbooks should include information on the interventions made in sufficient detail to provide feedback on their efficacy (i.e. on the animal's fate: dead/alive; released with/without hook; released with/without obvious injury etc.). Ideally observer data would be even more specific, giving an indication of species and possibly include basic morphometric measurements.

It is sometimes unclear whether the primary fishing gears described in reports relate only to *national* fleets, or to all fleets (including foreign vessels) operating within a country's EEZ. Similarly, licensing information provided by a member country sometimes does not specify whether it concerns only tuna fishing operators or any fishing gear operating in the IOTC convention area.

Conclusion

Despite these shortcomings, the national reports provided to the IOTC Scientific Committee include much information of interest and relevance to marine turtle conservation. The information on fleet size and distribution could be used as starting point for more in-depth investigation of overlaps and interactions with marine turtle populations. The usefulness of these reports will be further enhanced as more IOTC members make a concerted effort to include up-to-date and comprehensive information, in enough detail to allow impartial observers to assess the extent to which the provisions of IOTC Resolution 12/04 are being met.

As mentioned in the introduction, the national reports submitted by many of the same countries, as part of their reporting commitments to IOSEA, often provide complementary information on their fisheries and bycatch mitigation measures. In the interest of presenting a fuller picture of these efforts, Annex 2 to this report summarises the highlights of this additional information source.

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Annex 1: Spreadsheet summarising information relevant to marine turtle bycatch mitigation contained in IOTC national reports (2012). Available online at:

http://ioseaturtles.org/pom_detail.php?id=127

Annex 2: Summary of relevant information extracted from the IOSEA Online Reporting Facility², pertaining to countries that are members of both IOSEA and IOTC

NB: Some information may relate to fishing activities outside the IOTC convention area

Australia

- * Impact of purse seine: none
- * Impact of shrimp trawl, set gill nets and longline: unknown
- * Logbook data for 2010 recorded a total of 25 interactions with turtles in the ETBF (7 green turtles, 1 hawksbill turtle, 11 leatherback turtles, 4 loggerhead turtles and 2 turtles (unclassified)). 88% (22) were released alive. There were 4 turtle interactions reported in logbooks in the WTBF during 2010 (2 leatherbacks and 2 loggerheads). All 4 were released alive
- * Impact of Trap and Pot Fisheries: small green turtles and hawksbill turtles have been caught in collapsible crab pots. The mortality associated with crab fisheries is not quantified, but is thought to be less than 10 per year for each species
- * **Illegal fishing** is known to occur at Scott Reef and Browse Island in the Timor Sea where foreign fishers sometimes land (illegally) and harvest nesting green turtles
- * **Mitigation:**
 - ETBF has initiated a Marine Turtle Mitigation Strategy
 - Wire traces are not permitted in Australia's pelagic tuna and billfish longline fisheries (nylon traces are used). This increases the chances of a turtle escaping, as well as enabling easier release of turtles using line cutters without having to bring them onboard, in turn improving their post-release survival rates
 - Ghostnets Australia Programme: multi-million dollar program funded by the Government that takes place in cooperation with indigenous communities. The program works in one of the hotspots for the accumulation of derelict fishing gear on parts of the Northern Australian coastline
- * **Research activities:**
 - Trialing of set mesh nets with break-away panels: currently underway in Queensland under funding from the Fisheries Research and Development Corporation (FRDC)
 - Results of the circle hook research trials in the ETBF: reduction of Marine Turtle interactions, however, capture rates of shark species increased. As a consequence, the use of circle hooks is not compulsory but there is substantial voluntary use of circle hooks by industry
 - FRDC project 2011/009: Assessment of novel gear designs to reduce interactions between species of conservation interest and commercial fishing nets
 - FRDC project 2011/063: Tactical Research Fund: Quantifying the ecological and economic value of short soak time for gill nets used in the small mackerel / shark fishery in southern Queensland
- * Bycatch **education** programs in the Australian Pelagic Longline Fisheries

Comoros

- * **Illegal fishing** is frequent in Comoros waters
- * **Mitigation:**
 - Monitoring and recovery of FADs by the "Direction Nationale des Ressources Halieutiques" (*National bureau of fishing resources*)
 - Spatial and temporal control of fishing (e.g. seasonal closures of fishing activities): until the end of 2006, just a few studies were conducted on stocks and fishery (Direction Nationale des Ressources Halieutiques, Moheli Marine Park), but data are expected to improve thanks to EU funds on fishery studies
- * **Education** of fishermen on the implementation of measures to minimize incidental capture and mortality of turtles in national waters and in the high seas (collaboration between a fishermen syndicate and the Direction Nationale des Ressources Halieutiques)

France

- * Impact of longline: responsible for 73% of turtle bycatch in Mayotte
- * Impact of artisanal set gill nets: responsible for 33% of turtle mortality resulting from bycatch
- * **Pirate longliners** (unknown effort to date) and some illegal seiners may have an impact on marine turtles on Îles Eparses
- * Turtle **mitigation** measures:
 - Mayotte: Prohibition / management of fishing in the reserves of the "Passe en S" and Sazilé (created in

² <http://ioseaturtles.org/report.php>

1991). Under development: sponsorship of turtles by fishermen, with media coverage, and appointment of one resource fisherman per village in charge of collecting information about incidental catch (with compensation)

----- La Réunion : Since 4 years, a partnership has been developed with 11 longliners based in La Réunion to reduce the impact of incidental catch and study the diving behavior of *Caretta caretta*; turtles transferred to a care center and veterinary clinic: surgical procedures to remove any fish hooks; installation of Argos transmitters before release; an information leaflet to manage by-catch of marine turtles in longline fisheries was produced in close collaboration with IOSEA and IOTC

----- Îles Eparses : from 2011 on, use of FADs with meshing that is safe for marine turtles (90% of the tuna purse seine sets allowed to fish in the French EEZs are conducted with FADs)

* **Research activities:**

----- Ongoing project on alternative FADs with the IRD

----- La Réunion : fishermen are already testing different types of hooks; study of diving behaviour thanks to Argos tagging of incidentally caught turtles

* Many **educational** activities (Informative videos, brochures, printed guidelines). Mayotte : Creation of an intervention network in 2010-2011 (REMMAT); 18 people received training for handling injured turtles; In discussion: creation of a health center, distribution of circular hooks and of hook disgorgers to facilitate the release of turtles, etc.; Designing of a fact sheet about resuscitation of turtles intended to industrial fishermen.

India

* Impact of gill nets: responsible for 60-70 % of turtle mortality on the east coast of India

* **Mitigation** (legislation and practices highly variable according to the region):

----- TED promotion: however TEDs are not used in any of the coastal states, including Orissa

-----The MoEF, Govt. of India launched the National Sea Turtle Conservation Programme through the UNDP-supported GOI-UNDP sea turtle project. This project identified the threats and management strategies, guidelines and action plans which the maritime states, with support from the Government of India, implement

* **Research activities:** The Central Institute of Fisheries Technology developed a TED

Indonesia

* Impact of purse seine: in Java, at least 1 turtle caught during a trip, especially where the fishing ground was near a turtle nesting beach

* Impact of longline: "relatively high" (from onboard observations)

* **Illegal** use of explosives and chemicals

* **Mitigation:**

----- Shrimp trawls prohibited (Presidential Decree No 39/1980). Fishing vessels operating shrimp trawls operate only in Arafura Sea (southern part of Papua) and they must be equipped with TEDs. Shrimp trawlers in Papua are familiar with TEDs, but they don't install them in their trawls because they would reduce fish by-catch (considered as additional income, sometimes higher than their monthly wages).

----- Measures to avoid encirclement of marine turtles in purse seine fisheries: definition of capture areas and depth fishing practices (Decree of the Minister of Marine Affairs and Fisheries No 2/2002 concerning Guidance on Capture Fisheries Management)

----- Regulation on gear specification and monitoring and recovery of FADs regulated by Decree of the Minister of Marine Affairs and Fisheries No. 3/2002

----- A national Action Plan "*has been documented in 2004 for further refinement*"

* **Research activities:** WWF-Indonesia is now conducting circle hook trials in tuna longline fisheries, and the trials are showing promising results

* **Education:** Training onboard of de-hooking methods for fishers and field officers has been undertaken by the Ministry of Marine Affairs and Fisheries. Handling manuals were provided by WWF observers

Kenya

* Impact of shrimp trawls: at least 3 turtles caught in trawlers per day, depending on the season

* Impact of artisanal gill nets: up to 10000 turtles caught annually, both incidentally and intentionally (Wamukota 2005). At least half (54 to 75%) of them are slaughtered or traded by fishermen (Nzuki 2004)

* Impact of beach seine netting: estimated "relatively high"

* **Illegal fishing:**

----- Longline: 7 commercial vessels have been reported to operate in a single night in the KMNR

----- Harpooning and spear fishing: Traditional fishing gear such as these is being used by villagers in Gazi-Msambweni and Funzi-Bodo, and has been used to hunt turtles (Church and Palin 2003; KESCOM 2005). The extent to which turtles are being hunted in this way is uncertain

----- Poison was reported to be used in Ngomeni, Funzi-Bodo (KESCOM 2005), in the Msambweni area

* Observers lack sufficient training and the technical expertise to deal with faulty TEDs (FAO 2007)

* **Mitigation:**

----- Shrimp trawlers are required by law to have TEDs, however trawler operators consider TEDs to be ineffective (Okemwa et al. 2004; FAO 2007)

----- In some areas, a net-release programme provides for a monetary reward for artisanal fishermen releasing turtles from their nets (Zanre 2005)

----- Undersized meshed nets are prohibited

* **Training** programmes / workshops to educate fishers organized by the Fisheries Department

Madagascar

* **Impact of gill netting:** used by artisanal shark-fishermen, who reportedly catch turtles incidentally when they ascend beaches (Metcalf et al. 2007). This fishery is seasonal, with no or limited fishing taking place from April to September (Walker and Roberts 2005)

* **Illegal** purse seine fishing (tuna)

* **Mitigation:**

----- A national workshop on Marine turtles Conservation and Management was held in Antananarivo, Madagascar (9-11February 2011)

----- Draft National Conservation and Management Plan for implementing the IOSEA MoU

----- Since 2005, the use of TEDs has been successfully enforced

----- Measures taken by prawn fisheries: longer closed season, smaller sizes of trawl towing warp, increased legal mesh size, abolition of twin trawls, spatial and time-bound closures of activities in sensitive or overexploited areas

----- Deployed FADs are monitored by Blue Venture Conservation (UK NGO)

* **Research activities:** research was conducted to determine the most appropriate specifications for TEDs to be used by prawn trawlers

Malaysia

* High fishing effort by shrimp trawlers and moderate effort by set gill nets and drifnets, with moderate impact on marine turtles for both fisheries

* **Illegal fisheries:**

----- Use of large-meshed bottom gill-nets (more than 10 inches) for catching stingrays, which also frequently catch turtles

----- Illegal harvesting of marine turtles by foreign fishing vessels (especially from Hainan and Vietnam) in the territorial waters of Malaysia

* **Mitigation:**

----- Monitoring and recovery of FADs conducted regularly

----- A series of marine parks have been established in the coastal waters

* **Awareness program** intended to trawl net fishermen for proper handling of incidental caught turtles was conducted actively in some areas such in Sabah and Terengganu States of Malaysia

Maldives

* FADs are in use to catch tuna

* Ghost nets from foreign fisheries kill turtles in the waters of the Maldives

* **Illegal** purse seiners poaching marine turtles from Maldivian waters

* Marine Research Center has conducted data collection surveys on selected islands to determine the number of nesting islands and foraging areas

Mauritius

* **Mitigation:**

----- A National Action Plan for stranded marine mammals / turtles has been introduced in 2007 for the geographical area surrounding the lagoonal waters of Mauritius

----- A National Plan of Action to prevent, deter and eliminate IUU Fishing has been developed with the assistance of the Government of Norway, which is based on the International Plan of Action to combat IUU Fishing

----- Circular hooks are being used

----- Seasonal closure of fishing activities

* **Education:** the DVD obtained from IOSEA on the marine turtle conservation is being shown on television and at the Albion Fisheries Research Centre during open days and visits at the centre by students and other visitors

Mozambique

* Impact of trawling: one of the most important causes of turtle mortality (Louro et al. 2006): between 1932 and 5436 turtles per annum during the prawn fishery season, in Sofala Bank (Gove et al. 2001). A large proportion of these turtles are killed by fishermen for consumption.

* Impact of beach seining using tractors in the Inhassoro area (Inhambane): 20-35 marine turtles estimated killed every month, for eight months of fishing activity (Gove & Magane 1996; Hughes 1971; Magane et al. 1998)

* **Illegal fishing:**

----- Asian longline fishing vessels, which target tuna and sharks, are posing a new threat to turtles in Mozambique. Turtle by-catch, predominantly green turtles, are not released alive but simply beheaded during collection of the longline to increase the efficiency of the process (Lorou et al. 2006). In one incidence, 42 beheaded green turtles were reported by tourists from the beach between Inhassoro and Bartolomeu Dias

----- Capture of marine turtles for food and subsequent sale of carapace, (in trawling or gill nets, on the beach during nesting or using spear guns)

* **Mitigation:** Use of TED mandatory since 2003, in any trawling fishery aided by a motor. However, none of the trawlers operating in Mozambique is thought to have implemented TEDs (Pereira et al. 2008)

* **Education:** A number of marine turtle programmes; awareness campaigns aimed at local communities, and often at fishers specifically. Such initiatives include the Mozambique Marine Turtle Working Group (MMTWG) Project in Primeiras and Segundas Islands, and the ZSL (Costa et al. 2007; Garnier and Silva 2007)

Oman

* Fishing gear: a lot of drifted gill nets, set gill nets and traps are used by local fishermen. Trawling nets and longlines are used by companies

* **Mitigation:**

----- 2 turtle reserves at Ras al Hadd and Demaniyat Islands' beaches. Rangers units are covering most of Oman's terrestrial and coastal areas

----- "Fishermen release live turtles if they are caught in their nets or lines"

Philippines

* Impact of gillnets: moderate

* Impact of bottom set longlines: moderate (when set in shallow waters)

* **Illegal fishing:**

----- Illegal trawl fishing (with the exception of the province of Palawan): low estimated impact

----- Set gill net used by mainland Chinese fishermen, who illegally enter Philippine waters and target sea turtles in southern Palawan

----- Use of explosive (dynamite) and obnoxious devices

* Observer programme: the Philippines has a Fisheries Observer Program, part of which is by-catch monitoring of cetaceans and marine turtles. Includes promotion of circle hooks in longline fisheries, and provides for public awareness in set net operations for release of incidentally caught sea turtles

* Port sampling: there is inspection of fishing boats in port and landing sites conducted by maritime police and the Philippine Coast Guard

* **Mitigation:**

----- To implement the ban on use of explosive devices, the local government in collaboration with the Philippine Coast Guard and the Bureau of Fisheries and Aquatic Resources, established "Bantay Dagat" (Guard Sea) in many municipalities. However, due to lack of logistics and manpower in some areas, and lack of political will by some Local Government Officials, the Bantay Dagat is not effective

----- Spatial and temporal control of fishing: Closure of active fishing gear in municipal waters (0-15 km from shore), including boats more than 3 gross ton

----- TEDs: As part of the Philippine-Sabah TIHPA activities TEDs were introduced in 2009 to Sabah trawl fishers and currently some companies use TEDs in their fishing operations

----- MoA among 6 government agencies with WWF to build capacity to enforce fishery and relevant environmental laws in national waters

* **Information** materials provided by Pawikan (Sea Turtle) Project, Protected Area and Wildlife Bureau (c/o Mr Renato Cruz). A new set of information materials was produced in collaboration with Conservation International Philippines

* **Research activities:**

----- In 2009, TEDs were pilot-tested in western Philippines by the Bureau of Fisheries and Aquatic Resources

----- Bureau of Fisheries and Aquatic Resources: field survey for comparison between J-hook and circle hook in tuna longline fishery (catch efficiency, incidental catch of sea turtles)

Seychelles

* Impact of trawling outside of Seychelles EEZ, for example in the Mozambique Channel: “likely to negatively impact turtle populations of Seychelles during their regional migrations”

* Impact of purse seine (without FADs): some reports of incidental capture of large numbers of juvenile hawksbill turtles (Mortimer 1998a; Domingue and Mortimer 2001)

* **Mitigation:**

----- Switch to circle hooks for longliners has been successful in mitigating the few cases of by-catch previously reported

----- A National Strategy and Action Plan was developed and adopted in 2005 through a series of stakeholder workshops after which it was endorsed by MENRT, under the BHC/MCSSS Strategic Management of Turtles Programme (2003-2005)

* **Illegal fishing:**

----- Harpooning of turtles on nesting beaches. A few offenders have been arrested and prosecuted; there is however, an institutional gap to fully address those poaching incidents

----- Driftnet for shark fishing: “problematic” for turtles in Seychelles waters. Although this practice is banned (Fisheries Amendment regulation S.I. 5 of 1998), enforcement of the ban is not effective

* **Research activities:** Trials were done in 2004-2005 with FADs designed so that they would not catch turtles (strap bands were used instead of a net under the float)

South Africa

* Impact of shrimp trawls: relatively low. 8 National permits issued, only 2 to 3 vessels operating periodically (due to droughts). Estimated ~ 50 turtles caught /yr

* Impact of gillnets: moderate, used as bather protection nets against shark attacks in KwaZulu-Natal. They are set outside of protected areas, and checked ~ 20 times per month. 50 turtles/yr caught, of which about half are released alive.

* Impact of purse seine: relatively low. 100 vessels, of which most are pelagic

* Impact of longline: relatively high, 164 estimated turtles/yr (0.04 turtles /1000 hooks)

* **Illegal fishing:**

----- Illegal use of FADs in commercial ski-boat line-fishery to attract pelagic fish

----- Poaching in protected areas by foreign longliners, trawlers and beach poaching

* Observer programme: coverage of 10 - 20 % of the SA fishing fleet. However, few of the observers have been trained to deal with turtle bycatch especially in dehooking techniques etc.

* Port sampling: 80% coverage. Limited at-sea inspections and no high-seas monitoring

* **Mitigation:**

----- On the east coast: all FADs encountered are removed

----- Since 2007: up to half of the 27km of gillnets has been replaced with baited drum lines, more targeted to predatory sharks

----- A National Conservation and Management Plan is being drafted, outlining best practices as well as providing guidelines for data collection

----- An excellent network of marine protected areas exists

* **Booklets & training courses:** A practical guide to understanding and reducing vulnerable bycatch and a brochure "Keeping or endangered marine life off the hook: Benefits to fishers and marine life" by Samantha Petersen (BirdLife/WWF Responsible Fisheries Programme SA) have been produced

* **Research activities:**

----- Birdlife SA & WWF have been experimenting circle hooks on some of the SA longliners (however, lack of buy-in from industry)

----- Grids to exclude elasmobranchs and turtles are likely to be introduced on an experimental basis in 2006

----- A postgraduate project at the Nelson Mandela Metropolitan University (NMMU) is currently investigating the effect of shark nets on marine turtles in KZN. Natal Sharks Board is collecting data on an ongoing basis to evaluate the impacts of shark nets on target and non-target species

Sri Lanka

Mitigation:

* Sri Lanka's Monitoring, Control and Surveillance (MCS) capabilities are rudimentary and leave its waters exposed to poaching by foreign fishing boats

* Resuscitation or release by fishers using equipment such as de-hooking, line cutting tools and scoop nets

* Ban on dynamite fishing and use of explosives and chemicals; trammel netting in coral reef areas; and temporary ban on encircling nets in both coastal and offshore areas (2003)

* Marine Protected Areas: Hikkaduwa and Pigion island Marine National Parks and Barreef Sanctuary (under the DWC)

* The National Marine Turtle Conservation Action Plan (NMTCAP) has been developed by the DWC in collaboration with IUCN-SL (through a consultative process with all stakeholders)

Thailand

* Impact of set gill nets: moderate: Wounded turtles have been treated and released back to the sea. The percentage of sea turtles accidentally caught by gillnet is around 58% compared to other fishing gears

* Impact of longline: relatively low

* Impact of purse seine: moderate: The percentage of sea turtles accidentally caught by purse seine is around 5% compared to other fishing gears

* Impact of squid traps: relatively low: the percentage of sea turtles accidentally caught by squid trap is around 6% compared to other fishing gears

* **Illegal** fishing:

----- Boats often invade within 3 km of coastal zone, even though fisheries patrol is set up to guard the 3 km coastal area (ineffective enforcement)

----- Pair trawlers fishing illegally in the area within 3 km of the shoreline (moderate impact)

* **Mitigation:**

----- Very few mitigation measures are periodically reviewed and evaluated for their efficacy

----- Thailand is developing a National Plan for Sea Turtle Conservation and Management, in which DMCR is participating (on behalf of Government) along with Thailand Wildlife Foundation (NGO representation)

* **Trainings** have been conducted for appropriate handling of incidentally caught turtles, but not frequently.

Information on TEDs available, however fishermen don't use them because they think that no turtles are caught by small shrimp trawlers

United Kingdom (British Indian Ocean Territory BIOT)

* **Illegal** inshore fishing, including catches of marine turtles. Measures taken: tougher fines and sentences imposed on the illegal fishermen caught

* In 2000, **educational** signboards were produced under an FFI project to inform people visiting Turtle Cove about the importance of the foraging hawksbill population in the Cove (Mortimer, 2000). Those signs were still there in 2006. Independently, the management of BIOT erected viewing platforms adjacent to Turtle Cove, so that visiting base personnel could view the turtles without getting into the water. Base personnel are not allowed to swim in Turtle Cove

Annex 3: List of Acronyms and Abbreviations

AFRDEC: Andaman Sea Fishery Research and Development Center (Thailand)
 AFMA: Australian Fisheries Management Authority
 APEC: Asia Pacific Economic Cooperation
 APFIC: Asia Pacific Fisheries Commission
 AZTI : AZTI-Tecnalia (Spain)
 BIOT: British Indian Ocean Territory
 CFVL: Commercial Fishing Vessel License
 CMFRI: Central Marine Fisheries Research Institute (India)
 CTI: Coral Triangle Initiative
 DFAR: Department of Fisheries and Aquatic Resources (Sri Lanka)
 DoE: Department of Environment (Islamic Republic of Iran)
 DPMA: *Direction du Personnel, de la Modernisation et de l'Administration* (Office for staff, modernization and administration, France)
 EBA: Ecosystem Based Approach
 ECTF: East Coast Trawl Fishery (Australia)
 EEZ: Exclusive Economic Zone
 ERA: Ecological Risk Assessment
 ERS: Electronic Recording and Reporting System
 ESO: Environment Society of Oman
 ETBF: Eastern Tuna and Billfish Fishery (Australia)
 FAD: Fish Aggregating Device
 FSARG: Fisheries Statistics Analysis and Research Group (Thailand)
 GN: Large-mesh gillnet
 GN/LL: Gillnet cum longline
 HL: Handline
 IEO: *Instituto Espanol de Oceanografia* (Oceanography Institute, Spain)
 ICAR: Indian Council of Agricultural Research
 ICEIDA: Icelandic International Development Agency
 IPMA: *Instituto Portuges do Mar e Atmosfera* (Institute for the Sea and Atmosphere, Portugal)
 IFREMER: *Institut Francais de Recherche pour l'Exploitation de la Mer* (Institute for Research and Exploitation of the Sea, France)
 FSI: Fishery Survey of India
 IFO: Iran Fisheries Organization
 IOSSS: Indian Ocean Swordfish Stock Structure (France)
 IRD: *Institut de Recherche pour le Developpement* (R&D Institute, France)
 ISN: Information and Sampling Network (by IPMA, Portugal)
 JTED: Juvenile and Turtle Excluding Device
 LKIM: Fisheries Development Authority of Malaysia
 LL: Longline
 LME: Large Marine Ecosystem
 LOP: Letter of Permission (India)
 LOV: “Vessels Operation Report” (Malaysia)
 MADE project: Mitigating Adverse Ecological Impacts of Open Ocean Fisheries
 MECA: Ministry of Environment and Climate Affairs (Oman)
 MFRDB: Marine Fisheries Research and Development Bureau (Thailand)
 MPA: Marine Protected Area
 MPEDA: Marine Products Export Development Authority (India)
 MPRH: Ministry of Fisheries and Marine Resources (Madagascar)
 NARA: National Aquatic Resources Research and Development Agency (Sri Lanka)
 NFRDI: National Fisheries Research and Development Institute (Korea)
 NPOA: National Plan of Action
 NPF: Northern Prawn Fisheries (Australia)
 NRIFSF: National Research Institute of Far Seas Fisheries (Japan)
 OFCF: Overseas Fishery Cooperation Foundation of Japan
 OROP: Offshore Resources Observer Programme (South Africa)

RBA: Rapid Bycatch Assessment (Australia)
RCFMC: Research Center for Fisheries Management and Conservation (Indonesia)
RITF: Research Institute for Tuna Fisheries (Indonesia)
RPOA: Regional Plan of Action to Promote Responsible Fishing Practices Including Combating
Illegal, Unreported and Unregulated Fishing
SEAFDEC: Southeast Asian Fisheries Development Council
SFA: Seychelles Fishing Authority (Seychelles)
SHOU: Shanghai Ocean University (China)
SIH : *Systeme d'Information Halieutique* (Fisheries Information System, France)
SJF: Western Skipjack Fisheries (Australia)
SOOI: *Sud-Ouest de l'Ocean Indien* (Southwest Indian Ocean)
STRAP: Sea Turtle Recovery Action Plan (Kenya)
SU: Statistical Unit
SWIOFP: South West Indian Ocean Project
TAE: Total Applied Effort (South Africa)
TED: Turtle Excluder Device
TEP species: Threatened, Endangered and Protected species (Australia)
WTBF: Western Tuna and Billfish Fishery (Australia)