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Deliverable D2.9

WP2 final report

30/03/2022

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Executive Summary

In this report we review the main findings, lessons learnt, and provide recommendations based on the nine deliverables that correspond to the five main tasks of WP2 (Advancing biological knowledge and evaluation of current stock assessment models) of the FarFish project. For each task, a summary is provided of the main findings and lessons learnt and recommendations made, based on the deliverables corresponding to each task:

Task 2.1: Case study characterization

- D2.1 Case study characterization

Task 2.2: Create a Data Management Plan under the H2020 Open Research Data Pilot

- D2.2: Data Management Plan under the H2020 Open Research Data Pilot

Task 2.3: Advancing biological and ecological knowledge

- D2.3: Report on biological and ecological data in FFDB pilot version 1
- D2.6: Report on biological and ecological data in FFDB pilot version 2
- D2.8: Report on biological and ecological data in FFDB
- D2.10: Report on data collected on small pelagics and environmental forcing on the west coast of Africa

Task 2.4 Evaluation of current stock assessment models

- D2.5: Report on the evaluation of current stock assessment models used in CS

Task 2.5 Self-sampling programme:

- D2.4: Templates and protocols for self-sampling
- D2.7: Report on the success of the self-sampling programme

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Abbreviations

ASAP	Age-Structured Assessment Program
ASPIC	A Stock Production Model Incorporating Covariates
ASPM	Age Structured Production Model
B_{CUR}	Current Biomass
BDM	Biomass Dynamic Model
BRP	Biological Reference Point
BSP	Bayesian Surplus Production Model
BSP-SS8	Bayesian state-space production model
CCMAR	Centro de Ciências do Mar (Portugal)
CECAF	Fishery Committee for the Eastern Central Atlantic
CMEMS	Copernicus Marine Service
CMSY	Catch at MSY
CMM	Conservation Management Measures
CSIC	Consejo Superior de Investigaciones Científicas (Spain)
COREWAM	Conservation and Research of West African Aquatic Mammals (Senegal)
CRODT	Centre de Recherches Océanographiques de Dakar-Thiaroye (Senegal)
CS	Case Study
CWA	CEN Workshop Agreements
DCF	Data Collection Framework
DG MARE	Directorate-General for Maritime Affairs and Fisheries
DLM	Data Limited Methods
DMP	Data Management Plan
DNA	Deoxyribonucleic Acid
ERA	Ecological Risk Analysis
EU	European Union
EAF	Ecosystem Approach to Fisheries
EEZ	Exclusive Economic Zone
FAO	Fisheries and Agricultural Organization of the United Nations
FFDB	FarFish Data Base
F	Instantaneous Fishing Mortality rate
F_{CUR}	Current Instantaneous Fishing Mortality rate
F_{MSY}	Fishing mortality rate corresponding to MSY
HCR	Harvest Control Rule
IOTC	Indian Ocean Tuna Commission
JABBA	Just Another Bayesian Biomass Assessment
JSC	Joint Scientific Committee
ICCAT	International Commission for the Conservation of Atlantic Tunas
IMROP	Institut Mauritanien de Recherche Océanographique et des Pêches
IMR	Institute of Marine Research (Norway)
INDP	Instituto Nacional de Desenvolvimento das Pescas (Republic of Cape Verde)
IOTC	Indian Ocean Tuna Commission
LDAC	Long Distance Fleet Advisory Council
LRP	Limit Reference Point
MP	Management Plan

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MR	Management Recommendation
MS	Member State
MSY	Maximum Sustainable Yield
NORAD	Norwegian Agency for Development Cooperation
OCOM	Optimised Catch Only Method
OPROMAR	Organización de Pordutores de Pesca del Puerto y Ria de Marín
OT	Outcome Target
PS	Purse Seine
PSA	Productivity-Susceptibility Analysis
RFMO	Regional Fisheries Management Organization
SEAFO	South East Atlantic Fisheries Organisation
SCAA	Statistical catch-at-age analysis
SFA	Seychelles Fishing Authority
SFPA	Sustainable Fisheries Partnership Agreement
SO	Specific Objective
SPICT	Surplus Production Models in Continuous Time
SRA	Stock Reduction Analysis
SS	Stock Synthesis
TAC	Total Allowable Catch
TRF	Target Reference Point
UCA	Université Cadi Ayyad (Morocco)
UiT	Universitetet i Tromsø (Norway)
USP	Universidade de São Paulo (Brazil)
VME	Vulnerable Marine Ecosystem
VPA	Virtual Population Analysis
WP	Work Package
WPB	WP on Billfish
WPDCS	WP on Data Collection and Statistics
WPEB	WP on Ecosystems and Bycatch
WPM	WP on Methods
WPNT	WP on Neritic Tunas
WPTmT	WP on Temperate Tunas
WPTT	WP on Tropical Tunas

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1 Introduction to WP2

WP2 (Advancing biological knowledge and evaluation of current stock assessment models) is linked to Specific Objective 1 (SO1) of FarFish: *To advance knowledge and collate data related to biological characteristics of the main fish stocks in selected fisheries outside EU waters that are important for the EU fleet, and to evaluate the relevance and applicability of appropriate stock assessment methods for these fisheries.* The scope of WP2 included analysing the current status of relevant stocks, as well as investigating how stock assessments are being conducted, what data is available, how it is gathered and what models/tools are used for management in the different case studies (CS). It was also to advance biological and ecological knowledge in the CSs, and provide input to the WP3, WP4, WP5, WP6 as an integral component of the Responsive Fisheries Management System (RFMS) iterative process (Figure 1).

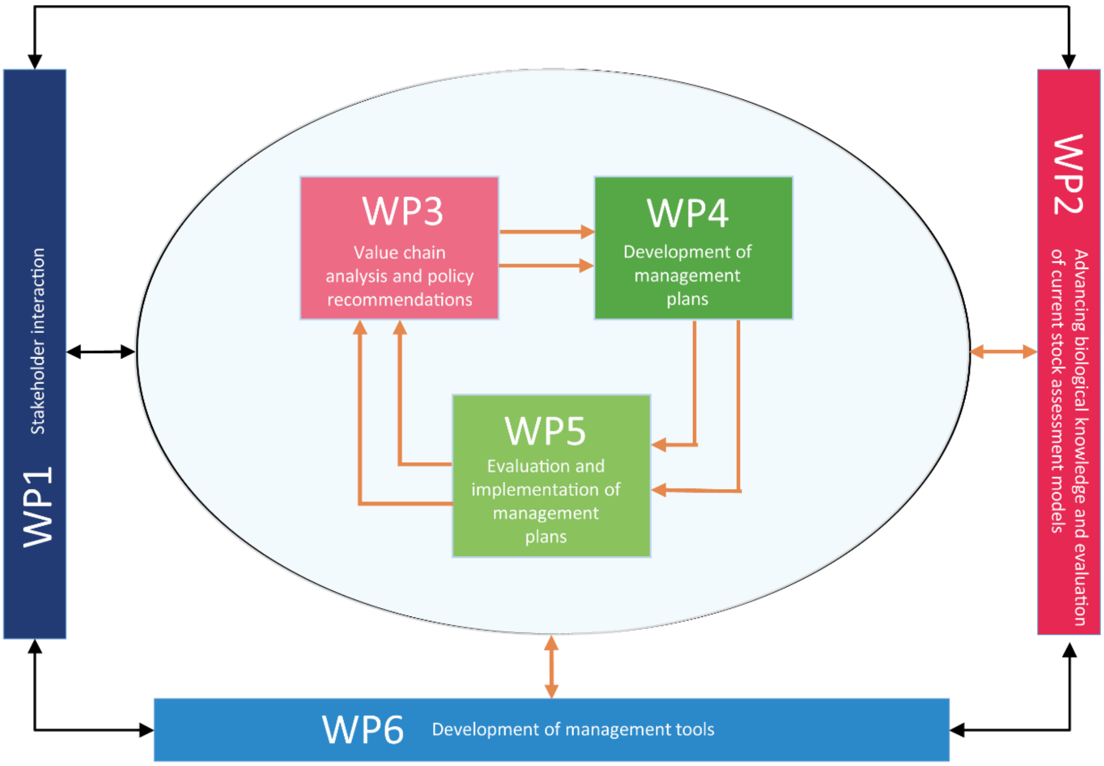

Figure 1: FarFish WP interactions. Orange arrows show WP interactions of the RFMS iterative process.

WP2 involved the participation of CCMAR, USP, INDP, LDAC, IMPROP, UCA, IMR, UiT COREWAM, CRODT, SFA, and CSIC.

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2 Overview of the different tasks

WP2 is broke into five tasks, which are described as follows in the project description (DoA).

Task 2.1 Case study characterization: *WP2 will generate a CS characterization for all FarFish CSs which will include an initial description of geographical and biological boundaries, fisheries activity and production in the area, explaining existing management procedures and overall objectives, description of main relevant authorities, operators and other stakeholders, it will also contain links to most relevant literature and data.* The six CS are:

1) Cape Verde Tuna Fishery (SFPA)
2) Senegal Tuna and Hake Fishery (SFPA)
3) Mauritania Mixed Fishery (SFPA)
4) Seychelles Tuna Fishery (SFPA)
5) Mixed Fishery in the international waters of South West Atlantic (FAO Major Fishing Area 41)
6) Mixed Fishery in the international waters of South East Atlantic (FAO Area 47)

Task 2.2 Create a Data Management Plan under the H2020 Open Research Data Pilot: *FarFish will participate in the H2020 Open Research Data Pilot, and this entails three requirements. Firstly, the collected research data should be deposited in data repository. Secondly, the project will have to take measures to enable third parties to access, mine, exploit, reproduce and disseminate this research data. Finally, a Data Management Plan (DMP) has to be developed detailing what kind of data the project is expected to generate, whether and how it will be exploited or made accessible for verification and reuse, and how it will be curated and preserved. The two last steps are the main content of this task, and the DMP will outline the degree, means and timing of data access for third parties.*

Task 2.3 Advancing biological and ecological knowledge: *FarFish will compile biological and ecological data for the relevant stocks in the CSs and make them, as far as possible, publicly available in a database (FFDB) accessible on the FarFish web page. The database itself will be developed in WP 6, but the content on biological and ecological components will be supplied from WP2. This task will focus on compiling available biological and fisheries data. Existing sources of data include CS national research institutes, RFMOs such as ICCAT, IOTC and SEAFO, the FAO and international initiatives such as the EAF-Nansen Project "Strengthening the Knowledge Base for and Implementing an Ecosystem Approach to Marine Fisheries in Developing Countries" funded by NORAD. The data collected in this task will feed into the FFDB, which will then feed into models and management tools (WP 6) that will provide better understanding of biology and ecology of the respective species and ecosystems. The data collected will also be used for making visualisation materials. All of these outputs will be used by WPs1, 3, 4 & 5 for stakeholder interaction and development of MPs within RFMS.*

Task 2.4 Evaluation of current stock assessment models: *The main stock assessment procedures, models and methods currently in use in each CS will be identified. The type of data (fisheries dependent catch and landings and fisheries independent research survey data) and or parameters used in the stock assessments will be identified. Based on the review of biological and fisheries information carried out in T2.1 and T2.3, the potential use of alternative data-limited methods will be evaluated (WP6).*

Task 2.5 Self-sampling programme: *Due to the extreme costs associated with employing research vessels for gathering new biological and ecological knowledge, FarFish will engage the EU fleet to gather data via self-sampling. FarFish will develop templates for the self-sampling which will be tested and improved within the project and the data made available in the FarFish database. The data will then be incorporated into the management tools developed in WP6. FarFish industry partners and LDAC will assist with the pilot testing and give feedback on the applicability of the self-sampling programme and associated templates. The templates will become a part of the CWA developed in WP3.*

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3 Deliverables

Originally, the proposal had nine deliverables for WP2, of which D2.9 is the WP2 final report. However, given the decision to include a study on small pelagics of north-west Africa and the influence on their population dynamics of environmental variability, an additional deliverable was included in the final year of the project (D2.10). The complete list of deliverables by tasks is:

Task 2.1: Case study characterization

- D2.1 Case study characterization

Task 2.2: Create a Data Management Plan under the H2020 Open Research Data Pilot

- D2.2: Data Management Plan under the H2020 Open Research Data Pilot

Task 2.3: Advancing biological and ecological knowledge

- D2.3: Report on biological and ecological data in FFDB pilot version 1
- D2.6: Report on biological and ecological data in FFDB pilot version 2
- D2.8: Report on biological and ecological data in FFDB
- D2.10: Report on data collected on small pelagics and environmental forcing on the west coast of Africa.

Task 2.4 Evaluation of current stock assessment models

- D2.5: Report on the evaluation of current stock assessment models used in CS

Task 2.5 Self-sampling programme:

- D2.4: Templates and protocols for self-sampling
- D2.7: Report on the success of the self-sampling programme

D2.9: WP2 final report, including recommendations relating to data sampling, stock assessment methods and management procedures.

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4 Main findings and lessons learnt

Task 2.1: Case study characterization

For Task 2.1, comprehensive reviews were carried out for the six CSs. The D2.1 report contains descriptions of the CSs, four of which have Sustainable Fisheries Partnership Agreements (SFPA) with the EU and two are within international waters. The CSs cover the Cape Verde tuna fishery (SFPA), the Senegal tuna and hake fishery (SFPA), the Mauritanian mixed fishery (SFPA), Seychelles tuna fishery (SFPA), the high-seas mixed fishery in the South-West Atlantic (FAO Major Fishing Area 41) and the mixed fishery in the international waters of South-East Atlantic (FAO Major Fishing Area 47). The information presented in D2.1 is primarily based on a review of the available literature, with an emphasis on the data that would feed other FarFish WPs. For each CS, information on the following was compiled and reviewed:

1. Geographical and biological boundaries.
2. Commercial species, catch statistics, volume and value.
3. Relevant authorities.
4. Operators and other stakeholders.
5. Supply- and value chain.
6. Existing management plan, procedures and objectives.
7. International agreements, RFMO and EU SFPA.
8. Governance, compliance and transparency.
9. Main findings in the evaluation of the fishery and the SFPA.
10. Data collection and stock assessment.
11. How FarFish will address the challenges.
12. Relevant literature.

D2.1 was updated during the project as new information became available or was requested by other WPs. The interested reader referred to D2.1 for the main findings and lessons learnt for each CS.

Task 2.2: Create a Data Management Plan under the H2020 Open Research Data Pilot

Task 2.2 and (D2.2) contributed towards the goals of "*advance knowledge and collate data related to biological characteristics of the main fish stocks in the selected fisheries, and to evaluate the appropriateness, relevance and applicability of stock assessment models currently in use for these fisheries*", by creating a "Data Management Plan" (DMP), as per the Horizon 2020 Open Research Data Pilot. Forms were created and distributed to the FarFish participants, with instructions and examples. The DMP-forms include details on (see templates and instructions in Annex I and II):

- the handling of research data during and after the end of the project.
- what data will be collected, processed and/or generated.
- which methodology and standards will be applied?
- whether data will be shared/made open access.
- how data will be curated and preserved (including after the end of the project).
- ethical issues related to the data.
- estimated costs associated with data archiving/sharing.

Completion of data forms was on a voluntary basis. Periodic revisions of the DMP took place within each 18-month periodic reporting period. In total, 47 forms detailing the content of the different datasets, the ways in which data will be stored and how/if it will be made available at the project end were provided, grouped according to case study, with datasets not pertaining to one individual case study grouped in a separate category: "Non-case study specific", are included in the final D2.2. These include data sets on small pelagics and environmental forcing on the west coast of Africa (D2.10) and deposited in the repository (https://zenodo.org/record/6371237#.YjoVy03P02w), and the self-sampling and DNA analysis data from D2.7, deposited in the zenodo repository: https://zenodo.org/record/6363365#.YjNKUXrP02w

Some relevant datasets were uploaded to the FarFish Database (FFDB), created as part of task 6.1 in WP6 "Development of management tools" as a means of storing research data. The FFDB is accessible from the FarFish webpage. At the project end, datasets will be uploaded from the FFDB to OpenAire.

Lessons learned and Recommendations

As noted in the next section (Task 2.3), national institutes possess valuable time series of survey and other data that would have been extremely beneficial for FarFish. However, there was great reluctance to provide this data. Likewise, it was not possible to obtain data from other sources (e.g. R/V Nansen surveys). We recommend that steps should be taken to ensure that data such that from

R/V Nansen surveys can be made available (see next section and Annex 3). In the case of CS partners and national institute survey and other data, data sharing issues should be clarified, and agreements made at the start of the project so that the aims of the projects can be fully attained, with the best possible outcomes in terms of results To facilitate and ensure collaboration in terms of data sharing in international projects such as FarFish, we recommend that issues of data ownership, availability, sharing and use for the purposes of the project and for potential publications should be discussed early on in the project. Special emphasis should be placed on reaching agreement regarding use of national survey data for publications and on authorship. A document should be prepared outlining the agreed terms of use of the shared data, with lists of expected outputs and authors of the expected publications. Plans should also be drawn up for actual collaboration in terms of data analysis, modelling and writing of the manuscripts. This would reduce suspicions concerning "parachute science" where case study partners may feel excluded in the scientific process and that their European partners are simply taking advantage and use of their national survey and biological data, with little in return or benefit for them.

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Task 2.3: Advancing biological and ecological knowledge

Task 2.3 was a pivotal part of the FarFish project, providing important input to work in other WPs and tasks. The following four deliverables were associated with this task.

- D2.3: Report on biological and ecological data in FFDB pilot version 1
- D2.6: Report on biological and ecological data in FFDB pilot version 2
- D2.8: Report on biological and ecological data in FFDB
- D2.10: Report on data collected on small pelagics and environmental forcing on the west coast of Africa

The initial focus was on compiling data that was obtained and used as example data sets for the implementation of the Data-Limited Methods (DLM) package (WP6) and as input to the other WPs. This included data provided by DG MARE on the fishing activity of EU vessels operating under SFPAs. Although data was not provided by the CS, a comprehensive overview of Nansen surveys and national research surveys that have been carried out in CS was prepared, thus providing an overview of the data available for stock assessment and ecological studies. The results of reviews of data collected by SFPA observers and data collected by observers within the Data Collection Framework (DCF) were also presented.

Given the importance of the small pelagics to the fisheries and ecosystems of the North-West African countries, a new task was added to the project to model the population dynamics of key small pelagic in NW Africa, based on time series of abundance, effort, landings and environmental variables (D2.10). While the modelling part of the task was carried out within WP6 of the project, the tasks of compiling existing fishery and non-fishery data (e.g. scientific cruises, biology of the relevant species) on small pelagics in the area was allocated to WP2. This included fishery and non-fishery data (e.g. scientific cruises, biology of the relevant species) necessary to advance in the implementation of integrated models. The task also involved the formatting of the data and parameters to run the model(s) in WP6 and to incorporate the data and parameters into the FarFish database. Information on national surveys is provided in annexes 1 to 5 of D2.8. Furthermore, survey data from Morocco, Mauritania, Senegal and other case studies has in fact been uploaded as can be seen in D2.2. For Morocco, this was in response to the comments of the evaluators. This is now mentioned in the deliverable.

Time series suitable for modelling were compiled from a number of sources, national and international as well as fisheries dependent and fisheries independent (research surveys) for three key small pelagics, namely sardine (*Sardina pilchardus*), chub mackerel (*Scomber colias*) and European anchovy (*Engraulis encrasicolus*) in Morocco and Mauritania. Life history parameters (size distributions, growth, weight-length relationships) were also compiled from different sources. Catch data time series are available since the 1970s, with reconstructed time series (Sea Around Us project) extending the time series back to 1950. Fishing effort data is available from the early 1990s, with shorter time series of abundance indices available from research surveys, for Morocco. Time series of fishing effort for Mauritania are however lacking. Abiotic parameters, namely Sea Surface Temperature (SST) and salinity, as well as chlorophyll or primary production rate were obtained from the Copernicus Marine Service (CMEMS) portal (https://resources.marine.copernicus.eu/) for the period from 1993 to 2018. Average daily and monthly values over each of the fishing regions were computed so the environmental variability during the common duration of both time-series (fishing and environment) could be analysed and included in the models.

The data compiled for the Moroccan coast was found to be suitable for the application of Surplus production models in Continuous time (SPiCT), and also length or age-based models. Nevertheless, data available for the Mauritanian fisheries was more limited, making it difficult to estimate population trends and therefor compromising the ability of the proposed modelling approach to evaluate the influence of environmental variability on the population dynamics of the small pelagics of NW Africa.

Later in the project, CCMAR was given the task of taking the lead, in collaboration with authorities and operators, in carrying out more in-depth analysis of issues relating to data collection with a focus on bycatch species, in particular. This is related to various Outcome Targets (OT) that were defined in the Management Recommendations (MR) concerning harmonisation of data collection. These tasks concerned the following CS countries:

- Cabo Verde with a focus on the longline fishery for swordfish and blue shark.
- Senegal with a focus on trawl fisheries for black hake.
- Seychelles with a more general focus on the fisheries information system.

Although not formally required, a report was prepared on the findings and recommendations concerning data harmonisation. This included recommendations for specific actions/indicators to be used in the context of MRs as well as longer term and/or broader recommendations concerning data collection, information sharing/review, and flow.

Findings/lessons learned – data harmonisation

One common theme across CSs is that the electronic logbook (e-logbook) system, which is mandatory on EU vessels, provides for the recording of species bycatches and reporting on a daily basis (as well as all the other relevant data) to flag and coastal states authorities, and should therefore be straightforward. However, three of the CS counties are experiencing challenges in receiving this data, because of technical issues. That obliges EU vessels to report using predefined “paper based” forms. Then, problems sometimes arise in reconciling data collected through electronic or paper-based systems. The issue appears not to be so much a lack of bycatch data, but to ensure that the data flows to all the interested parties, since reporting follows different paths and involves different institutions.

Another recurring theme concerns the focus of FarFish, which are the EU fisheries active in the CS countries, but the OTs appear in some cases to be more relevant when the scope is broadened to include other national and/or foreign fleets operating in the same areas. This is important to bear in mind, as the MRs would become more effective, if these other fleets were taken into consideration when considering the issue of bycatch data. The lack of bycatch data appears to be an issue that concerns non-EU fleets, in particular, and attempts at improving and harmonising data collection should have a broader scope.

Findings/lessons learned – data

It has become clear that a plethora of data suitable for the application of Data Limited Methods (DLM) exists, especially in the form of national pelagic and demersal research surveys that are more continuous than the Nansen surveys.
However, there was a general and consistent reluctance on the part of CS national institutes to provide national fisheries and survey data in the context of FarFish. This appears to be a common strategy to guard against "parachute science" where researchers from industrialized nations take data from low-income nations and publish it with little benefit to the data-owners. The same has guided the EAF Nansen Data Policy which has made it difficult to access R/V Nansen survey data (Annex 3).

Recommendations – data harmonisation

Considering the aim of harmonisation in data collection, for tunas in particular, it should be noted that this is an ongoing process involving different initiatives across t-RFMOs. In order to be effective, the perspective used should be broad and include all fleets involved.

At the national level, there is generally a need to strengthen logbook schemes and observer programmes to cover all the fleets involved in specific fisheries (ideally all fisheries). Good coverage of the EU fleets operating under SFPAs does not provide the full picture, and should also include national fleets as well as other foreign vessels when this is relevant.

Efforts to harmonise existing observer logbook schemes across fleets and countries should be supported, considering the requirements across the five tuna-RFMOs.

The use of electronic tools should replace paper-based reporting and these data should be shared and reviewed by the relevant stakeholders, including operators.

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Recommendations – data

We strongly recommend that CS partners explore the use of national survey and fisheries biology data for assessment of data limited stocks.

Acquisition of Nansen data was hindered by bureaucratic procedures and we strongly recommend a revision of the Data Policy to facilitate access to data when there is explicit interest expressed by data-owners (CS) (Annex 3).

It is important to guarantee the benefits to third countries in the future design of these types of projects. Although the overall objectives were for the purpose of improving management in the CSs, there should also be an important emphasis on the development of capacity for analysis and assessment. It became clear that CSs were only willing to make data available for specific purposes such as DLM workshops, where their researchers were directly involved.

While not all Nansen survey data is suitable or adequate for FarFish purposes, due to limitations in terms of survey design, frequency and coverage, there are certainly series of surveys that would provide data that could have been useful. We strongly endorse the recommendations of Dr. Erik Olsen in the memo (Annex 3) for "the need for an urgent revision of the Data Policy to make it more open and transparent, allow automatic access to data older than five years as well as meta-data, and importantly to reduce bureaucracy and complexity when applying for access to data still under limited access criteria".

Furthermore, we suggest that improvements be made in the strategic planning and survey design so that useful time series of data can be obtained for different regions, that can be used for stock assessment, application of EAF and monitoring global changes.

Task 2.4: Evaluation of current stock assessment models

The evaluation of stock assessment models used in the different CS and the status of the stocks was the primary objective of Task 2.4 (D2.5). A review of the main stock assessment procedures, models, methods, reference points and harvest control rules (HCR) currently in use was carried out for the target species of the four SFPA CSs: Cape Verde, Mauritania, Senegal and Seychelles, as well as for the two fisheries in international waters of the South-West and South-East Atlantic.

For each CS the main species of interest were identified, taking into consideration the focus of the FarFish project. In the case of EU purse seine and longline tuna fisheries, in addition to the main tuna target species, so-called tuna-like by-catch species such as billfish, sharks and other pelagic species were also included. Demersal, largely bottom trawl fisheries catch a wide variety of commercial demersal fish and cephalopod species in addition to target species such as black hake, so these were also included in the review.

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For each CS, information was gathered on responsibility for data collection and stock assessment, the stock assessment models or approaches used, stock status and reference points used, harvest control rules, and the management measures in place. Following is a summary of the main findings based on FarFish D2.5, for the different CS fisheries.

Cape Verde and Senegal Tuna Fisheries (SFPA)

In Cape Verde, the EU fleet consists of longline vessels that mainly target blue shark (*Prionace glauca*), swordfish (*Xiphias gladius*), and a variety of by-catch species, including tunas, purse seiners and pole and line vessels that target yellowfin (*Thunnus albacares*), skipjack (*Katsuwonus pelamis*) and bigeye tuna (*Thunnus obesus*), with purse seine by-catch including sharks and other fish species.

In Senegal, Yellowfin (*Thunnus albacares*), skipjack (*Katsuwonus pelamis*) and bigeye tuna (*Thunnus obesus*) are the main tropical species targeted by the EU fleet of purse seiners and pole and line vessels. Other tuna species caught largely as by-catch by the industrial fleet include little tunny (*Euthynnus alletteratus*), bonito (*Sarda sarda*), Spanish mackerel (*Acanthocybium solandri*) and Atlantic sailfish (*Istiophorus platypterus*).

Management of the above mentioned highly migratory species is co-ordinated through ICCAT. Responsibility for the collection of fisheries data lies with the flag state national authorities or institutions and it is an obligation for members and cooperating non-members to report these data to the ICCAT Secretariat. In addition to target species, data are collected on non-target, associated and dependent species affected by tuna fishing operations, i.e. marine turtles, marine mammals, seabirds, sharks and fish species caught incidentally (bycatch). The main types of data collected are catches, discards, bycatches, and effort by species/fleet/gear by 1º squares (purse seine) or by 5º squares (longline). This is supplemented by data from tagging (e.g. growth, mortality, movement), and any other data available for scientific research in the various countries or at regional level

A variety of different methods are used by ICCAT for stock assessment of large pelagics and highly migratory species in the Atlantic. These include non-equilibrium production models and Bayesian state-space (JABBA - Just Another Bayesian Biomass Assessment) production models to an Integrated Age Structured Model (Stock Synthesis: SS3) for bigeye tuna, age-structured models and non-equilibrium production models (ASPIC - A Stock Production Model Incorporating Covariates; ASPM – Age-Structured Production Model, VPA – Virtual Population Analysis, SS3) for yellowfin tuna, surplus biomass production models (one non-equilibrium conventional model and one Bayesian model) for skipjack tuna, and ASPIC, a Bayesian Surplus Production Model with process error (BSP2 - Bayesian Surplus Production 2, and SS3 for swordfish. Quantitative stock assessments are also carried out for the following species: white marlin, blue marlin, sailfish, blue shark, and shortfin mako.

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Reference points in relation to maximum sustainable yield (MSY), are based on fishing mortality and biomass: FMSY is the fishing mortality rate that eventually results in the largest yield on average (MSY) and BMSY is the corresponding average stock size:

- Subject to overfishing (Fyear/FMSY> 1)
- Not subject to overfishing (Fyear/FMSY≤ 1)
- Overfished (Byear/BMSY< 1)
- Not overfished (Byear/BMSY≥ 1)

According to recent assessments of the main species of interest for the EU fleet, bigeye tuna is overexploited, yellowfin tuna is overfished, blue shark and swordfish are being fished sustainably in the North Atlantic stock. However, there is concern for the state of stocks of other billfish and the shortfin mako shark.

Although harvest control rules and harvest strategies are not in place yet, these are under development for several stocks/fisheries (Rec. 15-07: Recommendation by ICCAT on the Development of Harvest Control Rules and of Management Strategy Evaluation). ICCAT has also implemented a number of Conservation and Management Measures (CMM) to address specific problems of overfishing.

Mauritania and Senegal small pelagics and demersal fisheries

Mauritania and Senegal have many small pelagic and demersal species in common. Coastal, small pelagics consist mainly of species from four families: Clupeidae (sardines and sardinellas), Engraulidae (anchovies), Carangidae (jacks, scads and horse mackerels) and Scombridae (mackerals and tunas). The main species are round sardinella (*Sardinella aurita*), flat sardinella (*Sardinella maderensis*), West African ilisha (*Ilisha africana*), bonga (*Ethmalosa fimbriata*), European anchovy (*Engraulis encrasicolus*), black horse mackerel (*Trachurus trecae*), Atlantic horse mackerel (*Trachurus trachurus*), scad (*Caranx rhonchus*), chub mackerel (*Scomber japonicus*), and mackerel (*Scomber scombrus*).

Coastal demersal fish species include many species of groupers, soles, croakers, mullet, and sea breams. The main coastal cephalopod species are the common octopus (*Octopus vulgaris*) and cuttlefish (*Sepia officinalis hierreda*), while the main coastal crustaceans are the white shrimp (*Penaeus notialis*) and the green spiny lobster (*Panilurus regius*).

In addition to the black hakes (*Merluccius senegalensis* and *M. polli*), the resources exploited by trawlers, both national and EU, exploit generally high value deep-water species, including deep-water rose shrimp (*Parapenaeus longirstris*), striped red shrimp (*Aristeus varidens*), scorpion fish, sharks, rays and monkfish.

The responsibility for collecting data on fishing effort and catches of both artisanal and industrial fisheries in Senegal lies with the Oceanographic Research Centre of Dakar Thiaroye (CRODT), while in Mauritania fisheries data is collected by the Institut Mauritanien de Recherches Océanographiques et

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des Pêches (IMROP). Stock assessment of the demersal species is carried out jointly within the framework of the FAO/CECAF Working Group on the Assessment of Demersal Resources, while for small pelagics, joint assessments are carried out by the FAO Working Group on the Assessment of Small Pelagic Fish off Northwest Africa. Both working groups use essentially the same type of data (time series of catch and effort) and stock assessment models, namely surplus production models, and Catch MSY (CMSY), a data-limited method. Length-based cohort analysis is also used for some species to estimate current fishing mortality (F) and recent fishing exploitation, which are then used in yield per recruit models to calculate Fmax and F0.1.

The Biological Reference Points (BRP) adopted by CECAF used by the Working Group are:

- Target reference points (TRP): B0.1 and F0.1
- Limit reference points (LRP): BMSY and FMSY

To assess the current situation with respect to the LRPs, Bcur/BMSY and Fcur/FMSY are used. To assess the situation relative to the TRPs, Bcur/B0.1 and Fcur/F0.1 are used. The CECAF scientific Working Groups assign the results in three categories:

- "Non-fully exploited: The stock is in good condition and fishing pressure can be increased without affecting the sustainability. All increases must be seen in the context of the general environmental situation."
- "Fully exploited: The fishery operates within the limits of sustainability. Current fishing pressure seems sustainable and can be maintained." But without increase of effort.
- "Overexploited: The fishery is in an undesired state both in terms of biomass and fishing mortality. Fishing pressure should be reduced to allow the stock to grow."

For the 26 demersal species/stocks assessed by CECAF/FAO, half of the 19 that could be assessed were judged to be over-exploited, while seven were considered fully exploited and only three not fully exploited. Due to insufficient data, inconclusive results were obtained for seven stocks, although additional information from fisheries and scientific surveys suggests that many are overexploited.

For small pelagic species or stocks from Mauritania and/or, no assessment results are available for *Sardinella* species due to insufficient data in the case of surplus production models or inconclusive results for the data-limited CMSY approach. The chub mackerel is considered fully exploited, while the two species of horse mackerel are considered over-exploited.

Seychelles tuna fishery

An average of 27 EU tuna purse seiners (PS) were authorized to fish in the Seychelles EEZ during the period 2014-2018, mainly targeting three tropical tuna species: yellowfin, skipjack and bigeye tuna, catching an average 48,000t per year. However, a much greater number of pelagic longliners from many countries fish in the Seychelles EEZ, with bigeye tuna accounting for roughly 50% of catches.

However, there is substantial by-catch of yellowfin tuna, swordfish, as well as marlins, blue sharks, other fish species, sea birds and turtles.

Collection of fisheries data is the responsibility of flag state national authorities or institutions, and it is an obligation for members of the Indian Ocean Tuna Commission (IOTC), of which the Seychelles is a member since 1995, to report the data to the IOTC Secretariat.

The IOTC is responsible for the assessment and management of species/stocks of tuna and tuna-like species. Stock assessment is carried out by specific Working Parties (WP) using the best available data:

- WP on Billfish (WPB)
- WP on Data Collection and Statistics (WPDCS)
- WP on Ecosystems and Bycatch (WPEB)
- WP on Methods (WPM)
- WP on Neritic Tunas (WPNT)
- WP on Temperate Tunas (WPTmT)
- WP on Tropical Tunas (WPTT)

A wide range of models are used by IOTC:

- ASAP Age-Structured Assessment Program
- ASPIC A Stock Production Model Incorporating Covariates
- ASPM Age Structured Production Model
- BDM Biomass Dynamic Model
- BSP Bayesian Surplus Production Model
- BSP-SS Bayesian state-space production model
- C-MSY Catch at MSY
- ERA Ecological Risk Analysis
- JABBA Just Another Bayesian Biomass Assessment
- OCOM Optimised Catch Only Method
- PSA Productivity-Susceptibility Analysis
- SCAA Statistical catch-at-age
- SRA Stock Reduction Analysis
- SS3 Stock Synthesis

As in ICCAT stock assessments, reference points relate to fishing mortality and biomass in relation to MSY, defined as the largest average catch that can be taken continuously from a stock under existing environmental conditions. There are two related reference points: FMSY is the fishing mortality rate that eventually results in the largest yield on average (MSY) and BMSY is the corresponding average stock size. The following definitions have been set in relation to these reference points:

- Subject to overfishing (Fyear/FMSY> 1)
- Not subject to overfishing (Fyear/FMSY≤ 1)
- Overfished (Byear/BMSY< 1)
- Not overfished (Byear/BMSY≥ 1)

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Of the main species of interest, bigeye and skipjack tunas are considered to be fished sustainably, but the stock of yellowfin tuna is considered to be overfished as well as being subject to overfishing. According to IOTC, swordfish and blue shark are being fished sustainably, but yellowfin tuna and striped marlin are considered overfished/subject to overfishing, while blue marlin and indo-pacific sailfish are assessed as not overfished but subject to overfishing. In the Indian Ocean, based on the same reference points used by ICCAT, bigeye tuna, skipjack, swordfish and blue shark are considered not overfished or subject to overfishing.

There are no harvest control rules and harvest strategies in place, but the first steps have been taken in relation to skipjack tuna (Resolution 16/02 On harvest control rules for skipjack tuna in the IOTC area of competence; Resolution 16/09 On establishing a Technical committee on management procedures).

South East Atlantic (FAO major fishing area 47)

The main commercial target species in recent years are deep sea red crab (mainly *Chaceon erytheiae*), alfonsino (*Beryx splendens*), Patagonian toothfish (*Dissostichus eleginoides*), and pelagic armourhead/southern boarfish (*Pseudopentaceros richardsoni*). By-catch is dominated by the blackbelly rosefish (*Helicolenus mouchezi*) in the Valdivia Bank trawl fishery, and macrourid species (*Macrourus* sp.) in the Patagonian toothfish fishery. A fishery for orange roughy (*Hoplostethus atlanticus*) was important between 1995 and 2005, as was rock lobster (*Jasus tristani*) that took place until 2006. In recent years there has been little or no EU fishing activity in this area.

Conservation and management of living resources, except for highly migratory species and sedentary species subject to the fishery jurisdiction of coastal States is the responsibility of the South East Atlantic Fisheries Organisation (SEAFO), with scientists from Contracting Parties contributing to the assessment of marine resources in the SEAFO Convention Area and providing their scientific advice to the Commission through the Scientific Committee.

Five key stocks (Patagonian Toothfish, Deep-Sea Red Crab, Alfonsino, Orange Roughy and Pelagic Armourhead) in the SEAFO area are managed by TACs which are set for specific areas/fishing grounds. These TACs are defined in Conservation Measure 32/16 on Total Allowable Catches and related conditions. With the exception of orange roughy, which has a closed fishery, harvest control rules are in place for the other four main species, although in some cases with considerable uncertainty due to lack of data. Nevertheless, the fisheries for toothfish and deep-sea red crab appear to be well managed.

Southwest Atlantic (FAO major fishing Area 41)

FAO Statistical Area 41 covers a huge area of almost 18 million km^2 off the eastern coast of South America, where the EU fleet is vastly outnumbered by vessels from other nations such as Taiwan, China and South Korea, that fish beyond the territorial waters of the south American countries.

The target species are hakes (Argentine Hake, *Merluccius hubbsi* and Australian hake, *M. australis*), cephalopods/squid (Argentine shortfin squid, *Illex argentinus* and *Loligo gahi*), Patagonian grenadier (*Macruronus magellanicus*), red cod (*Salilota australis*), southern blue whiting (*Micromesistius australis*), kingclip (*Genypterus blacodes*), skates (*Raja* spp), and toothfish (*Dissostichus eleginoides*). By-catch species include the Patagonian squid (*Loligo* spp.), flying squid (*Martialia hyadesi*), grenadier (*Macrourus whitsoni*), Antarctic cod (*Notothenia rossii*), rockcods (*Notothenia* spp.), and various elasmobranchs.

Data for stock assessment is collected by the coastal states and Spain, with the largest EU fleet in these waters, has carried out research on estimation of abundance and density of commercially important species, as well as habitat mapping and identification of sensitive habitats. As the area has no Regional Fisheries Management Organization (RFMO), complete stock assessments for most species are lacking, with studies from individual countries. Nevertheless, the limited stock assessments available indicate that most target and by-catch species are over-fished.

EU vessels fishing in subarea 41.3.1 and 41.3.2 need a special fishing permit (time limited, species, zone, fishing gear and depth). EU vessels are not allowed to fish in unassessed areas. Spain has adopted to a comprehensive set of measures and standards that are binding on the shipping company (vessel owner), including mandatory presence on board of an observer. However, restrictions due to existing trawling footprint or identified Vulnerable Marine Ecosystems (VME) area not accepted by non-EU fishing fleets, mainly Asian countries (China, Taiwan and South Korea)

Lessons learnt

The following bullet points identify the highlights of lessons learned on the evaluation of current stock assessment models (T2.4) in FarFish:

- In practical terms, many coastal countries struggle with being able to provide complete data for their tuna fisheries and there is often the issue of data quality.
- Data on catches of large pelagics by other foreign fleets that are taken in the waters of Cape Verde and Senegal are generally not available.
- There is insufficient data for quantitative stock assessment of many other pelagic species fished in the territorial waters of Cape Verde, Senegal and Mauritania, including tunas: Blackfin tuna (*Thunnus atlanticus*), Bullet tuna (*Auxis rochei*), Atlantic bonito (*Sarda sarda*), Plain bonito (*Orcynopsis unicolor*), Serra Spanish mackerel (*Scomberomorus brasiliensis*), Cero (*Scomberomorus regalis*), Frigate tuna (*Auxis thazard*), King mackerel

(*Scomberomorus cavalla*), Little tunny (*Euthynnus alletteratus*), West African Spanish mackerel (*Scomberomorus tritor*), Atlantic Spanish mackerel (*Scomberomorus maculatus*), Wahoo (*Acanthocybium solandri*), and Dolphinfish (*Coryphaena hippurus*).

- Most demersal and small pelagic species from Mauritania and Senegal lack adequate data and parameters to allow quantitative stock assessment and a sound scientific basis for management and conservation.
- Observer coverage in most fisheries is in many cases non-existent or inadequate.
- There is insufficient data for assessment of most of the by-catch species taken by EU and other fleets fishing in the EEZ of the Seychelles.
- The lack of suitable data for classical stock assessment methods is an underlying theme in all the case studies and that to date, there has been limited use of data-limited models or approaches.
- In the South East Atlantic, there are limited, seamount-based fisheries, with limited fisheries data for quantitative stock assessment for most species.
- In the South West Atlantic, lack of a RFMO hampers the assessment and management of the species fished by many fleets from the coastal countries as well the EU and other nations such as Taiwan and Russia.

Recommendations

The following bullet points represent the recommendations of FarFish regarding the evaluation of current stock assessment models (T2.4):

- There is a wealth of data available in the form of national research surveys for small pelagics, demersal species, supplemented by environmental data. Such data can and should be used for analysis of trends, calculation of indicators, implementing DLM, and for management.
- In conclusion, we highly recommend that full use is made of national research survey data in the context of DLM approaches for stock assessment, for multi-species and trophic modelling, and for monitoring of global changes.
- Collaboration of the different nations in sampling, data collection and stock assessment and management of the target and by-catch species in the South West Atlantic is required, preferably within the framework of a RFMO, in order to ensure sustainable fisheries.

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Task 2.5: Self-sampling programme

The overarching objective of the FarFish project is to provide knowledge, tools and methods to support responsible, sustainable and profitable EU fisheries outside European waters, both within the jurisdiction of non-EU nations as well as international waters. In order to achieve this, the FarFish project explored the applicability of implementing self-sampling programmes within EU long-distance fisheries and carried out a pilot self-sampling program as "proof of concept". The pilot study focused on the "black hakes", *Merluccius senegalensis* and *M. polli*, two morphologically very similar species with overlapping geographic distributions in Mauritania and Senegal (Figure 2).

The latter two species are important demersal resources in Mauritania and Senegal where they have overlapping distributions for over 2000 km, where they are fished jointly in a mixed fishery. There is also an overlap in their depth range: *M. polli* is reported from 50 to 1,100m; and *M. senegalensis* from 15 to 800m (Froese and Pauly, 2021). According to Rey et al. (2015), the two species may have different ecological strategies, which is reflected in their depth range distributions and differences in the maximum and average sizes.

Black hake captures in the east central Atlantic (FAO zone 34) amounted to 29,547 tonnes in 2017, the last year with available data, of which 18,843t were reported as *M. senegalensis*, 4,677t as *M. polli* and the rest (6,027t) not specified (FAO, 2000). Spain, one of the biggest importers of hakes, reported a total of 13,847t landings in 2019 (Eurostat, 2021): 8,389t of *M. senegalensis*, 5,456t of *M. polli*, and the remaining 2t not specified.

Misidentification and misrepresentation of the actual catch may leave one of the species underrepresented while the other is overrepresented, leading to negative consequences for their sustainable management (Cawthorn et al., 2018; Giovos et al., 2021). *Merluccius senegalensis* is classified as endangered in the International Union for Conservation of Nature –IUCN- Red List of Threatened Species (Iwamoto, 2015b), while *M. polli* is globally considered of least concern (Iwamoto, 2015a). Stock assessment carried out within the framework of an FAO working group is based on catch per unit effort data for both species combined because of the difficulties in identification, making species-specific management impossible. Thus, the aim of the pilot study was to evaluate the potential of self-sampling to collect data that could be useful for management of these valuable resources and to test the ability of self-samplers to identify the two species based on morphological characteristics.

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Figure 2: Photos of the black hakes Merluccius senegalensis (left) and Merluccius polli (right) (source: Thiam et al., 2014, in Ba, 2021).

To this end, self-sampling kits were provided to three OPROMAR trawlers fishing in Mauritania, a trawler from a SOPERKA Spanish-Senegal industrial vessel and to Senegal artisanal longline vessels. Samples of fin clips, along with data on location, depth, morphological identification, sex, and length were sent to the Department of Functional Biology of the University of Oviedo, Spain, for DNA analysis. While the species identification and sampling on the OPROMAR vessels was done by the crew, the samplers on board the Senegal fishing vessels were limited to recording date, depth, and location and taking whole fish samples. Identification of the species, biological sampling and sampling of fin clips for DNA analysis was carried out by CRODT technicians in the laboratory. Follow-up questionnaires were used to evaluate the views of the fishers on the difficulties of collecting data, the identification of the black hakes, whether they were willing to participate in self-sampling programmes and if they thought the results of the study were useful for management of the fishery.

Findings

In total, 358 hake were identified by DNA from three OPROMAR fishing vessels. Differences in mislabelling were found between the 3 trawlers: 2.5%, 13.5% and 27.9%. Overall, 26% of hakes labelled as *M. polli* were shown to be *M. senegalensis* by DNA analysis (Table 1).

In total, 448 hake caught by Senegal vessels were successfully identified by DNA analysis (Table 1). Of the samples from the SOPERKA trawler 46% of the hake were mis-classified, with 43% and 48% of *M. polli* and *M. senegalensis* respectively not identified correctly. For the artisanal fleet, 116 *M. polli* were classified as *M. senegalensis*, with no misclassification of individuals of the latter species, giving an overall misclassification of 41% (n = 286).

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Table 1: Total number of samples per vessel categorized according to their label and DNA identity

Labelled as	*M. polli*		*M. senegalensis*			
DNA identification	*M. polli*	*M. senegalensis*	*M. senegalensis*	*M. polli*	N	% Mislabelling
OPROMAR Vessel 1	103	16	0	0	119	13.5
OPROMAR Vessel 2	114	44	0	0	158	27.9
OPROMAR Vessel 3	66	0	13	2	81	2.5
Senegal trawler	30	23	57	52	162	46.3
Senegal artisanal fleet	0	116	170	0	286	40.6
TOTAL	**313**	**199**	**240**	**54**	**806**	**31.4**

Lessons learnt

Statistical analysis showed that labelling errors were mainly due to the assumption of *M. polli* being bigger and inhabiting deeper waters, and the opposite in *M. senegalensis*. Thus, location of fishing grounds and depth were contributing factors to mislabelling (see Figure 3 and Figure 4).

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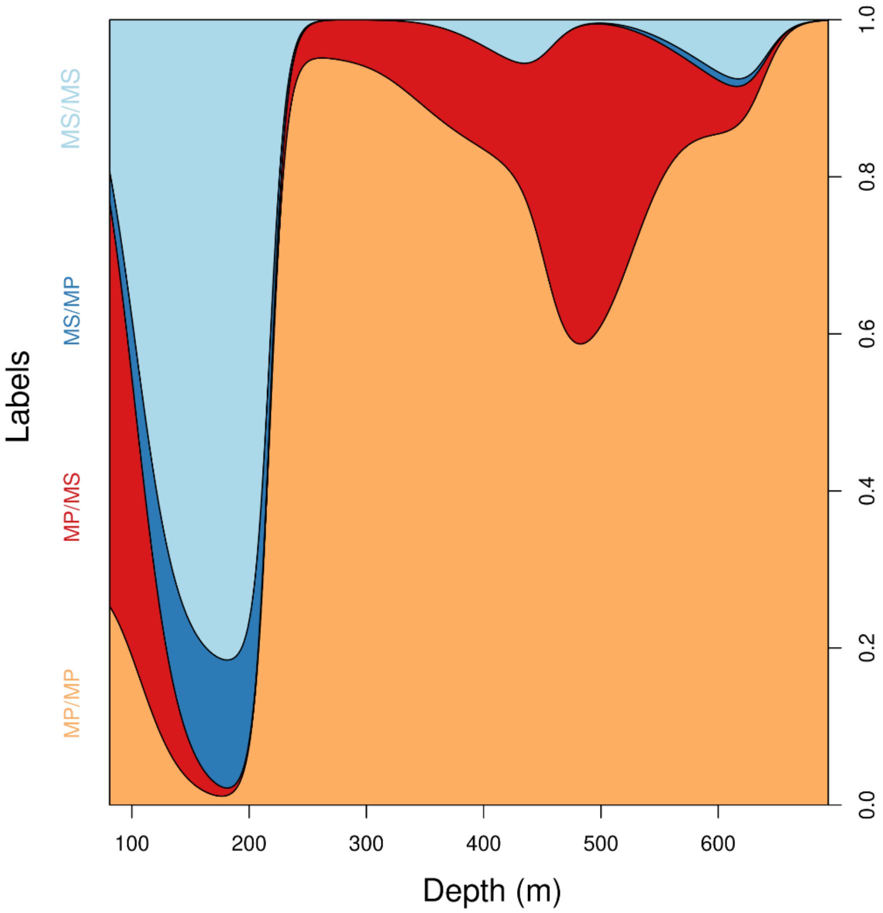

Figure 3: Distribution of samples by labelling categories and depth for OPROMAR vessels: MP/MP: samples labelled as M. polli and DNA-assigned to M. polli (orange); MP/MS: samples labelled as M. polli and DNA-assigned to M. senegalensis (red); MS/MS: samples labelled as M. senegalensis and DNA-assigned to M. senegalensis (light blue); MS/MP: samples labelled as M. senegalensis and DNA-assigned to M. polli (blue).

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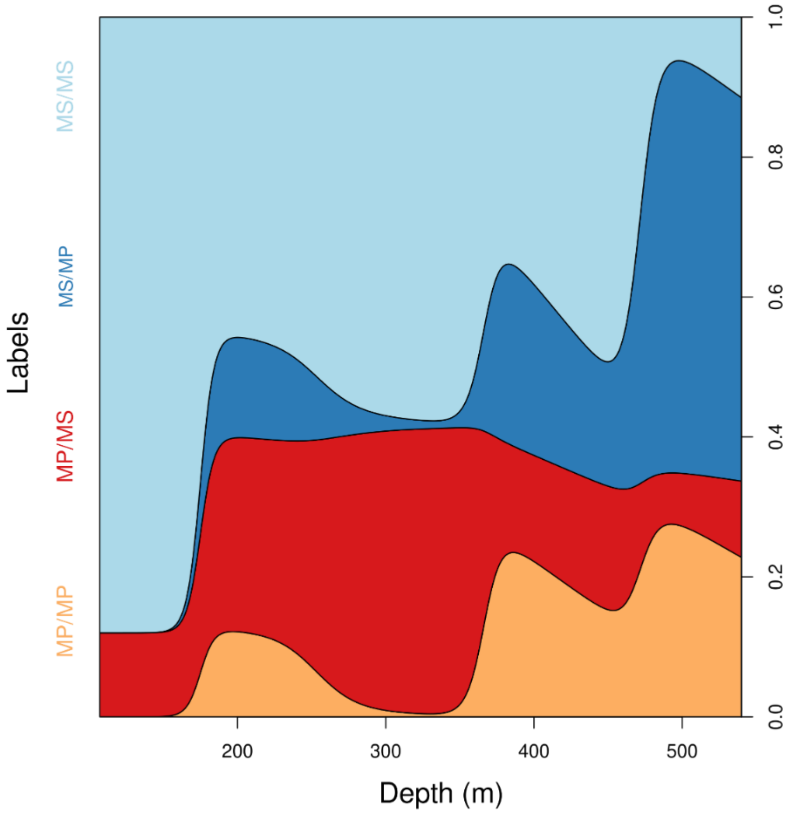

Figure 4: Distribution of samples by labelling categories and depth for Senegal vessels. MP/MP: MP/MP: samples labelled as M. polli and DNA-assigned to M. polli (orange); MP/MS: samples labelled as M. polli and DNA-assigned to M. senegalensis (red); MS/MS: samples labelled as M. senegalensis and DNA-assigned to M. senegalensis (light blue); MS/MP: samples labelled as M. senegalensis and DNA-assigned to M. polli (blue).

In general, the sampling protocols were found to be clear, understandable and easy to follow. The crews could reliably take samples for DNA studies and record the required data. The amount of time needed to sample ranged from a few minutes to less than 30 minutes per haul, meaning that duration of self-sampling could affect willingness of fishers to participate in self-sampling, although in general they showed willingness to collaborate in the future.
Self-samplers were interested in the study, believing that the results would be important for the management of the fishery.

Recommendations

Training and resources for continuation of molecular analyses of landed fish after the end of the project was not foreseen in the FarFish project. The self-sampling study for DNA analysis was a pilot study to determine the feasibility of self-sampling and to evaluate the levels of misclassification in

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the different fleets exploiting black hakes. This issue was discussed with the case study partners who proposed a follow-up study that would enlarge the scope of the molecular studies and include training. With regard facilities and equipment for carrying out DNA analysis, it is not known what is available in Senegal. However, it is highly likely that the necessary equipment and facilities do indeed exist at universities or national laboratories. The alternative would be to send the samples to Europe for analysis.

Specific training in catch species identification is recommended for fishers and fishing industry, to improve the accuracy of labelling and traceability. Follow-up studies should also evaluate differences in mislabelling between crew, officers and skippers, and continued engagement with fishermen at sea is an essential requisite for successful implementation of self-sampling programmes.

DNA barcoding could be applied as a method for routine control of species identification, to confirm in periodical surveys, that species are correctly labelled and also contribute valuable data on species composition (relative abundance of each species) for a scientific basis for management of the fisheries.

Outputs

A scientific peer-reviewed paper, based on the pilot study, has been published:

Blanco-Fernandez, C., K. Erzini, S. Rodriguez-Diego, P. Alba-Gonzalez, N. Thiam, F. N. Sow, M.Diallo, J.R. Viðarsson, D. Fernández-Vidal, J.M.S. Gonçalves, M. Rangel, K. Stobberup, E. Garcia-Vazquez and G.Machado-Schiaffino. 2022. Two fish in a pod. Mislabelling on board threatens sustainability in mixed fisheries. Frontiers in Marine Science. Marine Fisheries, Aquaculture and Living Resources.
https://www.frontiersin.org/articles/10.3389/fmars.2022.841667/abstract

Two flyers were prepared (one in Spanish and one in French) to disseminate the results to the non-scientific community stakeholders, namely the fishers and fleets involved in the pilot study,

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Annexes

Annex 1. Data management plan form.

1. Data set reference/name	
2. Data summary	
3. FAIR Data	
3.1 Making data findable, including provisions for metadata	
3.2 Making data openly accessible	
3.3 Making data interoperable	
3.4 Increase data re-use (through clarifying licences)	
4. Allocation of resources	
5. Data security	
6. Ethical aspects	
7. Other	

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Annex 2. Data management plan explanation

1. Data set reference/name	• Identifier for the data set to be produced
2. Data summary	• State the purpose of the data collection/generation, and explain the relation to the objectives of the project • Specify the types and formats of data generated/collected • Specify if existing data is being re-used (if any) • Specify the origin of the data • State the expected size of the data (if known) • Outline the data utility: to whom will it be useful
3. FAIR Data	
3.1 Making data findable, including provisions for metadata	• Outline the discoverability of data (metadata provision) • Outline the identifiability of data and refer to standard identification mechanism. Do you make use of persistent and unique identifiers such as Digital Object Identifiers (DOI)? • Outline naming conventions used • Outline the approach towards search keyword • Outline the approach for clear versioning • Specify standards for metadata creation (if any). If there are no standards in your discipline, describe what type of metadata will be created and how
3.2 Making data openly accessible	• Specify which data will be made openly available? If some data is kept closed, explain why • Specify how the data will be made available • Specify what methods or software tools are needed to access the data? Is documentation about the software needed to access the data included? Is it possible to include the relevant software (e.g. in open source code)? • Specify where the data and associated metadata, documentation and code are deposited • Specify how access will be provided in case there are any restrictions • For a useful registry of possible data repositories, see: https://www.re3data.org/. Search for repositories by subject, content type or country.
3.3 Making data interoperable	• Assess the interoperability of your data. Specify what data and metadata vocabularies, standards or methodologies you will follow to facilitate interoperability. • Specify whether you will be using standard vocabulary for all data types present in your data set, to allow inter-disciplinary interoperability. If not, will you provide mapping to more commonly used ontologies? • For suggestions on relevant vocabularies, see: http://vest.agrisemantics.org/ • For resources on data and metadata standards, see: https://fairsharing.org/
3.4 Increase data re-use (through clarifying licences)	• Specify how the data will be licenced to permit the widest reuse possible • Specify when the data will be made available for re-use. If applicable, specify why and for what period a data embargo is needed • Specify whether the data produced and/or used in the project is useable by third parties, in particular after the end of the project? If the re-use of some data is restricted, explain why • Describe data quality assurance processes • Specify the length of time for which the data will remain re-usable

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Annex 3. Memo:

EAF Nansen data for the EU FarFish project

By: Dr. Erik Olsen, Head of Research – Marine Research in Developing Countries, Institute of Marine Research, Norway

March 25th, 2021

The EU project FarFish (https://www.farfish.eu/) started in 2017, and since then has been attempting to access data from surveys collected as part of the FAO EAF Nansen programme with the RV *Dr. Fridtjof Nansen* in Senegal, Cabo Verde, Mauritania and Seychelles. Partners within the FarFish consortium, including IMROP, CRODT, INDP/IMAR and SFA have requested approval from their authorities that EAF Nansen data from their countries be used in the FarFish project. These approvals were confirmed by Senegal, Mauritania, and Seychelles in 2019. However, the project has been unsuccessful in gaining access to the data, thereby limiting the planned data analysis for these regions.

During the project planning, both IMR and FAO were invited to become project partners, in large part to facilitate access to EAF Nansen data. IMR accepted the invitation, but FAO declined. Upon the start of the project, a process for gaining access to EAF Nansen data from FarFish partner countries started. The first attempt was made directly through IMR, who are custodians of the EAF Nansen data. The FarFish consortium was informed that IMR is, however, not at liberty to share EAF Nansen data without approval from the EAF Nansen project. This requires clearance by both the relevant partner countries and the EAF Nansen coordination unit at FAO. In June 2019, the FarFish Coordinator submitted a formal request for access to EAF Nansen data to the partner countries. The formal data requests were followed by correspondence with the EAF Nansen coordination unit at FAO to ensure that the correct protocols and procedures were followed. At this time, the EAF Nansen data policy was under revision and FAO informed the FarFish Coordinator that this would cause some delays in handling the data requests.

By June 2020, several partners had responded positively to the data requests, but not all had supplied official letters by their relevant data owners (e.g. official EAF Nansen partner institutions). Some also responded that data older 5 years were freely available, which was the rule under the old data policy, but is not continued in the revised policy. Others also responded that IMR had full access to the data and could share it, which is contrary to IMRs role as data custodian. Thus, the EAF Nansen coordination unit at FAO never gave clearance for access to the data.

As of 2020 the FarFish project had therefore failed to gain access to the EAF Nansen data. This was due to a combination of lack of formal letters allowing access of data by the official EAF Nansen partner institutions in Senegal, Cabo Verde, Mauritania and Seychelles, delays caused by the revision of the EAF Nansen data policy, and delays by the EAF Nansen coordination unit at FAO in processing and helping with handling the request for data.

By the end of 2020, the FarFish project decided it was too late to process any EAF Nansen data even if access was granted, and the process of trying to get access to the data was terminated.

Conclusions:

In its attempts to guard against "parachute science" where researchers from industrialized nations take data from low-income nations and publish it with little benefit to the data-owners, the EAF Nansen Data Policy has gone to the extreme where even legitimate data-requests from reputable projects like FarFish are effectively stopped due to bureaucratic and convoluted processes.

Furthermore, it is also unfortunate that the revised data policy is even stricter than the old one, barring the open access to data older than five years. The EAF Nansen Data Policy has thus evolved contrary to the current aims and objectives of open science and data sharing that are the foundations for addressing global challenges and achieving the SDGs.

The failure of FarFish to access relevant EAF Nansen data highlights the need for an urgent revision of the Data Policy to make it more open and transparent, allow automatic access to data older than five years as well as meta-data, and importantly to reduce bureaucracy and complexity when applying for access to data still under limited access criteria.

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