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IOTC-2026-WPEB22(AS)-15

MANAGEMENT PROCEDURES FOR BLUE SHARK IN THE INDIAN OCEAN: CURRENT PROJECT STATUS

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Purpose, expectation and action intended (select one or more and include corresponding text)

Feedback (to collect input and suggestions)

- Feedback is required on the feasibility of implementing size-based landing restrictions for blue shark (Section 3.2), including compliance and the ability to monitor and enforce size-based restrictions.

Recommendation (to ask the meeting to endorse a recommendation)

- To evaluate the impact of length-based restrictions on the catch, recommendations are required on the appropriate size and fleet based, post-discard survivorships to assume during simulation testing, including the mortality that may occur prior to hauling of the gear (Section 3.2).

Decisions (to request formal approval of actions)

- Given the difficulties associated with estimation of MSY reference points, a decision is required on appropriate depletion-based target and limit reference points for the management of blue shark (Section 3.1).

Abstract

An update is provided regarding the current status of the Indian Ocean blue shark MSE, with requests for feedback from the WPEB.

IOTC-2026-WPEB22(AS)-15

Management procedures for blue shark in the Indian Ocean: current project status

Prepared for the Indian Ocean Tuna Commission

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CESCAPE Client Report

Client project code:	–
Project name:	Management strategy evaluations for Indian Ocean blue shark
Date of report:	September 14, 2026
Prepared for:	22nd Working Party on Ecosystems and Bycatch

1 Introduction

The IOTC Resolution 15/10 requested the IOTC Scientific Committee (SC) to develop and assess, through Management Strategy Evaluation (MSE), the performance of Management Procedures (MP) and Harvest Control Rules (HCRs), to achieve Target Reference Points (TRPs) and avoid the Limit Reference Points (LRPs) with a high probability, taking into account imperfect knowledge of the population dynamics, for the priority species (IOTC, 2015). In recent years, substantial progress has been achieved in the MSE initiatives for key commercial species. These efforts have led to the successful adoption of an MP for skipjack tuna, bigeye tuna, and swordfish (IOTC, 2022, 2024a,b, 2025a). Despite these advancements, similar processes have yet to be applied to pelagic sharks, primarily due to their status as bycatch species and the challenges associated with limited data availability.

Among pelagic sharks, the blue shark is the most frequently caught species in the Indian Ocean (IOTC, 2021, 2025d). It is commonly captured as bycatch in the longline fisheries but also supports targeted catch by several fleets. Notably, compared to other pelagic sharks, data availability for the blue shark is more comprehensive, and there is a longer history of reported catches. This data sufficiency has allowed the application of an integrated assessment model, Stock Synthesis (Methot & Wetzel, 2013), to assess stock status, which has been performed by the Working Party on Ecosystem and Bycatch (WPEB) since 2015 (Rice & Sharma, 2015, Rice, 2017, 2021, 2025a,b). Stock Synthesis (SS) models for blue shark have similarly been developed by the Western Central Pacific Fisheries Commission (ISC, 2017, Neubauer et al., 2021, 2022) and the International Commission for the Conservation of Atlantic Tunas (ICCAT, 2023, Courtney et al., 2023, Gustavo-Cardoso et al., 2023).

Recognizing the need for structured management for blue shark, the Commission, during its 28th session, mandated the SC to initiate the MSE for this species. Although blue shark is not currently listed under the IOTC Convention Annex, Article 61.4 of the United Nations Convention on the Law of the Sea (UNCLOS) provides an obligation to maintain bycatch species above levels at which their reproduction would be seriously threatened. Accordingly, the development of an MSE for blue shark has been incorporated into the SC's program of work and formalised via Resolution 25/8 (IOTC, 2025b).

In response to this request, a preliminary scoping study was conducted on the potential MSE methodologies and options available for blue shark in the Indian Ocean (Edwards, 2025). This study concluded that the current SS stock assessment for blue shark could likely be utilised as an Operating Model (OM) for simulation-based development of Candidate Mangement Procedures (CMPs), but noted significant uncertainties in the data inputs (Figure 1). It further concluded that in this and other blue shark stock assessments, the length frequency data provide more information on the fishing mortality than data on abundance, and that catch rate data were therefore unlikely to provide a suitable basis for management decisions. Length-based management measures were proposed for consideration on the basis that selectivity of the fishery can have a noticeable effect on productivity, which meant that limitations on juvenile mortality could promote sustainability of the stock. These recommendations were presented for review to the 16th IOTC Working Party on Methods (IOTC, 2025c).

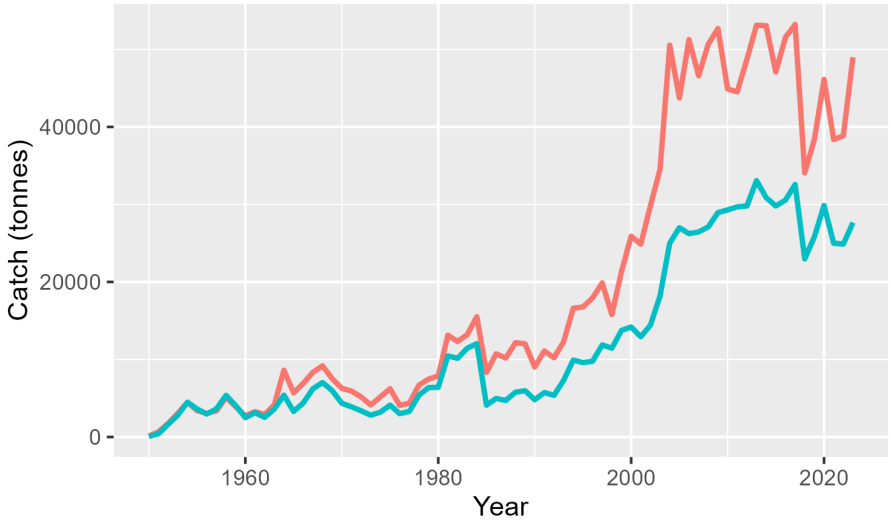

Figure 1: Catch time series for blue shark in the Indian Ocean, illustrating uncertainties in the input data. High and Low scenarios are shown (Coelho, 2025).

Project objectives

Give the preliminary scoping work by Edwards (2025), the current project intends to begin development of an MSE for blue shark, including the following tasks.

1. Explore options for OM construction:
   - Investigate potential approaches for developing an Operating Model compatible with the current and anticipated data sets;
   - Condition the OM with historical and recent data, and construct forward simulation modules that represent the key features of the blue shark population, fishing fleet, data collection, and management systems;
2. Test key uncertainties:
   - Use simulation testing of critical uncertainties, including catch history, biological parameters, and other relevant data necessary to ensure a robust Operating Model.
3. Develop candidate blue shark MPs with harvest control rules:
   - Develop a suite of candidate MPs for blue shark, including relevant TAC-based harvest control rules, evaluate their performance using appropriate performance indicators against management objectives;
   - Discard survivorship should be reviewed to ensure it is realistic for the main target fisheries, and allows evaluation of size limit measures; and,
   - Take into consideration that the number of sharks caught may be more relevant than biomass, but catches may be reported in weight in some fisheries, and TAC would also need to be in weight;
4. Provide suitable candidate MPs for consideration of potential adoption by the Commission;
   - Present progress on the Blue Shark MSE development to the IOTC Working Party on Ecosystem and bycatch (WPEB) and Working Party on Methods (WPM) in 2026
   - Present proposed candidate Management Procedures for blue shark to the MSE Taskforce and the Technical Committee on Management Procedures (TCMP) in 2027.

2 Current project status

The scoping study by Edwards (2025) has recieved feedback and review from the Working Party on Methods (IOTC, 2025c) and the Technical Committee on Management Procedures (IOTC, 2026), which can be summarised as follows:

- MPs may recommend a Total Allowable Catch (TAC) or length-based restrictions on the retained catch and both of these should be considered;
- Length-based restrictions are difficult to monitor and enforce, and would likely best be implemented as static control measures in conjunction with a dynamic TAC that can be adjusted via feedback control;
- The efficacy of length-based restrictions will be dependent on post-release survivorship of individuals which is thought to be high but is poorly quantified and may differ between fleets depending on fishing practices;
- Even though blue shark may be caught as both a target and bycatch species, there is no clear definition between these fishing practices, and vessels may switch during the course of a voyage;
- Management measures would need to be applicable to all vessels and all fleets, even if they conflict with their fishing of other tuna or tuna-like species;
- Given uncertainties in the historical catch, traditional catch-based reference points (e.g., MSY) cannot be defined, and a TAC-based MP should recommend an adjustment to the current catch rather than relative to a global reference point – this is dependent on the availability of reliable contemporary estimates of the catch (see Rice, 2026);
- Changes in the length-composition of catches may provide the only useful information on changes in fishing mortality (see Coelho & Fu, 2026), but care should be taken to standardise these data prior to input into an MP.

3 Discussion points

Continued development of CMPs for blue shark depend on a clear definition of the desired population outcome, and an assessment of the feasiblity of alternative management options, which are introduced here for discussion by the WPEB (IOTC, 2026).

3.1 Management objectives

Management of target species by the IOTC is typically based on MSY principles; i.e., optimisation of resource utilisation. For shark species, given limitations in the data, it is harder to estimate MSY, and even if it could be estimated, it is not clear that MSY is an appropriate target for management. Stock assessments for the IOTC (e.g., Rice, 2021, 2025b) and other RFMO's (e.g., Gustavo-Cardoso et al., 2023, Kell et al., 2023, Courtney et al., 2023) report stock status against MSY reference points, but it has been suggested that depletion-based reference points should also be considered for this species (IOTC, 2026).

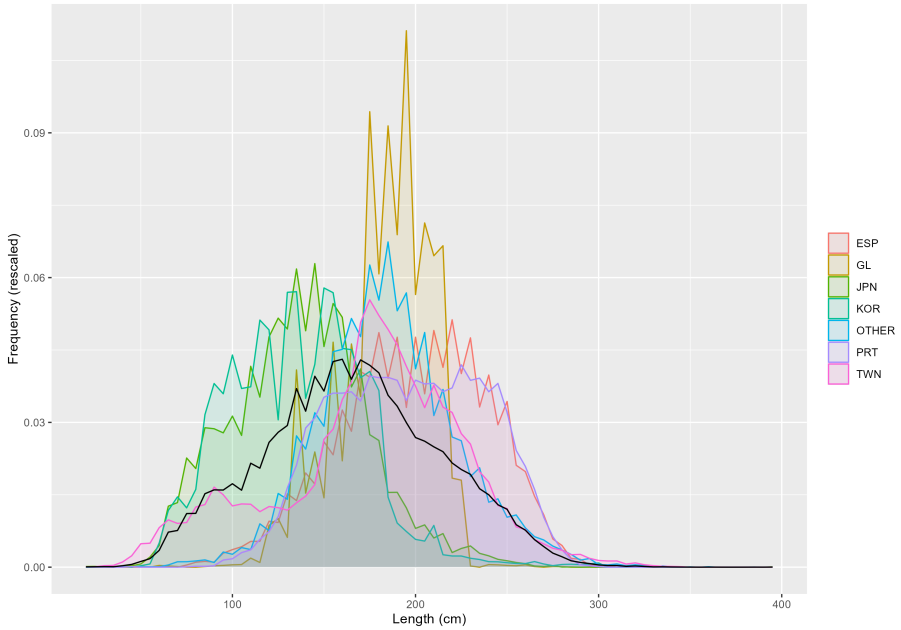

Figure 2: Length frequency data for blue shark in the Indian Ocean, aggregatted across years and renormalised to the same scale (Rice, 2025b).

3.2 Length-based management

A variety of biological studies have suggested that, based on life-history characteristics of the species, limiting juvenile mortality through a minimum size limit could be a useful tool for protecting population productivity (Cortés, 2002, da Silva & Gallucci, 2007, Tsai et al., 2014). This idea has been further validated by simulation testing of management strategies designed to limit juvenile mortality (Kai & Yokoi, 2017, Geng et al., 2021, Edwards, 2025).

Size-baseed limitations on the catch are currently in effect for marlin and sailfish in the Indian Ocean (IOTC, 2018), with a stipulation that undersized individuals should be returned "immediately to the sea in a manner that maximizes post-release survival potential." The effectiveness of a similar measure for blue shark will depend on the proportion of sharks that are dead at hauling, and the post-release survivorship of live individuals. Currently available information suggest that approximately 15% of individuals are dead at hauling, with smaller individuals more likely to be dead (Coelho et al., 2011, 2013). It is likely that post-release survivorhsip is high ($> 80\%$) and also dependent on the size of the individual, as well as the gear configuration (Gallagher et al., 2014, Campana et al., 2016).

The post-release survivorship for blue shark is an important component required for evaluation of any management strategy, such as a size limit, that is designed to encourage the discarding of live individuals. Longline fleets in the Indian Ocean typically catch different size classes (Figure 2), meaning that different discard mortalities might be expected, but it is not clear whether this is due to differences in targetting, gear configuration or the spatio-temporal distribution of fishing. It is important to consider both the possibility of a fleet specific discard mortality, and the prospect of these being changed as a consequence of management intervention.

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