Deliverable No. 4.4

Project acronym:
FarFish

Project title:
Responsive Results-Based Management and capacity building for EU Sustainable Fisheries Partnership Agreement- and international waters

Grant agreement No: **727891**
Project co-funded by the European Commission within the
Horizon2020 Research and innovation programme

Due date of deliverable:	30/11/2020
Submission date:	30/11/2021
File Name:	FarFish_D4.4_MR2_Revision02
Revision number:	02
Document status:	Final
Dissemination level:	PU[1]

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[1] PU: Public, PP: Restricted to other programme participants (including the Commission Services), RE: Restricted to a group specified by the consortium (including the Commission Services), CO: Confidential, only for members of the consortium (including the Commission Services)

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Executive Summary

Background

More than 20% of the catches of the European fishing fleet are caught in non-European waters. Access to fish in these waters is based on agreements with coastal states. EU pays for access to fish from surplus stocks. These agreements have been criticised, as the fisheries are sometimes poorly regulated, and management decisions are often based on limited knowledge. In addition, the level of compliance is considered low, and enforcement capabilities are limited. In many cases, the trust between different stakeholders involved in a fishery is low. The FarFish project aimed to overcome these challenges.

Approach

The FarFish project was designed around six case studies (CSs) in fishing areas where the European fleet is active, namely Cape Verde, Mauritania, Senegal, Seychelles, and the international high-seas areas in the South East and South West Atlantic. This document serves as the second proposal for management recommendations (MR2) for each FarFish CSs. The MRs are arrangements between relevant management authorities and the operators in the respective CSs. The MR defines the actors/partners in the fishery and their roles, the agreed management objectives for the fishery, the management rules and regulations that apply, and other relevant details about the fishery. We apply the results-based management (RBM) when developing the MR in each CS.

The RBM approach aims to reduce micro-management by involving stakeholders and increasing the degree of co-management by delegating responsibilities to resource users. According to this approach, the formal responsibility for developing the MRs is largely delegated to the resource users e.g. EU fishing fleet. Yet, within the FarFish CSs, the formal responsibility is a common venture involving both the authorities in the EU and in the coastal state in question, and the European operators. This means that third state (e.g., China, Korea, Japan, Russia) activity is left outside these MRs. However, getting these MRs in place creates arenas for dialogue and allows for informal discussions with third country authority and operator representatives. This may in turn facilitate common agreements to enhance sustainability in the fishery in question.

The FarFish project does not intend to replicate measures that are already being worked on within the contexts of the SFPA agreements, national management authorities, or RFMOs. We, therefore, address issues that can potentially support these previously initiated measures and thereby be of added benefit to authorities and operators. To ensure relevance and impact FarFish involved respective CS authorities, RFMOs, and other stakeholders, to decide on where the project can be of greatest benefit, to support the ongoing measures.

Here we present the main steps and meetings conducted. The MRs within the FarFish project were developed in iterations. The first dialogue with stakeholders was conducted in a meeting “Strengthening fisheries sustainability outside EU” in Vigo, Spain, in June 2018. This was followed by a meeting in Mindelo, Cape Verde, in November 2018. Here the operators and the authorities agreed on the OTs for the first MR for each case study. The first MRs were made available in summer 2019 (D4.3). Several workshops facilitated transparent and inclusive stakeholder hearings. E.g. FarFish presented the results of the initial OTs to stakeholders of the Senegal and Mauritania CSs In Las Palmas, Spain, in October 2019. The challenges and opportunities for developing the second MR were also assessed in

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the meeting. The MR1 was audited in the "Report on the MR1 audit" (D5.1) according to the RBM framework. The OTs were revisited and the 'Second MR invitation' was prepared in Marrakesh, Morocco, November 2019, and was made available in January 2020. The second audit was performed on the first version of the MR2 (D4.4 November 2020, available on request). The recommendations from the 'Report on Management Recommendation 2 Audit' (FarFish, D5.4) of June 2021, and input from operators, CS leaders, and scientists, were used to update and adopt the final MRs in November 2021 (D4.4 resubmitted).

Additional input was received from the FarFish External Advisory Group and from the 36-month review meeting facilitated by the European Commission. Case specific meetings are mentioned in each CS section.

In this executive summary, we present highlights from RBM implementation based on SFPA case studies (also available at FarFish.eu) and the High Seas CSs. First, we summarise the lessons learned from the case studies.

Lessons learned from RBM models in SFPA case studies

RBM is applied to four SFPA countries outside the EU (Cape Verde, Senegal, Mauritania, and Seychelles) and two high sea fisheries (Southwest Atlantic and Southeast Atlantic).

"Even when not implemented in detail, the RBM process facilitates learning and capacity building as it engages relevant actors in a concrete and practical process of identifying problems and solutions, emphasising the roles, opportunities, and incentives of fishing industry actors (mainly fleets but also post-harvest). A results-based approach to the development of the SFPA fisheries management allows for co-management and reduces micromanagement, and fosters simplification of regulations, and is thereby in line with the ambition and approach of the European Commission to regionalise the CFP as laid out in art 18 of CFP Regulation. However, challenges remain in relation to the implementation of regionalisation within EU waters and outside EU waters, where there are clashing international regulations for conservation and management of fish stocks (e.g., retention of bycatch rules established by RFMOs or transfer of fishing opportunities between EU fleets under the framework of SFPAs)." (D.4.5 and Aschan et al. Results-based management applied to fisheries governed by Sustainable fisheries partnership agreements, in submission)

The RBM implementation in SFPA cases produced many success stories compared to the two case studies in the high sea fisheries (Southwest Atlantic and Southeast Atlantic). Detailed summaries of each case study are available on FarFish website. Below we present the management recommendations of the four SFPA countries and two High Seas areas.

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South West Atlantic management recommendation

Area: FAO Fishing Area 41 and subareas.

Type of fishery: Mixed fishery: The focus of the case study is on target species and bycatch.

Fisheries management	Specific challenges	Outcome targets, level of achievement, further steps
There is no active RFMO with legal competence to regulate the fisheries. However, the areas fall under convention and are subject to the rules of ICCAT and CCSBT.	Lack of level playing field is a major challenge in the area. The EU operators are bound to strict regulations than non-EU fleets fish in the area. Available fisheries data in the area appears to be fragmented, and not easily accessible. Insufficient monitoring, control, and surveillance (MSC) in the area makes it challenging to fight illegal, unreported, and unregulated (IUU) fisheries in the area.	**A soft-law mechanism (International Conference) focused on sustainable management in ABNJ (FAO area 41) available:** CETMAR, LDAC, IEO, and FarFish organised an online international conference, that aimed to understand the potential paths for scientific cooperation in the SWA, bringing together international researchers and experts, to share knowledge on sustainable fisheries. **All vessel transmitting AIS signals:** FarFish partner CSIC conducted a big-data analysis, by combining information from AIS and VIIRS-DNB, to increase monitoring in the SWA. **Theoretical frame for a specific control and inspection programme in FAO area 41 as a basis for a future pilot project on a joint deployment plan for this region:** LDAC drafted a concept paper to be presented in the international fora, to allow Flag and Coastal States interested in the SWA fisheries to discuss the possibility of making an operational plan, beyond the life of the project.

South East Atlantic management recommendation

Area: FAO Fishing Area 47

Type of fishery: Mixed fishery

Fisheries management	Specific challenges	Outcome targets, level of achievement, further steps
The South East Atlantic Fisheries Organisation (SEAFO), is the responsible RFMO in the area. Each SEAFO contracting party is obliged to ensure that regulations are adhered to by their flagged vessels.	The status of bycatch species is unknown. Biological and catch data is available on request via the SEAFO secretariat. Insufficient monitoring of the fisheries, due to the challenge of physical capacity to control vessels at sea and in port.	**Reporting of all catches via e-logbooks:** No further action was taken on this OT. SEAFO SC agreed that no action was required from the Commission, due to no fishing activity by the EU fleet in the area. **All vessels transmit AIS or VMS signals:** No VMS data for EU vessels exist in the SEAFO system. FarFish got access to data that can only identify what countries have been detected with fishing vessels in the SEAFO area. **All vessels have onboard observers:** SEAFO conducts training of observers in neighbouring countries to ensure that observers are in place in case of fishing activities in the area.

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Cape Verde management recommendation

Area: Cape Verde exclusive economic zone (EEZ)

Type of fishery: Mixed fishery: however, the focus of the case study on tuna, swordfish, and blue shark

Fisheries management	Specific challenges	Outcome targets, level of achievement, further steps
The fisheries management is based on the Cape Verde Fisheries management Plan (PGRP), adopted in 2004 under the National Environment Plan 2004-2014: The Common Fisheries Policy, which regulates the fishing activities of EU vessels fishing outside EU waters, and Relevant ICCAT recommendation that sets limit reference points and total allowable catch.	Data harmonisation is required because of uncertainties in data collection observed between EU and ICCAT and the coastal state authorities. Insufficient control and monitoring in the Cape Verde EEZ. Transmission of VMS/AIS signals to required authorities is needed to track the activities of the vessels.	**A harmonised catch data protocol in place that facilitates improved reporting of swordfish and blue shark commercial and biological data:** Data collection systems were identified with the EU-logbook system used by EU vessels as bases for collecting relevant data on swordfish and blue shark. However, both inspectors and COSMAR staff need training to adapt to the complexities of the data. **All vessels transmit AIS and/or VMS signals:** This outcome target relied on data availability. This could not be achieved because it is difficult to access the data although the AIS and VMS data exist. Support from relevant authorities to make the data available is required. **Strengthened scientific observer program in place:** FarFish provided materials and training needed for establishing an onboard observer program. Scientific observer program could not be implemented because of the lack of support in the Cape Verdean legislation. **Trade flow data provided:** Data on catches, landings, and trade flows are of good quality. Information on operating costs and profitability to be able to discuss sharing of value added and access fees are of relevance to EU and Cape Verde.

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Senegal management recommendation

Area: Senegal EEZ

Type of fishery: mixed fishery: black hake

Fisheries management	Specific challenges	Outcome targets, level of achievement, further steps
The fishing regulations are based on the Maritime Fisheries Code adopted in 2015 to combat illegal, unreported, and unregulated (IUU) fishing. The CFP obligates EU vessels fishing outside EU waters to adhere to the same objectives under EU law. FAO/CECAF, which contributes to managing demersal resources in Northwest Africa and the Joint Scientific Committee (CSC) on the SFPA between Senegal and the EU, makes recommendations for the EU fishery.	Insufficient availability/reporting of bycatch data in black hake fisheries. Concerns related to sharing and analysing observation reports data have been raised. Data limitation for sustainable conservation and separate stock assessment of black hake. Difficulty to separate the two species of black hake (*M.polli* and *M.senegalensis*) due to morphological resemblance and overlapping habitats. Insufficient monitoring of the fishery.	**Information on the proportion of the two species of black hake in catches provided:** FarFish self-sampling pilot project shows mislabelling in the two species of black hake in both industrial and artisanal fleet. **Bycatch data in black hake fishery available:** FarFish proposed new logbook template that could collect data useful for scientific purposes. The new template consists of two sampling sheets: commercial catch and discards. **VMS and/or AIS signals are transmitted:** Comparing AIS and VMS signals provides an accurate and helpful method to identify compliance of vessels. It is challenging to know the proportion of EU or non-EU vessels with redundant AIS+VMS and their reasons. **Trade flow data on black hake provided:** Trade flow of hake from EU and Senegalese fleet, and information on the potential of hake in the West-African market is provided. Nonetheless, FarFish attempted to shed more light on Senegalese hake resources' potential in West-African markets by initiating collaboration with local researchers but was unsuccessful.

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Mauritania management recommendation

Area: Mauritania EEZ

Type of fishery: mixed fishery: black hake and small pelagics

Fisheries management	Specific challenges	Outcome targets, level of achievement, further steps
The Ministry of Fisheries and the Maritime Economy (MPEM) has the overall responsibility of regulating and monitoring government policy implementation of the fishery. The Institut Mauritanien de recherche Océanographique et des Pêches (IMROP) is the official Mauritanian research entity for fisheries. IMROP aims to analyse constraints and determinants of biological, physical, socio-economic, and technical issues of the fisheries sector.	Divergent conversion factors are used in logbooks to obtain live weight. The relevant authorities deal with this challenge. Data limitation for sustainable conversion and separate stock assessment of black hake due to their morphological resemblance. High bycatch of black hake in non-hake fisheries especially in the pelagic fishery. The presence of bycatch in black hake fisheries due to ineffective communication between observers and operators. Insufficient monitoring of catch concerning the Total Allowable Catch (TAC). An electronic reporting system (ERS) is needed to improve the monitoring of TAC consumption.	**Information on the proportion of the two species of black hake in catches provided:** Results from the self-sampling project show significant differences between the two black hake species. **Information on black hake caught as bycatch provided:** Evidence of black hake caught as bycatch is reported in the pelagic fishery. Materials for self-sampling are available for fishers to carry out self-sampling onboard vessels to improve stock assessment. **Increased onboard observer coverage on all high-capacity pelagic vessels in place:** The authority proposes a 30% observer coverage. FarFish could not assess if the proposed 30% observer coverage was good enough. However, it is vital to have a mechanism to allow effective implementation of observers onboard all the high-sea trawlers fishing for small pelagic species. **Data on all catches, discards and bycatches provided:** Time-series data suitable for modelling compiled from several sources, national and international, and fisheries dependent and independent research surveys are available. Data on discard and bycatch are not available due to the lack of a robust monitoring scheme for this data. **Trade flow data on small pelagic species provided:** Data on catch quantities, landing destination, processing, trade, and selected socio-economic variables are available. Most of the resources are utilised for fish meal production. This affects employment and impact on local food security.

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Seychelles management recommendation

Area: Seychelles EEZ

Type of fishery: mixed fishery

Fisheries management	Specific challenges	Outcome targets, level of achievement, further steps
The Government of Seychelles has the responsibility for policy development and oversight. The Ministry of Fisheries and Agriculture (MFAg) develop plans based on the policy and implemented by the SFA. The Ministry of Environment, Energy and Climate Change (MEECC) is leading the Marine Spatial Plan (MSP) development process. The CFP regulates the activities of EU fishing vessels outside EU waters, ensuring that their activities are based on same principles applicable under EU law.	Implementation of the MSP is expected to impact approximately 4000 to 5000 tonnes of catch the EU vessels fishing under the SFPA agreement. The fishing effort associated with this catch is expected to be re-directed to other zones within or outside the Seychelles EEZ. Limited or complete lack of data to undertake stock assessment of bycatch in the tuna fishery. Monitoring transhipment and landings have been difficult for the distant water industrial longline vessels as they do not land in Port Victoria. Attempts have been made using drones to improve surveillance, but this has been scrapped due to non-feasibility.	**Harmonised fisheries information system in place:** The EU tuna purse seine operators already provide data by different channels or tools. The data depends on the end receiver and is not dealt with consistently. Efforts of collaboration between operators and coastal state authorities need to be developed to harmonise the fisheries information system. **Catches of non-target species registered in e-logbooks:** Seychelles uses paper logbooks and struggles to implement the ERS system fully. Using FLUX data would be desirable for exchanging Fisheries Monitoring Centre (FMC) data between the EU and Seychelles. FarFish implemented DLMtool for stock estimation of two species: dolphinfish and the wahoo. The results show that it is possible to obtain abundance and mortality estimates when using scaled catches together with the CPUE of a nearby region for the common dolphinfish. **MPAs and no-take zones identified in the SMSP are respected:** COVID-19 delay the MSP process. FarFish could not get access to the data due to protocol restrictions. SFA cannot share VMS data from the EU and non-fleet unless it relates to search and rescue purposes, or the authority has reasonable grounds of an offense. **Updated observer program in place:** Electronic Monitoring System (EMS) program is being set up. It focuses on compliance, but support may be provided to expand its scope for scientific purposes. Institutional challenges related to data validation and reporting are expected when the program is expanded to cover foreign fleets. **Trade flow data provided:** All catches from Seychelles EEZ are landed or transhipped in Port Victoria. Many tuna landings are processed in Seychelles, but tuna is also transhipped into other countries, especially Mauritius and Madagascar. **VMS or AIS signals are transmitted:** VMS catch data processing is difficult because some CPCs have not implemented the national VMS framework yet. Operators are reluctant to comply with compulsory AIS reporting due to piracy, which is problematic within the Seychelles EEZ.

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We provide separate case reports for case-specific use. This means that some of the text, especially on the methodology and RBM framework, is repeated in each MR. The MRs are compiled according to the CS number (see the table of contents below), and separated by a coloured front page easy to identify when you scroll through the document.

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CASE STUDY 1

SOUTH WEST ATLANTIC

Deliverable No. 4.4

Project acronym:
FarFish

Project title:
Results-Based Management and Capacity Building for EU Sustainable Fisheries Partnership Agreement – and International Waters

Grant agreement No: **727891**
Project co-funded by the European Commission within the Horizon 2020 research and innovation programme

Start date of project: **1 June 2017**
Duration: **54 months**

Due date of deliverable:	30/11/2020
Submission date:	30/11/2021
File Name:	FarFish D4.4_MR2 South West Atlantic
Revision number:	02
Document status:	Final
Dissemination Level:	PU[1]

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[2] The initials of the revising individual in capital letters

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Deliverable D4.4

Management Recommendation 2

South West Atlantic

30/11/2021

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Summary

This document serves as an update of the draft proposal for a management recommendation (MR) for the international mixed fishery in the South West Atlantic (ASW), FAO Area 41. The MR2 draft proposal was submitted internally for the second audit iteration within the FarFish project in March 2021. The aim of this document is to respond to the second audit report (FarFish, D5.4) and provide a final version of the MR2. Fishing activity is concentrated mainly in the FAO subareas 41.3.1 and 41.3.2, at the part of the Patagonian shelf and slope (<300m) that extends beyond the Argentina exclusive economic zone (EEZ) and the Falkland Islands outer conservation zone.

The overall objective of this proposal is to develop a flexible, dynamic, and ready-to-use MR document in close collaboration with stakeholders based on results-based management (RBM) principles for the selected fisheries. The fact that there is no Regional Fisheries Management Organisation (RFMO), and the lack of any form of management within the area make this case study (CS) challenging.

The MR2 is developed following the "General Guidelines for Making MRs" (FarFish D3.5) and is based on the "Second MR Invitation" (FarFish, D3.6), where the outcome targets (OTs) are proposed. The proposed OTs are based on input from "MR 1" (FarFish, D4.3), the "Audit of MR1" (FarFish, D5.1), as well as the roadmap presented in "Report on Challenges and Suggestions for Improvements" (FarFish, D5.2). In addition, stakeholder meetings facilitated by FarFish stakeholder interaction (WP1) and input from other FarFish work packages (WP) and case study (CS) meetings serve as a base for this document.

The OTs for this CS are as follows:

OT 1.1: A soft-law mechanism (international conference) focused on sustainable management in areas beyond national jurisdiction (ABNJ) (FAO 41 (subareas 41.3.1 and 41.3.2)) available. **Obligatory**. **Achieved**

OT 1.2: All vessels transmit automatic identification system (AIS) signals. **Obligatory**. **Achieved**

OT 1.3: Theoretical frame for a specific control and inspection programme in FAO 41 as a basis for a future pilot project on a joint deployment plan for this region. **Recommended. Partly achieved**

The main goal of the MR2 for the ASW is to improve the sustainability of high seas mixed fisheries by a) contributing to a level playing field for international fleets involved in the fisheries, and b) contributing to improved fishing and conservation through monitoring, control, and surveillance. Due to the lack of an authority for the area, or an area specific RFMO that might play this role, operators need to abide by their flag state authorities. As some of the OTs require contribution from the authority, operators cannot be made solely responsible for achieving the OTs. For this MR to make progress, therefore, requires a joint effort between authorities and operators.

The goal for the MR2 is long-term and not all its objectives will be achieved during the lifetime of the FarFish project. Yet arranging an international conference and developing a pilot joint deployment plan are steps in the right direction to improve sustainability in the ASW high seas in the future.

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Abbreviations

ABNJ	Areas beyond national jurisdiction
AIS	Automatic identification system
ASW	South West Atlantic (i.e. "Atlantic Southwest")
CAFS	Chinese Academy of Fishery Sciences
CETMAR	Centro Tecnológico del Mar – Fundación CETMAR (Spain)
CFP	Common Fisheries Policy
CPC	Vessels entitled to fly their flags and authorised to fish species managed by the ICCAT in the Convention area, Flag Contracting Parties, Cooperating non-Contracting Parties, Entities or Fishing Entities.
CPUE	Catch per Unit Effort
CS	Case Study
CSIC	Spanish National Research Council
DG MARE	Directorate-General for Maritime Affairs and Fisheries (EU)
EC	European Commission
EEZ	Exclusive economic zone
ERS	Electronic recording systems
EFCA	European Fisheries Control Agency
FAO	Food and Agriculture Organisation of the United Nations
FarFish RG	FarFish Reference Group
GFW	Global Fishing Watch
HS	High seas
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICMAN-CSIC	Institute for Marine Sciences of Andalucía (ICMAN) – Spanish National Research Council (CSIC)
IMO	International Maritime Organisation
IUU	Illegal, unreported, and unregulated fishing
JDP	Joint Deployment Plan
LDAC	EU Long Distance Fleet Advisory Council
MATIS OHF	Icelandic Food and Biotech R&D Institute
MCS	Monitoring, control, and surveillance
MR	Management recommendation
OT	Outcome target
RBM	Results-Based management
RFMO	Regional Fisheries Management Organisation
SAP/MAPA	Secretariat of Aquaculture and Fisheries (SAP) of the Ministry of Agriculture, Livestock, and Supply (MAPA) (Brazil)
SCIP	Specific control and inspection programme
SFPA	Sustainable fisheries partnership agreement
SMEFF	Sustainable management of external fishing fleet
STECF	Scientific, Technical and Economic Committee for Fisheries (EU)
UIT	The Arctic University of Norway
UNGA	United Nations General Assembly
USP	University of São Paulo (Brazil)
VIIRS-DNB	Visible infrared imaging radiometer suite day/night band
VME	Vulnerable marine ecosystems
VMS	Vessel monitoring system

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Concepts/definitions

Indicator	A variable, pointer, or index related to a criterion. Indicators are selected such that they reflect variations in key elements of the fishery resource, the social and economic well-being of the sector, and the sustainability of the ecosystem. The position and trend of an indicator in relation to reference points or values indicate the present state and dynamics of the system. Indicators provide a bridge between objectives and actions (source: FAO 1999).
Management goals	The higher-order objective to which a management intervention is intended to contribute (OECD 2011). A management goal is derived from a management principle (constitutional-order) and is specified into a set of more operational management objectives (collective-order).
Management intervention	Strategies or instruments aimed to impact the state of a fishery with reference to authorised objectives. Examples are input and output controls and economic measures.
Management measures	Can be technical (e.g. gear selectivity, etc.); input (effort)/output (catch) control-based; or right-based.
Management objectives	Fisheries management objectives are typically framed within the overall concept of sustainable development and may reflect one or more of the various dimensions and criteria that relate to it (FAO 1999). OTs are controlled by operators through setting and implementing management measures.
Management Plan	In RBM, the management plan (MP) is a formal arrangement between a management authority and operators that specify the partners in the fishery and their respective roles, the agreed objectives for the fishery, and the management rules and regulations that apply. It also provides other relevant details about the fishery. In RBM, the formal responsibility for developing the management plan is delegated to an operator.
Management Recommendation	In RBM, the management recommendation is a formal arrangement between a management authority and operators that specify the partners in the fishery and their respective roles, the agreed objectives for the fishery, and the management rules and regulations that apply. It also provides other relevant details about the fishery. In RBM, the formal responsibility for developing the management recommendation is delegated to an operator.
Management strategies	In a FarFish context, this term means the strategies applied to achieve OTs
Outcome Target	An outcome target (OT) is a specific and measurable performance goal defined for a fishery based on agreed and appropriately authorised general goals, standards, and principles, as defined by the authorities based on the policy objectives. An OT is a textual or mathematical statement that can be evaluated as "true" or "false" where "true" is the target value. The OT is the indicator value that the management actions aim to stay above or below e.g. F<Fmsy

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1 Introduction

This document updates the draft proposal for a management recommendation (MR2) in the FarFish project, submitted internally for audit purposes, for European operators active in the fishery in the South West Atlantic high seas.

1.1 FarFish overall objective

The overall objective for FarFish is to improve knowledge of and management of EU fisheries outside Europe while contributing to their sustainability and long-term profitability. The role and responsibilities of the EU fleet are significant in ensuring sustainable utilisation of the resources to which they are allowed access, whether that is under a Sustainable Fisheries Partnership Agreement (SFPA) in place or in international waters, also called the high seas.

The concept of sustainability is about meeting the needs of the present without compromising the ability of future generations to meet their own. Put more simply, it is about managing people, the planet, and profit. Therefore, the fleet should cooperate with the Regional fisheries management organisations (RFMOs) and national authorities in partner countries to improve knowledge and make management more effective. However, there is no RFMO currently in place for the high seas bottom fisheries in the South West Atlantic (ASW) region, making this case study (CS) especially challenging

The FAO report, "The State of World Fisheries and Aquaculture 2020"[3], says that there is no alternative to sustainability; the world needs programs to further improve fisheries to allow humans to fish in oceans for edible seafood continually, and the only path to sustainability is effective management of the world fisheries. This obligates the EU national authorities and the fishing industries.

1.2 South West Atlantic high seas

Two thirds of the ASW region are areas outside national jurisdiction, also called the high seas or international waters. FAO area 41 covers large parts of the high seas, as well as the EEZs of Brazil, Argentina, Uruguay, and the Falkland Islands. There is now an RFMO covering demersal and deep-sea fisheries in the high seas within the ASW. The ASW falls under the convention area of the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Commission for the Conservation of Southern Bluefin Tuna (CCSBT). Yet other species in the ASW, such as hake and squid, are not addressed in these commissions. During peak fishing season, from January to July, the number of active fishing vessels in the area exceeds 400 (Greenpeace, 2019).

The ASW has abundant biodiversity that is identified as needing protection. However, due to the lack of law enforcement in the area, it is exposed to overfishing, destructive fishing practices such as bottom trawl and longlining, and the inability of states to cooperate in ensuring that marine ecosystems are effectively protected and fisheries sustainably managed. According to the FAO, it is estimated that over 53% of the stocks in the ASW are fished at biologically unsustainable levels.[4]

There is a lack of a level playing field in the ASW. The EU is the only CPC that has adopted a regulation to implement UNGA Resolution 61/105[5] on the conservation of deep-sea habitats from bottom fishing

[3] http://www.fao.org/documents/card/en/c/ca9229en
[4] http://www.fao.org/documents/card/en/c/ca9229en
[5] UNGA, *Resolution 61/105 Sustainable Fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982*

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in the ASW. Spain is the only EU flag state to date that has actively protected nine marine areas (Wright et al., 2015), with an extension of over 41 000 sq. km. These areas were previously identified as vulnerable marine ecosystems (VME). The lack of implementation of this legally binding instrument by non-EU flag states, combined with the relatively high numbers of fishing vessels operating in the area, has affected the productivity of stocks and jeopardizes the biological sustainability of resources.

Figure 1. VME areas identified within the Atlantic Southwest (ASW). Vulnerable Marine Ecosystems (VMS) identified in South West Atlantic FAO 41 (41.3.1 and 41.3.2). Source: Developed by FarFish using data from Estudio de los ecosistemas marinos vulnerables en aguas internacionales del Atlántico sudoccidental Espanol de Oceanografía, published by Instituto Espanol de Oceanografía.

The international mixed fishery in the ASW (FAO Area 41) mainly occurs in the subareas 41.3.1 and 41.3.2, at the part of the Patagonian shelf and slope (<300m) that extends beyond the Argentina exclusive economic zone (EEZ) and the Falkland Islands outer conservation zone (Figure 2).

Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and Related Instruments, UNGA A/RES/61/105, 2007

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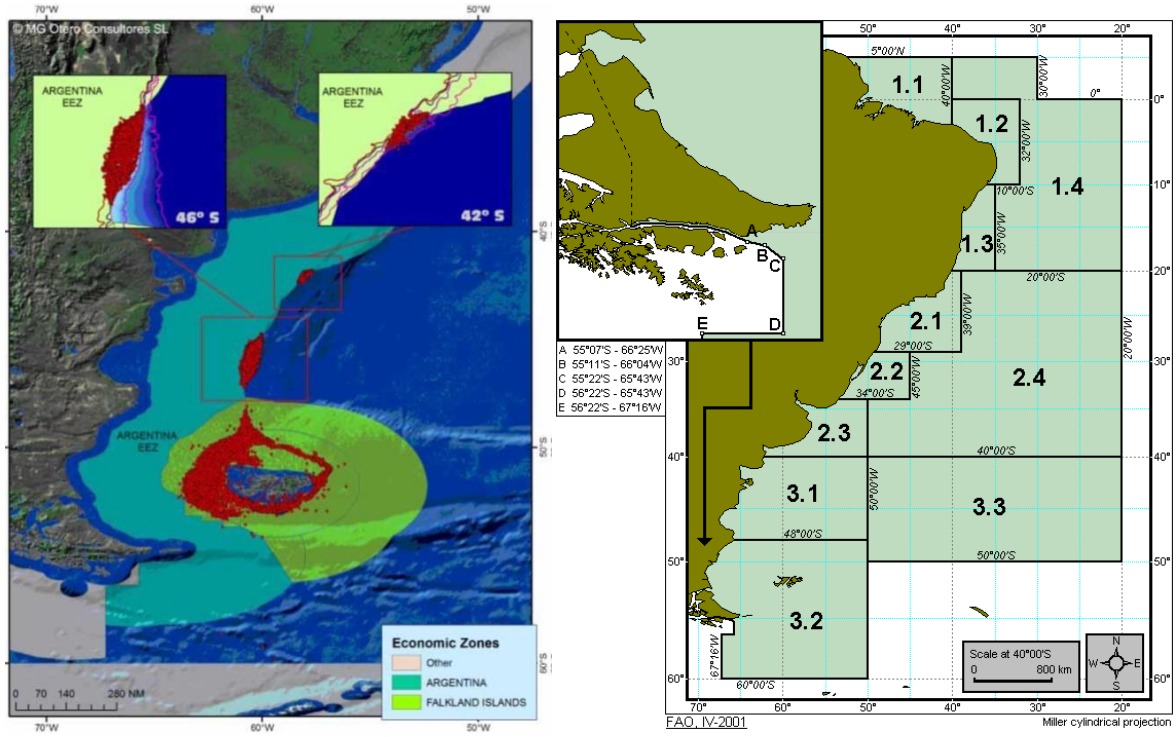
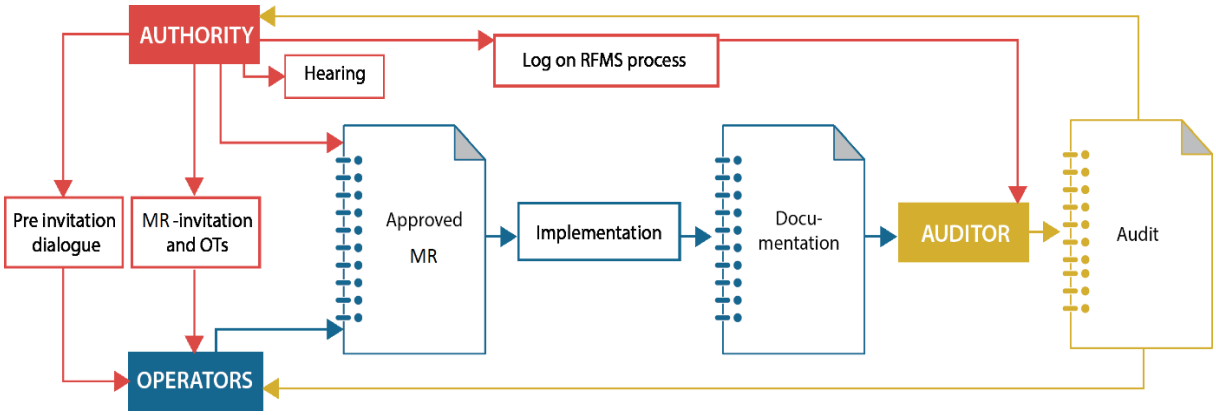


Figure 2. Left: Locations of Spanish fishing activity in Southwest Atlantic: Right: FAO Fishing Area 41 and its subareas. Sources: Left: www. FAO.org; Right: Bensch et al. (2009). The fishery within the case study is mostly concentrated on international waters just outside the Argentinian EEZ and around the Falklands islands (EC, 2008)

1.3 The process for developing MR2 for ASW

The management recommendations (MRs) within the FarFish project are developed in two iterations and build on results-based management (RBM)[6] principles (Nielsen et al., 2017). RBM requires that the relevant authority defines specific and measurable objectives for a fishery but allows resource users (operators) to find ways to achieve these objectives and provide adequate documentation (Figure 3).



[6] The RBM is also referred to as the Responsive Fisheries Management System (RFMS) in the EcoFishMan project and other FarFish documents

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Figure 3. General description of the process of making an MR based on RBM in FarFish (FarFish, D3.1). The different colours demonstrate the responsibilities of each of the three entities. Authority: red; Operators: blue; Auditors: yellow.

The MR1 for ASW (FarFish, D4.3) was made available on 30 September 2019. The MR2 presented here has been developed following the "Draft 2 General Guidelines for Making MRs" (FarFish, D3.5). It is based on the "Second MR Invitation" (FarFish, D3.6), where the updated outcome targets (OTs) for the CS were set. The OTs were based on the MR1, as well as advice from the auditor, and input from meetings facilitated by FarFish for "stakeholder interaction" (WP1). The consortium reviewed the OTs at the meeting of CS and WP leaders in Marrakesh, Morocco, in November 2019. After the meeting, a draft of the "Second MR Invitation" was sent to operators for a hearing. Based on their responses, the authority (MATIS) further adjusted some of the OTs, and the "Second MR Invitation" was made available on 21 January 2020. The External Advisory Group, and the experts in the 36-month review meeting in August 2020, also provided valuable input to the MR2 development. Following the RBM approach, the "Audit of MR1" (FarFish, D5.1) was made available on 30 November 2019. The recommendations from the audit and input from the "Report on Challenges and Suggestions for Improvements" (FarFish, D5.2) were applied in this MR2. The second audit, 'Report on Management Recommendation 2 Audit' (FarFish, D5.4), was made available on 30 June 2021. The recommendations from the second audit report were used to update the second MR.

A workshop arranged for this CS under the title "Bringing Fisheries Sustainability into the High Seas: the Case of the South West Atlantic (FAO area 41)" was held in Madrid in September 2019. The workshop brought together international experts and representatives from the fishing industry, policymakers, international institutions, and FarFish partners. A result of this workshop was the international conference "Challenges in the Design and Implementation of Sustainable Fisheries Management for the South West: a Scientific-Based Approach" which was held on 4 March 2021. The title of the conference is preliminary and might change.

In addition to the workshop mentioned above, WP1 ensured continuous contact and input with the relevant stakeholders through six physical and 11 online meetings, e-mail correspondence, and phone calls.

1.4 Partners involved in MR2

The authority is defined as the organisational entity acting to pursue the management objectives decided for a fishery, e.g. a coastal state or the European Commission. They oversee the RBM process and issue the "MR invitation", which includes a clear specification of OTs, which are set to operationalise the goals of existing policies and local management objectives. In the absence of an RFMO for the ASW high seas, there is no competent fisheries management authority in this area to take the lead in the RBM process. Therefore, FarFish Work Package 3 (WP3), represented by MATIS, will act as the leading authority by implementing input from relevant authorities, such as the FAO, DG MARE, SAP/MAPA[7], and CAFS.

[7] SAP/MAPA: previous CGPOP (General Coordination of Fisheries Planning and Management) (Brazil)

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The operator is defined as an organised group of resource users, for example, an association of fishers or stakeholders with rights in each fishery. They develop, propose, and implement an MR based on the OTs set by the authority. The European fishing operators qualified to respond to the MR Invitation will provide feedback through the EU Long Distance Fleet Advisory Council (LDAC).

LDAC developed this MR draft, supported by CETMAR. FarFish WP 4, led by UiT The Arctic University of Norway, aimed to demonstrate how to meet the OTs listed in the second MR Invitation (FarFish D3.6). The OTs were revised during this process, illustrating the iterative dialogue between authority and operators characterising the RBM (Nielsen et al., 2017).

The leader of WP 5, Sjókovin, blue resource, evaluated and provided the audit of the MR2 once approved by both operators and authorities.

Table 1. Partners and FarFish WPs involved in the ASW case study

South West Atlantic – FAO area 41		
AUTHORITY	WP3	FAO, DG MARE, SAP/MAPA, and CAFS
OPERATORS	WP4	LDAC
AUDITOR	WP5	Sjókovin

1.4.1 Other partners and stakeholder interaction

A workshop organised by CETMAR and LDAC was held in Madrid, Spain, in September 2019. Organised within the framework of the FarFish project, the workshop brought together international experts and representatives from the fishing industry (ANAMER, ARVI, CEPESCA, OPRAS, CONEPE), policymakers (EFCA, SAP/MAPA), international institutions (FAO, LDAC), in addition to FarFish partners (SAKANA, CETMAR, MATIS, USP, and UiT).

The goal of the workshop was to explore the priorities and challenges for sustainable fisheries management in the ASW. The focus was on understanding the potential paths for cooperation in FAO area 41 to support sustainable fisheries management and ensure a level playing field for international operators. The outcome from the workshop was important for the development of MR2.

1.5 Objectives of the MR2 for the ASW

The main objectives of the MR2 for ASW were to improve the sustainability of high seas mixed fisheries (FarFish D3.2, and D3.6) by:

(1) Initiating dialogue between stakeholders involved in mixed fisheries within FAO area 41.
(2) (2) Improving the quality and quantity of data collection.
(3) Compiling knowledge of the straddling stocks from the different scientific institutions.
(4) Contributing monitoring in the area by supporting enforcement, utilising the latest available satellite systems and tools.

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2 The current legal framework in the high sea's fisheries in ASW

The scope of the ASW MR comprises areas beyond national jurisdiction (ABNJ) where there is no RFMO in place with the legal competence to regulate demersal or deep-water fisheries. Nevertheless, the area falls under the convention area and is subject to the rules of ICCAT and CCSBT for stocks of Atlantic tuna and bluefin tuna. With the lack of an RFMO covering the demersal, small pelagic, and deep-sea target species in the area, it is difficult to define the power balance between various authorities, coastal countries, EU, and non-EU fleets operating in the area or their legitimacy.

Soft-law mechanisms, like those promoted by the FAO (non-binding) through the "International Guidelines for the Management of Deep-Sea Fisheries in the High Seas[8]", refer to quasi-legal instruments that are designed to encourage rather than act as legally binding obligations (Guzman and Meyer, 2010). Soft-law instruments are a flexible tool of compromise that can ease bargaining problems and open up mutually preferred compromises (Abbott and Snidal, 2000).

The same situation applies with UNGA resolutions 61/105[9] and 64/72[10] for the management of deep-sea fisheries in the high seas. With the handicap of not having an RFMO, it is ultimately up to each flag state to implement this resolution within their national legislations.

The EU fleet is subject to the EU Common Fisheries Policy[11] (CFP), which aims to ensure that fishing activities are environmentally, economically, and socially sustainable (the so-called three pillars of sustainability). The EU stresses the need to promote the objectives of the CFP internationally, ensuring that fishing activities outside EU waters are based on the same principles and standards as those applicable under Union law, while promoting a level playing field for both EU and non-EU fishing operators. In this respect, the EU has established a system concerning sustainable management of the external fishing fleet (SMEFF), covering the scope of activities of EU fishing vessels outside EU waters within the high seas[12]. The EU's reformed CFP, which came into effect in January 2014, states that all EU fishing activities, inside and outside EU waters, are subject to the same environmental and other standards (EC, 2013). Thus, the EU must conduct its external fleets following the objectives and principles set out in Articles 2 and 3 of the CFP. According to Article 2, those objectives include the application and promotion of the precautionary approach to ensure that the stocks targeted are at levels that deliver maximum sustainable yield (MSY) by 2020 at the latest, the application of the ecosystem principle, the promotion of the collection of scientific data, and the gradual elimination of discards (FarFish, D1.1).

Additionally, the EU has committed to fulfil UN Sustainable Development Goal 12[13], which is to "ensure sustainable consumption and production patterns", as well as Sustainable Development Goal 14[14], which is to "conserve and sustainably use the oceans, seas and marine resources for sustainable development".

[8] http://www.fao.org/fishery/topic/166308/en
[9] https://undocs.org/A/RES/61/105
[10] https://undocs.org/A/RES/64/72
[11] https://ec.europa.eu/fisheries/cfp_en
[12] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017R2403
[13] https://sdgs.un.org/goals/goal12
[14] https://sdgs.un.org/goals/goal14

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3 Fishery overview

According to the FAO (FAO, 2020), total catches in the ASW have varied between 1.8 and 2.44 million tonnes, reaching 1.8 million tonnes in 2018, a 25% decrease from 2015. Coastal states are key players in the ASW fisheries. Their share (77.5%) comes to a great extent from harvests in their EEZs. Distant water fishing states (DWFS), with a share of 22.5%, play an important role in high seas fisheries. The EU is the most important DWFS in the area, with a share of 7.4% of the total harvest. In 2017, the EU harvests were mainly undertaken by Spanish vessels (91.8%), followed by the Portuguese (4.9%) and the British (3.3%). Other DWFSs harvesting in the area include China (7.0%), Taiwan (4.6%), and Korea (3.2%).

Table 2. Total catches in FAO area 41 by country in 2017 (FAO 2019)

Country	Total harvest (tonnes)	%
Coastal States		
Argentina	813 007	44.5%
Brazil	479 213	26.2%
Falkland Is. (Malvinas)	67 428	3.7%
Uruguay	58 028	3.2%
Total coastal states	**1 417 676**	**77.5%**
DWFS		
Spain	124 065	6.8%
Portugal	6 639	0.4%
UK	4 427	0.2%
EU total	**135 131**	**7.4%**
China	128 578	7.0%
Taiwan	84 529	4.6%
Korea	58 969	3.2%
Other DWFS	3 242	0.2%
Total other DWFS	**275 318**	**15.1%**
Total coastal states + DWFS	**1 828 125**	**100%**

The EU fleet operating in the ASW is almost exclusively represented by Spanish demersal trawlers over 40 m. The EU fleet landings in 2017 amounted to 135 131 tonnes, while other DWFS amounted to 275 318 tonnes.

3.1 Target species and bycatch

The most important species in the landings is the Argentine shortfin squid (*Illex argentinus*), which represents 19.7% of the region's total catches in 2017. However, total landings of this species experienced a sharp drop, from more than 1.0 million tonnes in 2015 to 360 000 tonnes in 2017. Landings of Argentine hake (*Merluccius hubbsi*), the second-most important species, has remained stable at about 350 000 tonnes over the past decade. Still, its status remains unsustainable, despite signs of slow recovery. Patagonian grenadier (*Macruronus magellanicus*) and southern blue whiting (*Micromesistius australis*) have shown a continuous decrease in catches in the past 20 years. Overall,

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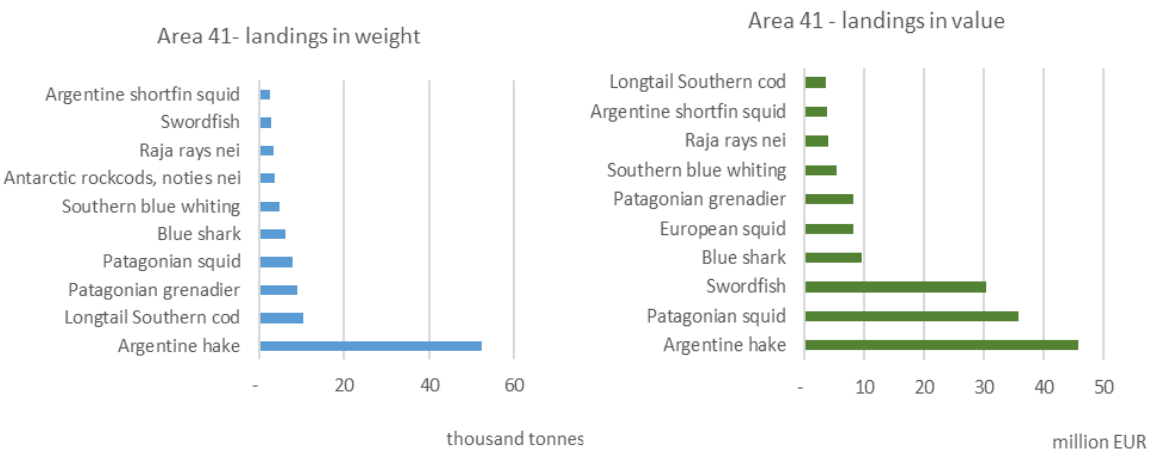
46.7% of the assessed stocks in the ASW were fished within biologically sustainable levels in 2017, a 4% improvement from 2015[15].

As shown in Table 3, the Argentine shortfin squid was the species with the largest harvested yield, closely followed by the Argentine hake (19.5%). All top five species shown in Table 3 are harvested in the Patagonian shelf, which hosts the most important fisheries in the area.

Table 3. Top five species by total catches in FAO area 41 (based on data from FAO 2019).

Species	Total catches	%
Argentine shortfin squid	359 722	19.7%
Argentine hake	356 788	19.5%
Argentine red shrimp	244 073	13.4%
Whitemouth croaker	78 350	4.3%
Patagonian squid	66 801	3.7%

Target species include demersal species such as Argentine hake, and to a lesser extent swordfish, blue shark, and blue whiting. While swordfish and Patagonian squid are not very important in terms of landed weight, they are almost as important as Argentine hake in terms of value.[16]



Source: MS data submissions under the DCF 2018 Fleet Economic (MARE/A3/AC(2018))

Figure 4. Ten top landed species in weight and value from FAO area 41, 2016 (STECF, 2018)

[15] The state of World Fisheries and Aquaculture 2020, FAO_SOFIA

[16] https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/2018-annual-economic-report-eu-fishing-fleet-stecf-18-07

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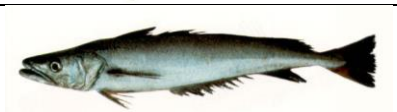
Table 4. An overview of the EU fleets' primary target species and bycatch in ASW

English name	Target species	Scientific name
Argentine hake		*Merluccius hubbsi*
Southern (Austral) hake		*Merluccius australis*
Argentine shortfin squid		*Illex argentinus*
Southern blue whiting		*Micromesistius australis*
Patagonian squid		*Loligo gahi*
Wahoo		*Acanthocybioum solandri*
Blue shark		*Prionace glauca*
By-catch		
Patagonian grenadier		*Macruronus magellanicus*
Longtail southern cod		*Patagonotothen ramsayi*
Patagonian toothfish		*Dissostichus eleginoides*
Sting rays		*Dasyatis spp*
Rays mantas nei		*Raijiformes*

3.2 Stock status of major target species

Argentine hake (*Merluccius hubbsi*)

For some species, such as Argentine hake (*Merluccius hubbsi*), stock assessment has been carried out for the Uruguay-Argentina fishery using dynamic surplus production models from 1980 to 2000 (Gutiérrez and Defeo, 2013). Results indicate a decrease in biomass of 43% over this period and an MSY of 91 430 tons. Furthermore, as noted in this study, the Argentine hake has a wide distribution beyond the area fished by the Uruguay and Argentine fleets as it is fished by other fleets and undertakes seasonal migrations. Thus, adequate stock assessment requires incorporating data from other fleets and areas where the Argentine hake is fished. According to Maguire et al. (2006, cited in Bensch et al. (2009)), Argentine hake was considered overexploited or depleted at the time, with signs of recovery in recent years.

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Southern (Austral) hake (*Merluccius australis*)

Austral hake, also known as southern hake (*Merluccius australis*), is mainly found south of 50°S, in the SW Atlantic and SE Pacific. Giussi and Zavatteri (2016) carried out a stock assessment from 1986 to 2015 using a statistical catch-at-age model. Their conclusion was that spawning stock biomass in 2015 amounted to 30% of the spawning biomass in 1986, with a marked drop in abundance in the initial years of the fishery.

Argentine short-fin squid (*Illex argentinus*)

According to Maguire et al. (2006, cited in Bensch et al. (2009)), the Argentine short-fin squid (*Illex argentinus*), was considered fully exploited then. Chen and Chiu (2009) standardized the catch per unit effort (CPUE) and reported an increase in abundance from 1995 to 1999 before a subsequent sharp decline from 1999 to 2003. However, as with all short-lived species, environmentally driven recruitment variability plays a major role in the population dynamics of the short-fin squid. Wang et al. (2018) used an environmentally dependent surplus production model to evaluate the southern Patagonian stock of *Illex argentinus* and estimated an MSY ranging from 351 600 to 685 100 tonnes and biomass of 1 322 400 to 1 803 000 tonnes, with instantaneous fishing mortality (F) less than $F_{0.1}$ and F_{MSY}. According to Wang et al. (2018), the Argentine short-fin squid is not currently overfished.

Southern blue whiting (*Micromesistius australis*)

Southern blue whiting (*Micromesistius australis*) was considered fully overexploited (Maguire et al., 2006) at the time. These findings were supported by cohort analysis carried out for the 1987–1999 period by Wohler et al. (2002), who used catch data from the Argentinian and other fleets operating around the Malvinas Islands as well as data from Argentine-British surveys. Results indicated decreasing trends in biomass and recruitment and spawning biomass of 34% of the virgin biomass. This species is also considered overexploited by the FAO (2016).

Bycatch species

Bycatch species such as the Patagonian grenadier (*Macruronus magellanicus*) and Patagonian squid (*Loligo* spp.) are considered fully exploited. Pink cusk eel (*Genypterus blacodes*) is considered overexploited. At the same time, the status of other bycatch species such flying squid (*Martialia hyadesi),* tadpole mora (*Salilota australis*), grenadier (*Macrourus whitsoni*), Antarctic cod (*Notothenia rossii*), rock cods (*Notothenia* spp.), sharks, and rays are not known (FAO, 2016).

4 Specific challenges in ASW

The ASW high seas workshop at the Secretaría General de Pesca (SAP/MAPA) in Madrid in September 2019 highlighted challenges such as the lack of enforcement of port state control, uncertainty, and alternative scenarios associated with Brexit. In addition, the longstanding dispute between the United Kingdom and Argentina over the Falkland/Malvinas Islands was identified as a significant barrier to strengthening fisheries governance in the region. The workshop also confirmed that the challenges FarFish focus on are highly relevant to the ASW, namely the lack of a level playing field, data availability, and insufficient monitoring, control, and surveillance (MCS). These three factors are discussed below.

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4.1 Lack of level playing field

A major management challenge in the ASW is the lack of a level playing field, whereby all operators should abide by the same rules regarding conservation and management of fish stocks and their habitats. Currently, EU operators are obliged to stricter requirements and regulations (SMEFF Regulation (EU) 2017/2403) than non-EU international fleets operating in the area (FarFish, D3.3). Furthermore, in terms of avoiding fishing in the VME closed for bottom trawl fishing activities to protect deep-sea habitats, the EU fleets are bound by (EC) Council Regulation 734/2008 implementing the UNGA Resolutions 61/105 and 64/72. There is little to no dialogue or exchange of information between the different fishing nations or authorities operating in this area.

4.2 Data availability

Another challenge is data availability, as the available fisheries data appears to be sparse, fragmented, and not easily accessible (i.e. it is often not publicly disclosed). Data holders include Argentinean and Falkland Islands national fisheries institutions and flag state distant-water fishing nations (FarFish, D2.3). The Scientific, Technical, and Economic Committee for Fisheries (STECF) of the European Union notes that it is unclear if the stocks in international waters constitute separate biological stocks from those in Argentinian or Falkland Islands' waters, so efforts to improve stock identification are desirable (FarFish, D4.2). The STECF further notes that to provide analytical and evidence-based advice, information from the commercial fisheries exploiting this stock throughout its distribution range is desirable. It emphasizes the need for a multilateral approach for assessing and managing the fisheries in the ASW (FarFish, D4.2).

4.3 Insufficient monitoring, control, and surveillance

The fight against illegal, unreported, and unregulated (IUU) fishing is important for sustainable fisheries and necessary to ensure a level playing field for all fleets operating in a fishing area. There is a need for improved monitoring in the ASW, and despite many distant water fleets transmitting AIS or/and VMS data (e.g. Spain, South Korea), there are many gaps in signals from other nations fishing in the area. It has been found that several gaps in the signal last more than 24 hours[17]. EU vessels are always obliged to transmit their position with a given frequency (usually every two hours) with a vessel monitoring system (VMS) to their flag state.

An automatic identification system (AIS), which provides public real-time information of ship traffic, is compulsory for vessels over 300 gross tonnes (GT) engaged on international fishing trips. The AIS was intended to increase security at sea and support ship-to-ship collision avoidance. But AIS transposes dynamic information such as ship position, course, speed, type of ship, and navigational status, in addition to the International Maritime Organisation (IMO) number. The processed AIS data can provide insights and information for regulatory bodies and researchers. Tracking AIS signals may aid monitoring and conservation of marine ecosystems. The IMO Convention for the Safety Of Life At Sea (SOLAS), Regulation V/19.2, requires vessels to operate AIS Class A on-board at all times, unless there are valid security reasons to turn it off, temporarily. In 2014, the European Commission required the entire fishery fleet >15 m to install AIS Class A transmitters (Shelmerdine, 2015).

[17] https://globalfishingwatch.org/data/what-can-we-see-when-ais-signals-disappear/

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AIS is an open-source information system, so the EU operators transmitting AIS can be continuously monitored by their competitors and vice versa as an unintended effect. This can give them indications, based on their interpretation of the AIS positions over time, of where their fishing activity might take place. Therefore, this valuable commercial information could be a handicap due to the public exposure of their fishing activity, even if indirectly.

If non-EU fleets do not comply with the same rules, the level playing field is undermined and therefore becomes ineffective for conservation and management purposes, as it risks leading to a lack of compliance[18].

5 Outcome targets and indicators

Outcome targets (OTs) are specific and measurable requirements set by an authority to make management goals operational. An OT is a statement of the condition of an indicator relative to a reference point, often in the form of inequality ("A>B") or a statement of presence or absence of some entity. An OT should commonly be SMART, meaning: Specific, Measurable, Attainable, Relevant, and Time-based.

The background concerning the policy objectives and jurisdiction of authorities needed to fulfil the theoretical requirements for creating OTs within the RBM process was largely absent. This complicated the process of identifying applicable OTs for this case study. However, it did also provide FarFish with an exciting opportunity to test the RBM concept and process in an unprecedented environment, which is why this particular case study was chosen for the project. Applying the RBM process in such a scenario required realistic expectations from all relevant parties, so the OTs identified in this case study were somewhat modest. The OTs for the ASW related to the main objectives in the fishery in the ASW (section 1.5).

Following were three OTs identified for the ASW mixed fisheries:

Table 5: OTs for the ASW mixed fisheries

OT 1.1	Obligatory	A soft-law mechanism (international conference) focused on sustainable management in ABNJ (FAO area 41) available.
OT 1.2	Obligatory	All vessels transmit AIS signals.
OT 1.3	Recommended	Theoretical frame for a specific control and inspection program in FAO area 41 as a basis for a future pilot project on a joint deployment plan for this region.

[18] According to the GFW, Spain is among the three countries with the most AIS gaps after China and Argentina. The reasons for this may be due to broken signals due to bad satellite coverage, this may also be in the case for other fleets https://globalfishingwatch.org/data/ais-gaps-by-fleet/.

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5.1 Changes in OTs between MR1 and MR2

Several OTs presented in the first MR have been changed or removed from the second MR. To ensure transparency, the reasoning for these changes is described below (Table 6).

Table 6 Changes in OTs between MR1 and MR2

OTs in MR1	OTs in MR2	Change
OT 1.1 Develop a soft-law mechanism [e.g. conference] focused on sustainable management of ABNJ (FAO area 41) (Obligatory)	**OT 1.1** A soft-law mechanism (international conference) focused on sustainable management in ABNJ (FAO area 41) available (Obligatory)	The OT was reworded.
OT 1.2 Commitment to transmit VMS/AIS signals (Obligatory)	**OT 1.2** All vessels transmit AIS signals (Obligatory)	The OT was reworded, and VMS was removed from the OT. This is due to the lack of access to VMS data from the non-EU fleet in this area.
OT 1.3 Set a pilot project on operational coordination through the development of a specific control and inspection programme (Obligatory)	**OT 1.3** Theoretical frame for a specific control and inspection programme in FAO area 41 as a basis for a future pilot project on a joint deployment plan for this region (Recommended)	The OT was reworded and changed from obligatory in MR1 to recommended in MR2, as there is no authority that can be responsible for the implementation of this OT.
OT 1.4 Both EU and non-EU fleet VMEs protection in accordance with UNGA 61/105 and FAO Guidelines for Management of Deep-Sea Waters in the high seas	The OT was removed. The reason for not including this as an official OT in the second MR invitation and MR is that there are already 11 areas closed for bottom trawling for the EU fleet (in accordance to UN Resolution 65/105 2006), while Spain closed off an additional nine areas for bottom trawling in 2011 due to identified VMEs[19]. Two other areas are also closed for the EU fleet due to the existing trawling footprint. These restrictions currently apply only to the EU fleet and have not been adopted by other foreign fleets operating in the area. This experience highlights a need for collaborative efforts from authorities, operators, researchers, and others to establish a consensus on the need for protecting these VMEs before this can be presented as an official or. The soft-law mechanism, presented in OT 1.1, is to address this partly.	

[19] http://www.savethehighseas.org/2011/04/04/spanish-institute-oceanography-releases-results-research-vulnerable-deep-sea-ecosystems-southwest-atlantic/

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5.2 Indicators

OTs most commonly refer to an indicator value. An indicator is a variable, pointer, or index related to a criterion. Indicators are selected such that they reflect variations in key elements of the fishery resource, the social and economic well-being of the sector, and the sustainability of the ecosystem.

The position and trend of an indicator in relation to reference points or values indicate the present state and dynamics of the system. Indicators provide a bridge between objectives and actions.

The suggested indicators in FarFish are set to measure the degree of adherence to the OTs (Table 6) and are classified according to their level of measurability. The most detailed indicator category, A, is quantitative, whereby the degree of achievement of the OT is measured by percentage. Indicator category B is qualitative, with the level of achievement considered to be high, moderate, fair, low, or not present. The last indicator category, C, is binomial, with only two outcomes, such as yes or no, true or false, success or failure.

During the process of identifying the appropriate OTs, it became apparent that the operators cannot be made solely responsible for some OTs, meaning that different authorities will need to take on the part of the responsibility to ensure their successful implementation.

Table 7. FarFish indicator categories and level of OT achievement

Indicator category	Level of OT achievement				
A	0%	25%	50%	75%	100%
B	Not present (NP) 0	Low level (LL) 1	Fair Level (FL) 2	Moderate Level (ML) 3	High level (HL) 4
C	No (False/Failure) 0				Yes (True/Success) 1

The obligations involved in some of the OTs identified here are already being implemented for the EU fleet, such as AIS signals and the avoidance of VMEs in line with Council Regulation No. 734/2008. The reason for them being included as OTs was to increase the pressure on other international fleets operating in the area to comply with these restrictions. Within this case study, multiple international fleets are operating. Therefore, compliance with only one fleet would have limited effects on the overall sustainability of this fishery, aside from highlighting a true interest in responsible fishing practices. In its attempt to take on the role of authority, the FarFish project, therefore, did its best to establish an equal playing field for all operators fishing in the area.

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5.3 OT 1.1 A soft-law mechanism (International Conference) focused on sustainable management in ABNJ (FAO area 41) available.

In MR1, this OT was defined as to "develop a soft-law mechanism (e.g. conference) focused on sustainable management of ABNJ (FAO area 41)". This was rephrased to "a soft-law mechanism (international conference) focused on sustainable management in ABNJ (FAO area 41) available" in MR2.

The aim and key activities for this outcome target were as follows:

Aim	Key activities to meet the OT
Contribute to a level playing field for international fleets involved in the fisheries in the ASW high seas	• Provide a summary report (FarFish, 2021) from the international conference, including challenges and research priorities on scientific collaboration, management and control. Ensure the inclusion of topics related to fisheries management and knowledge-transfer about the FAO 41 area in the following International Ocean Governance Forum

OT 1.1 was obligatory and aims to contribute to a level playing field for international fleets involved in the fisheries in the ASW ABNJ. The objective for this OT is long-term, and this conference aimed to explore various means of scientific collaboration to advance fisheries assessment. For this reason, the first step in this process was to arrange a conference with a scientific-based approach. The workshop in Madrid (Cap. 1.4.1) indicated the need for an arena where stakeholders, scientists, policymakers, and others with interest in the ASW, can meet, start a dialogue, and share information around issues concerning sustainable management in the ASW high seas.

The specific objectives from the conference were:

- To share advances in knowledge in the area, particularly regarding stocks and conservation of biodiversity, monitoring, control, and surveillance tools.
- To allow a digested summary of research findings and promote networking and outreach among international operators.

Progress:

CETMAR, together with LDAC, IEO, and FarFish, organised an online international conference titled "Sustainable Fisheries Management in South West Atlantic: A Scientific Approach[20]" on 4 March 2021. The conference's goals were to understand the potential paths for scientific cooperation in the South West Atlantic, to bring together international researchers and experts on the area to share their knowledge, to support sustainable fisheries management, and to strengthen the level playing field between international stakeholders.

Over 141 participants attended the event from Brazil, the UK, Spain, Portugal, Norway, Cape Verde, Jamaica, Iceland, Argentina, Morocco, Madagascar, Uruguay, Belgium, Faroe Island, Mauritania, Ghana, France, Namibia, the US, Sweden, Italy, Ireland, the Netherlands, Lithuania and Sri Lanka. Relevant international and European institutions that participated in the conference included DG

[20] https://www.farfish.eu/international-conference/

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MARE, the FAO, CECAF, Secretaria da Comissão Interministerial para os Recursos do Mar – SECIRM (Brazil), Secretaria General de Pesca Sostenible-MAPA (Spain), the Long Distance Advisory Council, the MidAtlantic Fisheries Management Council (US), the Brazilian Secretariat of Aquaculture and Fisheries, the Ministry of Agriculture (Brazil), and the Ministerio de Agricultura, Ganadería y Pesca (Argentina).

Exploring scientific collaboration to advance fisheries assessment

The conference agreed on the need for international cooperation in scientific research in the South West Atlantic. Data sharing on catch and biological data of straddling stocks within and outside the Argentinian EEZ and Malvinas/Falkland Islands Fisheries zones is essential to make this possible.

Challenges to scientific collaboration to advance in fisheries assessment

The conference acknowledged a need to improve knowledge of squid fisheries by determining habitat suitability, integrating ecosystem/environmental predictive models with biological stock assessments, and extending this research to other flag states. Mapping as a visualisation tool is needed to inform management decisions, for example, the spatial distribution of sea ice and sea temperatures. There is also a lack of implementation of UN Resolution 61/105 due to poor enforcement by non-EU flag states, resulting in inadequate protection of VMEs. Furthermore, there is no collaboration on data collection and knowledge-sharing on VMEs or the impact on them of fishing activities, despite the extensive seabed mapping exercise carried out by IEO-Spain under the ATLANTIS projects.

Research priorities

A multilateral action plan is needed to define, through a stepwise approach to data collection, programmes on the biology, habitat characteristics, fisheries management, and climate and environmental conditions in the South West Atlantic. Also, there is a need to set up an adequate international legal framework for scientific cooperation in the area that, combined with an effective control and inspection plan, focuses on preventing IUU fishing and overfishing. This framework will help to promote sharing and exchange of scientific and technical information. It will also contribute to improving MCS and compliance by all fleets for the protection of VMEs in ABNJ waters.

Next steps

From the conference, FarFish will facilitate advances in scientific collaboration within the South West Atlantic until the project's end, covering any interest identified by fisheries scientists and EU operators. FarFish will also promote any other science-based forum or arrangement to support the sustainability of fisheries in the South West Atlantic. Lastly, FarFish conducted a value chain analysis for the EU hake fisheries in the ASW (Agnarsson & Arias-Hansen, in prep). The study analyses the increased dependence of Spain, as the largest hake producer in Europe, on Argentine hake in the last decade. The high-seas fishing is neither governed by internationals agreements or RFMO. The lack of cooperation for a more coordinated management of this stock creates uncertainty about the future sustainability of the Argentine hake fishery. Reduced supply of Argentine hake will affect the Spanish value-chain for hake, as turnover will probably decrease, and some loss of jobs occur. The effect on prices is more uncertain.

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5.3.1 Level of OT 1.1 achievement

OT 1.1 has four indicators. One is category A, and three belong to category C. The indicators were evaluated after the conference. The responsible entities for this OT were LDAC and CCMAR.

Indicator		Indicator category	Indicator baseline	Indicator achievement
I_1_CS1	Number of invited stakeholders attending the conference	A	100%	High level
I_2_CS1	Verify that the international conference has been held	C	1	Yes
I_3_CS1	Report from the conference delivered	C	1	Yes
I_4_CS1	Ensure the inclusion of topics related to fisheries management and knowledge-transfer about the FAO 41 area in the following International Ocean Governance Forum	C	0	Indicator not ready to be evaluated next year

In MR1 this OT had only two indicators (1 and 2). From the audit of MR1, it was suggested to add indicators about the conference proceedings. Two more indicators (3 and 4) were therefore developed for this OT.

5.3.2 Main risk for achieving OT 1.1

To ensure the success of this OT at middle-term, the initiative must be followed up after the FarFish project has ended. There is a need for further regulation in the ASW, and RFMOs can promote the development, adoption, and application of environmental and social standards in the region (EU, 2020). So, to maintain a continuous discussion on these relevant aspects, it must ensure the participation of key stakeholders in oncoming international forums (e.g. International Ocean Governance Forum) However, the risk does exist, because it is always difficult to ensure stakeholder participation and to achieve equity in the representation of these actors.

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5.4 OT 1.2 All vessel transmitting AIS signals

In MR1 this OT was defined as a "commitment to transmit VMS/AIS signals". This was rephrased to "all vessels transmitting AIS signals" in MR2. This was due to the lack of access to VMS data from the fisheries in this area.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Contribute to improved fishing and conservation through monitoring, control, and surveillance mechanisms	Develop a big-data analysis of AIS and VIIRS-DNB

OT 1.2 was obligatory and aimed to improve fishing and conservation through monitoring, control, and surveillance mechanisms by developing a big-data analysis of AIS and VIIRS-DNB.

Progress:

Increased monitoring in the ASW was achieved through a big-data analysis done by FarFish partner CSIC (Ruiz et al., 2019). Two independent sources of information (AIS and VIIRS-DNB) were combined to measure the degree of consistency of remote sensing. Global Fishing Watch (GFW) compiles and processes AIS information recorded by satellites and then makes it publicly accessible through a user-friendly platform or gives direct access to the raw data for research purposes. VIIRS-DNB (visible infrared imaging radiometer suite day/night band) signals presented in this work were based on the database and the tools provided by Google Earth Engine (GEE).

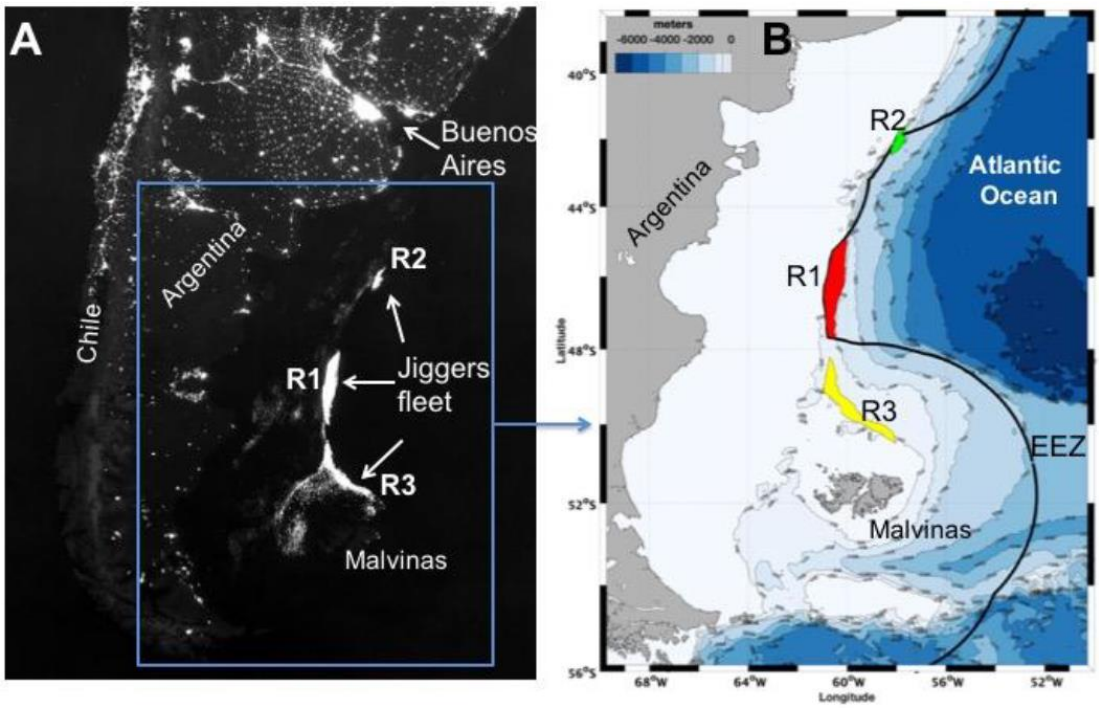

Figure 5. (A) Visible infrared imaging radiometer suite day/night band (VIIRS-DNB) radiance image. (B) Map showing ASW bathymetry. R1, R2, and R3 are the regions of interest. The black line shows the EZZ of Argentina. Source: Ruiz et al. (2019)

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AIS-data and VIIRS-DNB signals were compared for the jigger fleet in FAO area 41 during the maximum feasible period (2012–2018). Both signals showed a high degree of consistency at all temporal and spatial scales analysed, including seasonal cycles, lack of signal for some years, and inter-annual tendencies. This indicated that both signals were a fair representation of the fishing effort exerted by the jigger fleet in this area. This demonstrates the value of remote sensing (especially when independent sources of information are combined) to add transparency and support compliance with fishing activities on the high seas.

Results:

The result showed a high level of consistency between AIS-GFW and VIIRS-DNB signals at different spatial and temporal scales for the jigger fleet at FAO area 41. No traces of a significant manipulation were detected in the data. The results add to the evidence supporting the value of remote sensing, particularly when independent sources of information (such as VIIRS-DNB and AIS) are combined as a relevant tool to add transparency and support compliance of fishing activities in vast and distant regions of the ocean. The study demonstrated that remote sensing adds transparency to fishing operations on the high seas where enforcement is challenging.

5.4.1 Level of OT 1.2 achievement

Indicator 5 related to OT 1.2 was to verify operator compliance to submit AIS signals. The indicator category for this OT is B, where the level of OT achievement is high, moderate, fair, low, or not present. Since there was no information available on big-data analysis before this analysis, the indicator baseline is not present for this OT.

Indicator		Indicator category	Indicator baseline	Indicator achievement	Responsible entity
I_5_CS1	Verify operator compliance	B	Not present	High level	CSIC

There was a significant correlation between AIS-GFW and VIIRS-DNB, and the level of indicator achievement for this OT was considered to be at a high level (Ruiz et al., 2019).

This indicator was rephrased from “operator compliance” in MR1 to “verify operator compliance” in MR2.

5.4.2 Main risk for achieving OT 1.2

Since the level of indicator achievement was considered to be at a high level, there was no risk for achieving OT 1.2. The result demonstrated that remote sensing adds transparency to fishing operations on the high seas where enforcement is challenging, and that remote sensing can improve fishing and conservation through MCS mechanisms. Since there is no governing body in the ASW high seas, the risk is that no one will take responsibility for implementing this big-data analysis to improve MCS in the long term.

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5.5 OT 1.3: Theoretical frame for a specific control and inspection programme in FAO area 41 as a basis for a future pilot project on a joint deployment plan for this region

In MR1, this aim of this OT was defined as to "set a pilot project on operational coordination through the development of a specific control and inspection programme" but rephrased to a "theoretical frame for a specific control and inspection programme in FAO area 41 as a basis for a future pilot project on a joint deployment plan for this region". The degree of OT requirement was changed from obligatory in MR1 to recommended in MR2, as there is no authority responsible for the implementation of this OT.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Contribute to improved fishing and conservation through regional cooperation with monitoring, control, and surveillance mechanisms.	Develop a proposal of a pilot project on a joint deployment plan for MCS in ASW.

OT 1.3 was recommended and aimed to improve fishing and conservation through monitoring, control, and surveillance mechanisms by developing a pilot project proposal on a joint deployment plan which promotes regional cooperation between concerned flag and coastal states.

Progress:

At the international workshop on the sustainability of the high seas (ASW FAO area 41) held in Madrid in September 2019[21], the participants agreed that progress should be made in monitoring, control, and surveillance (MCS) in the area.

Some of the areas identified to explore further include:

- Advances in analysis and research are hampered by data confidentiality and sensitivity of some fisheries data (e.g. who will be the data holder?).
- Willingness to cooperate with all international operators in the area (e.g. EU, Argentina, Brazil, China, Korea, etc.). A regional conference might be the first step in this direction.
- A potential pilot project on regional control scheme in the area would first require a clear set of rules and principles (e.g. closed areas as VMEs, zonal management, and other technical measures).

[21] https://www.farfish.eu/bringing-fisheries-sustainability-into-the-high-seasthe-case-of-the-atlantic-south-west-fao41/chrome-extension://oemmndcbldboiebfnladdacbdfmadadm/https://www.farfish.eu/wp-content/uploads/2021/04/FarFish_Summary-High-Seas-FAO-41.pdf

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- Once the general principles are agreed upon, the EFCA could play a role in assisting in developing a risk-based assessment methodology under the European Commission´s explicit request.
- There was a proposal to consider involving the Control and IUU units from DG MARE in the project and the officials dealing with the MoU EU-China on Blue Partnership Initiative for further MCS in the area (control of transhipments included).

When OT 1.3 was presented to the stakeholders at the workshop in Madrid, those present (including fishing operators from Spain, Brazil and Argentina) agreed on the possibility of exploring the drafting of a theoretical frame for a specific control and inspection programme (SCIP) in FAO area 41. This SCIP would serve as a basis for a future pilot project on a joint deployment plan for this region. This would be largely inspired, although not directly related to or bound by, the methodology and structure of the SCIPs developed by the European Fisheries Control Agency (EFCA), which is also a member of the FarFish Reference Group.

It must be recalled that the EFCA coordinates control activities in EU and international waters and on ports. This is conducted through the joint deployment plans, the vehicle through which the EFCA organises the deployment of human and material resources of control and inspection pooled by the member states and EFCA. EFCA coordinates the deployment of pooled national means in cooperation with member states, including chartering of patrol vessels, the embarkment of EU and MS fisheries inspectors on vessels, and the presence of national coordinators at EFCA premises for operational coordination and dedicated training.

In international waters, the European Commission has entrusted the EFCA with the implementation, through a joint deployment plan (JDP), of the international obligations of the EU, subject to the existence of international control schemes adopted by the respective RFMO.

The OT is an attempt to benefit from this pool of expertise and knowledge by EFCA and the relevant stakeholders to develop a concept paper that can focus on the ASW fisheries in FAO area 41. The aim was to set a theoretical framework which can be agreed by FarFish and presented in international forums to allow those flag and coastal states interested in the ASW fisheries to discuss the possibility of making an operational plan through a coordinated SCIP beyond the life of the project.

If successful, this would be ground-breaking work as it would likely become the first case of a joint control plan for a high seas fishing area not regulated by an RFMO. It would then be up to the competent authorities to designate a control and enforcement authority entrusted with coordinating inspection forces, with, for example, a similar role as the EFCA has for EU vessels in RFMOs.

The structure of the concept paper would be similar to those of EFCA JDPs and would consist of three phases: planning, implementation, and assessment. This concept paper has been drafted (Appendix 2) and will be presented for EFCA for input and validation at the end of November 2021

5.5.1 Level of OT 1.3 achievement

The indicators related to OT 1.3 were “proposal for a pilot project developed" and “pilot project launched”. The category for both indicators is C (binomial), where the outcomes are yes or no, true or false, success or failure.

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Indicator		Indicator category	Indicator baseline	Indicator achievement
I_6_CS1	Proposal for a pilot project developed	C	Yes	Will be ready by November 2021
I_7_CS1	Pilot project launched	C	No	Indicator not ready to be evaluated

The development indicator 6 was an academic and theoretical exercise. This indicator would define if a pilot project proposal was available, whereas indicator 7 requested that the pilot project itself has been launched. This would rely on political will from competent authorities in the area.

Indicator 7 was not achieved in the FarFish project given the geostrategic disputes over an area subject to political challenges in the field of international fisheries and ocean governance, in particular due to the unresolved controversy over Falkland-Malvinas FPZ between Argentina and the UK.

5.5.2 Main risk for achieving OT 1.3

The concept paper ready and would be submitted to the relevant experts/control authorities in the EFCA for their revision and potential validation.

For indicator 6, the LDAC will produce a first draft based on academic and background information (grey literature) available at EFCA and EC.

For indicator 7, any future development beyond the lifetime of the project would require peer-review validation and a check-up on the methodology and feasibility of this regional control programme by the relevant control authorities and experts. Therefore, the outcome will heavily rely on the commitment and involvement of these bodies.

Lastly, additional risks and uncertainties that jeopardised the process include the evolution of the Covid-19 pandemic and associated travel restrictions. This impaired getting direct feedback from authorities and concerned stakeholders from different overseas nations.

6 Potential actions supplemental to the MR

Apart from the OTs identified for the EU fleet operating in the ASW, a number of potential tasks[22] have been identified that could strongly support the case study objectives identified in the MP0. These potential tasks were not included in the list of OTs as they cannot be solely operationalised by the operators and require input or action from other relevant parties, such as authorities, scientific institutions, and other international fleets. They include:

- Compilation of existing biological and environmental knowledge on the main commercial stocks being targeted in the fishery. This information exists to some degree at different scientific institutions, mainly on the two hake species as well as the main targeted cephalopods.

[22] "Action points" were reworded to "potential tasks" in MR2 to clarify that these are not obligatory.

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- Development and testing of self-sampling protocol for fleets targeting the two hake stocks (*Merluccius australis* and *Merluccius hubbsi*). This should be done to facilitate discrimination of the two hake species in catch. Although *M. hubbsi* largely dominates catches, due to an initially more northwards distribution of *M. australis* it is important to separate between the two species, as environmental changes might facilitate increasing overlapping distribution of the stocks. (*Authority comment: It was recognised that this cannot realistically be addressed further within the FarFish project, and the EU fleet cannot be made solely responsible for such an initiative. However, this is an important issue that could be taken up voluntarily by forward-thinking operators and/or research institutions.*)
- Development of user-friendly, digital maps (VMS/AIS-based) with the intention of: a) demonstrating the EU fleet's good level of compliance in reporting of activities and avoidance of identified VMEs – thus compelling other international fleets to do the same; b) mapping fishing activities of other distant water fleets operating in identified VMEs; and c) visualising the frequency of VMS/AIS gaps. This could facilitate improved compliance with the VMEs following UNGA 61/105 and FAO Guidelines for Management of Deep-Sea Waters in the high seas, as well as Council Regulation No 734/2008.

7 Conclusion

The main goal of the MR2 for the ASW is to improve the sustainability of high seas mixed fisheries, by a) contributing to a level playing field for international fleets involved in the fisheries, and b) contributing to improved fishing and conservation through monitoring, control, and surveillance. Due to the lack of an RFMO in the ASW area, operators cannot be made solely responsible for achieving the OTs. It must therefore be a joint effort between the various authorities and operators to make progress in this MR.

The goal for the MR2 is long-term and will not be achieved during the lifetime of the FarFish project. But arranging an international conference with a scientific approach and developing a pilot on a joint deployment plan are steps in the right direction to improve the sustainability in the ASW high seas in the future.

8 Auditor

FarFish partner Sjókovin conducted two audits following the the RBM process, The first audit on documentation system conformance and the second audit on performance effectiveness and compliance. The final audit of this MR will not be conducted.

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 727891.
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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 727891.
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Appendix

Appendix 1.
Draft agenda for South West Atlantic International Conference. Updated Jan. 15. 2021

Areas Beyond National Jurisdiction

South West Atlantic International Conference

March 4th, 2021

CHALLENGES IN THE DESIGN AND IMPLEMENTATION OF A SUSTAINABLE FISHERIES MANAGEMENT FOR THE SOUTH WEST ATLANTIC: A SCIENTIFIC-BASED APPROACH

AGENDA

11.00 Housekeeping rules: aim of the meeting – **Rosa Chapela, CETMAR**

11.10 Welcome and opening – **Javier Ruiz, Managing Director IEO**

Session I. Exploring scientific collaboration to advance in fisheries assessment

11.20 Response of habitat patterns of Argentine shortfin squid (Illex argentinus) to Antarctic sea ice changes – **Wei Yu, Shanghai Ocean University**. *Questions & Answers (Q&A)*

11.40 Fishery and biological data from scientific observers aboard commercial vessels – **Mikel Casas/ José Luis del Río, IEO**. *Q&A*

12.00– Scientific knowledge and advice for conservation and sustainable management within the Falkland Islands fisheries. – **Alexander Arkhipkin, Falkland Islands Fisheries Department**. *Q&A*

12.20 Round table with panelist – **IEO** (Moderator)

12.35 Coffee-break

Session II. Best practices on management and control: Recourses and proposals

12.50 Update on FAO ABNJ Deep Sea Project – **William Emerson, FAO**. *Q&A*

13.10 Interactions between fishing activities and Vulnerable Marine Ecosystems: Lessons learnt on seabed mapping from ATLANTIS projects – **José Luis del Río, IEO**. *Q&A*

13.30 The value of remote sensing as a relevant tool to support compliance on fishing activities – **Tony Long, Global Fishing Watch**. *Q&A*

13.50 The role of Administration as a facilitator of scientific cooperation processes **Antonio Lizcano, Sub-Directorate General for Regional Fisheries Agreements and Organizations, MAPA**. *Q&A*

14.00 Round table with panelist –**Javier Garat, CEPESCA [TBC]** (Moderator). *Q&A*

14.15 Coffee-break

Session III. Diagnosis of upcoming priorities by stakeholders: next steps

14.20 Summary report of recommendations, insights and needs detected: Action plan for next steps – **Alexandre Rodriguez, LDAC**

14.40 Validation and feedback from operators, policy makers and stakeholders: Open debate amongst panelists and participants – **Javier Touza, ARVI [TBC] (Moderator)**

15.00 Closing

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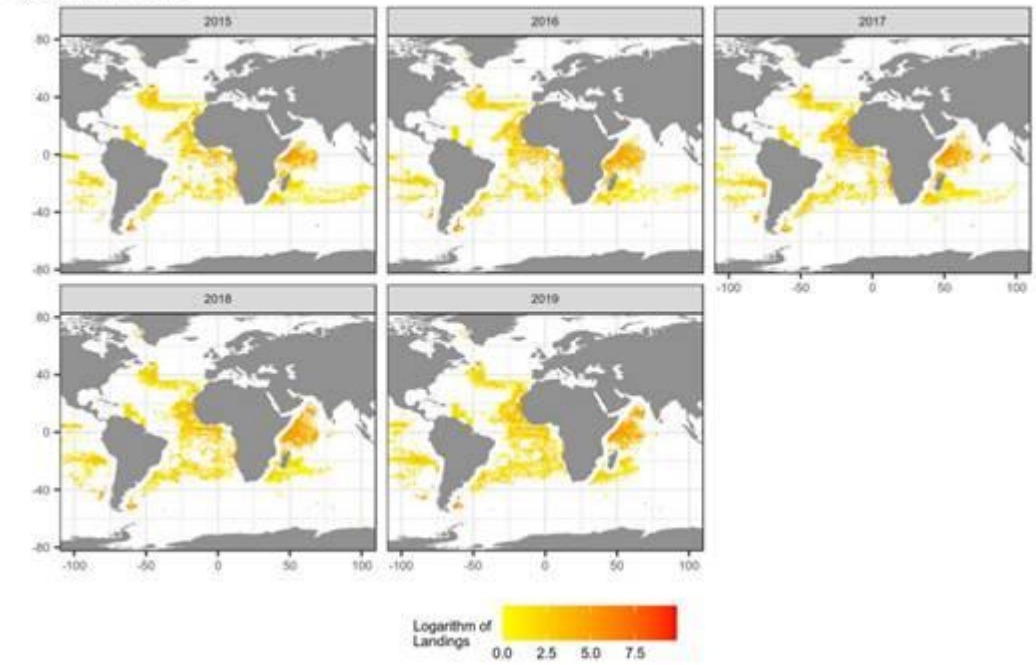
Organizers

Data available in STEFC AER 2020, https://stecf.jrc.ec.europa.eu/reports/economic/-/asset_publisher/d7Ie/document/id/2788167

f) Distant waters



f) Distant Waters

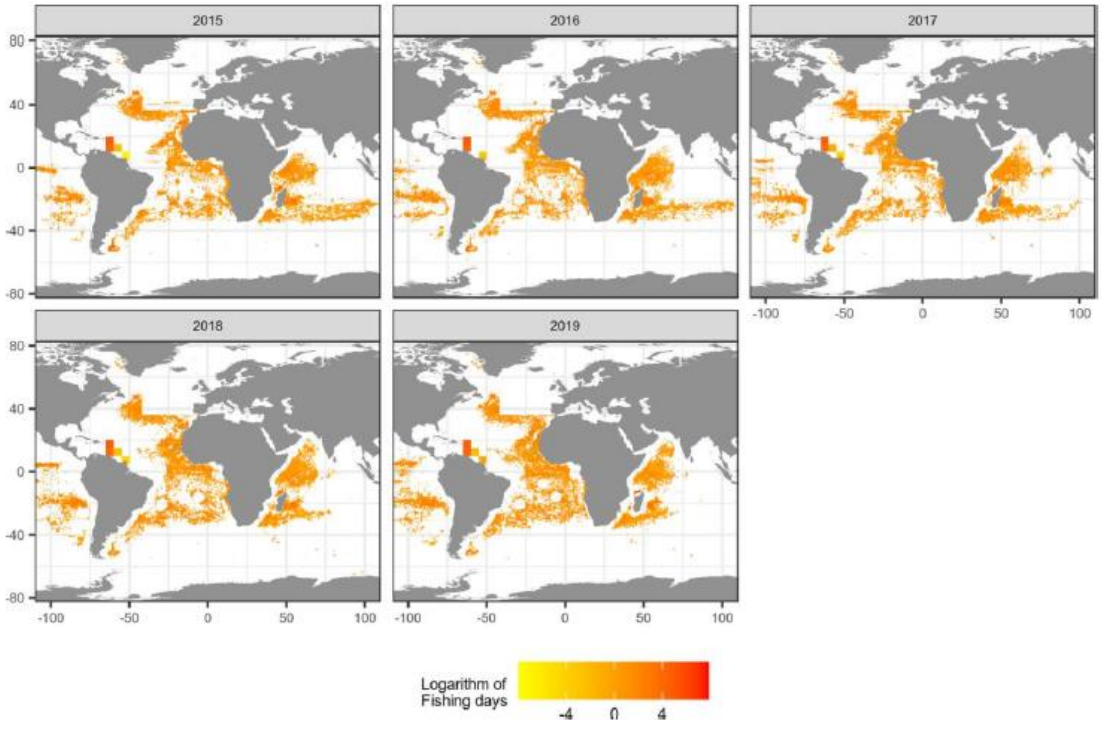


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Table 2-6 Main results for the EU-28 Distant-water fleets for 2008-2018 and nowcasts for 2019

EU28 DWF		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	%Δ 2018-2017	%Δ 2018-avg2008-17	%Δ 2018-2008
Number of vessels	number	385	353	370	347	328	287	287	278	266	255	250	*260*	-2.0%	-20.8%	-35.1%
Total vessel tonnage	thousand GT	282.4	288.7	281.7	271.2	274.3	249.6	286.0	279.5	259.7	256.8	247.0	*247.8*	-3.8%	-9.5%	-12.5%
Total vessel power	thousand kW	409.8	404.0	388.4	369.6	372.8	337.6	377.4	371.9	352.2	345.7	338.9	*346.6*	-2.0%	-9.1%	-17.3%
Engaged crew	thousand	6.9	7.3	8.7	7.1	6.0	5.8	6.4	6.2	5.6	6.2	6.2	*6.4*	-0.9%	-6.7%	-10.4%
FTE national	thousand	8.2	8.8	9.7	8.2	7.2	6.4	7.2	7.5	7.1	7.3	7.4	*7.6*	1.1%	-4.9%	-10.3%
Days at sea	thousand	97	92	92	90	81	72	71	73	72	73	69	*62*	-5.4%	-15.0%	-28.4%
Fishing days	thousand	75	72	78	77	70	63	63	62	61	62	55	*48*	-12.1%	-19.8%	-27.4%
Energy consumption	million litre	269	373	385	354	362	374	393	474	372	372	370	*385*	-0.5%	-0.7%	37.8%
Live weight of landings	thousand tonnes	598	651	648	688	631	694	779	693	728	723	716	*744*	-1.0%	4.7%	19.8%
Value of landings	million EUR	926	908	922	1,033	1,162	1,239	1,358	1,007	1,245	1,177	996	*1,393*	-15.4%	-9.3%	7.6%
Gross value of landings	million EUR	626	786	928	1,049	1,045	1,074	1,194	1,043	1,049	1,092	1,023	*1,381*	-6.3%	3.5%	63.4%
Other income	million EUR	0	5	14	27	1	7	16	15	11	11	5	*5*	-58.5%	-56.8%	
Operating subsidies	million EUR	14.6	7.0	14.7	12.0	13.3	6.4	5.7	3.6	0.9	1.8	1.5		-18.7%	-81.4%	-89.9%
Income from leasing out quota	million EUR	-	-	-	-	0.0	0.9	0.7	0.8	0.4	0.6	0.7		1.8%	92.4%	
Personnel costs	million EUR	114	170	199	199	184	185	180	197	193	228	223	*235*	-2.0%	20.7%	96.0%
Value of unpaid labour	million EUR	0.8	1.8	0.5	1.5	1.4	0.7	0.4	0.2	0.6	0.0	2.3	*2.3*		191.4%	178.6%
Energy costs	million EUR	180	184	212	234	236	234	224	200	134	143	163	*172*	13.3%	-17.9%	-9.5%
Repair & maintenance costs	million EUR	51	76	75	87	89	89	93	92	97	91	114	*118*	25.4%	35.5%	124.6%
Other variable costs	million EUR	168	239	257	261	231	236	274	322	314	278	257	*269*	-7.6%	-0.4%	53.4%
Other non-variable costs	million EUR	52	87	82	82	95	84	97	113	97	103	107	*112*	3.7%	20.2%	105.9%
Consumption of fixed capital	million EUR	73	77	67	55	53	54	47	75	59	72	74	*77*	2.3%	16.4%	0.4%
Lease/rental payments for quota	million EUR	0.8	0.6	2.4	3.4	1.4	0.8	1.0	3.7	3.1	3.8	2.3		-37.9%	11.4%	190.7%
Opportunity cost of capital	million EUR	2.4	27.2	12.8	10.3	10.8	9.8	10.8	9.4	4.4	- 3.9	- 4.8	- *4.4*	-21.9%	-150.9%	-300.9%
Value of physical capital	million EUR	616	605	542	509	486	414	487	535	539	496	495	*512*	-0.3%	-5.4%	-19.7%
Value of quota and other fishing rights	million EUR	-	-	11	-	-	9	19	10	10	60	53		-11.7%	347.9%	
Investments	million EUR	27	13	49	31	8	13	21	37	27	30	41	*45*	37.4%	59.4%	50.7%
Gross Value Added	million EUR	167	199	316	413	395	437	522	331	417	487	387	*715*	-20.6%	5.0%	131.6%
Net Value Added	million EUR	91	95	236	347	331	374	464	246	353	419	318	*643*	-24.1%	7.5%	248.5%
Gross profit	million EUR	52	27	116	212	210	251	341	134	223	259	161	*477*	-37.8%	-11.8%	208.6%
Net profit	million EUR	- 21	- 41	32	128	116	165	278	55	137	156	60	*375*	-61.6%	-40.4%	379.2%
GVA to revenue	%	27.1	25.3	33.5	38.4	37.8	40.5	43.1	31.3	39.3	44.2	37.6	*51.6*	-14.8%	4.4%	39.1%
Gross profit margin	%	8.5	3.5	12.3	19.7	20.1	23.3	28.2	12.6	21.0	23.5	15.7	*34.4*	-33.2%	-9.2%	85.3%
Net profit margin	%	-3.5	-5.9	3.8	13.5	13.0	17.5	26.0	5.9	15.1	16.6	7.2	*31.5*	-56.6%	-29.4%	306.9%
Average wage per FTE	thousand EUR	14.4	20.0	21.2	25.3	26.5	29.7	25.4	26.7	28.1	31.9	30.7	*31.2*	-3.7%	23.2%	113.3%
GVA per FTE (labour productivity)	thousand EUR	20.9	23.2	33.5	52.0	56.6	69.9	73.6	44.8	60.4	68.1	52.6	*93.9*	-22.7%	4.6%	151.3%

Data source: MS data submissions under the 2020 Fleet Economic data call (MARE/A3/ACS(2020)); All monetary values adjusted for inflation; constant prices (2015). Nowcast values for 2019

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Appendix 2

APPENDIX TO D4.4 CS1 ASW FARFISH

Theoretical framework to develop a pilot project proposal on a joint deployment plan, which promotes regional cooperation between concerned flag, coastal, market and port states in the Atlantic South West (FAO 41)

Author: Alexandre Rodríguez (LDAC)

Date: 23 November 2021

PHASE 1 - POLITICAL AGREEMENT ON A SPECIFIC CONTROL AND INSPECTION PROGRAMME FOR THE SOUTH WEST ATLANTIC (SCIP)

Two thirds of the South West Atlantic (ASW) are areas outside National Jurisdiction, also called high seas areas or international waters. FAO area 41 covers large parts of the high seas, as well as EEZs of the Brazil, Argentina, Uruguay and the Falkland Islands/Islas Malvinas. ASW falls under the convention area of ICCAT and Commission for the Conservation of Southern Bluefin Tuna (CCSBT). However, there is no RFMO for regulating two of the most important fisheries in terms of volume of catch and landings and commercial value: hake and squid.

The main goal of this paper is to improve the sustainability of high seas mixed fisheries by contributing to: a) a level playing field for international fleets involved in the fisheries; and b) improved fishing and conservation through monitoring, control, and surveillance. Due to the lack of an international organisation (RFMO or similar arrangement) to regulate conservation, management and control for hake and squid fisheries in FAO41, there is an objective need first to reach an international agreement between relevant authorities with stakes in the area (i.e. flag, coastal and port states).

In view of the above, political multilateral commitment is key for setting a regional control plan in the area subject to pre-agreed criteria, common rules and procedures, and pooled resources. This should be done in a joint effort with operators to develop a culture of compliance with adequate measures in place (e.g. VMS, ERS, regional and flag state inspection programmes with observers at sea and at port).

This medium/long term goal largely depends on political and diplomatic relations so it cannot be achieved during the lifetime of the FarFish project. However, the steps made to date, i.e. arranging an international conference for looking at present challenges in MCS and developing the idea of a regional joint deployment plan might contribute to improve sustainability and governance in the ASW high seas in the future.

A pre-identification of the main actors and stakeholders has been done during the lifetime of the project, namely: International organisations with competencies in the high seas: FAO (UN Fisheries and Agriculture Organisation), EU DG MARE (European Commission); Fisheries administrations: SAP (Secretariat of Aquaculture and Fisheries, Brazil), SGP MAPA (General Secretariat of Fisheries in Spain), Falkland fisheries department, and CAFS (Chinese Academy of Fisheries Sciences); Control authorities from MS and EFCA (European Fisheries Control Agency); Operators and PO organisations with direct

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stake at ASW fisheries: ANAMER (Spain), CEPESCA (Spain), OPRAS (Argentina) or CONEPE (Brazil); scientific Institutes and universities (IEO-CSIC Spain, INIDEP Argentina, CEAB, Shanghai Ocean University); and technological and R&D private companies (Bioconsult SH GMBH, Global Fishing Watch)

PHASE 2 – DESIGN AND DEVELOPMENT OF A JOINT DEPLOYMENT PLAN (JDPs)

The structure of the concept paper would be similar to those of EFCA JDPs and would consist of three phases: planning, implementation, and assessment.

PHASE 2.1 - PLANNING

This phase would cover the selected fisheries with a permanent exchange of information, and intelligence and control activities planned based on risk assessment results. Member States' control authorities would then assess the risks regarding the stocks and areas in accordance with the regional risk assessment (RRA) methodology established in cooperation with the coordinating regional authority (similarly to EFCA within the EU).

It aims for cost-efficient planning of future inspection activities and is used at three levels during the life cycle of JDPs:

1. Strategic planning — to facilitate long-term (annual) spatial and temporal planning for deployment of control resources and identify JDP campaigns' specific objectives and actions (e.g. reduce IUU fishing, misreporting, observance of VMEs, etc.)
2. Priority risk management — to identify priority fisheries and fleet segments under a specific threat analysis.
3. Work at an operational level — to facilitate the exchange of best practices and targets between different flag and coastal States on a short-term tactical level.

PHASE 2.2 – IMPLEMENTATION

The JDP's establish that the deployment of pooled national means is coordinated by a specialised agency at the regional level (e.g., for the EU, it would be EFCA) in cooperation with the Member State. It is implemented through two common groups:

a. A Regional Steering Group (RSG) is composed of regional and national representatives from authorities responsible for ensuring the proper implementation of the plan.

b. A Technical Joint Deployment Group (TJDG) composed of regional and national control staff in charge of the daily follow-up of the control activities, and adopts the decision needed to guarantee an effective deployment of the means.

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PHASE 2.3 - ASSESSMENT

The regional control agency (e.g., EFCA) assesses the effectiveness of the JDPs based on performance indicators and benchmarks in a common evaluation in cooperation with the concerned flag, coastal, port and market States, including the common reporting of joint control activities at a regional level.

The JDP annual assessment reports will be submitted to the decision-makers (e.g., for the EU it would be the European Parliament, the European Commission, and the EU Member States).

Different elements to improve the control and inspection at a regional level will be considered for discussion and implementation through this concept note. The Steering Group would serve as a forum for discussion and exchange of best practices at a regional level. It would be tasked with implementing at a regional level of projects concerning regional risk analysis, best practices for coordination and the optimum use of information tools and assessing the cost-effectiveness of control operations.

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CASE STUDY 2

SOUTH EAST ATLANTIC

Deliverable No. 4.4

Project acronym:
FarFish

Project title:
Results-Based Management and Capacity Building for EU Sustainable Fisheries Partnership Agreement and International Waters

Grant agreement No: **727891**
Project co-funded by the European Commission within the Horizon2020 Research and Innovation Programme

Start date of project: **1st June 2017**
Duration: **54 months**

Due date of deliverable:	30/11/2020
Submission date:	30/11/2021
File Name:	FarFish D4.4_MR2 Southeast Atlantic
Revision number:	02
Document status:	Final
Dissemination Level:	PU[1]

Role	Name	Organization	Date	File suffix[2]
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[1] PU: Public, PP: Restricted to other programme participants (including the Commission Services), RE: Restricted to a group specified by the consortium (including the Commission Services), CO: Confidential, only for members of the consortium (including the Commission Services)
[2] The initials of the revising individual in capital letters

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Deliverable D4.4

Management Recommendation 2
South East Atlantic

30/11/2021

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Summary

This document serves as an update to the second and final proposal for a management recommendation (MR2) for the international mixed fisheries in the South East Atlantic (FAO Area 47). The aim of this document is to respond to the second audit report (FarFish, D5.4). Due to the low fishing activity in the area over recent years, MR2 is just a minor revision of MR1. The South East Atlantic Fisheries Organization (SEAFO) manages the fisheries in this area. MR2 follows the "General Guidelines for making MRs" (FarFish, D3.5) and is based on the "Second MR Invitation" (FarFish, D3.6), where outcome targets (OTs) were proposed. The identified OTs are based on input from stakeholders and authorities who identified challenges and management objectives in "MR zero" (FarFish, D4.1), "MR-Kick-off meeting" (FarFish, D4.2), "MR1" (FarFish, D4.3), and the "Audit of MR1" (FarFish, D5.1).

FarFish partner MATIS acted as the leading authority whilst considering input from the competent authority in this case study (e.g., SEAFO, DG MARE, and coastal states). Due to the low fishing effort in the area, FarFish partners from NOFIMA, in collaboration with the Institute of Marine Research (IMR), are acted as operators in this case study, assisted by UiT The Arctic University of Norway (FarFish leader of WP4).

The aim of this MR is to serve as a good practice recommendation, focusing on improving monitoring for sustainable fisheries on fisheries managed by SEAFO. The identified OTs are classified to the governance dimension. FarFish acknowledges that the operators or the institutions acting as operators cannot be made solely responsible for achieving the OTs in this CS. Achieving them must therefore be a joint effort between authorities and operators. Indicators are suggested to measure the performance of the OTs, and the strategy for achieving the OTs is outlined.

The OTs for this case study (CS) are as follows:

OT 2.1: Reporting all catches via e-logbooks. **Obligatory. Partly achieved.**

OT 2.2: All vessels transmitting Automatic Identification System (AIS) or Vessel Monitoring System (VMS) signals. **Obligatory. Not achieved.**

OT 2.3: All vessels having onboard observers. **Recommended. Not achieved.**

The OTs identified in the "Second MR invitation" are on a more "theoretical" level, and the MR2 serves as a guideline.

Nevertheless, SEAFO is a well-functioning and active RFMO responsible for ensuring the long-term conservation and sustainable use of the fishery resources (excluding migratory fish stocks) of the high seas of South East Atlantic (ASE) within the Convention Area (CA). SEAFO recognizes the need to cooperate with coastal states and all other states and organizations having a real interest in the fishery resources of the ASE. Therefore, should the fishing activity be resumed, the SEAFO system will work towards the sustainable management of the ASE, hopefully considering this MR2 provided by FarFish.

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Abbreviations

ABNJ	Areas beyond national jurisdiction
AIS	Automatic identification system
ASE	Southeast Atlantic
CA	Convention area
CS	Case study
CSIC	Spanish National Research Council (Spain)
DG MARE	Directorate-General Maritime Affairs and Fisheries (EU)
EC	European Commission
EcoFishMan	Ecosystem-based Responsive Fisheries Management in Europe
EEZ	Exclusive economic zone
ES	Executive Secretariat
FAO	Food and Agriculture Organization of the United Nations
GFW	Global Fishing Watch, NGO
HS	High seas
ICMAN-CSIC	Institute for Marine Sciences of Andalucía (ICMAN)-Spanish National Research Council (CSIC) (Spain)
IMO	International Maritime Organization
IMR	Institute of Marine Research (Norway)
IUU	Illegal, unreported, and unregulated fishing
MATIS	Matis ohf. – Icelandic Food and Biotech R & D Institute (Iceland)
MCS	Monitoring, control, and surveillance
MFMR	Ministry of Fisheries and Marine Resources (Namibia)
MR	Management recommendation
MSY	Maximum sustainable yield
NAFO	North Atlantic Fisheries Organization
NOFIMA	The Norwegian Institute of Food, Fisheries, and Aquaculture Research
OECD	The Organization for Economic Co-operation and Development
OT	Outcome target
RBM	Results-based management
RFMO	Regional fisheries management organizations
SC	Scientific committee
SDG	Sustainable development goal
SEAFO	South East Atlantic Fisheries Organization
SOLAS	Safety of life at sea
TAC	Total allowable catch
UCAM	University of Cadiz (Morocco)
UiT	UiT The Arctic University of Norway (Norway)
UN	United Nations
UNGA	United Nations General Assembly
VME	Vulnerable marine ecosystems
VMS	Vessel monitoring system
WP	Work package

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Concepts/definitions

Indicator	A variable, pointer, or index related to a criterion. Indicators are selected such that their variations reflect variations in key elements of the fishery resource, the social and economic well-being of the sector, and the sustainability of the ecosystem. The position and trend of an indicator in relation to reference points or values indicate the present state and dynamics of the system. Indicators provide a bridge between objectives and actions (source: FAO 1999).
Management goals	The higher-order objective to which a management intervention is intended to contribute (OECD 2011). A management goal is derived from a management principle (constitutional-order) and is specified into a set of more operational management objectives (collective-order).
Management intervention	Strategies or instruments aimed to impact the state of a fishery with reference to authorized objectives. Examples are input and output controls and economic measures.
Management measures	Can be technical (e.g., gear selectivity etc.), input (effort)/output (catch) control, right-based.
Management objectives	Fisheries management objectives are typically framed within the overall concept of sustainable development and may reflect one or more of the various dimensions and criteria that relate to it (FAO 1999). Operators control OTs through setting and implementing management measures.
Management plan	In RBM, the management plan is a formal arrangement between a management authority and operators that specify the partners in the fishery and their respective roles, the agreed objectives for the fishery, the management rules, and the regulations that apply, and it provides other relevant details about the fishery. In RBM, the formal responsibility for developing the management plan is delegated to an operator.
Management recommendation	In RBM, the management recommendation (MR) is a formal arrangement between a management authority and operators that specify the partners in the fishery and their respective roles, the agreed objectives for the fishery, the management rules, and the regulations that apply, and it provides other relevant details about the fishery.
Management strategies	In the FarFish context, this indicates the strategies applied to achieve OTs.
Outcome Targets (OTs)	OTs are a specific and measurable performance goal defined for a fishery based on agreed and appropriately authorized general goals, standards, and principles, as defined by the authorities based on the policy objectives. An OT is a textual or mathematical statement that can be evaluated as “true” or “false”, where “true” is the target value. The OT is the indicator value that the management actions aim to stay above or below (e.g., $F < F_{msy}$).

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1 Introduction

This document updates the second and final proposal for a management recommendation (MR2) from European operators active in the fisheries in the Southeast Atlantic (ASE). This document aims to respond to the second audit report (FarFish, D5.4). Due to the low fishing effort in the area, this MR is rather "theoretical" and aims at serving as a good practice recommendation, focusing on improving monitoring for sustainable fisheries on fisheries managed by SEAFO. Thereby, MR2 has minor changes from MR1, and FarFish put more effort into areas where fishing activities are high.

1.1 FarFish overall objective

The overall objective for FarFish is to improve the knowledge on and the management of EU fisheries outside Europe, while contributing to sustainability and long-term profitability. The role and responsibilities of the EU fleet are significant in ensuring the sustainable utilization of the resources to which they are allowed access, whether that is under the Exclusive Economic Zone (EEZ) of third countries with SFPAs or in international waters, also known as the high seas.

The concept of sustainability is about meeting the needs of the present without compromising the ability of future generations to meet their own. More simply, it is about managing people, the planet, and profit. The fleet should therefore cooperate with Regional Fisheries Management Organizations (RFMOs) and national authorities in partnership countries to improve knowledge and make management more effective. The EU has agreed on strengthening capacity in their SFPA countries to ensure the efficient management of fisheries. This will ultimately lead to sustainable utilization and increasing the long-term profitability of all stakeholders.

The FAO report "The State of World Fisheries and Aquaculture 2020"[3] states that there is no alternative to sustainability; the world needs programmes to further improve fisheries to allow humans to continually fish in oceans for edible seafood, and the only path to sustainability is the effective management of world fisheries. This obligates the EU national authorities and fishing industries.

1.2 South East Atlantic – FAO area 47

Angola, Namibia, and South Africa are the three countries bordering the South East Atlantic Region (FAO area 47) along the African coast, in addition to the United Kingdom, on behalf of St. Helena and its dependencies of Tristan da Cunha and Ascension Island. It is important to note that in the ASE, the continental shelf along the coasts does not extend beyond the EEZ of the coastal states, meaning that most of the high seas areas in this case study (CS) are depths over 2,000 meters.

The former Union of Soviet Socialist Republics (USSR) developed a fishery for alfonsino (*Beryx spp*.) in the ASE in the late 1970s. Iceland, Norway, Poland, Russia, and Spain all reported catches of alfonsino during the mid-to-late 1990s. For the last 15 years, the total number of vessels fishing in the SEAFO area ranged between one and five vessels per year.

[3] http://www.fao.org/documents/card/en/c/ca9229en

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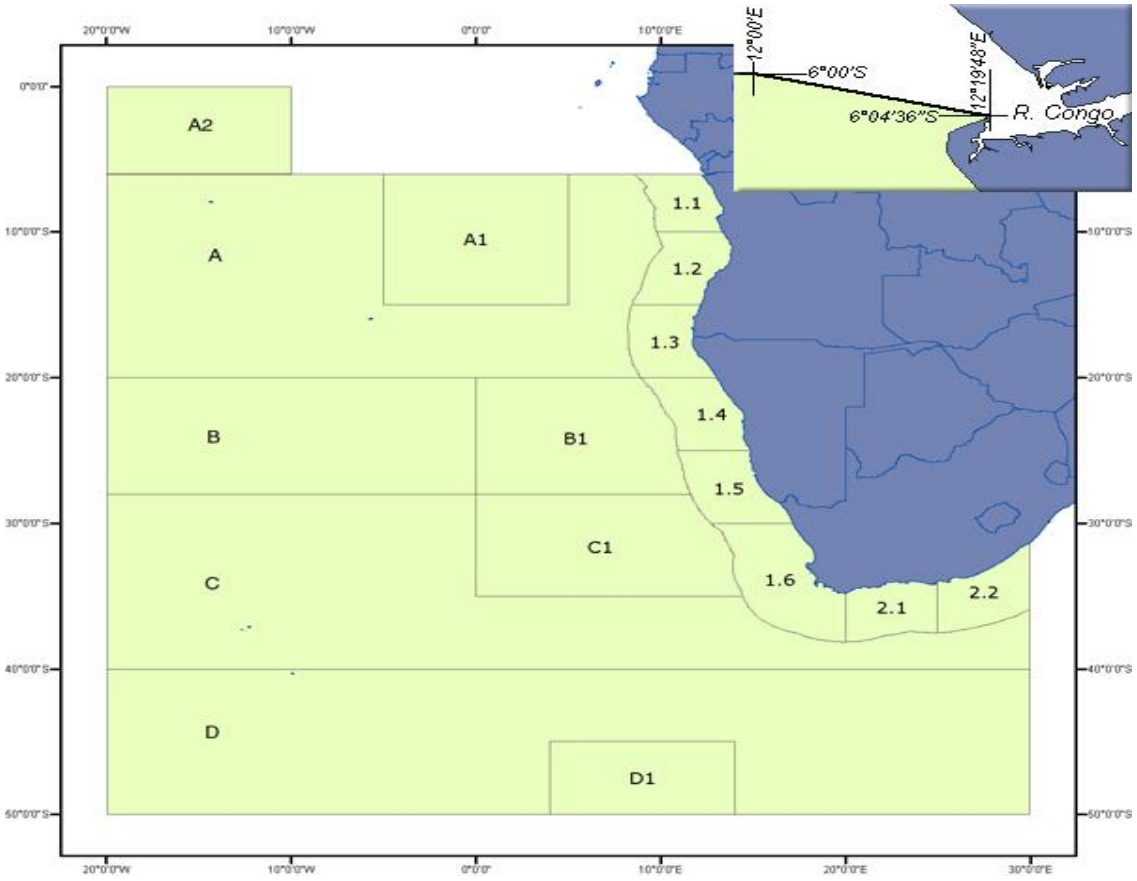
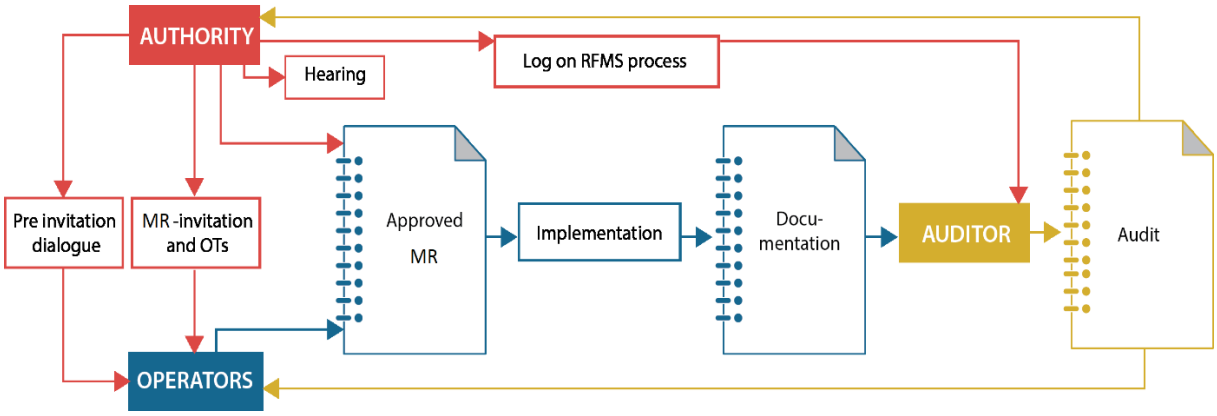


Figure 1. South East Atlantic – FAO area 47 (Source: FAO)

1.3 The process of developing MR2 for the South East Atlantic

The MRs within the FarFish Project are developed in two iterations and build on results-based management (RBM)[4] principles (Nielsen et al., 2017). RBM requires that the relevant authority defines specific and measurable objectives for a fishery but allows resource users (operators) to find ways to achieve these objectives and provide adequate documentation (Figure 2).



[4] The RBM is also referred to as the Responsive Fisheries Management System (RFMS) in the EcoFishMan project and other FarFish documents

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Figure 2: General description of the process of making MR based on RBM in FarFish (FarFish, D3.1). The different colours demonstrate the responsibilities of each of the three entities. Authority: Red / Operators: Blue / Auditors: Yellow.

The "MR1" for ASE (FarFish, D4.3) was made available on 30/09/2019. MR2 is developed following the "General Guidelines for making MRs" (FarFish, D3.5) and is based on the "Second MR Invitation" (FarFish, D3.6), where the updated OTs for the CS were set. The OTs are based on "MR1", advice from the auditor, and input from meetings facilitated by FarFish "Stakeholder interaction" (WP1). The consortium reviewed the OTs at the CS and WP leader meeting in Marrakesh (Morocco, Nov. 2019). After the meeting, a draft of the "Second MR Invitation" was sent for hearing among operators. Based on the response, the authority (MATIS) further adjusted some of the OTs, and the "Second MR Invitation" was made available on 21/01/2020. The External Advisory Group and the experts in the 36-month review meeting in August 2020 also provided valuable input to the MR2 development. Following the RBM approach, the "Audit of MR1" (FarFish, D5.1) was made available on 30/11/2019. The recommendations from the audit and input from "Report on challenges and suggestions for improvements" (FarFish, D5.2) were applied in this MR2. The second audit report, "Report on Management Recommendation 2 Audit" (FarFish, D5.4), was made available on 30/06/2021. The recommendations from the audit report were used to update the second MR.

1.4 Partners involved in MR2 for the South East Atlantic

MATIS (task leaders D3.6) acts as the leading authority within RBM whilst considering input from the relevant authorities (e.g., SEAFO, DG MARE, and coastal states). The RBM approach depends on operators being incentivized to develop MRs for a given fishery. Due to a lack of fishing activity by European flagged vessels in the area in recent years, the incentive is missing from this CS. Since no operators are willing to put in the effort of developing this MR2, this CS will therefore be more theoretical. The UiT The Arctic University of Norway (WP4) will act as operators, with involvement from the task contributors NOFIMA, IMR, and UCAM. The audit will be conducted by WP5 leader Sjókovin, who will provide the audit of the MR2 once approved by both operators and authorities.

Table 1: **Work packages and partners involved in the South East Atlantic (FAO area 47)**

South East Atlantic – FAO area 47			
Partners involved	AUTHORITY	WP3	MATIS, SEAFO, and DG MARE (EU)
	OPERATORS	WP4	NOFIMA, UiT, IMR, and UCAM
	AUDITOR	WP5	Sjókovin

1.5 Southeast Atlantic objectives

In short, the objectives of MR2 for the ASE high seas area (SEAFO area) are as follows:

1) Improve data quality and quantity.
2) Advance biological knowledge in the SEAFO area.
3) Contribute to better monitoring in the area by supporting enforcement through the utilization of the latest available satellite systems and tools.

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2 Southeast Atlantic Fisheries Organization (SEAFO)

The Southeast Atlantic Fisheries Organization (SEAFO) is an intergovernmental regional fisheries management organization (RFMO) established in 2003. SEAFO is responsible for ensuring the long-term conservation and sustainable use of fishery resources (excluding migratory fish stocks) and for safeguarding the environment and marine ecosystem in which the resources occur in the CA (Figure 3). The CA is a large area of about 16 million km^2. It is mainly deep-sea (> 2000 m), but it also has several seamount chains, isolated seamounts, guyots[5], and banks.

SEAFO comprises the Commission, the Scientific Committee, the Compliance Committee, and the Standing Committee on administration and finance as subsidiary bodies and the Secretariat. The Commission may establish other subsidiary bodies from time to time to assist in meeting the objective of the Convention. The Commission has oversight responsibility of the organization and has met annually since 2004, and the Scientific Committee has met annually since 2005.

Contracting parties are Angola, the European Union, Japan, Namibia, Norway, South Africa, and South Korea. It is the responsibility of each SEAFO contracting party to ensure that regulations are being adhered to by vessels of their flag.

The limited fishing activity that is conducted in SEAFO occurs on or around seamounts. Currently, vessels have mainly concentrated fishing operations in four distinct areas: Valdivia Bank Seamounts Complex, Meteor, and Discovery Seamounts (Figure 3).

[5] Also named Tablemount, this is an isolated seamount with a flat top of more than 200 m.

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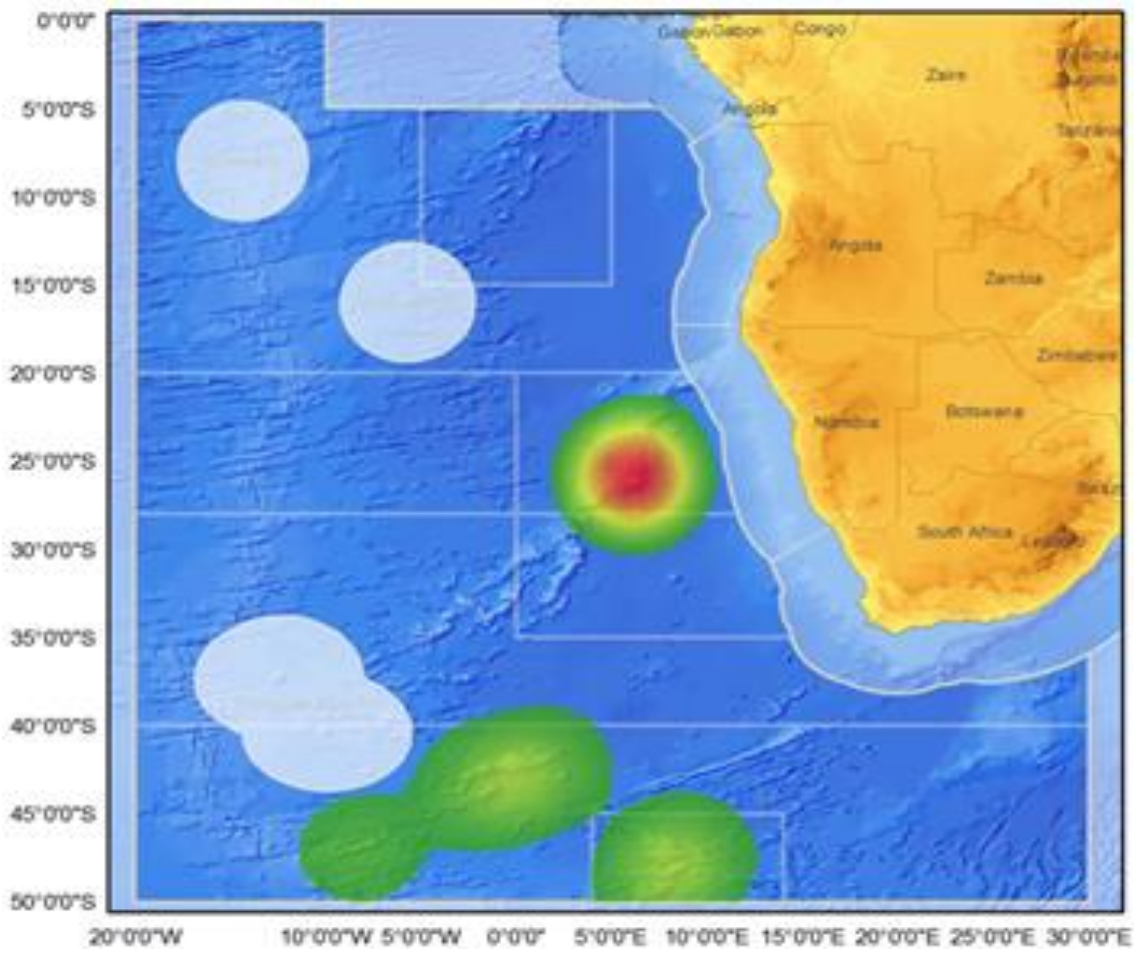

Figure 3: SEAFO area boundary and composite map of existing fishing areas.
Source: www.seafo.org

2.1 SEAFO management of the ASE high seas

Monitoring, Control, and Surveillance System

To monitor, control, and survey (MCS) the fisheries, vessels entering the SEAFO area are required to report Vessel Monitoring System (VMS) positions on a two-hourly interval. VMS is a satellite-based monitoring system that at regular intervals provides data to the fishery authorities on the location, course, and speed of vessels. In addition, the vessels must report catches on a five-day interval to the Secretariat. The Executive Secretary shall close the fisheries when the total allowable catches are deemed to be exhausted.

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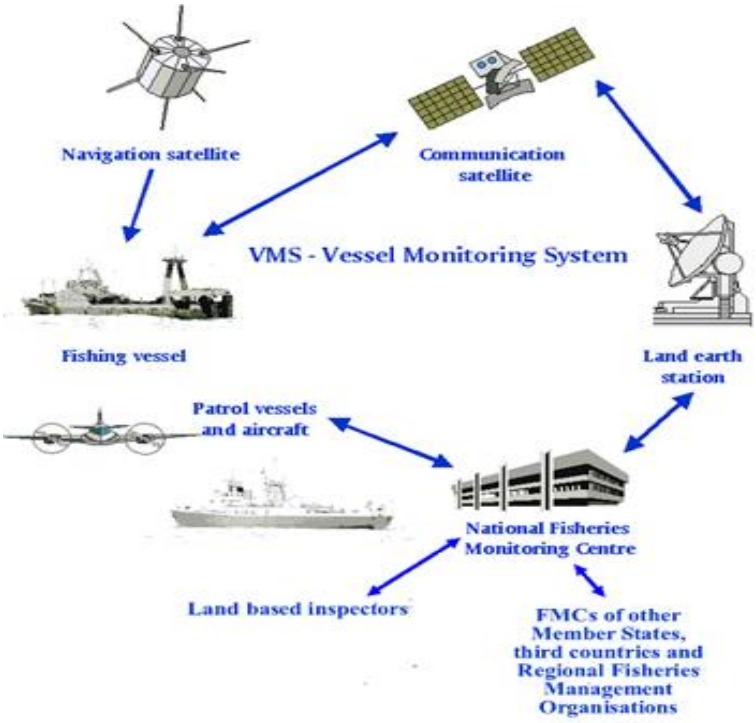

Figure 4: A graphic explaining VMS

Illegal, Unregulated, and Unreported Fishing

SEAFO has adopted several measures to combat illegal, unregulated, and unreported (IUU) fishing. It has banned at-sea transhipment in the SEAFO CA, implemented an authorized vessel list, and established an IUU vessel list that incorporates vessels found on the NEAFC, NAFO, and CCAMLR IUU-lists.

Protection of Deep-sea sharks

SEAFO has implemented management measures for the protection of deep-sea sharks by banning sharks as a targeted species. Vessels are expected to report all catches of sharks, have full utilization and retention (not including gut, skin, and head), and not have fins that total more than 5% of the weight of sharks onboard.

Reduce Bycatch

Management measures have been put in place to reduce the incidental bycatching of seabirds in the SEAFO CA and to improve the reporting of the bycatching of sea turtles with the intent of reducing mortality due to fishing operations.

Vulnerable Marine Ecosystems (VME)

In response to UNGA Resolution 61/105[6], SEAFO has made progress in protecting seamounts and vulnerable marine habitats from significant adverse impacts caused by fishing. SEAFO has defined its fishing footprint, closed 11 areas to bottom contact gears, and implemented exploratory and

[6] https://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/61/105&Lang=E

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encounter fishing protocols. Furthermore, new fishing areas (areas outside existing fishing areas) are subject to scientific assessment by the SEAFO Scientific Committee before approval. SEAFO has closed approximately 505,000 km^2 to bottom fishing (Figure 4).

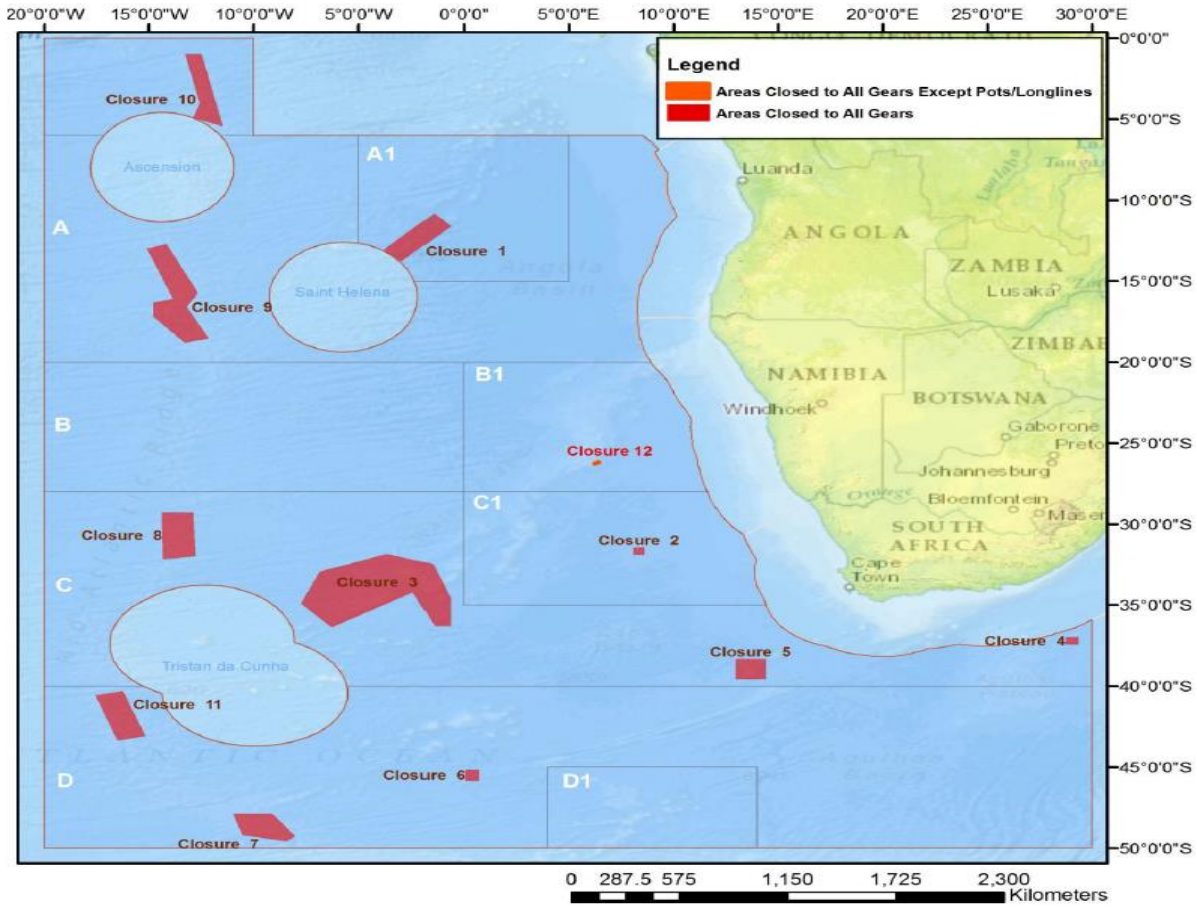

Figure 5. Map of the SEAFO area and FAO Area 47 displaying closed areas. Source: www.seafo.org

Gillnets and lost gear

SEAFO has recommended a ban on all use of gillnets in the CA and has adopted stringent protocols for the retrieval and reporting of lost gear.

Observers

As part of achieving good management in the area, all vessels are required to have an independent scientific observer onboard and comply with port inspection procedures.

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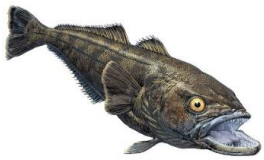
3 Fishery Overview

3.1 Identity of species in the South East Atlantic high seas

The SEAFO list of species includes 93 species, including crustaceans, cephalopods, bony, and cartilaginous fish[7]. Of these, the main targeted species are the Patagonian toothfish, the orange roughy, the deep-sea crab, the pelagic armourhead, and the alfonsino.

Table 2: The main targeted species in the South East Atlantic

Common name	Picture	Scientific name	FAO code
Patagonian toothfish		*Dissostichus eleginoides*	TOP
Orange roughy		*Hoplostethus atlanticus*	ORY
Deep-sea red crab		*Chaceon maritae*	CGE
Pelagic armourhead (Southern boarfish)		*Pseudopentaceros richardsoni*	EDR
Alfonsino		*Family Berycidae*	ALF

3.2 Total allowable catch (TAC) for key species in the SEAFO CA

The Commission, taking account of the scientific advice provided by the Scientific Committee, has adopted the following measures for 2021:

[7] http://www.seafo.org/About/Species-Resource-List

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Species	Tonnes and fishing area
Patagonian toothfish	275 tonnes for Sub-area D and zero tonnes for the remainder of the SEAFO CA
Orange roughy	Zero tonnes and a four-tonne bycatch allowance in Division B1, and 50 tonnes in the remainder of the SEAFO CA subject to exploratory fishing protocols
Deep-sea red crab	171 tonnes in Division B1 and 200 tonnes in the remainder of the SEAFO CA
Pelagic armourhead	135 tonnes for the SEAFO CA
Alfonsino	200 tonnes for the SEAFO CA of which a maximum of 132 tonnes may be taken in Division B1

Table 3: Total allowable catches (TAC) for 2021

3.3 Annual catch in the SEAFO CA

For the period from 2005 to 2020, the total number of vessels fishing in the SEAFO CA ranged between one and five vessels per year. During 2020, only one fishing vessel (an EU vessel) was active, according to SEAFO. The vessel was a longliner targeting Patagonian toothfish. After 21 days of fishing, they caught 59 tonnes[8].

The total catch of directed species in the SEAFO CA has decreased from 1,129 tonnes in 2010 to 59 tonnes in 2020 (Figure 5). It is noteworthy that the total observed catch in 2010 is mostly because of a proportionately large catch of pelagic armourheads (688 tonnes) in 2010. Notably, 2016 is the first year in which deep-sea red crab was not fished since 2010. During 2017, the catch of deep-sea red crab was 148 tonnes and increased in 2018 to 173 tonnes. During 2020 (September), the only reported catch was 59 tonnes of Patagonian toothfish (SEAFO; report of fishing data received from 1 Oct 2019 to 31 Sep 2020).

[8] http://www.seafo.org/

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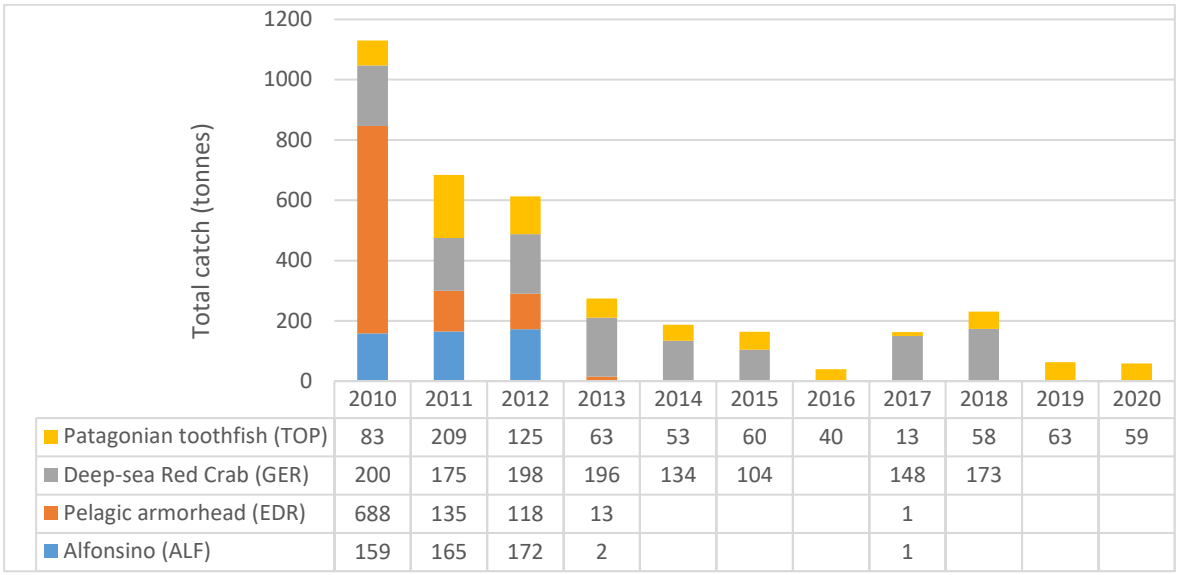

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Patagonian toothfish (TOP)	83	209	125	63	53	60	40	13	58	63	59
Deep-sea Red Crab (GER)	200	175	198	196	134	104		148	173		
Pelagic armorhead (EDR)	688	135	118	13				1			
Alfonsino (ALF)	159	165	172	2				1			

Figure 5: Annual catch of TAC species in tonnes from 2010 to 2020 in the SEAFO CA (Source: SEAFO).

When comparing annual catches (landings) and the TACs set by the Commission over the period 2010 to 2020, it becomes apparent that commercial fishing operations in the SEAFO CA are consistently well below the TAC thresholds set by the Commission and that resources are not being exploited to their potential, as determined by the TAC thresholds.

4 Specific challenges in ASE case study

4.1 Data availability

Biological and catch data are available via the SEAFO Secretariat only by request. Catch data are considered to be well documented but are sometimes submitted beyond the reporting date specified in the SEAFO system (SEAFO, 2018d). Although no reports of IUU fishing vessels were reported in 2018, there was one IUU vessel that caught 101 tonnes of Patagonian toothfish in the SEAFO CA in 2016, according to the Executive Secretary of SEAFO (SEAFO, 2018c). The TAC is based on limited data, especially when fishing activity is low and if IUU fishing occurs.

The status of bycatch species is unknown.

4.2 Insufficient monitoring of the fishery

The theoretical challenge for the monitoring, control, and surveillance (MCS) of the SEAFO fisheries is related to the physical capacity to control vessels at sea and in port. However, vessels are obliged to transmit their position at all times with a satellite vessel monitoring system (VMS) to their flag state, which should provide the requested VMS data to SEAFO. Some countries have problems with VMS requirements described in the SEAFO "SYSTEM" (SEAFO, 2018b). A supplement to VMS is the Automatic Identification System (AIS), transmitting information on the position of the vessel. The AIS was intended to increase security at sea and to support ship-to-ship collision avoidance, but as AIS transposes dynamic information such as ship position, course, speed, type of ship, navigational status,

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and International Maritime Organization (IMO) number, the processed AIS data can provide insights and information for regulatory bodies and researchers. The EU fleet is obliged by EU regulation to transmit both VMS and AIS signals. Although many fleets transmit AIS, recent investigations by Global Fishing Watch (GFW) show that there are gaps in AIS signals from vessels operating in international waters[9]. Gaps in AIS signals can occur due to gaps in signal coverage, signal inference in crowded areas, or consciously turning off the signal.

As AIS is an open-source information system, it allows all fleets to monitor the vessels transmitting AIS. This can provide information on where fishing activity might take place (e.g., if non-EU fleets do not transmit AIS, the level playing field is undermined).

5 Outcome targets and indicators

OTs are specific and measurable requirements set by an authority to make management goals operational. An OT is a statement of the condition of an indicator relative to a reference point, often in the form of an inequality ("A > B") or a statement of presence or absence of some entity. An OT should commonly be specific, measurable, attainable, relevant, and time-based (SMART).

As previously mentioned, the RBM approach depends on operators being incentivized to develop MRs for a given fishery. However, such incentives are missing in this CS, and therefore no operators are willing to put in the effort of developing an MR. The OTs identified in the MR invitation are therefore on a more "theoretical" level, and the MR2 serves as a good practice recommendation. Following are three OTs identified for the ASE mixed fisheries:

Table 4: OTs for the ASE mixed fisheries

OT 2.1	Obligatory	Reporting of all catches via e-logbooks.
OT 2.2	Obligatory	All vessels transmit AIS or VMS signals.
OT 2.3	Recommended	All vessels have onboard observers.

[9] http://globalfishingwatch.org/data/ais-gaps-by-fleet/

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5.1 Changes in OTs between MR1 and MR2

In MR1 for this case study, there were three OTs identified, all of which are included in MR2 with slight rewording but no change in content. To allow transparency, the description for these minor changes is included below (Table 5).

Table 5. Changes in OTs between MR1 and MR2

OTs in MR1	OTs in MR2	Changes
OT 2.1 Reporting of all catches via e-logbooks. **Obligatory**	**OT 2.1** Reporting of all catches via e-logbooks. **Obligatory**	No changes made
OT 2.2 Commitment to transmit VMS/AIS signals. **Obligatory**	**OT 2.2** All vessels transmit AIS or VMS signals. **Obligatory**	The OT was reworded
OT 2.3 Onboard observers. **Recommended**	**OT 2.3** All vessels have onboard observers. **Recommended**	The OT was reworded

5.2 Indicators

The suggested indicators in FarFish are set to measure the degree of adherence to the OT (Table 6) and are classified according to their level of measurability. The most detailed indicator category, A, is where the level of achievement of OT is quantitative, measured in percentage. Indicator category B is qualitative, where the level of OT achievement is considered to be high (score level 4), moderate (score 3), fair (score 2), low (score 1), or not present (score 0). The last indicator category is binomial, measured to have only two outcomes, such as yes (score 1) or no (Score 0), true or false, success or failure.

Table 6: FarFish indicator categories and the level of OT achievement

Indicator category	Level of OT achievement				
A (quantitative)	0%	25%	50%	75%	100%
B (qualitative)	Not present (NP) 0	Low level (LL) 1	Fair Level (FL) 2	Moderate Level (ML) 3	High level (HL) 4
C (binomial)	No (False/Failure) 0				Yes (True/Success) 1

5.3 OT 2.1: Reporting of all catches via e-logbooks

In MR1, this OT was defined as “Reporting of all catches via e-logbooks” and has the same definition in this MR.

The aim and key activities for this OT were as follows:

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Aim	Key activities to meet the OT
Improve the knowledge base for sustainable fisheries management.	• Initiate a dialogue between MFMR and SEAFO for the development of a pilot study • A pilot project could be developed for deep-sea crab fishery, which the Namibian fleet is targeting

OT 2.1 was obligatory and aimed to improve the knowledge base for sustainable fisheries management by getting all vessels operating in the SEAFO area to report their catches via e-logbooks.

Progress:

In October 2019, the FarFish Project sent a request to the SEAFO Secretariat with the subject "Proposed development of a pilot project to introduce e-logbooks" (Appendix 1). FarFish suggested the possibility of introducing e-logbooks into the SEAFO CA by approaching FarFish Reference Group Members SEAFO and the ministry of Fisheries and Marine Resources (MFMR) in Namibia. The idea was to develop a pilot project for deep-sea crab fishery, which the Namibian fleet is targeting.

At SEAFO's 15th annual meeting of the Scientific Committee (SC) taking place in November 2019, Dr. Arved Staby (representing the Institute of Marine Research, Norway) introduced the FarFish Project to the SC and outlined the objectives of the project. He highlighted that one of the deliverables of the FarFish Project includes a proposal for implementing a pilot e-logbook project with a Namibian vessel that conducts deep-sea red crab fishing operations in the SEAFO CA. The SC took note of the project objectives and agreed that any advancement that may enhance data integrity and quality should be pursued by the SC. However, SEAFO already uses an electronic reporting system (e.g., entry and exit fishing reports and five-day catch reports). Furthermore, with the limited information presented on the setup costs (as well as hardware and software implementation requirements) of the proposed e-logbook system, the SC agreed that there would be very little benefit from upgrading to another electronic system. The SC agreed that no further action was required from the Commission on this proposal.

Conclusions:

As the SEAFO SC agreed that no further action was required from the Commission on this proposal due to a lack of fishing activity by the EU fleet in the area, no further action was taken on this OT.

5.3.1 *Level of OT 2.1 achievement*

The indicator category for OT 2.1 is C, where the level of OT achievement is considered to be binomial, measured to have only two outcomes such as yes (score 1) or no (Score 0), true or false, success or failure.

Indicator		Indicator category	Indicator baseline	Indicator achievement
I_1_CS2	Initiate a dialogue meeting between MFMR and SEAFO and contracting party defined as a developing country	C	0	1
I_2_CS2	Develop a pilot project to introduce e-logbooks	C	0	0

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FarFish initiated a dialogue between MFMR and SEAFO for the development of a pilot study, thereby indicator 1 was achieved, resulting in a score of 1.

Indicator 2 was not achieved, as SEAFO agreed that no further action was required from the Commission on this. The indicator 2 score is 0. Yet, if fishing activity in the area increases, this indicator will become relevant.

5.4 OT 2.2: All vessels transmit AIS or VMS signals

In MR1, this OT was defined as "Commitment to transmit VMS/AIS signals", but rephrased to "All vessels transmit AIS or VMS signals" in this MR.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Support fight against the IUU fisheries by utilising the latest available satellite system and tool	• Develop a big-data analysis of AIS data • Approach SEAFO to request VMS data • Strive to ensure funding for least-developed country members of SEAFO for the full adoption of the VMS transmission

OT 2.2 was obligatory and aimed to support the fight against IUU fishing by utilising the latest available satellite system and tool.

Progress:

In September 2019, the FarFish Project sent a request for access to VMS data in SEAFO CA for the period 2012–2018 to the SEAFO Executive Secretariat (ES) (Appendix 2). The ES informed the SC about the request for VMS data from the FarFish Project related to EU vessels operating within the SEAFO CA. SC refers the request for access to SEAFO VMS data on EU vessels active within the SEAFO CA to the Commission for further consideration. At the 16th annual meeting of the Commission held in November 2019, the Commission agreed that the ES should inform FarFish that no VMS data for EU vessels exist in the SEAFO system[10].

One of the key activities for this OT was to develop a big-data analysis of AIS data from Global Fishing Watch (GFW) for the SEAFO area to confirm activity. Due to a lack of VMS data from SEAFO and challenges with GFW data, the big-data analysis was not possible to do. The data available could only be used to see what countries have been detected with fishing vessels in the SEAFO area during 2012–2018. FarFish reached out to the GFW support team to get further clarification on the received data in hope to be able to use it, but, we did not received any replies.

From 2012–2014, vessels from a total of 23 flag states were detected by GFW, most of which were longliners (Figure 6).

[10] http://www.seafo.org/About

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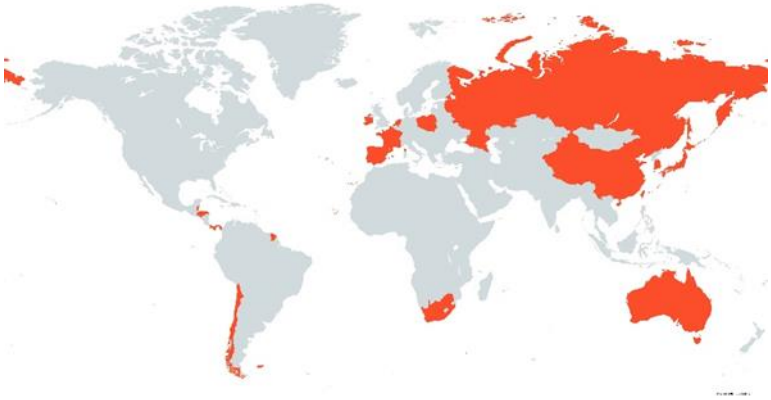

Figure 6. Vessels (longliners, trawlers, purse seiners) that were detected by GFW in SEAFO area between 2012–2014 belonged to Australia, Chile, China, Taiwan, Japan, Korea, Portugal, Seychelles, South Africa, Spain, Panama, Belize, Comoros, the Falkland Islands, Ireland, Poland, Russia, Cabo Verde, France, Curaçao, Netherlands, Saint Vincent, the Grenadines, and Honduras. Based on data from GFW.

In the following years, 2015–2018, the number of flag states present in the area increased by 48%, from 23 to 34 (Figure 7). Countries that had previously not been detected in the area mostly include African countries (Ghana, Côte d'Ivoire, Angola, Senegal, Kenya, Tanzania, and Namibia) but also those from Europe (UK, Norway, and Ukraine).

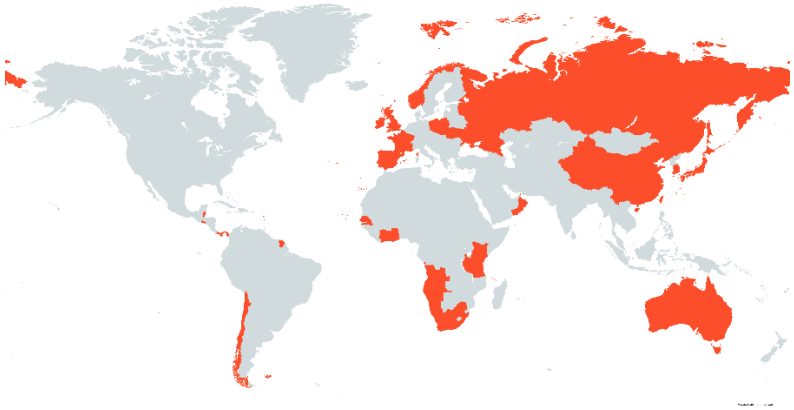

Figure 7. Vessels (longliners, trawlers, purse seiners) that were detected by GFW in SEAFO area between 2015–2018 were from Australia, Chile, China, Taiwan, Japan, Korea, Portugal, Seychelles, South Africa, Spain, Panama, Belize, Comoros, the Falkland Islands, Ireland, Poland, Russia, Cabo Verde, France, Curaçao, Angola, Côte d'Ivoire, Namibia, Senegal, Kenya, Norway, Oman, UK, Saint Kitts and Nevis, Ukraine, Tanzania, El Salvador, Ghana, and the Cook Islands. Based on data from GFW.

Figure 8 demonstrates how longlining became the most preferred fishing method in the area, with only six flag states using longlines in 2012 and increasing to 18 flag states in 2018.

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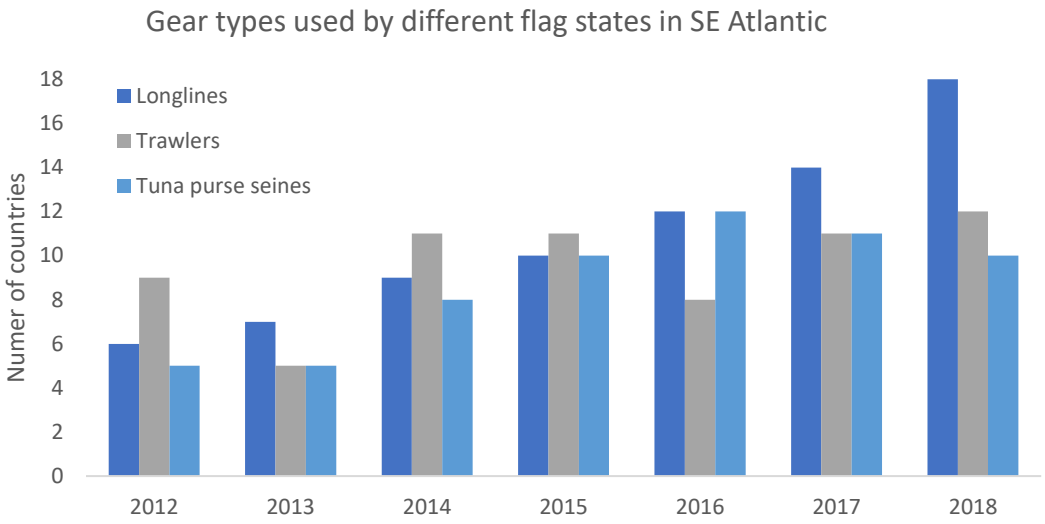

Figure 8. Number of fleets present in SE Atlantic fisheries (SEAFO CA) from 2012–2018. Dark blue: Longliners; Grey: Trawlers; Light Blue: Purse seiners (tuna). Based on data from GFW.

Conclusions:

No VMS data for EU vessels exist in the SEAFO system.

Better and additional data from GFW allowing for identifying vessels by country, and by week/month/year, are needed to perform the big-data analysis. The data FarFish had access to could only be used to see what countries have been detected with fishing vessels in the SEAFO area during 2012–2018.

5.4.1 *Level of OT 2.2 achievement*

Indicators 3 and 4 measuring the achievement for OT 2.2 both depended on geolocation. Geolocation refers to the identification of the geographic location of a user or computing device via a variety of data collection mechanisms. Since we had access to neither AIS nor VMS data, we were not able to evaluate the indicators, meaning that the OT was not achieved.

Indicator		Indicator category	Indicator baseline	Indicator achievement
I_3_CS2	The proportion of vessels, either EU or non-EU, geolocation	B	4	0
I_4_CS2	The proportion of vessels, either EU or non-EU, with redundant (AIS + VMS) geolocation	A	0%	0%

Indicator 3 is in category B. SEAFO has an overview of the fishing activities and the number of vessels operating in the area, which is why the baseline is 4, or a high level. We were not able to verify the indicator because of data availability, which is why indicator achievement is 0, or not present. The same goes for indicator 4, where indicator achievement is 0%, due to a lack of AIS and VMS data.

The GFW data detected the nationality of the vessels we assume targeting migratory fish stocks, which are outside the scope of SEAFO.

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5.5 OT 2.3: All vessels have onboard observers

In MR1, this OT was defined as "Onboard observers" but rephrased to "All vessels have onboard observers" in this MR.

The aim and key activities for this OT was as follows:

Aim	Key activities to meet the OT
Ensure compliance by observer programme	Capacity building and observers onboard

OT 2.3 was recommended and aimed to ensure compliance by the SEAFO observer programme. The key activities are capacity building and observers onboard.

Progress:

Each Contracting Party in SEAFO shall ensure that all its vessels operating in the CA shall carry scientific observers qualified by the flag state (SEAFO, 2018b). The compliance committee report (SEAFO, 2018c) reveals some challenges related to the competence of the inspectors, who are not always qualified to report in line with the observer scheme.

Due to a lack of fishing activity by the EU fleet in the area, there was no interest in training observers onboard from the operators' side, but the SEAFO Secretariat facilitated a training programme in May 2019 for observers from SEAFO Contracting Parties. The training programme focused on data collection protocols for onboard observers deployed in the SEAFO CA. Specific emphasis was placed on the data recording and reporting requirements under SEAFO's "the System" (2019), Chapter V Art. 18.1, 18.2 for the scientific observer programme.

FarFish acknowledges the comprehensive work on compliance and capacity building by SEAFO. SEAFO conducts the training of observers in neighbouring countries to ensure that observers are in place in case of fishing activities in FAO Area 47.

5.5.1 *Level of OT 2.3 achievement*

This OT was not achieved by the FarFish Project because no operators were willing to put in the effort of training observers due to a lack of fishing activity in the area. However, the compliance and capacity building of observers performed by SEAFO is well-acknowledged.

Indicator		Indicator category	Indicator baseline	Indicator achievement
I_5_CS2	Training of observers and observers available	C	0	0*

*No fishing activities in the area and little interest from the EU fleet for several years now.

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6 Other potential actions as a supplement to the MR

Apart from the OTs above, several potential tasks[11] have been identified that could strongly support the CS objectives. These action points have not been included in the list of OTs because they cannot be (solely) operationalized by the operators, as they require input/action from other relevant parties (authorities, scientific institutions, other international fleets, etc.). These are as follows:

- Compiling existing knowledge on main stocks being targeted in the area, which exist to some degree at different scientific institutions and research programmes.
- Developing user-friendly digital maps (VMS/AIS based) to identify fishing pressure of different fishing fleets. This will potentially create pressure on international fleets to send uninterrupted AIS signals.

7 Conclusion

There is currently very little fishing activity within the SEAFO CA, and the EU fleet showed little interest in the area for several years. This severely limits the relevance and applicability of this RBM approach within the CS. Given the nature of the CS, expectations towards an MR must be realistic and take the limited operations of the EU fishing fleet into consideration. The OTs identified and the indicators provided in this MR are rather theoretical, and the MR2 serves as a guideline.

Nevertheless, SEAFO is a well-functioning and active RFMO responsible for ensuring the long-term conservation and sustainable use of the fishery resources (excluding migratory fish stocks) in the high seas of ASE, within the CA. SEAFO recognizes the need to cooperate with coastal states and all other states and organizations having a real interest in the fishery resources of the ASE. Therefore, should the fishing activity be resumed, the SEAFO-system will work towards the sustainable management of the ASE, hopefully considering this MR2 provided by FarFish.

8 Auditor

FarFish partner Sjókovin conducted two audits following the RBM process, The first audit on documentation system conformance and the second audit on performance effectiveness and compliance. The final audit of this MR will not be conducted.

[11] “Action points” was reworded to “potential tasks” in MR2 to clarify that these are not obligatory.

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Appendix

Appendix 1.

Letter to SEAFO Secretariat proposing pilot project to introduce e-logbooks.

DOC/SC/14/2019

The SEAFO Secretariat
Executive Secretary
Strand Street No. 1
Swakopmund, Namibia

4th October 2019

Subject: Proposed development of a pilot project to introduce e-logbooks

The FarFish project (www.farfish.eu) is a four-year Research & Innovation project that started in 2017 and will finish in 2021. It is funded by the European framework programme HORIZON 2020 under the topic H2020-SFS-21-2016: Advancing biological knowledge and improving management tools for commercially important fish and other seafood species. The focus of the project is on providing knowledge, tools and methods to support responsible, sustainable and profitable EU fisheries outside European waters. Main efforts are awarded to six non-European waters, one of which covers the SEAFO convention area.

The SEAFO system requires that all authorised vessels fishing in the area submit logbook data to the SEAFO secretariat within 30 days of leaving the convention area. There are three different logbooks, depending on which gear is applied (1) SEAFO Logbook From 2015-Longline, (2) SEAFO Logbook Form 2015 Pot and (3) SEAFO Logbook Form 2015 –Trawl. Currently SEAFO does not have an electronic e-logbook system in place. An e-logbook system would contribute to better monitoring, as these systems can collect and transmit some data automatically at set time intervals or in near real time. When used along with vessel tracking tools, e-logbooks can help reduce misreporting at the point of harvest.

FarFish suggests the possibility of introducing e-logbooks in the SEAFO CA, by approaching FarFish Reference Group Members SEAFO and the ministry of Fisheries and Marine Resources (MFMR) in Namibia. A pilot project could be developed for deep sea crab fishery, which the Namibian fleet is targeting.

Yours sincerely

Arved Staby
FarFish contributor
Institue of Marine Research, Bergen, Norway

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Appendix 2.

Letter to SEAFO Secretariat requesting access to VMS data.

DOC/SC/15/2019

The SEAFO Secretariat
Strand Street No. 1
Swakopmund, Namibia

30. Sept. 2019

Subject: Request for access to VMS data in SEAFO CA

Dear SEAFO commission

The FarFish project (www.farfish.eu) is a four-year Research & Innovation project that started in 2017 and will finish in 2021. It is funded by the European framework programme HORIZON 2020 under the topic H2020-SFS-21-2016: Advancing basic biological knowledge and improving management tools for commercially important fish and other seafood species. The focus of the project is on ***providing knowledge, tools and methods to support responsible, sustainable and profitable EU fisheries outside European waters***. Main efforts are awarded to six non-European waters; one of which covers the SEAFO convention area.

Even though there is currently very little EU fleet activity in the area, the SEAFO CA still remains an interesting case study for the FarFish project. Among the knowledge, tools and methods that the project is developing to support responsible fisheries is a consistency assessment of AIS and VMS data. FarFish has already access to AIS data in the SEAFO CA for the period between 2012 and 2018; and would like to compare that data to VMS data for the same period. ***We are therefore requesting access to VMS data in the SEAFO CA for the period 2012 – 2018.***

Our hope is that this assessment may contribute to a better understanding of fishing activities in the area. The results will be freely available to SEAFO members; and potentially to the general public, depending on SEAFO's conditions for making such information publicly available.

The consistency assessment of AIS and VMS data is a part of the knowledge, tools and methods developed in work package six of the FarFish project. The title of that work package is "Development of management tools" and it is led by Javier Ruiz at CSIC in Spain, who will be the main person responsible for the data and its use in the project.

We hope this formal request has helped to explaining our intentions, which we hope are also of interest to SEAFO. We are happy to provide further information, if needed.

Yours sincerely,

Javier Ruiz (CSIC)
Leader of WP6 in FarFish

Jónas R. Viðarsson (Matís)
Coordinator of the FarFish project

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CASE STUDY 3

CAPE VERDE

Deliverable No. 4.4

Project acronym:
FarFish

Project title:
Results-Based Management and Capacity Building for EU Sustainable Fisheries Partnership Agreement - and International waters

Grant agreement No: **727891**
Project co-funded by the European Commission within the Horizon 2020 Research and Innovation Programme

Start date of project: **1st June 2017**
Duration: **54 months**

Due date of deliverable:	30/11/2020
Submission date:	30/11/2021
File Name:	FarFish D4.4_MR2 Cape Verde
Revision number:	02
Document status:	Final
Dissemination Level:	PU[1]

Role	Name	Organisation	Date	File suffix[2]
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[1] PU: Public, PP: Restricted to other programme participants (including the Commission Services), RE: Restricted to a group specified by the consortium (including the Commission Services), CO: Confidential, only for members of the consortium (including the Commission Services)
[2] The initials of the revising individual in capital letters

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Deliverable D4.4

Management Recommendation 2
Cape Verde

30/11/2021

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Summary

This document serves to update the draft proposal for a Management Recommendation (MR2) for the fishery under the Sustainable Fisheries Partnership Agreement (SFPA) between Cape Verde and the European Union (EU). The MR2 draft proposal was internally submitted for the second audit iteration with the FarFish project in March 2021. The aim of this document is to respond to the second audit report (FarFish, D5.4) and provide a final version of the MR2. The MR for Cape Verde is founded on Results-based Management (RBM) principles. The MR represents a formal agreement between competent authorities and relevant operators that specifies partners in the fishery and their respective roles, the agreed objectives for the fishery, the management rules and regulations that apply, and other relevant details about the fishery.

The MR2 was developed following the "General Guidelines for making MRs" (FarFish, D3.5) and is based on the "Second MR Invitation" (FarFish, D3.6), where the outcome targets (OTs) are proposed. The proposed OTs are based on "MR1" (FarFish, D4.3), the "Audit of MR1" (FarFish, D5.1), and the roadmap presented in "Report on challenges and suggestions for improvements" (FarFish, D5.2). In addition, stakeholder meetings facilitated by FarFish stakeholder interaction (WP1) as well as input from other FarFish work packages (WP) and case study (CS) meetings provide a basis for this document.

The objective of MR2 for Cape Verde is to strengthen data analysis and monitoring for sustainable fisheries, especially for blue shark and swordfish. Data are available for these species, but there is no capacity to analyse and use the data to generate evidence and support decision-making.

The OTs for this case study (CS) are as follows:

OT 3.1 A harmonised catch data protocol in place that facilitates improved reporting of swordfish and blue shark commercial and biological data. **Obligatory. Partly achieved.**

OT 3.2 All vessels transmit Automatic Identification System (AIS) and/or Vessel Monitoring System (VMS) signals. **Obligatory. Not evaluated due to lack of data.**

OT 3.3 Strengthened scientific observer program in place. **Recommended**. **Partly achieved.**

OT 3.4 Trade flow data from operators provided. **Recommended. Partly achieved.**

The FarFish analysis of existing catch data protocols shows that the EU e-logbook system used by EU vessels enables collecting relevant data regarding swordfish and blue shark. This protocol has not yet been implemented by the ICCAT (see pages 24-25).

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Abbreviations

AIS	Automatic Identification System
B_{msy}	Maximum Sustainable Yield Biomass
CCMAR	Centre of Marine Sciences (Portugal)
CETMAR	Centro Tecnológico del Mar Fundacion CETMAR (Spain)
CFP	Common Fisheries Policy
COSMAR	Operations Centre for Maritime Safety (Cape Verde)
CS	Case Study
CSIC	Spanish National Research Council
DG MARE	Directorate-General Maritime Affairs and Fisheries (EU)
EU	European Union
EcoFishMan	Ecosystem-based Responsive Fisheries Management in Europe
EEZ	Exclusive Economic Zone
ERS	Electronic Recording Systems
FAD	Fish Aggregation Device
FAO	Food and Agriculture Organization of the United Nations
FarFish RG	FarFish Reference Group
FMC	Fisheries Monitoring Centre
GFW	Global Fishing Watch
ICMAN-CSIC	Institute for Marine Sciences of Andalucía (ICMAN)-Spanish National Research Council (CSIC)
IGP	General Inspection of Fisheries
IMAR	Instituto do Mar (former INDP) (Cape Verde)
IMO	International Maritime Organization
INDP	National institute for Fisheries Development (Cape Verde)
IUU	Illegal, unreported, and unregulated fishing
LDAC	EU Long Distance Fleet Advisory Council
MATIS OHF	Icelandic Food and Biotech R & D Institute (Iceland)
MCS	Monitoring, Control and Surveillance
MP	Management plan
MR	Management Recommendation
NOFIMA	The Norwegian Institute of Food, Fisheries and Aquaculture research
NPOA	National Plan of Action
OECD	The Organisation for Economic Co-operation and Development
OT	Outcome Target
PGRP	Cape Verde Fisheries Management Plan
RBM	Results-Based Management
RFMO	Regional Fisheries Management Organisation
SDG	Sustainable Development Goal
SOLAS	Safety Of Life At Sea
UiT	The Arctic University of Norway
UNCLOS	United Nations Convention on the Law of the Sea
UNIDO	United Nations Industrial Development Organization
VMS	Vessel Monitoring System
WP	Work Package

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Concepts/definitions

Indicator	A variable, pointer, or index related to a criterion. Indicators are selected so that their variations reflect variations in key elements of the fishery resource, the social and economic well-being of the sector and the sustainability of the ecosystem. The position and trend of an indicator in relation to reference points or values indicate the present state and dynamics of the system. Indicators provide a bridge between objectives and actions (source: FAO, 1999).
Management goals	The higher-order objective to which a management intervention is intended to contribute (OECD 2011). A management goal is derived from a management principle (constitutional-order) and is specified into a set of additional operational management objectives (collective-order).
Management intervention	Strategies or instruments aimed at impacting the state of a fishery with reference to authorised objectives. Examples are input and output controls and economic measures.
Management measures	Can be technical (e.g., gear selectivity), input (effort)/output (catch) control, right based.
Management objectives	Fisheries management objectives are typically framed within the concept of sustainable development and may reflect one or more various dimensions and criteria that relate to it (FAO, 1999). Operators, through setting and implementing management measures, control OTs.
Management Plan	In RBM, the management plan is a formal arrangement between a management authority and operators that specifies the fishery partners and their respective roles, the agreed objectives for the fishery, the management rules and regulations that apply, and other relevant details about the fishery. In RBM, the formal responsibility for developing the management plan is delegated to an operator.
Management Recommendation	In RBM, the management recommendation (MR) is a formal arrangement between a management authority and operators that specifies the partners in the fishery and their respective roles, the agreed objectives for the fishery, the management rules and regulations that apply, and other relevant details about the fishery.
Management strategies	In the FarFish context, this refers to strategies applied to achieve OTs.
Outcome Target	Outcome targets (OT) are specific and measurable performance goals defined for a fishery based on agreed and appropriately authorised goals, standards, and principles, as defined by authorities using policy objectives. OTs regard a textual or mathematical statement that can be evaluated as “true” or “false”, where “true” represents the target value. The OT is the indicator value that management actions aim to stay above or below, such as F< Fmsy.

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1 Introduction

This document updates the draft proposal for a Management Recommendation (MR2) in the FarFish project, submitted internally for auditing purposes from European operators fishing in Cape Verdean waters. This document responds to the second audit report (FarFish, D5.4)

1.1 FarFish overall objective

The overall objective of FarFish is to improve knowledge and management regarding EU fisheries outside Europe while contributing to sustainability and long-term profitability. The role and responsibilities of the EU fleet are significant to ensuring sustainable utilisation of the resources to which they are allowed access, whether under SFPAs or in international waters, also known as the high seas.

The concept of sustainability regards meeting present needs without compromising future generations' ability to meet their own, which includes managing people, the planet, and profit. The fleet should therefore cooperate with the Regional Fisheries Management Organisations (RFMO) and national authorities in partner countries to improve knowledge and make management more effective. The EU has agreed to strengthen capacity in their SFPA countries to ensure the efficient management of fisheries, which will ultimately lead to sustainable utilisation and increasing the long-term profitability of all stakeholders.

The FAO report "The State of World Fisheries and Aquaculture 2020" (FAO, 2020) states that there is no alternative to sustainability. The world needs programs to improve fisheries to allow humans to continually fish in oceans for edible seafood. The effective management of world fisheries represents the sole path to sustainability, which obligates EU national authorities and fishing industries.

1.2 About Cape Verde and the fishery

The Cape Verde archipelago is in the Atlantic Ocean approximately 455 kilometres from the African continent's western coast and near Senegal, Gambia, and Mauritania. The country comprises a horseshoe-shaped cluster of 10 islands (nine inhabited) and 5 islets. The continental shelves are narrow and irregular, with a total area of 5,394 km^2 (accumulated; down to depths of 200 m). The Exclusive Economic Zone (EEZ) of Cape Verde covers about 785,000 km^2 and is characterised by oceanic waters and relatively low productivity, where mostly foreign fishing fleets can operate.

The population of Cape Verde was estimated to be 549,935 people in July 2019 (FAO, 2020). The fisheries sector plays a key role in the country's economy regarding employment, livelihood, food, and nutrition, as the sector reported around 6,300 full-time fishers.

In 2019, Cape Verde's total export value was $95.5M, with over 70% from seafood products, led by processed fish representing 42.5% of the total export and followed by non-fillet frozen fish accounting for 23.7%.[3]

Tuna and tuna-like species represent the most significant fishery resources. For the EU fleet, the target species are mostly skipjack (*Katsuwonus pelamis)*, yellowfin (*Thunnus albacares),* and bigeye tuna (*Thunnus obesus),* but blue shark (*Prionace glauca*) and swordfish (*Xiphias gladius*) are also caught to a considerable extent (as target or bycatch species). Other tuna species fished in the area include

[3] https://oec.world/en/profile/country/cpv/

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Atlantic bonito (*Sarda sarda*) and frigate tuna (*Auxis thazard)*. All these species are exploited by foreign fleets (which operate within the full extent of the EEZ) and national fleets closer inshore (Stobberup, 2005).

The EU and Cape Verde signed a Sustainable Fisheries Partnership Agreement (SFPA) that gives EU fishing vessels access to Cape Verdean waters. Cape Verde also offers fishing opportunities to fishing vessels from other states, where the following nationalities have a license to fish: Japan (8 vessels), Senegal (6 vessels), El Salvador (4 vessels), Curaçao (3 vessels), Panama (2 vessels), and Belize (1 Vessel).

Figure 1. Map of Cape Verde. *The EZZ covers 785,000 km^2, but the continental shelves around the islands are only 5,394 km^2 (down to depths of 200m). Source:* (Nations Online Project)

1.3 The process for developing MR2 for Cape Verde

The MRs are developed in two iterations and are based on the results-based management (RBM)[4] principles (Nielsen et al., 2017). RBM requires relevant authorities to define specific and measurable objectives for a fishery but allows resource users (operators) to find ways to achieve these objectives and provide adequate documentation (Figure 2).

[4] The RBM is also referred to as the Responsive Fisheries Management System (RFMS) in the EcoFishMan project and other FarFish documents

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The MR represents a formal agreement between competent authorities and relevant operators that specifies partners in the fishery and their respective roles, the agreed objectives for the fishery, the management rules and regulations that apply, and other relevant details about the fishery.

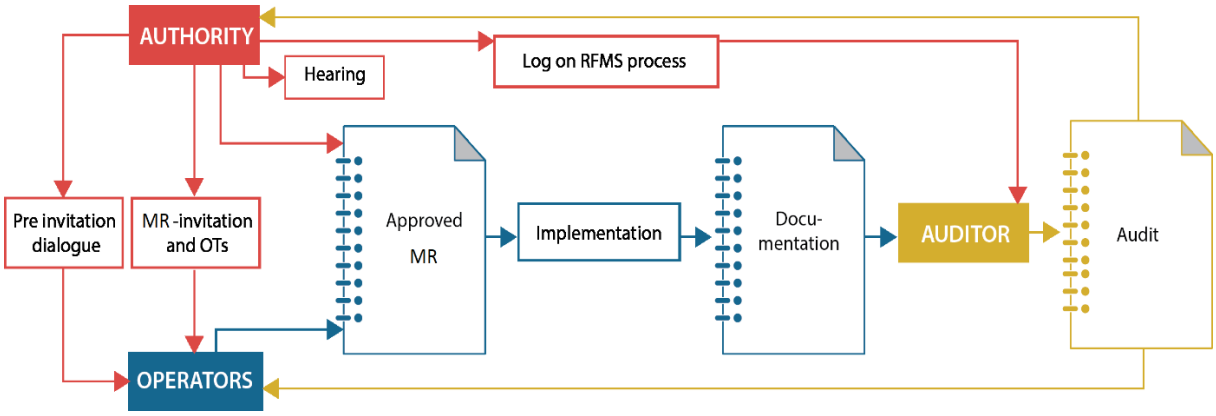

Figure 2: General description of the process of making MRs based on RBM in FarFish (FarFish D3.1). The different colours demonstrate the responsibilities of each of the three entities. Authority: red / Operators: blue / Auditors: yellow.

The MR1 for Cape Verde (FarFish, D4.3) was made available on 30 September 2019. MR2 is developed following the "General Guidelines for making MRs" (FarFish, D3.5) and is based on the "Second MR Invitation" (FarFish, D3.6), which set the updated outcome targets (OTs) for the CS. The OTs set were based on "MR1" (FarFish, D4.3), advice from the auditor (FarFish, D5.2?), and input from meetings facilitated by FarFish "Stakeholder interaction" (WP1). The consortium reviewed the OTs at the FarFish CS and WP leader meeting in Marrakesh (Morocco, Nov. 2019). After the meeting, a draft of the "Second MR Invitation" was sent for hearing among operators. Based on the response, the authority (MATIS) further adjusted some OTs and the "Second MR invitation" (FarFish, D3.6) was made available on 21.01.2020. The External Advisory Group and experts in the 36-month review meeting in August 2020 also provided valuable input to develop MR2. Following the RBM approach, the "Audit of MR1" (FarFish, D5.1) was made available on 30.11.2019, which included audit and input recommendations applied from the "Report on challenges and suggestions for improvements" (FarFish, D5.2). The second audit, 'Report on Management Recommendation 2 Audit' (FarFish, D5.4), was made available on 30.06.2021. The recommendations from the second audit report were used to update the second MR.

A workshop organised by CETMAR was held in Mindelo, São Vicente in November 2019. The workshop's goal was to present results from the audit of Cape Verde MR1 and to assess constraints and opportunities for developing MR2 for Cape Verde.

In addition, WP1 ensured continuous contact with relevant operators by conducting five physical and two online meetings, e-mail correspondence, and phone calls. WP4 represents the operator and developed the MRs, while the FarFish coordinator representing the authority had meetings (online and physical), e-mail correspondence, and phone calls with the CS leader.

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1.4 Partners involved in MR2

This case study (CS) focused on the EU fleet, meaning that not all operators in Cape Verde were involved in the RBM.

MATIS acted as the leading authority within the project while considering input from relevant authorities such as the Directorate National of Maritime Economy (DNEM), General Directorate of Marine Resources (DGRM), and DG MARE. The European operators qualified to respond to the second MR invitation for Cape Verde included the EU Long Distance Advisory Council (LDAC), which represents all long-distance fisheries conducted by EU vessels; Asociacion Nacional de Fabricantes de Conservas de Pescados y Mariscos- (ANFACO-CECOPESCA), which represents the Spanish tuna processors and can factories; Organizacion de palangreros guardeses (ORPAGU), representing the Galician/Spanish Surface longliners targeting tuna stocks, swordfish and sharks (blue shark and mako); and Organización Productores Asociados Grandes Atuneros Congeladores (OPAGAC) (represented by the LDAC), which regards Basque/Spanish purse seiners targeting tropical tuna stocks. Blue resource, Sjókovin, WP5 leader conducted the audits.

Table 1. RBM roles of work packages, stakeholders, and FarFish research institutions (indicated in italics) involved in developing the Cape Verde MR2.

Cape Verde case study			
RBM roles	AUTHORITY	WP3	DNEM, DGRM, and DG MARE; *Matis, IMAR*
	OPERATORS	WP4	LDAC, ANFACO-CECOPESCA, ORPAGU; *UiT*
	AUDITOR	WP5	*Sjokovin*

Instituto do Mar (IMAR) (formerly INDP) in Cape Verde was the case study leader.

1.4.1 *Other partners and stakeholder interaction*

The workshop held in Mindelo, São Vicente in November 2019 involved 21 participants representing Ministério da Economia Marítima (MEM) (3), Coast Guard (1), IMAR (10), ORPAGU (2), ATUNLO (2), Frescomar (1), and CETMAR (2).

1.5 Objectives of the MR2 for Cape Verde

The objectives of MR2 for Cape Verde were to improve data collection and monitoring for sustainable fisheries, especially for blue shark and swordfish. FarFish identified gaps and differences in the data flow between authorities, which cause the diverging catch data from the EU, Cape Verde, and ICCAT. The improvement of data collection and monitoring will be achieved through:

- Data collection: In conformity with the ICCAT, collect and analyse data regarding catches of swordfish and blue shark by the EU fleet in the Cape Verdean EEZ, when the data are available. If sufficient data are accessible, provide model scenarios, which may contribute to developing harvest control rules for these bycatch species.
- Data monitoring: Contribute to better monitoring in the area by supporting enforcement by utilising the latest available satellite systems and tools.

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2 SFPA between EU and Cape Verde

Cape Verde and the EU have signed a Sustainable Fisheries Partnership Agreement (SFPA) allowing EU vessels from Spain, Portugal, and France to fish in Cape Verdean waters (EU, 2019). The first SFPA between the EU and Cape Verde commenced in March 2007, while the current SFPA was signed on May 20th, 2019. The legal framework behind this agreement is based on *Art. 62 UNCLOS* (UN, 1995), stating that coastal states should assess their fishing capacity and allow other states to catch surplus in their EEZ through agreements. The protocol covers a period of five years (2019-2024) and provides fishing opportunities for a maximum of 69 EU vessels to fish in Cape Verdean waters based on the best available scientific advice and recommendations of the International Commission for the Conservation of Atlantic Tunas (ICCAT).

The SFPA with Cape Verde has the pre-defined structure of all SFPAs consisting of 3 major parts: agreements, protocols, and technical annexes[5]:

- Fisheries Agreements: set the scope, principles of cooperation, and commitment to cooperate, mainly through committees that are jointly established to monitor the application of the SFPA.
- Protocol: authorises fishing access of EU vessels and specifies fishing opportunities, amounts and methods of payment, modalities of cooperation, etc.
- Technical Annexes: establish implementation and licensing systems, electronic catch reporting systems (ERS), observers, vessel monitoring systems (VMS), control and enforcement.

The agreement establishes the principles, rules, and procedures governing:

> (a) Economic, financial, technical, and scientific cooperation in the fisheries sector to promote responsible fishing in Cape Verdean waters to ensure the conservation and sustainable exploitation of fisheries' resources and develop the Cape Verde fisheries sector.
>
> (b) The conditions governing access of EU fishing vessels to Cape Verdean waters.
>
> (c) Cooperation regarding the arrangements for policing fisheries in Cape Verdean waters to prevent illegal, undeclared, and unregulated fishing.
>
> (d) Partnerships between companies aimed at developing economic activities in the fisheries sector and related activities.

The protocol attached to the agreement specifies the fishing opportunities assigned to EU fishing vessels and the financial contribution granted to Cape Verde. In addition, the annex establishes conditions governing fishing activities by EU fishing vessels in the Cape Verde fishing zone (e.g., applying for and issuing licenses, catch reporting, landing, observers, monitoring, and transhipment) (EU, 2019).

Table 2. Cape Verde SFPA (2019-2024) in numbers

Cape Verde SFPA in numbers	
Freezer tuna seiner vessels	28 licenses
Pole-and-line tuna vessels	14 licenses
Surface longline vessels	27 licenses

[5] https://ec.europa.eu/fisheries/documentation/eu-sustainable-fisheries-partnership-agreements_en

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Specific amount to support Cape Verde sectoral fisheries policy	€ 350,000 per year
Reference tonnage for financial compensation	8,000 tonnes per year
Fees	€ 70 per tonne caught
TOTAL VALUE (estimated)	**€ 3,750,000**

3 EU Fishery in the Cape Verdean EEZ

The SFPA between the EU and Cape Verde concerns highly migratory tuna species (yellowfin, skipjack, and bigeye) and blue shark (EU, 2019). These species are exploited by foreign fleets (which operate within the full extent of the EEZ) and national fleets closer inshore. In the new agreement, turtles are considered bycatch. The Cape Verdean tuna fishery is a well-regulated fishery subjected to ICCAT limits regarding catch and effort.

Table 3. The main target species for the EU fleet in Cape Verde

Common name	Picture	Scientific name	FAO code
Skipjack tuna		*Katsuwonus pelamis*	SKJ
Yellowfin tuna		*Thunnus albacares*	YFT
Bigeye tuna		*Thunnus obesus*	BTH
Blue shark		*Prionace glauca*	BSH
Swordfish		*Xiphias gladius*	SWO

3.1 Fishery Overview

The SFPA provides fishing opportunities to 69 EU vessels within the categories pole and line (14), freezer tuna seiners (28), and surface longliners (27) from Spain, France, and Portugal, which represent a total reference tonnage of 8,000 tonnes per year.

Table 4 shows the total catches by EU fleets under the SFPA during the period 2014-2017. Catches are dominated by Spanish vessels, which accounted for 98% of the catch in 2017.

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*Table 4: Catches in tonnes under Cape Verde license by Member State 2014-2017**

	2014	2015	2016	2017*
Spain total	8,246	4,617	3,802	9,791
France total	1,453	251	517	66
Portugal total	0	98	175	125
Grand total	**9,699**	**4,966**	**4,494**	**9,983**

Source: DG MARE, 2017 *2017 data provisional

Five species accounted for 98% of reported catches in 2017:

1. Skipjack tuna, *Katsuwonus pelamis* (61%)
2. Blue shark, *Prionace glauca* (20%)
3. Yellowfin tuna, *Thunnus albacares* (8%)
4. Bigeye tuna, *Thunnus obesus* (8%)
5. Swordfish, *Xiphias gladius* (1%)

The management of these highly migratory species is coordinated through ICCAT. The tuna species and swordfish are covered by the ICCAT Convention, which identifies blue shark as 'bycatch species of special importance'.

Table 5 presents the total catches by species. Skipjack catches by the purse seine segment cause much of the annual variation in catches.

*Table 5. Catches by EU vessels in tonnes by species 2014-2017**

	2014	2015	2016	2017*
Tuna total	8,253	2,042	2,392	7,820
Shark total	1,392	2,797	1,979	2,058
Others total	54	127	124	104
Grand total	**9,699**	**4,966**	**4,494**	**9,983**

Source: DG MARE, 2017 *2017 data provisional

Spanish purse seiners represented most (64%) of the catch in 2017, which target skipjack and yellowfin tuna in Cape Verdean waters. In other years, Spanish surface longliners accounted for the highest volumes targeting blue shark.

Other fishing fleets occasionally operate in Cape Verdean waters. According to Amador et al. (2018), in 2017 these fleets were from: Japan (8 longliners), Senegal (4 purse seine, 2 pole and line), El Salvador (4 purse seine), Curaçao (3 purse seine), Panama (2 purse seine), and Belize (1 purse seine).

Catch data for these non-EU foreign vessels in the Cape Verdean EEZ are not readily available, and it is unclear whether these vessels have operated in Cape Verdean waters or how much of their catches were taken inside the EEZ (Amador et al., 2018).

3.2 State of the resources

The potential of waters under the jurisdiction of Cape Verde varies between 36,000 and 44,000 tonnes per year for an overall catch level of 10,000 tonnes per year[6]. Tuna presents a potential 25,000 tonnes for an average catch level of 6,000 tonnes per year, which does not include many species present in

[6] http://spcsrp.org/en/cabo-verde

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the national EEZ, however, such as molluscs, cephalopods, sharks, sea turtles, certain demersal species found in rocky shoals as well as other resources with unknown potential in deep waters.

Table 6. Stock status of selected species under management by the ICCAT. The explanation of what the different colours represent is shown below.

Species	Catch in 2017 (unit: 000 tons)	MSY estimate (unit: 000 tons)	Relative Biomass	Relative Fishing Mortality	Overfished	Overfishing	Kobe colour codes	Year of full assessment
Tropical tunas								
Bigeye tuna	78.5	76.2 (72.7-79.7)	0.59 (0.42-0.80)	1.63 (1.14-2.12)	Yes	Yes		2018
Skipjack tuna: East Atlantic	242.3		Likely >1	Likely <1	Not likely	Not likely		2014
Yellowfin tuna	139.3	126.3 (119.1 – 151.3)	0.95 (0.71-1.36)	0.77 (0.53-1.05)	Yes	No		2016
Billfish								
Swordfish: North Atlantic	10.0	13.1 (11.8-15.0)	1.04 (0.82-1.39)	0.78 (0.62-1.01)	No	No		2017
White marlin	0.40	0.87-1.60	0.50 (0.42-0.60)	0.99 (0.75-1.27)	Yes	Not likely		2012
Blue marlin	2.0	3.1 (2.4-3.5)	0.69 (0.52-0.91)	1.03 (0.74-1.50)	Yes	Yes		2018
Sailfish: East Atlantic	1.6		0.22-0.70	0.33-2.85	Yes	Possibly		2016
Sharks								
Blue shark: North Atlantic	39.7		1.35-3.45	0.04-0.75	Not likely	Not likely		2015
Shortfin mako shark: N. Atlantic	3.1		0.57-0.95	1.93-4.38	Yes	Yes		2017

Note: Stock status definitions and colour code

Source: ICCAT

Biomass (B) Fishing Mortality (F)	Overfished (Byear/BMSY< 1)	Not overfished (Byear/BMSY≥ 1)
Subject to overfishing (Fyear/FMSY> 1)		
Not subject to overfishing (Fyear/FMSY≤ 1)		
Not assessed / Uncertain		

3.2.1 *Tuna resources*

Tunas are identified as highly migratory stocks under Annex 1 of the UNCLOS[7]. Their management is conducted through the RFMO, ICCAT.

The main tuna resources in Cape Verde are yellowfin (*Thunnus albacore)* and skipjack (*Katsuwonus pelamis)*. Yellowfin was assessed in 2019 by ICCAT as being below sustainable levels but was not considered subject to excessive fishing pressure, while skipjack was assessed in 2014 as being within sustainable levels. Bigeye tuna (*Thunnus obesus)* represents another important species, which was assessed in 2018 as being below sustainable levels and continues to be overfished.

3.2.2 *Shark resources*

An ecological risk assessment of Atlantic shark stocks in 2010 and 2012 showed that blue shark is the most productive of all pelagic shark species and is therefore capable of sustaining relatively high levels of fishing mortality compared to less productive shark species (Amador et al., 2018).

[7] https://www.un.org/Depts/los/convention_agreements/texts/unclos/annex1.htm

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The latest Atlantic blue shark stock assessments were conducted by the ICCAT in 2015, which showed that the North Atlantic stock was unlikely to be overfished, despite high levels of uncertainty.

A report by the Cape Verdean fisheries research institute regarding the conservation and management of sharks in Cape Verde (INDP, 2017) noted limited scientific information. The report claimed that not all countries exploiting shark resources in the region fully declare their catches, thereby reducing the validity of abundance estimates. The study concluded that "Without an observer scheme, there is limited accurate information. For the species, there is an urgent need to create management measures and regulations to mitigate the fishing effort until we have statistical information and biological data that is robust and consistent."

3.2.3 *Swordfish resources*

From 2014-2017, the average total catch of swordfish in the North Atlantic was 20 812 tonnes (ICCAT, 2018 SCRS report), whereas the EU fleet in Cape Verdean waters accounted for 0.4% of the total catch. On average, swordfish accounted for 86% of other catch categories by the EU fleet from 2014-2017 in Cape Verdean waters.

In 2017, swordfish accounted for only 1% of the reported catches by the EU fleet and are registered under "other catch" in the logbook; however, swordfish is one of the most important species for some Spanish operators and must be counted as a target species for them.

3.2.4 *Other resources*

Local fishers mostly catch small pelagic and demersal fish. Stocks of small pelagic species are understood to substantially fluctuate between years. The abundance of small pelagic species is mostly impacted through predation by tunas rather than fishing mortality. Most demersal species are caught with handlines, along with tunas. Recent demersal catch data broken down by species were not available, resulting in an uncertain stock status regarding various demersal fishes.

Cape Verde provides important nesting sites for several sea turtle species. The nesting population of loggerhead turtles (*Caretta caretta*) is considered the second largest population in the Atlantic and the third largest in the world (Marco et al., 2011). The National Plan for the Conservation of Sea Turtles was adopted in 2010, but the bycatch of sea turtles in longline fisheries represents a global problem. Reports show turtle bycatch in Cape Verdean waters by European longline vessels (Santos et al., 2012). Research conducted by Santos et al. (2012) examined the effects of hook and bait on sea turtle catches in the pelagic longline fishery in the equatorial Atlantic, which showed significant bycatches and mortality of sea turtles in the fishery. ORPAGU, which represents the Spanish surface longline fleet targeting swordfish and blue shark in Cape Verde, have taken steps to reduce turtle bycatch by promoting courses for turtle capture mitigation and release management[8]. The EU purse seiner fleets pursue voluntary approaches to reduce the impact of fishing on bycatch species, including the use of less-fatal Fish Aggregating Devices (FAD) and procedures for maximising the survival rates of released marine turtles[9].

[8] http://fipblues.com/en/archivos/962

[9] https://www.lavozdegalicia.es/noticia/maritima/2018/05/28/palangreros-gallegos-aprenden-primeros-auxilios-tortugas/0003_201805G28P22992.htm

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4 Fishery Management in Cape Verde

4.1 Management plan

The current management plan is named the Cape Verde Fisheries Management Plan (PGRP), which was adopted in 2004 under the National Environment Plan 2004-2014 (Plano de Acção Nacional para o Ambiente - PANA II) to ensure that the fisheries of Cape Verde contribute to increasing national production, food safety, quality of fishery products, and employment as well as to decreasing the balance of payments deficit. The PGRP proposes measures to rationally exploit fisheries' resources and to develop the fisheries sector in a sustainable manner. This plan also addresses shark fishery by foreign vessels.

A review of the plan is pending; in the meantime, the plan is implemented through Biannual Executive Plans published in the Boletim Oficial da República de Cabo Verde, which details the regulations and management measures (FarFish, D3.3). The current execution of the plan concerns the period 2018-2019. The plan sets several policy restrictions on foreign fishing as well as measures targeting specific fisheries, including foreign fishing. Regarding tuna fishing, the plan estimates the potential available in the EEZ, allows gradually developing the fishery, and proposes a cautious expansion of fishing efforts by controlling the issued number of fishing licenses. Fishing for live bait by foreign vessels is prohibited within 12 nautical miles. Live bait is usually caught within 3 nautical miles in an area exclusively reserved for artisanal fishing; however, support vessels are allowed to catch live bait in bays and non-inhabited areas within 3 nautical miles. Bait caught under such conditions shall under no circumstances be marketed for consumption (FarFish, D3.3).

The INDP is elaborating a National Plan of Action (NPOA) for the conservation and management of sharks in the EEZ of Cape Verde with the support of FAO[10]. The plan will be aligned with the FAO International Plan of Action (IPOA) and ICCAT recommendations to conserve and manage sharks. The catches of sharks have also been a part of the new protocol negotiations between the EU and Cape Verdean authorities. Article 6 (EU, 2019) says that the EU and Cape Verdean authorities shall monitor the evolution of captures, fishing efforts, and the state of fishery resources in the Cape Verdean fishing zone for all species covered by this protocol. The parties agree to improve data collection and analysis in order to draft a national action plan to conserve and manage sharks in the Cape Verdean EEZ.

4.2 Common Fisheries Policy

The EU has established a system concerning fishing activities of EU vessels fishing outside EU waters under the SFPA and in the high seas[11]. The Common Fisheries Policy (CFP) requires SFPAs to be limited to surplus catches and stresses the need to promote the objectives of CFP internationally, ensuring that EU fishing activities outside EU waters are based on the same principles and standards as those applicable under EU law while promoting a level playing field for EU and third-country operators. The main objective of the CFP is to ensure that fishing activities are environmentally, economically, and socially sustainable. In addition, fishing activities must be managed consistently with the objectives of

[10] http://www.fao.org/ipoa-sharks/background/about-ipoa-sharks/en/

[11] REGULATION (EU) 2017/2403 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 December 2017 on the sustainable management of external fishing fleets, and repealing Council Regulation (EC) No 1006/2008

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achieving economic, social, and employment benefits as well as restoring and maintaining fish stocks above levels that can produce maximum sustainable yield and contribute to food supplies' availability.

In addition, the EU has committed to Sustainable Development Goal 14[12] (SDG 14) and Sustainable Development Goal 12[13] (SDG 12). EU vessels operating under the SFPA shall comply with all recommendations adopted by ICCAT (SFPA protocol, Appendix 2, Chapter III Technical conservation measures). All EU vessels fishing under the SFPA must keep a fishing logbook (Appendix 4 Vessel monitoring systemin, SFPA protocol), and all vessels fishing tuna must report data regarding nominal catch (Task I) and catch and effort (Task II) to the ICCAT.

4.3 Relevant ICCAT recommendations

To ensure conserving the North Atlantic Swordfish, the ICCAT recommends maintaining B_{MSY} with greater than 50% probability (ICCAT 2016, Rec. 17-02). The total allowable catch (TAC) shall be 13,200 tonnes for swordfish for 2018, 2019, 2020, and 2021. Several ICCAT recommendations apply to the fisheries in question.

5 Specific challenges in Cape Verde

Specific challenges have been identified for the Cape Verde CS regarding data collection and insufficient Monitoring, Control, and Surveillance (MCS).

5.1 High level of uncertainty in data collection

There is a need to harmonise data collection and processes between the EU and ICCAT. This need has been raised by EU operators due to a perceived lack of consistency in documentation requirements of the EU, ICCAT, national flag states, and coastal state authorities. There are also concerns about the flow of data to authorities and how they are transmitted between administrations, which includes the processing and handling of data and the ('lack of') feedback provided to operators contributing to inconsistencies.

Another related issue raised by EU operators concerns the data collected through the scientific observer program by the Spanish Institute of Oceanography (IEO, Spain). There are concerns that the data are not being used to their full potential and are not feeding stock assessments in the ICCAT. The recommended OT 3.3 was thus defined to overcome this issue (strengthened scientific observer program in place).

These concerns and defined OTs must involve relevant authorities and should represent a joint effort between authorities and operators to achieve progress.

APPENDIX 2 of the new SFPA (Art. 6) describes measures to promote a national plan for the conservation and management of sharks. During the period covered by this protocol, the EU and Cape Verdean authorities shall endeavour to follow the evolution of catches, fishing efforts, and state of resources in the Cape Verdean fishing zone for all species regulated by the protocol. The parties agree

[12] SDG14: conserve and sustainably use the oceans, seas, and marine resources for sustainable development.
[13] SDG12: Ensure sustainable consumption and production patterns and their targets

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to intensify the collection and analysis of data to develop a national plan to conserve and manage sharks in the Cape Verdean EEZ.

One main challenge is that oceanic sharks (including blue shark) have been listed as miscellaneous fish in the logbook. This listing posed problems in practice due to ignoring the reality that blue shark comprised most of the recent year's catches in Cape Verde under the SFPA (near 80%) for the ORPAGU fleet, which generated inspection conflicts due to ambiguity of a directed rather than a secondary or bycatch fishery. Inspired by the operators' request, the current SFPA has included blue shark as a species listed in the logbook. The quality of reporting is expected to increase and positively affect control and inspection procedures. In addition, EU operators are involved in identifying various shark species to prevent including other sharks in miscellaneous fish. This progress has been achieved during the transition from MR1 to MR2.

5.2 Insufficient control and monitoring in the Cape Verdean EEZ

The fight against Illegal, unreported, and unregulated (IUU) fishing is important for sustainable fisheries and ensures a level playing field for all fleets fishing within the Cape Verdean EZZ. Monitoring and control represent important parts of this work. The case study leader for Cape Verde has highlighted insufficient control and monitoring as a challenge in addition to non-compliance of the Cape Verde Fisheries Management Plan (PGRP) by foreign vessels, particularly Asian fleets. Competition with national commercial fleets has also been mentioned as a challenge. Amador et al. (2018) emphasise the ineffectiveness of monitoring and surveillance in Cape Verde, where sharing European logbooks represents the sole means to determine catches (FarFish, D3.4). EU vessels are obliged to transmit their position with a satellite monitoring system (VMS) to their flag state[14]; for example, ORPAGU vessels send their VMS positions (location and speed) every second hour to their flag state (Spain), which subsequently transmits these data to Cape Verdean authorities when fishing in their EEZ. Some technical challenges have affected data transmission between states, but the Electronic Reporting System (ERS) has been technically solved (discrepancies and incompatibilities) and can acquire information nearly in real-time (8-hour delay) regarding landing declaration, captures, tracking vessels entering the EEZ, or transhipment. Nevertheless, training is needed for inspectors and COSMAR staff to address new ERS complexities.

The Automatic Identification System (AIS) represents another compulsory monitoring system for vessels over 300 gross tonnages (GT) engaged in international cruises, which shares real-time maritime and ship traffic information. Tracking AIS signals may aid monitoring and conserving marine ecosystems. The IMO Convention for the Safety of Life at Sea (SOLAS) Regulation V/19.2.4[15] requires vessels to always operate AIS Class A onboard unless there are valid security reasons to turn it off temporarily. The AIS was intended to increase security at sea and support ship-to-ship collision avoidance. Because AIS transposes dynamic information such as ship position, course, speed, type of ship, navigational status, and IMO number, the combined processed AIS data can provide valuable information to authorities and researchers. In 2014, the EU required the entire fishing fleet >15 m to install AIS Class A transmitters (Shelmerdine, 2015).

[14] Protocol between European Union and Cape Verde, Appendix 4, Vessel Monitoring System

[15] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/343175/solas_v_on_safety_of_navigation.pdf

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Because AIS represents an open-source information system, EU operators transmitting AIS are continuously monitored by competitors and experience a public exposure of their fishing activity. EU operators have consequently been expelled from traditional fishing grounds due to increasing competition and the proliferation of Asian vessels.

5.3 Data flow

Figure 3 illustrates the flow of data concerning catch reporting from ORPAGU vessels, which applies to all EU vessels fishing in Cape Verde. According to the conditions set in the SFPA and associated protocol, EU vessels are required to report their catches and fishing activity in Cape Verdean waters. The capacity to receive data from e-logbooks in Cape Verde has represented an issue before the ERS was in place, when data were received through a logbook template akin to a paper-based system, while the EU flag states utilise the ERS.

From the perspective of EU fishing vessels, they fed data to two separate systems: the Cape Verdean authorities and vessel flag state authorities (as well as DG MARE). The fact that one system was electronic and the other akin to a paper-based system led to difficulties reconciling the end-product such as aggregated data. This difference led to data discrepancies reported to the ICCAT by Cape Verde and the EU (DG MARE) regarding the catch, bycatch, and discards of EU vessels in Cape Verde. Although the ERS is now in place, training is needed for inspectors and COSMAR staff to address new ERS complexities.

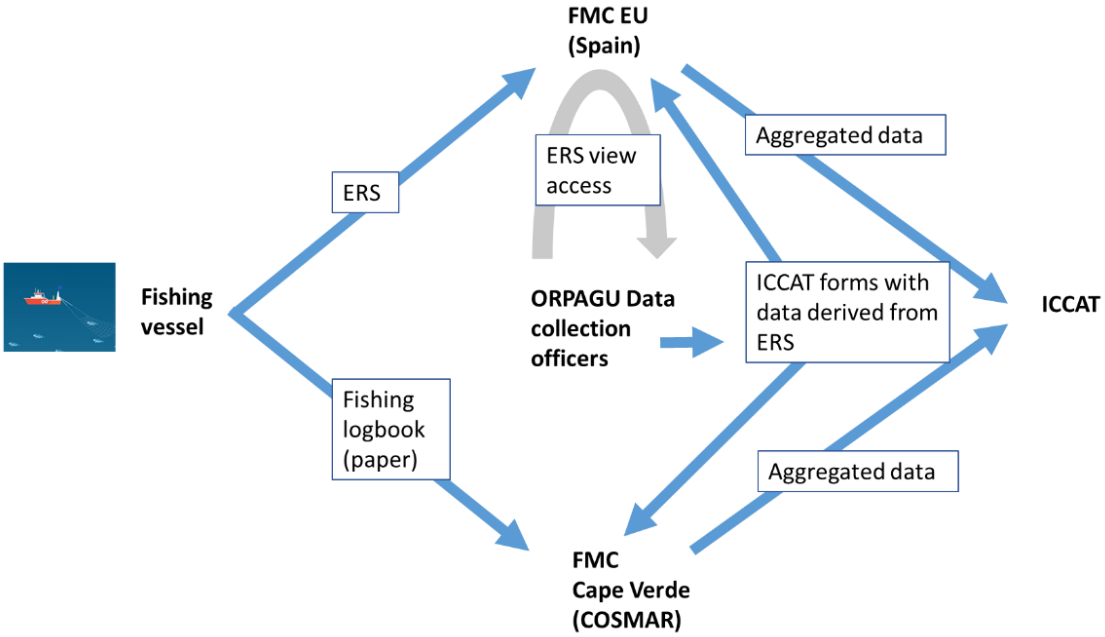

Figure 3. Transmission of catch data from ORPAGU vessels fishing under the SFPA in the Cape Verdean EZZ before the ERS system was in place. FMC: Fisheries Monitoring Centre, ERS: Electronic Reporting System (electronic fishing logbooks).

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6 Outcome Targets and Indicators

Outcome targets (OTs) are specific and measurable requirements set by an authority to make management goals operational. An OT is a statement of the condition of an indicator relative to a reference point, often in the form of inequality ('A>B') or a statement of presence or absence of some entity. An OT should commonly be SMART, meaning specific, measurable, attainable, relevant, and time-based.

The RBM approach depends on incentivising operators to develop MRs for a given fishery.

The OTs set for the Cape Verde CS were based on "MR1" (FarFish, D4.3), the "Audit of MR1" (FarFish, D5.1), and consultation with authorities, operators, and other stakeholders in the fishery (e.g., Workshop in Mindelo, Nov. 2019). The suggested OTs were defined in the "Second MR Invitation" (FarFish, D3.6), and four OTs were identified for Cape Verde, with two being obligatory and two recommended.

Table 7. OTs in MR2 for the Cape Verde fisheries

OT 3.1	Obligatory	A harmonised catch data protocol in place that facilitates improved reporting of swordfish and blue shark commercial and biological data
OT 3.2	Obligatory	All vessels transmit AIS and/or VMS signals
OT 3.3	Recommended	Strengthened observer programme in place
OT 3.4	Recommended	Trade flow data from operators provided

6.1 Changes in OTs between MR1 to MR2

Four OTs were identified in MR1 for Cape Verde, all of which are included in MR2. Some OTs' wording has been changed to address broader challenges or create more concrete targets. These changes are described below for transparency (Table 8).

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Table 8. Changes in OTs between MR1 to MR2 for Cape Verde.

OTs in MR1	OTs in MR2	Changes
OT 3.1 A harmonised catch data protocol in place that facilitates improved reporting of swordfish and blue shark commercial and biological data. **(Obligatory)**	**OT 3.1** A harmonised catch data protocol in place that facilitates improved reporting of swordfish and blue shark commercial and biological data. **(Obligatory)**	No changes
OT 3.4 Commitment to transmit VMS/AIS signals. **(Obligatory)**	**OT 3.2** All vessels transmit AIS and/or VMS signals **(Obligatory)**	The OT was reworded and the OT number changed from 3.4 to 3.2
OT 3.2 Setting of conditions for better coordination of observer programme: content (protocols, criteria), schedules, processes, sharing of information. **(Recommended)**	**OT 3.3** Strengthened observer programme in place. **(Recommended)**	This OT was postponed from MR1 to MR2. In the process, the OT was reworded to create a more concrete target. Nevertheless, the meaning of the OT remained the same. OT number changed from 3.2 to 3.3
OT3.3 Increase knowledge and data collection of trade flow to include, e.g., destination, utilisation, quantity, value. **(Recommended)**	**OT 3.4** Trade flow data provided. **(Recommended)**	This OT was postponed from MR1 to MR2 because it was a recommended OT. The nature of trade flow data can include business-sensitive information, which could have hindered this OT's achievement; therefore, the OT was reworded to provide a broader scope for ensuring its achievement. The OT number changed from 3.3 to 3.4

6.2 Indicators

The suggested indicators in FarFish were set to measure the degree of adherence to the OT (Table 9) and are classified in three dimensions: ecological, socio-economic, and governance. The indicators were classified according to their level of measurability. The most detailed indicator category A is where the level of OT achievement is quantitative and measured in percentage. Indicator category B is qualitative, where the level of OT achievement is considered to be high (score 4), moderate (score 3), fair (score 2), low (score 1), or not present (score 0). The last indicator, category C, is binomial and measured to have only two outcomes: yes (score 1) or no (score 0), true or false, success or failure.

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Table 9. FarFish indicator categories and the level of OT achievement

Indicator category	Level of OT achievement				
A	0%	25%	50%	75%	100%
B	Not present (NP) 0	Low level (LL) 1	Fair level (FL) 2	Moderate level (ML) 3	High level (HL) 4
C	No (False/Failure) 0				Yes (True/Success) 1

6.3 OT 3.1: A harmonised catch data protocol in place that facilitates improved reporting of swordfish and blue shark commercial and biological data

No changes have been made to this OT between MR1 and MR2.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Improve data collection in conformity with ICCAT on directed catch and bycatch of swordfish and blue shark	• Perform an analysis of all current catch data protocols, forms, and templates, which the EU fleets are obliged to submit to their flag state, Cape Verde, and ICCAT • Provide a template for reporting as well as suggestions regarding how effective harmonisation can be achieved

OT 3.1 was obligatory and targeted establishing a harmonised data protocol that facilitates improved reporting on the catch of swordfish and blue shark. Key activities included analysing data protocols (logbooks) as well as providing a template for reporting and suggestions regarding how effective harmonisation can be achieved.

Progress:

The following data collection systems were identified as having direct relevance to the EU tuna fisheries in Cape Verde: EU e-logbook system, logbook defined in the SFPA (paper-based), Cape Verde fisheries data collection system, and a proposed e-logbook and observer scheme (developed with support from DG MARE).

An analysis of all current catch data protocols performed by CCMAR concludes that the EU e-logbook system used by EU vessels enables collecting relevant data regarding swordfish and blue shark as well as their transmission to all relevant parties (FarFish, D2.4). A harmonised catch data protocol has thus already been designed (Appendix 1).

The capacity to implement a compatible system with e-logbook data from EU vessels represented an ongoing issue since 2015 and has been solved; however, training is needed for inspectors and COSMAR staff to address data complexities.

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Short-term recommendations that may be achieved during the FarFish project lifetime:

- Establish a data revision and reconciliation process/mechanism involving the relevant flag states and institutions in Cape Verde (by the end of 2021).
- Cape Verdean authorities raise the need to address data consistency and scientific issues to include in the next Joint Scientific Committee meeting. Operators and scientific institutes (including IMAR) are invited to participate (2021).

Longer-term and/or broader recommendations:

- In the context of the ICCAT, call for harmonising data collection from tuna fisheries (logbook templates). Work towards implementing existing proposals (section on final considerations) by 2025.
- Call for the ICCAT to promote and develop ERS for coastal states (by 2025).
- Implement the observer program and self-sampling (or logbook scheme) proposed for Cape Verdean national fisheries, and allocate SFPA sector support funding for this purpose (2021-2025).
- Establish the requirement for all foreign vessels (EU and non-EU) to use an ERS that can communicate with the system envisaged for Cape Verde (by 2025).

6.3.1 *Level of OT 3.1 achievement*

Indicator		Indicator category	Indicator baseline	Indicator achievement	Responsible entity	OT dimension
I_1_CS3	Data flow described	C	0 (No)	1 (Yes)	CCMAR	Ecological
I_2_CS3	Improved data recording in e-logbooks of all catches (target and bycatches)	C	0 (No)	1 (Yes)		
I_3_CS3	Harmonised protocol designed	C	0 (No)	1 (Yes)		
I_4_CS3	Harmonised protocol implemented	C	0 (No)	0 (No)	ICCAT	

Indicators 1 and 2 were achieved. The data flow has been described and data recording has been improved since the blue shark is now listed as a species in the e-logbook. The quality of reporting is expected to increase and positively affect control and inspection procedures. Blue shark was previously registered as miscellaneous fish in the e-logbook.

Indicator 3 was also achieved since a harmonised protocol has been designed. The EU e-logbook system enables collecting relevant data regarding swordfish and blue shark as well as their transmission to all relevant parties.

Indicator 4 was not expected to be achieved within the FarFish project; however, the ICCAT is working towards harmonising data collection from tuna fisheries (logbook templates) and implementing existing proposals in the long term.

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6.3.2 *Main risk for achieving OT 3.1*

There was no risk for achieving OT 3.1 within the EU fleet, because a harmonised catch data protocol that facilitates improved reporting swordfish and blue shark commercial and biological data has been designed. The risk occurs when the rest of the fishing fleet operating in Cape Verdean waters does not implement a similar harmonised protocol. The FarFish project identified a harmonised protocol, but the project needed to rely on other entities to implement it.

6.4 OT 3.2: All vessels transmit AIS and/or VMS signals

In MR1, this OT was defined as "Commitment to transmit VMS/AIS signals" but was reworded to "All vessels transmitting AIS and/or VMS signals" in MR2. The OT number was changed from OT 3.4 in MR1 to OT 3.2 in this MR.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Support the fight against IUU fishing by utilising the latest available satellite systems and tools.	• Facilitate initiative to access VMS/AIS data from Cape Verde for EU and non-EU fleets. • Analyse VMS data (if available) and compare with the AIS data obtained from the Global Fishing Watch.

OT 3.2 was obligatory and aimed to support the fight against IUU fishing by analysing VMS data and comparing them with AIS data from Global Fishing Watch (GFW) by utilising the latest available satellite systems and tools. The EU fleet is committed to transmitting both VMS and AIS signals. This OT was included to increase pressure on other international fleets operating in the area[16] to commit to VMS/AIS transmission as well, which ensures a level playing field regarding compliance and transparency of fishing activities. EU operators requested this OT during development of the MR.

Progress:

In MR1, some technical issues experienced by the EU fleet transmission of VMS signals and Cape Verde problems to receive the data were described. According to the DGRM (General Directorate of Marine Resources), this incompatibility of the software and hardware to receive data reported by the EU fleet has been eliminated. The systems now work properly and receive data in time record as well. The ERS receives data from both EU and non-EU vessels.

The FarFish project requested VMS data from COSMAR, the main player for maritime safety in Cape Verde. COSMAR receives VMS data, but the data are managed by IGP services (General Inspection of Fisheries), which must authorise access to the data, but these data may be confidential, and the FarFish project could not yet receive feedback on this issue.

Geolocalisation, also known as geotracking, determines or estimates the geographic position of an object. Without access to VMS data, they cannot be compared with AIS data obtained from the GFW.

Short term: IMAR will ask the Ministry of Fisheries to initiate a round table to further develop training strategies and a protocol regarding efficient data sharing. This action is proposed to occur during the

[16] "Cape Verde undertakes to apply the same technical and conservation measures to all industrial tuna fleets operating in its fishing zone to contribute to proper fisheries governance "(Protocol, Article 1, Principles 1).

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annual Ocean Week in Cape Verde in November 2021. IMAR, COSMAR, and IGP are all expected to contribute to establishing and implementing the protocol for efficient data sharing.

Long-term: Joint Scientific Committee or General Inspection of Fisheries (IGP) provides VMS data and map to allow identifying non-EU vessels that only transmit AIS.

6.4.1 *Level of OT 3.2 achievement*

	Indicator	Indicator category	Indicator baseline	Indicator achievement	OT dimension
I_5_CS3	Proportion of vessels, either EU or non-EU, with geolocalisation	A	0%	Not able to evaluate	Governance
I_6_CS3	Proportion of vessels, either EU or non-EU, with redundant (AIS+VMS) geolocalisation	A	0%	Not able to evaluate	

Due to the lack of available data, indicators 5 and 6 could not be evaluated within the FarFish project, and therefore the OT was not possible to achieve. The "and/or" in the OT should be replaced with "and" to allow evaluating compliance between AIS and VMS.

Nevertheless, these two indicators importantly determine the achievement of OT 4.3 if and when data are made available.

6.4.2 *Main risk for achieving OT 3.2*

This OT regards management measures identified in management plans (National, SFPA, ICCAT, and the SOLAS convention (for AIS)). Multiple risks emerged during the project time, however, which constrained the achievement of OT 3.2, especially the EU fleet's lack of access to VMS data from the country or state of the vessel. Nevertheless, the efforts of the FarFish project to obtain the data must be highlighted.

6.5 OT 3.3: Strengthened scientific observer program in place

In MR1, this OT was defined as "Setting of conditions for a better coordination of observer programme: content (protocols, criteria), schedules, processes, sharing of information" but was reworded to "Strengthened scientific observer programme in place" in MR2.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Improve the use of observer data and feed them into stock assessment in the context of ICCAT	• Designing an observer programme • Facilitating conditions for better coordination of observer program

The recommended OT 3.3 aimed to strengthen the observer program to improve the use of scientific observer data and feed them into stock assessment in the ICCAT. This OT would be achieved by designing an observer programme and facilitating conditions to better coordinate a scientific observer program.

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Progress:

FarFish directed attention to work funded by the EU Commission with reference to "Framework Contract ARE/2012/21 on the 'Scientific advice for fisheries beyond EU waters: specific contract no. 7", which proposed a logbook and self-sampling scheme and provided training to observers (Coelho et al., 2017). CCMAR (FarFish, D2.4) produced materials and training for establishing an onboard observer program, including manuals, sampling protocols, and a self-sampling programme protocol with respective data collection forms (Appendix 2) in cooperation with Cape Verdean scientists to train technicians. These forms are currently used in EU national observer programs. Furthermore, a relational database was developed in cooperation with IMAR in Cape Verde to store current and historical fisheries data from EU and non-EU fleets operating in the Cape Verde region, thereby facilitating data storage, processing, and compilation.

There is no provision for scientific observers in Cape Verdean legislation. The country lacks an observer programme in place and does not participate in the ICCAT Regional Observer Program (FarFish, D2.4). Despite several attempts at training and establishing such an observer programme, they have not yet been successful, which is primarily due to the lack of provisions in the fisheries legislation.

Implementing an observer program is recommended as a two-step process.

> Short term: A national pilot project should be developed to start the observer programme's implementation and testing phase.
>
> Long term: National funds and legislation will need to be secured by the government to guarantee the programme's long-term stability and viability and to maintain a continuous time series of data that can be used in future stock assessments.

6.5.1 *Level of OT 3.3 achievement*

Indicator		Indicator category	Indicator baseline	Indicator achievement	OT dimension
I_7_CS3	Observer program established	C	0 (No)	1 (Yes)	Ecological
I_8_CS3	Observer program in place	C	0 (No)	0 (No)	

An observer program has been established but is not in place primarily due to the lack of provisions in the fisheries legislation. This means that only indicator 7 has been achieved for this OT, and if the observer program is not in place, this OT will not be achieved.

6.5.2 *Main risk for achieving OT 3.3*

If there is no provision for scientific observers in the Cape Verdean legislation, an observer programme will not succeed, and implementation is recommended as a two-step process.

Implementing the observer programme depends on collaboration between skippers and crews in domestic and foreign vessels. Efforts by Cape Verdean authorities and scientists are required to promote this programme and secure the sector's participation.

Comprehensive and reliable fisheries data regarding catches of commercial species, bycatch, and discards are needed to improve knowledge and the scientific basis for managing fisheries. As a member

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of the ICCAT, Cape Verde has responsibilities regarding shark data collection consistent with ICCAT Recommendations on reporting Task I and Task II data (Art-IX in ICCAT Convention, Rec. 05-09 and Res. 66-01) as well as bycatch and discard data (ICCAT Rec. 11-10). This observer program could cover fleets fishing in Cape Verdean waters under license agreements and eventually a Cape Verdean domestic fleet.

6.6 OT 3.4: Trade flow data provided

In MR1, the authority defined this OT this as "Increase knowledge and data collection of trade flows to include for example destination, utilisation, quantity, value", but reworded to "Trade flow data provided" in MR2. The OT number was changed from 3.3 in MR1 to 3.4 in this MR.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Improve knowledge on the value chain, processing, and market conditions	Study harvest and trade flow on tuna ○ Gather catch and landing information ○ Gather processing information ○ Gather trade information

OT 3.4 was recommended and was suggested in the first MR invitation (FarFish, D3.2) since Cape Verdean authorities have minimal information regarding the trade flow of the tuna caught (by all fleets) within the Cape Verdean EEZ (FarFish, D4.3). In MR1, it was decided to postpone the recommended OTs to MR2.

OT 3.4 aimed to acquire better knowledge about tuna trade flows. Key activities included collecting trade data and conducting interviews with representatives from vessel operators, processors, traders, and national authorities.

Progress:

"Description of CS value chains" (FarFish, D3.4) provides an overview of the value chain, including information regarding vessels, catches, landings, processing, and trade from Cape Verde. Vessel data are gathered from the SFPA ex-ante evaluation report as well as data from GFW. Landing data regarding flag state, species, and quantity are obtained from IMAR along with data regarding landings originating from Cape Verdean port authorities.

Landing site information is obtained from UNIDO along with information about the three major processing firms and sites utilising tuna from foreign fleets. The ex-ante evaluation report provides the raw material sourcing, processing type, and general product mix of these firms. Although it is impossible to separate SFPA landings from other raw material sources, export statistics from ITC provide insights into product types and destination countries for tuna products from Cape Verde.

In addition to the general information, work is ongoing to expand on the processing and trade indicator. Interviews have been carried out to obtain more information about the product transformation, sales of finished products, and traceability information. This work is presented in "Report on the value chain analysis for EU fisheries" (FarFish, D3.9) as manuscript intended for journal publication focussing on tuna traceability and in a chapter describing the West-African tuna SFPAs. Catches and landings from EU vessels is described in relatively good detail from data that have been made available to FarFish. Processing and trade information is provided using interview information

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as well as publicly available trade data from ITC and Eurostat. This gives a relatively good overview of processing and trade, but the level of detail is limited.

6.6.1 *Level of OT 3.4 achievement*

Indicator		Indicator category	Indicator baseline	Indicator achievement	Responsible entity	OT dimension
I_9_CS3	Information on catch and landings provided	C	0	1 (Yes)	Nofima/UoP	Socio-economic
I_10_CS3	Information on processing and trade provided	C	0	1 (Yes)		

6.6.2 *Main risk for achieving OT 3.4*

The public trade flow data do not distinguish between products originating from the SFPA and other fisheries. The public statistics only cover exports, which includes raw materials from other fisheries. This OT thus heavily depended on information from interviews, where the primary risk regarded obtaining access to informants and informants' willingness to share information that may have been considered commercially sensitive. The COVID-19 pandemic and travel restriction limited the opportunity to conduct face-to-face interviews, which exacerbated gaining access to informants and their willingness to share information.

7 Other potential actions as supplement to the MR

Besides the OTs above, several potential tasks[17] have been identified that could strongly support the CS objectives identified in the MP0 (FarFish D4.1). These action points have not been included in the listed OTs since they cannot be (solely) operationalised by operators due to requiring input/action from other relevant parties (e.g., authorities, scientific institutions, other international fleets, etc.).

These tasks are as follows:

1. There is a data gap regarding trade flows within the value chains of Cape Verde, such as catches of all fleets operating within the Cape Verdean EEZ. There is fairly useful data regarding catches landed in Cape Verde (port of Mindelo) and the EU but limited data regarding catches landed in other African countries or transhipments. Cape Verdean authorities thus have little insight regarding what happens with much of the catches caught in their EEZ or regarding value streams. This also raises concern regarding food safety and value chain development, including local consumption and represents a gap that needs to be addressed.
2. Capacity building is needed within Cape Verdean institutions regarding tuna stock assessment and management. This task cannot be delegated to operators and needs to be addressed on other levels. (*Authority comment: To strengthen Cape Verdean administrative*

[17] ''Action points" were reworded to "potential tasks" in MR2 to clarify that these are not obligatory.

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and scientific capacity, a number of FarFish partner representatives from INDP/IMAR have participated in capacity-building initiatives or identified capacity building within the project. These are:

- *The UNU-FTP six-month training program (from which two INDP/IMAR employees have already graduated)*

3. A need has been identified for increased cooperation between Cape Verdean national authorities, relevant RFMOs, and the EU. *(Authority comment: This is partly addressed in OT1.*)

4. There is a need for electronic reporting through e-logbooks by all fleets operating within the Cape Verdean EEZ so that Cape Verdean authorities can fully monitor catches within their EEZ and thereby contribute to an improved stock assessment of local stocks (which may serve as prey for other important commercial species) and stocks assessed by the ICCAT. It is also important for authorities in Cape Verde (including INDP/IMAR) to have full access to the logbook data. The EU fleet is currently providing logbook data to flag states, but to decrease uncertainty in stock assessment, fleets operating within the area need to provide such data.

5. The development of VMS/AIS digital maps that clearly show a) fishing activities of EU fleets and other fleets and b) frequency of VMS/AIS gaps, which can be valuable to evaluating compliance to agreements and requirements of the ICCAT. Such development is not within the power of operators to facilitate, however, which is why it cannot represent an official OT.

6. There is a need to increase research into the socio-economic and ecological impacts of FADs. Analysis (including trade-off analysis) is required regarding the economic impacts of using drifting FADs in Cape Verdean waters and estimating the economic consequences of reducing the number of allowable FADs. This could lead to identifying the optimal number and spatial distribution of drifting FADs. (*Authority comment: Although this is important, the workload of such an investigation was too comprehensive to be properly addressed within the FarFish project.)*

7. There is a need to strengthen collaboration to design and further implement an experimental pilot-plan for monitoring blue shark within the Cape Verdean EEZ. A first step has been taken in the newly signed (2019) SFPA protocol, where blue shark is now identified as a target species. This pilot plan should be designed and implemented fairly soon since it is needed to evaluate whether Cape Verdean authorities could assume responsibility of running it. (*Authority comment: FarFish partners INDP/IMAR and ORPAGU were interested in contributing to such a pilot plan, which likely could be linked to the development of the "National action plan for the conservation and management of sharks in the Cape Verdean EEZ").*

8. The EU fleet, particularly surface longliners, are involved in relevant actions that demonstrate best practices supporting the sustainable management of blue shark and swordfish stocks. These practices should be disseminated and acknowledged in a credible and transparent manner beyond what is currently done. Potential pathways for cooperation between authorities, operators, and the scientific community should therefore be

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expanded, such as by utilising the 30 years of data from scientific campaigns available for the above-mentioned species as well as a proven track record regarding scientific cooperation.

9. Complementary measures should be integrated into an action plan to support the development, capacity, and modernisation of the national fishing fleet. This integration requires a transitioning process that includes technological development and capacity building, such as social organisation, processing sector, commercial vision, etc. The capacity building could be linked to 'Escola do Mar' for fisheries and coastal navigation training. (*Authority comment: FarFish contributed to capacity building within Cape Verde in a number of ways, including the UNUFTP programme, regional training, and the university diploma programme; however, the ability of FarFish to impact complementary measures to support modernisation of the national fleet was unclear. The work done within value chain analysis (D3.9) and analysis of the potential return of investment by the EU fleet (D5.3) could provide background for such work).*

10. Cabo Verde data on catches, landings, and trade flows are of relatively favourable quality, well organised and provide useful insights regarding trade flows into the highly competitive and well-developed tuna value chains. The contributions from the information provided through these indicators are thus not likely to result in considerable socioeconomic gains, and it does not seem highly relevant to pursue them in future projects. The EU and Cabo Verde would find greater relevance in information regarding operating costs and profitability to enable better discussing sharing added value and access fees.

8 Conclusion

Analysing existing catch data protocols shows that the e-logbook system used by EU vessels enables collecting relevant data regarding swordfish and blue shark. The FarFish project has identified a harmonised protocol, but the project must rely on other entities for implementation in non-EU vessels.

The established observer program can cover fleets fishing in Cape Verdean waters under license agreements and the Cape Verdean domestic fleet. The observer program will increase reliable fisheries data regarding catches of commercial species, bycatch, and discards, thereby improving knowledge and the scientific basis for managing these fisheries. To establish this observer program, efforts must be made by Cape Verdean authorities, especially DNEM.

To improve the MCS in the area, access to AIS and VMS data is necessary to verify compliance. The national authorities have access to data, but these data are sensitive and cannot easily be shared with others; however, if the data are made available, analysing VMS and AIS represents a useful method to verify AIS and VMS compliance.

9 Auditor

FarFish partner Sjókovin conducted two audits following the RBM process, The first audit on documentation system conformance and the second audit on performance effectiveness and compliance. The final audit of this MR will not be conducted.

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Appendix

Appendix 1.

Suggested harmonised catch data protocol (logbook template used by ORPAGU operators)

ZEE: CABO VERDE				ICCAT LOGBOOK For TUNA FISHERY				Palangrero de Superficie	X																				
NOMBRE BUQUE				Toneladas Brutas																DÍA		MES		AÑO		Puerto			
BANDERA				Capacidad (M.T.)																									
MATRÍCULA				CAPITÁN				Puerto de Salida																					
COMPAÑÍA				Fecha				Puerto de Entrada																					
DIRECCIÓN				Enviado por:				Días de marea				Dias de Pesca				Tripulantes													
DATOS		AREA		CAPTURAS																									
MES AÑO	DÍA	Latitud N	Longitud W	Agua °C	Anzuelos	SWO Espada		SMA Marrajo		BSH Quella		BET Atún		SAI Pez vela		LMA marr. M		SSP Marlín		WAH Peto		DOL Lampuga		LEC escolar		TOTALES			
						Nº	PESO	Nº	peso	Nº	PESO	Nº	PESO	Nº	PESO	Nº	PESO	Nº	PESO	Nº	PESO	Nº	PESO	Nº	PESO	PESO			
	1																									0			
	2																									0			
	3																									0			
	4																									0			
	5																									0			
	29																									0			
	30																									0			
	31																									0			
	Pesca Mes Especies (solo Kg.)						0		0		0		0		0		0		0		0		0		0	0			

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Appendix 2.

Form developed for the self-sampling scheme to register data on catch and bycatch by haul in the longline fishery. The project provides a detailed guide on how to install the Excel workbook and its configuration as well as the data to be entered. There are 31 sheets, one for each daily haul in a month.

				Latitude (º ' S/N)			Longitude (º ' S/N)																		
Dados do lance	Data	Nº lance	Posição inicial	01°	03'	N	34°	24'	W	Rumo	Profundidade pesca	Nº anzóis	Nº bóias	Tipo estralho	Vento	Lua	Temperatura (ºC	Nº Tartarugas libertadas	Nº Tartarugas mortas	Nº Aves capturadas	Cetáceos				
	26.03.14	1	Posição final	06°	05'	N	34°	24'	W	180	30	1140	18	AÇO	45	MENG	27ºC	2	0	Não	Não				

Espécie	Espadarte (SWO)	Tintureira (BSH)	Anequim (SMA)	Atum-patudo (BET)	Atum-albacora (YFT)	Atum-voador (ALB)	Espadim-azul (BUM)	Espadim-branco (WHM)	Veleiro (SAI)	Escolar (LEC)	Doirado (DOL)	T.luzidio (FAL)	T.pt.branca (OCS)	T.martelo (SPN)	T. sardo (POR)	An. gadanha (LMA)	Atum rabilho (BFT)
Capturas lance peso-vivo	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos
	416	697	0	219	402	0	128	0	0	0	0	0	0	0	0	0	0
Comprimentos dos peixes capturados (incluindo os de pequena dimensão)	160 170 175 205 130 130 140 115	230 230 215 205 205 200 200 190 190 185 180 180 170 170		130 130 160 120	110 160 170 150 160 150		200 195										
Nº peixes não medidos																	

	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos	Quilos
Total peso vivo	416	697	0	219	402	0	128	0	0	0	0	0	0	0	0	0	0
Total peso limpo	316	333	0	168	309	0	106	0	0	0	0	0	0	0			

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CASE STUDY 4

SENEGAL

Deliverable No. 4.4

Project acronym:
FarFish

Project title:
Results-Based Management and Capacity building for EU Sustainable Fisheries Partnership Agreement and international waters

Grant agreement No: **727891**
Project co-funded by the European Commission within the Horizon 2020 Research and Innovation Programme

Start date of project: **1st June 2017**
Duration: **54 months**

Due date of deliverable:	30/11/2020
Submission date:	30/11/2021
File Name:	FarFish_D4.4_MR2 Senegal
Revision number:	02
Document status:	Final
Dissemination Level:	PU[1]

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[1] PU: Public, PP: Restricted to other programme participants (including the Commission Services), RE: Restricted to a group specified by the consortium (including the Commission Services), CO: Confidential, only for members of the consortium (including the Commission Services)
[2] The initials of the revising individual in capital letters

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Deliverable D4.4

Management Recommendation 2
Senegal

30/11/2021

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Summary

This document serves to update the draft proposal for a Management Recommendation (MR2) for the black hake fishery under the Sustainable Fisheries Partnership Agreements (SFPA) between Senegal and the European Union (EU). The MR2 draft proposal was internally submitted for the second audit iteration within the FarFish project in March 2021. The aim of this document is to respond to the second audit report (FarFish, D5.4) and provide a final version of the MR2. The EU vessels currently targeting black hake are trawlers from Spain. Two black hake species are targeted, and there is no distinction between the two species in the catch reports, observer reports, and catch statistics. These two species are assessed as one by the Committee for the Eastern Central Atlantic Fisheries (CECAF).

The MR2 was developed following the "General Guidelines for making MRs" (FarFish, D3.5) and is based on the "Second MR Invitation" (FarFish, D3.6), where the outcome targets (OTs) are proposed and based on "MR1" (FarFish, D4.3), the "Audit of MR1" (FarFish, D5.1), and the roadmap presented in "Report on challenges and suggestions for improvements" (FarFish, D5.2). In addition, this document included contributions from stakeholder meetings facilitated by FarFish stakeholder interaction (WP1) as well as input from other FarFish Work Packages (WP) and Case Study (CS) meetings.

The MR2 aims to improve data collection to promote sustainable fisheries and improve Monitoring, Control, and Surveillance (MCS). The OTs are classified into ecological and governance dimensions, and we acknowledge that the operators cannot be made solely responsible for achieving the OTs, which must therefore regard a joint effort between authorities and operators to achieve progress.

The OTs for this case study are as follows:

OT 4.1 Information on the proportion of the two species of black hake in catches provided. **Obligatory. Achieved.**

OT 4.2 Bycatch data on black hake fishery available. **Obligatory. Achieved.**

OT 4.3 Vessel Monitoring System (VMS) and/or Automatic Identification System (AIS) signals are transmitted. **Obligatory. Partly achieved.**

OT 4.4 Trade flow data on black hake provided. **Recommended. Achieved.**

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Abbreviations

AIS	Automatic Identification System
CCMAR	Centre of Marine Science (Portugal)
CECAF	Committee for the Eastern Central Atlantic Fisheries
CECAF-SC	Committee for the Eastern Central Atlantic Fisheries Scientific Committee
CETMAR	Centro Tecnológico del Mar - Fundación CETMAR
CFP	Common Fisheries Policy (EU)
C_{msy}	Catch Maximum sustainable yield
COREWAM	Conservation and Research of West African Aquatic Mammals (Senegal)
ISRA-CRODT	Oceanographic Research Centre of Dakar-Thiaroye (Senegal)
CS	Case Study
CSC	Joint Scientific Committee on Fisheries Agreement between Senegal and the EU
CSIC	Spanish National Research Council
DG MARE	Directorate-General Maritime Affairs and Fisheries, EU.
DPM	Directorate of Maritime Fisheries/Direction des Pêches Maritimes (Senegal)
DPSP	Direction de la Protection et de la Surveillance des Pêches
EEZ	Exclusive Economic Zone
ERS	Electronic Recording Systems
FAO	Food and Agriculture Organization of the United Nations
FarFish RG	FarFish Reference Group
GFW	Global Fishing Watch
HCR	Harvest Control Rule
IEO	The Spanish Institute of Oceanography
IMO	International Maritime Organization
ISRA	Senegalese Institute of Agricultural Research
IUU	Illegal, unreported, and unregulated fishing
LDAC	EU Long Distance Advisory council
MPEM	Ministry of Fisheries and Maritime Economy
MATIS	Icelandic Food and Biotech R & D Institute
MCS	Monitoring, Control, and Surveillance
MP0	Management Plan Zero
MSY	Maximum sustainable yield
NOFIMA	The Norwegian Institute of Food, Fisheries and Aquaculture research
OPRPOMAR	Organization of Fresh Fish Producers of the Port and Ría de Marín, Spain
RBM	Results-Based Management
RFMO	Regional Fisheries Management Organisations
SFPA	Sustainable Fisheries Partnership Agreements
TAC	Total Allowable Catch
UIT	The Arctic University of Norway
VMS	Vessel Monitoring System

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Concepts/definitions

Indicator	A variable, pointer, or index related to a criterion. Indicators are selected so that they reflect variations in key elements of the fishery resource, the social and economic well-being of the sector, and the sustainability of the ecosystem. The position and trend of an indicator in relation to reference points or values indicate the present state and dynamics of the system. Indicators provide a bridge between objectives and actions (source: FAO, 1999).
Management goals	The higher-order objective to which a management intervention is intended to contribute (OECD 2011). A management goal is derived from a management principle (constitutional-order) and is specified into a set of additional operational management objectives (collective-order).
Management intervention	Strategies or instruments aimed at impacting the state of a fishery with reference to authorized objectives. Examples are input and output controls and economic measures.
Management measures	Can be technical (e.g., gear selectivity), input (effort)/output (catch) control, right based.
Management objectives	Fisheries management objectives are typically framed within the concept of sustainable development and may reflect one or more various dimensions and criteria that relate to it (FAO, 1999). Operators control OTs through setting and implementing management measures.
Management Plan (MP)	In RBM, the management plan is a formal arrangement between a management authority and operators that specifies the partners in the fishery and their respective roles, the agreed objectives for the fishery, the management rules and regulations that apply, and other relevant details about the fishery. In RBM, the formal responsibility for developing the management plan is delegated to an operator.
Management Recommendation (MR)	In RBM, the management recommendation (MR) is a formal arrangement between a management authority and operators that specifies the partners in the fishery and their respective roles, the agreed objectives for the fishery, the management rules and regulations that apply, and other relevant details about the fishery.
Management strategies	In the FarFish context, this refers to strategies applied to achieve OTs.
Outcome Target (OT)	Outcome targets (OTs) are specific and measurable requirements set by an authority to make management goals operational. An OT is a statement of the condition of an indicator relative to a reference point, often in the form of inequality ('A>B') or a statement of presence or absence of some entity. Using relevant information, this statement can be assessed as true or false at a given point in time. For instance, the management objective that "the fishery should be biologically sustainable" could be expressed in terms of one or more OTs, such as 'Catch < 20,000t; 'bycatch < 20%'; SSB > 30,000t; 'a catch reporting system is present', etc.

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1 Introduction

This document updates the second proposal for a management recommendation (MR2) in the FarFish project, which was submitted internally for auditing purposes. This document responds to the second audit report (FarFish, D5.4). The MR2 was developed with European operators active in the fishery in Senegal under the current SFPA.

1.1 FarFish overall objective

The objective of FarFish is to improve knowledge and management regarding EU fisheries outside Europe while contributing to sustainability and long-term profitability. The role and responsibilities of the EU fleet are significant to ensuring sustainable utilisation of the resources to which they are allowed access, whether under the Exclusive Economic Zone (EEZ) of third countries with SFPAs or in international waters, also known as the high seas.

The concept of sustainability regards meeting present needs without compromising future generations' ability to meet their own, which includes managing people, the planet, and profit. The fleet should therefore cooperate with the Regional Fisheries Management Organisations (RFMO) and national authorities in partner countries to improve knowledge and make management more effective. The EU has agreed to strengthen capacity in their SFPA countries to ensure the efficient management of fisheries, which will ultimately lead to sustainable utilisation and increasing the long-term profitability of all stakeholders.

The FAO report "The State of World Fisheries and Aquaculture 2020"[3] states that there is no alternative to sustainability. The world needs programs to improve fisheries to allow humans to continually fish in oceans for edible seafood. The effective management of world fisheries represents the sole path to sustainability, which obligates EU national authorities and fishing industries.

1.2 About Senegal

The Republic of Senegal is a country in West Africa that shares borders with Mauritania in the north, Mali to the east, Guinea to the southeast, and Guinea-Bissau to the southwest. Senegal also surrounds the Gambia, a country occupying a narrow sliver of land along Gambia River banks, separating Senegal's southern region of Casamance from the rest of the country. Senegal also shares a maritime border with Cabo Verde, and the country's economic and political capital is Dakar. Senegal is known in the West African region as a traditional fishing nation, and the sector employs around 84,600 mainly full-time fishers. Approximately 47,800 people work in auxiliary activities, where around 30% of the (full-time) workforce is women mainly employed in the postharvest sector. The total Senegalese capture fisheries production is estimated to be 545,300 tonnes[4].

Fish constitutes a significant part of the Senegalese diet. The annual per capita fish consumption is 26.8 kg, where fish contributes on average to almost 70%-75% of the total animal protein intake[5]. The Senegalese Exclusive Economic Zone (EEZ) covers 198,000 km^2 and is divided into two parts separated by Gambia's EEZ (Antonova, 2016).

[3] http://www.fao.org/documents/card/en/c/ca9229en
[4] http://firms.fao.org/firms/fishery/472/en#FisheryIndicator-Employment

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Figure 1: The Senegal EZZ covers 198,000 km² and is divided into two parts separated by Gambia's EZZ. (source: Antonova (2016))

Senegal has a long-standing Sustainable Fisheries Partnership Agreement (SFPA) with the EU since 1980, when Senegal was the first African country to sign a fishing agreement with the EU[5].

1.3 The process for developing MR2 for Senegal

The MRs within the FarFish project are developed in two iterations based on results-based management (RBM)[6] principles (Nielsen et al., 2017). RBM requires the relevant authority to define specific and measurable objectives for a fishery but allows resource users (operators) to find ways to achieve these objectives and provide adequate documentation (Figure 2).

[5] https://agritrade.cta.int/Fisheries/Topics/ACP-EU-relations-FPAs/Senegal-EU-Fight-against-IUU-fishing-as-a-basis-for-renewed-relations.html

[6] The RBM is also referred to as the Responsive Fisheries Management System (RFMS) in the EcoFishMan project and other FarFish documents

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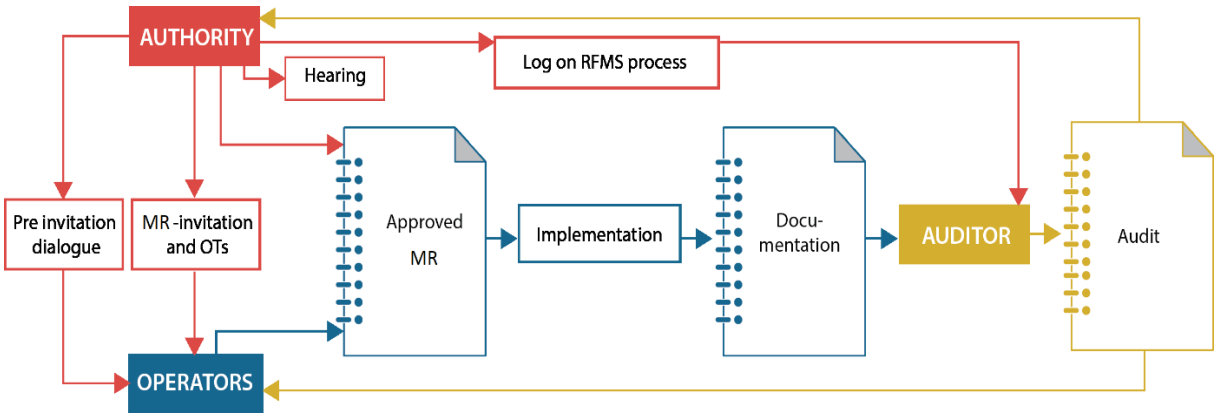

Figure 2. General description of the process of making MRs based on RBM in FarFish (FarFish, D3.1). The different colours demonstrate the responsibilities of each of the three entities. Authority: red / Operators: blue / Auditors: yellow.

The MR1 for Senegal (FarFish, D4.3) was made available on 30 September 2019. The MR2 is developed following the "General Guidelines for making MRs" (FarFish, D3.5) and is based on the "Second MR Invitation" (FarFish, D3.6), which set the updated OTs for the CS. The OTs are based on "MR1", advice from the auditor, and input from meetings facilitated by FarFish "Stakeholder interaction" (WP1). The consortium reviewed the OTs at the CS and WP leader meeting in Marrakesh (Morocco, Nov. 2019), after which a draft of the "Second MR Invitation" was sent for hearing among operators. Based on the response, the authority (MATIS) further adjusted some OTs, and the "Second MR invitation" was made available on 21.01.2020. The External Advisory Group and experts in the 36-month review meeting in August 2020 also provided valuable input to develop MR2. Following the RBM approach, the "Audit of MR1" (FarFish, D5.1) was made available on 30 November 2019, which included audit and input recommendations applied from the "Report on challenges, and suggestions for improvements" (FarFish, D5.2). The second audit 'Report on Management Recommendation 2 Audit' (FarFish, D5.4) was made available on 30.06.2021. The recommendations from the second audit report were used to update this final MR2.

A workshop for Senegal was arranged in Las Palmas, Spain in October 2019, organised by CETMAR (WP1). The workshop's main goal was to present the results from the audit of MR1 for Senegal to stakeholders and to assess constraints and opportunities for developing the MR2. Five participants attended the workshop from Senegal representing MPEM, DPSP-MPEM, COREWAM, ISRA-CRODT, and Société PEREIRA & KANDJI (SOPERKA).

In addition, WP1 ensured continuous contact with relevant operators through conducting five physical meetings, e-mail correspondence, and phone calls. WP4 represented the operator and developed the MRs. The FarFish coordinator represented the authority had meetings (online and physical), e-mail correspondence, and phone calls with the case study leader, a representative from COREWAM.

1.4 Partners involved in MR2 for Senegal

This case study (CS) focused on the EU fleet, meaning that not all operators in the Senegalese waters were involved in RBM.

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MATIS acted as the leading authority within the project and considers input from relevant authorities, such as the Ministry of Fisheries and Maritime Economy (MPEM), Directorate-General Maritime Affairs and Fisheries (DG MARE), Oceanographic Research Centre of Dakar (ISRA-CRODT), and Conservation and Research of West African Aquatic Mammals (COREWAM). The European operators qualified to respond to the second MR invitation for Senegal are the EU Long Distance Advisory Council[7] (LDAC), the Organization of Fresh Fish Producers of the Port, and Ría de Marín[8] (OPROMAR), and Société PEREIRA & KANDJI (SOPERKA)[9], which is a Senegalese-Spanish company. The WP5 leader Sjókovin conducted the audit[10].

Table 1. RBM roles of work packages, stakeholders, and FarFish research institutions (indicated in italics) involved in developing the Senegal MR2.

Senegal			
RBM roles	**AUTHORITY**	WP3	MPEM, DG MARE; *ISRA-CRODT, COREWAM, MATIS*
	OPERATORS	WP4	LDAC, OPROMAR and SOPERKA; *UiT*
	AUDITOR	WP5	*Sjókovin*

Conservation and Research of West African Aquatic Mammals (COREWAM) in Senegal is the case study leader.

1.4.1 Other partners and stakeholders' interaction

A workshop for this CS was arranged in Las Palmas, Spain in October 2019 and included five participants from Senegal, representing MPEM, DPSP-MPEM, COREWAM, ISRA-CRODT, and SOPERKA.

1.5 Objectives of the MR2 for the Senegalese case study

Developing a case study covering all species targeted by the EU fleet within the Senegalese EEZ was considered unattainable within the FarFish project. The case study leader was thus asked to prioritise a fishery to address based on the main challenges and ability of FarFish to contribute. The black hake fishery was consequently selected due to the belief that ICCAT assesses and manages the tuna fishery well, while the black hake fishery presents greater challenges.

This MR2 applies to the EU Fishery for a deep-sea demersal fishery mainly targeting black hake in the Senegalese EEZ (Figure 1). The black hake fishery targets two species: the Tropical African hake (*Merluccius polli*) and Senegalese hake (*Merluccius senegalensis*). There is a lack of knowledge regarding the proportion of these two species caught in Senegalese waters and regarding this fishery's bycatch species.

To support sustainable fisheries, FarFish addressed the following steps:

[7] http://ldac.eu/
[8] http://opromar.com/
[9] http://www.soperka.com/
[10] https://blueresource.fo/

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- Develop an MR for the two hake species to enable species discrimination and identification. This MR will allow authorities to improve traditional stock assessment, such as specific biological reference points (F and SSB) for the two species. Species discrimination will enable improvements in managing this fishery through applying catch limits and/or technical measures since the two stocks have different biological characteristics (such as size at maturity). Improved species-specific knowledge and access to data will allow national management institutions to advance research on the hake species.
- There is a need to improve MCS in the area by, for example, utilising the latest available satellite systems and tools.
- There are opportunities to utilise onboard observers more efficiently, such as by improving bycatch registration, monitoring catches, registering effort and sizes for hake as target and bycatch species, and developing self-sampling protocols.

2 SFPA between the EU and Senegal

A five-year SFPA was signed in July 2019, replacing the agreement that expired in November 2019[11]. This fisheries agreement allows EU vessels from Spain and France to fish in Senegalese waters as part of the tuna network fisheries agreement in West Africa. This agreement allows 28 EU seiner vessels, 8 pole-and-line vessels, and 5 longline vessels targeting highly migratory species (tunas) in the Senegalese EEZ. Two trawlers are allowed to target deep-sea demersal species (hake).

The total value of the SFPA is estimated at EUR 15,253,750 or EUR 3,050,750 per year. The annual amount can be divided as follows:

- EUR 1,700,000 per year as financial compensation for access to resources, of which EUR 900,000 per year is earmarked to promote the sustainable management of fisheries in Senegal, particularly through measures that reinforce control and surveillance capacities and that combat illegal, unregulated, and unreported (IUU) fishing. Moreover, the EU funds are used to promote scientific capacities and the development of artisanal fishing.
- EUR 1,350,750 per year represents the estimated fees to be paid by vessel owners for fishing authorisations.

Table 2: Senegal SFPA (signed July 2019) in numbers[12]

Senegal SFPA in numbers	
Freezer tuna seiner vessels	28 licenses (16 Spain, 12 France)
Pole-and-line vessels	10 licenses (8 Spain, 2 France)
Longline vessels	5 licenses (3 Spain, 2 Portugal)
Trawlers	2 licenses (2 Spain)
Reference tonnage for tuna	10,000 tonnes
Total allowable catch for hake *(M.polli and M.senegalensis)*	1,750 tonnes
Estimated value of Protocol	**€ 3,050,750 per year**

[11] https://ec.europa.eu/fisheries/cfp/international/agreements/senegal_en
[12] https://ec.europa.eu/fisheries/cfp/international/agreements/senegal_en

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EU vessels operating under the SFPA must comply with all technical conservation measures set in the SFPA.

3 Fishery Overview

3.1 Legal framework for fisheries in Senegal

The fishing regulations in Senegal are based on the Maritime Fisheries Code adopted in 2015. The code's main objectives are to increase penalties against IUU fishing, organise fisheries' management, and ban the manufacture and import of monofilament and multifilament nets. The Senegalese Fisheries Code establishes the principle for the conservation, management, and monitoring measures of various fisheries by establishing fisheries management plans (FarFish, D3.3).

3.1.1 Common Fisheries Policy

The Common Fisheries Policy (CFP) regards a set of EU secondary law rules for managing European fishing fleets and conserving fish stocks. The CFP was reformed and enacted in January 2014 and is valid for 10 years (until 2023), where the main objective is to ensure that fishing activities are environmentally, economically, and socially sustainable.

Fishing activities must be managed consistently with the objectives of achieving economic, social, and employment benefits. In addition, fish stocks must be restored and maintained at levels that can produce a maximum sustainable yield to contribute to food supplies' availability. The CFP Regulation (EU) 1380/2013[13] states in Recital 50 that the EU should promote the objectives of the CFP internationally, ensuring that EU fishing activities outside EU waters are based on the same principles and standards as those under EU law and promoting a level playing field for EU and third country operators.

The EU also committed to the UN Sustainable Development Goal (SDG) 14, which is to "Ensure sustainable consumption and production patterns," as well as UN SDG 12, which is to "Conserve and sustainably use the oceans, seas, and marine resources for sustainable development".

3.1.2 Vessels Monitoring System

Senegalese vessels and assigned inspectors conduct monitoring and fishing control at sea in Senegalese fishing zones. The Vessel Monitoring System (VMS) has been mandatory since 2006; thus, fishing activities in waters under Senegalese jurisdiction require equipment on board that allows the vessel to be monitored by the VMS system, which enables receiving a report showing the position of vessels fishing in Senegalese waters. The Directorate of Fisheries Protection and Surveillance (DPSP) is responsible for surveying marine and inland fisheries (FarFish D3.3). According to the DPSP, the VMS

[13] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R1380

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only functions for Senegalese vessels. In addition, the Electronic Reporting Systems (ERS) from EU vessels in the Senegalese EEZ are not visualised.

Senegal adopted a strategy addressing IUU fishing in 2013. The main objective is to eradicate IUU fishing in the Senegalese EEZ by strengthening fisheries' surveillance and better coordinating intervention actions on national, regional, and international levels. Implementing the national action plan to combat IUU fishing requires external support (FarFish, D3.3), and the EU supported strengthening control and monitoring of fishing activities in the Senegalese EEZ during the last protocol[14].

AIS is a monitoring system that shares real-time information regarding ship traffic, which is compulsory for vessels over 300 gross tonnes (GT) engaging in international voyages. The International Maritime Organization (IMO) Convention for the Safety of Life at Sea (SOLAS) Chapter V, Regulation 19.2 requires vessels to always operate AIS Class A onboard unless there are valid security reasons to turn it off temporarily[15]. The AIS was intended to increase security at sea and support ship-to-ship collision avoidance. The AIS transposes dynamic information such as ship position, course, speed, type of ship, navigational status, and IMO number, and this processed AIS data can provide information to authorities and researchers. Tracking AIS signals may aid monitoring and conserving marine ecosystems.

In 2014, the EU required the entire fishing fleet over 15 meters to install AIS Class A transmitters (Shelmerdine, 2015).

3.1.3 FAO/CECAF and the Joint Scientific Committee

The FAO/CECAF working group on the Assessment of Demersal Resources – northern subgroup contributes to managing demersal resources in Northwest Africa by They are assessing the state of stocks and fisheries to ensure the optimal and sustainable use of resources in African coastal countries (FAO, 2018b), including the black hake. According to the most recent assessment, the black hake is fully exploited. The CECAF has expressed concerns about some demersal stocks of Northwest Africa, and fisheries managers in the concerned countries are expected to implement the CECAF working group's recommendations organised by FAO; however, the CECAF can only provide recommendations that are not mandatory for concerned member states (e.g., non-binding resolutions).

The Joint Scientific Committee (CSC) on the SFPA between Senegal and the EU provided several recommendations for the EU fishery under Category 1 in the agreement, which concern deep demersal species (mostly black hake). These recommendations regard the importance of collecting, sharing, and analysing scientific observer data collected onboard vessels as well as difficulties in implementing the agreement's obligations (Fall et al., 2018). Due to the high levels of catches in the whole sub-region in recent years, fishing mortality is high and the catch levels in the sub-region are not considered sustainable in the long term. The CSC therefore supports the FAO/CECAF recommendation to reduce fishing mortality, particularly of black hake as a bycatch species in other fisheries (Fall et al., 2018).

[14] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1424957307348&uri=CELEX:22019A1120(02)

[15] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/343175/solas_v_on_safety_of_navigation.pdf

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The CSC also recommends more frequently monitoring black hake's productivity on a regional level by reinforcing data collection via logbooks and by placing observer programs onboard hake fishing vessels. Observers should thus be onboard all vessels fishing in areas where black hake occurs, including those targeting shrimp (both high seas and coastal), regardless of the flag state.

3.2 Black hake fishery overview

The black hake quota includes two different species, the Tropical African hake (*Merluccius polli*) and Senegalese hake (*Merluccius senegalensis*), which have been denominated under the generic name of black hake *Merluccius* ssp. for more than 60 years (FAO, 2018c). Due to their morphological resemblance and overlapping distribution at certain depths and areas, both species are mixed in catches, are commonly marketed as *Merluccius* spp. (FAO, 2016), and are reported as black hake in catch statistics. Neither the SFPA nor the stock assessment recommendation by FAO/CECAF discriminate between the two species, although they have different biological characteristics and should preferably be managed separately (Fernández-Peralta et al., 2017).

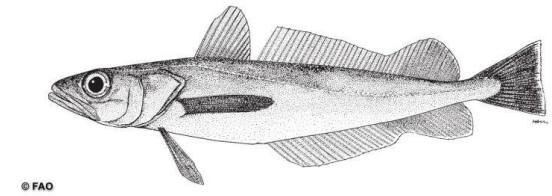
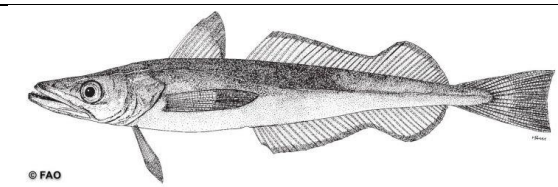
Common name	Picture	Scientific name	FAO code
Tropical African hake		*Merluccius polli*	HKB
Senegalese hake		*Merluccius senegalensis*	HKM

Figure 3: The two species of hake fished by the EU fleet in Senegal[16]

Spanish demersal trawlers are the only foreign fleet allowed to target black hake in Senegalese waters, but Senegalese trawlers, longliners, and artisanal fleets also target these species, which are generally targeted at depths between 150 and 1,000 m (Fall et al., 2018). In the north, European freezer vessels fish deeper than Senegalese vessels, with most activities occurring at depths from 500-600 m, while Senegalese trawlers fish at 300-600 m.

The Senegalese industrial fleet catches most of the black hake in the Senegalese EEZ, and the catch increased during the previous SFPA (2014-2019).

The total catches of black hake in the Senegalese EEZ caught by EU and Senegalese vessels amounted to approximately 6,000 tonnes in 2017, with an average catch of 5,066 tonnes in the Senegalese EEZ

[16] https://www.biolib.cz/en/gallery/dir2556/pos21,21/

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from 2015-2017. The total catch by the EU fleet was 1,394 tonnes in 2015, 138 tonnes in 2016, and 1,700 tonnes in 2017, which approaches the fishing opportunity's full utilisation (Table 3).

Table 3. Black hake catches in the fishing zone of Senegal by different fleet segments. Source: Caillart (2019).

Fleet	2015	2016	2017	2018
EU trawlers				
Number of vessels	2	2	2	2
Catch (tonnes)	1,394	138	1,700	1,237*
Senegalese trawlers				
Number of vessels	2	3	3	4
Catch (tonnes)	3,822	3,781	3,924	n.a**
Other trawlers***				
Number of vessels	n.a	n.a	n.a	
Catch (tonnes)	102	149	130	
Artisanal fishing				
Number of vessels		n.a	n.a	
Catch (tonnes)		25	32	
Total catch (tonnes)	**5,318**	**4,093**	**5,786**	

**Provisional data extracted from Aggregated Catch Data Reporting (ACDR) database 5/2/2019*
*** Not available*
**** mainly deep demersal trawlers deep shrimp*

The EU fleet constituted 26.2%, 3.4%, and 29.4% of the total catch in the Senegalese EEZ in 2015, 2016, and 2017 respectively (Fall et al., 2018), which accounts for less than 10% of black hake's total EU catches in this sub-region (compared to 70% in Mauritania).

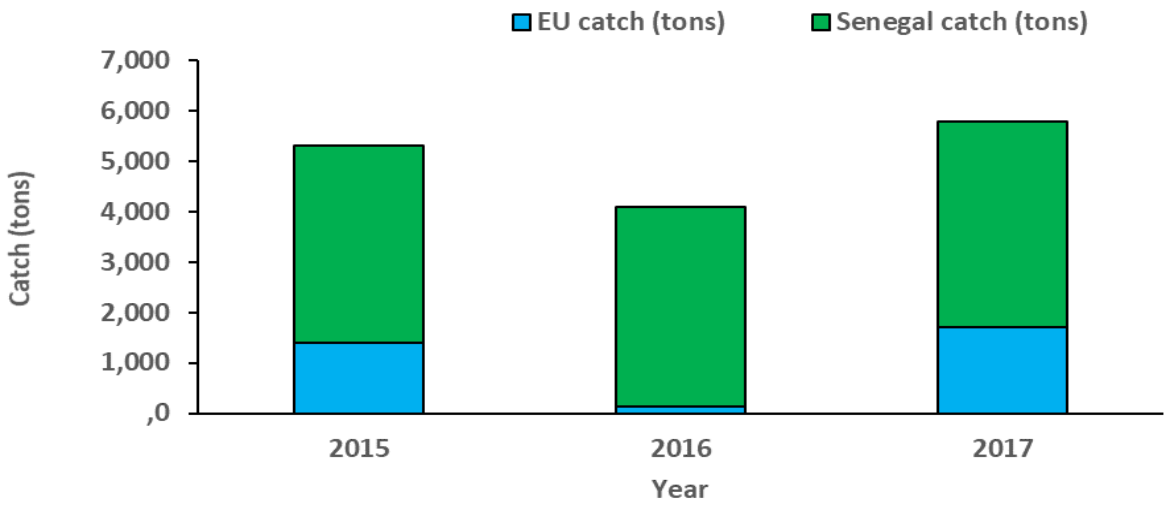

Figure 4. Total catch of black hake in the Senegal EZZ in the period 2015-2017 by EU and Senegal. Source: Caillart (2019)

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Important bycatch species reported by Spanish vessels include cephalopods (mainly *Todarodes sagittatus* and *Todaropsis eblanae*), deep-sea shrimp (mainly *Aristeus varidens*), and other fish (main species St. Peter/John Dory and Monkfish-*Lophius spp*.) (Fall et al., 2018). The landings of the two species of cephalopods include differences between fleets and years, which could be due to confusion in recording these cephalopods in logbooks. Onboard observers could provide more accurate information regarding the proportion of these species in the catches. According to the CSC annual report in 2018, bycatch data for the Senegalese fleet are not available (Fall et al., 2018).

3.3 Stock status of black hake

The black hake represent a shared resource in the sub-region between Morocco, Mauritania, Senegal, and the Gambia, and the two species (*M.polli* and *M.senegalensis)* are generally assessed as one (*Merluccius* spp). The last scientific assessment on black hake occured in 2018. The stock is considered fully exploited (although not overfished, $B_{cur}>B_{0.1}$) by the FAO/CECAF working group on the Assessment of Demersal Resources Subgroup North in 2017, as shown in

Table 4. Summary of stock assessment of black hake in the CECAF North area in 2017 and management recommendations. Source: FAO (2018a, b)

Table 4. Summary of stock assessment of black hake in the CECAF North area in 2017 and management recommendations. Source: FAO (2018a, b).

	Catches (tonnes) 2016 (Average 2012-2016)	Bcur/$B_{0.1}$	Fcur/$F_{0.1}$
Sub-regional stock of black hake: *Merluccius polli* and *M. senegalensis*	16,972 (9,668)	115%	137%
Assessment	Fully exploited - The catch level of the previous year is not sustainable in the short term. This stock has also been evaluated by other models (Bayesian and Cmsy, which give the same situation as Biodyn[17]).		
Management Recommendations	Given the relatively low level of effort targeting black hake and the bycatch of these species in 2016 (7,076 tonnes), the working group recommends taking necessary steps to reduce bycatch to the average of the 2014-2015 period (3,300 tonnes).		

Because fishing mortality exceeds $F_{0.1}$ (137%), there is a considerable risk of overexploitation of the stock in the short term when maintaining current catch levels (FAO, 2018b). The catch levels during the past years have been approximately 16,500 tonnes in the whole sub-region, which is well above the MSY estimated to be 10,900 tonnes (FAO, 2018b). The CECAF recommends taking steps to reduce the bycatch of black hake in non-hake fisheries to 2014-2015 levels of 3,300 tonnes (FAO, 2018a). The total catch of black hake now exceeds the total catch of white hake in the area, as shown in Figure 5.

[17] Biodyn: Assessment tool, spreadsheet approach assists understanding of models and allows for adaptation, here for Schaefer surplus model. Bayesian refers to the statistical method applied.

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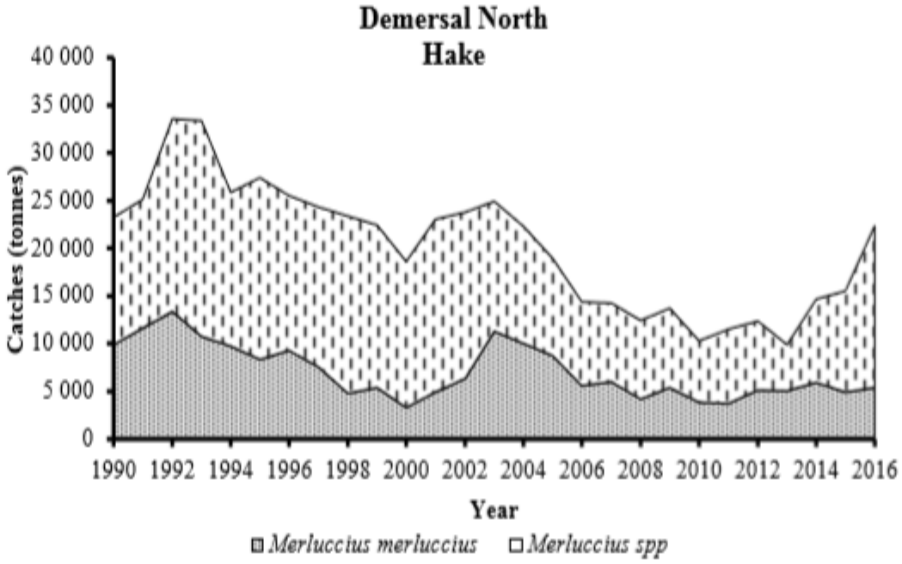

Figure 5: Capture of white hake (Merluccius merluccius) and black hake (Merluccius spp.) in the northern zone of CECAF (1990-2016). Merluccius spp. consist mainly of M. polli and M. senegalensis. Source: FAO/CECAF (2018b)

4 Specific challenges related to black hake fishery

The CS leader from COREWAM identifies the listed challenges in the Senegal CS with aid from the ISRA-CRODT partner (FarFish, D4.1) as well as stakeholders at the MR kick-off meeting and other meetings and workshops (e.g., the workshop in Las Palmas). In addition, challenges are identified from the CSC annual report (2018) and SFPA evaluation (DG MARE, 2019), which are summarised as follows:

4.1 Insufficient availability/reporting of bycatch data in the black hake fisheries

There are concerns related to sharing and analysing data from observation reports as well as in implementing the obligations in the agreement related to such data (Fall et al., 2018).

There are also challenges related to logistics and deploying European observers due to the recent low fishing activity of the EU fleet targeting black hake. Reporting bycatch regards a joint responsibility between captains onboard the fishing vessels and observers[18].

The EU vessels are obliged to report catches under chapter IV in the Annex of the Protocol of the SFPA, who must daily transmit the fishing logbook by the ERS to the Fisheries Monitoring Centre (FMC) of their flag state. The FMC must automatically and immediately send the data to the Senegalese FMC. EU vessels' e-logbooks must record the quantity of each species caught and kept aboard as target species, bycatch, or discard for each fishing operation. In the total catch of each trip, the SFPA allows the following bycatch: 15% cephalopods, 5% crustaceans, and 20% other deep-water demersal fish.

[18] https://ec.europa.eu/fisheries/sites/fisheries/files/docs/publications/report-jsc-senegal-2018-10_fr.pdf

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According to Section 5, Chapter IV in the Annex of the Protocol, observers onboard the vessels shall submit a report of observations to the captain before leaving the vessel, and both the observer and captain must sign the observer's report. This report must also verify percentages of bycatch and estimate the discarded catch.

Following the obligation stated in the protocol, Senegalese observers have observed trips of the EU fishing trawl fleet; however, Senegalese observers are not providing observers' reports to the vessel captain and generally provide little feedback. The observers' reports have also not been made available to scientific institutions, despite the obligation outlined in the protocol (Fall et al., 2018).

The Spanish Institute of Oceanography (IEO) has proposed sharing their methodology for common scientific observation to support the logistics and deployment of European observers to ensure a program with sufficient coverage. This would include training Senegalese observers in simplified taxonomic differentiation of the two black hake species, as described in Annex 5 in the CSC report of 2018.

There is no record of observers onboard Senegalese trawlers since this initiative is voluntary. Due to the absence of comprehensive datasets regarding catch and effort, length measurements, and discards at sea, the CSC has been unable to precisely diagnose the stock state; however, the CSC has evaluated interactions between fleet segments and found that Senegalese bottom trawlers fish most of the catch. There is an urgent need to improve this part of the reporting expressed in the CSC Report (2018) and Ex-ante report of 2019 (Caillat, 2019).

4.2 Data limitation for sustainable conservation and separate stock assessment of black hake

The two black hake species (*M.polli* and *M.senegalensis*) are mixed in catches and commonly marketed as *Merluccius* spp., due to their morphological resemblance and overlapping occurrence at certain depths (FAO, 2016). Neither the SFPA nor the stock assessment by CECAF discriminate between the two species, although they have different biological characteristics and should therefore preferably be managed separately (Fernández-Peralta et al., 2017). The two species are reported together as black hake in catch statistics by CECAF/FAO. Landing data by species are available for the large fresh hake since they are gutted and sorted by species onboard for economic reasons; however, the freezer fleet unloads all hake catches without performing any sorting by species[19].

4.3 Insufficient monitoring of the fishery

Efforts opposing IUU fishing are important to ensure sustainable fisheries and promote a level playing field for all fleets. Senegal adopted a strategy against IUU fishing[20] in 2013, but combatting IUU fishing requires external support.

EU vessels are obliged to transmit their position at all times using a VMS. All EU vessels holding a fishing authorisation through the SFPA must be equipped with VMS to enable automatically and continuously

[19] https://ec.europa.eu/fisheries/sites/fisheries/files/docs/publications/report-jsc-senegal-2018-10_fr.pdf

[20] https://fcwc-fish.org/projects/pescao

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communicating their position every second hour to their flag state FMC. The FMC must ensure the automatic processing and, if necessary, electronic transmission of the position messages, which are securely recorded and kept for three years.

In 2014, the EU required the entire EU fishing fleet over 15 meters to install AIS Class A transmitters (Shelmerdine, 2015). Because AIS represents an open-source information system, the EU fleet's competitors may continuously monitor the EU operators transmitting AIS. The interpretation of these AIS positions over time can indicate to competitors where fishing activity might occur. If non-EU fleets do not comply with the same rules, the level playing field is undermined.

The Regulation (EU) 2017/2403[21] regarding the sustainable management of external fishing fleets commenced in 2018, establishing eligibility criteria and standards to issue, renew, and withdraw fishing authorisations within the scope of SFPAs.

If there is evidence that the conditions used to issue a fishing authorisation are no longer met, the flag state should take appropriate action, including amending or withdrawing the authorisation and, if necessary, imposing effective, proportionate, and dissuasive sanctions. If an EU vessel does not comply with the conditions of a fishing authorisation under the SFPA and the member state fails to take action to remedy the situation, even after being required to by the Commission, the Commission should take additional action to ensure that the concerned vessel concerned no longer fishes. This provides a legal instrument to tackle monitoring and control of EU fishing activities within the framework of SFPAs.

5 Outcome targets and indicators

OTs and associated indicators were established to provide measurable performance goals for the EU distant water fleet fishery under the SFPA between Senegal and the EU. OTs represent specific and measurable requirements set by an authority to make management goals operational. An OT is a statement of the condition of an indicator relative to a reference point, often in the form of inequality ('A>B') or a statement of presence or absence of an entity. An OT should be SMART, meaning specific, measurable, attainable, relevant, and time-based.

The RBM approach depends on incentivising operators to develop MRs for a given fishery. Black hake stocks are shared between several countries in the subregion, including Mauritania, Senegal, Morocco, and the Gambia. We thus acknowledged that the related OTs should be applied at a regional level, but this exceeded the scope of the FarFish project (regarding project lifetime and resources). The matter was being handled by authorities such as CECAF and FAO, who are implementing this approach.

OTs set for the Senegalese CS are based on MR1 (FarFish, D4.3), the audit of MR1 (FarFish, D5.1), and consultation with authorities, operators, and other stakeholders in the fishery (e.g., Workshop in Las Palmas). The suggested OTs were defined in the Second MR Invitation (FarFish, D3.6). The following four OTs were identified for the black hake fisheries in Senegal, where three are obligatory and one is recommended.

[21] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017R2403

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Identifying appropriate OTs showed that operators cannot be solely responsible for some OTs, meaning that various authorities need to accept part of the responsibility to ensure successful implementation.

Table 5. OTs for Senegal black hake fisheries

OT 4.1	Obligatory	Information on the proportion of the two species of black hake in catches provided.
OT 4.2	Obligatory	Bycatch data in black hake fishery available.
OT 4.3	Obligatory	VMS and/or AIS signals are transmitted.
OT 4.4	Recommended	Trade flow data on black hake provided.

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5.1 Changes in OTs between MR1 and MR2

Several OTs presented in the first MR have been changed in the second MR, and these changes are described below for transparency.

Table 6. Changes in OTs between MR1 and MR2

OTs in MR1	OTs in MR2	Change
OT 4.1 Make bycatch data available. **Obligatory**	**OT 4.2** Bycatch data in black hake fishery available. **Obligatory**	The OT has been reworded to be more precise and focus on the black hake fisheries' actions. OT number changed from 4.1 to 4.2.
OT 4.2 Provide information on the proportion of the two species of black hake in catches. **Obligatory**	**OT 4.1** Information on the proportion of the two species of black hake in catches provided. **Obligatory**	The OT has been slightly reworded. OT number changed from 4.2 to 4.1.
OT 4.3 Commitment to transmit VMS and/or AIS signals. **Obligatory**	**OT 4.3** VMS and/or AIS signals are transmitted. **Obligatory**	The OT has been slightly reworded.
OT 4.4 Trade flow data on black hake from operators provided. **Recommended**	**OT 4.4** Trade flow data on black hake provided. **Recommended**	This OT is recommended, was not addressed in MR1, and was reworded in MR2 to exclude the "operators" since it was unrealistic to expect operators to provide business-sensitive information. Nevertheless, the operators are expected to provide some trade flow data, which can be aggregated and can concern volumes, products (e.g., fresh/frozen/canned), and destination.

5.2 Indicators

OTs commonly refer to an indicator value. An indicator is a variable, pointer, or index related to a criterion. Indicators are selected so that they reflect variations in key elements of the fishery resource, social and economic well-being of the sector, and sustainability of the ecosystem.

The position and trend of an indicator related to reference points or values indicate the system's present state and dynamics. Indicators provide a bridge between objectives and actions.

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The suggested indicators in FarFish aimed to measure the degree of adherence to the OTs (Table 7) and were classified according to their level of measurability. The most detailed indicator category A regards a quantitative level of OT achievement, measured in percentages. Indicator category B is qualitative, where the level of OT achievement is considered high (score 4), moderate (score 3), fair (score 2), low (score 1), or not present (score 0). The last indicator category C is binomial, which is measured to have only two outcomes such as yes (score 1) or no (score 0), true or false, success or failure.

Table 7. FarFish indicator categories and level of OT achievement.

Indicator category	Level of OT achievement				
A	0%	25%	50%	75%	100%
B	Not present (NP) 0	Low level (LL) 1	Fair level (FL) 2	Moderate level (ML) 3	High level (HL) 4
C	No (False/Failure) 0				Yes (True/Success) 1

5.3 OT 4.1 Information on the proportion of the two species of black hake in catches provided

In MR1, the authority defined this OT as “Provide information on the proportion of the two species of black hake in catches”, but it was reworded to “Information on the proportion of the two species of black hake in catches provided” in this MR. The OT number was changed from 4.2 in MR1 to 4.1 in MR2.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Enhance data collection for species identification of black hake in catches	• Create training materials following the IEO identification guide to train Senegalese observers; • Provide a sampling protocol and templates for data collection; • Lead the collection of samples and logistics for transport from vessels to laboratory facilities; • Perform molecular analysis of the samples; • Obtain information about operators’ perceptions on the self-sampling activity assessing their interest in the activity; • Provide feedback to the operators and fishers involved in the self-sampling.

OT 4.1 was obligatory and aimed to enhance data collection to identify species of black hake in catches.

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Progress:

Sampling kits, sampling protocols, and data sheets were provided (in French) at the Centre of Marine Science (CCMAR) and sent to ISRA-CRODT for delivery to Senegalese vessels participating in self-sampling. The sampling kits consisted of 9 x 9 boxes containing labelled micro-tubes filled with 100% ethanol, tweezers, scissors, ethanol, pads for cleaning tweezers and scissors, pencils, pencil sharpeners, clipboards, fish measuring boards, sampling protocol, and datasheets for each box with an example (Appendix 1).

Samples from the Senegalese national fleets were taken under supervision of ISRA-CRODT, including 162 samples from the fishing vessel Kanbal of the SOPERKA company and 286 samples from the artisanal fishing fleet. All samples were processed at the University of Oviedo by January 2021. The DNA analysis results show that 46% of the samples from the industrial fleet were mislabelled along with 40% from the artisanal fleet. Regarding the industrial vessel samples, 43% of *M. polli* (n=53) and 48% of *M. senegalensis* (n=109) were mislabelled. All *M. polli* (n=116) samples from the artisanal fleet were mislabelled, and 100% of the *M. senegalensis* (n=170) samples were correctly identified.

Results:

Based on this pilot study, we can conclude that self-sampling represents a viable and cost-effective method for obtaining samples; however, the results show that black hake mislabelling in the Senegalese national fisheries poses a significant problem. Improved training is needed for better morphological identification of the two black hake species. Such data will improve our understanding of the black hake fishery and allow separately assessing the two species *M. polli* and *M. senegalensis*.

After conducting the self-sampling project, the people involved in the fieldwork (operators and crew) were contacted and received a questionnaire to provide feedback about the process. A summary of the results from the questionnaires will be sent to the operators and crew. “Report on the success of the self-sampling program" (FarFish D2.7) will be updated with the results of the self-sampling and questionnaire surveys, and the report will be available to case study partners in Senegal.

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5.3.1 *Level of OT 4.1 achievement*

OT 4.1 has five indicators, with two classified as indicator category C and three as indicator category A.

Indicator		Indicator category	Indicator baseline	Indicator achievement	Responsible entity	OT dimension
I_1_CS4	Training of Senegalese observers in visual species identification of black hake	C	0	1	CCMAR	Ecological
I_2_CS4	Collection of fin samples of black hake for molecular analysis	C	0	1	ISRA-CRODT	
I_3_CS4	Molecular analysis to verify visual identification of black hake	A	0%	100%	CCMAR	
I_4_CS4	Feedback provided from operators and crew via questionnaires	A	0%	100%	CCMAR/ISRA-CRODT	
I_5_CS4	Feedback is given to operators and crew about the results from the self-sampling	A	0%	100%	CCMAR/ISRA-CRODT	

5.3.2 *Main risk for achieving OT 4.1*

This OT provided information regarding the proportion of two species of black hake in catches via self-sampling. All indicators were achieved. All samples were subjected to molecular analysis, and the achievement for indicator 3 with an indicator category A is 100%. The results showed, however, that mislabelling black hake in the Senegalese national fisheries represents a significant issue, and improved training is needed for better morphological identification of the two black hake species. The work performed in WP1 on stakeholder interaction minimised the risk of not achieving the indicators.

5.4 OT 4.2 Bycatch data in black hake fishery available

In MR1, this OT was defined as “Make bycatch data available” but it was reworded to “Bycatch data in black hake fishery available” in this MR. The OT number was changed from 4.1 in MR1 to 4.2 in MR2.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Enhance data collection for species identification of black hake in catches	• Ensure that reporting bycatch species in the e-logbook contains the requested information; • Ensure that bycatch is reported in the same way in observers’ reports and e-logbooks; • Conduct periodic review of e-logbook reports; • Ensure that the observers’ reports contain bycatch data.

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OT 4.2 was obligatory and aimed to enhance data collection to identify species of black hake in catches. CCMAR was tasked with leading more in-depth analysis of this OT's issues.

Data collection:

The following section concerned data collection and monitoring of the EU fishery for black hake.

> **EU e-logbook system** provides the collection of relevant data regarding caught target species and bycatch. A provision enables automatically transmitting e-logbooks to Senegalese authorities, but it is yet to be implemented due to technical issues and lack of capacity (Caillart, 2019).
>
> A **logbook template** is defined in the SFPA and is used by operators to report to Senegalese authorities. Akin to a paper-based template, it was developed for aggregate data but is poorly designed and lacks detail for scientific purposes (Appendix 2).
>
> The utilised Senegalese **observer report template** is provided in Appendix 3; however, it is reported to be used for compliance purposes only. The enforcement officers are not trained scientific observers, which implies that the data collected offer limited scientific value.

Progress:

The logbook template in the SFPA for trawl fisheries should be improved (Appendix 2). FarFish proposed an improved logbook template (Appendix 4) that would provide data that can be used for scientific purposes, which would involve crew effort regarding self-sampling and consist of two sampling sheets:

- **Commercial catch** – this entails detailed information and sampling on a per-haul basis, which could be performed for a certain percentage of the hauls (5%-10%). In addition to recording the catches (kg) of the main species for each haul, fishers should take a random sample of black hake, sort them by species and measure them (total length) to obtain length-frequency distributions. The list of commercial species was based on Fall et al. (2018).
- **Discards** – for the hauls sampled following the protocol above, information regarding discards should also be collected. Fishers should take a sub-sample of about 10 kg, sort by major taxonomic groups, and weigh the different groups.

Based on the findings, the recommendations for specific actions are:

- As stated in the protocol, the vessel's captain should sign the observer report and has the right to include comments. Senegalese authorities should share these reports with EU authorities (represented by DG MARE and shared with the flag state Spain). This can be implemented immediately.
- This issue should be raised at the next Joint Committee meeting in 2021, where operators and scientific institutes (ISRA-CRODT and IEO) should be invited to participate.
- Training should be provided to Senegalese observers to monitor EU vessels' compliance with approved measures and bycatch limits. ISRA-CRODT can provide this training and has in the

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past. Funding from the SFPA sector support should be made available to cover this training. The FarFish suggests that ISRA-CROT can provide training in 2021.

Longer-term and/or broader recommendations

- Develop a harmonised template for trawl fisheries (hake and non-hake) and implement it for all Senegalese and foreign vessels. The template developed by FarFish (Appendix 4) applies to excising national fisheries data collection systems, but the template requires implementation, which is realistic to occur by 2025.
- Establish a system for automatically receiving e-logbook data from EU vessels (in 2021), which can be funded through SFPA sector support.

5.4.1 Level of OT 4.2 achievement

This OT had two indicators, both classified as indicator category C.

Indicator		Indicator category	Indicator baseline	Indicator achievement	Responsible entity	OT dimension
I_6_CS4	Bycatch data specified by operators in the fishing logbook to IEO and/or ISRA-CRODT	C	0	1	CCMAR	Ecological
I_7_CS4	Observers' reports, including bycatch data made available to IEO and/or ISRA-CRODT and captain of the vessel	C	0	1		

5.4.2 Main risk for achieving OT 4.2

This OT aimed to make bycatch data in the black hake fishery available. The level of indicator achievement is 1 (Yes) for both indicators, but several actions are needed to achieve the OT. The next step for this OT is to implement the short- and long-term recommendations listed above, which needs to be done by the relevant ministry and institutions in Senegal (e.g., MPEM, DPM, DPSP, ISRA-CRODT).

5.5 OT 4.3 VMS and/or AIS signals are transmitted

In MR1, this OT was defined as "Commitment to transmit VMS and/or AIS signals" but rephrased to "VMS and/or AIS signals are transmitted" in this MR.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Support the fight against IUU fishing by utilising the latest available satellite systems and different kinds of electronic devices, such as AIS and VMS.	• Develop a big-data analysis for AIS signals; • Cross-check data activity (GFW/AIS and ISRA-CRODT/VMS signals); • Develop a diagnostic assessment to identify different levels of compliance among vessels.

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OT 4.3 was obligatory and aimed to support the fight against IUU fishing by utilising the latest available satellite system and tools. A big-data analysis was initially to be conducted for this OT; during the process, however, it was deemed more appropriate to cross-check data activity regarding the GFW/AIS signals due to the lack of VMS data and other fisheries-related and maritime surveillance data.

Progress:

The Spanish National Research Council (CSIC) gathered the AIS from Global Fishing Watch (GFW) for each vessel found in the Senegal EEZ area from 2012-2016. ISRA-CRODT provided the coordinates of the EEZ area, and ISRA-CRODT gave a list of vessel names from which they received transmitted VMS signals. ISRA-CRODT is a research institution and is not the compliance authority to which the vessels send the signals, meaning that we lacked access to the VMS data and could therefore only use this cross-checking activity as a proxy to study the situation in the Senegalese EEZ.

Results:

We compared the list of vessels that transmit AIS signals via GFW with the ISRA-CRODT list of vessels that provide VMS signals. This comparison shows that most non-EU vessels (mainly Chinese and Russian) identified via AIS do not appear on the ISRA-CRODT/VMS transmitting vessels list, which could be due to a communication gap between the compliance authority and ISRA-CRODT or due to a lack of VMS transmission by the vessels.

Although we could not be sure that the list of vessels reporting VMS activity to Senegalese authorities is complete, comparing AIS and VMS signals can be useful to identify the level of compliance.

5.5.1 Level of OT 4.3 achievement

There were four indicators for OT 4.3, where two are category B and two are category C.

Indicator		Indicator category	Indicator baseline	Indicator achievement	Responsible entity	OT dimension
I_8_CS4	The proportion of vessels, either EU or non-EU, with geolocalisation	B	0	Not able to evaluate	CSIC	Governance
I_9_CS4	The proportion of vessels, either EU or non-EU, with redundant (AIS+VMS) geolocalisation	B	0	Not able to evaluate		
I_10_CS4	AIS signals have been cross-checked with VMS signals using ISRA-CRODT info as a proxy	C	0	1	CSIC ISRA-CRODT LDAC	
I_11_CS4	The comparison between AIS and VMS signals is an accurate and useful method to identify if vessels are compliant	C	0	1		

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Due to the lack of available data, indicators 8 and 9 could not be evaluated within the FarFish project, but they remain important since they determine the achievement of OT 4.3 "VMS and/or AIS signals are transmitted". The new indicators 10 and 11 supported evaluating VMS and AIS data when available. The "Report on challenges and suggestions for improvements" (FarFish, D5.2), including a road map, suggested a key activity; and "Develop a big-data analysis by AIS signals" is translated into indicator 10 "AIS signals have been cross-checked with VMS signals using ISRA-CRODT info as a proxy". The activity "Develop diagnostic tools to detect suspicious activities in the area" is translated into indicator 11 "The comparison between AIS and VMS signals is an accurate and useful method to identify if vessels are compliant". Indicator 10 performs analysis while Indicator 11 determines whether it succeeds and could be used. This analysis aided illustrating the difficulty of accessing VMS data from relevant institutions (we did not receive the data but instead a list of vessels that transmit VMS from CRODT and not the control authority). This proxy study should be conducted by the control authority in Senegal or by CRODT if they have access to VMS.

5.5.2 Main risk for achieving OT 4.3

This OT aimed to verify that VMS and/or AIS signals are transmitted. Indicators 8 and 9 for this OT cannot be evaluated due to lacking data access, and therefore this OT is not possible to achieve during the FarFish project. The "and/or" in this OT should be replaced with "and" to evaluate compliance. If the authorities make the VMS data available, the OT will be achieved and verify whether vessels provide both VMS and AIS data. The indicators could be defined as category B, where low = below 50% of the total number of vessels correlating information from AIS and VMS, medium = 50%-79%, and high = 80%-100%. These data could be reported by fleet or year, depending on needs.

Indicators 10 and 11 demonstrated that cross-checking AIS and VMS signals represents an effective method to identify potentially non-compliant vessels. Access to VMS data from the compliance authority would nonetheless be needed to ensure that all VMS data are available for cross-checking signals with AIS. This exercise demonstrated that even with limited data available, there is potential to achieve more transparency for monitoring, control, and surveillance purposes.

5.6 OT 4.4 Trade flow data on black hake provided

In MR1, this OT was defined as "Trade flow data on black hake from operators provided" but rephrased to "Trade flow data on black hake provided" in this MR. This OT was proposed in the first MR1 Invitation (FarFish, D3.2) but was postponed from MR1 (FarFish, D4.3) to MR2.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Improve knowledge regarding the value chain, processing, and market conditions	• Study trade flow on black hake; • Study potential of hake in the West-African market.

OT 4.4 were recommended and aimed to improve knowledge regarding the value chain, processing, and market condition for black hake. Key activities included collecting trade flow data and conducting interviews with fishers, processors, sellers, and national authorities.

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Under “Potential actions as a supplement to the MR” (Chap. 6), potential task 1 identifies “The need to increase supply/demand and local markets within the black hake fishery, including those of neighbouring countries”. Hake consumption in Senegal is currently limited since few markets exist for the species and prices are low. Increasing marketing activities, value-chain development, and analysis could enable black hake to become an important contribution to local markets. Social aspects are included, such as employment and revenues defined in the MR2 invitation.

Progress:

“Description of CS value chains” (FarFish, D3.4) provides an overview of the value chain of hake from the Senegalese SFPA, including trade flows. Information regarding active vessels, catch, and landing is obtained from the Scientific Committee report from 2018[22]. Only two Spanish trawlers are targeting black hake under the Senegalese SFPA, and the black hake caught by these trawlers are mainly landed frozen in Spain (Vigo and Las Palmas). Only one vessel landed fresh hake in Cadiz, Spain, although this activity seems to have decreased over the past years. The hake caught in the Senegalese SFPA represent a small component of the large Spanish hake value chain. Because the EU fleet has reduced catches of black hake since the early 2000s, the hake fishery in Senegal was considered too small since the small quantities of hake fished within the SFPA lands directly in Spanish ports without value-adding activities occurring within Senegal. These factors discouraged pursuing a value chain analysis of the Senegalese hake under the SFPA.

Local fisheries have sharply increased since 2016, resulting in the recent overexploitation of hake in Senegal. To highlight Senegalese hake resources’ potential in West-African markets, FarFish attempted to initiate collaboration with local researchers, which was interrupted due to failure to locate a FarFish researcher in Dakar as initially planned. This development has unfortunately prevented pursuing further studies; however, this initiative is undertaken by researchers within the FarFish partner ISRA-CRODT, and results of their studies regarding the potential of black hake for the West-African market are expected after the project’s lifetime.

5.6.1 Level of OT 4.4 achievement

Indicator 12 was partly fulfilled since it was described for the EU fleet in D3.4. The Ministry of Fisheries annually publishes updated information from the Senegalese fleet (“résultats généraux des pêches maritimes”). Indicator 13 was not analysed further since no steps occur in Senegal besides landing and shipping. Obtaining information regarding hake in African markets was attempted by collaborating with local researchers but was ultimately not executed.

[22] https://ec.europa.eu/fisheries/documentation/studies/report-2018-meeting-joint-scientific-committee-eu-senegal-fisheries_da

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Indicator		Indicator category	Indicator baseline	Indicator achievement	Responsible entity	OT dimension
I_12_CS4	Trade flow of hake from EU and Senegalese fleet provided	C	0	1 (Yes)	Nofima/UoP	Socio-economic
I_13_CS4	Economic data on steps of EU value chain provided	C	0	1 (Yes)	UoP	
I_14_CS4	Information on the potential of hake in the West-African market provided	C	0	1 (Yes)		

5.6.2 Main risk for achieving OT 4.4

This OT aimed to provide trade flow data. Current EU catches of Senegalese hake are delivered in Spanish ports, mainly landed frozen, and sold in Spain. The hake catches under the SFPA represent a small component of the large hake value chain with volumes insufficient to pursue a value chain analysis. Detailed trade flow data for Senegalese hake caught by local fleets could only be acquired through interviews. This OT thus heavily depended on information from interviews, and therefore the primary risk regarded obtaining access to informants and their willingness to share information that could be considered commercially sensitive. Existing studies must be relied on when informants are hesitant to share information. The ongoing COVID-19 and travel restrictions limited opportunities to conduct face-to-face interviews, which exacerbated accessing informants and their willingness to share information. Restrictions on travel to Senegal represented a major factor preventing the fulfilment of indicator 14, particularly regarding fieldwork and face-to-face interviews.

6 Potential actions as a supplement to the MR

Apart from the OTs identified for the EU fleet operating in Senegal, several tasks have been identified that could support achieving the case study objectives identified in the MP0. These tasks[23] were not included in the list of OTs since they cannot be (solely) operationalised by the operators due to requiring input/action from other relevant parties (authorities, scientific institutions, other international fleets, etc.). These OTs are:

1. A main need identified on a socio-economic level within the fishery regards increasing supply/demand in local markets, including those of neighbouring countries (and other African countries) such as Cabo Verde, Côte d'Ivoire, and Cameroon, and increasing local prices for black hake. Hake consumption in Senegal is currently limited, as few markets exist for the species and prices are low. By increasing efforts in marketing activities, value chain development, and analysis, black hake could become an important contribution to local markets and social aspects such as employment and revenues.

[23] "Action points" were reworded to "potential tasks" in MR2 to clarify that these are not obligatory.

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2. There is a need to improve the quality of current stock assessments for black hake, including separate stock assessments for the two species.

3. Knowledge gap analysis is needed, especially concerning the black hake stocks. The responsibility for this goal cannot realistically fall on operators.

4. Obtaining a useful overview of hake trade flows has improved current knowledge, but repeating such studies is not likely to strongly contribute to socioeconomic aspects in Senegal or EU since their hake trade flows feed into highly competitive and large-scale value chains. Investigating bottlenecks for further utilising these resources in local markets could provide knowledge contributing to improving food supply in the region. The contribution would be minor, however, due to relatively high prices and small quantities.

5. Developing user-friendly, digital maps (VMS/AIS based) that support monitoring all fleets operating in the area could be valuable for this case study. (Authority comment: The FarFish project has explored the applicability of such maps, and this OT is partly linked to OT 4.3.)

7 Conclusion

This case study examines a fishery targeting the two black hake species, Tropical African hake (*Merluccius polli*) and Senegalese hake (*Merluccius senegalensis*). There is a lack of knowledge regarding the proportion of these species caught in Senegalese waters. Species discrimination will potentially enable improvements in managing this fishery through catch limits (such as setting TAC/Harvest Control Rule (HCR)) and/or technical measures since the two stocks have different biological characteristics (such as size at maturity). Improving species-specific knowledge and access to data will allow national management institutions to advance research on the hake species. The results show that self-sampling represents a viable and cost-effective method for obtaining samples; however, the results show that black hake mislabelling in the Senegalese national fisheries represents a significant problem. Improved training is needed to achieve better morphological identification of the two black hake species. Such data improve understanding of the black hake fishery and the individual species compared to analysis based on pooled data for the two black hake species.

To improve the MCS in the area, access to AIS and VMS data is necessary to verify compliance. The national authorities have access to data, but these data are sensitive and cannot be easily shared with others; however, the FarFish project has demonstrated potential to achieve greater transparency for MCS purposes despite limited available data.

8 Auditor

FarFish partner Sjókovin conducted two audits following the RBM process. The first audit on documentation system conformance and the second audit on performance effectiveness and compliance. The final audit of this MR will not be conducted.

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Appendix

8.1 Appendix 1.

Sampling protocol for Senegalese fishing vessels (ISRA-CRODT)

Protocole d'échantillonnage du merlu noir pour l'analyse d'ADN.

1. Notez l'emplacement géographique (les coordonnées géographiques), la date, l'heure et la profondeur dans la feuille d'échantillonnage

2. Sélectionnez entre 20 et 30 merlus de chaque trait, au hasard parmi la totalité de la capture: attribuez un identifiant unique (F1, F2, etc.), identifiez l'espèce selon la morphologie (visuelle) et enregistrez la longueur totale et le sexe.

3. Coupez un petit morceau de nageoire caudale (environ 1 cm^2) qui contient des rayons plus fins et plus de tissu. Pour la conservation correcte de l'ADN, il est nécessaire que le tissu ne représente pas plus d'environ 1/4 du volume total (1/4 de tissu et ¾ d'éthanol).
Placer le tissu dans un microtube avec bouchon à vis.

4. Nettoyez / désinfectez les ciseaux avec de l'éthanol avant de prélever l'échantillon suivant. Sécher et vérifier qu'il n'y a aucune trace de tissu pour éviter les contaminations.

5. Conservez les tubes dans un endroit frais (par exemple un réfrigérateur).
Exemple de feuille d'échantillon sur la page suivante.

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8.2 Appendix 2.

Logbook template defined for deep-sea trawlers in the SFPA with Senegal[24]

Appendix 3c

SFPA — SENEGAL
YEAR — QUARTER

Catch declaration for deep-sea demersal trawlers

Name of vessel | Flag State | Zone (1)

Catch in kilograms

Month	(1)	Hake	Pandora	Angler-fish						Other fish (3)	Other cephalopods (3)	Other crustaceans (3)	Other shellfish (3)	Total catch
	(FAO CODE)													
January														
February														
March														
April														
May														
June														
July														
August														
September														
October														
November														
December														
Total														

(1) Indicate whether 'Senegal' or 'Senegal/Guinea-Bissau common zone'
(2) One column for each species caught (with FAO Code)
(3) Indicate aggregate catches if species is not determined

[24] https://ec.europa.eu/fisheries/cfp/international/agreements/senegal

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8.3 Appendix 3.

Form used by Senegalese compliance observers

RÉPUBLIQUE DU SÉNÉGAL

MINISTÈRE DE LA PÊCHE ET DE L'ÉCONOMIE MARITIME

DIRECTION DE LA PROTECTION ET DE LA SURVEILLANCE DES PÊCHES

DPSP

FICHE STATISTIQUE DEMERSALE CÔTIERE ET PROFONDE

Immatriculation **Navire** :..... **Capitaine** :.....
Armateur :.....

Observateur :..... **Date d'embarquement** :..... **Date de débarquement**.....

Type de Pêche :..... **Equipage** :.....

N° Trait	Date Trait	Latitude début	Latitude Fin	Longitude de début	Longitude de Fin	Profondeur début	Profondeur de Fin	Heure de début	Heure de Fin
1									
2									
3									
4									
5									
6									
7									
8									

Espèces Ciblées	Trait1		Trait2		Trait3		Trait4		Trait5		Trait6		Trait7		Trait8	
	Quantité	Echantillon	Quantité	Echantillon	Quantité	Echantillon	Quantité	Echantillon	Quantité	Echantillon	Quantité	Echantillon	Quantité	Echantillon	Quantité	Echantillon

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8.4 Appendix 4:

Propose self-sampling form to be used in connection with the deep-sea trawl fisheries. To be used on a per-haul basis (5-10% of hauls).

Catches

SFPA - Senegal		Date:	
Name of vessel:		Time of start of tow:	
Flag state:		Latitude at start:	
Zone:		Longitude at start:	
		Depth (m) at start:	
		Time of end of tow:	
		Latitude at end:	
		Longitude at end:	
		Depth (m) at end:	
Commercial species			
Scientific name	**Common name**	**FAO code**	**Catch (kg)**
1. Fish			
Merluccius senegalensis			
Merluccius polli			
Zenopsis conchifer			
Lophiidae			
Brotula barbata			
Zeus faber			
Rajidae			
Tetraodontidae			
Sparidae			
Helicolenus dactylopterus			
Squaliformes			
Other fishes			
2. Crustaceans			
Parapenaeus longirostris			
Chaecon maritae			
Palinurus mauritanicus			
Aristeus varidens			
Other crustaceans			
3. Cephalopods			
Todarodes sagittatus			
Todaropsis eblanae			
Octopus vulgaris			
Other cephalopods			
		TOTAL (kg):	
Length distribution sampling of black hakes: take a random sample of at least 30 black hake, sort them by species and record the total lengths (cm)			
Merluccius senegalensis			
Merluccius polli			

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Discards

SFPA - Senegal		Date:	
Name of vessel:		Time of start of tow:	
Flag state:		Latitude at start:	
Zone:		Longitude at start:	
		Depth (m) at start:	
		Time of end of tow:	
		Latitude at end:	
		Longitude at end:	
		Depth (m) at end:	
Instructions:			
1. record the total weight (kg) of the discards (if it is not possible to weigh, then estimate).			
2. take a random sample of approximately 10 kg of discards, and record the weight.			
3. separate the discards in the sample and weigh the different species and groups.			
Total quantity of discards(kg):			
Sample discards (if possible identify main species, otherwise group as bony fishes, elasmobranchs, etc.)			
Species or group	**Quantity (kg)**	**Reason for discarding (NV=no value; CU=commercial**	
Bony fishes			
Elasmobranchs			
Crustaceans			
Cephalopods			
Echinoderms			
Sponges			
Others			
TOTAL(kg):			
Comments / observations:			

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CASE STUDY 5

MAURITANIA

Deliverable No. 4.4

Project acronym:
FarFish

Project title:
Results-Based Management and Capacity Building for EU Sustainable Fisheries Partnership Agreement and International Waters

Grant agreement No: **727891**
Project co-funded by the European Commission within the Horizon2020 Research and innovation programme

Start date of project: **1 June 2017**
Duration: **54 months**

Due date of deliverable:	30/11/2020
Submission date:	30/11/2021
File Name:	FarFish D4.4_MR2 Mauritania
Revision number:	02
Document status:	Final
Dissemination Level:	PU[1]

Role	Name	Organisation	Date	File suffix[2]
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[1] PU: Public, PP: Restricted to other programme participants (including the Commission Services), RE: Restricted to a group specified by the consortium (including the Commission Services), CO: Confidential, only for members of the consortium (including the Commission Services)
[2] The initials of the revising individual in capital letters

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Deliverable D4.4

Management Recommendation 2
Mauritania

30/11/2021

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Summary

This document serves as an update to the draft proposal for a management recommendation (MR2) with a focus on the black hake fishery and the small pelagic species under the Sustainable Fisheries Partnership Agreement (SFPA) between the Islamic Republic of Mauritania and the European Union (EU). The MR2 draft proposal was submitted internally for the second audit iteration within the FarFish Project in March 2021. The aim of this document is to respond to the second audit report (FarFish, D5.4) and provide a final version of MR2. The EU vessels currently targeting black hake are trawlers from Spain. Two different species of black hake are targeted, and there is a lack of distinction between the two in terms of catch statistics. Therefore, the two species of black hake are assessed as one by the Committee for the Eastern Central Atlantic Fisheries (CECAF).

MR2 was developed following the "General Guidelines for making MRs" (FarFish, D3.5) and is based on the "Second MR Invitation" (FarFish, D3.6), in which outcome targets (OTs) are proposed. The proposed OTs are based on "MR1" (FarFish, D4.3), the "Audit of MR1" (FarFish, D5.1), and the roadmap presented in "Report on challenges and suggestions for improvements" (FarFish, D5.2). In addition, stakeholder meetings facilitated by FarFish stakeholder interaction (WP1) and input from other FarFish work packages (WP) and case study (CS) meetings serve as a basis for this document.

MR2 aims to improve knowledge on the species composition of black hake in catches, thereby adding value to both species' stock assessment. In addition, MR2 aims to improve knowledge on the trade flow of small pelagic species.

The OTs for this CS are as follows:

OT 5.1: Information on the proportion of the two species of black hake in catches provided. **Obligatory. Achieved.**

OT 5.2: Information on black hake caught as bycatches provided. **Obligatory. Partly achieved.**

OT 5.3: Increased onboard observer coverage on all high-capacity pelagic vessels in place. **Obligatory. Partly achieved.**

OT 5.4: Data on all catches, discards, and bycatches provided. **Recommended. Partly achieved**.

OT 5.5: Trade flow data on small pelagic species provided. **Recommended. Partly achieved.**

The main goal for MR2 was to improve the catch reporting and quality of the stock assessment for the species included in the SFPA. The focus is on the two species of black hake (*M. polli* and *M. senegalensis)* and small pelagic species (*S. pilchardus, S. colias,* and *E. encrasicolus)* caught in the area.

Progress has been made, and tools with which to achieve the MR2 objectives have been developed. The operators can easily implement the self-sampling programme, but the training of the crews in the visual identification of black hake species is needed. To improve data collection, FarFish provides templates and sampling protocols. Still, implementation requires collaboration between operators and authorities in the Mauritania EZZ, and funding for the training of the crews and observers is needed.

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Abbreviations

CCMAR	Centro de Ciencias do Mar do Algarve (Portugal)
CETMAR	Centro Tecnológico del Mar- Fundación CETMAR (Spain)
CFP	Common Ffisheries Policy
CS	Case Study
JSC	Joint Scientific Committee on Fisheries Agreement between Mauritania and the EU
DARE	Directory of Fisheries Management in Mauritania
DCF	Data Collection Framework
DG MARE	Directorate-General Maritime Affairs and Fisheries, EC
DPI	The management of industrial fishing is responsible for granting licenses and monitoring access rights payments, Mauritania
EC	European Commission, executive of the European Union
EEZ	Exclusive Economic Zone
ERS	Electronic Recording Systems
FAO	Food and Agriculture Organization of the United Nations
FiTI	Fisheries Transparency Initiative
GCM	Coast Guard (Garde Côtes Mauritanienne)
IEO	Instituto Español de Oceanografía
IMROP	Mauritanian Institute for Oceanographic Research and Fisheries
LDAC	Long Distance Advisory Ccouncil
MATIS	Matís ohf. – Icelandic Food & Biotech R&D (Iceland)
MPEM	Ministry of Fisheries and Maritime Economy
MR	Management Recommendation
ONISPA	National Office for Sanitary Inspection of Fishery and Aquaculture Products (Mauritania)
OPROMAR	Organization of Fresh Fish Producers of the Port and Ría de Marín (Spain)
OT	Outcome Targets
PFA	Pelagic Freezer Trawler Association
RBM	Results-Based Management
RBMP	Results-Based Management Principles
RFMO	Regional Fisheries Management Organization
SFPA	Sustainable Fisheries Partnership Agreement
RG	Reference Group
SAU	Sea around us
SGP	Secretaría General de Pesca (Spain)
SSB	Spawning Stock Biomass
STECF	Scientific, Technical, and Economic Committee for Fisheries (EU)
TAC	Total Allowable Catch
UCA	Université Cadi Ayyad (Morocco)
UiT	The Arctic University of Norway
UoP	University of Portsmouth Higher Education Corporation
VMS	Vessel monitoring system
WP	Work package

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Concepts/definitions

Indicator	A variable, pointer, or index related to a criterion. Indicators are selected such that their variations reflect variations in key elements of the fishery resource, the social and economic well-being of the sector, and the sustainability of the ecosystem. The position and trend of an indicator in relation to reference points or values indicate the present state and dynamics of the system. Indicators provide a bridge between objectives and actions (source: FAO 1999).
Management goals	The higher-order objective to which a management intervention is intended to contribute (OECD 2011). A management goal is derived from a management principle (constitutional-order) and specified into a set of more operational management objectives (collective-order).
Management intervention	Strategies or instruments aimed to impact the state of a fishery with reference to authorized objectives. Examples are input and output controls and economic measures.
Management measures	Can be technical (e.g., gear selectivity etc.), input (effort)/output (catch) control, or right-based.
Management objectives	Fisheries' management objectives are typically framed within the overall concept of sustainable development and may reflect one or more of the various dimensions and criteria that relate to it (FAO 1999). OTs are controlled by operators through setting and implementing management measures.
Management plan	In RBM, the management plan is a formal arrangement between a management authority and operators that specifies the partners in the fishery and their respective roles, the agreed objectives for the fishery, and the management rules and regulations that apply; it also provides other relevant details about the fishery. In RBM, the formal responsibility for developing the management plan is delegated to an operator.
Management recommendation	In RBM, the management recommendation (MR) is a formal arrangement between a management authority and operators that specifies the partners in the fishery and their respective roles, the agreed-upon objectives for the fishery, and the management rules and regulations that apply; it also provides other relevant details about the fishery.
Management strategies	In the FarFish context, this term refers to the strategies applied to achieve OTs.
Outcome targets (OTs)	OTs are specific and measurable requirements set by an authority to make management goals operational. An OT is a statement of the condition of an indicator relative to a reference point, often in the form of an inequality ("A > B") or a statement of presence or absence of some entity. On the basis of relevant information, this statement can be assessed as being either true or false at a given point of time. For instance, the management objective that "the fishery should be biologically sustainable" could be expressed in terms of one or more OTs such as "Catch < 20,000 t"; "bycatch < 20%"; "SSB > 30,000 t"; "a catch reporting system is present," etc.

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1 Introduction

This document updates the draft proposal for a management recommendation in the FarFish Project, which was submitted internally for audit purposes, for European operators fishing in Mauritanian waters under the current SFPA. The document responds to the second audit report (FarFish, D5.4).

1.1 FarFish overall objective

The overall objective for FarFish is to improve the knowledge on and the management of EU fisheries outside Europe while contributing to sustainability and long-term profitability. The role and responsibilities of the EU fleets are significant in ensuring the sustainable utilisation of the resources to which they are allowed access, whether under SFPAs or in international waters, hereafter called the high seas.

The concept of sustainability concerns meeting present needs without compromising future generations' ability to meet their own. More simply, it is about managing people, the planet, and profit. Therefore, the fleet should cooperate with the RFMOs and national authorities in partner countries to improve knowledge and make management more effective. The EU has agreed on strengthening capacity in its SFPA countries to ensure the efficient management of fisheries. This will ultimately lead to the sustainable utilisation of the fisheries and increase the long-term profitability of all stakeholders.

The FAO report titled "The State of World Fisheries and Aquaculture 2020" (FAO, 2020) states that there is no alternative to sustainability; the world needs programmes to further improve fisheries to continually allow humans to fish in oceans for edible seafood. The only path to sustainability is the effective management of world fisheries. This obligates EU national authorities and fishing industries.

1.2 About Mauritania

Mauritania, officially the Islamic Republic of Mauritania, is a country in Northwest Africa. It is the 11th largest sovereign state in Africa. It borders the Atlantic Ocean to the west, the Western Sahara to the north and northwest, Algeria to the northeast, Mali to the east and southeast, and Senegal to the southwest. The capital and largest city is Nouakchott.

The Mauritanian Exclusive Economic Zone (EEZ) covers 234,000 km^2, of which around 16% corresponds to the continental shelf. The area is among the world's most fish-abundant waters due to its strong upwelling coastal currents and a large continental shelf favouring the development of fishery resources. Traditionally, more than 95% of catches from the Mauritanian EEZ are exported. The export value of fisheries products was estimated at over USD 1 billion in 2018. However, the main commercial transactions are linked to fishing licenses granted to foreign fleets rather than fishery products.[3]

Fishing is essential to the Mauritanian economy. It accounts for between 4% and 10% of the country's gross domestic product, depending on the year, and between 35% and 50% of Mauritanian exports. Fishing also generates around 55,000 direct and indirect jobs; this figure represents 40% of employment in the country. It is estimated that 31% of these jobs are generated by small-scale fishing and 12% by industrial fishing. Most jobs are on land, with 3% involving other secondary activities.[4]

[3] http://www.fao.org/fishery/facp/MRT/en

[4] https://www.europarl.europa.eu/RegData/etudes/STUD/2018/617458/IPOL_STU(2018)617458_EN.pdf

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Despite its importance to the Mauritanian economy, the fisheries sector is relatively undeveloped. This is partly due to the lack of a maritime tradition and the remoteness of Nouadhibou, which was previously the only landing point for the industrial fleet. The same is true for the fish-processing industry, which is underdeveloped and under-utilised.

The national demand for fish is low. The average consumption per capita, originating mainly from the artisanal sector, increased from 10 kg in 2014 to 12.6 kg/year in 2018 and can reach 20 kg/year in coastal urban areas (Marti, 2018).

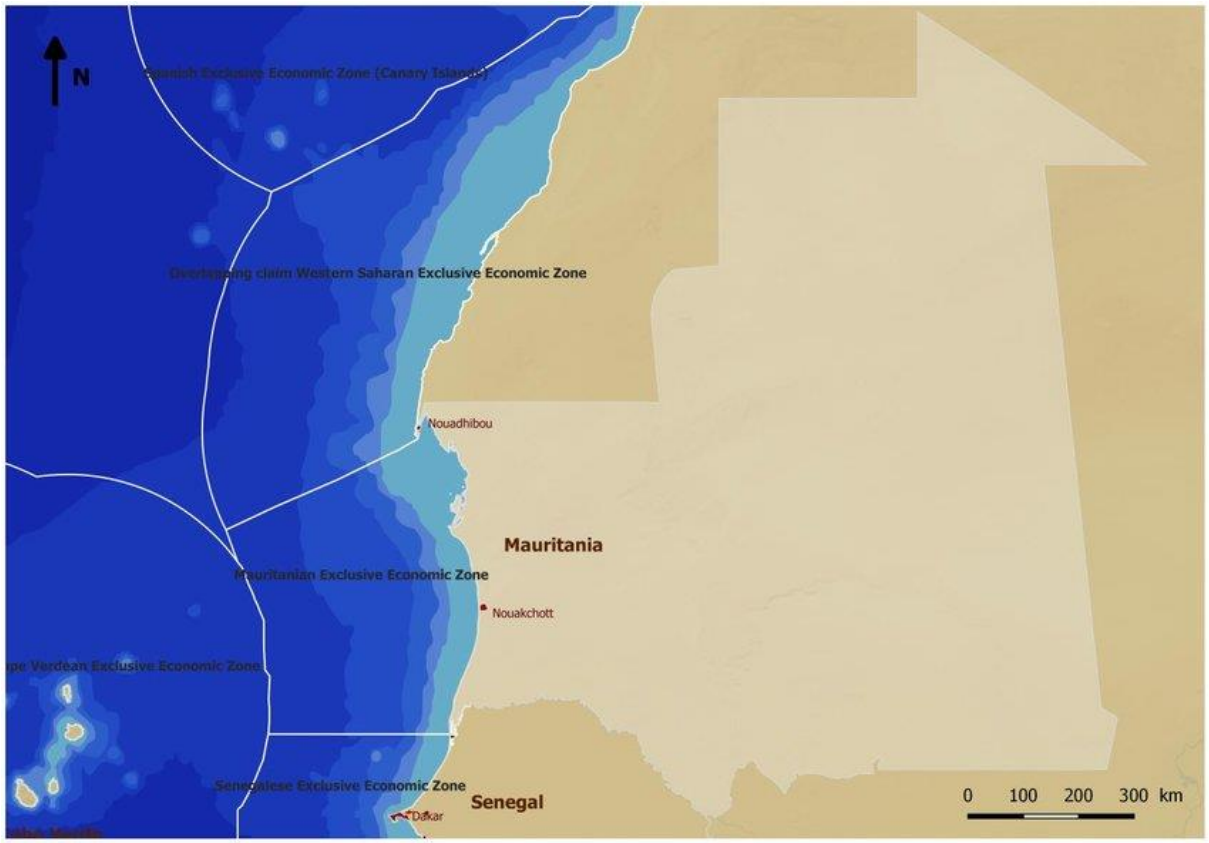

Figure 1: Map of Mauritania showing its exclusive economic zone (EEZ). Source: Flanders Marine Institute (2018)

1.3 The process for developing MR2 for Mauritania

The MRs within the FarFish Project were developed in two iterations and build on results-based management (RBM)[5] principles (Nielsen *et al.*, 2017). RBM requires that the relevant authority defines specific and measurable objectives for a fishery but allows resource users (operators) to find ways to achieve these objectives and provide adequate documentation (Figure 2).

[5] The RBM is also referred to as the Responsive Fisheries Management System (RFMS) in the EcoFishMan project and other FarFish documents

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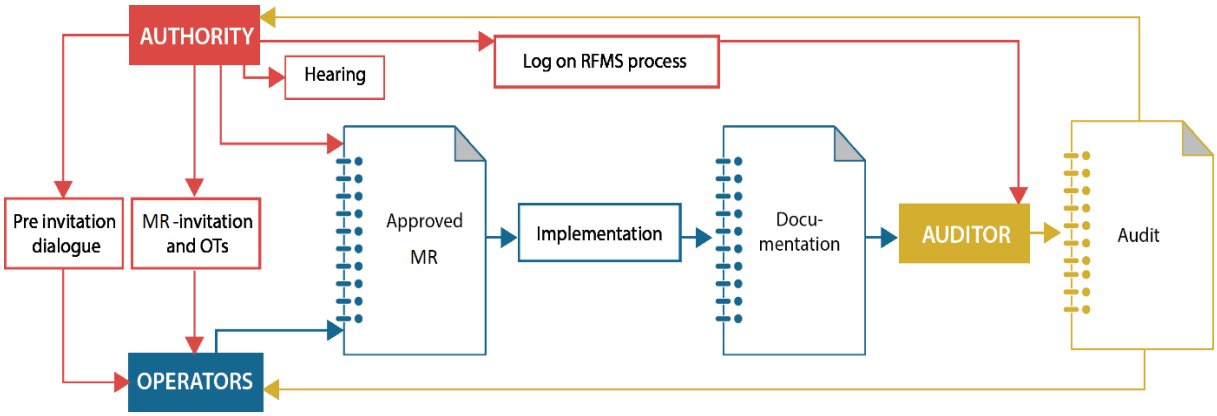

Figure 2. General description of the process of making an MR based on RBM in FarFish (FarFish, D 3.1). The different colours demonstrate the responsibilities of each of the three entities. Authority: Red / Operators: Blue / Auditors: Yellow.

The Mauritanian authority wished to include black hake, shrimp, and small pelagic fisheries in the first MR1. At the FarFish WP/CS leaders' meeting in Mindelo, held in November 2018, it was decided that the focus of MR1 should be on black hake and shrimp and that MR2 would focus on black hake and the pelagic fishery. MR1 for Mauritania (FarFish, D4.3) was made available on 30 September 2019. MR1 acknowledged that there is little interest among operators in applying RBM to the shrimp fishery. This is due to declining catches and increased effort because of the closures of fishing grounds for the EU fleet. Therefore, the shrimp fishery is not included in MR2, despite it being mentioned in the "Second MR Invitation" (FarFish, D3.6). MR2 was developed following the "General Guidelines for Making MRs" (FarFish, D3.5) and is based on the "Second MR Invitation" (FarFish, D3.6), where the OTs for the CS were set for the second loop. The focus of MR1 was on the black hake and shrimp fisheries, but, in MR2, the focus was on the black hake and pelagic fisheries.

The OTs were first outlined in the MR2 invitation after input from the stakeholders. The consortium reviewed the OTs at the CS and WP leader meeting in Marrakesh (Morocco, Nov. 2019). After the meeting, a draft of the "Second MR Invitation" was sent for hearing among operators. Based on the response, the authority (MATIS) further adjusted some of the OTs, and the "Second MR invitation" (FarFish, D3.6) was made available on 21/01/2020. The External Advisory Group and the experts in the 36-month review meeting in August 2020 also provided valuable input regarding the development of MR2. The second audit, "Report on Management Recommendation 2 Audit" (FarFish, D5.4), was made available on 30/06/2021. The recommendations from the second audit report were used to update the second MR.

CETMAR (WP1) arranged a workshop for Mauritania case study in Las Palmas, Spain, in October 2019. The workshop's main goal was to present the results from the audit for Mauritania MR1 and assess constraints and opportunities for developing MR2 for Mauritania.

In addition to the workshop mentioned above, WP1 has ensured continuous contact with relevant operators through seven physical meetings, e-mail correspondence, and phone calls. WP4 represented the operator and developed the MRs. The FarFish coordinator represented the authority had meetings

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(online and physical), e-mail correspondence, and phone calls with the CS leader and representatives from the Mauritanian Institute for Oceanographic Research and Fisheries (IMROP).

1.4 Partners involved in MR2 for Mauritania

This CS focused on the EU fleet, meaning that not all operators in Mauritania waters were involved in RBM.

MATIS acted as the leading authority considering input from the competent authorities; for example, the Ministry of Fisheries and Maritime Economy (MPEM), the Management of Oceanic Resources (DARE), the Office National d'Inspection des Produits de la Pêche et Aquaculture (ONISPA), the Management of Industrial Fishing (DPI), IMROP, and the Directorate-General for Maritime Affairs and Fisheries (DG MARE). The European operators qualified to respond to the MR Invitation for Mauritania are the Long-Distance Advisory Council (LDAC) and the Organization of Fresh Fish Producers of the Port and Ría de Marín (OPROMAR). WP5 leader Sjókovin will conduct the audit.

Table 1: RBM roles of work packages, stakeholders, and FarFish research institutions taking their respective roles in the project (indicated in italics) in the development of the Mauritanian MR2

Mauritanian CS			
RBM roles	**AUTHORITY**	WP3	MPEM, ONISPA, DARE, DPI, IMROP, DG MARE, *MATIS*
	OPERATORS	WP4	LDAC and OPROMAR, *UiT*
	AUDITOR	WP5	*Sjókovin*

IMROP acts as the CS leader in the FarFish Project.

1.4.1 Other partners and stakeholder interactions

An uptake meeting organised by CETMAR (WP1) took place in Las Palmas, Spain, in October 2019. The objective was to present the results from the Mauritanian MR1 audit to relevant stakeholders and FarFish Consortium members, and to assess constraints and opportunities for developing MR2 for Mauritania. One participant from Mauritania, representing IMROP, attended the meeting.

1.5 Aims of MR2 for Mauritania

MR2 aimed to improve the quality of the current stock assessment for the species included in the SFPA and strived to provide information on the proportion of the two species of black hake in catches and bycatches. The aims for the different species were as follows:

- **Black hake:** Improved discrimination between the two hake species and value chain analysis to explore alternatives for increasing the importance of the black hake to the national economy and employment.
- **Small pelagic**: The small pelagic species within the Mauritanian EEZ are vulnerable to environmental forces that need further study. Uncertainties around stock assessment and catch reporting/estimates make this fishery highly relevant for FarFish. In addition, there have been recent significant changes in the value chain of small pelagic species caught in Mauritanian waters that need to be studied, as, for example, fishmeal plants have been established in considerable numbers.

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2 The SFPA between the EU and Mauritania

The first fisheries agreement between Mauritania and the EU dates to 1987 (Marti, 2018). Since then, regular collaboration has been maintained. In 2006, this agreement became a Sustainable Fisheries Partnership Agreement (SFPA), and the current protocol entered into force in November 2015 for four years. However, the partners agreed on an extension, which allowed them to negotiate another SFPA.[6] The extension will allow the EU vessels' fishing activities in Mauritanian waters to continue until November 2021 (EU, 2021).

Under the terms of the SFPA, the European fleet can fish in the Mauritanian EEZ for up to 287,050 tonnes per year of shrimp, demersal fish, tuna, and small pelagic fish. Octopus is exclusively reserved for national artisanal fishers.

The SFPA with Mauritania is the most expensive agreement the EU has with a coastal state. Europeans pay Mauritania a financial contribution of EUR 61,625,000 per year in the form of royalties. EUR 4,125,000 is earmarked to support local fishing communities in Mauritania and improve fisheries' governance.

Table 2: Categories of fishing and total allowable catches per year according to the EU – Mauritania SFPA (2015–2019, with an extension until November 2021)

Categories of fishing		Total allowable catches
1	Vessels fishing for crustaceans other than spiny lobster and crab	5 000 tonnes
2	Black hake (non-freezer) trawlers and bottom longlines	6 000 tonnes
3	Vessels fishing for demersal species other than black hake with gear other than trawls	3 000 tonnes
4	Tuna seiners	12 5000 tonnes (reference tonnage)
5	Pole-and-line tuna vessels and surface longlines	7 500 tonnes (reference tonnage)
6	Pelagic freezer trawlers	225 000 tonnes (*)
7	Non-freezer pelagic vessels	15 000 tonnes (**)
8	Cephalopods	(pm) tonnes
(*) This figure may be exceeded by a 10% margin without any impact on the financial contribution paid by the EU for access. (**) If the fishing opportunities are utilised, they shall be deducted from the total allowable catch provided for Category 6.		
Based on the scientific advice available, the two parties may agree within the Joint Committee on the allocation of fishing opportunities for freezer trawlers targeting demersal species in respect of which a surplus has been identified.		

[6] https://ec.europa.eu/fisheries/press/sustainable-fisheries-eu-and-islamic-republic-mauritania-extend-existing-protocol_en

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3 Fishery Overview

3.1 Catches in the Mauritanian EEZ

Catches of shrimp, pelagic species, and black hake in the Mauritanian EEZ exceeded 145,000 tonnes in 2018. The total catch of shrimp was 2,475 tonnes, black hake 15,100 tonnes, and pelagic species about 127,500 tonnes.[7] In addition, tuna catches in industrial fishing represent between 85 and 90% of all tuna catches. The industrial fishing of small pelagic species is notable because it represents around 90% of total industrial fishing. In recent years, EU vessels have represented on average 10% of the total catch of small pelagic species. The artisanal sector targets all species, and, beyond supplying the local market, it provides a large part of the fish destined for processing into meal and oil.[8]

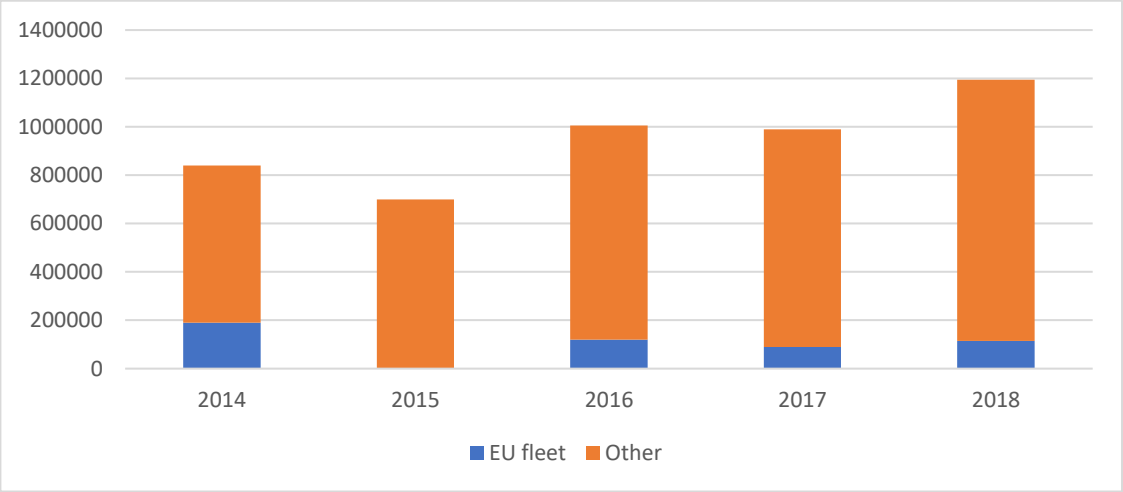

Figure 3. Catches of small pelagic species (in tonnes) in Mauritania between 2014 and 2018 (Source: GT 2019, IMROP)

The EU fresh and frozen trawlers' catch of black hake amounted to 13,200 tonnes in 2018, while the rest of the black hake was a bycatch or taken by foreign vessels with local crews.

[7] https://ec.europa.eu/fisheries/documentation/studies/report-2019-meeting-joint-scientific-committee-eu-mauritania-fisheries_en

[8] https://ec.europa.eu/fisheries/sites/fisheries/files/docs/body/summary-mauritania-2014_en.pdf

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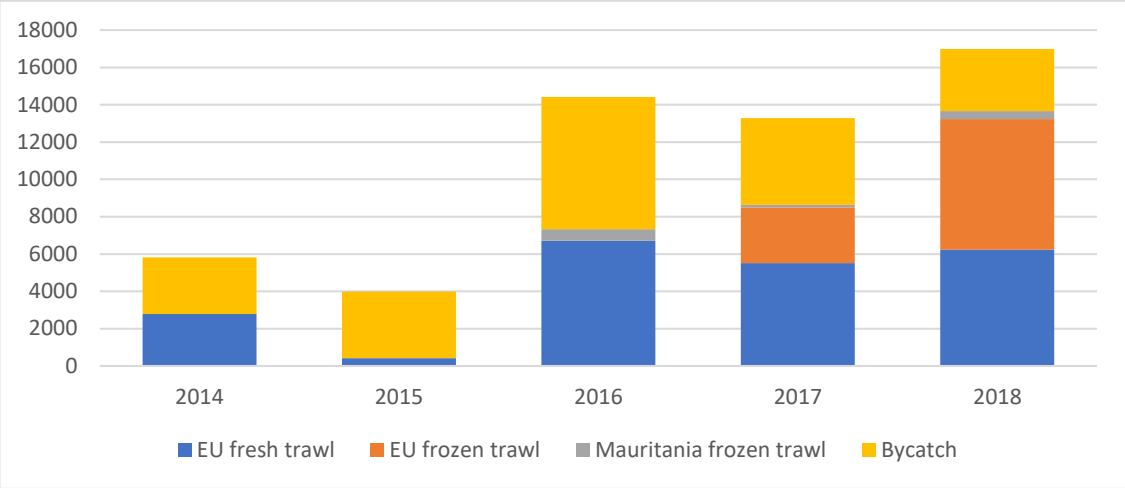

Figure 4. Catches of black hake (in tonnes) in Mauritania between 2014 and 2018. (Source SGP, IEO and IMROP)

The EU's fishing activity during 2015 was halted due to the renegotiation of the SFPA between the EU and Mauritania.

3.2 Fisheries management in Mauritania

The Ministry of Fisheries and the Maritime Economy (MPEM) has the overall responsibility for designing, coordinating, promoting, and monitoring government policy implementation in fishing areas, oceanography, the merchant navy, and maritime training. It is the competent national authority for monitoring the quality, hygiene, and sanitation of establishments, products, and fishing production areas. The laws and regulations of fishing are to be found in the Fisheries Code of 29 July 2015 and the decree implementing the legislation.

This ministerial department is responsible for developing and utilising living marine resources and brackish and inland waters. The conservation, preservation, and exploitation of fishing resources are an integral part of its remit. The same is true for research into fisheries-related activities, oceanography, aquaculture, the fisheries' social economics, and related activities. The monitoring and surveillance of fisheries in waters under national jurisdiction also fall under the ministry's authority.

3.2.1 Fisheries policy

Mauritania began to develop its fisheries policy in 1979. Since then, the development has undergone six phases with three objectives: the sustainable conservation of marine resources, the integration of fishing into the economy to maximise employment and added value (Marti, 2018).

To adopt a management system that prevents the overexploitation of resources, the Mauritanian authorities have moved from a license-based system to one of transferable quotas based on scientific assessments through the years (Marti, 2018).

The government has consequently established the Strategy for the Management and Sustainable Development of the Fisheries Sector and the Maritime Economy, which contains the 2015–2019 action plan and identifies six strategic objectives:

1. Improving the understanding of fishery resources and their environment

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2. Optimising the management of resources
3. Strengthening the integration of the sector with the national economy
4. Promoting inland fishing and aquaculture
5. Developing business
6. Strengthening governance

This new national management strategy implements a profound reform of the management system by introducing quotas for fisheries management. The legal and regulatory basis for this is the new fisheries code of 2015 and its legislation. The new system for the management of fisheries resources is based on fishery development plans. It provides for two operating schemes:

1. The national scheme
2. The international scheme

The national scheme regulates access to fishing through quotas for allocating rights of use to legal or natural persons based on inland or offshore investment. The operation of a quota is subject to the payment of an access fee for the resource, including a direct access fee, a fixed fee, and a license fee. This fee is set taking into consideration the value of the product. Access to the international scheme's resources is provided under agreements or conventions with third-party states or private entities.

3.2.2 Research

The Institut Mauritanien de recherche Océanographique et des Pêches (IMROP) is the official Mauritanian research entity for fisheries.[9] Under the Mauritanian Ministry of Fisheries and Maritime Economy's tutelage, IMROP's main purpose is to analyse the constraints and determinants of the biological, physical, socio-economic, and technical issues associated with the fisheries sector.

IMROP includes four research laboratories:

- Laboratory of Ecology and Biology of Aquatic Organisms (LEBOA)
- Aquatic Living Resources Assessment Laboratory (LERVA)
- Laboratory for the Study of the Marine and Coastal Environment (LEMMC)
- Laboratory of Social and Economic Studies (LESE)

4 Specific challenges in Mauritania related to black hake

The following challenges have been identified in the FarFish Project, several of which are taken from the 2018 report titled "Research for PECH Committee – Fisheries in Mauritania and the European Union" (FarFish, D3.3, and D3.4).

4.1 Lack of a level playing field where all operators oblige to the same rules

The EU has established a system concerning fishing activities for EU vessels fishing outside Union waters under the SFPA and the high seas.[10] The Common Fisheries Policy (CFP) requires SFPAs to be

[9] http://www.fao.org/fishery/facp/MRT/en

[10] REGULATION (EU) 2017/2403 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 December 2017 on the sustainable management of external fishing fleets, and repealing Council Regulation (EC) No 1006/2008

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limited to surplus catches and to provide a comprehensive report of all catches and bycatches via an electronic logbook/ERS.

Furthermore, the CFP stresses the need to promote the objectives of the CFP internationally to ensure that EU fishing activities outside Union waters are based on the same principles and standards as those applicable under EU law while promoting a level playing field for Union and third-country operators.

EU vessels report on their position (VMS) and catch (e-logbook) both to the control authorities of their flag states and to the authorities of Mauritania (via paper logbook) on a daily/weekly basis. Through this system, it is possible to perform real-time monitoring of the quota consumption under the reference tonnage allocated under each of the categories in the SFPA.

However, for the non-EU fleets operating under private/chartering agreements in Mauritania, there is little knowledge on the vessels catching black hake and the quota allocation for each of them, which affects the stock's sustainability. As a result, there are no official statistics available from the coastal state, and thus no figures regarding the fish caught by non-EU fleets is included in the estimation of the surplus in the scientific assessments.

Furthermore, the *ex-ante* and *ex-post* evaluations of the SFPA[11] help understand the main problems. These evaluations make recommendations to the governing bodies, including the Scientific Committee and Mixed Committees responsible for management. The *ex-ante* and *ex post* evaluations are vital for ensuring the transparency and accountability of the EU fleet's fishing activities in third countries. They are also helpful in providing specific recommendations and guidance on how to improve the conservation and management measures derived from the practical implementation of SFPAs. This information is drawn from the competent governing bodies' decisions, namely the Scientific and Mixed Committees.

Considering the above, there is a lack of a level playing field between the EU and non-EU operators, which hinders the reporting and use of these data for stock assessments. However, it is worth noting that Mauritania has joined the Fisheries Transparency Initiative (FiTI),[12] which has released a report[13] concerning the improvement of information on all fleets' fishing activity within the Mauritanian EEZ and governance structures through annual country reports.

4.2 Divergent conversion factors used in logbooks to obtain live weight

The challenges concerning the conversion factors are dealt with by the relevant authorities; therefore, FarFish only summarises the state of the art. The Joint Scientific Committee on Fisheries Agreement (JSC) suggests solutions to the differences between the landings data of IMROP, IEO, and DG MARE; these solutions are related to the use of different conversion factors to estimate tonnage in live weight equivalents.

The estimation of the conversion factor applied by IEO and IMROP for black hake creates misunderstanding and a loss of value for operators. JSC addressed this issue during the most recent

[11] https://op.europa.eu/en/publication-detail/-/publication/08e725d1-5a8f-11e9-9151-01aa75ed71a1
[12] https://fisheriestransparency.org/fiti-implementing-countries
[13] https://www.peches.gov.mr/IMG/pdf/gmn_vfrapport_fiti_mauritanie_2018_20210518.pdf

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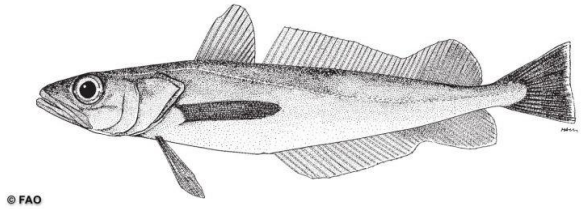
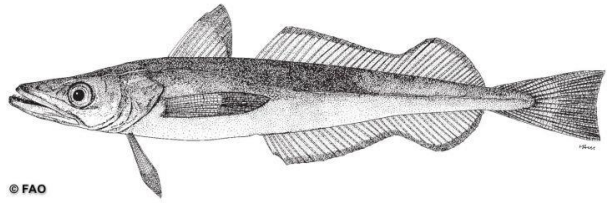
JSC meeting and recommended the application of 1.51 instead of 1.67 for fresh black hake (gutted) and 2.60 for frozen fillets (BOE 55/03/19).[14]

4.3 Data limitation for sustainable conservation and separate stock assessment of black hake

Due to the two species of black hake having a morphological resemblance and an overlapping occurrence at certain depths, both species are mixed in catches and commonly marketed as *Merluccius* spp (FAO, 2016). Neither the SFPA nor the stock assessment by the CECAF discriminated between the two species, even though they have different biological characteristics and should therefore preferably be managed separately (Fernández-Peralta *et al*., 2017). The two species are reported together as black hake in both the catch statistics released by the CECAF/FAO and the STECF's annual reports.

Table 3: The two species of hake reported together as black hake[15]

Common name	Picture	Scientific name	FAO code
Tropical African/Benguela hake		*Merluccius polli*	HKB
Senegalese hake		*Merluccius senegalensis*	HKM

4.4 High bycatch of black hake in non-hake fisheries

Black hake frequently occurs as a bycatch in other non-hake fisheries, especially in the pelagic fishery. Both the JSC and the demersal working group in the CECAF have raised concerns regarding this bycatch. The CECAF's recommendation is that management takes necessary steps to reduce bycatches to the average of the 2014–2015 period (3,300 tonnes).

4.5 Bycatch in black hake fisheries

Operators and onboard scientific observers are responsible for most of the activities related to bycatch reporting. However, the observer reports are not made available to the operators, as the reports lack transparency and incentives for cooperation. There is a need to improve communication between observers and operators. This would allow for better fisheries data reporting, data exchange, communication gaps identification, and research initiatives such as industry–science partnerships.

[14] https://www.boe.es/boe/dias/2019/03/05/pdfs/BOE-A-2019-3167.pdf
[15] https://www.biolib.cz/en/gallery/dir2556/pos21,21/

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4.6 Insufficient monitoring of catch in relation to the TAC

According to Article 2, bullet point 5, in the SFPA[16] protocol, the EU and Mauritania shall ensure the joint monitoring of catches. When the catches within a category reach 80% of the annual total allowable catch (TAC) (concessions), the authorities should monitor the monthly catches. The establishment of an ERS is likely to improve the monitoring of TAC consumption.

Mauritania is in the process of setting up an alert mechanism to track TAC consumption in the Garde Côtes Mauritanienne (GCM) system (EC, 2019). As a result, a commission led by the GCM has been established. The members of this commission are include DARE, IMROP, and the Observatory. This operational commission performs a quarterly assessment of the operation of the concessions and provides an early warning to the GCM when the 70% concession operation level is reached.

5 Outcome Targets and Indicators

OTs are specific and measurable requirements set by an authority to make management goals operational. An OT is a statement of the condition of an indicator relative to a reference point, often in the form of an inequality ("A > B") or a statement of the presence or absence of some entity. An OT should usually be specific, measurable, attainable, relevant, and time-based (SMART).

Black hake stocks are shared between several countries in the subregion, mainly Mauritania, Senegal, Morocco, and the Gambia. As a result, we acknowledge that the OTs should be applied at a regional level, but this beyond the scope of the FarFish Project (in terms of both project lifetime and resources). Authorities such as the CECAF and FAO are already implementing this regional approach.

The RBM approach depends on operators being incentivized to develop MRs for a given fishery. The OTs set for the Mauritania CS are based on MP0 (FarFish D4.1), MR1 (FarFish D4.3), and the audit of MR1 (FarFish D5.1), as well as a lengthy and detailed consultation process with authorities, operators, and other stakeholders in the fishery (e.g., Workshop in Las Palmas). The applied OTs are defined in the second MR Invitation (FarFish D3.6). Five OTs are identified for the Mauritanian fisheries, three of which are obligatory and two recommended.

Table 4: OTs for the Mauritanian fisheries

OT 5.1	Obligatory	Information on the proportion of the two species of black hake in catches provided
OT 5.2	Obligatory	Information on black hake caught as bycatches provided
OT 5.3	Obligatory	Increased onboard observer coverage on all high-capacity pelagic vessels in place
OT 5.4	Recommended	Data on all catches, discards, and bycatches provided
OT 5.5	Recommended	Trade flow data on small pelagic species provided

5.1 Changes in OTs between MR1 and MR2

Several OTs presented in the first MR have been changed in the second MR. In MR1, seven OTs were identified; these have been reduced to five in this second MR. The main reason for this reduction is

[16] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A22015A1201%2801%29

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that OTs addressing the improved registration of catches, especially bycatches and discards, in the black hake (MR1, OT 5.3) and pelagic (MR1, OT 5.5) fisheries, have been merged into one in this MR; this OT addresses the issue in general (MR2, OT 5.4). The OT addressing the shrimp fishery has been erased (MR1, OT 5.4; see Chapter 1.3). To allow for transparency, a description of these changes is included below (Table 5).

Table 5. Changes in OTs between MR1 and MR2

OTs in MR1	OTs in MR2	Change
OT 5.1 Estimate the proportion of *M. polli* and *M. senegalensis* into the catch composition **(Obligatory)**	**OT 5.1** Information on the proportion of the two species of black hake in catches provided **(Obligatory)**	The OT has been rephrased
OT 5.2 Collecting data of the black hake as bycatch by all operators in Mauritanian waters **(Obligatory)**	**OT 5.2** Information on black hake caught as bycatch provided **(Obligatory)**	The OT has been rephrased
OT 5.3: Improved data collection and reporting from all operators fishing for small pelagics, in Mauritanian waters where data on landings and catches of all species are reported via electronic reporting (E-logbook, target, bycatch, and discard where applicable) **(Recommended)**	**OT 5.4** Data on all catches, discards, and bycatches provided **(Recommended)**	OT 5.3 and 5.5 from MR1 have been merged into OT 5.4 in MR2, which addresses the issue in general, while OT 5.4 has been erased
OT 5.4 Increase knowledge and data collection of all catches in the shrimp fishery, including bycatches **(Recommended)**		
OT 5.5 Improved data collection and reporting from all operators fishing for small pelagics in Mauritanian waters where data on landings and catches of all species are reported via electronic reporting (E-logbook should include target species, bycatch species and discard where applicable) **(Obligatory)**		
OT 5.6 Full onboard observer coverage on all high-capacity pelagic vessels **(Obligatory)**	**OT 5.3** Increased onboard observer coverage on all high-capacity pelagic vessels in place **(Obligatory)**	The OT has been rephrased and the OT number changed from 5.6 to 5.3.
OT 5.7 Increase knowledge and data collection of all fleets fishing for small pelagics on trade flows. **(Recommended)**	**OT 5.5** Trade flow data on small pelagic species provided **(Recommended)**	The OT has been rephrased and the OT number changed from 5.7 to 5.5.

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In MR1, OT 5.3 and 5.5 have the same definition, but OT 5.3 is recommended, while OT 5.5 is obligatory. This is due to a mistake made in MR1, where OT 5.3 has been omitted. According to the first MR invitation (FarFish D3.2), OT 5.3 is recommended and states, "Increase knowledge and data collection of all fleets fishing for black hake operating in the Mauritanian EEZ on trade flows to include for example catches, destination/landings, utilization/processing, exports, value, etc. This could include providing copies of sales invoices (sales certificates) to verify what markets the catches enter."

In this MR, OT 5.1 and 5.2 have the same objective: improving the current stock assessment quality for the species included in the SFPA. The difference between the two OTs is that they refer to different fleets: OT 5.1 refers to the fleet that targets black hake, while OT 5.2 refers to the fleet that targets small pelagic species but harvest black hake as bycatch.

5.2 Indicators

An OT most commonly refers to an indicator value. The suggested indicators in FarFish are set to measure the OT's degree of achievement (Table 6) and are classified with three dimensions: ecological, socio-economic, and governance. The indicators are classified according to their level of measurability and provide a bridge between objectives and actions. The most detailed indicator category A is where the level of OT achievement is quantitative, measured in percentage. Indicator category B is qualitative, where the levels of OT achievement are considered to be high (score 4), moderate (score 3), fair (score 2), low (score 1), or not present (score 0). The last indicator, category C, is binomial, as it is measured based on only two outcomes: yes (score 1) or no (score 0). This represents a true or false, success or failure approach to measurement.

Table 6: FarFish indicator categories and levels of OT achievement

Indicator category	Level of OT achievement				
A	0%	25%	50%	75%	100%
B	Not present (NP) 0	Low level (LL) 1	Fair level (FL) 2	Moderate level (ML) 3	High level (HL) 4
C	No (False/Failure) 0				Yes (True/Success) 1

During the identification of the appropriate OTs, it became apparent that the operators cannot be solely responsible for some of the OTs, meaning that different authorities will need to assume some responsibility to ensure successful implementation.

5.3 OT 5.1: Information on the proportion of the two species of black hake in catches provided

In MR1, this OT was defined as "Estimate the proportion of *M. polli* and *M. senegalensis* into the catch composition." The OT was rephrased to "Information on the proportion of the two species of black hake in catches provided" in MR2. This OT referred to the fleet that targets black hake.

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The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Improve the quality of the current stock assessment for the species included in the agreement	• Create training materials following the IEO identification guide • Provide a sampling protocol and templates for data collection • Lead the collection of samples and logistics for transport from vessel to laboratory facilities • Perform molecular analysis of the samples • Obtain information from operators and crew on their perceptions of the self-sampling activity by assessing their interest in the activity • Provide feedback to the operators and crew involved in the self-sampling

OT 5.1 was obligatory and aimed to improve the current stock assessment quality for the species included in the agreement. The OT provided information on the proportion of the two species of black hake in catches. This information was enhanced by creating training materials, providing a comprehensive protocol with visual explanations to illustrate the sampling procedure, and requiring crews to identify and collect fin samples. The samples were collected only from Spanish vessels, as no vessels from the Mauritanian fleet were involved.

Progress:

Given the importance of the black hake identification problem (FarFish, D2.1 and D2.4), the FarFish Project decided to implement a pilot self-sampling programme using a fishing industry partner (OPROMAR). The objective was to test the crew's capacity to sample and identify the two species of black hake. For evaluating the species' identification, FarFish collaborated with specialists in DNA analysis from the University of Oviedo, who processed and analysed the samples obtained from the self-sampling programme.

Sampling kits, sampling protocols, and data sheets (in Spanish) were prepared at CCMAR (FarFish D2.7) and sent to CETMAR. CETMAR delivered the sampling equipment to OPROMAR for three Spanish trawlers participating in the self-sampling. Sampling protocols included visual explanations of the methods to be used by the crew. CETMAR explained the objectives and methodology, and the partners signed a confidentiality agreement.

CCMAR, in collaboration with the University of Oviedo, carried out the self-sampling project. CETMAR contacted operators and the crew involved in the fieldwork and sent a questionnaire to obtain feedback about the self-sampling process.

Results:

A total of 358 samples of black hake were obtained by self-sampling on board the three OPROMAR trawlers (n = 119, n = 158, n = 81) operating in the Mauritanian EEZ. The crew successfully collected the samples following the sampling protocol and recorded the data on the data sheets provided. The samples were delivered to CETMAR in Vigo and sent to the University of Oviedo for analysis.

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The University of Oviedo completed the DNA analysis in January 2021. Of the total samples of black hake (n = 358), 17% (n = 61) were mislabelled. For *M. polli,* 21% were mislabelled. For *M. senegalensis,* 15% were mislabelled. There were significant differences in the identification of the black hake between the three vessels, which provide an indication of human error in morphological identification. The DNA analysis results, along with the results from the questionnaire survey, will be included in the updated "Report on the success of the self-sampling programme" (FarFish D2.7). Feedback on the results will be made available to the CS partners and sent to the operators and crews involved in the self-sampling.

5.3.1 Level of OT 5.1 achievement

Indicator		Indicator category	Indicator baseline	Indicator achievement	Responsible entity	OT Dimension
I_1_CS5	Visual identification of black hake species from self-sampling	C	0	1	OPROMAR	Ecological
I_2_CS5	Collection of fin samples of black hake for molecular analysis	C	0	1		
I_3_CS5	Molecular analysis to verify visual identification of black hake	A	0%	100%	CCMAR	
I_4_CS5	Feedback provided by operators and crew via questionnaires	A	0%	100%	CETMAR	
I_5_CS5	Feedback given to operators and crew on the results of the self-sampling	A	0%	100%		

5.3.2 Main risk for achieving OT 5.1

This OT was to provide information on the proportion of the two species of black hake in catches. Both indicators 1 and 2 were achieved, and the indicators demonstrated the operators and crews' capacity to perform the self-sampling procedure. Indicator 3 was achieved, all the samples were processed, and the percentage of mislabelling was known. The work done by WP1 on stakeholder interaction minimised the risk that the indicators would not be achieved.

Even though all indicators were achieved, the results showed that the vessels' crews require additional training to enhance data collection for the black hake species. A film demonstrating the identification of the two hake species might help the crews more than providing them with printed material for identification.

5.4 OT 5.2: Information on black hake caught as bycatch provided

In MR1, this OT was defined as "Collecting data of the black hake bycatch by all operators in Mauritanian waters" but rephrased to "Information on black hake caught as bycatch provided" in MR2.

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This OT referred to the fleet that targets small pelagic species and gets black hake as a bycatch in Mauritanian waters.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Improve the quality of the current stock assessment for the species included in the agreement	• Provide a sampling protocol and templates for data collection • Encourage the fleet to participate in a self-sampling programme • Encourage the authorities to train scientific observers in visual black hake identification and sample collection

OT 5.2 was obligatory and aimed to improve the current stock assessment quality for the species included in the SFPA. This could be achieved by providing a sampling protocol and templates for data collection, encouraging the fleet that targets small pelagic species and gets black hake as bycatches to participate in a self-sampling programme, and encouraging authorities to train scientific observers in visual black hake identification and sample collecting.

Progress:

The Joint Scientific Committee on Fisheries Agreement between Mauritania and the EU (JSC) drew attention to the bycatches of black hake, which are mainly taken by the pelagic vessels. The JSC recommends that both the pelagic vessels and other fleets catching black hake as bycatches register their catches in their logbooks. The JSC also suggests increasing the number of observations at sea and sampling at landings to obtain data on bycatches' impacts on black hake stocks (Bouzouma et al., 2018).

To the best of the FarFish Project's knowledge, there was no information available on the proportion of the two black hake species reported as bycatches. Given the quantity of this bycatch, it was considered necessary that the pelagic vessels collect data, identify the species, and report the proportion of the two black hake species in their catches. These recommendations were in line with what was requested for the fleet targeting black hake. The sampling protocol and training material created to achieve OT 5.1 was available for use in the pelagic fishery or other fisheries where black hake is a bycatch species.

In this CS, only Spanish vessels targeting black hake were involved in collecting data (Self-sampling, OT 5.1). However, in the Senegalese CS, local fishers participated in self-sampling to identify the two different species of black hake. The Senegalese results showed that the fishers could do the sampling but that better training on identifying the two species of black hake is needed. The FarFish Project believes that the Senegalese CS result is transferable to this CS, meaning that fishers can successfully carry out self-sampling onboard vessels to improve the current stock assessment quality.

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5.4.1 Level of OT 5.2 achievement

Indicators		Indicator category	Indicator baseline	Indicator achievement	OT dimension	Responsible entity
I_6_CS5	Sampling protocol and templates for data collection provided	C	0 (No)	1 (Yes)	Ecological	CCMAR
I_7_CS5	Training of skippers, crews, and observers in visual species identification of black hake	C	0 (No)	0 (No)		Flag state authorities, IMROP
I_8_CS5	Visual species identification from subsamples of black hake as bycatch species	C	0 (No)	0 (No)		Operators
I_9_CS5	Collection of fin samples from visually identified black hakes for molecular analysis	C	0 (No)	0 (No)		

5.4.2 Main risk for achieving OT 5.2

This OT was to provide information on black hake caught as bycatches by the fleet targeting small pelagic species. Indicator 6 has been achieved, as a sampling protocol and templates for data collection are available (Appendices 3 and 4). The FarFish Project could not achieve Indicators 7, 8, and 9 because most of the pelagic fishery in the Mauritanian EZZ is done by non-EU vessels. The Authorities of the vessels' flag states or other entities must be involved to achieve these indicators. However, the FarFish Project demonstrated that self-sampling is a viable and cost-effective method for improving stock assessment quality. Still, appropriate training for skippers, crews, and observers is needed.

5.5 OT 5.3: Increased onboard observer coverage on all high-capacity pelagic vessels in place

In MR1, this OT was defined as "Full onboard observer coverage on all high-capacity pelagic vessels" but rephrased to "Increased onboard observer coverage on all high-capacity pelagic vessels in place" in MR2. The OT number was changed from OT 5.6 in MR1 to OT 5.3 in MR2.

This OT was obligatory in MR1, but no action was taken towards it. In MR1, it was decided that OTs related to the small pelagic fishery require a differentiated strategy than the black hake fishery, prioritized in MR1.

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The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Increase and improve the data collection on bycatches and discards from high-capacity pelagic vessels in Mauritania	Define a specific protocol with well-described units for the observers

OT 5.3 was obligatory and aimed to increase and improve the quality of the stock assessment for the species included in the agreement by standardising data collection on high-capacity pelagic vessels.

Progress:

The OT was included in the MR following an expression of interest from the authorities. It was rephrased following a consensus during the CS leader meeting in Marrakech in November 2019 to reflect that the project alone does not have the capability to implement a programme that will lead to full onboard observer coverage. Instead, it was decided that we would find ways to increase the current coverage percentage, with the authority proposing 30% coverage as an estimated goal.

Apart from the minimum observer coverage stated in public agreements, it was not possible for FarFish to determine the actual observer coverage. Without knowing the observer covering rate and given that it is impossible for FarFish to determine whether the proposed 30% observer coverage would be adequate, this OT falls outside of the project's scope.

However, this issue is being dealt with in other international projects. One example is the project "Improved Regional Fisheries Governance in Western Africa (PESCAO)",[17] in which one of the main objectives is as follows: "Prevention of and responses to IUU fishing are strengthened through improved monitoring, control and surveillance (MCS) at national and regional levels". The European Fisheries Control Agency (EFCA) is contributing to the achievement of this objective by supporting and creating a network of regional observers to improve the monitoring of the industrial fleet operating in the region. It also has the attention of international organisations such as FAO through the Working Group on the Assessment of Small Pelagic Fisheries of Northwest Africa (FAO, 2019).

Another example is that a scientific observation system onboard the EU vessels is established through the SFPA between the EU and Mauritania signed in December 2015. The system is described in Chapter 10 of the Protocol (EU, 2015).

[17] https://www.efca.europa.eu/en/content/pescao

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Table 7. An excerpt of the requirements for Observers onboard EU vessels established by the protocol

Type of requirement	SFPA – Observers' requirements
Observer coverage rate (bullet point 2 in Chapter 10)	For each fishing category, the parties shall designate at least two vessels per year that shall take on board a Mauritanian scientific observer, except for tuna seiners, which shall board observers at the Ministry's request. There shall be only one scientific observer at a time per vessel.
Observer coverage duration (bullet point 3 in Chapter 10)	The period spent on board a vessel by a scientific observer shall be the length of the trip. However, at the express request of one of the parties, this embarkation may be spread over several trips depending on the average duration of the trips planned for a particular vessel.
Observer task (bullet point 11 in Chapter 10)	• observe the fishing activities of the vessels • check the position of vessels engaged in fishing operations • perform biological sampling in the context of scientific programmes • record particulars of the fishing gear and the mesh sizes of the nets used
Observer reporting obligations (bullet point 14 in Chapter 10)	At the end of the observation period and before disembarking the vessel, the scientific observer shall draw up a report in accordance with the model in Appendix 11 in the protocol. The scientific observer shall sign it in the presence of the master of the vessel, who may add or cause to be added to it any observations considered relevant, followed by the master's signature. A copy of the report shall be handed to the master when the observer is put ashore as well as to the Ministry and the European Union.

The JSC on the SFPA between Mauritania and the EU also addresses onboard observers (Fernández-Peralta et al., 2019). As mentioned above, the agreement provides for Mauritanian observers boarding EU vessels. However, the JSC notes that the boarding of scientific observers aboard pelagic vessels is rare. Therefore, it is necessary to set up an intensive monitoring programme for the small pelagic fishery through a strengthening of observation at sea (onboard EU vessels and other those belonging to other fleets) and a sampling of landings.

The JSC states that it is vital that data on the activities of all the segments and all the fleets in the Mauritanian fishing zone be supplied to the FAO working group to allow it to carry out stock assessments. Therefore, the JSC recommends that the EU takes the necessary steps to impose the pelagic trawlers from the EU operating in Mauritania to have scientific observers to ensure data collection on bycatches and discards.

Since 2009, scientific observers have been deployed through IMROP, which established a target coverage level of 5,000 fishing days per year (based on six months per observer or 10% of total fishing days; JSC, 2010). This target was not achieved, and there was only partial coverage of the fleets. According to IMROP, this was mainly due to vessel owners' reluctance to have observers on their vessels, and it was not possible to apply sanctions when an observer refused to board a vessel. This resulted in a limited amount of information being submitted to the EU Mauritania JSC. No observer

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trips were undertaken between 2014 and 2017, but, according to the "Report of the Regional Co-ordination Meeting for the Long-Distance Fisheries" (RCM LDF) of 2018, they recommenced in 2018.[18]

IMROP stated that they keep observer reports and have emphasised their observer programmes' intermittent nature since their beginning. IMROP has improved the observation at sea covered by scientific observers, particularly for the coastal segment (national vessels) that has just emerged, and it requires close monitoring to control its development. In 2019, there were 18 observation missions, 12 of which were on board pelagic vessels. In 2020, 16 observation missions were carried out, 10 of which were on board pelagic vessels. As for the pelagic vessels covered, the non-EU deep-sea vessels (free licenses) were the subject of observation.

The importance of having a mechanism in place allows the effective implementation of the programme to place observers onboard all high-sea trawlers, whether from the EU or elsewhere, fishing for small pelagic species.

5.5.1 Level of OT 5.3 achievement

Indicators		Indicator category	Indicator baseline	Indicator achievement	OT dimension	Responsible entity
I_10_CS5	A specific protocol with well-described units for the observations available	C	0 (No)	1 (Yes)	Ecological	CCMAR
I_11_CS5	Number of vessels having onboard observers	B	0 (Not present)	Not able to evaluate		IMROP

5.5.2 Main risk for achieving OT 5.3

This OT was to increase onboard observer coverage on all high-capacity pelagic vessels. Indicator 10 was achieved. A specific protocol with well-described units for the observations is available (Appendices 5 and 6). The main risk for not achieving this OT would be a failure to implement a protocol that requires collaboration among the operators in the Mauritanian EEZ and funding for training the observers, but this was beyond the project's scope.

The FarFish Project could not evaluate indicator 11 because we did not have enough observer coverage information. After discussions on how to evaluate this indicator, the CS leader suggested using the percentage number of vessels with onboard observers. A high level of achievement would be an observer coverage on 30% of the vessels. The indicator category is B, and the suggested levels of achievement are as follows: low level < 5%, fair level = 5–15%, moderate level = 16–30%, and high level < 30%.

The FarFish Project could not achieve this OT on increasing onboard observer coverage on all high-capacity pelagic vessels.

[18] https://datacollection.jrc.ec.europa.eu/documents/10213/1239599/2018_RCG+LDF.pdf/e0948aff-633c-4084-a53e-68319e1e2161?version=1.0

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5.6 OT 5.4: Data on all catches, discards, and bycatches provided

MR1 had several OTs (5.3, 5.4, and 5.5) regarding "increase knowledge and improve data collection" on black hake, shrimp, and small pelagic species. These OTs were cut down to one and defined as OT 5.4 – "Data on all catches, discards, and bycatches provided" – in this MR. This OT focused only on data on the small pelagic species, namely sardine *(Sardina pilchardus)*, chub mackerel *(Scomber colias),* and anchovy *(Engraulis encrasicolus)*.

The aim and key activities for OT 5.4 were as follows:

Aim	Key activities to meet the OT
Gathering available fisheries data for catches, discards, and bycatches.	• Make data available • Ensure proper reporting of catches of target species to authorities (sardine, chub mackerel, and anchovy)

OT 5.4 was recommended. The objective was to gather available fisheries data on catches, discards, and bycatches from the small pelagic fishery in Mauritania.

Progress:

The Université Cadi Ayyad (UCA) in Morocco delivered a report on data collected on small pelagic species and environmental forcing on the west coast of Africa (FarFish, D2.10) in December 2020. The report was on the biological and fisheries data compiled for three key small pelagic species (sardine, chub mackerel, and anchovy). Time series data suitable for modelling were compiled from several sources, both national and international, and both fisheries-dependent and independent research surveys. However, the time series data of fishing efforts for Mauritania were not available. Data on discard and bycatches were also not available, as the area lacks a robust monitoring scheme for these data (FAO, 2019b).

Results:

Catches of the main small pelagic fish in Mauritania have shown interannual fluctuations from 1990 to 2017. There was an overall increasing trend from 1994 until 2010, followed by a general decreasing trend from 2010 until 2013. In 2010, the main small pelagic catches were the highest of the time series (1,186,000 tonnes) before decreasing in 2013 (536,000 tonnes). In 2014, the catches increased again and reached 794,000 tonnes. In 2015, the total catch fell by 23%, with 614,000 tonnes. In 2016, catches increased by 38% in relation to 2015, with catches of about 848,000 tonnes (FAO, 2017).

Sardine

In 2017, the sardine (*S. pilchardus*) was the dominant small pelagic species in the catches in Mauritania. The four different data sources show the sardine constituting 21%, 19%, 15%, and 20% of the total catch of small pelagics. The total catch of sardines increased from 79 000 tonnes in 2016 to 166 000 tonnes in 2017 (FAO, 2018c).

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Table 8. Available time series of sardine (Sardina pilchardus) catch data from Mauritania

Data source	Period	Fleets
FAO, 2018	1990–2017	Mauritanian artisanal fleets
CECAF, 2016	1970–2016	Countries with vessels in COPACE area: Belize, Bulgaria, China, Comoros, Cuba, Cyprus, France, Georgia, Germany, Ireland, Lithuania, Mauritania, Netherlands, Nevis, Norway, Poland, Portugal, Russia, Saint Kitts, Spain, Ukraine, United Kingdom, and Vanuatu
Fishbase, 2018	1950–2017	Mauritanian artisanal fleets
SAU, 2016	1950–2014	Mauritanian fleets (artisanal, industrial, and subsistence)

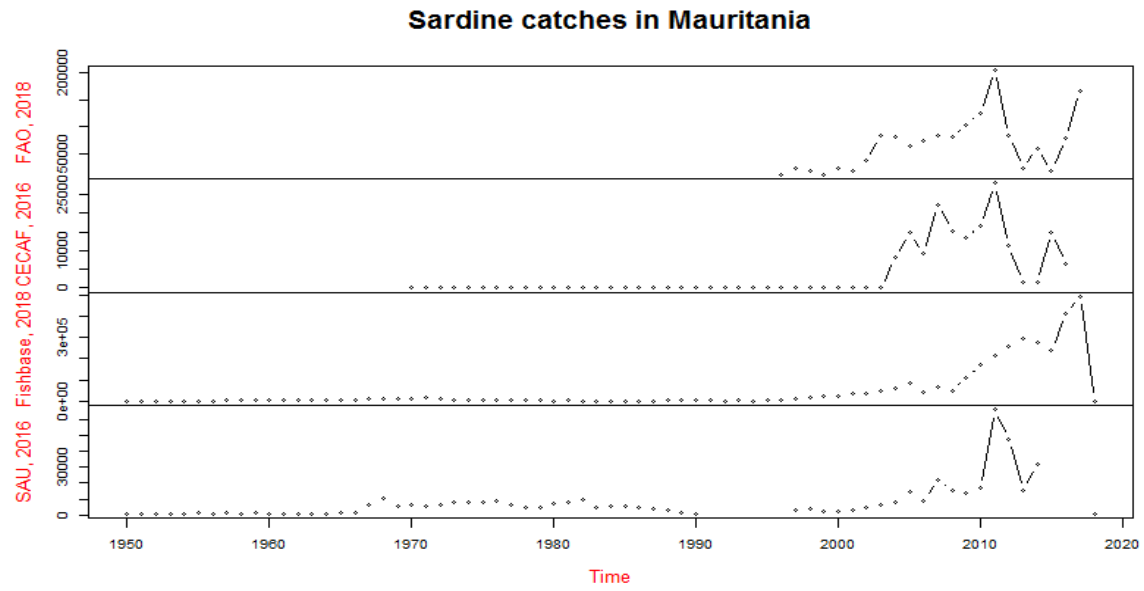

Figure 5. Evolution of sardine catches in Mauritania, based on four sources (FAO, 2016; CECAF, 2016; Pauly et al., 2020; Fishbase, 2018).

Chub mackerel

Catches of chub mackerel (*S. colias*) almost doubled from 42,000 tonnes in 2013 to 83,000 tonnes in 2014 (FAO, 2012). Catches doubled again from 82,000 tonnes in 2016 to 123,000 tonnes in 2017. Three sources of catch data were available: FAO (all fleets and zones), CECAF (Mauritanian fleets), and Sea Around Us (SAU) (artisanal fleets).

Table 9. Available time series of chub mackerel (Scomber colias) catch data from Mauritania

Data source	Period	Fleets
FAO, 2018	1990–2017	EU-type (Lithuania and Holland), non-EU, artisanal
CECAF, 2016	1991–2016	Russian fleets
SAU, 2013	1950–2014	Mauritanian artisanal fleets

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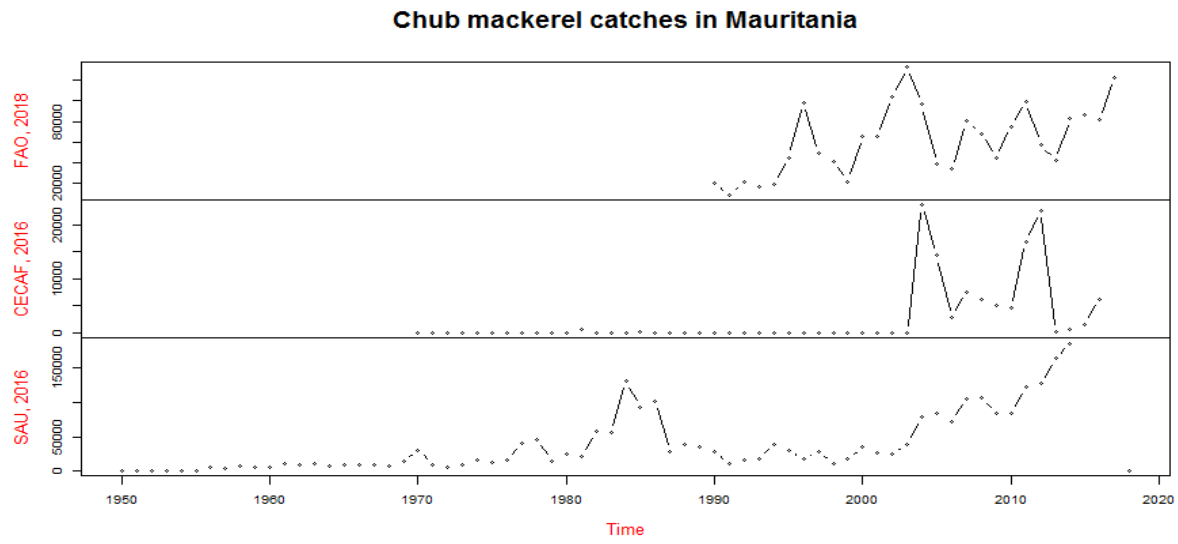

Figure 6. Evolution of chub mackerel catches in Mauritania, based on three sources (FAO, 2016; CECAF, 2016; Pauly et al., 2020).

Anchovy

Catches of anchovy (*E. encrasicolus*) show large fluctuations over the time series. In 2013, this species' catches were 3,000 tonnes. In 2014, the catches were down to 1,400 tonnes; this figure fell again in 2015 and 2016, only to increase to 1,490 tonnes in 2017 (FAO, 2018c).

Table 10. Available time series of anchovy (Engraulis encrasicolus) catch data from Mauritania

Data source	Period	Fleets
FAO, 2018	1990–2017	Estonia, Latvia, Lithuania, Poland, Russia, and Ukraine
CECAF, 2016	1970–2016	Countries with vessels in COPACE areas: Belize, Bulgaria, China, Comoros, Cuba, Cyprus, France, Georgia, Germany, Ireland, Lithuania, Mauritania, Netherlands, Nevis, Poland, Portugal, Romania, Russia, Saint Kitts, Spain, Ukraine, United Kingdom, and Vanuatu.
Fishbase, 2018	1950–2017	Mauritanian artisanal fleets
SAU, 2016	1950–2014	Mauritanian fleets (artisanal and industrial)

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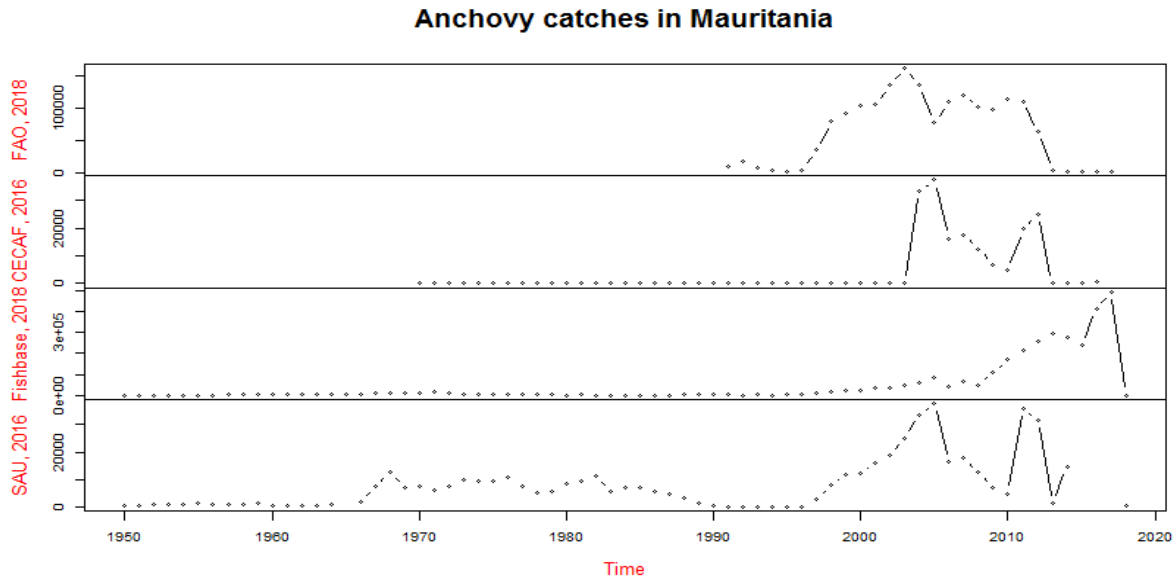

Figure 7. Evolution of anchovy catches in Mauritania, based on four sources (FAO, 2016; CECAF 2016; Pauly et al., 2020; Fishbase, 2018).

5.6.1 Level of OT 5.4 achievement

Indicators		Indicator category	Indicator baseline	Indicator achievement	OT dimension	Responsible entity
I_12_CS5	Data on all catches available	C	0 (No)	1 (Yes)	Ecological	UCA
I_13_CS5	Data on discards and bycatch available	C	0 (No)	0 (No)		

5.6.2 Main risk for achieving OT 5.4

This OT was to provide data on catches, discards, and bycatches from the small pelagic fisheries. Indicator 12 has been achieved and shows how progress has been made regarding data compilation for small pelagic species in Mauritania. However, there was uncertainty in the data provided. In Fishbase, there was no data on chub mackerel because this species is considered part of the "Marine fishes not identified" group. Another uncertainty was that there is a "score" calculated for evaluating the quality of time series of reconstructed catches in SAU data. The SAU data are with high agreement and medium evidence, or medium agreement and robust evidence.

Indicator 13 was used to find data on discards and bycatches. Only a few studies have published quantitative data on discards and bycatches, and, in general, discarding rates in pelagic trawling are considered low. In addition, there was no robust monitoring scheme for this data in the area, meaning that indicator 13 was not achieved.

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5.7 OT 5.5: Trade flow data on small pelagic species provided

In MR1, this OT was defined as “Increase knowledge and data collection of all fleets fishing for small pelagic species on trade flows” but rephrased to “Trade flow data on small pelagic species provided” in MR2. The OT number changed from OT 5.7 in MR1 to OT 5.5 in MR2.

The aim and key activities for this OT were as follows:

Aim	Key Activities to Meet the OT
Improve knowledge in the value chain, processing, and market conditions	Study harvest and trade flows on small pelagic fish • Gather catch and landing information • Gather processing and trade information • Obtain socio-economic variables

OT 5.5 was recommended. It was proposed in the first MR Invitation (FarFish, D3.2), but it was included in MR1 (FarFish, D4.3) and postponed to this MR. The OT was therefore transferred to the second MR2 invitation (FarFish, D3.6). The need to analyse “Socio-economic effects and conditions linked to small pelagic fish, e.g., employment, human consumption, and value” was identified as “Other potential actions as a supplement to the MR1” and was now integrated into OT 5.5.

OT 5.5 aimed towards increased knowledge of the trade flow of small pelagic species. Key activities included gathering existing data and conducting interviews with a sample of operators, processors, distributors, and national authorities.

Progress:

The responsible entity for this OT is NOFIMA and UoP. Information about catches and landings from the EU fleet were provided in “Description of CS value chains” (FarFish, D3.4). The data sources for catches and landings were the minutes from the joint scientific committee meetings with IMROP, the ex-ante/ex-post evaluations of the SFPAs, and DG MARE data. This information was supplemented with key Mauritanian informants.

Information about the processing and trade of raw materials originating from the EU SFPA small pelagic fishery is partly provided in “Description of CS value chains” (FarFish D3.4). Additional information is available in the “Report on the value chain analysis for EU fisheries in SFPA waters” (FarFish, D3.9). Information about small pelagic fish trade, used for raw materials was difficult to follow through official export statistics, such as FAO Fishstat or ITC; hence, we acquired qualitative information from key informants. Similarly, socio-economic data, such as that on revenue, profitability, and value creation, were not directly available, and business operators were reluctant to share such information. Some data on socio-economic variables were gathered, however; these are reported in D3.9.

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5.7.1 Level of OT 5.5 achievement

Indicator		Indicator category	Indicator baseline	Indicator achievement	Responsible entity	OT dimension
I_14_CS5	Data on catch quantities and landing destination available	C	0	1 (Yes)	NOFIMA/ UoP	Socio-economic
I_15_CS5	Data on processing and trade available	C	0	1 (Yes)		
I_16_CS5	Data on selected socio-economic variables available	C	0	0 (No)		

Obtaining data on the selected indicators was useful and provided improved knowledge about the value chains of the fisheries under this CS. However, in terms of contributing towards improvements in some socio-economic variables, other actions would be more relevant. Currently, most of the resources are utilised for fish meal production This has relatively low value-adding, employment and impact on local food security. Changing utilisation towards human consumption would likely improve these variables.

5.7.2 Main risk for achieving OT 5.5

This OT was to provide trade flow data on small pelagic species. Trade flow data on specific products originating from the SFPA or other fisheries were not available. The public statistics only cover exports, including raw materials from other fisheries. In addition, the data do not reflect internal consumption. It was not possible to gather data directly on many socio-economic variables. This OT was intended to obtain detailed trade flow data for the specific fishery and different products and socio-economic information through interviews and estimations based on other data sources. This OT, therefore, depended heavily on information from interviews. Thus, the primary risk was related to obtaining access to informants and shared information that would be considered commercially sensitive. The COVID-19 pandemic and travel restrictions limited opportunities to conduct face-to-face interviews, which exacerbated the challenge of gaining access to informants.

6 Other potential actions as supplements to the MR

Apart from the OTs identified for the EU fleet operating in Mauritania, a number of potential tasks[19] were identified that could strongly support the CS objectives identified in the MP0. These potential tasks were not included in the list of OTs because they could not be (solely) operationalised by the operators, as they require input/action from other relevant parties (authorities, scientific institutions, other international fleets, etc.). These tasks are as follows:

1. Collecting data on the black hake as a bycatch by all operators in Mauritanian waters by observers (IEO/CECAF/IMROP) would be beneficial for stock assessment. Issues with data reporting and misclassification of the two black hake species by crew and trained scientists hamper a sound scientific evaluation of both stocks (*M. senegalensis* and *M. polli*). Training

[19] "Action points" were reworded to "potential tasks" in MR2 to clarify that these are not obligatory.

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and data collection protocols are needed based on the results of the self-sampling on species identification. (Authority comment: FarFish can provide tools for discriminating between the two black hake species [OT1] and attempted to improve data collection on black hake bycatches [OT2], but the project could not make any further contributions. There were no partners within the project that could handle the proof of concept for this action. There were discussions with RG members [particularly PFA], but they currently do not operate in Mauritanian waters.)

2. Knowledge gap analysis is needed for small pelagic species in this CS. (Authority comment: The responsibility for this cannot realistically be placed on the EU operators. This was partly addressed within the FarFish Project.)
3. Effort could be directed toward increasing local demand and expanding local markets for black hake, including those in other African countries (e.g., Cape Verde, Côte d'Ivoire, and Cameroon). Through investing increased effort in marketing activities, value-chain development, and analysis, black hake could become an important contribution to local markets and social aspects (e.g., employment and revenues). (Authority comment: FarFish analysed the Mauritanian black hake value chains and suggested improvements, which would potentially contribute to solving this issue.)
4. Socio-economic effects and conditions linked to small pelagic species need to be analysed in more detail than has been done until now (i.e., employment, human consumption, and value). (Authority comment: FarFish addressed this to a point as part of value chain studies, governance analysis, and suggestions for improvement.)
5. The development of user-friendly digital maps (VMS/AIS based) that support the monitoring of all fleets operating in the area would be valuable for this CS. (Authority comment: The FarFish Project exploreed the applicability of such maps.)

7 Conclusion

The SFPA with Mauritania is the most extensive agreement the EU has with a coastal state. Under the SFPA, the European fleet can fish up to 287,050 tonnes per year in the Mauritanian EEZ. The areas are among the world's most fish-abundant waters due to their strong upwelling coastal currents and a large continental shelf favouring the development of fishery resources.

The main goal for MR2 is to improve the catch reporting and quality of the stock assessment for the species included in the SFPA. The focus is on the two species of black hake (*M. polli* and *M. senegalensis)* and the small pelagic species (*S. pilchardus, S. colias,* and *E. encrasicolus)* caught in the area.

We acknowledge that the operators cannot be made solely responsible for achieving the OTs in this MR. Therefore, achieving them must be a joint effort between authorities and operators across nations to improve catch reporting and the quality of the stock assessment in the EEZ of Mauritania.

However, during the FarFish Project, progress was made, and tools to achieve this MR's goals were developed. The operators can easily implement the self-sampling programme, but it would be necessary to train crews on the visual identification of black hake species. The project could provide templates and sampling protocols to improve data collection. Still, implementation would require collaboration between operators and authorities in the Mauritania EZZ and funding for the training of the crews.

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8 Auditor

FarFish partner Sjókovin conducted two audits following the RBM process, The first audit on documentation system conformance and the second audit on performance effectiveness and compliance. The final audit of this MR will not be conducted.

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Appendixes

Appendix 1

Summary of existing (2008) self-sampling systems (ICES, 2008).

Country	Fishery / species / stock	Self-sampling
Belgium	Western Waters	Involvement in the EU project "Joint data collection between the fishing sector and the scientific community in Western Waters"; design and implement pilot programmes to obtain information from the fishery industry.
	National	ILVO investigating the possibility of including self-sampling programmes in the National Data Gathering Programme.
Canada	Lobster	Logbooks to 15–20% of license holders; fishers record numbers of commercial-sized animals, berried females, non-commercials and any v-notched animals each day the traps are hauled. Detailed instructions on logbook and at-sea sampling data entry provided by DFO staff.
	Herring (Gulf of St. Lawrence)	Logbooks and sampling with multi-mesh gillnets.
	Silver hake (Maritimes region)	Industry samples length distributions.
Denmark	Baltic salmon	Volunteers (60% of fleet) record effort, landings and discard data.
	Sand eel (North Sea)	Reference fleet of 15–20 vessels; fishermen take approximately 400 samples per year.
	Sand eel larvae (North Sea)	Two vessels paid to take 60 samples (EUR 500 per sample)
	Sole (Kattegat)	Private logbooks with catch and effort (by haul) data
	Cod (Kattegat-Skaggerak)	Pilot study initiated in 2008 using six trawlers and gillnetters; participants get additional quota.
	Cod (Baltic)	Reference fleet of five trawlers record catch data in logbooks on haul-by-haul basis since 2007, with length distribution and discard information collected since 2008.
	Cod in Øresund (sport fishing)	Plan to initiate daily catch data collection with a reference fleet in 2008.
	Non-commercial fishing with passive gears (not sport fishing)	Ninety-three (93) fishers provide monthly catch data since 2002; paid with free gear.
	Herring and sprat (Baltic)	Industry samples landings in three harbours.
Germany	Trawl and gillnets (Baltic)	Participation of the Institute for Baltic Sea Fisheries (OSF) in the EU project JOIFISH/Lot8 (joint data collection between the fishing sector and the scientific community in the Baltic Sea); four

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		trawlers and four gillnets collect haul by haul data (effort, catch composition [landings and discards]) and biological characteristics of the catch (samples of cod). Fishers paid 50 EUR per sample.
Iceland	Cod	Fishers paid to sample cod and collect and freeze their stomachs.
Ireland	Irish Sea (VIIa) trawl fishery	Two-year Irish Sea Data Enhancement Pilot (ISDEP) conceived in 2006 to obtain landings and discard data from Irish trawlers.
	Irish Sea demersal trawl and seine fisheries	Pilot programme initiated in 2007; four *nephrops* and one whitefish vessel participating on a semi-regular basis by January 2008.
	Norway lobster (Irish Sea West, Porcupine Bank, Aran Grounds, Ireland SW, and SE Coast, Celtic Sea)	Voluntary self-sampling programme for *nephrops* landings and discards; about 15 vessels per year; samples are paid. Catch sample: one box, random sample of unsorted bulk catch; discards sample: random sample (one box) of discards.
Latvia	Coastal fishery	Reference fleet and self-sampling system since 1993: 20 to 30 fishers and fishing enterprises per year; record information on catches, bird and mammal bycatch, and Chinese mitten crab. In some areas, all salmon and sea trout were measured and weighed, and scale samples were taken. Length measurements were taken for cod and flounder in some areas.
Malta	Surface and bottom longliners	Seven (7) surface and three bottom longline vessels making at least 25 trips per year paid 700 € per year to record seabird, turtle, and shark bycatch.
Netherlands	Dutch demersal fleet	Self-sampling (about 20 vessels) since 2004; sample of catch and discards % (volume) of plaice recorded twice a week. Cod discards also recorded since 2006.
Norway	High seas and coastal fishing vessels	Reference fleet (17 high sea and 22 coastal vessels) paid to measure subsamples of fish and on a less regular basis collect otoliths, stomachs, and genetic and other biological samples for IMR. Also provide information on fleet behaviour and technological developments influencing efficiency and effort.
	Tourist sea fishing	Collaboration of IMR with owners of fishing resorts; diaries for recording daily catch and effort data distributed to anglers.
Poland	Baltic coastal fisheries and offshore fisheries; salmon, sea trout, whitefish, and cod.	Baltic cod fisheries: special haul information forms; landings and discards recorded. Salmonids and whitefish: selected fishers (paid) trained and equipped to collect length, weight, sex, maturity data, and scales from 70–85% of the catch. Fykenet fishery in Vistula lagoon: fishers authorized to fish in prohibited areas; obliged to provide all information requested by SFI. Hook and line fleet self-sampling: length and other data recorded.

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Spain	Recreational tuna fishery	Volunteer tag and release programme since 2001. Anglers trained; fish measured, tagged, and released. Spatial information (catch and effort recorded).
Sweden	Vendace fishery, Bothnian Bay	Self-sampling programme since 2001; all vessels (36 in 2007) voluntarily sample each trawl haul (weight by species data collected).
Northern Ireland	M. Irish fleet (mainly *Nephrops* trawl)	Self-sampling programme initiated in 2008: log-book data for each haul including bulk catch and discards estimated in boxes/baskets. Subset of vessels provide biological samples. Incentives: monetary compensation and additional days at sea.
Scotland	Demersal fleets	Pilot study carried out by FRS in 2004 on the < 10m sector; samples of unsorted catch brought to land.
	Pelagic fisheries	Pilot study (herring fishery) in 2008 to test and develop sampling protocols.
United States	Northeast	"Study fleets" used in two pilot studies to evaluate accuracy of fishery-based data: 32 and 20 vessels.

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Appendix 2

Important considerations for designing a self-sampling programme.

Aims	Clearly define the aim(s), mutually agreed and communicated to all participants.
Survey design	1) Preliminary analysis of existing or similar sampling programmes (e.g., observer surveys, harbour samples) to understand expected sources of variance and to evaluate sampling needs. 2) Define optimal temporal and spatial coverage and stratification. 3) A reference fleet of representative fishing vessels is recommended in many cases, especially when the number of vessels and metiers is high (van Helmond et al., 2012).
Financing	Financing can be handled in a number of ways, including by direct payment of fishers (industry, national programme, or DCF) and access to extra quota for participants, fishing grounds, or more days at sea. Fishers should be motivated to participate not only by financial means but also by participatory meetings to show and discuss data, observe trends over time and compare data collected by different fishers and observers.
Confidentiality	Data collected by fishers should be confidential.
Training	Participants need to be properly trained in sampling and data collection, with regular training courses and training onboard fishing vessels by observers/scientists. Fishers should be provided with clear sampling and data protocols and guidelines, as well as the necessary equipment and forms.
Quality	Data quality should be evaluated by cross-checking with VMS data, logbook information, and observer data, and also for consistency (variability within each fishing vessel and between different fishing vessels).

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Appendix 3

Example of haul information obtained from PFA self-sampling.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	AF
1	vessel	trip	haul	date	shoot time	haul time	shoot lat	shoot NS	shoot long	shoot EW	haul lat	haul NS	haul long	haul EW	surface temp	headline temp	Wind direction	Windforce (Bft)	headline depth	water depth	mesh size	vert opening	horz opening	netcode	number meshes	catch
2	BX791	201701	1	23/11/2017	00:55	07:45	55°39'	N	009°18'	W	55°45'	N	009°14'	W	11.5		n	6.0		150	44	40	130	6490		14.4
3	BX791	201701	2	25/11/2017	10:45	15:50	55°38'	N	009°09'	W	55°33'	N	008°51'	W	11.5		n	4.0		90	44	30	120	5690		35.2
4	BX791	201701	3	25/11/2017	03:00	04:50	52°36'	N	012°04'	W	52°28'	N	012°01'	W	12.5		nw	5.0		300	44	40	130	6490		4.8
5	BX791	201701	4	25/11/2017	06:30	18:55	52°28'	N	012°01'	W	52°31'	N	012°06'	W	12.5		nw	5.0		300	44	40	130	6490		54.2
6	BX791	201701	5	26/11/2017	09:10	19:15	52°27'	N	012°01'	W	52°40'	N	012°03'	W	12.4		w	5.0		260	44	40	130	6490		32.4
7	BX791	201701	6	26/11/2017	22:20	05:15	52°43'	N	012°01'	W	52°35'	N	012°01'	W	12.4		w	5.0		250	44	40	130	6490		1.2
8	BX791	201701	7	27/11/2017	10:30	18:55	52°46'	N	012°06'	W	52°42'	N	012°06'	W	12.3		nw	6.0		260	44	40	130	6490		15.6
9	BX791	201701	8	28/11/2017	04:00	05:20	53°39'	N	010°48'	W	53°44'	N	010°47'	W	11.6		n	5.0		150	44	40	130	6490		-
10	BX791	201701	9	28/11/2017	10:50	14:15	54°24'	N	010°47'	W	54°27'	N	010°27'	W	11.5		n	5.0		140	44	40	130	6490		-
11	BX791	201701	10	29/11/2017	05:00	09:05	55°47'	N	009°09'	W	55°53'	N	009°06'	W	11.0		n	5.0		140	44	40	130	6490		3.6
12	BX791	201701	11	29/11/2017	10:25	18:25	55°52'	N	009°08'	W	56°06'	N	009°07'	W	11.0		n	5.0		160	44	40	130	6490		60.4
13	BX791	201701	12	29/11/2017	23:05	08:15	56°08'	N	009°03'	W	56°18'	N	009°09'	W	10.9		n	5.0		160	44	40	130	6490		59.8
14	BX791	201701	13	30/11/2017	10:25	18:30	56°12'	N	009°05'	W	56°10'	N	009°04'	W	10.9		n	5.0		170	44	35	115	6490		55.1
15	BX791	201701	14	30/11/2017	22:40	07:50	56°51'	N	009°14'	W	56°53'	N	009°14'	W	11.0		n	4.0		180	44	40	130	6490		57.5
16	BX791	201701	15	01/12/2017	10:30	17:50	56°56'	N	009°12'	W	56°58'	N	009°08'	W	11.0		n	3.0		180	44	40	130	6490		36.9
17	BX791	201701	16	02/12/2017	10:50	11:50	55°40'	N	008°58'	W	55°44'	N	008°59'	W	10.9		nw	5.0		110	44	35	115	5690		59.9
18	BX791	201701	17	02/12/2017	16:30	18:55	55°56'	N	009°08'	W	55°59'	N	009°10'	W	11.0		nw	5.0		180	44	40	130	6490		-
19	BX791	201701	18	04/12/2017	10:40	11:15	52°46'	N	012°05'	W	52°42'	N	012°04'	W							44	40	130	6490		-
20	BX791	201701	19	06/12/2017	01:00	01:05	50°05'	N	001°03'	W	50°05'	N	001°02'	W	13.0		s	3.0		50	44	25	85	5690		53.8
21	BX791	201701	20	06/12/2017	04:35	04:45	50°03'	N	000°49'	W	50°03'	N	000°41'	W	13.0		s	3.0		50	44	25	85	5690		23.9
22	BX791	201701	21	06/12/2017	06:30	06:40	50°04'	N	000°49'	W	50°04'	N	000°43'	W	13.0		s	3.0		50	44	25	85	5690		43.1
23	BX791	201701	22	06/12/2017	11:15	11:20	50°05'	N	000°39'	W	50°05'	N	000°36'	W	13.0		sw	4.0		50	44	25	85	5690		64.6
24	BX791	201701	23	06/12/2017	13:55	00:00	50°05'	N	000°39'	W	50°05'	N	000°37'	W	13.0		sw	4.0		50	44	25	85	5690		45.4
25	BX791	201701	24	06/12/2017	17:23	17:46	50°01'	N	000°32'	W	50°01'	N	000°30'	W	13.0		sw	5.0		50	44	25	85	5690		12.0
26	BX791	201701	25	06/12/2017	19:10	19:30	50°01'	N	000°29'	W	50°00'	N	000°32'	W	13.0		sw	5.0		50	44	25	85	5690		44.3
27	BX791	201701	26	07/12/2017	00:10	00:30	50°01'	N	000°31'	W	50°01'	N	000°27'	W	13.0		sw	6.0		50	44	25	85	5690		59.8
28	BX791	201701	27	07/12/2017	03:30	03:45	50°00'	N	000°31'	W	49°59'	N	000°33'	W	13.0		sw	6.0		50	44	25	85	5690		33.5
29	BX791	201701	28	07/12/2017	07:55	08:05	50°02'	N	000°24'	W	50°02'	N	000°25'	W	13.0		sw	7.0		50	44	25	85	5690		19.1
30	BX791	201701	29	07/12/2017	12:50	13:25	50°01'	N	000°28'	W	50°03'	N	000°23'	W	13.0		sw	8.0		50	44	25	85	5690		29.9
31	BX791	201701	30	07/12/2017	16:10	16:35	50°00'	N	000°23'	W	50°01'	N	000°26'	W	13.0		sw	7.0		50	44	25	85	5690		25.1
32	BX791	201701	31	07/12/2017	18:55	19:30	50°01'	N	000°39'	W	50°01'	N	000°28'	W	13.0		nw	5.0		50	44	25	85	5690		60.1
33	BX791	201701	32	07/12/2017	23:25	23:40	50°00'	N	000°28'	W	50°01'	N	000°25'	W	13.0		nw	6.0		50	44	25	85	5690		59.6
34	BX791	201701	33	08/12/2017	02:50	03:10	50°02'	N	000°26'	W	50°02'	N	000°23'	W	13.0		nw	6.0		50	44	25	85	5690		87.3
35	BX791	201701	34	08/12/2017	10:35	10:45	50°01'	N	000°27'	W	50°01'	N	000°26'	W	12.6		nw	7.0		50	44	25	85	5690		65.8
36	BX791	201701	35	08/12/2017	15:22	15:50	50°01'	N	000°31'	W	50°01'	N	000°28'	W	12.8		nw	7.0		50	44	25	85	5690		56.2

Appendix 4

Example of length information obtained from PFA self-sampling.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	vessel	BX791	BX791	BX791	BX791	BX791	BX791	BX791	BX791	BX791	BX791	BX791	BX791	BX791
2	trip	201701	201701	201701	201701	201701	201701	201701	201701	201701	201701	201701	201701	201701
3	merk	HOM 008	HOM 009	HOM 010	MACP 011	HOM 012	SQU 013	HOM 014	HOM 015	HOM 016	HOM 017	HOM 018	HOM 019	MACK 020
5	species	HOM	HOM	HOM	MAC	HOM	SQU	HOM	HOM	HOM	HOM	HOM	HOM	MAC
6	sampleWeight	23.0	23.1	23.1	23.0	23.1	25.0	23.1	23.1	23.0	23.04	23.09	23.0	23.0
7	date	23/11	23/11	23/11	23/11	25/11	25/11	26/11	27/11	30/11	30/11	30/11	30/11	02/12
8	lengthType	TTL	TTL	TTL	TTL	TTL	TTL	TTL	TTL	TTL	TTL	TTL	TTL	TTL
28	20									3				
29	21	1								8				
30	22	1								57				
31	23	36								104	28			
32	24	121								36	73			
33	25	48			5					11	64			
34	26		3		43					6	10	7		
35	27		18		53						3	20		
36	28		43		47							45		
37	29		34		9							35		
38	30		25	8	6		4					14	2	10
39	31		8	18		3	6	1					2	23
40	32			23		9	9	3					17	29
41	33			21		14	6	12	1				18	16
42	34			8		16	10	21	12				21	7
43	35			7		11	12	11	21				7	1
44	36			1		8	18	16	18				4	
45	37					4	12	2	8				2	
46	38					1	14		1					
47	39					1	17		1					
48	40						16							
49	41						10							
50	42						8							
51	43						7							
52	44						3							
53	45													

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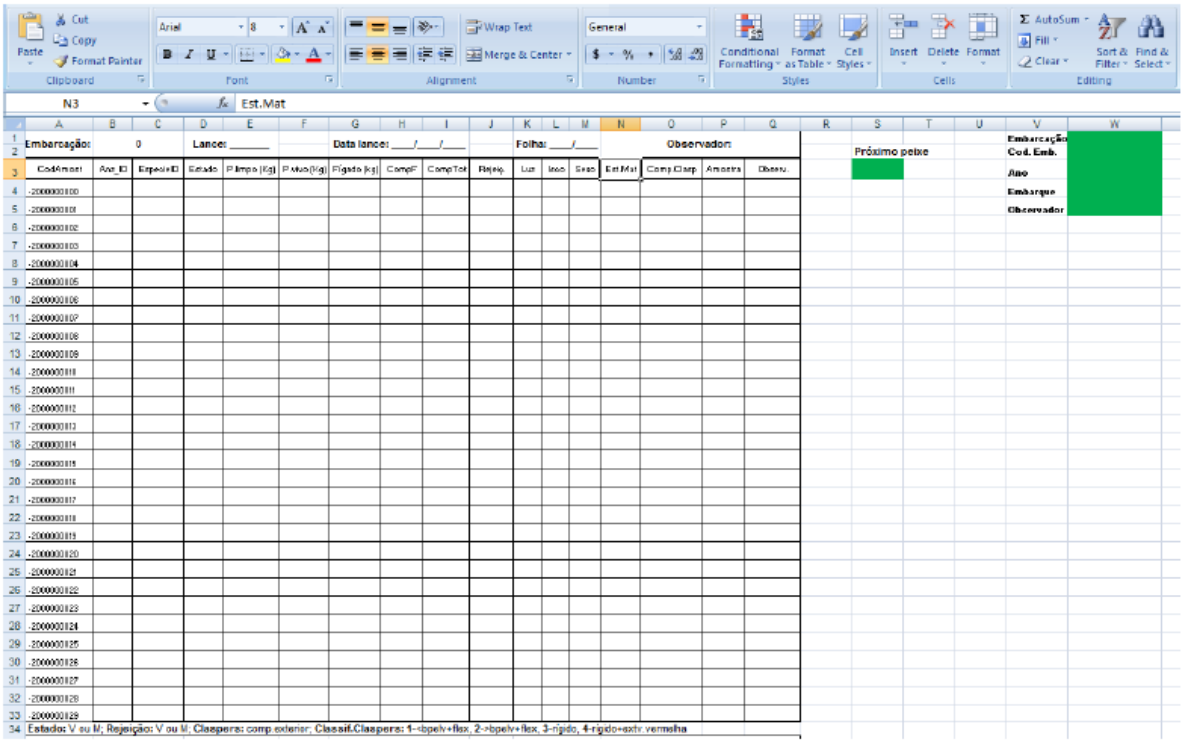
Appendix 5

Form developed for collecting biological information to be entered in the Observer database



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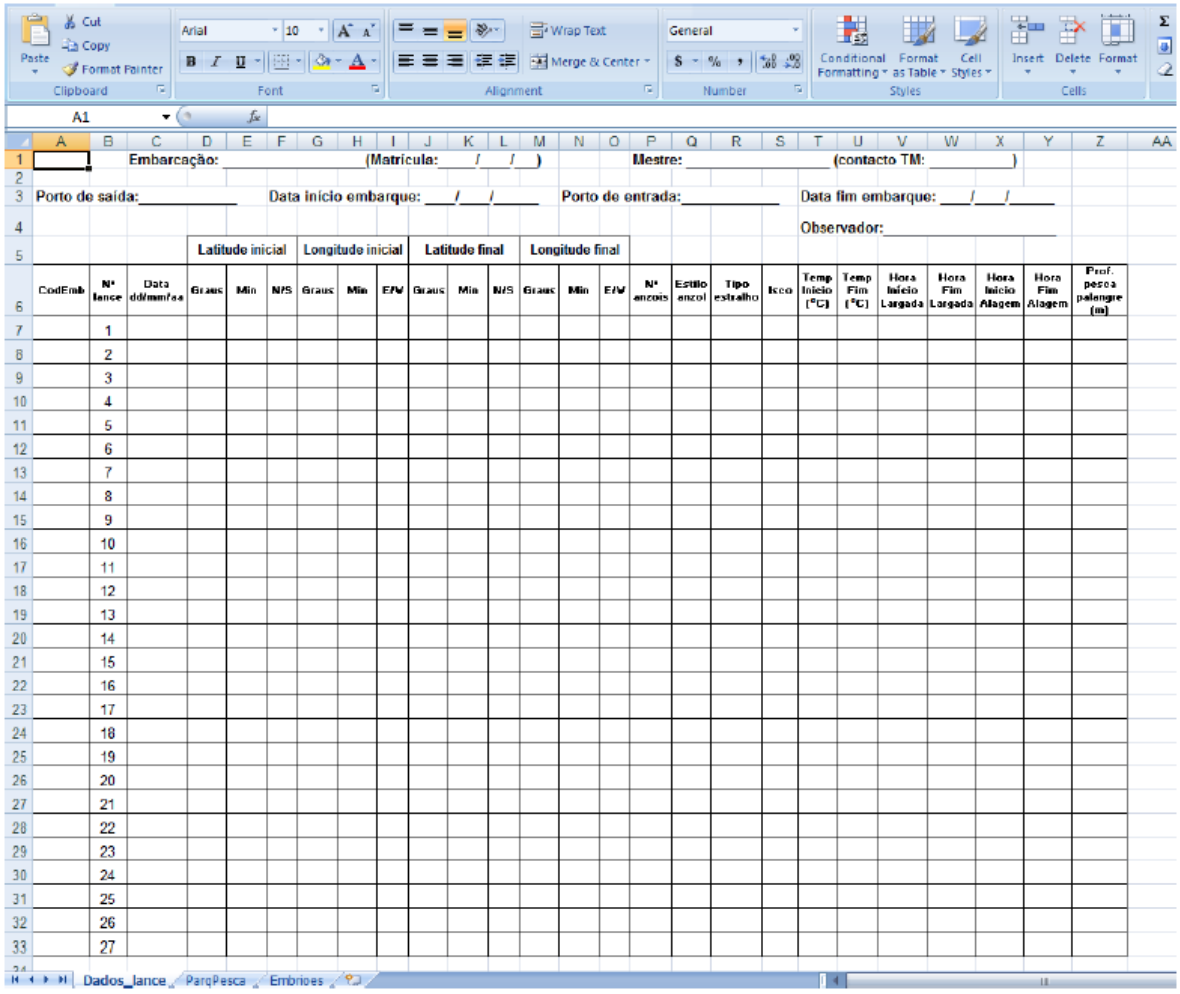
Appendix 6

Form developed for collecting haul information to be entered in the Observer database



Embarcação: _____ (Matrícula: ___/___/___) Mestre: _____ (contacto TM: _____)

Porto de saída: _____ Data início embarque: ___/___/_____ Porto de entrada: _____ Data fim embarque: ___/___/_____

Observador: _____

			Latitude inicial			Longitude inicial			Latitude final			Longitude final													
CodEmb	Nº lance	Data dd/mm/aa	Graus	Min	N/S	Graus	Min	E/W	Graus	Min	N/S	Graus	Min	E/W	Nº anzois	Estilo encol	Tipo estralho	Iceo	Temp Início (ºC)	Temp Fim (ºC)	Hora Início Largada	Hora Fim Largada	Hora Início Alagem	Hora Fim Alagem	Prof. pesca palangre (m)
	1																								
	2																								
	3																								
	4																								
	5																								
	6																								
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CASE STUDY 6

SEYCHELLES

Deliverable No. 4.4

Project acronym:
FarFish

Project title:
Results-based management and capacity building for EU Sustainable Fisheries Partnership Agreement and international waters

Grant agreement No: **727891**
Project co-funded by the European Commission within the Horizon 2020 Research and Innovation Programme

Start date of project: **1st June 2017**
Duration: **54 months**

Due date of deliverable:	30/11/2020
Submission date:	30/11/2021
File Name:	FarFish D4.4 MR2 Seychelles
Revision number:	02
Document status:	Final
Dissemination Level:	PU[1]

Role	Name	Organisation	Date	File suffix[2]
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[1] PU: Public, PP: Restricted to other programme participants (including the Commission Services), RE: Restricted to a group specified by the consortium (including the Commission Services), CO: Confidential, only for members of the consortium (including the Commission Services)
[2] The initials of the revising individual in capital letters

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Deliverable D4.4

Management Recommendation 2

Seychelles

30/11/2021

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Summary

This document serves to update the second proposal for a Management Recommendation (MR2) for the tuna fishery under the Sustainable Fisheries Partnership Agreement (SFPA) between Seychelles and the EU. The aim of this document is to respond to the second audit report (FarFish, D5.4). The EU fleet targeting yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*), and skipjack tuna (*Katsuwonus pelamis*) are from Spain, France, and Italy. The tuna species in Seychelles waters are managed by the Regional Fisheries Management Organisation (RFMO) framework and The Indian Ocean Tuna Commission (IOTC). The Seychelles Fishing Authority (SFA) is the government's executive arm for fisheries and related matters within the Seychelles Exclusive Economic Zone (EEZ). The SFA's mandate exceeds the Seychelles EEZ regarding flagged vessels.

This MR2 was developed following the "General Guidelines for making MRs" (FarFish, D3.5) and is based on the "Second MR Invitation" (FarFish, D3.6), where the outcome targets (OTs) are proposed and based on input from MR1 (FarFish, D4.3), the "Audit of MR1" (FarFish, D5.1), and the "Report on challenges and suggestions for improvements" (FarFish, D5.2). In addition, this document is created based on stakeholder meetings facilitated by FarFish stakeholder interaction (WP1) and input from other FarFish work packages (WP) and case studies (CS).

This MR aims to strengthen data collection to promote sustainable fisheries and reinforce monitoring, control, and surveillance (MCS). The subsequent OTs are related to support standardising the data of fisheries' information systems, enhancing data collection regarding non-target species, and improving MCS tools to strengthen compliance.

The OTs for this case study (CS) are as follows:

OT 6.1 Harmonised fisheries information system in place. **Obligatory. Partly achieved**

OT 6.2 Catches of non-target species registered in e-logbooks. **Obligatory. Partly achieved**

OT 6.3 Marine Protected Area (MPAs) and no-take zones identified in the Seychelles Marine Spatial Planning (SMSP) are respected. **Obligatory. Not achieved.**

OT 6.4 Updated observer program in place. **Recommended. Not achieved.**

OT 6.5 Trade flow data provided. **Recommended. Partly achieved.**

OT 6.6 Vessel Monitoring System (VMS) or Automatic Identification System (AIS) signals are transmitted. **Recommended. Not achieved.**

The OTs are classified into ecological and governance dimensions, and we acknowledge that the operators are not solely responsible for achieving the OTs, which must therefore regard a joint effort between authorities and operators to achieve progress in this MR. Indicators are suggested to measure the OTs' performance, and the strategy for achieving OTs is outlined. The strategies do not affect or oppose current management and conservation measures fixed by the IOTC, EU External Dimension of the Common Fisheries Policy, or Seychelles authorities.

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Abbreviations

AIS	Automatic Identification System
ANABAC	National Association of Tuna Freezer Vessel Shipowners (Spain)
ANFACO-CECOPESCA	National Association of Fish and Seafood Canning Manufactures (Spain)
AZTI	Fundación AZTI – AZTI Fundazioa
CCMAR	Centre of Marine Sciences (Portugal)
CCTV	Electronic observer coverage (Video technology)
CETMAR	Centro Tecnológico del Mar - Fundación CETMAR (Spain)
CFP	Common Fisheries Policy
CPC	Vessels entitled to fly their flags and authorised to fish species managed by ICCAT in the Convention area, flag Contracting Parties, Cooperating non-Contracting Parties, Entities or Fishing Entities
CPUE	Catch per Unit Effort
CS	Case Study
CSIC	Spanish National Research Council
DG MARE	Directorate-General for Maritime Affairs and Fisheries (EU)
EC	European Commission
EEZ	Exclusive Economic Zone
EMS	Electronic monitoring system
ERS	Electronic Recording Systems
FAD	Fish Aggregation Device
FarFish RG	FarFish Reference Group
FIP	Fishery Improvement Program
FiTI	Fisheries Transparency Initiative
FLUX	Rapid or constant change
FMC	Fisheries Monitoring Centre
FPA	Fisheries Partnership Agreement
GFW	Global Fishing Watch
ICMAN-CSIC	Institute for Marine Sciences of Andalucía (ICMAN)-Spanish National Research Council (CSIC) (Spain)
IMO	International Maritime Organization
IO	Indian Ocean
IOTC	The Indian Ocean Tuna Commission
ISSF	International Seafood Sustainability Foundation
IUU	Illegal, unreported and unregulated fishing
LDAC	EU Long Distance Fleet Advisory Council
LL	Longline
MATIS OHF	Icelandic Food and Biotec R & D Institute
MCS	Monitoring, Control and Surveillance
MEECC	The Ministry of Environment, Energy and Climate Change
MFAg	Ministry of Fisheries and Agriculture
MPA	Marine Protected Area
MR	Management Recommendation

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MSP	Marine spatial planning
MSY	Maximum Sustainable Yield
NGO	Non-Governmental Organisation
NOFIMA	The Norwegian Institute of Food, Fisheries and Aquaculture research
OPAGAC	Organisation of Associated Producers of Large Tuna Freezer Vessels (Spain)
ORTHONGEL	Organisation of producers of frozen and deep-frozen tropical tuna (France)
OT	Outcome Target
PS	Purse Seine
RBM	Results-Based Management
RFMO	Regional Fisheries Management Organization
SDG	Sustainable Development Goal
SeyCCAT	Seychelles Conservation & Climate Adaptation Trust
SFA	Seychelles Fishing Authority
SFPA	Sustainable Fisheries Partnership Agreements
SGP	Secretaría General de Pesca (Spain)
SMSP	Seychelles Marine Spatial Planning
SOLAS	Safety Of Life At Sea
TAC	Total Allowable Catch
TNC	The Nature Conservancy
UIT	The Arctic University of Norway
VMS	Vessel Monitoring System
WIO	Western Indian Ocean
WWF	World Wildlife Fund

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Concepts/definitions

Indicator	A variable, pointer or index related to a criterion. Indicators are selected so that they reflect variation in key elements of the fishery resource, the social and economic well-being of the sector, and the sustainability of the ecosystem. The position and trend of an indicator in relation to reference points or values indicate the present state and dynamics of the system. Indicators provide a bridge between objectives and actions (source: FAO, 1999).
Management goals	The higher-order objective to which a management intervention is intended to contribute (OECD 2011). A management goal is derived from a management principle (constitutional-order) and is specified into a set of additional operational management objectives (collective-order).
Management intervention	Strategies or instruments aimed at impacting the state of a fishery with reference to authorised objectives. Examples are input and output controls and economic measures.
Management measures	Can be technical (e.g., gear selectivity), input (effort)/output (catch) control, right based.
Management objectives	Fisheries management objectives are typically framed within the concept of sustainable development and may reflect one or more various dimensions and criteria that relate to it (FAO, 1999). Operators control OTs through setting and implementing management measures.
Management Plan (MP)	In RBM, the management plan is a formal arrangement between a management authority and operators that specifies the partners in the fishery and their respective roles, the agreed objectives for the fishery, the management rules and regulations that apply, and other relevant details about the fishery. In RBM, the formal responsibility for developing the management plan is delegated to an operator.
Management Recommendation (MR)	In RBM, the management recommendation (MR) is a formal arrangement between a management authority and operators that specifies the partners in the fishery and their respective roles, the agreed objectives for the fishery, the management rules and regulations that apply, and other relevant details about the fishery.
Management strategies	In the FarFish context, this refers to strategies applied to achieve OTs.
Outcome Target (OT)	Outcome targets (OTs) are specific and measurable requirements set by an authority to make management goals operational. An OT is a statement of the condition of an indicator relative to a reference point, often in the form of inequality ('A>B') or a statement of presence or absence of some entity. Using relevant information, this statement can be assessed as true or false at a given point in time. For instance, the management objective that "the fishery should be biologically sustainable" could be expressed in terms of one or more OTs, such as 'Catch < 20 000t; 'bycatch < 20%'; SSB > 30 000t; 'a catch reporting system is present', etc.

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1 Introduction

This document updates the second proposal for a management recommendation (MR2) in the FarFish project with the aim to respond to the second audit report (FarFish, D5.4). The MR2 was developed with European operators active in the Seychelles tuna fishery under the current SFPA (2020-2026).

1.1 FarFish overall objective

The objective of FarFish was to improve knowledge and management regarding EU fisheries outside Europe while contributing to sustainability and long-term profitability. The role and responsibilities of the EU fleet are significant to ensuring sustainable utilisation of the resources to which they are allowed access, whether under SFPAs or in international waters, also known as the high seas.

The concept of sustainability regards meeting present needs without compromising future generations' ability to meet their own, which includes managing people, the planet, and profit. The fleet should therefore cooperate with the RFMO and national authorities in partner countries to improve knowledge and make management more effective. The EU has agreed to strengthen capacity in their SFPA countries to ensure the efficient management of fisheries, which will lead to sustainable utilisation and increasing the long-term profitability of all stakeholders.

The FAO report "The State of World Fisheries and Aquaculture 2020"[3] states that there is no alternative to sustainability; the world needs programs to improve fisheries to allow humans to continually fish in oceans for edible seafood. The effective management of the world's fisheries represents the sole path to sustainability, which obligates EU national authorities and fishing industries.

1.2 About Seychelles

The Republic of Seychelles is an archipelago of 115 islands within a rich tropical marine ecosystem in the Western Indian Ocean. Seychelles' EEZ and Territorial Sea are 1.35 million km^2 with a land area of only 455 km^2. The population of 98,350 (2020) largely resides on three main granitic islands of a large submerged mid-oceanic shelf (Mahe Plateau).

Due to the development of industrial tuna fisheries in the Western Indian Ocean, Seychelles has progressed considerably over the past three decades. It is a regional hub and hosts the IOTC.

Although industrial fisheries are a pillar of the economy, artisanal fisheries remain important to food security, employment, and cultural identity. The revenue and capacity building generated by the industrial fisheries sub-sector has supported significant national investment in developing and managing artisanal fisheries. These two sub-sectors have complemented each other well[4].

1.3 The process for developing MR2 for Seychelles

The MRs were developed in two iterations and are based on results-based management (RBM)[5] principles (Nielsen et al., 2017). The RBM requires the relevant authority to define specific and

[3] http://www.fao.org/documents/card/en/c/ca9229en
[4] http://www.fao.org/fishery/facp/SYC/en
[5] The RBM is also referred to as the Responsive Fisheries Management System (RFMS) in the EcoFishMan project and other FarFish documents

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measurable objectives for a fishery but allows resource users (operators) to find ways to achieve these objectives and provide adequate documentation (Figure 1).

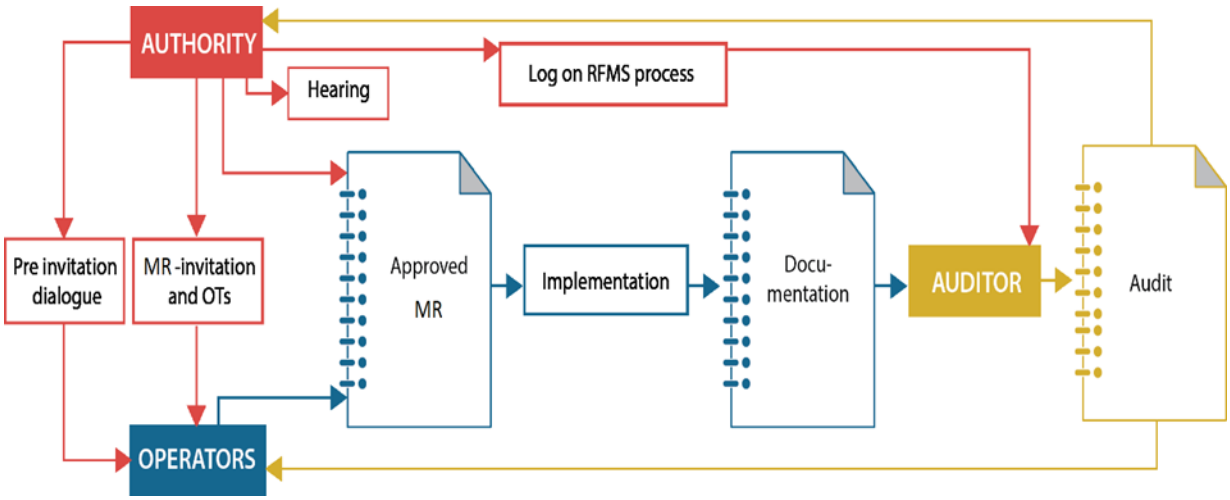

Figure 1: General description of the process of making MRs based on RBM in FarFish (FarFish, D3.1). The different colours demonstrate the responsibilities of each of the three entities. Authority: red / Operators: blue / Auditors: yellow.

The MR1 for Seychelles (FarFish, D4.3) was made available on 30 September 2019. The MR2 was developed following the "General Guidelines for making MRs" (FarFish, D3.5) and was based on the "Second MR Invitation" (FarFish, D3.6), which set the updated outcome targets (OTs) for the CS. The OTs were based on "MR1" (FarFish, D4.3), advice from the auditor, and input from meetings facilitated by FarFish "Stakeholder interaction" (WP1). The consortium reviewed the OTs at the CS and WP leader meeting in Marrakesh (Morocco, Nov. 2019), after which a draft of the "Second MR Invitation" was sent for hearing among operators. Based on the response, the authority (MATIS) further adjusted some OTs, and the "Second MR invitation" was made available on 21 January 2020. The External Advisory Group and experts in the 36-month review meeting in August 2020 also provided valuable input to develop MR2. Following the RBM approach, the "Audit of MR1" (FarFish D5.1) was made available on 30.11.2019, which included audit and input recommendations applied from the "Report on challenges and suggestions for improvements" (FarFish, D5.2). The second audit report, 'Report on Management Recommendation 2 Audit' (FarFish, D5.4), was made available on 30.06.2021. The recommendations from the audit report were used to update the second MR.

Several physical meetings to review ongoing work were held with administration, scientists, and stakeholders in Seychelles in March 2020, which were organised by representatives of WP1 (LDAC), WP6 (CSIC), and WP7 (GRO-FTP). The goal was to agree on the way forward with the CS leader (SFA). SFA staff from several departments were represented, such as management, scientific research, and statistics including data related to fisheries, monitoring and control, and value chain analysis. Representatives from Seychelles companies and fishing operators (purse seiner and artisanal fisheries) also attended meetings. The coordinator arranged a final online meeting with five SFA scientists and key FarFish partners to acquire detailed information and finalise the draft of MR2 in February 2021.

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In addition to the meetings mentioned above and other events, WP1 ensured continuous contact with relevant operators through three physical and six online meetings, e-mail correspondence, and phone calls. WP4 represented the operator and develops the MRs. The FarFish coordinator representing the authority held meetings (online and physical), e-mail correspondence, and phone calls with the CS leader and representatives from SFA.

1.4 Partners involved in MR2 for Seychelles

This CS focused on the EU fleet, meaning that not all operators in Seychelles waters were involved in the RBM.

MATIS acted as the leading authority within the project while considering input from relevant authorities, such as the EU Commission department responsible for EU policy on maritime affairs and fisheries (DG MARE) and the SFA.

The European operators qualified to respond to the MR2 Invitation will provided feedback through three designated stakeholder organisations: OPAGAC, ANFACO-CECOPESCA, and LDAC. The leader of WP4, UiT, assisted operators' representatives in developing the MR2.

The LDAC is composed of 60% fishing sector organisations (including catching, processing, marketing sectors, and trade unions), while the remaining 40% is represented by other groups (mainly environmental and development NGOs). OPAGAC is one of two main Spanish tuna fishing organisations mainly representing the purse seine fleet. OPAGAC signed a Memorandum of Understanding[6] with the World Wildlife Fund (WWF) to implement a Fishery Improvement Program (FIP)[7]. ANFACO-CECOPESCA is the National Association of Fish and Seafood Canning Manufacturers – National Technical Centre for the preservation of Fish Products in Spain, representing the interests of more than 240 associate members from a multi-sectorial cluster linked to seafood producers and the industrial processing sector. The WP5 leader Sjókovin conducted the audits.

Table 1. RBM roles of work packages, stakeholders and FarFish research institutions (indicated in italics) involved in the development of the Seychelles MR2.

Seychelles CS			
RBM roles	AUTHORITY	WP3	DG MARE and SFA; *MATIS*
	OPERATORS	WP4	LDAC, OPAGAC, ANFACO-CECOPESCA; *UiT*
	AUDITOR	WP5	*Sjókovin*

Seychelles Fisheries Authority (SFA) in Seychelles is the CS leader

1.4.1 Other partners and stakeholder interaction

Three representatives of WP1 (LDAC), WP6 (CSIC), and WP7 (GRO-FTP) travelled to Seychelles in March 2020 to conduct several meetings with administration, scientists, and stakeholders to review the

[6] https://fisheryprogress.org/system/files/documents_mou/MOU%20FIP%20OPAGAC-WWF%202016_0.pdf

[7] The intention is to facilitate certification of the OPAGAC Fishery with the Marine Stewardship Council, an evaluation process that has begun and should be done before 2021. http://opagac.org/en/spanish-tuna-association-agac-enters-full-msc-assessment/.

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ongoing work of the CS and agreed on the way forward with the CS leader (SFA). The visit included a stakeholders meeting; a bilateral meeting with the Deputy CEO to examine administrative and financial issues related to the project; several interviews for candidates to join the UN GRO Fisheries Training Program in 2020-2021; and identifying interested scientists who may attend the DLM tool training course planned for April in Cape Verde.

The stakeholder meeting was attended by SFA staff from diverse departments, including representatives from Seychelles companies, fishing operators representing purse seiner, and artisanal fisheries and representatives from Spanish purse seiner fishing companies, with one from OPAGAC and another from PEVASA.

The stakeholder meeting was held with several presentations on:

- What is FarFish and progress achieved to date, with a focus on the Seychelles CS.
- State of play of the MR1 and review of OTs ahead of MR2 – feedback from SFA.
- Roadmap (D5.2) to identify the actions partners responsible in Seychelles CS.
- A practical demonstration by CSIC regarding how the DLM tool functions.
- UNESCO Fisheries Training Program and capacity-building options available to SFA through FarFish (e.g., tutor web modules and “education in a suitcase”).

1.5 Objectives of the MR2 for Seychelles

The main objectives of the MR2 for Seychelles were to enhance knowledge for managing these fisheries, minimise the lack of data to undertake stock assessments of bycatch species, and support the fight against IUU fishing. These objectives were achieved by:

(1) Harmonising the fisheries information system by producing a report on all relevant data protocols for the EU fleet fishing under the SFPA agreement and by creating a standardised fisheries information system.
(2) Developing a template for a catch-reporting protocol for non-target species to be implemented in e-logbooks.
(3) Contributing to better monitoring, control, and surveillance (MCS) in the area by supporting enforcement by utilising the latest satellite systems and tools.

For the market, a solution was to increase knowledge regarding the value chain, processing, and market conditions by studying harvest and trade flow data on tuna products by conducting interviews, implementing questionnaires with harvesters, processors, sellers, and by investigating available trade data.

2 Seychelles Fisheries Sector Policy and Strategy 2019

The Fisheries Act of 2014 provides a legal framework for developing and managing environmentally responsible and sustainable fisheries and aquaculture, including sea-ranching in the Republic of Seychelles.

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The objective of this act[8] is:

- to provide for the efficient and effective management and sustainable development of fisheries in accordance with international norms, standards, and best practices;
- to provide an ecosystem approach to fisheries;
- to provide for the licensing of fishing vessels to regulate fishing activities (including sport fishing);
- to provide for offenses and penalties;
- and to repeal the Fisheries Act of 1986.

The Government of Seychelles is responsible for policy development and oversight. The policy provides a framework for Development Plans by the Ministry of Fisheries and Agriculture (MFAg) to guide the policy's implementation by the SFA. As the government's lead technical executive arm for fisheries and aquaculture, the SFA will continue to discharge responsibilities and functions as defined by its act.

The SFA coordinates fisheries' MCS through the Monitoring Control and Surveillance Section. The MCS hosts the Fisheries Monitoring Centre (FMC), which *inter alia* issues fishing authorisations and monitors fishing vessels' compliance with lawful conditions. This includes monitoring the operations of satellite Vessel Monitoring Systems (VMS) within its EEZ and beyond for flagged vessels, validating statistical documents for ICCAT, IOTC, EU, and Non-EU, including catch certificates (Goulding et al., 2019).

The goal of the Fisheries Sector Policy is to provide effective, efficient, transparent, and accountable service delivery through a participatory approach to ensure long-term sustainable fisheries as well as aquaculture management and conservation, where the aim is for the sector to continue playing a key role in the country's sustainable development and socio-economic well-being.

The policy has the following objectives:

- Manage fisheries' resources through ecosystem-based approaches and ensure that policies, legislation, and infrastructure development are aligned towards achieving sustainability while considering climate change, international commitments, and global developments;
- Stimulate economic growth and transformation of the economy to create work and vibrant, equitable, and sustainable livelihoods contributing to food security for all;
- Foster optimum utilisation of fisheries and aquaculture resources to ensure ecological and socio-economic sustainability in resource use and domestic developments while recognising traditional norms;
- Maximise economic benefits from resource use in waters under national jurisdiction and across all value chains and nationally reinvest the benefits, including modernising local fisheries and developing the aquaculture sector;
- Promote the use of rights-based management approaches supported by the best research and industry practices across fisheries and aquaculture;

[8] https://seylii.org/sc/legislation/act/2014/20

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- Promote visibility, transparency, participation, and inclusivity in decision-making processes, which will enable the industry to develop to its full potential within a supportive regulatory framework;
- Safeguard the welfare of current and future generations while recognising gender equity and vulnerable groups and while protecting the country's sovereignty and jurisdiction;
- Reinforce the development of human resources through effective capacity programs and training certification for marine fisheries education for the future growth of the fisheries and aquaculture sectors;
- Develop an institutional environment that facilitates investment in fisheries and aquaculture and that promotes Seychelles ownership and stakeholder engagement in the sector;
- Improve public awareness of the potential benefits of fisheries and aquaculture for the country.

2.1 Seychelles Marine Spatial Plan

In 2012, Seychelles committed to a 30% marine protection goal for its waters and 50% for terrestrial islands. At that time, more than 47% of the land was protected but only 0.04% of the ocean. A central pillar of sustaining the blue growth policy is to implement the Seychelles Marine Spatial Planning process (MSP)[9] [10].

The MSP initiative represents a process of analysing and allocating human activities' spatial and temporal distribution in marine areas to achieve ecological, economic, and social objectives. This initiative focused on planning and managing the sustainable and long-term use and health of the Seychelles EEZ, which encompasses 1,374,000 km^2 of ocean and 115 islands (Figure 2).

The MSP began in 2014 and had two phases, where phase 1 was launched in February 2014 and completed in February 2018, while phase 2 began in March 2018, with two milestones of 7.5% by area and representation to complete the 30% goal set by the government of Seychelles in 2014. Milestone 2 was held from March to October 2018, and new marine protections gazetted in April 2019 for 26% in marine protections. Milestone 3 occurred from March to October 2019, and new marine protections gazetted on 26 March 2020 to meet the 30% marine protection target.

The Seychelles MSP will be completed in 2020-2021, and implementation is planned for 2021. To achieve the best practice of MSP, the plan will be monitored and adapted over time.

The Ministry of Environment, Energy, and Climate Change (MEECC) leads the development process, with planning and facilitation managed by The Nature Conservancy (TNC) and TNC Canada in partnership with the government of Seychelles under the UNDP GEF Programme Coordinating Unit (PCU). The development process includes input from all major sectors of Seychelles, including commercial fishing, tourism, marine charters, biodiversity conservation, renewable energy, port

[9] https://seymsp.com/

[10] MSP is a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives, usually specified through a political process (UNESCO 2009)

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authority, maritime safety, and non-renewable resources. The aim is to develop a comprehensive marine plan using stakeholder input and to create maps using ecology knowledge to show how the ocean is used. Scientific data and local expert knowledge are also considered.

Funding for the initiative is provided through grants to the government of Seychelles, such as the Seychelles Conservation & Climate Adaptation Trust (SeyCCAT) and an Oceans 5 grant awarded to TNC. To provide further support, TNC has also funded the Seychelles administration with “Blue Bonds”.

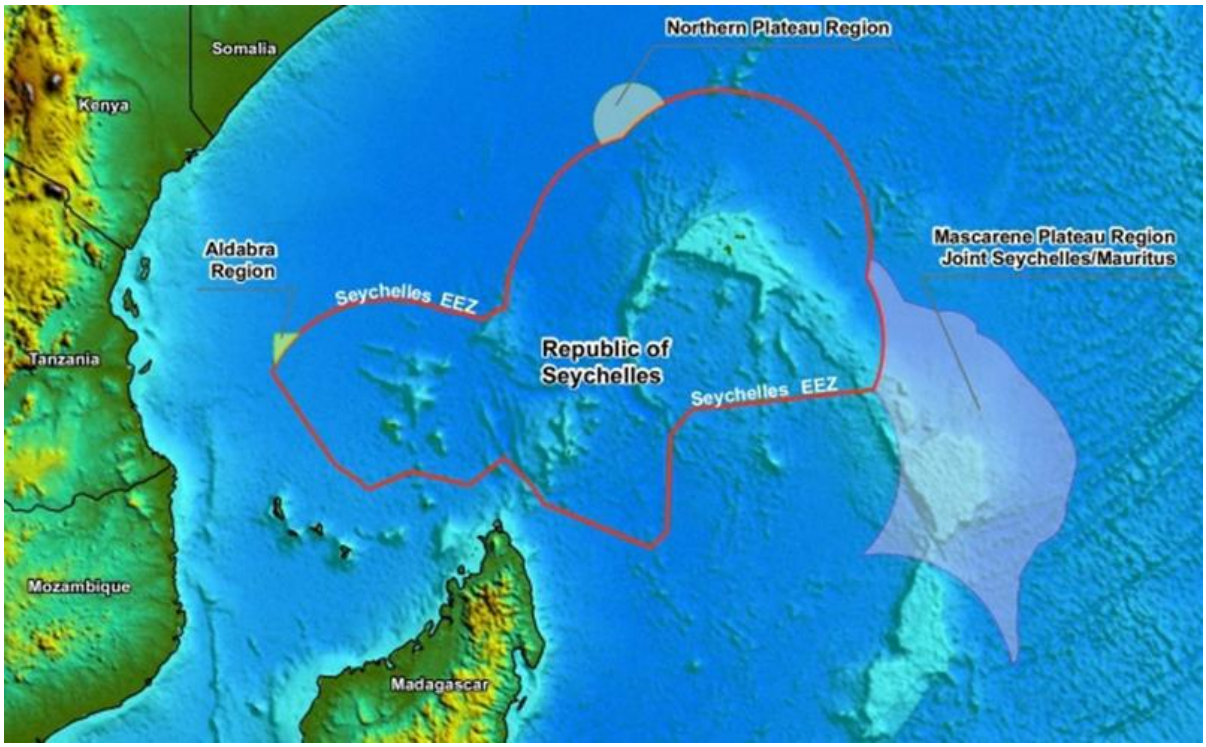

Figure 2 The Seychelles EEZ is the largest in the West Indian Ocean. Picture: maheship.com

2.2 The EU Common Fisheries Policy

The EU established a system concerning the fishing activities of EU vessels fishing outside EU waters under SFPAs[11] and in the high seas. This Common Fisheries Policy (CFP) requires EU catches under SFPAs to be limited to surplus stocks. The EU reformed the previous CFP, which came into effect in January 2014 and is currently in force. The CFP stresses the need to promote its objectives internationally by ensuring that EU fishing activities outside EU waters are based on the same principles and standards as those applicable under EU law, while promoting a level playing field for EU and third-country operators (EU, 2017)[12]. The EU must therefore conduct its external fleet in accordance with the objectives and principles described in Articles 2 and 3 of the CFP. According to Article 2, these objectives include applying and promoting a precautionary approach to ensure that

[11] REGULATION (EU) 2017/2403 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 December 2017 on the sustainable management of external fishing fleets, and repealing Council Regulation (EC) No 1006/2008
[12] https://ec.europa.eu/fisheries/cfp_en

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targeted stocks exceed levels that deliver Maximum Sustainable Yield (MSY) by 2020 at the latest; application of the ecosystem principle; promotion of collecting scientific data, and the gradual elimination of discards.

The main objective of the CFP is:

- to ensure that fishing activities are environmentally, economically, and socially sustainable;
- to consistently manage fishing activities to achieve economic, social, and employment benefits;
- to restore and maintain fish stocks above levels that can produce a MSY and contribute to the availability of food supplies.

In addition, the EU committed itself to the UN Sustainable Development Goal 12[13] (SDG 12) and Goal 14[14] (SDG 14).

2.2.1 SFPA between EU and Seychelles

The first fisheries agreement concluded between the EU and Seychelles in 1987. On 24 February 2020, the EU and Republic of Seychelles signed a new 6-year SFPA. The associated implementing protocol establishes EU vessels' fishing opportunities, the financial compensation to be paid by the EU, and the modalities of sectoral support to the fishing sector of Seychelles. The current protocol covers the period from 24.02.2020 to 23.02.2026. The total estimated value of the SFPA amounts to EUR 58.2 million, which is equivalent to EUR 9.7 million per year. The EU financial contribution is EUR 5.3 million per year, of which EUR 2.8 million is earmarked to support Seychelles' fisheries policy.

The turnover of EU purse seiners under the previous SFPA was approximately EUR 70 million per year on average over 2014-2018, varying between EUR 39.2 million in 2015 and EUR 83.0 million in 2017 (Goulding et al., 2019).

This fisheries agreement allows EU vessels from Spain, France, Italy, and Portugal to fish in Seychelles' fishing zone, comprising part of the tuna network fisheries agreements in the Indian Ocean[15].

Table 2. Main features of the SFPA

Duration of the agreement:	6 years renewable (24.2.2020 – 23.2.2026)
Duration of the protocol:	6 years (24.2.2020 – 23.2.2026)
Nature of the SFPA	Tuna fishery agreement
Financial contribution:	EUR 5,300,000 per year, of which EUR 2,800,000 is dedicated to supporting Seychelles' fisheries sector.
Fee for ship owners:	EUR 80 per tonne for the first and second years of protocol application. EUR 85 per tonne from the third to the sixth years of protocol application.
Reference tonnage:	50,000 t/year

[13] SDG12: Ensure sustainable consumption and production patterns and their targets
[14] SDG14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
[15] https://ec.europa.eu/fisheries/cfp/international/agreements/seychelles_en

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3 Fishery overview

Seychelles' fishing activity can be divided into three categories: artisanal, semi-industrial, and industrial fisheries. Artisanal fisheries target coastal, inshore resources, while semi-industrial fisheries target large pelagic fish, such as tunas and swordfish. These two types of fisheries are operated by boats that are locally owned and operated.

The focus of FarFish is industrial fisheries, using purse seine and longline gear in Seychelles, which includes about 45-50 national and foreign purse seine vessels that operate under various agreements. Note that these vessels operate inside the Seychelles EEZ and outside in the Indian Ocean (IO). Thirteen large purse seines currently operate under the Seychelles flag, most of which are under Spanish beneficial ownership (Goulding et al., 2019). Up to five purse seines vessels from Mauritius can fish under a Seychelles-Mauritius fisheries agreement; however only two have operated in recent years, while an additional five Korean purse sein vessels have operated in the Seychelles EEZ (SFA, 2016).

An average of 27 EU tuna purse seine vessels drew fishing authorisations in 2014-2018, representing almost all EU tuna purse seine vessels active in the IO. Only one EU longline vessel conducted fishing activities in 2016 and 2017 (none in 2018) (Goulding et al., 2019).

3.1 Identity of the fishery

The international fleet consisting of purse seine vessels and industrial longline vessels conducts most of the fishing in the Seychelles EEZ. The purse seine fishery targets mostly surface-swimming tuna (skipjack and yellowfin), while the longline fishery targets deep-swimming bigeye and yellowfin tuna (FarFish, D3.4).

The SFPA allows 40 tuna purse seine vessels and 8 surface longline vessels[16] from the EU to target tuna and tuna-like species within the Seychelles EEZ. A total catch of 50,000 tonnes per year is allowed during the agreement period (EU, 2020).

OPAGAC, ANABAC, and ORTHONGEL are the three main EU tuna purse seine operators within the Seychelles EEZ operating under the SFPA, and some Seychelles-flagged boats are owned by these companies. These agreements regard public information with published information regarding money paid for access to fishing, sectoral support, volume of annual catches by species and national fleets in tonnes, and provisions regarding control at sea and ports, the landing of fish for processing, and the composition/hiring of the local crew.

The IOTC manages the tuna and billfish species in Seychelles waters, and Seychelles has been a contracting party and non-contracting party (CPC) member of IOTC since 1995. The IOTC has the mandate to adopt conservation and management measures for tuna and billfish species in the IO, and it published a compendium of the active conservation and management measures (IOTC, 2018a). These decisions are passed through resolutions or recommendations, and the measures are legally binding for contracting parties, including Seychelles and the EU.

[16] Previous SFPA included 6 surface longliners, but France is now allocated 4 vessels, gaining 2.

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Table 3. Allocation of fishing opportunities under the SFPA in the Seychelles EEZ (Source: EU, 2020)

	Spain	France	Italy	Portugal	Total
Tuna purse seiners	22	16	2	-	**40**
Surface longliners	2	4	-	2	**8**

3.2 Processing sector and value chain

At least one Seychelles processing facility is dedicated to bycatch, where the raw material acquired seems to be of favourable quality with volume high enough to be profitable. The raw materials, however, do not fulfil the technical, health, and sanitary requirements to qualify for exporting products to the EU market. The processing facility has been used to grade the bycatch, packaging, and ship the products to Sri Lanka as the main market, although there have also been shipments to Cote d'Ivoire.

Since 2014, the French investing company SAPMER wanted to develop a presence as close as possible to its fishing area, with Victoria in Seychelles representing the closest port suitable for tuna infrastructures. The company's objective was to relocate its vessels close to the fishing areas to decrease travel and increase fishing time, thereby increasing the catch volume per vessel by 50%, despite the entailed investment in constructing infrastructure (landing dock, storage hall, etc.). At the same time, the costs of traveling in the fishing area would be reduced. The company's economic growth has been rapid, from a turnover equivalent to EUR 87.2 million in 2015 to EUR 180.9 million in 2018. The turnover fell to EUR 165.2 million in 2019 due to a decreased skipjack tuna price due to large catches. This EU investment In Seychelles was briefly analysed in the report on return of investments (FarFish D5.3).

3.3 EU catch statistics and the EU fleet

Catches of the EU purse seine fleet in the Seychelles EEZ have been on average 48,000 tonnes from 2014-2018. In 2018, the EU fleet's total catches amounted to 55,355 tonnes, mostly split between French and Spanish fleets, with Italy catching around 3,000 tonnes. Following the IOTC's introduction of the full landing obligation from 2018, most bycatch is landed in Seychelles (Goulding et al., 2019), but landings also occur in other ports in the region. The EU fleet catches in the Seychelles EEZ in 2017 feature differences compared to catches in the IO. France (and one purse seine vessel from Italy) take about 37% of their catches inside the Seychelles EEZ, while Spain takes about 16%.

Table 4 shows a breakdown of the "Other species" group, which can be considered bycatch of the EU purse seine fleet. Albacore tuna represents an important component but regards small quantities since the main fishing grounds for this tuna are further south in the IO. Bycatches are generally minor and include undetermined species (e.g., billfish and tunas). Some data were gathered regarding important bycatch species such as the common dolphinfish and wahoo, which allows diagnosing various data-limited methods to estimate exploitation status. Undersized specimens of targeted species are treated similarly to bycatch for this purpose. See the report "Interactive platform for FarFish tools" (FarFish D6.8) for details regarding implementing these methods. Albacore tuna and kawakawa have been assessed and are sustainably exploited by the IOTC.

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Another important component is the industrial longline fleets in the Seychelles fishing zone, which consists of fleets under the Seychelles flag and several other countries. The numbers of vessels with licenses have varied greatly but were 158 in 2015, including 45 under the Seychelles flag, 85 Taiwanese, 19 from China, and a few vessels from other countries such as Oman, the Philippines, Tanzania, and Thailand (SFA, 2016). Most vessels are reportedly still operating (Goulding et al., 2019).

Table 4: Total EU tuna catches (tonnes) in the Seychelles EEZ. A breakdown of EU catches is also given on purse seine catches inside the Seychelles EEZ and in the Indian Ocean (IO). (Source: Goulding et al., 2019)

Entity	Species	2014	2015	2016	2017	2018	Average
EU	Yellowfin tuna	23,384	17,205	30,095	24,579	16,610	22,375
EU	Skipjack tuna	15,160	12,656	28,206	19,971	33,457	21,890
EU	Bigeye tuna	3,416	2,075	3,452	4,062	5,249	3,651
EU	Other species	56	49	179	121	39	89
	Total	**42,016**	**31,985**	**61,932**	**48,733**	**55,355**	**48,004**
EU breakdown							
Spain	Whole IO	133,720	120,890	136,147	151,392		135,537
	Seychelles	20,179	16,791	30,631	23,914		22,879
	% Seychelles	**15%**	**14%**	**22%**	**16%**		**17%**
France & Italy	Whole IO	58,339	54,390	68,250	66,934		61,978
	Seychelles	21,837	15,194	31,301	24,818		23,288
	% Seychelles	**37%**	**28%**	**46%**	**37%**		**38%**

Like the purse seine vessels, longline vessels operate within and outside the Seychelles EEZ. A total of 59 long line vessels are registered under the Seychelles flag in 2019, but some do not operate within the EEZ and have until now not required a license for this activity (Goulding et al., 2019). These vessels are owned and operated by Chinese operators, where the main target is bigeye tuna for the sashimi market (Goulding et al., 2019).

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Table 5: Breakdown of bycatch species (other species) in EU catches (tonnes) (Source: DG MARE)

Code	Species	2014	2015	2016	2017
ALB	Albacore	56.4	49.3	95.7	111.9
BIL	Billfish			1.8	
BLM	Black marlin			0.6	1.8
DOL	Dolphinfish			1.0	0.4
FRI	Frigate tuna			3.0	3.3
LTA*	Kawakawa				3.1
TUN	Tuna nei			76.2	
WAH	Wahoo			0.8	0.2
		56.4	49.3	179.1	120.8

The available data for 2014 and 2015 indicate total longline catches of 18,000 and 14,200 tonnes respectively (Table 6) from longline vessels licensed to fish in Seychelles, which does not include the whole longline fleet operating in the Western Indian Ocean (WIO). These figures are presumably underestimated by about 10% since the data are based on the return of logbooks, which was about 90% (SFA, 2016). The proportion of catches inside the Seychelles EEZ varies from about 30% to 55%. According to the SFA, the Seychelles fleet of 13 purse seine vessels caught 88,740 tonnes of tuna in 2015, of which 11,650 tonnes were taken inside the Seychelles EEZ (13%). These figures are similar for the Spanish purse seine fleet, where most vessels are under Spanish beneficial ownership and thus operate using the same fishing strategy.

* This is presumably *Euthynnus affinis,* so this is a misidentification, and the code should be KAW

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Table 6: Total catches (tonnes) by the longline fleets under license to fish in the Seychelles EEZ. This is presented separately for vessels under the Seychelles flag and all fleets together, indicating how many catches are taken inside and outside Seychelles (Source: SFA, 2016)

				Percentage species composition					
Fleet	**Year**	**SYC EEZ**	**Catch**	**Yellowfin**	**Bigeye**	**Swordfish**	**Marlin**	**Shark**	**Other**
Seychelles	2014	WIO	10,689	15	49	9	6	5	15
		SYC EEZ	3,031	21	61	6	5	4	2
Seychelles	%		28%						
	2015	WIO	12,255	18	46	13	10	3	9
		SYC EEZ	3,205	30	50	9	7	3	1
	%		26%						
All	2014	WIO	18,000	19	51	8	7	6	10
		SYC EEZ	9,927	23	55	7	6	7	3
	%		55%						
All	2015	WIO	14,243	19	47	12	10	4	8
		SYC EEZ	5,054	28	49	8	8	4	2
	%		35%						

(Source: SFA, 2016)

The above data confirm that bigeye tuna is the main target of these longline vessels, showing substantial catches of yellowfin tuna and swordfish (Table 6). The other species can be considered bycatch, including unspecified marlin and shark, where the blue shark is presumed to be the dominant species caught as bycatch. Concerns about the status of the yellowfin and several billfish stocks imply that longline fisheries are subject to measures such as rebuilding the yellowfin tuna stock and limiting capacity.

3.4 Stock status of target species

Stock assessments are regularly conducted by IOTC Working Parties, which then report to the IOTC Scientific Committee (Table 7). The models used for stock assessment depend on the available data, and in some cases, it is not considered possible to perform a full assessment, such as for various neritic tuna and other bycatch species. When the data do not allow a formal assessment, various indicators are used instead (e.g., catch, CPUE, size, etc.).

Tropical tunas such as yellowfin, skipjack, and bigeye tuna represent the main targets of the industrial purse seine fishery and are important to the EU purse seine fleet. Bigeye and skipjack tunas are fished sustainably, but the stock of yellowfin tuna is considered overfished (Table 7). The IOTC has adopted various measures such as a rebuilding plan for yellowfin tuna (Resolution 18/01) (IOTC, 2018b), limitations on fishing capacity (Resolution 15/10) (IOTC, 2015d), and the development of an allocation system (quota) for tropical tunas stocks (Resolution 14/02) (IOTC, 2014). These and other measures, however, potentially affect the exploitation of tropical tunas.

Swordfish and blue shark represent important target species of the EU and the Seychelles longline fleet, which are fished sustainably according to the IOTC (Table 7). The EU fleet notably takes most catches in the southern IO rather than the Seychelles EEZ. The other billfish species are included for

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the sake of completeness since they may be caught as bycatch in longline fleets. The situation seems to include overexploitation (Table 7).

***Table 7:** Stock status for species of tuna and tuna-like species under management by the IOTC (IOTC, 2020, SC23). See notes below for the meaning of the colour key.*

Stock	Catch 2019	Average catch 2015-2019	Colour key			Stock status
Tropical tunas			***2018***	***2019***	***2020***	
Bigeye tuna (*Thunnus obesus*)	73,165 t	88,303 t				In 2019, a stock assessment was conducted in the IOTC area of competence to update the stock status undertaken in 2016. The stock status determination changed in 2019 from **not overfished** to **subject to overfishing.**
Skipjack tuna (*Katsuwonus pelamis*)	547,248 t	506,555 t				A stock assessment was conducted in 2020 using Stock Synthesis with data up to 2019. The stock is determined to be **not overfished** and **not subject to overfishing.**
Yellowfin tuna (*Thunnus albacares*)	427,240 t	424,103 t				No stock assessment was conducted in 2020; thus, the stock status is determined based on the 2018 assessment and other information presented in 2020. Based on the evidence available in 2018 and 2019, the stock is determined to remain **overfished** and **subject to overfishing.**
Billfish						
Swordfish (*Xiphias gladius*)	32,671 t	31,712 t				An assessment in 2020 used stock synthesis with fisheries data up to 2018. Based on the evidence available in 2020, the stock is determined to be **not overfished** and not **subject to overfishing.**
Black marlin (*Makaira indica*)	17,415 t	18,599 t				No stock assessment was conducted in 2020; thus, the stock status is determined based on the 2018 assessment. The stock is **not subject to overfishing** and is currently **not overfished**; however, these status estimates are subject to a high degree of uncertainty.
Blue marlin (*Makaira nigricans*)	8,316 t	8,958 t				The stock status based on the Bayesian State-Space Surplus Production model JABBA suggests that an 87% probability that the stock in 2017 is in the red zone of the Kobe

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						plot, indicating that the stock is **overfished** and **subject to overfishing.**
Striped marlin (*Tetrapturus audax*)	2,860 t	3,455 t				No stock assessment was conducted in 2020; thus, the stock status is determined based on the 2018 assessment and other indicators presented in 2019. Based on the evidence available in 2019, the stock status is determined to be **overfished** and **subject to overfishing**.
Indo-Pacific sailfish (*Istiophorus platypterus*)	29,872 t	30,306 t				No stock assessment was conducted in 2020; thus, the stock status is determined based on the 2019 assessment. Based on the evidence available in 2019, the stock status cannot be assessed and is determined to be **uncertain.**
Sharks						
Blue shark (*Prionace glauca*)	22,719 t	54,735 t				No stock assessment was conducted in 2020; thus, the stock status is determined based on the 2017 assessment. Based on the evidence available in 2017, the stock status is determined to be **not overfished** and **not subject to overfishing**.

**Note: Stock status definitions and colour code

Biomass (B) Fishing Mortality (F)	Overfished ($B_{year}/B_{MSY} < 1$)	Not overfished ($B_{year}/B_{MSY} \geq 1$)
Subject to overfishing ($F_{year}/F_{MSY} > 1$)		
Not subject to overfishing ($F_{year}/F_{MSY} \leq 1$)		
Not assessed / Uncertain		

4 Specific challenges in Seychelles

Although the Seychelles administrative, institutional, and legal framework is well established, the SFA's ongoing reorganisation may affect the MCS of the EU fishing fleet. Challenges were raised during the stakeholder interaction in FarFish, with no data thus far provided by the MCS of SFA regarding sharing the AIS and/or VMS data for the project's research purposes, which was mostly due to legal impediments and the fact that the FMC did not collect AIS data at that time. The following challenges form the basis for the OTs described in Chapter 5 and were based on output from the stakeholder interaction in FarFish, including contributions from the operators, CS leader, and IOTC. In addition, some challenges were based on the most recent Ex-post evaluation of the agreement between Seychelles and the EU (Goulding et al., 2019).

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4.1 Marine Protected Area

410,000 km^2 of the ocean in Seychelles is safeguarded as Marine Protection Areas (MPAs), where the protected areas are divided into two 'zones' (Figure 3). Zone 1 is a high biodiversity protection area where almost no extractive human activities are allowed. This zone includes a UNESCO world heritage site and is one of the world's most ecologically important habitats, including the waters around the Aldabra Group. This area is home to the IO's only dugongs, the world's second-largest raised atoll, regionally significant seabird populations, and critically endangered turtles. This zone is on migratory routes for calving Southern Ocean humpback whales and includes the highest fish densities in Seychelles. Zone 2 includes important areas for tourism and fisheries.

The Ministry of Environment, Energy, and Climate Change (MEECC) oversees the Seychelles Marine Spatial Planning (SMSP) development. The zones will be implemented in 2021 upon completion of the SMSP, which is expected to impact 4,000 to 5,000 tonnes of catch by EU vessels fishing under the agreement. The fishing efforts associated with this catch, however, are expected to be re-directed to other zones within or outside the Seychelles EEZ. The proposed regulatory restrictions will affect EU tuna operators who were consulted regarding the SMSP process (Goulding et al., 2019).

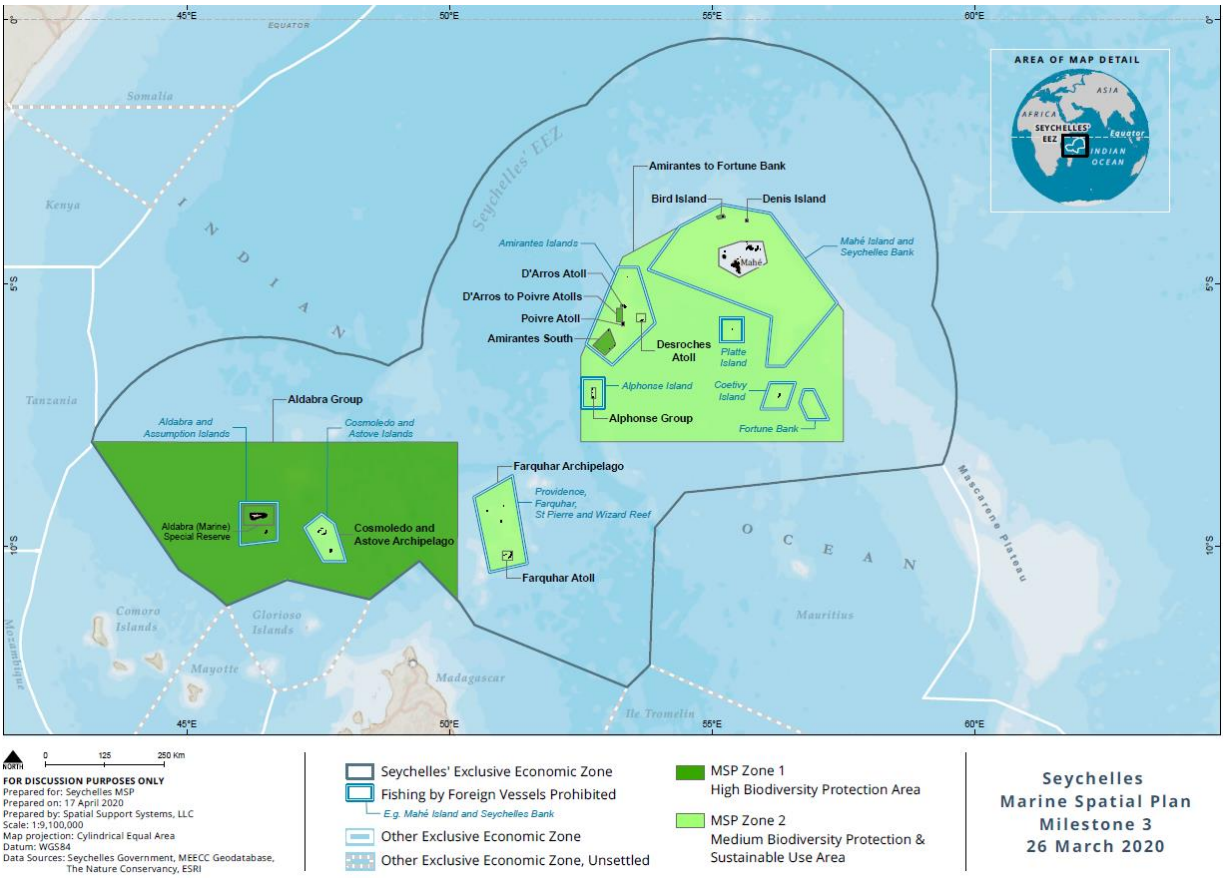

Figure 3. Seychelles Marine Spatial Plan (SMSP), Gazette Marine Zones 26 March 2020 (source: seymsp.com)

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4.2 Lack of data to undertake a stock assessment of bycatch species

Most IOTC CPC has failed to provide the IOTC Secretariat with estimates of total bycatch or observer reports from which bycatch levels can be assessed[17]. There are limited or absent data and stock assessments regarding non-target species regularly caught as bycatch in the tuna fishery and included in the recent discard ban (17/04)[18]. The operator OPAGAC is addressing some actions identified in the FIP action plan with a focus on bycatch and endangered, threatened, and protected species in the IO (IOTC, 2018c).

As a member of the FarFish RG, the IOTC suggested assessing the sustainability of non-target species included in the recent discard ban in FarFish, especially for dolphinfish, wahoo, barracuda, and rainbow runners. Some information was obtained from catches of non-target species reported by EU vessels operating within the Seychelles EEZ and was registered in logbooks. A preliminary analysis was conducted by the SFA and transmitted to IOTC for wahoo and dolphinfish regarding the percentage of catches reported as bycatch linked to the IOTC Resolution 17/04. This limited information system could allow determining catch ratios for the time being.

4.3 Status of MCS in the Seychelles EEZ

As discovered during the scoping process before MR1, the IOTC reported that it welcomed initiatives contributing to improving compliance. Monitoring transhipment and landings have been difficult for distant water industrial longline vessels since they do not land in Port Victoria, which impedes obtaining useful logbook coverage of this fishery part (FarFish, D3.3). The SFA interacts with other countries to combat IUU fishing and has been a leading partner in a project called FishGuard[19], where fishing activities were to be surveilled by drones, but this project was scrapped due to non-feasibility.

4.3.1 Vessel Monitoring System (VMS)

A VMS is used as a monitoring tool to ensure compliance in restricted zones, such as shallow water closure to industrial vessels (DG MARE, 2013; IOTC, 2017a). Using VMS data used along with an e-logbook can reduce misreporting during harvesting, thereby supporting efforts against IUU fishing. Representatives of EU operators in FarFish stress the need to combat IUU fishing as well as the need for coastal states such as Seychelles to enhance capacities regarding MCS systems and personnel to be better prepared to address IUU fishing and thereby ensure a level playing field for all operators.

The IOTC Resolution 15/03 (IOTC, 2017a, Appendix 3) states that all vessels 24 meters in length or above and carrying a flag from CPC shall adopt a VMS. When smaller than 24 meters, the VMS rule only applies to vessels operating in waters outside the EEZ of the flag state and fishing for species covered by the IOTC Agreement within the IOTC area of competence (IOTC Resolution 15/03). All Seychelles-flagged industrial vessels (71 at present according to Goulding et al., 2019) and foreign vessels operating within the EEZ are required to have a VMS, but this is currently not mandatory for

[17] https://www.iotc.org/documents/review-statistical-data-and-fishery-trends-ecosystems-and-bycatch-species-0

[18] https://www.iotc.org/sites/default/files/documents/compliance/cmm/iotc_cmm_1704.pdf

[19] http://www.grida.no/activities/275

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semi-industrial longline vessels (FarFish, D3.3), which is expected to be mandated by March 2021 according to the SFA.

Despite some areas of consistency, there is considerable variability regarding how the CPCs implement resolution 15/03due to widely different standards applicable to most system aspects (IOTC, 2019). Some developing states have not yet implemented the national VMS framework. According to the recommendations provided in the IOTC VMS study (2019), the IOTC should consider supporting the implementation of obligations during the design of areas beyond national jurisdiction.

Some technical challenges have occurred at the SFA related to monitoring received VMS data as well as internet connection problems for relatively long periods (days), so they could not perform their work adequately (FarFish, D6.3). According to the SFA, the French contractor CLS upgraded the VMS system and completed it by 2020, which included incorporating AIS and satellite data; installing the Electronic Recording System (ERS) for the automatic recording of catch data for Seychelles-flagged vessels; and a back-up system installed in 2019. Implementing AIS and satellite imagery is expected to be completed by June 2021 after finishing the procurement process. The effective implementation and combined use of the above-mentioned MCS tools are crucial to reliable control and enforcement systems that promote a culture of compliance. Enhanced capacities and staff will be required in the MCS unit in order to handle these tasks.

4.3.2 Automatic Identification System (AIS)

An AIS is a compulsory monitoring system for vessels over 300 gross tonnages (GT) engaged on international cruises, which provides real-time locations of vessels to increase security at sea and support ship-to-ship collision avoidance. An AIS transposes dynamic information such as ship position, course, speed, type, navigational status, and IMO number, which can provide information for authorities and researchers. Tracking AIS signals may hence aid the monitoring and conservation of marine ecosystems.

The IMO Convention for the Safety of Life At Sea (SOLAS) Regulation V/19.2[20] requires vessels to operate AIS Class A onboard, unless there are valid security reasons to temporarily turn it off. In 2014, the EU required the entire fishing fleet >15 m to install AIS Class A transmitters (Shelmerdine, 2015). Because AIS represents an open-source information system, the EU operators transmitting AIS are continuously monitored by competitors in the IO and potentially by pirates, forcing them to disconnect the AIS for security reasons.

Somali piracy has been a problem in the region since the 1990s, with serious impacts on Seychelles. This piracy limits the SFA's ability to monitor its fishery since national resources tend to become dedicated to combating piracy (FarFish, D3.3). This impacted monitoring ability can affect the security of the EU fleet and give competitors indications, based on interpreting the AIS positions over time, where their fishing activity might occur, thereby representing a public exposure of their fishing activity.

4.3.3 Observers

The logbooks are collected by SFA enforcement officers during port visits or are sent by agents if they do not return to Port Victoria. Due to minimal independent observer coverage, data regarding catches by the SFA's industrial sector rely on the fishing vessels' reports (FarFish, D3.3). The International

[20] https://www.navcen.uscg.gov/pdf/AIS/SOLAS.V.19.2.1-5.pdf

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Seafood Sustainability Foundation (ISSF) Conservation Measure 4.3(a) concerns observer coverage for large-scale purse seine vessels initiating a 100% observer coverage (human or electronic if proven to be effective) (ISSF, 2019). The ISSF also provided a survey report regarding human observer programs for purse seine vessels and best practices[21]. The coverage is variable and generally lower for surface longline vessels than the stipulated 5% target (FarFish, D2.4). Operators request setting conditions for better coordination of the observer program concerning content (protocols, criteria), schedules, processes, and information sharing.

At the MR kick-off meeting in Vigo (June 2018, Spain), OPAGAC cited difficulties caused by the fact that observers are usually required to be nationals from the SFPA coastal states, which means that vessels must go ashore and replace observers every time they cross an EEZ. This issue could be addressed by having an international pool of observers. Another challenge regards the associated costs for the vessels. OPAGAC pursues a regional strategy for improving training, targeting the regional training of observers, and suggested that FarFish might take input or build lessons learned from this program.

4.3.4 Catch data reporting

The SFA routinely collects catch and effort data from logbooks (Appendix 4, Appendix 5) of the EU purse seine vessels in compliance with IOTC mandatory requirements (IOTC, 2015a, 2015b, 2017b, Appendix 6), including length-frequency data for yellowfin, bigeye, and skipjack tuna through port sampling to supply data to IOTC sampling programs. After many years, the ERS for automatically recording catch reports from EU vessels continues to experience technical problems, where vessels submit data with missing data fields. The system currently cannot be relied upon (Goulding et al., 2019). Furthermore, ERS submissions were made obligatory since 2012 by the Regulation (EC) No 1224/2009 and merely represent the captain's estimates. SFA experts informed the FarFish team visiting Seychelles that monitoring the yellowfin catches near real-time is difficult and requires additional human resource capacity (FarFish, D6.3).

4.4 Lack of transparency

Non-EU fleets operate under private or charter agreements, particularly Asian longline fleets such as those from Taiwan. There is a lack of transparency regarding the agreements between Seychelles and Asian countries and regarding the nature and dynamics of their fishing activities. Due to a lack of available data, it is impossible to ensure a level playing field amongst fishing operators; nevertheless, Seychelles was one of the first countries to support the Fisheries Transparency Initiative (FiTI), which is a global initiative that supports SDG 14 and seeks to establish a globally level playing field among coastal states and fishing nations. In May 2019, the International Secretariat for FiTI was opened in Victoria, Seychelles.

On 3 April 2020, the International Board of the FiTI announced its approval of Seychelles' application[22], which could represent a step towards improving the public availability of information regarding the fisheries sector and towards increasing public understanding of the benefits, challenges, and best practices in FiTI's development of a sustainable fisheries sector. FiTI's efforts include a commitment to

[21] https://iss-foundation.org/downloads/16786/

[22] This made Seychelles the second country to be granted the status of a FiTI Candidate country, after Mauritania.

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regular assessments of the accessibility and completeness of information in the public domain for all transparency requirements outlined in the FiTI Standard[23].

4.5 Limited knowledge of ecological and economic effects of DFADs

The use of fish aggregating devices (FADs) by purse seine vessels has received increasing criticism due to its potentially deleterious impacts on tuna stocks, high levels of bycatch, and threats to the biodiversity of tropical pelagic ecosystems (Dagorn et al., 2013). The ecological impact of drifting FADs is addressed by the IOTC ad hoc Working Group on FADs (IOTC, 2017c). An Inter-RFMO Working Group coordinated by ICCAT is tasked with improving knowledge regarding the composition, types, tracking, and use of drifting FADs. Similar projects such as FAD-Watch, which is funded by OPAGAC and developed by AZTI Tecnalia, also research the tracking and retrieval of FADs, along with an ongoing experimental project concerning biodegradable FADs described in IOTC Res 18/04 (IOTC, 2018b).

In addition to environmental and sustainability aspects, drifting FADs could be explored from an economic perspective, but this is complicated since many factors are involved in business strategy decisions relating to the number and usage of drifting FADs. Operators and suppliers of drifting FAD equipment may have detailed information on drifting FADs, but it may not be easy to access since it likely regards confidential business information.

The 22nd session of the IOTC working party on tropical tunas was held July 2020 and highlighted favourable data resolution on drifting FADs and that all main EU fleets had received such data. Some data are confidentially related to the economic performance of the fleet; however, the EU fleet has provided all requested data stated by the IOTC, such as regarding buoys' daily position.

Given the extensive and technical work conducted at the Inter-RFMO working group level, the FarFish consortium decided to narrow the scope of this work to best utilise available resources, and it agreed to remove the OT concerning FADs that was included in MR1. The OT is instead included as a potential action with the following aim: to perform a cost-benefit analysis (including trade-offs) of the economic impacts of using drifting FADs in Seychelles' waters and to estimate the ecological and economic consequences of reducing the number of allowable FADs, if possible.

There is limited knowledge regarding drifting FADs within Seychelles EEZ and their ecological and economic effects. It is difficult to evaluate the impacts of FADs on the ecology of tunas, largely due to uncertainty regarding how tunas interact with floating objects (e.g., length of association, reasons for joining/leaving an object) (GTA, 2020). This work could lead to identifying the optimal number and spatial distribution of drifting FADs[24].

5 Outcome targets and indicators

OTs represent specific and measurable requirements set by an authority to make management goals operational. An OT is a statement of the condition of an indicator relative to a reference point, often

[23] The first FiTI Report is to be published at the end of 2020.

[24] The FarFish leader on this (NOFIMA) will look at the existing work being carried out by IOTC, particular in relation to various projects to estimate the ecological and economic impact of FADs.

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in the form of inequality ('A>B') or a statement of presence or absence of some entity. An OT should be SMART, meaning specific, measurable, attainable, relevant, and time-based.

The RBM approach depends on operators being incentivised to develop MRs for a given fishery.

The OTs set for the Seychelles CS were based on MR1 (FarFish, D4.3), the audit of MR1 (FarFish, D5.1), and the lengthy consultation process with authorities, operators, and other stakeholders in the fishery. Discussions led to identifying six OTs for the Seychelles fishery, with three obligatory and three recommended, described in the "Second MR invitation" (FarFish, D3.6).

The process of identifying appropriate OTs showed that operators cannot be solely responsible for some OTs, meaning that different authorities will need to accept part of the responsibility to ensure successful implementation.

Table 8. OTs for the Seychelles CS

OT 6.1	Harmonised fisheries information system in place.	**Obligatory**
OT 6.2	Catches of non-target species registered in e-logbooks.	**Obligatory**
OT 6.3	MPAs and no-take zones identified in the SMSP are respected.	**Obligatory**
OT 6.4	Updated observer program in place.	**Recommended**
OT 6.5	Trade flow data provided.	**Recommended**
OT 6.6	VMS or AIS signals are transmitted.	**Recommended**

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5.1 Changes in OTs between MR1 and MR2

Several OTs presented in MR1 were changed in MR2, and these changes are described below for transparency.

Table 9. Changes in OTs between MR1 and MR2

OTs in MR1	OTs in MR2	Change
OT 6.1 Standardisation of fisheries' information systems (including data provision, handling, processing, and analysis) to be used for scientific and research purposes. **Obligatory**	**OT 6.1** Harmonised fisheries' information systems in place. **Obligatory**	The OT has been rephrased.
OT 6.2 Development of a protocol for registering catches of non-target species in e-logbooks. **Obligatory**	**OT 6.2** Catches of non-target species registered in e-logbooks. **Obligatory**	The OT has been rephrased.
OT 6.3 Setting conditions for a better coordination of observer program: content (protocol criteria) schedules, processes, sharing information. **Recommended**	**OT 6.4** Updated observer program in place. **Recommended**	The OT has been rephrased. OT number changed from 6.3 to 6.4
OT 6.4 Provision of data on the use of FADs within the Seychelles EEZ. This includes catch data, operating costs, and other data relevant for estimating the economic advantages of using FADs (particularly drifting FADs). **Recommended**	The recommended OT 6.4 from MR1 has been removed from the Second MR invitation. Research on FADs is a complex matter which is handled differently by tuna RFMOs around the world. Due to the high demand for time and resources and because this topic is covered at the RFMO level by the CPCs, including Seychelles, it was decided to remove this OT from the MR2 invitation. Therefore, this OT is not present in MR2.	
OT 6.5 Commitment to transmit VMS/AIS signals. **Obligatory**	**OT 6.6** VMS or AIS signals are transmitted. **Recommended**	The OT has been slightly rephrased. OT number changed from 6.5 to 6.6
OT 6.6 Commitment to honouring MPAs and no-take zones identified in the SMSP. **Obligatory**	**OT 6.3** MPAs and no-take zones identified in the SMSP are respected. **Obligatory**	The OT has been slightly rephrased. OT number changed from 6.6 to 6.3
OT 6.7 Mandatory provision of sales invoices (sales certificates) in order to verify the markets tuna derived from Seychelles EEZ ends up in (i.e. canning or others). **Recommended**	**OT 6.5** Trade flow data provided. **Recommended**	OT has been rephrased. OT number changed from 6.7 to 6.5

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5.2 Indicators

The suggested indicators in FarFish aimed to measure the degree of adherence to the OT (Table 10) and are classified into three dimensions: ecological, socio-economic, and governance. The indicators were classified according to their level of measurability, where the most detailed indicator category A regards where OT achievement is quantitative and measured in percentage. Indicator category B is qualitative, where the level of OT achievement is considered to be a high level (score 4), moderate level (score 3), fair level (score 2), low level (score 1), or not present (score 0). The last indicator, category C, is binomial and measured to have only two outcomes: yes (score 1) or no (score 0), true or false, success or failure.

Table 10. FarFish indicator categories and the level of OT achievement

Indicator category	Level of OT achievement				
A	0%	25%	50%	75%	100%
B	Not present (NP) 0	Low level (LL) 1	Fair level (FL) 2	Moderate level (ML) 3	High level (HL) 4
C	No (False/Failure) 0				Yes (True/Success) 1

5.3 OT 6.1 Harmonised fisheries' information system in place

In MR1, this OT was defined as "Standardisation of a fisheries information system to be used for scientific and research purposes" but rephrased to "Harmonised fisheries information system in place" in this MR.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Improving the scientific knowledge base for the fisheries' management	• Analyse data protocols in catch and effort (e-logbooks) • Structure data flow and communication

OT 6.1 was obligatory and aimed to improve the fisheries' scientific knowledge base by establishing a harmonised fisheries information system (including data provision, handling, processing, and analysis) for scientific and research purposes. It is necessary to analyse protocols regarding catch and effort (optimally via e-logbooks) as well as to structure data flow and communication.

Progress:

The LDAC and CCMAR described a theoretical framework using a diagram of data flow between relevant organisations (Figure 4). The data provided were adequate, but the problem regards data transmission and flow between operators and authorities.

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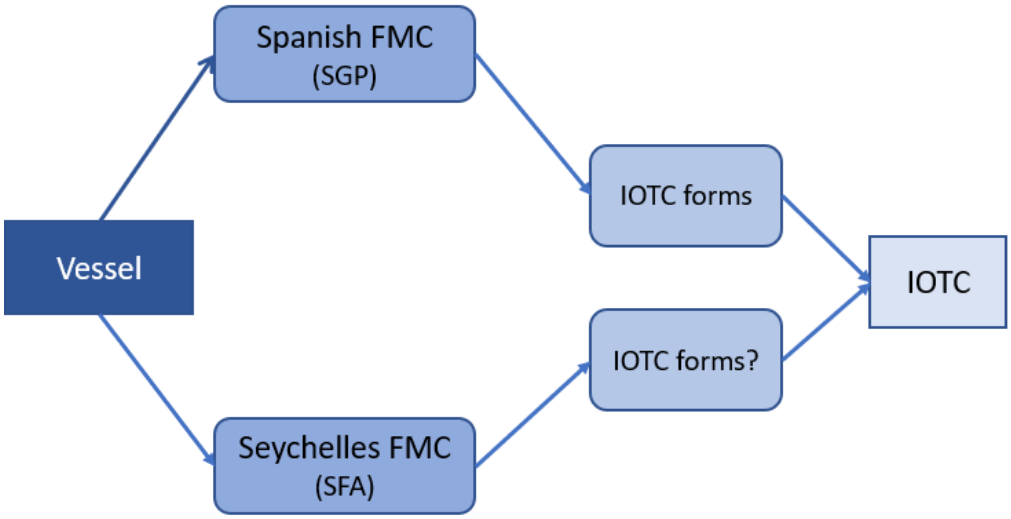
Figure 4. Data flow between relevant organisations (Source: LDAC)



IOTC: Indian Ocean Tuna Commission
FMC: Fisheries Monitoring Center
SGP: Secretaria General de Pesca
SFA: Seychelles Fisheries Authority

Discrepancies were identified regarding catch estimates due to information provided in different formats. The EU purse seine vessels transmit ERS e-logbooks to the flag state on a daily/weekly basis, while paper logbooks are provided to the SFA after each fishing trip. Problems were also identified that are linked to technical interoperability between ERS systems from the EU flag state and Seychelles.

The SFA reported that the ERS protocol currently used to exchange data between the EU and Seychelles impedes having all required fields to effectively and comprehensively exchange ERS data. The solution would be to use FLUX to exchange FMC data between the EU and Seychelles.

A possible remedial action would be to develop a pilot project to create a harmonised fisheries information system with a single method of reporting catch and effort data. Operators also reported a lack of feedback regarding the information collected by observers and submitted in aggregated form by Seychelles to the IOTC.

Considering relevant data protocols for the EU fleet fishing under the SFPA, the templates used for reporting are presumably based on SFA standard paper-based forms. Up to 2019, the SFA FMC requested the logbooks in paper form, but in most cases, the logbooks are presented in a mixed form combining paper-based and e-logbooks using Microsoft Excel files. An ERS is in place for purse seine vessels but is not fully implemented in all vessels. The development of ERS for longline vessels was completed, but deployment was delayed due to COVID-19 restrictions. The ambition was to achieve 100% coverage for all vessels in both fisheries equipped no later than March 2022. The lack of an ERS fully in place makes reporting more time-consuming, and the SFA FMC lacks resources to handle the catch data, which are not necessarily analysed and verified, or these processes are disrupted upon arrival of the EU vessels and upon handling paper logbooks when reaching Victoria's port. Nevertheless, all relevant data protocols are reported.

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Due to the aim of standardising the fisheries information system, this harmonisation effort should cover all fleets licensed to fish in the Seychelles EEZ. The current data exchange between Seychelles and the EU lacks harmonisation, which requires a transition from paper-based systems to an electronic information system that integrates various MCS tools such as VMS, AIS, ERS (e-logbook), and electronic observer coverage (CCTV). Standardisation in data collection regards an ongoing process through multiple initiatives, such as establishing an Electronic Monitoring System (EMS), which is still in its initial phase. This system aims to be in place by the beginning of 2022, initially for purse seine vessels and then for longline vessels. This information enables concluding that OT 6.1 is not achieved concerning indicator 2.

5.3.1 Level of OT 6.1 achievement

Indicators		Indicator category	Indicator baseline	Indicator achievement	OT dimension	Responsible entity
I_1_CS6	Report on all relevant data protocols for EU fleet fishing under the SFPA agreement.	C	0 (No)	1 (Yes)	Governance	LDAC/ CCMAR
I_2_CS6	Standardised fisheries information system presented	B	0 (No)	0 (No-in progress)		LDAC

Comments from operators:

The provision of data is currently measurable and operational in the EU fleet through the daily transmission of data by e-logbooks. The EU system's key data processing elements should be reviewed to determine whether it could be totally or partially applied to the Seychelles. The EU tuna purse seine operators currently provide significant data using various channels or tools, including VMS, ERS, observer reports from scientific surveys, fishing trip voluntary reports, etc; however, the data are not processed or handled consistently, depending on the end receiver. For Seychelles, the end receiver could be Spanish or France flag states, SFA as a coastal state authority, or the IOTC as a competent authority for tuna and tuna-like stocks. Further collaborative efforts require development between operators and authorities of flag and coastal states.

5.3.2 Main risks for achieving OT 6.1

This OT aimed for a harmonised fisheries information system in place, which can be developed based on the EU's experience working with EU MCS. Authorities and operators can jointly develop the definition of a protocol, including standards, indicators, and requirements for this system. The ideal situation would be to include non-EU fleets to ensure level playing field. This is however not feasible since non-EU fleets are not involved in the FarFish project.

FarFish facilitated this by:

(1) Reviewing the key elements of the EU data processing system to determine whether they could be totally or partially applied to the Seychelles CS;

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(2) Initiating joint work between the operator OPAGAC and SFA to identify standards and indicators necessary to generate protocols for:

- increasing reliability and accuracy of data;
- achieving transparency in the scale regarding how data are presented;
- regulating the level of use and treatment of data.

The logbook template is part of the SFPA protocol, and the Joint Scientific Committee is established to address this issue. Achieving this OT might be jeopardised by the lack of access to fishing logbook templates provided by the SFA and/or the lack of stakeholder involvement, which needs to be addressed at the EU Joint Scientific Committee meetings. Sometimes templates are exchanged between the SFA and EU, which then submits these templates to EU operators. The lack of access to fishing logbook templates could be avoided since the SFA has begun implementing ERS in all fleets and has begun standardising the fisheries information system.

5.4 OT 6.2 Catches of non-target species registered in e-logbooks

In MR1, this OT was defined as "Development of a protocol for registration of catches of non-target species in e-logbooks" but rephrased to "Catches of non-target species registered in e-logbooks" in this MR.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Improving the scientific knowledge base for the fisheries management	• Review data gaps for the non-target species • Explore data-limited methods (DLM) applied to data available for non-target species

Like OT 6.1, OT 6.2 was obligatory and aimed to improve the scientific knowledge base for the fisheries. The difference is that OT 6.2 aimed to achieve this goal by registering the catches of non-target species in e-logbooks. Important activities included reviewing data gaps for non-target species and exploring the implementation of DLM using the FarFish-DLMtool[25] (WP6) for non-target species.

This OT would be more relevant when applied to all fleets licensed to fish in the Seychelles EEZ, but this approach exceeded the scope of FarFish; nevertheless, the collection of relevant data and harmonisation require improvement. Moreover, the lack of data regarding bycatch species represents a wider problem in the IO, which must be addressed through the IOTC to handle multiple coastal states' multiple fisheries. Efforts in Seychelles would address this issue but only as part of a greater effort.

[25] The FarFish-DLM is an interactive tool where the users can incorporate their data and obtain diagnosis on what methods (data limited methods) or management procedures can be applied with the data available, it also provides an estimation of the fishing quota for each of the methods and in some cases an estimated stock status and fishing mortality time series. Detailed description of the tool and user guide provided in D6.8.

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Progress:

The EU fleet currently neglects developing a protocol for registering non-target species catches in e-logbooks. The e-logbook system provides required data, including catches of target species, bycatch, and discards. The same logbook format is used by French, Spanish and Seychellois fleets; however, detailed reporting on bycatch data varies.

Furthermore, the SFA currently does not automatically receive e-logbook data from EU vessels. Seychelles uses paper logbooks and struggles to fully implement the ERS system due to the ERS protocol used to exchange data fields between the EU and Seychelles. To solve this issue, using FLUX data is desirable for exchanging FMC data between the EU and Seychelles.

Data regarding two non-target species, common dolphinfish and the wahoo, were included in the FarFish-DLMtool, which was implemented to perform stock status estimation for the two species. These species were chosen according to their relevance and data availability. For common dolphinfish, it was possible to obtain abundance and mortality estimates when using scaled catches together with the CPUE of a nearby region. Because only two were explored, OT 6.2 concerning indicator 4 was not fully achieved, but important progress was made.

5.4.1 Level of OT 6.2 achievement

Indicators		Indicator category	Indicator baseline	Indicator achievement	OT dimension	Responsible entity
I_3_CS6	Template for catch protocol for non-target species to be implemented in e-logbooks	C	0 (No)	0 (No)	Governance	CCMAR
I_4_CS6	Model implementation of DLM to bycatch species	B	0 (NP)	3 (FL)	Ecological	CSIC

Comments from operators:

The bycatch reports of non-target species vary among operators. It is impossible for logistic and operational reasons to record the total catches, despite CCTV software operating in the OPAGAC fleet 365 days/24 hours (both Spanish and Seychelles flagged). Operators suggested considerations beyond the registration, such as thinking of predictive models that could estimate potential bycatch species regarding volume and species types. In addition, recorded bycatch could be verified on landings.

5.4.2 Main risks for achieving OT 6.2

This OT aimed to register catches of non-target species in e-logbooks. The FarFish consortium agreed that there were limited or completely lacking data and stock assessments regarding non-target species regularly caught as bycatch in the tuna fishery, such as dolphins, wahoo, barracuda, and rainbow runners. It was thus suggested to explore a template for providing data collection for non-target species in an e-logbook, which should be reinforced by scientific observers onboard regarding pilot sampling initiatives.

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To facilitate this goal, FarFish approached the IOTC and ask which data operators should collect and provide in the e-logbook concerning non-target species such as wahoo, common dolphinfish, rainbow runners, and barracuda.

FarFish recommended the following:

(1) Review data gaps for non-target species;
(2) When the stock assessment is available, identify relevant conservation management measures, in collaboration with the IOTC Working Party, regarding data collection and statistics to improve the scientific knowledge base of the species that were mentioned in Res 17/04[26] but were not assessed due to data limitations.

The reasons for not achieving this OT included the willingness of fleet crews to complete required fields concerning bycatch data collection; problems regarding the compatibility and interoperability of ERS systems; or mixed-use of the electronic and paper-based data collection system. The main risk related to the OT achievement thus regardws different levels of reporting of the same logbook system by different fleets as well as FLUX's delay in ERS implementation.

5.5 OT 6.3 MPAs and no-take zones identified in the SMSP are respected

In MR1, this OT was defined as "Commitment to honour MPAs and no-take zones identified in the SMSP" but was rephrased to "MPAs and no-take zones identified in the SMSP are respected" in this MR.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Enhance a level playing field where all fleets comply with the commitment to honour Marine Protected Areas (MPAs)	Analyse VMS or AIS data to verify operators' compliance with honouring MPAs

OT 6.3 is obligatory and aimed to enhance a level playing field where all fleets comply with the commitment to honour MPAs. This OT ensured that MPAs and no-take zones identified in the SMSP are respected, which required analysing VMS or AIS data to verify operators' compliance with honouring MPAs.

Progress:

The process of proposing designated sites for SMSP is completed but is currently consulted amongst stakeholders. The approval of designated sites and their implementation were not expected to occur before mid-2021, as the process was delayed due to the COVID-19 pandemic. A possible solution was to have the SFA provide coordinates or a map showing which MPAs were currently in force so that FarFish could verify operators' compliance with using AIS data available in GFW.

Due to protocol restrictions, the SFA cannot share VMS data from the EU and non-EU fleets unless related to search-and-rescue purposes; the authority has reasonable grounds for believing that an

[26] https://www.iotc.org/cmm/resolution-1704-%E2%80%A8-ban-discards-bigeye-tuna-skipjack-tuna-yellowfin-tuna-and-non-targeted-species

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offence is currently or about to be committed; or for criminal investigations. VMS data are shared under agreement with other FMSs to implement bilateral fisheries agreements. A solution to access VMS from the EU purse seine fleet could be achieved if corresponding flag states (Spain, France) agree to provide VMS data for the project.

5.5.1 Level of OT 6.3 achievement

Indicators		Indicator category	Indicator baseline	Indicator achievement	OT dimension	Responsible entity
I_5_CS6	Operator compliance verified by analysis of VMS or AIS data for SMSP Initiative	C	0 (No)	0 (No)	Governance	CSIC

5.5.2 Main risks for achieving OT 6.3

This OT aimed to verify that MPAs and no-take zones identified in the SMSP were respected, which currently was not achieved. We could not have access to VMS data, and AIS signals were not recorded because of the common practice of vessels turning off the system to avoid pirates; however, the SFA could undertake this analysis and share progress or outcomes with the project consortium.

Another risk was that the SMSP was not ready when the FarFish project is finished since the implementation phase was expected for mid-2021 due to delays related to COVID-19. It could not be possible to verify compliance as implementation did not happen and put into force, unless the project would have focused on existing MPAs, which is limited to national parks where no EU fishing activity occurs. It could thus be relevant for SFA to analyse AIS/VMS data verification themselves or to hire, for instance, a PhD with expertise in data analysis, with whom they can cooperate when the SMSP is fully implemented.

5.6 OT 6.4 updated observer program in place

In MR1, this OT was defined as “Setting of conditions for a better coordination of observer programme: content (protocol criteria) schedules, processes, sharing information” but was rephrased to “Updated observer program in place” in this MR.

The aim and key activities for this OT were as follows:

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Aim	Key activities to meet the OT
Support the fight against IUU fishing by utilising the latest available satellite system and tools	• Development of a protocol for a shared pool of observers • Integrate ongoing actions to create a mechanism of regional coordination of observer programs (scientific collection of data) • Establishing a mixed/combined system comparing information compiled by observer sampling on board with information originating from EMS for control purposes

OT 6.4 was recommended and aimed to support the fight against IUU fishing by utilising the latest available satellite system and by establishing an updated scientific and compliance observer program. It was necessary to develop a protocol for a shared pool of observers; integrate ongoing actions to create a regional scientific observer program; and establish a system comparing information compiled by observer sampling on board with information originating from EMS for control purposes. It was unclear, however, which body would be ideal for coordinating such a regional observer program, but the EU-funded ECOFISH Program represents a possibility to explore.

Progress:

The EMS program was being established with the deployment phase underway. The staff was recruited (mostly ex-observers) and were currently receiving necessary training to familiarise them with the EMS system, with some delays due to COVID-19. The necessary equipment was already installed at the SFA; however, the focus is mainly compliance, support may be provided to expand its scope for scientific purposes. Furthermore, the ministry plans to implement a compliance observer program; however, this plan is yet to be initiated due to other national priorities related to MCS. Capacity limitations allow for only some MCS programs to be run concurrently. The EMS deployment has begun for Seychelles-flagged purse seine and longline vessels, with timelines for full deployment expected by August 2021 and March 2022 respectively. Deployment on the EU fleet is expected to be initiated before the end of the first quarter of 2022, but a timeline for completing deployment is yet to be established due to the larger fleet size.

This OT refers to the need for better coordination between authorities as well as the need to increase observer coverage to improve efficiency for scientific and compliance purposes. There is a need for setting conditions to better coordinate the scientific observer program, including content (protocol criteria), schedules, processes, and information sharing.

A national observer program provides observers' training, and the observer capacity has been strengthened in recent years; however, institutional challenges affect data validation and reporting when the program expanded to cover fleets besides the national. Moreover, complex logistics hamper the program's extension to cover the longline fleet, and observer coverage has declined (probably due to the CCTV observation system's implementation). To complement data received from logbooks, Seychelles assesses the EMS's feasibility on industrial longline vessels to address the lack of observations at sea for this component of the Seychelles fishery. Three vessels were equipped with sensors and cameras to record setting and hauling activities, estimate the size and species composition of the catch retained, record bycatch and discards, and monitor transhipments at sea.

Challenges also affect the supervision of transhipments at sea with longline vessels, namely a lack of control, as transhipments occur without official control and data collection when not covered by the

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IOTC Regional Control Observer Program. Seychelles has 100% coverage for its longline transhipments at sea, but authorities must trust disaggregated, often delayed data from other flag states from the actors themselves. This is not an issue with tuna purse seine vessels since they are obliged to conduct all transhipments at the port, most of which occur in Port Victoria, which eases monitoring by national inspectors.

The key activities mentioned above will be crucial to address the challenges, achieve the OT, and reach the objective. Concerning the indicators below, this OT is not achieved.

5.6.1 Level of OT 6.4 achievement

Indicators		Indicator category	Indicator baseline	Indicator achievement	OT dimension	Responsible entity
I_6_CS6	Regional observer program in place	C	0 (No)	0 (No)	Governance	E.g., IOC, IOTC, or ETC
I_7_CS6	Regional observer program implemented	C	0 (No)	0 (No)		

5.6.2 Main risks for achieving OT 6.4

This OT aimed to establish an updated observer program. After conclusion of the FarFish project, this OT's responsibilities should be given to other stakeholders to ensure its achievement. Most plans were currently on hold due to the COVID-19 pandemic.

This OT's risk is related to the lack of control authorities' resources when patrolling the Seychelles EEZ for vessels not subject to observer coverage, preventing their reaction to reporting irregularities. In addition, the flag states' control of their vessels' activities in international waters might not be comprehensive. A regional observer program would mean increased resources allocated to MCS, thereby minimising the uncertainties mentioned above.

Another barrier related to observation regards the low capacity of air and sea patrol activities.

Tuna purse seine operators also experience challenges when switching between areas/coastal states and regarding the logistics of changing inspectors from different nationalities.

5.7 OT 6.5 Trade flow data provided

In MR1, this OT was defined as "Mandatory provision of sales invoices (sales certificates) in order to verify the markets tuna derived from Seychelles EEZ ends up in (i.e., canning or others)" but was rephrased to "Trade flow data provided" in this MR.

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The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Improve knowledge about the value chain and market conditions.	Study harvest and trade flows in tuna products • Gather catch and landing information • Gather processing and trade information • Gather information on socio-economic impacts of using drifting FADs

OT 6.5 was recommended. Several recommended OTs related to knowledge about the tuna value chain were proposed in the "First MR invitation" (FarFish, D3.2) but were all postponed to MR2. In addition to this OT, under "Other potential action", the "Second MR invitation" included the need for analysis of the economic impacts of using drifting FADs in Seychelles waters, and estimation of the economic consequences of reducing the number of allowable drifting FADs. This was included in order to identify an optimal number and spatial distribution of drifting FADs, which was to be conducted under MR2.

OT 6.5 aimed to acquire better knowledge about tuna trade flow and the socio-economic impact of reducing the use of drifting FADs. Key activities included collecting trade data and conducting interviews with representatives from vessel operators and processors. In addition, a questionnaire was circulated to representatives from vessel operators.

Progress:

The report "Description of CS value chains" (FarFish, D3.4) provided an overview of the value chain. Landing data regarding main gear type and species were gathered from the annual Seychelles Fisheries Statistics report. All catches from Seychelles EEZ are landed or transhipped in Port Victoria, which is mandatory. A large share of tuna landings is processed in Seychelles, but tuna is also transhipped to other countries, especially Mauritius and Madagascar. The source of this information was other published literature. There is one primary processor of tuna in Seychelles, Indian Ocean Tuna, which processes most of the landed tuna. They produce canned tuna products. This simplifies the value chain exercise. Finished products, however, are based on raw materials originating not only from the SFPA fishery. Export data provide information about products and trading partners, which are publicly available through ITC or UN Comtrade, for example.

Information about processing and trading of finished products was presented also in this report "Description of CS value chains" (FarFish, D3.4), which utilised interviews with vessel representatives, processing managers, and country's fisheries management. This information aims to be published in "Report on the value chain analysis for EU fisheries in SFPA waters" (FarFish, D3.9) as part of a draft journal manuscript with working title "Unpacking the Traceability Mosaic-EU SFPAs and the Tuna Value Chain". In this report showed that there are economic incentives for vessels to misreport, and clear traceability challenges as vessels fish several species and across several areas (both coastal and high seas). Both in Seychelles as well as Cape Verde, while an EU catch certificate scheme (CCS) operates to cover all tuna products imported into the EU market, there are flaws in the current system which need remedying (FarFish, D3.9).

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A questionnaire for operators (indicator 10) was planned to investigate information concerning the economic impacts and ecological benefits of reducing the number of drifting FADs in Seychelles waters. Initial discussions with vessel representative revealed a complicated area where operators likely lacked sufficient data or knowledge to perform reasonable assessment. This investigation was not pursued due to lack of adequate data and further, manifest concern by the operators in terms of the sensitive nature of the topic. Further research is undergone related FADs utilisation outside the FarFish consortium that can add knowledge to this topic.

5.7.1.1 Level of OT 6.5 achievement

The final evaluation of the indicators for OT 6.5 will be conducted when all results are made available.

Indicators		Indicator category	Indicator baseline	Indicator achievement	Responsible entity	OT dimension
I_8_CS6	Information on catch and landings provided	C	0	1 (Yes)	Nofima/ UoP	Socio-economic
I_9_CS6	Information on processing and trade provided	C	0	1 (Yes)		
I_10_CS6	Socio-economic impacts of using drifting FADs provided	C	0	0 (No)	Nofima/ LDAC/UoP	

5.7.2 Main risks for achieving OT 6.5

This OT aimed to provide trade flow data on the tuna value chain. Public trade flow data on the specific products originating from the SFPA, were not available. The public statistics only cover export, including raw materials from other fisheries. Both detailed trade flow data for the specific fishery and different products must be achieved through interviews and estimations based on other data sources, however this is considered as industry-sensitive data, which poses restrictions on the level of disaggregation of the data shared, if any. Therefore, this OT depended heavily on information from interviews. Thus, the primary risk was related to obtaining access to informants and informant's willingness to share information that may have been considered commercially sensitive. The COVID-19 pandemic and travel restriction limited the opportunity to conduct face-to-face interviews, which exacerbated the challenge of getting access to informants. Nevertheless, two reports on the value chain of the tuna fisheries in Seychelles were achieved, describing tuna trade flows with focus on traceability. Furthermore, it must be noted that Seychelles is working on a fisheries satellite account to enhance fisheries value chain and socio-economic information to show the real contribution of fisheries in the GDP. This initiative is ongoing with the NSB (National Statistics Bureau).

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5.8 OT 6.6 VMS or AIS signals are transmitted

In MR1, the OT was defined as "Transmission of VMS or AIS signals" but rephrased to "VMS or AIS signals are transmitted" in this MR.

The aim and key activities for this OT were as follows:

Aim	Key activities to meet the OT
Support the fight against IUU fishing by utilising the latest satellite systems and tools.	Explore ideas regarding monitoring fisheries in MPAs applying new methods and tools

Like OT 6.4, this OT was recommended and aims to support the fight against IUU fishing by utilising the latest available satellite system. In contrast to OT 6.4, OT 6.6 aimed to achieve this goal by having VMS or AIS signals transmitted in the Seychelles EEZ. OT 6.3 also involved AIS and VMS, but this was to verify operators' compliance with honouring MPAs.

Progress:

VMS catch data processing is currently difficult since some CPCs have yet to implement the national VMS framework.

Regarding the transmission of AIS signals, operators' comments reveal that the piracy issue makes them reluctant to comply with compulsory AIS reporting. The AIS is an open-source information system exposing fishing activities to the public regarding where they occur in real-time, which is particularly problematic within the EEZ of Seychelles. Security problems related to piracy pose a risk to skippers and crews operating in the area, which prevents guaranteeing periodic transmission of AIS. The onboard security arrangement facilitated by the Seychelles government, however, has improved the situation, as all piracy attempts in recent years have been fought off.

Due to the SFPA protocol, FarFish was not allowed access to VMS data since the SFA are only allowed to share data with outside organisations in matters concerning:

- search and rescue missions;
- situations where the authority has reason to believe that an offense is currently or about to be committed;
- criminal investigation.

Due to SFA's legal restriction of sharing VMS data with third parties, flag states and operators are better positioned to support this; however, VMS data are shared under agreements with other FMCs from flag states in order to implement bilateral fisheries agreements.

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5.8.1 Level of OT 6.6 achievement

Indicators		Indicator category	Indicator baseline	Indicator achievement	OT dimension	Responsible entity
I_9_CS6	Proportion of vessels, either EU or non-EU, geolocalisation	B	Not present	Not able to evaluate	Governance	SFA and flag state
I_10_CS6	Proportion of vessels, either EU or non-EU, with redundant (AIS+VMS), geolocalisation	B	Not present	Not able to evaluate		

Due to the lack of available data, indicators 9 and 10 could be evaluated within the FarFish project; nevertheless, they importantly determine the achievement of OT 6.6 "VMS or AIS signals are transmitted".

5.8.2 Main risks for achieving OT 6.6

This OT was to verify whether fishing vessels in the Seychelles EEZ were transmitting VMS or AIS. Increased monitoring in Seychelles waters can be achieved by utilising the latest available satellite systems and tools. The Global Fishing Watch[27] (GFW) collects high spatial and temporal resolution data regarding fishing efforts worldwide using AIS records from a communication satellite. The available data are currently aggregated, but companies such as Marine Traffic[28] can provide information concerning individual vessels for a fee.

Making AIS and VMS data available enables developing diagnostic tools to cross-check data, detect suspicious fleet dynamics, and thereby evaluate the proportion of transmitted VMS signals. Such diagnosis can also document challenges related to the range of AIS in some areas, which may increase the risk of ship collisions and reduce maritime safety. Vessels switching off AIS due to piracy threats should be documented to verify gaps in AIS signals.

The main risks and uncertainties that may jeopardise achieving this recommended OT are related to accessing VMS data from the SFA and flag states, data treatment, and AIS data deteriorating in quality once vessels are aware of the existence of GFW. If individual data are required, the vessel may not be willing to pay for this information. If VMS data are not available, the GFW data can be analysed.

[27] https://globalfishingwatch.org/
[28] www.marinetraffic.com

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6 Other potential actions as supplement to the MR

Apart from the OTs identified for the EU fleet operating in Seychelles, some action points were identified that could strongly support the CS objectives. These actions were not included in the list of OTs since they cannot be (solely) operationalised by the operators, because they require input/action from other relevant parties (authorities, scientific institutions, other international fleets, etc.). These actions are:

1. Analysis of opportunities for increasing landings, processing, and marketing of by-catches is needed. Bycatches from the EU tuna fleet (and other fleets operating in the area) often include valuable species that could present business opportunities
2. Analysis of the economic impacts of the discard ban (IOTC resolution 17/04, 2017) is needed.
3. Analysis (including trade-off analysis) of the economic impacts of drifting FADs in Seychelles waters and estimation of the economic consequences of reducing the number of allowable FADs are needed. This could lead to identifying the optimal number and spatial distribution of drifting FADs. (*Authority comment: This is currently being somewhat addressed by the IOTC, and it was therefore of little benefit for FarFish to assign significant effort here*.)
4. Seychelles data regarding catches, landings, and trade flows are of relatively favourable quality, well organised, and provide useful insight regarding flow through the highly competitive and well-developed tuna value chains. The contributions from the information provided through these indicators are thus not likely to result in considerable socioeconomic gains, and it does not seem highly relevant to pursue them in future projects. Information regarding sales prices for various tuna qualities, operating costs, and profitability could be more relevant to enable discussing value sharing and access fees, which are regularly estimated in the ex-post evaluations.

Several identified challenges are addressed in the new SFPA agreement, which will strengthen the capacity to monitor and control the EU fleet fishing in Seychelles waters, such as through ERS and EMD (Electronic Monitoring Device) as well as reinforce the role of observers and enable conducting joint EU-Seychelles inspections on EU vessels fishing in Seychelles waters. The EU's and EU ship owners' financial contributions to promote the sustainable management of the marine environment and fisheries in Seychelles are also strengthened[29].

7 Adaptive planning

Adaptive planning admits immediate adaptation within the planning period to support proper fisheries management in case abrupt changes occur, such as political changes or changes in distribution of fish stocks, etc. The nature of the obligatory OTs in this MR does not rely on data collection, which could be exposed to abrupt changes that would require adaptive planning.

[29] European Commission Press, 2019

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8 Monitoring, compliance, and sanctions

Because the IOTC is responsible for managing species under the EU-Seychelles agreement, their homepage www.iotc.org offers a comprehensive list of management measures.
Compliance with the CPC management measures is partly monitored by the FMC in flag states and the coastal state when the fishery occurs within a country's EEZ, such as for the Seychelles CS. The sanctioning system, including the public IUU vessel list, is also available on the IOTC homepage.

9 Auditor

FarFish partner Sjókovin conducted two audits following the RBM process. The first audit on documentation system conformance and the second audit on performance effectiveness and compliance. The final audit of this MR will not be conducted.

10 Planning process

Tentative plan

Medium term, due by 2022 (To be done by entity taking over for FarFish);

- Analyse data protocols in catch and effort (e-logbooks);
- Structure data flows and communication;
- Review the identification of standards and indicators necessary to generate non-target species' protocols;
- Review the needs for technical assistance and capacity building at SFA;
- Review the ideas explored regarding monitoring fisheries in MPAs applying new methods and tools;
- Review the development of a protocol for a shared pool of observers;
- Review the integration of ongoing actions to create a regional observer programme;
- Review the development of a mixed/combined system comparing information compiled by on-board observer sampling with information originating from EMS.

Long term, due by 2025 (To be done by the entity taking over for FarFish)

- Review data protocols regarding catch and effort (e-logbooks);
- Review the structure of data flows and communication;
- Review the identification of standards and indicators necessary to generate non-target species' protocols;
- Review the integration of ongoing actions to create a regional observer programme;
- Review the development of a mixed/combined system comparing information compiled by on-board observer sampling with information originating from EMS.

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11 Conclusion

Seychelles has the largest EEZ in the WIO, and foreign fleets conduct most of the fishing activities. This MR2 applies to the tuna fishery under the SFPA, covering from February 2020 to February 2026.

Contributing to sustainability and long-term profitability requires accurate data regarding fish stocks, including the target species, bycatches, and discard. The FarFish project identified problems related to data transmission and data flow between operators and authorities and, that logbooks are not harmonised. The SFA has begun implementing ERS in all fleets and begun standardising the fisheries information system to improve the data, but deployment has been delayed due to COVID-19 restrictions.

A regionally coordinated observer program is required to support the fight against IUU fishing; however, it is unclear which body is ideal for coordinating such a regional observer program. The EU-funded ECOFISH Program could be explored as a possibility.

To improve the MCS in the Seychelles EEZ and to verify that the MPAs and no-take zones identified in the SMSP are respected, access to AIS and VMS data is necessary to verify compliance. The national authorities and flag states have access to data, but these data are sensitive and cannot be easily shared with others.

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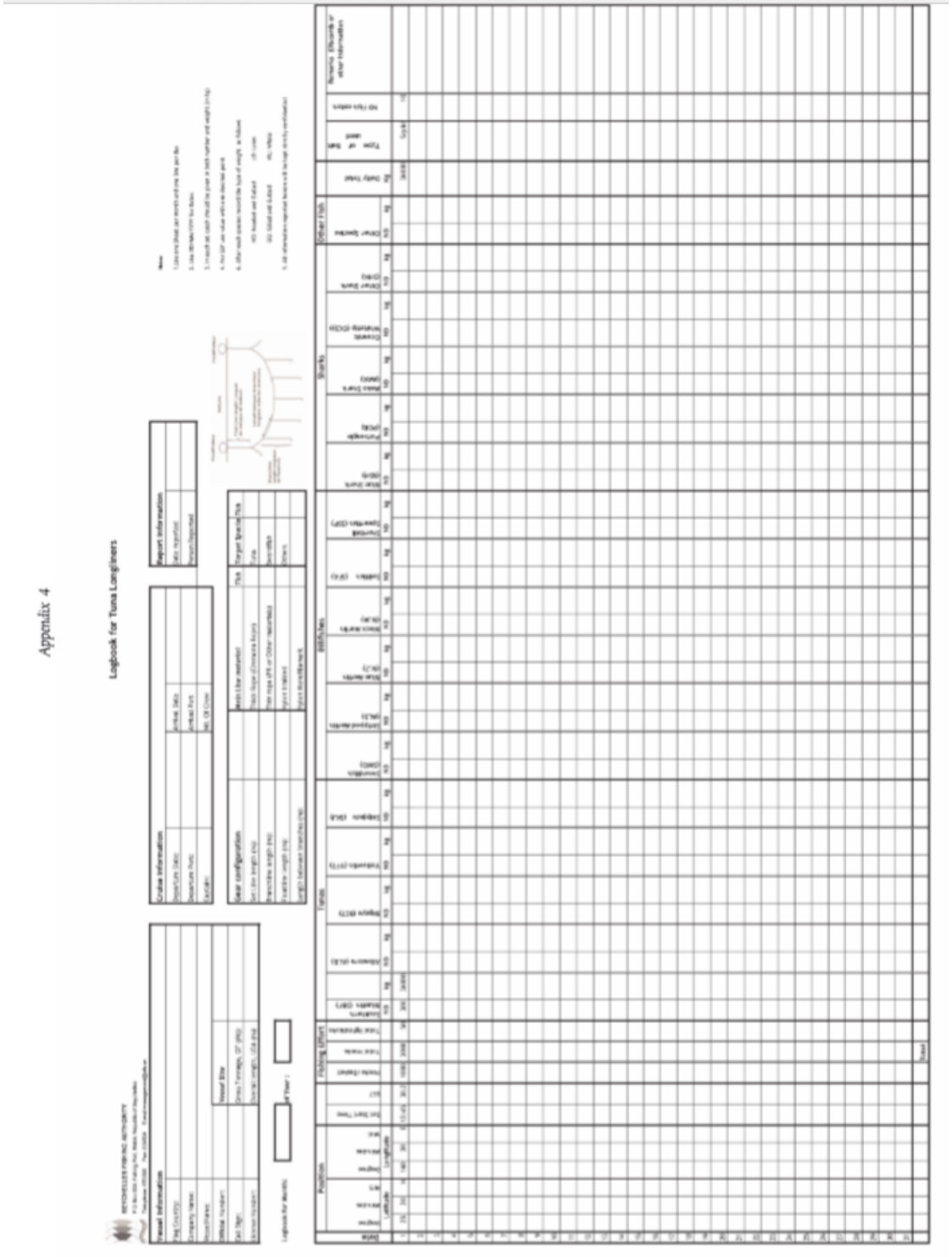
Appendix

Appendix 1. FPA logbook for Tuna Longliners



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Appendix 2. FPA logbook for Tuna Seiners

9.1.2014 EN Official Journal of the European Union L 4/25

Appendix 3

Statement of catch form for tuna seiners / Fiche de déclaration de captures pour thoniers senneurs

DEPART / SALIDA / DEPARTURE	ARRIVEE / LLEGADA / ARRIVAL	NAVIRE / BARCO / VESSEL	PATRON / PATRON / MASTER	FEUILLE
PORT / PUERTO / PORT DATE / FECHA / DATE HEURE / HORA / HOUR LOCH / CORREDERA / LOCH	PORT / PUERTO / PORT DATE / FECHA / DATE HEURE / HORA / HOUR LOCH / CORREDERA / LOCH			HOJA / SHEET N°

DATE FECHA DATE	POSITION (chaque calée ou midi) POSICIÓN (cada lance o mediadia) POSITION (each set or midday)	CALEE LANCE SET	CAPTURE ESTIMEE ESTIMACIÓN DE LA CAPTURA ESTIMATED CATCH												ASSOCIATION ASSOCIACIÓN ASSOCIATION	COMMENTAIRES OBSERVATIONES COMMENTS		COURANT CORRIENTE CURRENT
			1 ALBACORE RABIL YELLOWFIN		**2 LISTAO LISTADO SKIPJACK**		**3 PATUDO PATUDO BIGEYE**		**AUTRE ESPECE préciser le/les nom(s) OTRA ESPECIE dar el/los nombre(s) OTHER SPECIES give name(s)**			**REJETS préciser le/les nom(s) DESCARTES dar el/los nombre(s) DISCARDS give name(s)**				Route/Recherche, problèmes divers, type d'épave (naturelle/artificielle, balisée, bateau), prise accessoire, taille du banc, autres associations, … Ruta/Busca, problemas varios, tipo de objeto (natural/artificial, con baliza, barco), captura accesoria, talla del banco, otras asociaciones, … Steaming/Searching, miscellaneous problems, log type (natural/artificial, with radio beacon, vessel), by catch, school size, other associations, …		
			Taille Talla Size	Capture Captura Catch	Taille Talla Size	Capture Captura Catch	Taille Talla Size	Capture Captura Catch	Nom Nombre Name	Taille Talla Size	Capture Captura Catch	Nom Nombre Name	Taille Talla Size	Capture Captura Catch				

Une calée par ligne / Uno lance cada línea / One set by line

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Appendix 3: IOTC Resolution 15/03 VMS

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

RESOLUTION 15/03
ON THE VESSEL MONITORING SYSTEM (VMS) PROGRAMME

Keywords: Vessel Monitoring System (VMS).

The Indian Ocean Tuna Commission (IOTC),

TAKING NOTE of the results of the Intersessional Meeting on an Integrated Control and inspection scheme, held in Yaizu, Japan, from 27 to 29 March, 2001;

RECOGNISING the value of satellite-based Vessel Monitoring Systems (VMS) for the Commission's conservation and management programmes, including compliance;

RECOGNISING IOTC Resolution 02/02 [superseded by Resolution 06/03 and subsequently by Resolution 15/03] which called for the adoption of a pilot satellite-based vessel monitoring system (VMS) by 1st January 2004;

TAKING NOTE that the Resolution 02/02 [superseded by Resolution 06/03 and subsequently by Resolution 15/03] has allowed the progressive incorporation of these systems to accommodate Contracting Parties that lack sufficient capacity for immediate implementation at a national level;

RECOGNISING that this Resolution 02/02 [superseded by Resolution 06/03 and subsequently by Resolution 15/03] provides a process for developing States of the region to build the capacity to implement this Resolution;

AWARE that many Parties have established VMS systems and programmes for their fleets and that their experience may be very helpful in supporting the conservation and management programmes of the Commission;

ADOPTS in accordance with the provisions of Article IX paragraph 1 of the IOTC Agreement, that:

1. Each Contracting Party and Cooperating Non-Contracting Party (CPC) shall adopt a satellite-based vessel monitoring system (VMS) for all vessels flying its flag 24 metres in length overall or above or in case of vessels less than 24 meters, those operating in waters outside the Economic Exclusive Zone of the Flag State fishing for species covered by the IOTC Agreement within the IOTC area of competence.

2. Those CPCs currently without a VMS for any additional vessel now meeting the criteria for inclusion in the VMS obligation since Resolution 06/03 was superseded, as defined in paragraph 1 above, shall submit an implementation plan to the Compliance Committee in April 2016 that sets out a phased approach to full implementation of their national VMS obligation within a maximum of 3 years, i.e. by April 2019, with at least 50% of all qualifying vessels compliant by September 2017.

3. Any CPC with vessels not yet equipped with VMS as already required under Resolution 06/03 (or any subsequent superseding Resolution; superseded by Resolution 15/03) shall be required to fully implement its national VMS obligation within a maximum of 1 year, i.e. by April 2016 in respect of those vessels.

4. The Commission may establish guidelines for the registration, implementation and operation of VMS in the IOTC area of competence with a view to standardising VMS adopted by CPCs.

5. Information collected shall include:

   a) the vessel identification;

   b) the current geographical position of the vessel (longitude, latitude) with a position error which shall be less than 500 metres, at a confidence level of 99%; and

   c) the date and time (expressed in UTC) of the fixing of the said position of the vessel.

6. Each CPC shall take the necessary measures to ensure that their land-based national Fisheries Monitoring Center (FMC) receives through the VMS the information required in paragraph 5, and that the FMC is

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equipped with computer hardware and software enabling automatic data processing and electronic data transmission. Each CPC shall provide for backup and recovery procedures in case of system failures.

7. Each CPC shall ensure that the information in paragraph 5 is transmitted to the FMC at least once every 4 hours. Each CPC shall ensure the masters of fishing vessels flying its flag ensure that the satellite tracking device(s) are at all times fully operational.

8. Each CPC as a Flag State shall ensure that the vessel monitoring device(s) on board its vessels are tamper resistant, that is, are of a type and configuration that prevent the input or output of false positions, and that they are not capable of being over-ridden, whether manually, electronically or otherwise. To this end, the on-board satellite monitoring device must:

   a) be located within a sealed unit; and

   b) be protected by official seals (or mechanisms) of a type that will indicate whether the unit has been accessed or tampered with.

9. The responsibilities concerning the satellite-tracking devices and requirements in case of technical failure or non-functioning of the satellite-tracking devices are established in **Annex I**.

10. Fishing vessels referred to in paragraph 1 which are not yet equipped with VMS shall report to their FMC at least daily by email, facsimile, telex, telephone message or radio. Such reports must include, inter alia, information required in paragraph 5 when transmitting the report, to their competent authorities, as well as:

    a) the geographic position at the beginning of the fishing operation;

    b) the geographic position at the end of the fishing operation.

11. CPCs that cannot fulfil the obligations as outlined in this Resolution shall report to the IOTC Secretariat (i) the systems and infrastructure and capabilities existing with respect to the implementation this Resolution, and (ii) the hindrances for implementation of such a system and (iii) requirements for implementation.

12. Each CPC shall provide to the IOTC Secretariat, by 30 June each year, a report on the progress and implementation of its VMS programme in accordance with this Resolution. The IOTC Secretariat shall compile reports prior to the annual Session of the Commission and present a report to the IOTC Compliance Committee. Based on these reports, the Commission will discuss how best to proceed with future consideration of VMS to support its Conservation and Management Measures.

13. CPCs are encouraged to extend the application of this Resolution to their fishing vessels not provided for in paragraph 1 if they consider this to be appropriate to ensure the effectiveness of IOTC Conservation and Management Measures.

14. Resolution *06/03 On establishing a Vessel Monitoring System Programme* is superseded by this Resolution.

Conservation and Management Measures linked to Resolution 15/03 or return to the Table of Contents

Links from within Resolution 15/03	Links from other CMMs	
nil	Resolution 15/07	Resolution 15/08

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ANNEX I

RESPONSIBILITIES CONCERNING THE SATELLITE-TRACKING DEVICES AND REQUIREMENTS IN CASE OF TECHNICAL FAILURE OR NON-FUNCTIONING OF THE SATELLITE-TRACKING DEVICES

A) In the event that a CPC has information to suspect that on-board vessel monitoring device(s) do not meet the requirements of paragraph 4, or have been tampered with, it shall immediately notify the IOTC Executive Secretary and the vessel's Flag State.

B) Masters and owners/licensees of fishing vessels subject to VMS shall ensure that the vessel monitoring device(s) on board their vessels within the IOTC area of competence are at all times fully operational. Masters and owners/licensees shall in particular ensure that:

a) VMS reports and messages are not altered in any way;

b) the antennae connected to the satellite monitoring device(s) are not obstructed in any way;

c) the power supply of the satellite monitoring device(s) is not interrupted in any way; and

d) the vessel monitoring device(s) are not removed from the vessel.

C) A vessel monitoring device shall be active within the IOTC area of competence. It may, however, be switched off when the fishing vessel is in port for a period of more than one week, subject to prior notification to, and approval of, the Flag State, and if the Flag State so desires also to the IOTC Secretariat, provided that the first position report generated following the re-powering (activating) shows that the fishing vessel has not changed position compared to the last report.

D) In the event of a technical failure or non-operation of the satellite tracking device fitted on board a fishing vessel, the device shall be repaired or replaced within one month. After this period, the master of a fishing vessel is not authorised to commence a fishing trip with a defective satellite tracking device. Furthermore, when a device stops functioning or has a technical failure during a fishing trip lasting more than one month, the repair or the replacement has to take place as soon as the vessel enters a port; the fishing vessel shall not be authorised to commence a fishing trip without the satellite tracking device having been repaired or replaced.

E) In the event of a technical failure or non-functioning of the vessel monitoring device on board the fishing vessel, the master or the owner of the vessel, or their representative, shall communicate immediately to the FMC of the Flag State, and if the Flag State so desires also to the IOTC Secretariat, stating the time that the failure or the non-functioning was detected or notified in accordance with paragraph F of this Annex. In the event of a technical failure or non-functioning of the vessel monitoring device on board the fishing vessel, the master or the owner of the vessel, or their representative, shall also communicate to the FMC of the Flag State the information required in paragraph 5 of the Resolution every four hours, by email, facsimile, telex, telephone message or radio.

F) When the Flag State has not received for 12 hours data transmissions referred to in paragraphs 7 of the Resolution and E of this Annex, or has reasons to doubt the correctness of the data transmissions under paragraphs 7 of the Resolution and E of this Annex, it shall as soon as possible notify the master or the owner or the representative thereof. If this situation occurs more than two times within a period of one year in respect of a particular vessel, the Flag State of the vessel shall investigate the matter, including having an authorised official check the device in question, in order to establish whether the equipment has been tampered with. The outcome of this investigation shall be forwarded to the IOTC Secretariat within 30 days of its completion.

G) With regard to paragraphs E and F of this Annex, each CPC shall, as soon as possible but no later than two working days following detection or notification of technical failure or non-functioning of the vessel monitoring device on board the fishing vessel, forward the geographical positions of the vessel to the IOTC Secretariat, or shall ensure that these positions are forwarded to the IOTC Secretariat by the master or the owner of the vessel, or their representative.

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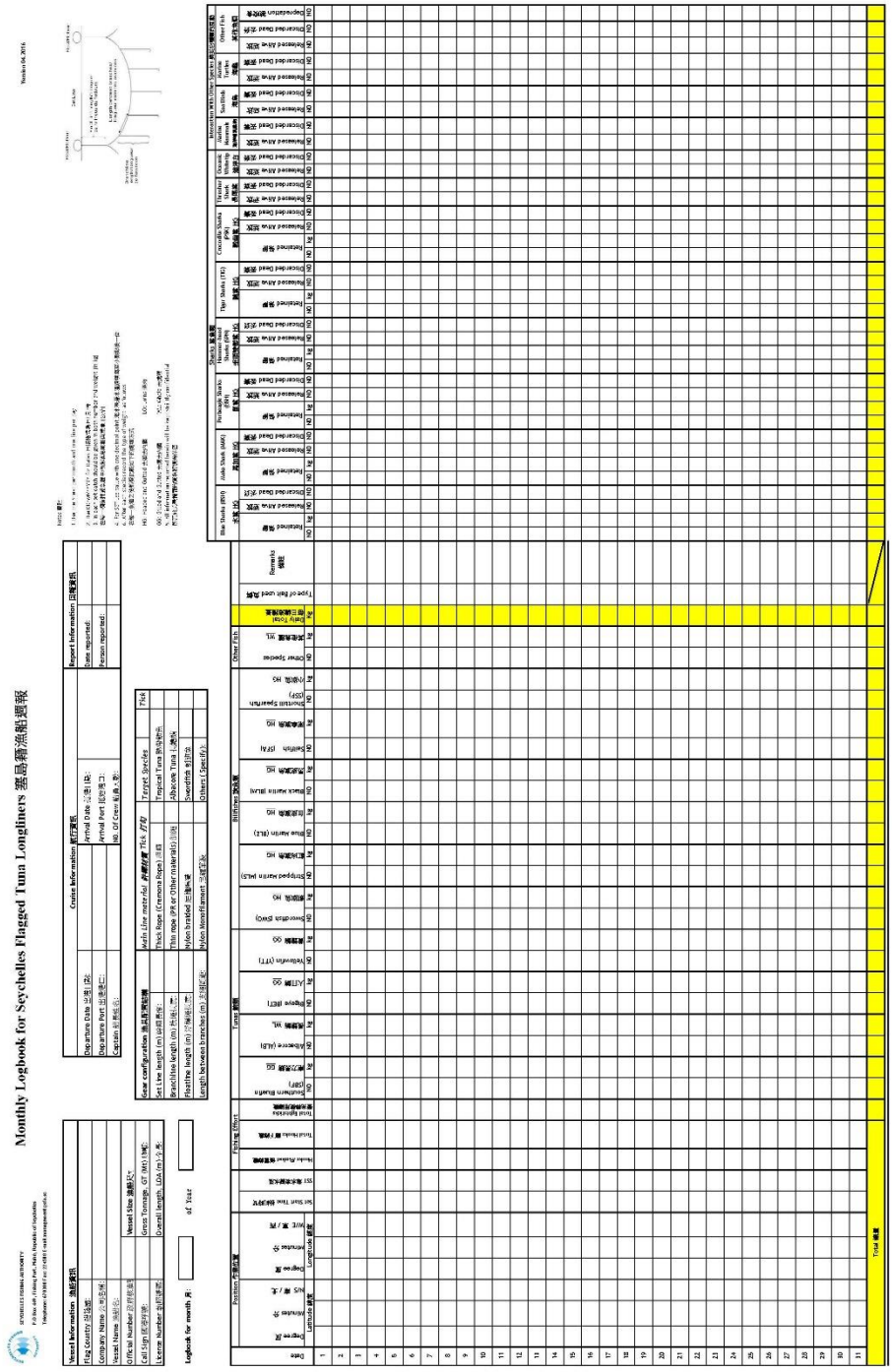
Appendix 4: Logbook for Seychelles Flagged Tuna Longliners



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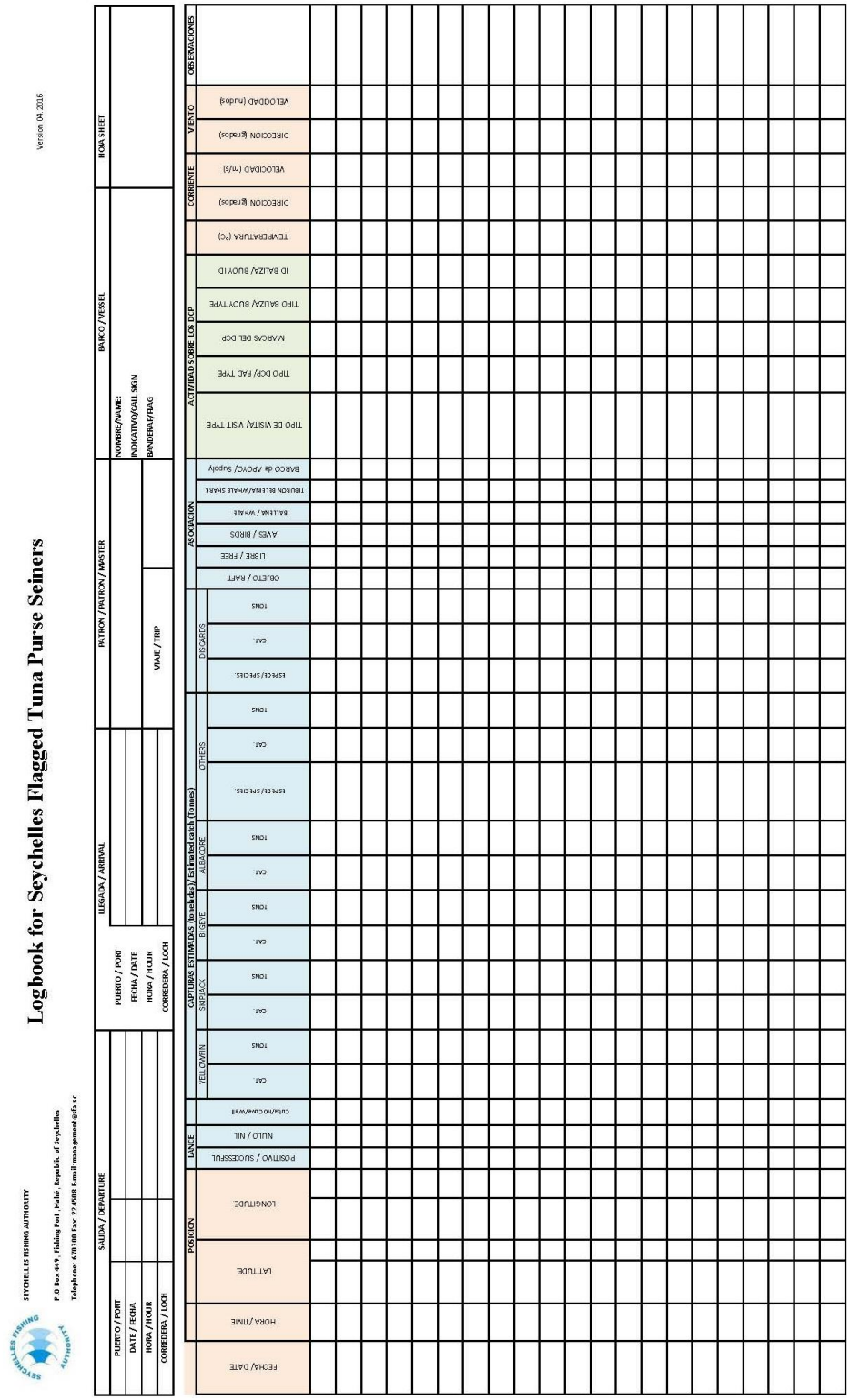
Appendix 5: Logbook for Seychelles Flagged Tuna PS



Logbook for Seychelles Flagged Tuna Purse Seiners

SEYCHELLES FISHING AUTHORITY

P O Box 449, Fishing Port, Mahe, Republic of Seychelles

Telephone: 4670300 Fax: 4224508 E-mail management@sfa.sc

Version 04.2016

SAILDA / DEPARTURE

PUERTO / PORT

DATE / FECHA

HORA / HOUR

CORREDERA / LOCH

LLEGADA / ARRIVAL

PUERTO / PORT

FECHA / DATE

HORA / HOUR

CORREDERA / LOCH

PATRON / PATRON / MASTER

VIAJE / TRIP

BARCO / VESSEL

NOMBRE/NAME:

INDICATIVO/CALL SIGN

BANDERA/FLAG

HOJA SHEET

POSICION

FECHA/ DATE

HORA/TIME

LATITUDE

LONGITUDE

LANCE

POSITIVO / SUCCESSFUL

NULO / NIL

CUBA/NO CUBA/WILD

CAPTURAS ESTIMADAS (Retenida) / Estimated catch (Tonnes)

YELLOWFIN

SKIPJACK

BIGEYE

ALBACORE

OTHERS

DISCARDS

CAT.

TONS

ESPECIE/ SPECIES

ASOCIACION

OBJETO / RAFT

LIBRE / FREE

AVES / BIRDS

BALLENA / WHALE

TIBURON BALLENA/WHALE SHARK

BARCO de APOYO/ Supply

ACTIVIDAD SOBRE LOS DCP

TIPO DE VISTA/ VISIT TYPE

TIPO DCP/ FAD TYPE

MARCAS DEL DCP

TIPO BALIZA/ BUOY TYPE

ID BALIZA/ BUOY ID

TEMPERATURA (°C)

CORRIENTE

DIRECCION (grados)

VELOCIDAD (m/s)

VIENTO

DIRECCION (grados)

VELOCIDAD (nudos)

OBSERVACIONES

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Appendix 6: Resolution 15-01 ITOC, Species listed in Annex II for longline and purse seine

Vessel category	FAO code	Other species	Optional species to be recorded
LL	SSP	Shortbill spearfish (*Tetrapturus angustirostris*)	
LL	BSH	Blue shark (*Prionace glauca*)	
LL	MAK	Mako sharks (*Isurus* spp.)	
LL	POR	Porbeagle shark (*Lamna nasus*)	
LL	SPN	Hammerhead sharks (*Sphyrna* spp.)	
LL, PS	FAL	Silky shark (*Carcharhinus falciformis*)	
LL	MZZ	Other bony fishes	PS
LL	SKH	Other sharks	PS
LL		Seabirds (in number)[30]	
LL, PS	MAM	Marine mammals (in number)	
LL, PS	TTX	Marine turtles (in number)	
LL, PS	THR	Thresher sharks (*Alopias* spp.)	
LL, PS	OCS	Oceanic whitetip shark (*Carcharhinus longimanus*)	
PS	RHN	Whale sharks (*Rhincodon typus*) (in number)	
LL	TIG	Tiger shark (*Galeocerdo cuvier*)	LL
LL	PSK	Crocodile shark (*Pseudocarcharias kamoharai*)	LL
LL	WSH	Great white shark (*Carcharodon carcharias*)	LL
LL, PS	MAN	Mantas and devil rays (*Mobulidae*)	LL, PS
LL	PLS	Pelagic stingray (*Pteroplatytrygon violacea*)	
LL, PS		Other rays	LL, PS

[30] When a CPC is fully implementing the observer program the provision of seabird data is optional

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