

EU-Portugal National Report to the Scientific Committee of the Indian Ocean Tuna Commission, 2023

Rui Coelho

IPMA - Portuguese Institute for the Ocean and Atmosphere, I.P.

INFORMATION ON FISHERIES, RESEARCH AND STATISTICS

<p>In accordance with IOTC Resolution 15/02 (and other data related CMMs as noted below), final scientific data for the previous year were provided to the IOTC Secretariat by 30 June of the current year, for all fleets other than longline [e.g., for a National Report submitted to the IOTC Secretariat in 2023, final data for the 2022 calendar year must be provided to the Secretariat by 30 June 2023]</p>	<p>N/A. Portugal does not have any fleets other than pelagic longlines</p>
<p>In accordance with IOTC Resolution 15/02, provisional longline data for the previous year was provided to the IOTC Secretariat by 30 June of the current year [e.g., for a National Report submitted to the IOTC Secretariat in 2023, preliminary data for the 2022 calendar year were provided to the IOTC Secretariat by 30 June 2023].</p> <p>REMINDER: Final longline data for the previous year are due to the IOTC Secretariat by 30 Dec of the current year [e.g., for a National Report submitted to the IOTC Secretariat in 2023, final data for the 2022 calendar year must be provided to the Secretariat by 30 December 2023].</p>	<p>YES (nominal catches and catch an effort); NO (size data)</p>
<p>If no, please indicate the reason(s) and intended actions: Size data was not possible to collect and submit for 2022 as the size data is collected exclusively by onboard fishery observers, and it was not possible to have onboard observers in 2022. We note that in 2023 there was a trip with onboard scientific observer, so it will be possible to report data next year relative to 2023.</p>	

Executive Summary

During 2022, the active fishing fleet of EU-Portugal operating in the IOTC convention area consisted of only 2 pelagic longliners targeting swordfish and blue shark, mostly in the temperate southwest Indian Ocean. Overall, a total of 1,452 MT was caught, of which 554 MT corresponded to swordfish, 746 MT to blue shark, 96 MT to shortfin mako, 28 MT to tuna, 15 MT to billfish (excluding swordfish) and 13 MT to other species. In 2022, EU-Portugal kept implementing the data collection program based on electronic logbooks, but due to problems with placing observers onboard the fishing vessels and restrictions in international travelling, it was not possible to have the onboard observers placed and collecting data. In 2022, and within the EU data collection framework, EU-Portugal continued the collection and revision of fisheries and biological data, including catch and effort, which were provided to IOTC Secretariat in due time. Size data was not possible to collect and submit due to the reasons explained above. EU-Portugal scientists produced and participated in several relevant working documents to several IOTC Working Parties, which are described in this report.

1. BACKGROUND/GENERAL FISHERY INFORMATION

The Portuguese fishing fleet operating in the IOTC area of competence consist only of pelagic longline vessels, which started their activities in 1998. Since then, there have been some changes and variability on the fleet composition, as after a sharp increase on the number of active vessels, after 2007 the active fleet was substantially reduced. Currently, the fleet uses semi-automatic pelagic longlines (Florida style gear), using J-hooks baited with squid and/or mackerel, depending on abundance of the target species as well as availability and price of the baits. Moreover, the increasingly use of wire traces has been registered, particularly in areas and/or seasons with higher abundance of pelagic sharks, mainly blue shark. More recently the number of active fishing vessels has been substantially reduced, with only 2 to 3 active vessels operating in recent years.

2. FLEET STRUCTURE

The Portuguese fishing vessels operating in the IOTC area of competence consist only of pelagic longline vessels targeting mainly swordfish. The number of vessels licensed increased from the beginning of the fishery in 1998 (5 vessels) until 2009 (24 vessels). The number of active vessels followed a similar trend, with a peak in 2006 (17 vessels). However, during the last years, the active vessels in the convention area decreased to as low as three (in 2009 and 2012), and now also more recently in 2018 to 2020 when again the number of active vessels was only three. One of the main reasons for some of the previous decreasing trends on the number of active vessels, specifically the drop seen between 2008 and 2012, was piracy in the Mozambique Channel, which traditionally was a major fishing area for the Portuguese fleet operating in the IOTC Convention area. Then, for several years, specifically in 2013 and 2014, the number of active vessels increased again to 7. But since then and to the present date it has continued to decrease and currently there are only 2 active vessels (**Table 1**). The fishing operations are surface pelagic drifting longlines, set in shallow waters with night setting and targeting mainly swordfish and blue shark.

Table 1: EU-Portugal longline fishing vessels licensed and actively operating in the IOTC area of competence, for the period 1998 to 2022.

Year	No. licensed vessels	No. active vessels
1998	5	1
1999	8	3
2000	9	3
2001	9	6
2002	11	7
2003	12	6
2004	14	5
2005	16	7
2006	18	17
2007	17	15
2008	21	4
2009	24	3
2010	18	4

2011	16	4
2012	16	3
2013	16	7
2014	18	7
2015	18	6
2016	18	6
2017	18	6
2018	18	3
2019	18	3
2020	20	3
2021	20	2
2022	20	2

3. CATCH AND EFFORT (BY SPECIES AND FISHERY)

The overall catch had a peak in 2006 (3,646 MT), followed by a sharp decrease in 2008. In recent years an increasing trend has been observed until 2017, followed by reductions in the most recent years of 2018 and 2019. The 2022 overall production was 1,452 MT.

The Portuguese fleet has swordfish and blue shark as the main target species. The peak of the catches of swordfish was in 2006 with 1,857 MT. In 2022, a total of 589 MT of swordfish were caught (**Table 2** and **Figure 1**). After a sharp decrease on the catches in 2008, most species groups followed an increasing trend up to 2017, which are followed by decreases in the most recent years. Among the pelagic sharks, the blue shark is the main species, followed by the shortfin mako. Their respective catches in 2022 were 746 and 96 MT (**Table 2** and **Figure 1**).

Table 2. Total EU-Portugal longline annual catch (MT - metric tons) and effort (x 10³ hooks) and catch for the primary species (or group of species) in the IOTC area of competence, for the period 2018 to 2022. SWO – swordfish; BSH – blue shark; SMA – shortfin-mako; TUS – tuna; BIL – other billfishes; NEI – not elsewhere included, category for all other species combined.

Year	Total effort	Total catch	SWO	BSH	SMA	TUS	BIL	NEI
2018	893	1808	741	806	166	42	25	28
2019	809	1544	629	711	114	52	21	17
2020	592	1102	443	499	104	26	20	9
2021	646	1383	458	742	112	42	21	8
2022	589	1452	554	746	96	28	15	13

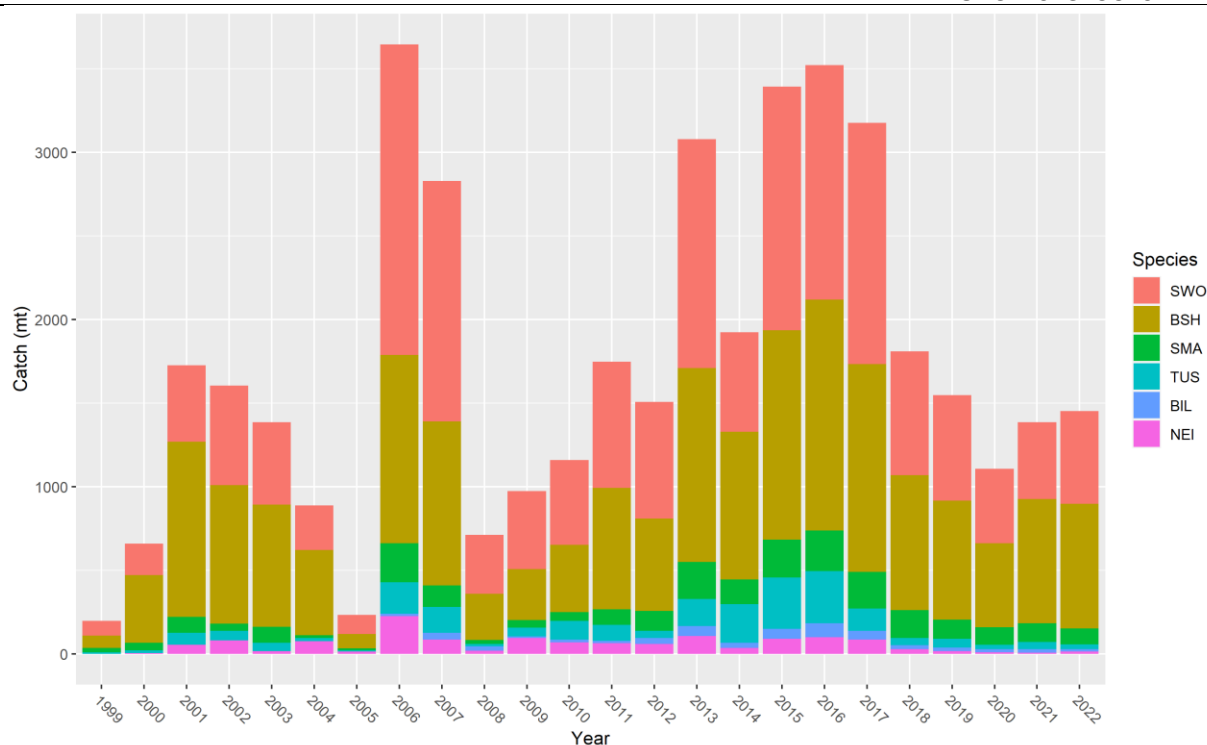


Figure 1. Historical annual catch for the Portuguese longline fleet, by primary species (or groups of species), for the IOTC area of competence for the entire history of the fishery (1999-2022). SWO – swordfish; BSH – blue shark; SMA – shortfin mako; TUS – tuna; BIL – billfishes; NEI - category for all other species combined.

During 2022 the overall fishing effort was 589 thousand hooks, with the SW Indian Ocean area being the most heavily fished (**Figure 2a**). During the first years of the fishery the fishing effort was concentrated in the SW Indian Ocean, but then developed towards the Central and Eastern regions of the convention area (**Figure 2b**). However, in recent years due to several reasons (including piracy, oil price and the decreased number of active boats), most of the fishing activity occurred in the SW area of the Indian Ocean. **Figure 3a** shows the spatial distribution of the catch for the three most important species in 2022. **Figure 3b** shows the geographical distribution of the catch (MT) for the three most important species during the period 2018-2022.

Total Hooks - 2022

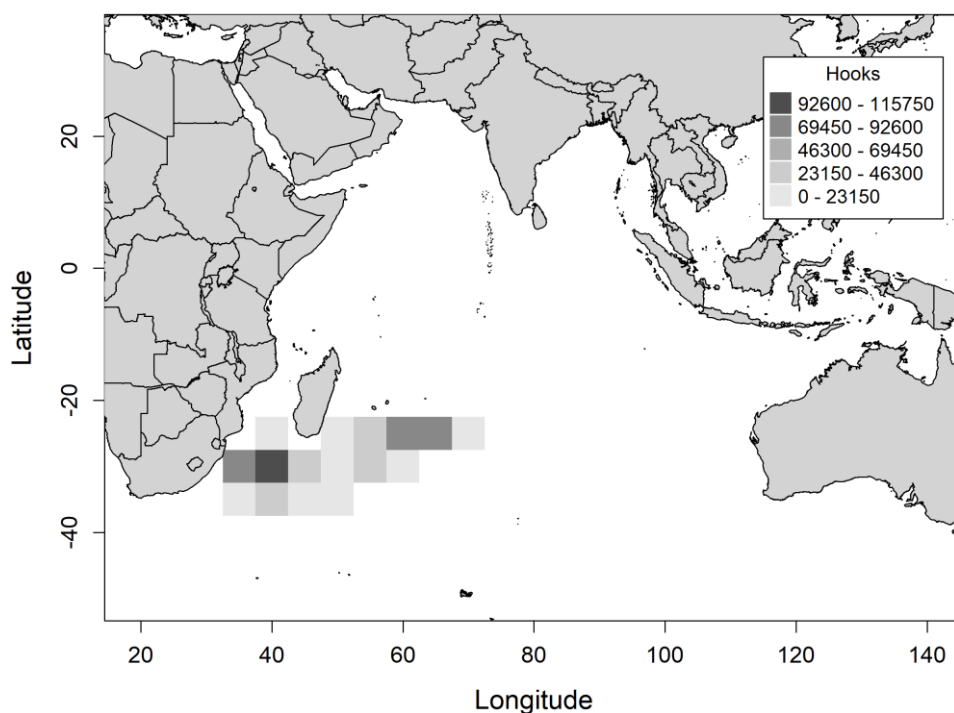


Figure 2a. Map of the distribution of fishing effort (number of hooks deployed), by the Portuguese longline fleet operating in the IOTC area of competence during 2022.

Mean Hooks - 2018-2022

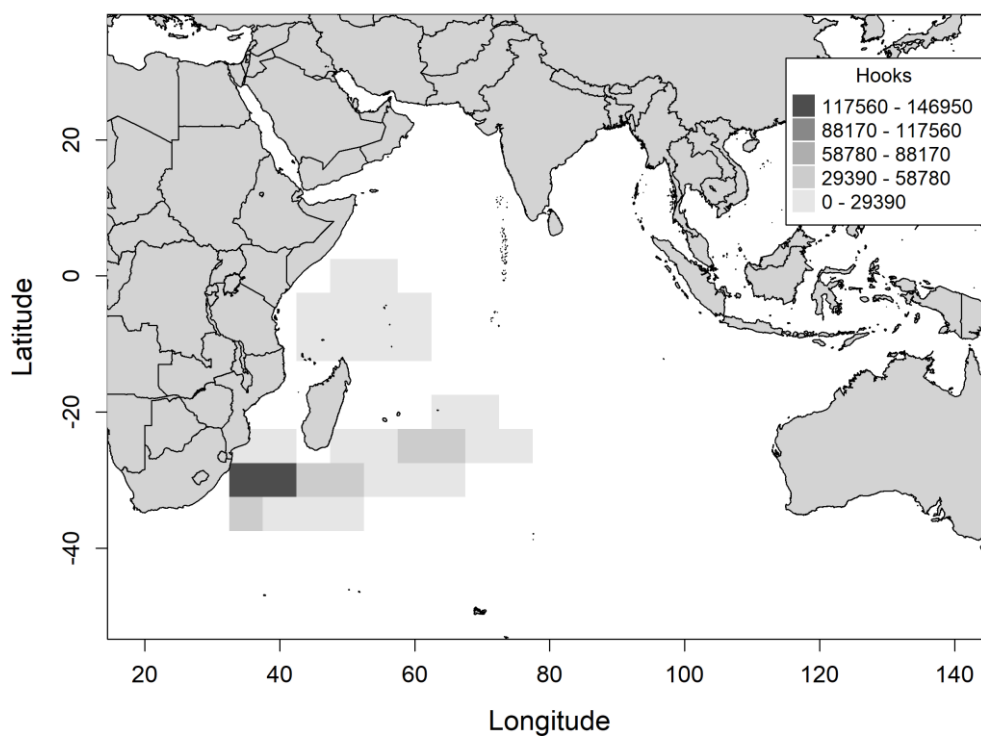


Figure 2b. Map of the distribution of mean fishing effort (number of hooks deployed), by the Portuguese longline fleet operating in the IOTC area of competence during the period 2018-2022.

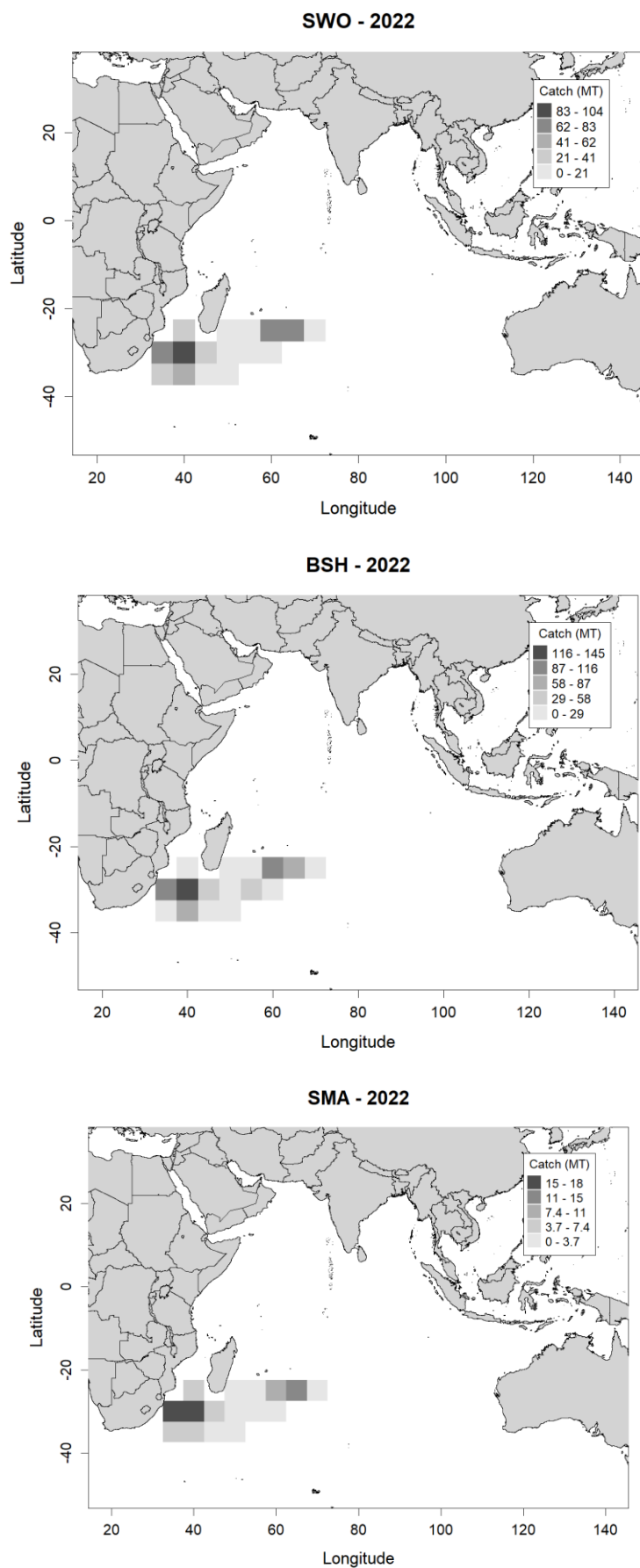


Figure 3a. Map of distribution of the catches (MT) by major species in the IOTC area of competence in 2022: SWO (swordfish) – *Xiphus gladius*; BSH (blue shark) – *Prionace glauca*; and SMA (shortfin mako) - *Isurus oxyrinchus*). Note: different catch scales.

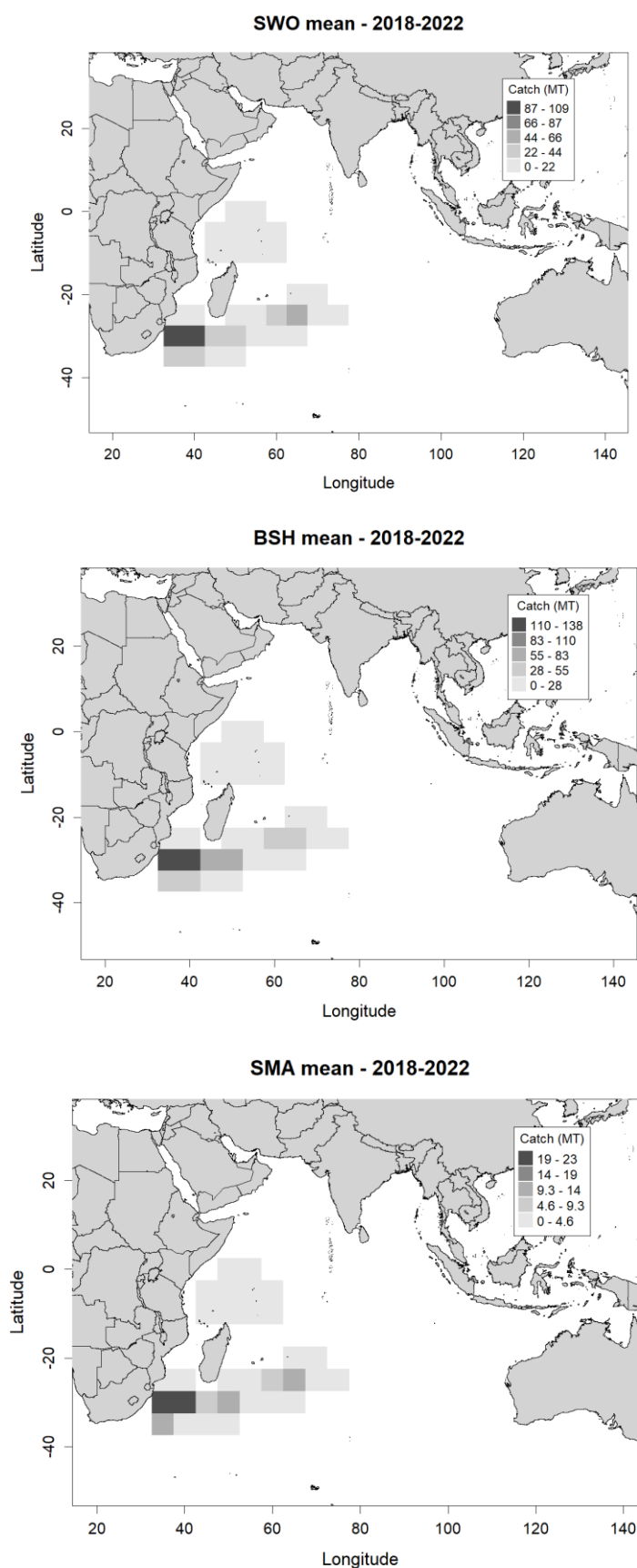


Figure 3b. Map of distribution of mean catches (MT) by major species in the IOTC area of competence during the period 2018-2022: SWO (swordfish) – *Xiphias gladius*; BSH (blue shark) – *Prionace glauca*; and SMA (shortfin mako) - *Isurus oxyrinchus*). Note: different scales in the colour codes.

4. RECREATIONAL FISHERY

No activity concerning recreational fishery by Portuguese vessels in the IOTC Convention area have been carried out for the last years.

5. ECOSYSTEM AND BYCATCH ISSUES

All IOTC Resolutions and Recommendations concerning Sharks, Seabirds and Marine Turtles are broadly publicized among fishermen operating in the IOTC convention area. The recently IOTC ID guides are being distributed as Portuguese and/or Spanish printed translations are made available when requested by the fleet. IPMA has participated in the Shark Ecological Risk Assessments that were presented and discussed by the WPEB in 2015.

5.1 Sharks

Major shark species catches are reported annually. Fishermen are encouraged to release by-catch species that are alive at-haulback, as well as juvenile specimens. The fleet must comply with the EU regulations on shark finning and fins-attached policy. Blue shark belly has been observed as being occasionally used as bait, particularly in areas/seasons when high shark bycatch occurs. Accordingly, an increased use of wire traces has also been observed. Shark catches have increased between 2014 and 2017 but dropped substantially especially after 2017 (**Table 3**). Only blue shark and shortfin mako are retained by the national fleet and commercialized, while the other species are discarded due to International and/or EU regulations. Those other species are therefore not retained nor landed, but are recorded and reported by the onboard observer programs when interactions occur.

5.1.1. NPOA sharks

The EU has presented and implemented a NPOA for sharks. This was approved in 2009 and it is currently being implemented.

5.1.2. Sharks finning regulation

EU.Portugal follows the EU regulations on this issue. Specifically, shark finning has been illegal under the EU shark finning Regulation since 2003. That regulation was amended in 2013 to introduce the fins-naturally-attached policy that prohibits all EU vessels, including EU.Portugal, from removing shark fins on board prior to landing the fish.

5.1.3. Blue shark

All vessels have electronic logbooks and major shark species catches, of which blue shark is the main species followed by shortfin mako, are recorded and reported annually. Table 3 below summarizes the catches of the main shark species, namely blue shark and shortfin mako over the last 5 years.

5.2 Seabirds

IOTC recommendations on seabirds have been made available to the fishermen operating longline gear. Skippers are asked to adopt mitigation measures, namely the use of tori lines, line weights and to conduct night gear setting with minimum deck lights, when fishing south of 25° South or whenever interaction with seabirds is foreseen. Moreover, within the scope of the EU data collection framework (EU-Portugal mainland component), skippers are encouraged to report the incidental catches of sea birds. The recently IOTC ID sea-bird guides are distributed to the fleet whenever there are requests.

The EU adopted in 2012 an Action Plan to address the problem of incidental catches of seabirds in fishing gears of its fishing fleets, that also applies to Portuguese vessels operating in the IOTC.

EU-Portugal fully complied with the Data Call for seabirds according to IOTC circular 2016/043 and submitted the requested data within the established deadlines (full datasets from 2011-2015). This full data is more complete than the data requested to be submitted in the tables for the IOTC National Reports.

Additionally, EU. Portugal has provided every year the interactions observer by fishery observers. Because in 2022 it was not possible to carry out fishery observer trips, this table cannot be provided in this 2023 report.

It is also noted that EU. Portugal scientists have participated in a collaborative work to evaluate the effectiveness of mitigation measures for sea-birds, that included raw detailed data analysis from various longline fleets operating in the southwest Indian Ocean and southern Atlantic (Jiménez et al., 2020).

5.3 Marine Turtles

Fishermen are encouraged to carefully handle marine turtles accidentally caught, and immediately release them after gear removal. IPMA has provided guidance on how to safely handle and release the turtles, as well as ID guides. Within the scope of the EU data collection framework (EU-Portugal mainland component), skippers are encouraged to report the incidental catches of marine turtles.

The EU Council Regulation (EC) No 520/2007 of 7 May 2007 lay down technical measures for the conservation of migratory species including marine turtles incorporating articles and provisions to reduce marine turtle bycatch on EU member states fisheries. This also applies to EU. Portugal vessels operating in the IOTC area.

In the 2020 SC report, and as requested by the WPEB and SC, we provided a table with detailed data on sea turtle captures and releases, using data from the Portuguese pelagic fishery observer program, that included data between 2016 and 2019.

Additionally, EU. Portugal has provided every year the interactions observer by fishery observers. Because in 2022 it was not possible to carry out fishery observer trips, this table cannot be provided in the 2023 report.

5.4 Other ecologically related species (e.g., cetaceans, mobulid rays, whale sharks)

The accidental catch of other species such as marine mammals are considered extremely rare. Whenever such animals are caught, fishermen are encouraged to immediately and safely release them. The catch of whale sharks does not occur in the EU. Portugal pelagic longline fishery.

EU. Portugal has provided every year the interactions of other ecologically related species observed by fishery observers. Because in 2022 it was not possible to carry out fishery observer trips, this table cannot be provided in the 2023 report.

6. NATIONAL DATA COLLECTION AND PROCESSING SYSTEMS

6.1. Logsheet data collection and verification

All longline vessels operating in the area have records of their catches registered on official logbooks, since the year they have beginning the fisheries operations in the area. In 2012 electronic logbooks became mandatory. All logbooks are transmitted to the Portuguese Fisheries Administration (DGRM), which processes the data and transmit it to IOTC Secretariat through the European Commission.

6.2. Vessel Monitoring System

Since 1998 all Portuguese vessels over 15 meters long are obliged to have VMS equipment on board. Thereby all Portuguese vessels operating in the convention area are monitored by a tracking satellite VMS. The specific national legislation that regulates the use of VMS in EU. Portugal vessels is Decreto-Lei n.º 310/98, from 14 October 1998.

6.3. Observer scheme

Since 2011 an observer program was fully implemented by IPMA. Until 2018 the onboard fishery observers were part of the technical staff of IPMA, but since 2019 the onboard observers are hired through a private company. IPMA provides the training to the observers from the company and those are required to use IPMA protocols and forms for data collections. The program aims to cover a minimum of 5% of the longline fishing effort. **Table 3** provides the coverage of the program by year calculated both in number of hooks and sets since the start of the program in 2011.

Eight observers have received the necessary training to collect a wide range of fisheries data, to fulfil all fields covered by the IOTC Observer Trip Report. Starting in 2011, the observers started collecting information on all specimens caught, which includes: ID to the most detailed taxonomic possible level; size; sex; the condition at-haulback (alive / dead); fate (retained/discarded); and, condition if discarded (alive/dead). Finally, biological samples were collected for some of the major shark and bony fish species, aiming a number of studies focusing on: life history issues (ages, growth and reproduction); genetics (population structure and paternity; and, morphometrics (weight:length, length:length, weight:weight relationships).

It is noted that the EU.Portugal observer program could not be executed during 2020, 2021 and 2022. In 2020 and 2021 was mostly due to restrictions related with Covid-19, specifically restrictions to place fishery observers onboard and restrictions related with international travelling. In 2022 it was mostly related with administrative issues. As such, it is not possible to provide the map requested in **Figure 4**. We also noted that the program had an observer trip carried out in 2023, and as such it will be possible to report this data to IOTC and include it in next year report.

Table 3. Annual observer coverage of the Portuguese pelagic longline fleet since it was established in 2011, measured as a percentage of the total effort in number of hooks and sets, for the period 2011–2022.

Year	Gear	Observer coverage		Size data coverage
		Hooks (%)	Sets (%)	
2011	Pelagic longline	17.9	16.3	Sizes are taken for all retained specimens and dead discards
2012	Pelagic longline	10.7	10.9	
2013	Pelagic longline	11.0	9.9	
2014	Pelagic longline	7.3	5.7	
2015	Pelagic longline	11.1	8.2	
2016	Pelagic longline	9.1	7.2	
2017	Pelagic longline	7.9	7.0	
2018	Pelagic longline	15.5	13.9	
2019	Pelagic longline	17.4	16.1	
2020*	Pelagic longline	0	0	
2021*	Pelagic longline	0	0	
2022*	Pelagic longline	0	0	

* Impossibility to place fishery observers onboard in that year.

Figure 4. Not possible to provide as the fishery observer program could not be executed in 2022.

6.4. Port sampling programme

Catches from Portuguese vessels operating in the IOTC convention area are usually moved to containers in ports and shipped to non-Portuguese ports in Europe (mostly Vigo, Spain). Thus, the current port sampling program for the Portuguese longline fleet does not cover those vessels operating in the IOTC conventional area. As such, **Tables 4 and 5** do not apply to this fleet.

Table 4. Not possible to produce as EU.Portugal does not have a port-sampling program for vessels operating in the IOTC area

Table 5. Not possible to produce as EU.Portugal does not have a port-sampling program for vessels operating in the IOTC area

6.5. Unloading/Transshipment of flag vessels

Catches from Portuguese vessels operating in the IOTC convention area are usually moved to containers in ports and shipped to non-Portuguese ports in Europe (mostly Vigo, Spain). Thus, the current port sampling program for the Portuguese longline fleet does not cover those vessels operating in the IOTC conventional area. As such, **Tables 6 and 7** do not apply to this fleet.

Table 6. Not possible to produce as EU.Portugal does not have a port-sampling program for vessels operating in the IOTC area.

Table 7. Not possible to produce as EU.Portugal does not have a port-sampling program for vessels operating in the IOTC area.

6.6. Actions taken to monitor catches & manage fisheries for Striped Marlin, Black Marlin, Blue Marlin and Indo-pacific Sailfish

In terms of species identification, the onboard observers and skippers are distributed with the IOTC Billfish identification cards, as well as material like dichotomic keys prepared by IPMA- Portugal.

In terms of data recording, all catch of all species including marlins, are recorded and reported in the electronic logbooks. Additionally, all catches, including retained species, alive and dead discards, are recorded in the observer program and dully reported in electronic format to the IOTC Secretariat by the established deadlines. This includes all billfish species when those are captured. However, as stated previously above, given the impossibility of conducting observer trips between 2020 and 2022, , observer data is not available from 2022 to report in this 2023 report.

6.7. Gillnet observer coverage and monitoring

This point does not apply to EU.Portugal, as EU.Portugal does not have any gillnets fisheries in the IOTC convention area.

6.8 Sampling plans for mobulid rays

This point is mostly related with subsistence and artisanal fisheries and therefore does not apply to EU.Portugal fleet.

However, we can add that all mobulids rays from the EU.Portugal longline fleet are released. In terms of data recording and reporting, and as mentioned previously, all catch for all species (including retained species, alive and dead discards) are recorded in the observer program and dully reported in electronic format to the IOTC Secretariat by the established deadlines. This includes all mobulid rays when those are captured and discarded. As stated previously, given the impossibility of conducting observer trips in 2020 to 2022, observer data is not available from 2022 to report in this 2023 report.

7. NATIONAL RESEARCH PROGRAMS

The Portuguese research program carried out by IPMA, I.P., for highly migratory species begun in 2010. The programme covers 3 main research lines: fisheries, fleet dynamics and biological studies. The fisheries research lines involves: i) revisiting historical official logbook data and the collection of skippers logbooks and VMS data; ii) spatial-temporal analysis of fishing effort and catch at size for major species caught; and iii) haulback mortality. The fleet dynamics involves: i) the spatial-temporal analysis of the fishing activity

and catches; and ii) investigating the link between gear configuration/characteristics and target vs. by-catch of sharks. Finally, the biological studies focus all major species, but primarily on pelagic sharks, namely in terms of: i) life history parameters (age, growth and reproduction); ii) genetics (population structure and paternity); iii) morphometrics (weight:length, length:length and weight:weight relationships); and iv) movements and habitat use. Among shark species, particular attention is being provided to the two most important species caught (blue shark and shortfin mako), and to a less extent to other species, including threshers, hammerheads, oceanic whitetip and silky sharks. It is also worth noting that IPMA scientists have participated in the technical work for the development of MSE for the Indian Ocean swordfish, and involved in several other EU funded projects that have focused migratory species in the Indian Ocean, such as tagging sea-turtles and swordfish.

7.1. National research programs on blue shark

As mentioned before, the biological studies carried out at IPMA focus all major species, but primarily on pelagic sharks, namely in terms of: i) life history parameters (age, growth and reproduction); ii) genetics (population structure and paternity); iii) morphometrics (weight:length, length:length and weight:weight relationships); and iv) movements and habitat use. Among shark species, particular attention is being provided to the two most important species caught (blue shark and shortfin mako), and to a less extent to other species, including threshers, hammerheads, oceanic whitetip and silky sharks.

One recent work specific to blue shark was estimating ages and modelling growth in the SW Indian Ocean. The results from that work have been shown to the WPEB (Andrade et al., 2017) and published in the peer-reviewed literature (Andrade et al., 2019).

Another major contribution was a revision for catch-at-size data for both the Indian Ocean and Atlantic, that has been provided to the WPEB and used in the 2017 stock assessment, to inform the size distribution in the integrated assessment models. This work has in the meanwhile been published in the peer-reviewed literature (Coelho et al., 2018).

In the first blue shark stock assessment (2017), EU.Portugal scientists have worked and provide to the WPEB an alternative catch series based on ratios (Coelho and Rosa, 2017), as well as developing priors for population dynamic parameters (Rosa and Coelho, 2016), that were used in the stock assessment. In 2021, the WPEB carried out a new blue shark stock assessment and EU.Portugal provided updated CPUE series and size data information for informing the new assessment models (Coelho et al., 2021).

Finally, EU.Portugal has lead a EU project (Coelho et al., 2019) that worked with several shark case studies, including a preliminary works for MSE and length-based indicators for blue shark in the Indian Ocean, that were also presented to the WPEB (Ortiz de Urbina et al., 2018; Walker et al., 2018).

7.2. National research programs on Striped Marlin, Black Marlin, Blue Marlin and Indo-pacific Sailfish

All billfish interactions are recorded in the observer program and reported to IOTC. Those interactions are relatively rare, so at this stage EU.Portugal only does some opportunistic, but not systematic, biological sampling on those species. A program has started a few years ago to collect spines and otoliths of swordfish and that could be expanded to other billfishes in the future.

EU.Portugal has in the past provided to the WPB observations on the Indo-Pacific sailfish from the Portuguese fleet in the Indian Ocean, and updates can be further provided if and when requested by the WPB (Rosa et al., 2015). Additionally, EU.Portugal has provided samples to a large scale effort for population genetics on sailfish, that has been accepted in the peer-reviewed literature (Ferrette et al., 2021).

Finally, EU.Portugal/IPMA is participating in a EU project lead by Ifremer (EU.France) to tag swordfish and marlins in the Indian Ocean (update provided in Nieblas et al., 2020).

7.3. National research programs on sharks

As mentioned before, the biological studies carried out at IPMA focus all major species, but primarily on pelagic sharks, namely in terms of: i) life history parameters (age, growth and reproduction); ii) genetics (population structure and paternity); iii) morphometrics (weight:length, length:length and weight:weight relationships); and iv) movements and habitat use. Among shark species, particular attention is being provided to the two most important species caught (blue shark and shortfin mako), and to a less extent to other species, including threshers, hammerheads, oceanic whitetip and silky sharks.

Some experimental work has been done with the use of monofilament *versus* wire leaders in the pelagic longline configuration, which has been presented to the WPEB (Santos et al., 2014) and published in the peer review literature (Santos et al., 2017).

Additionally, EU.Portugal recently lead a EU Project on a meta-analysis for the effects of hook, bait and leader type effects on surface pelagic longline retention and mortality rates, comparing target, bycatch and vulnerable fauna interactions. The last update made to the WPEB is provided in Santos et al. (2019). That project final report is available from Coelho et al. (2020).

7.4. National research programs on oceanic whitetip sharks

See point 7.3 above for a general description on the research carried out in sharks, with some aspects also applying to oceanic whitetip sharks.

EU.Portugal (IPMA) has participated in some previous studies focusing on oceanic whitetip sharks, including with samples from the Indian ocean (Mendes et al., 2015, Camargo et al., 2016). However, and with regards to biological samples, it is worth noting that since the inclusion of oceanic whitetip shark in CITES in 2014, all biological sampling has stopped (e.g., tissue for genetics and vertebrae). So only samples collected before the CITES listing are now being used.

IPMA has also carried out work focused on the hooking mortality of oceanic whitetip shark, in an attempt to provide information in the effectiveness of the no-retention of that species and at the request of the WPEB. That work has been presented to the WPEB (Coelho, 2016) and updates can be further provided in and when requested by the WPEB.

Finally, EU.Portugal/IPMA participates in a collaborative project on oceanic whitetip shark habitat use and post-release mortality using satellite telemetry (see update in Bach et al., 2021).

7.5. National research programs on marine turtles

All sea turtle interactions are recorded in the observer program and reported to IOTC.

EU.Portugal is currently participating in a collaborative research that includes the Atlantic (ICCAT) and Indian Ocean (IOTC) scientists and data. This work is currently in the revision stage for submission to the peer-review literature.

Furthermore, since 2016 IPMA has been collaborating with projects from Ifremer (EU.France) and NGOs to deploy satellite tags on sea turtles to study their movements and migrations in the Indian Ocean. A scientific paper has been produced with the results of this research (Monsinjon et al., 2023).

7.6. National research programs on thresher sharks

See point 7.3 above for a general description on the research carried out in sharks, with some aspects also applying to thresher sharks.

EU.Portugal/IPMA has participated in a bigeye thresher sharks study on population genetics for the Atlantic and Indian oceans (Morales et al., 2018). With regards to biological samples, it is worth noting that since the inclusion of thresher sharks in CITES in 2017, all biological sampling has stopped (e.g., tissue for genetics and vertebrae), due to complications in sample transportation. As such, only samples collected previous to CITES inclusion are currently being used.

Since 2018, IPMA has been collaborating with IOTC projects to deploy satellite tags on bigeye thresher sharks to study movement patterns and migrations, and determine post-release mortality (Romanov et al., 2020).

Table 8. Summary table of national (EU-Portugal) research projects focusing migratory species in the Indian Ocean, that were ongoing in 2022.

Project title	Period	Countries involved	Budget total	Funding source	Objectives	Short description
National Program for Biological Sampling (PNAB)	2011-2022	Portugal	~50,000€ (yearly)	EU (DCF – Data Collection Framework) and National funds	Data collection and reporting of data for the Portuguese pelagic longline fleet.	This yearly program involves the collection of data, reporting and scientific work to provide advice in the IOTC area of competence.

Based on the data collected in 2022 and in previous years, one working document was prepared and co-authored by the Portuguese research team during several 2022 IOTC meetings. Those also include technical documents produced within international cooperative initiatives, either involving other EU colleagues or having a broader international scope.

The technical papers presented to IOTC in 2022 with EU.Portugal participation:

- Séret, B., Coelho, R., Bach, P., Chavance, P., Ellis, J., Poisson, F., Rosa, D., Santos, C. C., Santos, M. N., Murua, H. 2022. Biological information for most commonly shark species caught in tuna fisheries. Working Party on Ecosystems and Bycatch (WPBE). 5-9 September 2022, Online meeting. IOTC Document: IOTC-2022-WPBE18-13.

8. IMPLEMENTATION OF SCIENTIFIC COMMITTEE RECOMMENDATIONS AND RESOLUTIONS OF THE IOTC RELEVANT TO THE SC.

Table 9. Scientific requirements contained in Resolutions of the Commission, adopted between 2012 and 2022.

Res. No.	Resolution	Scientific requirement	CPC progress
12/04	On the conservation of marine turtles	Paragraphs 3, 4, 6–10	Incidental interaction with marine turtles are recorded by onboard observers. The information is fully submitted and provided to the IOTC Secretariat in the fishery observer reports and datasets. Fishermen are encouraged to carefully handle marine turtles accidentally caught, and immediately release them after gear removal. They are aware of and use proper mitigation, handling and de-hooking techniques and should keep onboard all necessary equipment for the release of marine turtles (including line cutters and de-hookers), in accordance with IOTC and FAO handling guidelines. Furthermore, since 2016 IPMA has been collaborating with projects from Ifremer (EU.France) and NGOs to deploy satellite tags on sea turtles to study their movements and migrations in the Indian Ocean. A peer-review paper has been produced with those results (Monsinjon et al., 2023).

Res. No.	Resolution	Scientific requirement	CPC progress
12/06	On reducing the incidental bycatch of seabirds in longline fisheries.	Paragraphs 3–7	All longline fishing vessels are aware of the need to use tori lines and/or line weights when operating south of 25°S. The incidental capture of sea birds in Portuguese longliners is rare. EU-Portugal fully complied with the Data Call for seabirds according to IOTC circular 2016/043 and submitted to the IOTC Secretariat the requested data within the established deadlines (full and detailed datasets from 2011-2015). IPMA fishery observers record all interactions with seabirds, which are fully reported in the observer trips data submitted to IOTC in due time. Additionally, IPMA was recently involved in a large scale effort and work to assess the effectiveness of mitigation measures in sea-birds (Jimenez et al., 2020), that was also requested by the IOTC Commission.
12/09	On the conservation of thresher sharks (family alopiidae) caught in association with fisheries in the IOTC area of competence	Paragraphs 4–8	Fishers are encouraged to release thresher sharks if recognised on the line before bringing them onboard the vessel. Skippers are requested to record and report incidental catches as well as live releases of thresher sharks. Scientific observers from IPMA used to collect biological samples (vertebrae and tissues) from thresher sharks taken in the IOTC area of competence that were dead at haulback, as part of a research project approved by the IOTC Scientific Committee. The information compiled by IPMA has been presented to the WPEB. Given than thresher sharks were listed in CITES in 2016, IPMA had to completely stop all sampling on this species, due to complications in sample transportation. Since 2018, IPMA has been collaborating with IOTC projects to deploy satellite tags on bigeye thresher sharks to study movement patterns and migrations, and determine post-release mortality.
13/04	On the conservation of cetaceans	Paragraphs 7–9	EU.Portugal does not have purse seiners operating in the IOTC area of competence. For other gears, namely pelagic longlines, interactions with cetaceans are rare. If such animals are caught, fishermen are encouraged to immediately and safely release them. IPMA fishery observers record all interactions with cetaceans, which are reported in the observer trips and electronic data submitted to IOTC in due time.
13/05	On the conservation of whale sharks (<i>Rhincodon typus</i>)	Paragraphs 7–9	EU.Portugal does not have purse seiners operating in the IOTC area of competence. For other gears, namely pelagic longlines, such interactions are extremely rare (almost non-existent). In the extremely unlikely event of such animals being caught, fishermen are encouraged to immediately and safely release them. IPMA fishery observers would record any possible interaction with whale sharks, which if happened would be reported in the observer trips submitted to IOTC in due time.
13/06	On a scientific and management framework on the conservation of shark species caught in association with IOTC managed fisheries	Paragraph 5–6	Fishers are encouraged to release oceanic whitetip sharks if recognised on the line before bringing them onboard the vessel. Skippers are requested to record and report incidental catches as well as live releases of oceanic whitetip sharks. Scientific observers from IPMA used to collected biological samples (vertebrae and tissues) from oceanic whitetip sharks taken in the IOTC area of competence that were dead at haulback, as part of a research project approved by the IOTC Scientific Committee and before inclusion of this species in CITES in 2014. However, after 2014 all biological sampling on this species stopped after the CITES listings due to complications in sample transportation internationally.

Res. No.	Resolution	Scientific requirement	CPC progress
			Since 2018, IPMA has been collaborating with IOTC projects to deploy satellite tags on oceanic whitetip sharks to study movement patterns and migrations, and determine post-release mortality.
15/01	On the recording of catch and effort by fishing vessels in the IOTC area of competence	Paragraphs 1–10	All operating longline vessels have records of their catches registered on official logbooks, since the year they have begun the fisheries operations in the IOTC convention area. In 2012 electronic logbooks became mandatory. All logbooks are transmitted to the Portuguese Fisheries Administration (DGRM), which processes the data and transmit it to European Commission (EU). EU is responsible for providing the data to the IOTC Secretariat.
15/02	Mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs)	Paragraphs 1–7	Since 2009 catch by species in weight and effort in number of hooks deployed has been provided by 5° x 5° grid area.
17/05	On the conservation of sharks caught in association with fisheries managed by IOTC	Paragraphs 6, 9, 11	<p>EU. Portugal reports all data for catches of sharks, in accordance with IOTC data reporting requirements and procedures. Additionally, all data from sharks recorded by the onboard observers is also fully reported and submitted to the IOTC Secretariat in electronic format.</p> <p>Furthermore, IPMA continues several lines of research on sharks, including:</p> <ul style="list-style-type: none"> • Fishing gear selectivity • Improvement of knowledge on biological parameters • Shark tagging studies aiming to identify habitat use. • Shark tagging studies for post-release mortality. <p>Finally, fishermen, operating in the area, are made aware of practices that should be put in place, namely:</p> <ul style="list-style-type: none"> • Shark species catches need to be reported annually; • Shark fining is banned on all licensed vessels; commercial sharks that are retained must be landed with the fins attached <p>Bycatch species are released, and should use the best handling practices.</p>
18/02	On management measures for the conservation of blue shark caught in association with IOTC fisheries	Paragraphs 2-5	<p>The EU. Portugal longline fleet is aware that all major sharks, including blue shark catches, have to be fully reported. Portugal has an electronic logbook system and uses VMS data for preparing nominal catches and catch and effort data, respectively, that is fully submitted to the IOTC Secretariat.</p> <p>Additionally, EU. Portugal has an ongoing onboard observer program that records all shark species catches, including blue shark. All detailed data from the observer program is fully submitted to IOTC Secretariat in electronic format.</p> <p>IPMA continues scientific research in all shark species, including blue shark, especially for life history characteristics, and the information is made available to the WPEB.</p>
18/05	On management measures for the conservation of the Billfishes: Striped marlin, black marlin, blue marlin and Indo-Pacific sailfish	Paragraphs 7 – 11	Fishers are encouraged to release any stripped, black or blue marlins that are captured or brought alive alongside the vessel. Skippers are requested to record and report incidental catches as well as live releases of those marlin species. Scientific observers from IPMA record all catches of marlins as well as their status when captured and when released in trips with onboard observers. The information

Res. No.	Resolution	Scientific requirement	CPC progress
			is fully provided to the IOTC Secretariat in the observer trip reports and data.
18/07	On measures applicable in case of non-fulfilment of reporting obligations in the IOTC	Paragraphs 1, 4	<p>EU-Portugal reports annually the catches, catch and effort and size samples of the main IOTC species, including sharks and other bycatch. Besides the official statistics, skippers are encouraged to report data using the self-sampling program, and all data is reported to the IOTC Secretariat. Additionally, EU-Portugal has been fully reporting in due time the observer trip reports, providing full details on the operations and catches (including all bycatch) since the start of the fishery observer program in 2011.</p> <p>These reporting obligations are included in the Portuguese National Data Collection Framework under the EU legislation (article 25, of EU Regulation 1380/2013, of 11 December). Still according to EU rules, the failure by a Member State to collect and /or provide data in a timely manner may result in a proportionate suspension or interruption of relevant Union financial assistance to that Member State. Thus, according to EU Regulation 665/2008, of 14 July the proportion of reduction is 1% of the total Community financial assistance per failure to satisfy a demand.</p>
19/01	On an Interim Plan for Rebuilding the Indian Ocean Yellowfin Tuna Stock in the IOTC Area of Competence (<i>If not provided under Res 21/01 below</i>)	Paragraph 22	Tropical tunas are only an occasional bycatch of the EU.Portugal pelagic longline fleet that is mostly targeting swordfish and blue shark.
19/03	On the Conservation of Mobulid Rays Caught in Association with Fisheries in the IOTC Area of Competence	Paragraph 11	All mobulid rays incidentally captured by the EU.Portugal longline fleet are released. In terms of data recording and reporting, all interactions with those species are recorded in the observer program and dully reported in electronic format to the IOTC Secretariat by the established deadlines, including data on the status at discarding (dead or alive).
21/01	On an Interim Plan for Rebuilding the Indian Ocean Yellowfin Tuna Stock in the IOTC Area of Competence (<i>If not provided under Res 19/01 above</i>)	Paragraph 23	As stated under Res 19/01 above, tropical tunas are only an occasional bycatch of the EU.Portugal pelagic longline fleet that is mostly targeting swordfish and blue shark
22/04	On a regional observer scheme	Paragraph 12	<p>In late 2010 a national observer program was approved under the EU data collection framework. The observer program has been fully implemented since 2011 and is currently ongoing. The trip reports have always been submitted in due time to the IOTC Secretariat. Since 2017, all data has been fully transmitted in electronic format. Since 2019 the onboard observers are no longer part of the IPMA staff but hired through a private company. Still, all training and data protocols and forms used are from IPMA, and IPMA is still responsible for the implementation, data compilation and quality check, and data transmission to IOTC. It is noted that in 2020, 2021 and 2022, it was not possible to have onboard observers in this fleet. In 2020 and 2021 was mostly due to covid-19 related restrictions to have onboard observers and restrictions in international traveling, while in 2022 mostly due to administrative issues. In 2023 there was again observer trips covered.</p>

9. LITERATURE CITED

Andrade, I., Rosa, D., Lechuga, R., Coelho, R. 2017. Age and growth of blue shark in the Indian Ocean. 13th Working Party on Ecosystems and Bycatch, 4-8 September, San Sebastian, Spain. IOTC Document, IOTC-2017-WPEB13-20. 15pp.

Andrade, I., Rosa, D., Muñoz-Lechuga, R., Coelho, R. 2019. Age and growth of the blue shark (*Prionace glauca*) in the Indian Ocean. *Fisheries Research*, 211: 238–246.

Bach, P., Sabarros, P.S., Romanov, E.V., Coelho, R., Guillon, N., Massey, Y., Murua, H. 2021. Third progress report on tag deployments to investigate the post-release mortality of oceanic white sharks discarded by EU purse seine and pelagic longline fisheries in the South-West Indian Ocean (POREMO project). 17th Working Party on Ecosystems and Bycatch: Assessment Meeting (WPEB17-AS). 6-10 September 2021, Online Meeting. IOTC Document, IOTC-2021-WPEB17-AS-26_rev1. 9pp

Camargo SM, Coelho R, Chapman D, Howey-Jordan L, Brooks EJ, Fernando D, et al. 2016. Structure and Genetic Variability of the Oceanic Whitetip Shark, *Carcharhinus longimanus*, Determined Using Mitochondrial DNA. *PLoS ONE* 11(5): e0155623. <https://doi.org/10.1371/journal.pone.0155623>

Coelho, R. 2016. Hooking mortality of oceanic whitetip sharks caught in a pelagic longline fishery targeting swordfish in the SW Indian Ocean: comments on the efficiency of no-retention measures. 12th Working Party on Ecosystems and Bycatch, 12-16 September, Victoria, Seychelles. IOTC Document, IOTC-2016-WPEB12-26. 7pp.

Coelho, R., Rosa, D. 2017. Catch reconstruction for the Indian Ocean blue shark: an alternative hypothesis based on ratios. 13th Working Party on Ecosystems and Bycatch, 4-8 September, San Sebastian, Spain. IOTC Document, IOTC-2017-WPEB13-22. 15pp.

Coelho, R., Mejuto, J., Domingo, A., Yokawa, K., Liu, K-M., Cortés, E., Romanov, E., da Silva, C., Hazin, F., Arocha, F., Mwilima, A.M., Bach, P., Ortiz de Zarate, V., Roche, W., Lino, P.G., García-Cortés, B., Ramos-Cartelle, A.M., Forselledo, R., Mas, F., Ohshimo, S., Courtney, D., Sabarros, P.S., Perez, B., Wogerbauer, C., Tsai, W-P., Carvalho, F., Santos, M.N. 2018. Oceanic-wide distribution patterns and population structure of blue shark (*Prionace glauca*) in the Atlantic and Indian oceans. *Fish and Fisheries*, 19: 90–106.

Coelho, R., Apostolaki, P., Bach, P., Brunel, T., Davies, T., Díez, G., Ellis, J., Escalle, L., Lopez, J., Merino, G., Mitchell, R., Macias, D., Murua, H., Overzee, H., Poos, J.J., Richardson, H., Rosa, D., Sánchez, S., Santos, C., Séret, B., Urbina, J.O., Walker, N. 2019. Improving scientific advice for the conservation and management of oceanic sharks and rays. Final Report. European Commission. Specific Contract No. 1 under Framework Contract No. EASME/EMFF/2016/008. 620 pp + Anexes. DOI: 10.2826/229340. Available at: <https://publications.europa.eu/en/publication-detail/-/publication/bb27e867-6185-11e9-b6eb-01aa75ed71a1/language-en>.

Coelho, R., Bach, P., Santos, C.C., Rosa, D., Romanov, E., Infante, P., Massey, Y., Mees, C., Arrizabalaga, H. 2020. Evaluation of the effects of hooks' shape & size on the catchability, yields and mortality of target and bycatch species, in the Atlantic Ocean and adjacent seas surface longline fisheries. Final Report. European Commission. Specific Contract No. 16 under Framework Contract No. EASME/EMFF/2016/008. 143 pp + XI Appendices. Available at: <https://op.europa.eu/en/publication-detail/-/publication/da6d2ad9-1418-11eb-b57e-01aa75ed71a1/language-en/format-PDF/source-167066032>.

Coelho, R., Santos, C.C., Rosa, D., Lino, P.G. 2021. Updated blue shark catches and standardized CPUE for the Portuguese pelagic longline fleet in the Indian Ocean. 17th Working Party on Ecosystems and Bycatch Data Preparatory Meeting (WPEB17-DP). 12-14 April 2021, Online Meeting. IOTC Document, IOTC-2021-WPEB17-DP-10. 17pp.

Ferrette, B.L.S., Mourato, B., Hazin, F.H.V., Arocha, F., 5, Williams, S.M., Rodrigues-Jr, C.E., Porto-Foresti, F., Amorim, A.F., Rotundo, M.M., Coelho, R., Hoolihan, J.P., Sow, F.N., Diaha, N.C., Romanov, E.V.,

Domingues, R.R., Oliveira, C., Foresti, F., Mendonça, F.F. 2021-In press. Global phylogeography of sailfish: evolutionary lineages with implications for fisheries management. *Hydrobiologia*.

Jiménez, S., Domingo, A., Winker, H., Parker, D., Gianuca, D., Neves, T., Coelho, R., Kerwath, S. 2020. Towards mitigation of seabird bycatch: large-scale effectiveness of night setting and tori lines across multiple pelagic longline fleets. *Biological Conservation*, 247: 108642. DOI: <https://doi.org/10.1016/j.biocon.2020.108642>

Mendes, N.J., Cruz, V.P., Mendonça, F.F., Pardo, B.G., Coelho, R., Ashikaga, F.Y., Camargo, S.M., Martínez, P., Oliveira, C., Santos, M.N., Foresti, F. 2015. Microsatellite loci in the oceanic whitetip shark and cross-species amplification using pyrosequencing technology. *Conservation Genetics Resources*, 7: 585–589.

Monsinjon, J.R., Laforge, A., Gaspar, P., Barat, A., Bousquet, O., Ciccione, S., Jean, C., Ballorain, K., Dalleau, D., Coelho, R., Bonhommeau, S., Bourjea, J., Loggerhead turtle oceanic-neritic habitat shift reveals key foraging areas in the Western Indian Ocean. *Frontiers in Marine Science*, 10: 1204664. DOI:10.3389/fmars.2023.1204664

Morales, M.J.A., Mendonça, F.F., Magalhães, C.O., Oliveira, C., Coelho, R., Santos, M.N., Cruz, V.P., Piercy, A., Burgess, G., Hazin, F.H.V., Foresti, F. 2018. Population genetics of the bigeye thresher shark *Alopias superciliosus* in the Atlantic and Indian Oceans: implications for conservation. *Reviews in Fish Biology and Fisheries*, 28: 941–951.

Nieblas, A.E., Bonhommeau, S., Brisset, B., Bernard, S., Chanut, J., Coelho, R., Colas, Y., Evano, H., Faure, C., Hervé, G., Kerzerho, V., Rouyer, T., 2020. First results of the FLOPPED project : satellite tagging of billfish around the Indian Ocean. 16th Working Party on Data Collection and Statistics (WPDCS 16). 30 November – 3 December 2020, Online Meeting. IOTC Document, IOTC-2020-WPDCS16-15. 9pp

Ortiz de Urbina, J., Carruthers, T., Coelho, R., Rosa, D., Murua, H., Saber, S., Macias, D. 2018. Preliminary management strategy evaluation for blue shark in the Indian Ocean using a data-limited approach. 14th Working Party on Ecosystems and Bycatch, 10-14 September, Cape Town, South Africa. IOTC Document, IOTC-2018-WPEB14-36. 27pp.

Romanov, E.V., Bach, P., Bonhommeau, S., Coelho, R., DeBruyn, P., Martin, S., Murua, H., Norman, S., Sabarros, P.S., Semba, Y., Silva, C., Tsai, W.-P., Zhu, J. 2020. The third progress report on the implementation of the IOTC bigeye thresher shark post-release mortality study project (IOTC BTH PRM Project). 16th Working Party on Ecosystems and Bycatch (WPEB16). 7-10 September 2020, Online Meeting. IOTC Document, IOTC-2020-WPEB16-INF1. 13pp.

Rosa, D., Coelho, R. 2016. Estimates of intrinsic rate of population change and steepness for blue shark (*Prionace glauca*) in the Indian Ocean. 12th Working Party on Ecosystems and Bycatch, 12-16 September, Victoria, Seychelles. IOTC Document, IOTC-2016-WPEB12-18. 7pp.

Rosa, D., Coelho, R., Lino, P.G., Santos, M.N. 2015. Observations on the Indo-Pacific sailfish, *Istiophorus platypterus*, from the Portuguese pelagic longline fleet in the southwest Indian Ocean. 13th Working Party on Billfishes, 1-5 September, Olhão, Portugal. (IOTC Document: IOTC-2015-WPB13-23_Rev1). 18pp.

Santos, C.C., Rosa, D., Coelho, R., 2019. Hook, bait and leader type effects on surface pelagic longline retention and mortality rates: a meta-analysis with comparisons for target, bycatch and vulnerable fauna interactions. 15th Working Party on Ecosystems and Bycatch (WPEB). 3-7 September 2019, La Reunion Island. IOTC Document, IOTC-2019-WPEB15-39. 23pp.

Santos, M.N., Coelho, R., Lino, P.G. 2014. Preliminary results of the LL-Sharks Project: A comparison of wire versus monofilament leaders in the Portuguese pelagic swordfish fishery in the southwestern Indian



Ocean. 10th Working Party on Ecosystems and Bycatch, 27-31 October, Yokohama, Japan. IOTC Document, IOTC-2014-WPEB10-18. 13pp.

Santos, M.N., Lino, P.G., Coelho, R. 2017. Effects of leader material on catches of shallow pelagic longline fisheries in the southwest Indian Ocean. Fishery Bulletin, 115(2): 219-232.

Walker, N., Ellis, J., Coelho, R., Murua, H., Rosa, D. 2018. Exploring the use of length based indicators for blue shark in the Indian Ocean. 14th Working Party on Ecosystems and Bycatch, 10-14 September, Cape Town, South Africa. IOTC Document, IOTC-2018-WPEB14-35. 21pp.