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Potential management options and research needs

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Abstract	
A study on improving scientific advice on deep-water sharks in the SIOFA Area has been commissioned by the European Union, with the intention of helping to improve assessments of SIOFA Area deep-water shark conservation status, and to identify the value of obtaining improved information. The project is broken down into three Specific Objectives: 1. Improve knowledge on deep water sharks' biology, ecology and distribution, 2. Explore possibilities for deriving abundance estimates and conservation status information, and 3. Advice on potential management options and research needs. This paper relates to the final Specific Objective, Objective 3. The purpose of which is to provide advice on potential management options which could be applied in the short/medium term and on research needs, to build knowledge base without putting the stocks at risk. This project began in early 2023, and this paper details the intentions and progress to date.	

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² Documents available only to members invited to closed sessions.



1. Project overview

The Southern Indian Ocean Fisheries Agreement (SIOFA) aims to ensure the sustainable use of fishery resources and the long-term conservation of species through cooperation among Contracting Parties. This includes the European Union (EU), which has a vessel operating in the area. SIOFA also aims to promote the sustainable development of fisheries in its Regulatory Area, while taking into account the needs of developing states that are Contracting Parties to the Agreement. Fisheries in the SIOFA Area primarily target demersal and benthic-pelagic species such as toothfish (*Dissostichus* spp.), orange roughy (*Hoplostethus atlanticus*) and wreckfish (*Polyprion americanus*), but often bycatches of deep-sea sharks, particularly Portuguese dogfish (*Centroscymnus coelolepis*), Birdbeak dogfish (*Deania calcea*), Kitefin sharks (*Dalatias licha*), Gulper sharks (*Centrophorus* spp.) and Lanternsharks (*Etmopterus* spp.). To better understand shark bycatch, robust scientific data and analysis are needed.

Currently, as set out in the SIOFA Conservation and Management Measure 2022/12 for sharks (CMM 2022/12), CCPs shall ensure that fishing vessels flying their flag do not target any deep-sea shark species listed in Annex 1 within the Agreement Area, until the Scientific Committee defines, and the Meeting of the Parties agrees on possible appropriate fishing mortality and harvest levels for any of these species.

To deliver robust management options and regulate the capture of shark bycatch in the established fisheries operating in SIOFA, knowledge gaps need to be filled in order to ensure that advice on fishing intensity is sustainable and precautionary, and that assessments are robust to the main sources of uncertainty. The Scientific Committee has therefore identified a number of uncertainties which need to be addressed in order to ensure the sustainable harvest of these lesser-known species. These include better identification of deep-water sharks, increase of knowledge through increased data collection, as well as improved assessments and estimates of sustainable yields through suitable methodologies. The EU has committed to help tackle some of the knowledge gaps identified by the Scientific Committee, as well as contributing to improving the reliability and availability of scientific advice for deep-water sharks.

This study aims to help improve assessments of SIOFA Area deep-water shark conservation status, and identify the value of obtaining improved information. The project is broken down into three objectives:

1. Improve knowledge on deep water sharks' biology, ecology and distribution,
2. Explore possibilities for deriving abundance estimates and conservation status information, and
3. Advice on potential short term management measures and research needs.

This paper relates to the final Specific Objective, Objective 3 (SO3). The purpose of the 3rd objective is to provide advice on potential management options which could be applied in the short/medium term and on research needs, to build knowledge base without putting the stocks at risk. This will contribute to translating science into management decisions at the Meeting of the Parties and facilitating a roadmap for scientific developments at Scientific Committee level.

The expected results for SO3 are focused on the provision of potential management options in support to current CMM 2022/12 (Sharks) and to identify research needs to be included in the multiannual SIOFA Scientific Committee Work plan.

2. Tasks

2.1 Short and medium-term management measures

This aspect of the project will use results obtained in the previous objective tasks (tagging and stock assessment) to identify the most applicable short and medium-term management options that could be applied, and will suggest potential mitigation measures to reduce fishing mortality. The intention is that this information will contribute to the development and enhancement of SIOFA CMMs, particularly CMM 2022/12 (Sharks) through the provision of recommendations.

A) Review of current and previous management measures

This task will first focus on collating and reviewing the management measures currently adopted by SIOFA and will review reports from the Scientific Committee to explore the current measures in relation to the deep-water shark species examined within this project. We will identify their strengths and weaknesses, and will assess how these could support the SC in defining appropriate fishing mortality and harvest levels for any of these species.

This subtask will also examine relevant management measures used to reduce fishing mortality of deep-water sharks in other similar fisheries beyond the SIOFA region, such as those applied within the EU (i.e., fishing depth and gear restrictions). Where no information on management measures is available for the specific focal deep-water shark species, management of species with equivalent life histories likely to be impacted by fishing in similar ways will be considered.

Progress:

Shark fisheries management within the SIOFA Area:

Within the SIOFA Area there are 15 active Conservation and Management Measures (CMM), the majority of which do not directly manage the act of fishing, but rather relate to vessel requirements. The primary CMM associated with deep-water shark management is CMM 2022/12 (an amended issue of CMM 2019/12; see Appendix 1) which is the CMM requiring all Parties to refrain from targeting listed deep-sea species until such a time that the Meeting of the Parties can agree on appropriate fishing mortality and harvest levels for these species. In addition to this, there are two CMM's which may have indirect management impact on deep-water sharks, these are:

CMM 2016/05³ under which within the SIOFA Area the use of large-scale pelagic driftnets is prohibited by any vessel *“flying the flag of a Contracting Party, cooperating non-Contracting Party (CNCP) or participating fishing entity (PFE)”*, and *“Contracting Parties, CNCPs and PFEs recommend that deepwater gillnets not be used in the Agreement Area by any vessel flying the flag of a Contracting Party, CNCP or PFE.”*

CMM 2020/01⁴ limits the level and spatial extent of the bottom fishing effort of vessels, which is intended to prevent the increase of the fishing “footprint” of bottom fishing within the SIOFA Area through fishing effort and/or catch, and constraints on the spatial distribution, excluding line and trap methods.

³ CMM 2016/05: Conservation and Management Measures regarding the use of largescale pelagic driftnets and deepwater gillnets in the Southern Indian Ocean Fisheries Agreement Area (Pelagic Driftnets and Deepwater Gillnets).

⁴ CMM 2020/01 Conservation and Management Measure for the Interim Management of Bottom Fishing in the Agreement Area (Interim Management of Bottom Fishing) supersedes 2019/01 (Interim Management of Bottom Fishing). Some references have been updated by technical edits in 2022.

The EU transcribes these CMMs into European legislation through the annual provision of fishing opportunities regulations (for 2023 this is Council regulation 2023/194⁵).

Shark fisheries management further afield:

The IPOA-SHARKS⁶ was adopted by the 23rd session of COFI in 1999. The IPOA-Sharks is voluntary and it was elaborated within the framework of the Code of Conduct for Responsible Fisheries highlighting that management and conservation strategies should aim to keep total fishing mortality for each stock within sustainable levels by applying the precautionary approach. Each State and RFMO (and where required each sub-regional entity) should regularly carry out a regular assessment of the status of its shark stocks subjected to fishing so as to determine whether or not there is a need to develop a Shark Plan.

The FAO's Deepsea Fisheries guide⁷, developed at the request of the Committee on Fisheries (COFI) of the Food and Agriculture Organization of the United Nations (FAO), was created to assist states and RFMO/As to manage deep-sea fisheries sustainably whilst also implementing the United Nations General Assembly (UNGA) Resolution 61/105, paragraphs 76-95, concerning responsible fisheries in the marine ecosystem.

The FAO's Deepsea Fisheries guide has no specific or direct reference to shark fisheries. The guide itself states in paragraph 70 that *"States and RFMO/As should, based on the results of assessments carried out pursuant to Section 5.2, **adopt conservation and management measures** to achieve long-term conservation and sustainable use of deep-sea fish stocks, ensure adequate protection and prevent significant adverse impacts on VMEs. These measures should be developed on a case-by-case basis and take into account the distribution ranges of the ecosystems concerned."* The primary statement here is that *"States and RFMO/As should" **"adopt conservation and management measures** to achieve long-term conservation and sustainable use of deep-sea fish stocks"* providing a statutory mechanism to the implementation of CMMs. The guide follows on from this in paragraph 71, stating that these CMMs may include:

- i. effort controls and/or catch controls;
- ii. temporal and spatial restrictions or closures;
- iii. changes in gear design and/or deployment or operational measures (as discussed in the 2006 Bangkok Expert Consultation), including,
 - reduction of contact between the fishing gear and the seabed,
 - use of effective bycatch reduction devices,
 - and use of technical measures to eliminate or minimize ghost fishing;
- iv. or other relevant measures necessary to achieve the objective of paragraph 70.

The United Nations Convention on the Law of the Sea (UNCLOS, 1982) Section 2 specifically addresses the Conservation and Management of the Living Resources of the High Seas. In this section, no specific CMMs are mentioned, neither for fisheries nor specifically for shark.

⁵ COUNCIL REGULATION (EU) 2023/194 of 30 January 2023 fixing for 2023 the fishing opportunities for certain fish stocks, applicable in Union waters and, for Union fishing vessels, in certain non-Union waters, as well as fixing for 2023 and 2024 such fishing opportunities for certain deep-sea fish stocks

⁶ FAO Marine Resources Service. (2000). Fisheries management. 1. Conservation and management of sharks. FAO Technical Guidelines for Responsible Fisheries. No. 4, Suppl. 1. Rome, FAO. 2000. 37p

⁷ Food and Agriculture Organization. (2009). International guidelines for the management of deep-sea fisheries in the high seas. FAO.

⁸ United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 3.

Article 119, *Conservation of the living resources of the high seas*, states that “In determining the allowable catch and establishing other **conservation measures** for the living resources in the high seas, States shall: (a) take measures which are designed, on the best scientific evidence available to the States concerned, to maintain or restore populations of harvested species at levels which can produce the maximum sustainable yield”. This is as far as UNCLOS (1982) goes as to setting provisions for the implementation of CMMS.

EU Council Regulation 2347/2002

On the 12th of January 2017, EU Council Regulation 2016/2336⁹ came into force, whilst simultaneously repealing Council Regulation (EC) No 2347/2002. This regulation establishes specific conditions for fishing for deep-sea stocks in the north-east Atlantic and provisions for fishing in international waters of the north-east Atlantic. It carries over three Articles from Council Regulation (EC) No 2347/2002, Articles 3, 7 and 9, and shall continue to apply to Union fishing vessels operating in the Regulatory Area of NEAFC. These three Articles can be understood as management measures relating to:

- Fishing permits
- Designated ports
- Information sharing

Article 3⁹ - Issued by member states, states that EU vessel that annually catch 10 or more tonnes of Annex I species⁹ are required to hold special **deep-sea fishing permits**. A list of permitted deep-sea fishing vessels should be forward to the commission by each member state.

Article 7^{Error! Bookmark not defined.} – designated ports. Member states must land catches of any quantity of Annex I deep-sea species over 100kg at a designated port. They must also determine inspection and surveillance procedures and also share a list of these ports with the Commission. EU Council Regulation 2016/2336 Article adds a further point to this, adding that Member states shall also designate the ports in which any transshipment of deep-sea species is to take place.

Article 9^{Error! Bookmark not defined.} - Member states shall communicate information regarding catches of deep-sea species and the fishing effort deployed in their capture. This should be expressed as kilowatt-fishing days for each six-month period of a calendar year. Information should be presented by year-quarter, which gear was used, species caught and also the geographic subdivision (ICES or CECAF). Catches made for species that appear on Annex II⁹ should also be provided. Furthermore, member states are to share a list with the Commission of designated ports as well as observer reports, within 30 days after receipt of a written request.

Further Articles were either removed or replaced. Article 4, Effort restrictions, of Council Regulation (EC) No 2347/2002 is replaced by Article 6, Capacity management, of EU Council Regulation 2016/2336. This states that those member states whose vessels hold a deep-sea fishing permit are subject to fleet capacity management (i.e., effort restrictions). Article 6⁹ states that those member states whose vessels hold a deep-sea fishing permit are subject to capacity management. This means member states shall at no time exceed the aggregate fishing capacity of the vessels of that member state, measured in gross tonnage and in kilowatts, between 2009 – 2011, whichever year provides the higher figure.

⁹ European Commission. Regulation (EU) 2016/2336 of the European Parliament and of the council of 14 December 2016. Establishing specific conditions for fishing for deep-sea stocks in the north-east Atlantic and provisions for fishing in international waters of the north-east Atlantic and repealing Council Regulation (EC) No 2347/2002. L 354/1

Article 15⁹ sets out rules on data collection standards stating that member states shall observe the specific data collection and reporting requirements set out in Annex II⁹ including requirements for sampling of all deep-sea métiers.

Article 16⁹ states that member states must assign scientific observers to the fishing vessels for which deep-sea fishing has been permitted. Vessels using bottom otter trawls or bottom set gill nets for deep-sea species shall be subject to at least 20% observer coverage. All other vessels with an authorisation to catch deep-sea species are subject to at least 10 % observer coverage

Lastly paragraph 8⁹, states that in order to prevent damaging impacts of bottom otter trawling, the use of bottom otter trawling is banned when used at depths greater than 800 metres.

B) Recommendations for management options

In light of results obtained in previous tasks (e.g., Objectives 1 and 2: tagging and stock assessment), this subtask will focus on providing suggestions for potential mitigation measures to reduce fishing mortality where possible. We will recommend appropriate harvest levels in the context of the ecology and life history characteristics of these species. Where it has been possible to provide an estimation of fishing mortality, recommendations will be given on the potential levels of fishing mortality that could be permitted. These recommendations will be given in the context of ensuring sustainable harvest, and any proposed potential reference points which could be applied by SIOFA within Conservation and Management Measures.

Depending on the outcomes of the review, previous objective tasks (tagging and stock assessment), and the progress made at the SIOFA workshops, the project will suggest potential mitigation methods that could be applied in the short (1-2 years) and medium-term (5 years) with the intention of achieving sustainability of the different deep-water shark species in the long-term. Such measures could include seasonal, spatial, or depth restrictions, as well as gear or operating modifications e.g., restricted time of setting gear to account for any diurnal behaviour; and spatial or temporal restrictions for example to avoid migration routes or breeding aggregations. The experiences from other regional areas gathered in the first half of this task will be used to inform this subtask.

Progress:

The timeline for this part of the task is towards the end of the project once large parts of Specific Objectives 1 and 2 have been completed. This will begin around October 2023.

2.2 Knowledge gaps and research needs for the provision of scientific advice

This aspect of the project will use results obtained in the previous objectives (tagging and stock assessment) to inform understanding of knowledge gaps around deep-water sharks in the SIOFA Area and identify research needs that could be considered to improve scientific advice (including improvement of stock assessment quality) and provide recommendations to the Commission.

A) Knowledge gaps

We will determine the knowledge gaps on the distribution, biology and life history characteristics of the deep-water sharks, particularly any regional information gaps specific to the SIOFA area that still need to be filled following the literature review, data call(s) and the tagging study (outputs from Objective 1 and early work of Objective 2).

Although it is envisioned that this project will improve the understanding of SIOFA deep-water shark sustainability available through the review of data and provision of additional fisheries independent

data from tagging, it is expected that knowledge gaps will still remain. The intention of the project is, therefore, to additionally provide further advice on the remaining gaps needed to be filled to assist scientific advice and management of these fisheries. At this stage, it is highly likely to include examples of additional data required from the SIOFA fisheries data collection protocol to improve fishery dependent data, with more in-depth reporting on deep-water shark bycatches during fishing trips. Knowledge and understanding of the specifics with relation to data will be clearer upon review of the data made available to the WS2023-DWS workshop.

Recommendations are, from understanding at this early stage, likely to include further fishery independent surveys, further tagging studies to improve the understanding of the species use of the SIOFA area (i.e., breeding and nursery grounds, migration, site fidelity) and genetic studies to aid in stock hypotheses.

Progress:

The timeline for this part of the task is towards the end of the project, once large parts of Specific Objectives 1 and 2 will have been completed. This will begin around October 2023.

B) Research needs for scientific advice

Based on the review and findings of this project, we will identify specific research needs required to inform more robust stock assessments for the provision of scientific advice. Our preliminary understanding is that all assessments will be data-limited, as such, there will be a number of improvements which could be made to improve the robustness and quality of future assessments based on data types and time-series available. Using the information from the data-limited/assessment limited shark stocks categorisation, we will detail the additional data and or knowledge required to progress to the quality of information used to determine stock status.

Progress:

The timeline for this part of the task is towards the end of the project once large parts of Specific Objectives 1 and 2 have been completed. This will begin around October 2023.

C) Overview of future research needs

In light of results and outputs obtained, we will provide an overview of the research gaps that still remain to be filled and will determine the knowledge and research areas that are still required to provide sound scientific advice to ensure the protection and conservation of deep-water sharks in SIOFA.

Progress:

The timeline for this part of the task is towards the end of the project once large parts of Specific Objectives 1 and 2 have been completed. This will begin around October 2023.

Appendix 1

CMM 2022/12¹⁰ : Conservation and Management Measure for Sharks¹¹ (Sharks)

The Meeting of the Parties to the Southern Indian Ocean Fisheries Agreement:

RECALLING the relevant provisions of the Southern Indian Ocean Fisheries Agreement, in particular Article 4;

CONSIDERING that the United Nations Food and Agriculture Organization (FAO) International Plan of Action for Sharks calls on States to cooperate through regional fisheries organizations to

RECOGNIZING ensure the sustainability of shark stocks; the need to improve the collection of species-specific data on catch, effort,

RECALLING discards, and trade as a basis for improving the conservation and management of shark stocks; that the FAO International Plan of Action for Sharks calls on States to encourage full use of dead sharks, to facilitate improved species-specific catch and landings data and monitoring of shark catches and the identification and reporting of species-specific biological

FURTHER RECALLING and trade data; that United Nations General Assembly, adopted consensus Resolutions every year since 2007 (62/177, 63/112, 64/72, 65/38, 66/68, 67/79, 68/71, 69/109, 70/75 and 71/123), calling upon States to take immediate and concerted action to improve the implementation of and compliance with existing regional fisheries management organization or arrangement measures that regulate shark fisheries and incidental catch of sharks, in particular those measures which prohibit or restrict fisheries conducted solely for the purpose of harvesting shark fins, and, where necessary, to consider taking other measures, as appropriate,

ADOPTS the following Conservation and Management Measures (CMM) in accordance with such as requiring that all sharks be landed with each fin naturally attached; Article 4 and 6 of the Agreement:

1. This CMM applies to all fishing vessels of Contracting Parties, cooperating non-Contracting Parties (CNCs) and participating fishing entities (PFEs) to the Agreement (collectively CCPs), engaged in fishing operations in the SIOFA Area of Application (the Agreement Area).
2. CCPs shall ensure that fishing vessels flying their flag do not target any deep-sea shark species listed in Annex 1 within the Agreement Area, until the Scientific Committee defines and the Meeting of the Parties agrees on possible appropriate fishing mortality and harvest levels for any of these species.
3. CCPs shall ensure that fishing vessels flying their flag record and submit all reporting requirements as per CMM 2022/02 (Data Standards) for all deep-sea sharks to the lowest taxonomical level possible when engaged in fishing for fishery resources.
4. By 2020 the Scientific Committee shall advise the Meeting of the Parties on the need to adopt any appropriate by-catch limits for relevant SIOFA deep sea shark species and fleets, including on scientific and data needs for underpinning the elaboration of such advice.

¹⁰ CMM 2022/12 (Sharks) supersedes CMM 2019/12 (Sharks)

¹¹ The term “sharks” refers to Chondrichthyes for the purposes of this CMM, as defined by the Food and Agriculture Organisation (FAO)

5. CCPs shall, where possible, undertake research to identify ways to make all relevant fishing gears more selective to minimise deep sea shark by-catch and shall provide relevant information to the Scientific Committee.
6. CCPs shall, where possible, conduct research to identify shark nursery areas in the Agreement Area and provide relevant information to the Scientific Committee.
7. This CMM shall be reviewed every second year by the Scientific Committee and the Compliance Committee, unless the Meeting of the Parties decides otherwise.

ANNEX 1: List of “**high risk**” and “of concern” deep sea shark species for the purpose of this CMM¹²

Scientific name	French common name	English common name	FAO code
<i>Centroscymnus coelolepis</i>	Pailona commun	Portuguese dogfish	CYO
<i>Deania calcea</i>	Squale savate	Birdbeak dogfish	DCA
<i>Centrophorus granulosus</i>	Requin chagrin	Gulper shark	GUP
<i>Dalatias licha</i>	Squale liche	Kitefin shark	SCK
<i>Bythaelurus bachi</i>	Requin chat de Bach	Bach's catshark	BZO
<i>Chimaera buccanigella</i>	Chimère bouche-foncée	Dark-mouth chimaera	ZZC
<i>Chimaera didierae</i>	Chimère de Didier	The Falkor chimaera	ZZD
<i>Chimaera willwatchi</i>	Chimère du marin	Seafarer's ghostshark	ZZE
<i>Centroscymnus crepidater</i>	Pailona à long nez	Longnose Velvet Dogfish	CYP
<i>Centroscymnus plunketi</i>	Pailona austral	Plunket shark	CYU
<i>Zameus squamulosus</i>	Squale-grogneur à queue échancrée	Velvet dogfish	SSQ
<i>Etmopterus alphas</i>	Requin lanterne à joues blanches	Whitecheek lanternshark	EZU
<i>Apristurus indicus</i>	Holbiche artouca	Smallbelly catshark	APD
<i>Harriotta raleighana</i>	Chimère à nez rigide	Bentnose rabbitfish	HCR
<i>Bythaelurus tenuicephalus</i>	Requin chat à tête étroite	Narrowhead catshark	BZL
<i>Chlamydoselachus anguineus</i>	Requin lézard	Frilled shark	HXC
<i>Hexanchus nakamurai</i>	Requin gris	Bigeyed six-gill shark	HXN
<i>Etmopterus pusillus</i>	Sagre nain	Smooth lanternshark	ETP
<i>Somniosus antarcticus</i>	Requin dormeur antarctique	Southern sleeper shark	SON
<i>Mitsukurina owstoni</i>	Requin lutin	Goblin shark	LMO

¹² As defined by SC-04 paragraph 159 and paper SC-04-19.