Scientific and technical knowledge of the EU-fisheries, exploited stocks and sensitive marine habitats in the high seas and third countries waters not subject to SFPA and/or RFMOs jurisdiction

Final Report

EASME/EMFF/2019/014 Specific Contract No. 04

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LIST OF ABBREVIATIONS

Acronym	Definition
ABNJ	Area Beyond National Jurisdiction
ACDR	Aggregated Catch Data Report
ACM	Argentine Continental Margin
AIS	Automatic Identification System
ANAM	National Agency for Maritime Affairs
API	Application Programme Interface
BMSY	Biomass Maximum Sustainable Yield
CBD	Convention on Biological Diversity
CECAF	Fishery Committee for the Eastern Central Atlantic
CFP	Common Fisheries Policy
CINEA	Climate, Infrastructure and Environment Executive Agency
CNCAS	National Agricultural Credit Fund
CPUE	Catch Per Unit Effort
CRODT	The Oceanographic Research Center of Dakar-Thiaroye
CRU	Crustaceans
CSIC	Spanish National Research Council
CSW	Coastal State Waters
CTMFM	Technical Commission of Rio de la Plata and it Maritime Front Treaty
DCF	Data Collection Framework
DGMARE	Directorate-General Maritime Affairs and Fisheries
DINARA	Uruguay's National Directorate for Aquatic Resources
DOI	Digital Object Identifier
EAF	Ecosystem Approach to Fisheries
EASIFISH	Ecological Assessment of Sustainable Impacts of Fisheries
EASME	Executive Agency for Small and Medium-sized Enterprises
EEZ	Exclusive Economic Zone
EFSA	European Food Standards Agency
EMFAF	European Maritime, Fisheries and Aquaculture Fund
EMFF	European Maritime and Fisheries Fund
EPPO	European and Mediterranean Plant Protection Organisations
ERA	Ecological Risk Assessment
FAO	Food and Agricultural Organisation
FAR	Fishing Authorisation Regulation
FIFD	Falkland Island Fisheries Department
FIG	Falkland Island Government
FIP	Fisheries Improvement Project
FIRMS	Fisheries and Resources Monitoring System
FLR	The Fisheries Library in R
FMP	Fishery Management Plan
FMSY	Fishing effort Maximum Sustainable Yield
FOA	Fisheries Observer Agency
FOCZ	Falklands Outer Conservation Zone

Acronym	Definition
FPE	Economic Promotion Fund
FVR	Fishing vessel Register
GB-NNRAF	Great Britain Non-Native Risk Assessment Forum
GEF	Global Environment Facility
HSPS	High Seas Patagonian Shelf
IATTC	Inter-American Tropical Tuna Commission
ICCAT	The International Commission for the Conservation of Atlantic Tunas
ICES	The International Council for the Exploration of the Sea
IDN	The Republic of Indonesia
IEO	The Spanish Institute of Oceanography
INIDEP	National Institute of Fisheries Research and Development (Argentina)
INRH	Institute National de Recherche Halieutique
IUU	Illegal, Unreported and Unregulated
JABBA	Bayesian State-Space Surplus Production Model framework, 'Just Another Bayesian Biomass Assessment'
LLS	Set Long Lines
MARE	Maritime Affairs and Fisheries
MCF	Bottom otter trawl Mixed Cephalopod and Demersal species
MFMR	Namibian Ministry of Fisheries and Marine Resources
MGAP	Uruguay's Ministry of Animal Husbandry, Agriculture and Fisheries
NIOMR	Nigerian Institute for Oceanography and Marine Research
NOAA	The National Oceanic and Atmospheric Administration
NORAD	Norwegian Agency for Development Cooperation
OSPAR	Oslo and Paris Conventions
OTB	Otter Bottom Trawl
PET	Protected, Endangered or Threatened Species
PNOFA	DINARA's National Observer Program on board fishing vessels
PSA	Productivity Susceptibility Analysis
REM	Remote Electronic Monitoring
REVIZEE	Survey of the Living Resources in the Exclusive Economic Zone of Brazil
RFB	Regional Fishery Body
RFMO	Regional Fisheries Management Organisation
ROV	Remotely Operated Vehicle
SAFE	Sustainability Assessment for Fishing Effects
SEAFO	South East Atlantic Fisheries Organization
SFPA	Sustainable Fisheries Partnership Agreement
SGM	Spanish Ministry of Environment, Rural and Maritime Affairs
SMEFF	Sustainable Management of External Fishing Fleets
SOLSTICE-WIO	Sustainable Oceans, Livelihoods and food Security Through Increased Capacity in Ecosystem research in the Western Indian Ocean
TAF	ICES Transparent Assessment Framework
UNCLOS	United Nations Convention on the Law of the Sea
UNGA	United Nations General Assembly
USAID	United States Agency for International Development
VME	Vulnerable Marine Ecosystem

Acronym	Definition
VMS	Vessel Monitoring System
WARFP	West Africa Regional Fisheries Project
WCPFC	Western Central Pacific Fisheries Commission
WCPO	Western Central Pacific Ocean
WWF	World Wide Fund for Nature
XIN	High Seas

LIST OF COUNTRIES REFERRED TO WITH THEIR ISO ALPHA-3 CODE

Acronym	Definition
AFG	Afghanistan
AGO	Angola
ALB	Albania
ARG	Argentina
BES	Bonaire, Saint Eustatius and Saba
BLZ	Belize
BOL	Bolivia
BRA	Brazil
CAN	Canada
CHL	Chile
CHN	China
CIV	Ivory-Coast
CMR	Cameroon
COD	Democratic Republic of the Congo
COG	Republic of the Congo
COK	Cook Island
COM	The Union of the Comoros
CPV	Cape Verde
CUB	Cuba
CYP	Cyprus
DEU	Germany
DJI	The Republic of Djibouti
DNK	Denmark
ESP	Spain
FLK	The Falklands Islands
FIN	Finland
FRA	France
GAB	The Gabonese Republic
GBR	The United Kingdom of Great Britain and Northern Ireland
GEO	Georgia
GHA	The Republic of Ghana
GIN	The Republic of Guinea
GNB	The Republic of Guinea-Bissau

Acronym	Definition
GNQ	The Republic of Equatorial Guinea
GRC	Greece
GRL	Greenland
GUF	French Guiana
ITA	Italy
IRL	Ireland
ISL	Iceland
JPN	Japan
KHM	The Kingdom of Cambodia
KIR	The Republic of Kiribati
KNA	Saint Kitts and Nevis
KOR	The Republic of Korea
LBR	The Republic of Liberia
LKA	The Democratic Socialist Republic of Sri Lanka
LTU	Lithuania
LVA	The Republic of Latvia
MAR	The Kingdom of Morocco
MHL	The Republic of the Marshall Islands
MLI	The Republic of Mali
MRT	The Islamic Republic of Mauritania
NAM	Namibia
NLD	The Netherlands
NGA	The Federal Republic of Nigeria
NOR	The Kingdom of Norway
NRU	The Republic of Nauru
NZL	New Zealand
PAN	The Republic of Panamá
PER	The Republic of Perú
POL	Poland
PRT	Portugal
PSE	The State of Palestine
RUS	Russian Federation
SEN	Senegal
SGP	Singapore
SHN	Saint Helena
SLB	Solomon Islands
SLE	Sierra Leone
SOM	Somalia
STP	Sao Tome and Principe
SWE	Sweden
TGO	Togo
TON	Tonga
TUR	Turkey

Acronym	Definition
TWN	Taiwan
UKR	Ukraine
URY	Uruguay
USA	United States of America
VCT	Saint Vincent and the Grenadines
VEN	Venezuela
VUT	Vanuatu
ZAF	South Africa

LIST OF SPECIES REFERRED TO WITH THEIR ASFIS THREE LETTER CODE

Acronym	Definition
ARA	*Aristeus antennatus*
ARS	*Aristaeomorpha foliacea*
ARV	*Aristeus varidens*
CET	*Dicologlossa cuneata*
CGE	*Chaceon maritae*
CTC	*Sepia officinalis*
CTL	*Sepiidae, Sepiolidae*
CUS	*Genypterus blacodes*
DPS	*Parapenaeus longirostris*
FOX	*Phycis spp*
GER	*Chaceon spp*
GFB	*Phycis blennoides*
GOA	*Pseudupeneus prayensis*
GPW	*Epinephelus aeneus*
GRM	*Macruronus magellanicus*
GUS	*Parapenaeopsis atlantica*
HKE	*Merluccius merluccius*
HKN	*Merluccius australis*
HKP	*Merluccius hubbsi*
HKX	*Merluccius spp*
HKZ	*Merlucciidae*
HND	*Anisotremus davidsonii*
HUN	*Hypoplectrus unicolor*
HVP	*Merluccius patagonicus*
LKW	*Plesionika edwardsii*
MCH	*Macrourus holotrachys*
MNZ	*Lophius spp*
MON	*Lophius piscatorius*
MSF	*Arnoglossus laterna*
MUX	*Mullus spp*
MWU	*Mullus argentinae*

Acronym	Definition
OCC	*Octopus vulgaris*
OPJ	*Cirrhoscyllium japonicum*
POS	*Micromesistius australis*
PAT	*Patagonotothen ramsayi*
SAO	*Salilota australis*
SKA	*Raja spp.*
SOP	*Penaeus notialis*
SPO	*Spongiidae*
SQA	*Illex argentinus*
SQC	*Loligo spp.*
SQE	*Todarodes sagittatus*
SQP	*Doryteuthis (Amerigo) gahi*
SQR	*Loligo vulgaris*
SSB	*Lithognathus mormyrus*
SSH	*Aristaeopsis edwardsiana*
PAT	*Patagonotothen ramsayi*
TGS	*Penaeus kerathurus*
TOP	*Dissostichus eleginoides*
WIO	*Pegusa triophthalma*
WSM	*Thyrsitops lepidopoides*

Executive summary

The Sustainable Management of External Fishing Fleets (SMEFF) Regulation is in place to ensure European Union (EU) fishing vessels conducting fishing activities outside Union waters adhere to the same sustainability principles as those operating inside EU waters. The SMEFF Regulation sets rules, conditions, and criteria for fishing authorisations, and defines processes and protocols that must be followed by the fishing operator, the flag Member State and the European Commission (EC) throughout the authorisation process for EU vessels fishing in non-EU waters. The SMEFF Regulation also requires a scientific evaluation demonstrating the sustainability of the planned fishing operations, which must be provided by either a Regional Fisheries Management Organisation (RFMO), a regional fisheries body with scientific competence, or a third country (or in cooperation with it). The scientific protocols employed in these evaluations must be validated by a scientific institute of the flag Member State. Member States must ensure that their fishing operators provide all the necessary information to demonstrate fulfilment of the SMEFF Regulation, before passing the relevant information onto the EC for review. The EC may then request that further information be provided or, if the requirements of the SMEFF Regulation are suitably fulfilled, it can grant the fishing authorisation for such a fishery under the SMEFF Regulation (henceforth called 'SMEFF fishery'). However, the SMEFF Regulation does not set out specific criteria for what scientific information is required for any given SMEFF request.

This study offers recommendations for the development of a sound science-based decision framework, with associated scientific protocols required to demonstrate a prospective fishery's sustainability. To facilitate this, a review of the relevant factors requiring assessment during a SMEFF request process was undertaken. First, a summary of all current and potential SMEFF fisheries was completed. The geographical scope of this review covers countries in FAO Areas 34, 41, and 47, which are not party to a Sustainable Fisheries Partnership Agreement (SFPA), and it comprises marine species and high seas areas that are not covered by RFMOs. The summary identified candidate fisheries that may become the object of SMEFF requests presently or in the future. Following this, an assessment of the current conservation status and exploitation patterns of both, target and non-target species of the identified fisheries was undertaken. Part of this work involved the development of a hierarchical framework and an associated operational structure for data limited stocks, demonstrating a scientifically sound, well structured, and logical procedure by which the SMEFF Regulation might be complied to despite data paucity as regards the target and non-target stocks and species. For SMEFF fisheries on the high seas, an assessment of vulnerable marine ecosystems (VMEs) and their overlap with potential fisheries and the associated VME indicator species was also completed. Together, these reviews and assessments provide a better understanding of SMEFF fisheries and how they interact with, and affect, stocks and ecosystems in third country and international waters.

The study also addresses the existence and reliability of current research programmes relating to species targeted and bycaught by SMEFF fisheries in the geographical scope. It summarises the relevant information relating to existing scientific research programmes and further elaborates on scientific research programmes that might be needed in the future to scientifically support potential future SMEFF requests. Recommendations are then provided towards a set of minimum criteria that scientific research programmes should meet, such that they allow fishing operators and Member States to comply with the requirements of the SMEFF Regulation. Finally, a summary of the current procedural and administrative review system that all SMEFF requests must pass through, was

completed. Recommendations are presented to help improve this system's efficiency for future SMEFF request reviews.

The main outputs of this study include:

I. An advice framework, consistent with the Common Fisheries Policy (CFP), that can be applied to a variety of stocks and species, targeted and bycaught across a range of fisheries and management bodies. The framework forms the basis for decision-making using the data and information that is available for the stocks.

II. A series of decision trees for Member State authorities, national scientific institutes and the European Commission. The decision trees summarise how future SMEFF requests may be processed based on the findings of this study. The proposed pathway incorporates both data rich and data poor fisheries and accounts for VMEs that may be affected by proposed SMEFF fisheries.

III. Conclusions and recommendations from this study. Recommendations include improved data use at early stages of SMEFF requests to reveal where fisheries data may already exist for certain areas; training of national scientific institutes in carrying out productivity susceptibility analyses for fish stocks; deeper assessment of species-gear combinations and their interaction with VMEs; the establishment of a data repository and an interface, designed to allow relevant parties to determine whether a potential fishery meets the requirements of the SMEFF Regulation; a condition-based improvement system for authorised SMEFF fisheries; and a proposal of a timeframe for the review and authorisation of SMEFF request, allowing scientific rigour to be balanced with minimising administrative lag.

The level of scientific research in FAO Areas 34, 41, and 47 varies considerably, often falling short of the standards recommended for fisheries within EU waters. Numerous suggestions have been proposed to enhance data collection, analysis, and fisheries observer coverage rates, as well as to improve sample sizes for each stock. This comprehensive approach aims to incrementally enhance the overall data repository for each stock targeted or bycaught by SMEFF fisheries in terms of quantity, quality, and the types of data collected. Such improvements are intended to facilitate more sophisticated stock assessments, safeguard VMEs and ensure that European Union Member States' administrations have the most reliable information available for making informed and scientifically sound decisions regarding fishing authorisations under the SMEFF Regulation.

Sommaire exécutif

Le règlement relatif à la gestion durable des flottes de pêche extérieures («le règlement SMEFF») a été mis en place pour garantir que les navires de pêche de l'Union européenne (UE) menant des activités de pêche en dehors des eaux de l'Union respectent les mêmes principes de durabilité que ceux qui opèrent dans les eaux de l'UE. Le règlement SMEFF établit des règles, des conditions et des critères pour les autorisations de pêche, et définit les processus et les protocoles qui doivent être suivis par l'opérateur de pêche, l'État du pavillon et la Commission européenne (CE) tout au long du processus d'autorisation pour les navires de l'UE qui pêchent dans les eaux non-UE. Le règlement SMEFF exige également une évaluation scientifique démontrant la durabilité des opérations de pêche prévues, qui doit être fournie par une organisation régionale de gestion des pêches (ORGP), un organisme régional de pêche doté de compétences scientifiques, ou un pays tiers (ou en coopération avec celui-ci). Les protocoles scientifiques utilisés dans ces évaluations doivent être validés par un institut scientifique de l'État membre du pavillon. Les États membres doivent veiller à ce que leurs opérateurs de pêche fournissent toutes les informations nécessaires pour démontrer le respect du règlement SMEFF, avant de transmettre les informations pertinentes à la CE pour examen. La CE peut alors demander que des informations supplémentaires soient fournies ou, si les exigences du règlement SMEFF sont dûment remplies, elle peut accorder l'autorisation de pêche pour une telle pêcherie au titre du règlement SMEFF (ci-après dénommée «pêcherie SMEFF»). Toutefois, le règlement SMEFF ne définit pas de critères spécifiques concernant les informations scientifiques requises pour une demande SMEFF donnée.

Cette étude propose des recommandations pour le développement d'un cadre décisionnel scientifique solide, avec des protocoles scientifiques associés nécessaires pour démontrer la durabilité d'une pêcherie potentielle. Par conséquent, un examen des facteurs pertinents lors d'une demande de SMEFF a été entrepris. Tout d'abord, une synthèse des pêcheries SMEFF actuelles et potentielles a été réalisée. La portée géographique de cet examen s'étend à travers les pays des zones 34, 41 et 47 de la FAO, qui ne font pas parties d'un APPF, et comprend des espèces et des zones de haute mer qui ne sont pas couvertes par des ORGP. La synthèse a identifié des pêcheries candidates susceptibles de faire l'objet d'une demande SMEFF actuellement ou à l'avenir. Ensuite, une évaluation de l'état de conservation actuel et des modes d'exploitation des espèces cibles et non cibles des pêcheries identifiées a été entreprise. Une partie de ce travail a consisté à développer un cadre hiérarchique et une structure opérationnelle pour les stocks à données limitées, démontrant une procédure scientifiquement valable, bien structurée et logique par laquelle le règlement SMEFF pourrait être respecté malgré le manque de données concernant les stocks et les espèces cibles et non cibles. Pour les pêcheries SMEFF en haute mer, une évaluation des écosystèmes marins vulnérables (EMV) et de leur chevauchement avec les pêcheries potentielles, ainsi que des espèces indicatrices d'EMV a également été réalisée. L'ensemble de ces études et évaluations permet de mieux comprendre les pêcheries SMEFF et la manière dont elles interagissent avec les stocks et les écosystèmes des pays tiers et des eaux internationales, et dont elles les affectent.

L'étude porte également sur l'existence et la fiabilité des programmes de recherche actuels concernant les espèces cibles et non cibles par les pêcheries SMEFF à travers cette portée géographique. Elle résume les informations pertinentes relatives aux programmes de recherche scientifique existants et décrit plus en détail les programmes de recherche scientifique qui pourraient être nécessaires à l'avenir pour soutenir scientifiquement les futures demandes potentielles de SMEFF. Des recommandations sont ensuite formulées concernant un ensemble de critères minimaux auxquels les programmes de recherche scientifique devraient répondre, afin de permettre aux opérateurs de pêche et aux États membres de se conformer aux exigences du règlement SMEFF. Enfin, un résumé de la procédure actuelle et du système d'examen administratif par lequel toutes les demandes SMEFF doivent passer a été réalisé. Des recommandations sont présentées afin d'améliorer l'efficacité de ce système pour les futurs examens des demandes SMEFF.

Les principaux résultats de cette étude sont :

I. Un cadre d'avis, conforme à la PCP, qui peut être appliqué à une variété de stocks et d'espèces cibles et non cibles à travers une gamme de pêcheries et d'organismes de gestion la pêche. Ce cadre constitue la base de la prise de décision à partir des données et des informations disponibles sur les stocks.

II. Une série d'arbres de décision pour les autorités des États membres, les instituts scientifiques nationaux et la Commission européenne. Ces arbres de décision résument la manière dont les futures demandes SMEFF peuvent être traitées sur la base des conclusions de la présente étude. La voie proposée intègre à la fois les pêcheries riches en données et les pêcheries pauvres en données et tient compte des EMV susceptibles d'être affectés par les pêcheries proposées au titre du SMEFF.

III. Conclusions et recommandations de cette étude. Les recommandations portent sur l'amélioration de l'utilisation des données dès les premières étapes des demandes SMEFF afin de déterminer si des données sur la pêche existent déjà pour certaines zones ; la formation des instituts scientifiques nationaux à la réalisation d'analyses de sensibilité et productivité (PSA) pour les stocks de poissons ; une évaluation plus approfondie des combinaisons espèces-engins et de leur interaction avec les EMV ; la mise en place d'un référentiel de données et d'une interface, conçus pour permettre aux parties concernées de déterminer si une pêcherie potentielle répond aux exigences du règlement SMEFF ; un système d'amélioration basé sur les conditions pour les pêcheries SMEFF autorisées ; et une proposition de calendrier pour l'examen et l'autorisation des demandes SMEFF, permettant de concilier la rigueur scientifique et la réduction des retards administratifs.

Le niveau de la recherche scientifique dans les zones FAO 34, 41 et 47 varie considérablement et est souvent inférieur aux normes recommandées pour les pêcheries situées dans les eaux de l'UE. De nombreuses suggestions ont été faites pour améliorer la collecte et l'analyse des données, les taux de couverture par les observateurs des pêcheries et la taille des échantillons pour chaque stock. Cette approche globale vise à améliorer progressivement la base de données globale pour chaque stock cible et non cible capturée par les pêcheries SMEFF en termes de quantité, de qualité et de types de données échantillonnés. Ces améliorations visent à faciliter des évaluations de stocks plus sophistiquées, à préserver les EMV et à garantir que les administrations des États membres de l'Union européenne disposent des informations les plus fiables possibles pour prendre des décisions scientifiquement fondées en ce qui concerne les autorisations de pêche au titre du règlement SMEFF.

1 Introduction

The Sustainable Management of External Fishing Fleets (SMEFF) Regulation [1] (SMEFF Regulation from here onwards) was adopted to ensure that fishing operations by European Union (EU) vessels in non-EU waters must abide by the same sustainability principles as fisheries regulated inside EU's waters. The SMEFF Regulation establishes rules, prescribes conditions / eligibility criteria for fishing authorisations, and defines obligations for the operator, the flag Member State and the European Commission (EC) in the fishing authorisation process for EU vessels fishing in non-EU waters. It also establishes the rules for third country vessels fishing in EU waters.

For fishing operations by EU vessels under direct authorisations carried out in third country waters pursuant to SMEFF article 3(2.d)) outside the framework of a fisheries agreement, Article 17 of the SMEFF Regulation defines, inter alia, that fisheries can only be authorized if the operator has provided a scientific evaluation demonstrating the sustainability of the planned fishing operations, including consistency with the provisions of Article 62 of the United Nations Convention on the Law of the Sea (UNCLOS) (UN General Assembly, 1982), as applicable (Article 17(1)(c)). In addition, Article 17(3) defines that the scientific evaluation shall be provided by either:

- A Regional Fisheries Management Organisation (RFMO);
- A regional fisheries body with scientific competence; or
- A third country or in cooperation with it.

Further, the SMEFF Regulation requires that "scientific evaluation emanating from the third country should be reviewed by a scientific institute or body of a Member State or of the Union" (Article 17(3)).

Direct authorisation is where fishing activity has been authorised by a third country's competent authority to a Union fishing vessel outside the framework of a Sustainable Fisheries Partnership Agreement (SFPA) or of an agreement on exchange of fishing opportunities and joint management of species of common interest (SMEFF, Article 3(c)).

For fishing operations by Union fishing vessels on the high seas, outside the auspices of an RFMO, Article 24(b) defines that these fisheries can only be authorised if the planned fishing operations are:

- In accordance with a scientific evaluation, demonstrating the sustainability of the planned fishing operations, provided or validated by a scientific institute in the flag Member States; or are,
- Part of a research programme, including a scheme for data collection organised by a scientific body.

For both options, the SMEFF Regulation implies that the scientific protocol of the research, which will be required in any event, shall be validated by a scientific institute of the flag Member State. In both situations (i.e. 3rd country and high seas requests), Member States must verify that their operators provide all the necessary information to demonstrate the fulfilment of these obligations.

(1) 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, OJ L 347, 28.12.2017, p. 81

Once verified, the Member State must send the relevant information to the EC (Articles 18(1) and 25(1)) for final assessment whether the conditions set out in Articles 17 and 24 are fulfilled. If the information provided by the Member State is insufficient, the EC may request further information (Articles 18(2) and 25(2)) and, where appropriate, may object to granting the authorisation.

However, the SMEFF Regulation does not specify what scientific information must be provided. Further, information and knowledge of the wide range of fisheries, harvested stocks and vulnerable marine ecosystems (VMEs), which may fall under the SMEFF Regulation or simultaneously under the SMEFF and the VME Regulations [(2)] are currently not always easily available or accessible, or are in a format that is inadequate for the EC services to express judgments on the compliance of the planned fishing operations, and notify Member States.

1.1 Objectives

Focusing on the requests by EU operators who want to fish in third countries waters or on the high seas (because these requests depend on scientific input or reviews from Member State scientific bodies), this study aims to help clarify the minimum scientific requirements for a scientific evaluation demonstrating the sustainability of a planned fishing operation. The study also aims to provide updated knowledge and/or gaps concerning the relevant biological resources that might be object of a SMEFF request. This study has gathered and reviewed different data and information sources on the fishing operations, the target species/stocks and bycatch species, their conservation status and exploitation patterns and developed decision trees to help with SMEFF requests. For the fishing operations on the high seas, this study also considers the presence of VMEs. The ultimate purpose of the study is to facilitate an improved and more uniform implementation of the SMEFF Regulation by fishing operators, scientists from national institutes, Member State authorities and the EC, and where applicable the VMEs Regulation including forecasts to cover potential future SMEFF requests.

The findings are expected to facilitate the work processes of fishing operators, scientists from national institutes, Member State authorities and the EC around the granting of fishing authorisations in non-EU waters. This study therefore addresses two specific goals:

- **Goal 1:** For SMEFF requests where very limited scientific information is available, a generic conceptual approach has been developed that enables formulation of clear, generally applicable concept and implementation structure for the legally required “scientific evaluation demonstrating the sustainability of the planned fishing operations” that the operator must provide.
- **Goal 2:** For SMEFF requests where scientific information is available, the study provides up-to-date scientific information describing past, ongoing and likely future fishing operations in non-EU waters, their target species/stocks and bycatch species, conservation status and exploitation patterns and, where applicable, existing VMEs.

1.2 Structure of the report

This report is structured so that each chapter addresses an aspect of the overall objective of the study. Each chapter and its respective purpose are listed below:

- **Chapter 2** describes the fisheries being carried out, or those that have the potential of being carried out, by EU vessels in third country waters not subject to an SFPA in FAO Fishing

(2) Council Regulation (EC) No 734/2008 of 15 July 2008 on the protection of vulnerable marine ecosystems in the high seas from the adverse impacts of bottom fishing gears, OJ L 201, 30.7.2008, p. 8

Areas 34, 47 and 41, and high seas areas not covered by RFMOs (the geographical scope for this study). This identifies candidate fisheries, fleets and stocks that may come under the SMEFF Regulation.

- **Chapter 3** develops a hierarchical framework for data limited stocks, illustrating how the requirements of the SMEFF Regulation might be fulfilled. This uses the available data on stocks to determine how they fit into the management advice framework. This framework is consistent with the Common Fisheries Policy (CFP) and can be widely applied to stocks within and across different fisheries and management bodies. A step-by-step procedure of how the framework can be practically applied is also included to show how the requirements of the SMEFF Regulation can be fulfilled when the stocks are data limited. This chapter also assesses the current conservation status and exploitation levels of the species and stocks identified in Chapter 2.
- **Chapter 4** describes the structure and mapping of VME indicator species that are known or likely to occur within the geographical scope of the study, while also assessing the spatial overlap of VMEs with current and historic fishing operations.
- **Chapter 5** summarises the different scientific research programmes within the geographic scope which might be relevant to comply with the requirements of Article 24(b) of the SMEFF Regulation.
- **Chapter 6** provides recommendations towards minimum criteria that concerned Member States and/or fishing operators need to include in future scientific research programmes, such that they comply with the requirements of Article 24(b) of the SMEFF Regulation. The criteria are complemented through an assessment of the potential needs and improvements of current programmes.
- **Chapter 7** describes the current procedural, administrative, and data review set up for SMEFF evaluation used to demonstrate the sustainability of the fishing operations. Suggestions are made on how to streamline the procedures.
- **Chapter 8** provides decision trees that summarise findings from this study that could be used to perform scientific evaluations under SMEFF, in both data rich and data poor situations while accounting for VMEs. The decision trees integrate, and are informed by, the work completed for Chapters 2 - 7.
- **Chapter 9** synthesizes the body of work completed throughout Chapters 1 to 8 into a series of conclusions and recommendations.

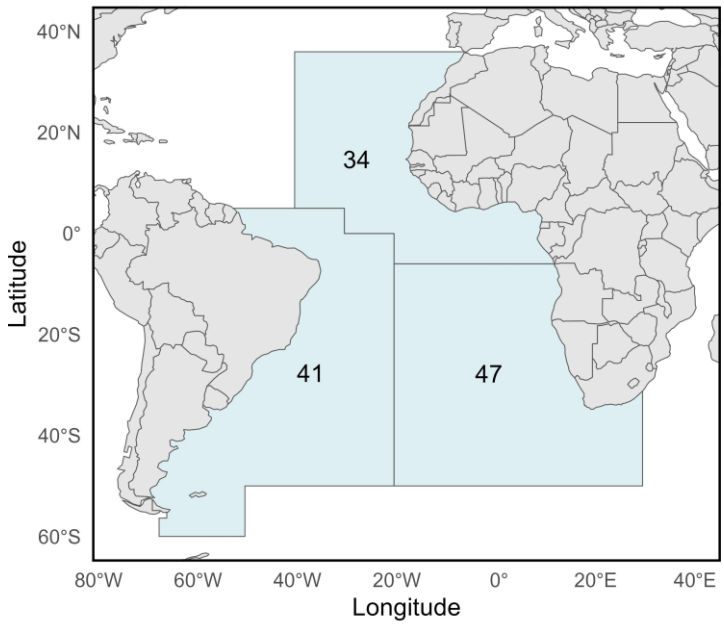
1.3 Geographical scope

This study covers fisheries by EU vessels in non-EU waters within FAO Areas 34 (Eastern Central Atlantic), 41 (Southwest Atlantic), and 47 (Southeast Atlantic) which are not subject to an SFPA and not subject to management by an RFMO (Figure 1). The exclusion of waters managed by RFMOs is because the relevant scientific information is provided by the RFMO, and EU vessels carry out activities following the quota given to the EU. The fisheries that are considered are the midwater and demersal fisheries that could potentially be carried out, operating in the Economic Exclusive Zones (EEZs) of Argentina, Angola, Equatorial Guinea, Falklands, Ghana, Guinea, Liberia, Namibia, Republic of Congo and Sierra Leone[3]. Other coastal States whose EEZs are potentially fished by the

[3] Argentina and Brazil are included even though no fishery takes place there, and is some cases is not legally possible currently by EU law, while Equatorial Guinea and Liberia are included as they have dominant SFPAs with the EU.

EU fleet but considered as low priority under this study, include Benin, Brazil, Democratic Republic of Congo, Nigeria, Togo, other UK Overseas Territories (apart from Falklands) and Uruguay.

Figure 1 - The geographical scope of this project showing FAO Areas 34, 41, and 47.



2 Historical, ongoing and future fisheries activities

Fisheries in FAO areas 34, 47 and 41 have long been integral to global marine resource utilization, serving as vital zones for fishing activities that contribute significantly to both local economies and the worldwide seafood market. These areas, encompassing diverse marine ecosystems and hosting an array of fish species, have historically been essential fishing grounds for numerous nations, including those within the EU. Over the years, these FAO regions have witnessed varying trends in fisheries activities, reflecting a complex interplay of factors such as evolving environmental conditions, technological advancements, regulatory changes, and shifts in market demands. The exploitation of marine resources in these areas has faced challenges linked to sustainability, including concerns about overfishing, habitat degradation, and the need to mitigate the impact of fishing practices on non-target species.

The objective of this chapter is to provide descriptions of recent and ongoing fisheries activities by EU fishing operations in FAO fishing areas 34, 41 and 47, including both the high seas and EEZs of nations not party to ongoing SFPA agreements. Fisheries descriptions have therefore been made based on four main data sets:

- EU vessel landings (provided by DG-MARE),
- Global Fishing Watch (GFW) data (held by MRAG),

- Landings and VMS information on the Spanish fisheries (held by IEO-CSIC), and
- Landings data from coastal State's EEZ (requested from coastal State fisheries departments).

Using a list of 64 species and area combinations of interest, species and area combinations with minimal catches (<100t per year) were removed from a FAO catch dataset for the last 5 years. This resulted in 33 species and area combinations of which 30 were the priority species caught by EU vessels in third countries (Table 1). Using this list, filters were applied to the dataset and used to tabulate the main fisheries in Areas 34, 41 and 47.

It is possible some species in this table are either misidentified or misreported. Misreporting or misidentification can be done by vessels when reporting to their Member State, who in turn can misreport to the EC. For example, in FAO area 34, *Aristeus antennatus, Sepia officinalis, Lophius piscatorius* and *Arnoglossus laterna* are more likely to be, respectively, *Aristeus varidens, Sepia hierredda, Lophius vaillanti* and other flatfish commercial species. Values from these species therefore should be viewed with caution.

Table 1 - List of species / area combinations used as the final species list.
Location codes: CSW refers to Coastal State Waters; XIN refers to High seas.

Location	FAO Area	Species Code	Scientific name	English name
CSW	34	ARA	*Aristeus antennatus*	Blue and red shrimp
CSW	34	ARV	*Aristeus varidens*	Striped red shrimp
CSW	34	CGE	*Chaceon maritae*	West African geryon
CSW	34	CTC	*Sepia officinalis*	Common cuttlefish
CSW	34	DPS	*Parapenaeus longirostris*	Deep-water rose shrimp
CSW	34	GOA	*Pseudupeneus prayensis*	West African goatfish
CSW	34	GPW	*Epinephelus aeneus*	White grouper
CSW	34	GUS	*Parapenaeopsis atlantica*	Guinea shrimp
CSW	34	MNZ	*Lophius spp*	Monkfishes nei
CSW	34	MON	*Lophius piscatorius*	Angler(=Monk)
CSW	34	MSF	*Arnoglossus laterna*	Mediterranean scaldfish
CSW	34	OCC	*Octopus vulgaris*	Common octopus
CSW	34	SOP	*Penaeus notialis*	Southern pink shrimp
CSW	34	SQE	*Todarodes sagittatus*	European flying squid
CSW	34	SSH	*Aristaeopsis edwardsiana*	Scarlet shrimp
CSW	34	TGS	*Penaeus kerathurus*	Caramote prawn
XIN	41	CUS	*Genypterus blacodes*	Pink cusk-eel
XIN	41	HKN	*Merluccius australis*	Southern hake
XIN	41	HKP	*Merluccius hubbsi*	Argentine hake
XIN	41	HKX	*Merluccius spp*	Hakes nei
XIN	41	PAT	*Patagonotothen ramsayi*	Longtail Southern cod
XIN	41	POS	*Micromesistius australis*	Southern blue whiting
XIN	41	SAO	*Salilota australis*	Tadpole codling
XIN	41	SKA	*Raja spp*	Raja rays nei
XIN	41	SQA	*Illex argentinus*	Argentine shortfin squid
XIN	41	SQC	*Loligo spp*	Common squids nei

XIN	41	SQP	*Doryteuthis gahi*	Patagonian squid
XIN	41	TOP	*Dissostichus eleginoides*	Patagonian toothfish
CSW	47	ARV	*Aristeus varidens*	Striped red shrimp
CSW	47	CGE	*Chaceon maritae*	West African geryon
CSW	47	DPS	*Parapenaeus longirostris*	Deep-water rose shrimp

2.1 FAO Area 34

2.1.1 FAO Area 34 – Aggregated Catch Data Report (ACDR) data and IEO data (for Spanish fisheries)

Landings data show that three EU Member States fishing fleets operate in Area 34 (Italy, Portugal, and Spain), fishing in three third country (i.e. State) waters (Republic of Congo, Guinea and Sierra Leone) as well as in the high seas. A summary of the annual catch, flag State, third country coastal State where fishing occurred, and gear used is presented in Table 2. Table 3 shows the number of vessels from the EU fleet that operate in third country coastal waters and the high seas in Area 34. Further, species-specific catch breakdowns of all species caught by EU vessels fishing in third countries of Area 34 can be found in Annex 1 (ACDR data) and Annex 2 (IEO data for Spanish fleet).

Table 2 - Catch, in tonnes per year, by flag state and third country waters where fishing took place in Area 34 (alphabetic order).

Source: IEO (for Spain) and DG-MARE (for other Member States). Gear codes: OTB – Single boat bottom otter trawl; OTB-CRU – bottom otter trawl for crustaceans; LLS – Set Longlines.

Flag state and coastal state EEZ (indented) with gear used	2018	2019	2020	2021	2022	Grand Total
ESP	985	1,669	983	751	386	4,774
Congo (Brazzaville)	606	756	528	562	386	2,838
OTB-CRU	606	756	528	562	386	2,838
Guinea	379	913	455	189	-	1,936
OTB-CRU	379	913	455	189	-	1,936
ITA	699	858	200			1,757
Guinea	14	274	133			421
OTB		258	133			391
Gear not stated	14	16				30
Sierra Leone	685	584	66			1,335
OTB		497	66			563
Gear not stated	685	87				772
PRT			0	0		0
High seas			0	0		5,374
LLS			0	0		1,936
Grand Total	1,681	2,574	1,119	751	386	6,511

Table 3 - Number of vessels from the EU fleet that operate in third countries EEZ and the high seas outside RFMOs of Area 34 (alphabetic order).

Source: IEO (for Spain) and DG-MARE (other Member States).

	2018	2019	2020	2021	2022	Grand Total
ESP						
Congo (Brazzaville)	4	4	6	4	2	6
Guinea	4	6	3	3	0	7
ITA						
Guinea	1	3	2			4
Sierra Leone	1	4	3			5
PRT						
High seas			1	1		1
Grand Total	10	17	15	8	2	23

Spain

Spanish flagged vessels in Area 34 fished in the EEZ of the Republic of Congo and Guinea, catching a total of 4774t in the period 2018-2022, using bottom otter trawls for crustaceans. Six Spanish vessels operated in the Republic of Congo, with reported landings of 1,566t of deep-water rose shrimp (*Parapenaeus longirostris*), 885t of striped red shrimp (*Aristeus varidens*), 189t of West African geryon (*Chaceon maritae),* 172t of angler (monk) (*Lophius spp,* mostly probably *L. vaillanti*), 25t scarlet shrimp (*Aristaeopsis edwardsiana*), 0.8t of common octopus (*Octopus vulgaris*) and 0.2t of cuttlefish Sepia spp. In Guinea, during the same period, 7 Spanish vessels fished using bottom otter trawls for crustaceans, landing 948t of deep-water rose shrimp, 702t of monkfishes, 147t of scarlet shrimp, 74t of striped red shrimp, 52t of shrimps belonging to the Family Pandalidae, 7t of black hake *Merluccius* spp and 3t of West African geryon.

Italy

Italian flagged vessels in Area 34 fished in the EEZ of Guinea and Sierra Leone catching a total of 1,757t. Italian vessels report using one gear, bottom otter trawls, with additional catch not attributed to a gear type. In Guinea, four vessels operated catching 168t of *Mullus spp*, 110t Mediterranean scaldfish (*Arnoglossus laterna*), 82t Anglerfishes, 48t of common cuttlefish and 7t of common octopus. In Sierra Leone, five vessels operated using bottom otter trawls landing 505t of common cuttlefish, 266t of common Octopus, 171t *Mullus spp*, 157t caramote prawn (*Penaeus kerathurus*) and 10t of white grouper (*Epinephelus aeneus*). Reported species for Italian vessel catches may be subject to some errors, as species reported are likely to be misidentified and thus misreported. *Mullus spp,* Mediterranean scaldfish, and common cuttlefish are commonly misidentified in the region, with species common in Area 34 more likely to have been caught *Pseudopeneus prayensis,* other commercial species of flatfish and *Sepia hierredda* respectively.

Portugal

One Portuguese vessel is reported to have been fishing in Area 34 and only in the high seas making minimal catches (less than 1 tonne) of anglerfishes using set longlines.

2.1.2 FAO Area 34 – Global Fishing Watch

Global Fishing Watch (GFW) data indicate a total of 67 flag states (Annex 3) operated in FAO major fishing Area 34 in a nine-year period (2012 to 2020).

Figure 2 displays a time series of estimated apparent fishing hours for each flag state whose total sum of fishing hours represents the highest 90% of fishing activity within the region.

Countries of interest under the SMEFF Regulation were identified by using GFW data for Area 34 that had been filtered to only contain EU flag vessels. These data were intersected with all coastal State EEZs of Area 34 (and high seas area) to produce a list of coastal States where EU vessels are active (Table 4). The list of coastal States where EU vessels are active was used to select EEZs of interest under the SMEFF regulation. This was done by removing coastal State EEZs without vessels of EU flags and countries party to SFPAs with the EU. The final list of EEZs relevant to the SMEFF Regulation was then used to intersect GFW data that were filtered to remove all gears specific to tuna fisheries (i.e. drifting longlines, tuna purse seine and pole and line) and thus covered by RFMOs.

The distribution and intensity of effort from EU flag vessels in the High seas area and coastal states EEZs of FAO Area 34 that contain EU flag vessels can be seen in

Figure 3, where hours of indicated fishing effort are summarised into 0.25 x 0.25 degree cells. A full break down hours spent fishing by EU flag states in the EEZs of Area 34 coastal states containing EU flags can be found in Annex 6, including hours of fishing by gear type.

Figure 2 - Time series of apparent fishing hours by countries that represent the top 90% of all fisheries in the FAO Area 34 by apparent fishing hours sourced from Global Fishing Watch.

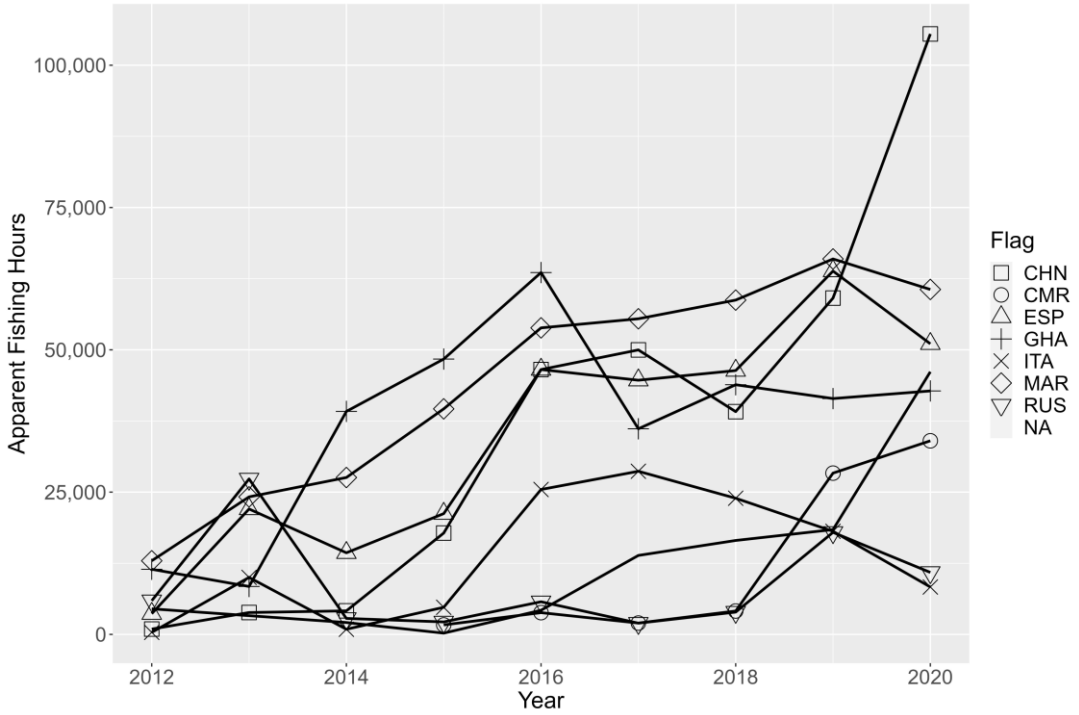
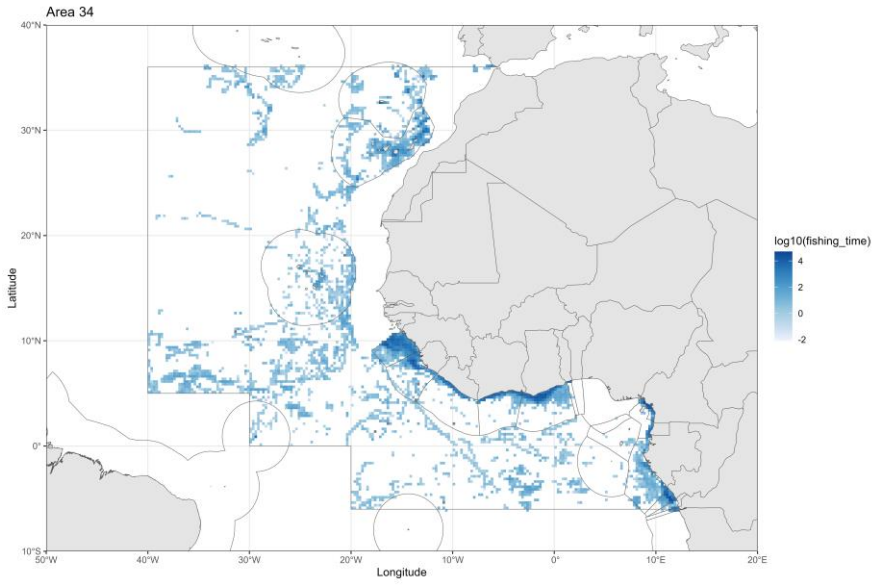


Table 4 - List of coastal States of Area 34 identified as containing EU vessels between within their EEZ 2012 and 2019.

Coastal state Identified as EU flags within EEZ	Full country name
AGO	Angola
BRA	Brazil
CIV	Ivory Coast
CMR	Cameroon
COD	Democratic Republic of the Congo
COG	Republic of the Congo
CPV	Cape Verde
GAB	Gabon
GHA	Ghana
GIN	Guinea
GNQ	Equatorial Guinea
LBR	Liberia
PRT	Portugal
SLE	Sierra Leone
STP	Sao Tome and Principe
TGO	Togo

NB: This country list may include tuna vessels that cannot be distinguished with the data sets available from those vessels covered by SMEFF.

Figure 3 - Distribution and intensity of indicated hours of fishing effort by EU vessels across FAO Area 34 using GFW derived AIS data.



2.2 FAO Area 41

2.2.1 FAO Area 41 - Aggregated Catch Data Report (ACDR) data and IEO data (for Spanish fisheries)

Data show four EU Member States and one former Member State (Spain, France, Lithuania, Portugal and the United Kingdom, respectively) operated in the high seas of Area 41 (Table 5). For the UK fleet, data are presented until 2020. Table 6 shows the number of Spanish and Portuguese vessels that operate in Area 41.

Further breakdowns of all species caught by EU vessels in fishing in third countries of Area 41 can be found in Annex 4.

Table 5 - Annual catch, in tonnes, by flag state and area in third country fished in Area 41. Source: IEO (for Spain) and DG-MARE (for other Member States).

Gear codes: OTB – Single boat bottom otter trawl.

Flag state and coastal state EEZs (indented) with gear used	2018	2019	2020	2021	2022	Grand Total
ESP	108,864	122,310	112,525	121,752	137,854	603,305
Falklands	33,131	63,877	53,222	60,324	61,852	272,405
OTB	33,131	63,877	53,222	60,324	61,852	272,405
HIGH SEAS	75,733	58,433	59,303	61,428	76,003	330,899
OTB	75,733	58,433	59,303	61,428	76,003	330,899
FRA			0			0
HIGH SEAS			0			0
Gear not stated			0			0
GBR	4,570	3,258	110			7,937
Falklands	4,282	3,251	110			7,642
Gear not stated	4,282	3,251	110			7,642
HIGH SEAS	288	7				295
Gear not stated	288	7				295
LTU					639	639
HIGH SEAS					639	639
Gear not stated					639	639
PRT			128			128
HIGH SEAS			128			128
OTB			128			128
Grand Total	113,434	125,568	112,763	121,752	138,493	612,010

Table 6 - Number of vessels that operate in EEZs and the high seas outside RFMOs of Area 41.

Source: IEO.

Flag state and coastal state (indented)	2018	2019	2020	2021	2022	Grand Total
ESP						
Falklands	18	15	17	16	11	22
HIGH SEAS	25	24	26	25	28	30
Grand Total	26	25	26	25	28	31
FRA						
HIGH SEAS			1			1
GBR						
Falklands	1	1	1			1
HIGH SEAS	1	1				1
LTU						
HIGH SEAS					1	1
PRT						
HIGH SEAS			1			1
Grand Total	2	2	2	0	1	

Spain

Spanish vessels in Area 41 fished in the EEZ of the Falklands and high seas catching a total of 272,405t and 330,899t respectively. Spanish vessels report using one gear, bottom otter trawls, with additional catch not attributed to a gear type. In the Falklands, the vessels caught 207,626t of Argentine hake (*Merluccius hubbsi*), 20,407t Patagonian grenadier (*Macruronus magellanicus*), 11,511t of Patagonian squid (*Doryteuthis gahi*), 8,532t of Argentine shortfin squid (*Illex argentinus*), 6,471t of pink cusk-eel (*Genypterus blacodes*) and 5,163t of tadpole codling (*Salilota australis*). Similarly, in the high seas, Spanish vessels caught 236,259t of Argentine hake, 63,199t of Argentine shortfin squid, 11,182t of longtail southern cod (*Patagonotothen ramsayi*), 5,440t of pink cusk-eel and 5,393t of Patagonian squid.

France

French flagged vessels in Area 41 only fished in the high seas, catching less than 1t of *Mullus spp* and common cuttlefish.

United Kingdom

United Kingdom flagged vessels in Area 41 fished in both the coastal waters and high sea areas of the Falklands, catching a total of 7,642t and 295t respectively. The top five species caught were 7,244t Patagonian squid, 382t Argentine hake, 10t tadpole codling (*Salilota australis*), 6t Pink cusk-eel and <1t Patagonian grenadier. In the high seas of Area 41, UK vessels reported catches of 224t Argentine shortfin squid, 63t Argentine hake, 6t Pink cusk-eel, 1t Patagonian squid and <1t Tadpole codling.

Lithuania

Lithuanian flagged vessels in Area 41 fished only in the high seas, catching a total of 639t of three main species: Argentine shortfin squid, Argentine hake and pink cusk-eel.

Portugal

Portuguese flagged vessels in Area 41 fished only in the High Seas, catching a total of 128t using bottom otter trawls. Catches were composed of five main species: Argentine shortfin squid, Argentine hake, Patagonian squid, Raja rays and pink cusk-eel.

2.2.2 FAO Area 41 - Global Fishing Watch data

Global fish watch data indicate that Area 41 hosted vessels of 55 flag states (Annex 3) over the nine years of data that were available. Fishing was indicated to have occurred for a total of 12,654,190 hours, averaging 1,406,021 hours per year. Figure 4 displays a time series of estimated apparent fishing hours for each flag state whose total sum of fishing hours represents the highest 90% of fishing activity within the region. The top 90% of total fishing hours is represented by four flag states Angola, Brazil, China and Uruguay. Table 7 lists the coastal states containing EU vessels in Area 41.

Figure 4 - Time series of apparent fishing hours by countries that represent the top 90% of all fisheries in the FAO Area 41 sourced from GFW.

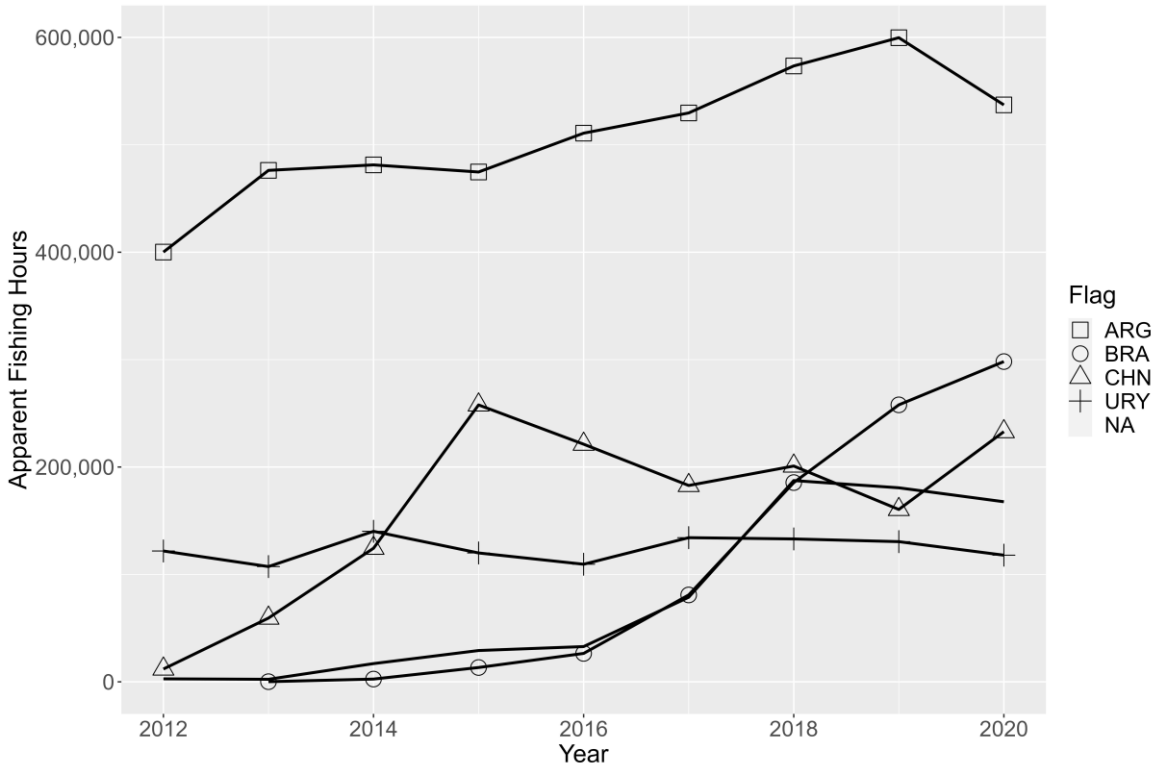
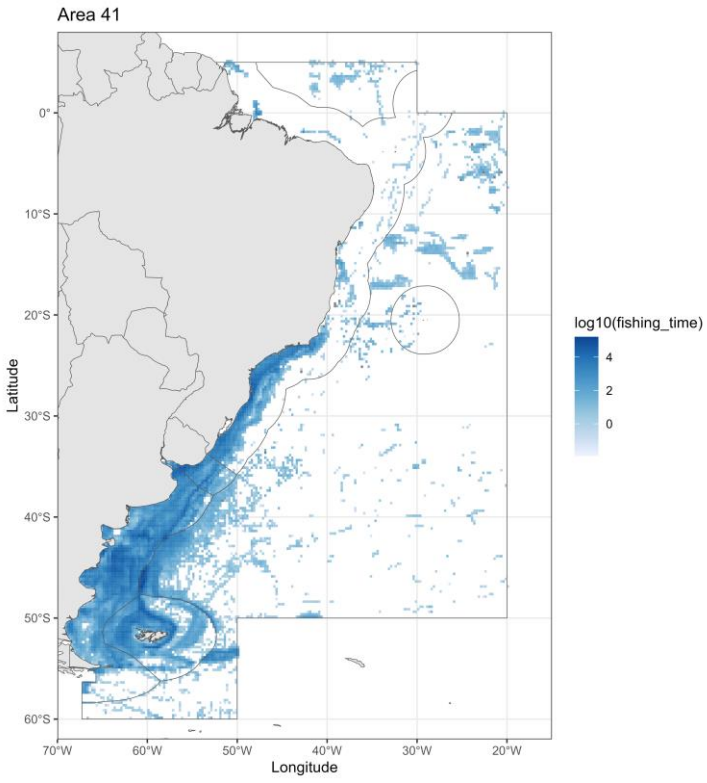


Table 7 - List of coastal states of Area 41 identified as containing EU vessels between 2012 and 2019.

Coastal states EEZs containing EU vessels	Full country name
ARG	Argentina
BRA	Brazil
GBR	United Kingdom (Overseas Territories)
URY	Uruguay

The distribution and intensity of effort from EU flag vessels in the High seas and coastal States EEZs of Area 41 that contain EU flag vessels is presented in Figure 5, where hours of indicated fishing effort are summarised into 0.25 x 0.25 degrees cells. A full break down of hours spent fishing by EU flag states in the EEZs of Area 41 coastal states containing EU flags is shown in Annex 7, including hours of fishing by gear type.

Figure 5 - Distribution and intensity of indicated hours of fishing effort by EU vessels across FAO Area 41 using GFW derived AIS data.



2.3 FAO Area 47

2.3.1 FAO Area 47 – ACDR Aggregated Catch Data Report (ACDR) data and IEO data (for Spanish fisheries)

Data show two EU Member State flagged vessels (Spain and Portugal) operate in Area 47 mainly in the coastal waters of Angola, as well as in the high seas (Table 8). Table 9 shows the number of Spanish and Portuguese vessels that operate in Area 47. Further breakdowns of all species caught by EU vessels in fishing in third countries of Area 47 can be found in Annex 5.

Table 8 - Annual catch, in tonnes by flag state and third country waters where fishing is done Area 47. Source: IEO (for Spain) and ACDR (for other Member States).

Gear codes: OTB-CRU – bottom otter trawl for crustaceans; OTB-DEF- bottom otter trawl for demersal.

Flag state and coastal state (indented) with gear used	2018	2019	2020	2021	2022	Grand Total
ESP	6,766	6,416	7,153	4,735	1,640	26,711
Angola	6,766	6,416	7,034	4,717	1,607	26,540
OTB-CRU	1,533	1,915	1,526	1,785	1,607	6,766
OTB-DEF	5,233	4,501	5,508	2,932	-	6,766
Namibia						
OTB-DEF	0	0	1	4,786	938	5,725
HIGH SEAS*			119	18	33	171
Gear not stated			119	18	33	171
PRT	13					13
Angola	13					13
OTB	13					13
Grand Total	6,779	6,416	7,153	4,735	1640	26,724

*Data from ACDR. There are no records of this fishery from the IEO.

Table 9 - Number of vessels that operate in EEZs and high seas of Area 47.

Row Labels	2018	2019	2020	2021	2022	Grand Total
ESP						
Angola	13	15	15	12	10	15
Namibia	0	0	1	2	1	3
PRT						
Angola	1					1
Grand Total	14	15	16	14	11	18

Spain

Seventeen Spanish flagged vessels fished in Area 47 catching a total of 4,861t using bottom otter trawls for crustaceans (in Angola) and for demersal fish (in Angola and Namibia). During the period considered 2018-2022, Spanish shrimper vessels fished as retained catch in deep waters of Angola, 6,580t of striped red shrimp, 1,222t of West African geryon, 192t of scarlet shrimp and 145 t of deep-water rose shrimp. In the same period, Spanish fish trawlers landed a total 7,507t of Cape and Benguela hakes (*Merluccius* spp), 1,462t of jack and horse mackerels (*Trachurus* spp), 1,436 t of large-eye dentex (*Dentex macrophthalmus),* 1,258t *of Dentex* spp, 1,223t of croakers of the Family Scianidae, 1,214t of cephalopods, 953t of John dory (*Zeus faber),* 567t of silvery John dory *(Zenopsis conchifer),* 367t of bearded brotula *(Brotula barbata)* and *2189t* of other Osteichtyes fish.

ACDR data in the high seas, show that catches are dominated by one species - Patagonian toothfish. However, taking into account the species landed, these data might correspond to FAO 41 instead FAO 47.

The three Spanish flagged trawlers that have fished in Namibian waters in the considered period (although no fishing in 2018, 2019 and almost negligible catch in 2020) are targeting both species of hakes, Cape and Benguela hakes (*Merluccius capensis*, *M. paradoxus*), with a total catch of 5,347t. The main bycatch species declared have been the anglerfish (*Lophius vomerinus*): 248t, the kinglip (*Genypterus capensis*):72t and the blackbelly rosefish (*Helicolenus dactylopterus*): 19t.

Portugal

The only Portuguese flagged vessels in Area 47 fished in the coastal waters of Angola, catching a total of 13t using bottom otter trawls. The catch was composed of four species *Loligo spp* (9t), common cuttlefish (4t), more likely to be *S. hierredda*; *Mullus spp,* more likely to be *P. prayensis* (<1 t); and Anglers (<1 t).

2.3.2 FAO Area 47 – Global Fishing Watch data

Global Fishing Watch data indicate a total of 50 flag states operated in Area 47 in a nine-year period (2012 to 2020) (Annex 8). Countries of interest under the SMEFF regulation (European Parliament, 2017) were identified by using Area 47 GFW data that had been filtered to only contain EU flag vessels (Table 10). The distribution and intensity of effort from EU flag vessels in the High seas and coastal states EEZs of FAO Area 47 that contain EU flag vessels were also plotted (Figure 7), where hours of indicated fishing effort are summarised into 0.25 x 0.25 degree cells.

Figure 6 displays a time series of estimated apparent fishing hours for each flag state whose total sum of fishing hours represents the highest 90% of fishing activity within the region. The top 90% of total fishing hours is represented by four flag states Angola, Spain, Namibia and South Africa.

Countries of interest under the SMEFF regulation (European Parliament, 2017) were identified by using Area 47 GFW data that had been filtered to only contain EU flag vessels (Table 10). The distribution and intensity of effort from EU flag vessels in the High seas and coastal states EEZs of FAO Area 47 that contain EU flag vessels were also plotted (Figure 7), where hours of indicated fishing effort are summarised into 0.25 x 0.25 degree cells.

Figure 6 - Time series of apparent fishing hours by countries that represent the top 90% of all fisheries in the FAO Area 47 sourced from Global Fishing Watch.

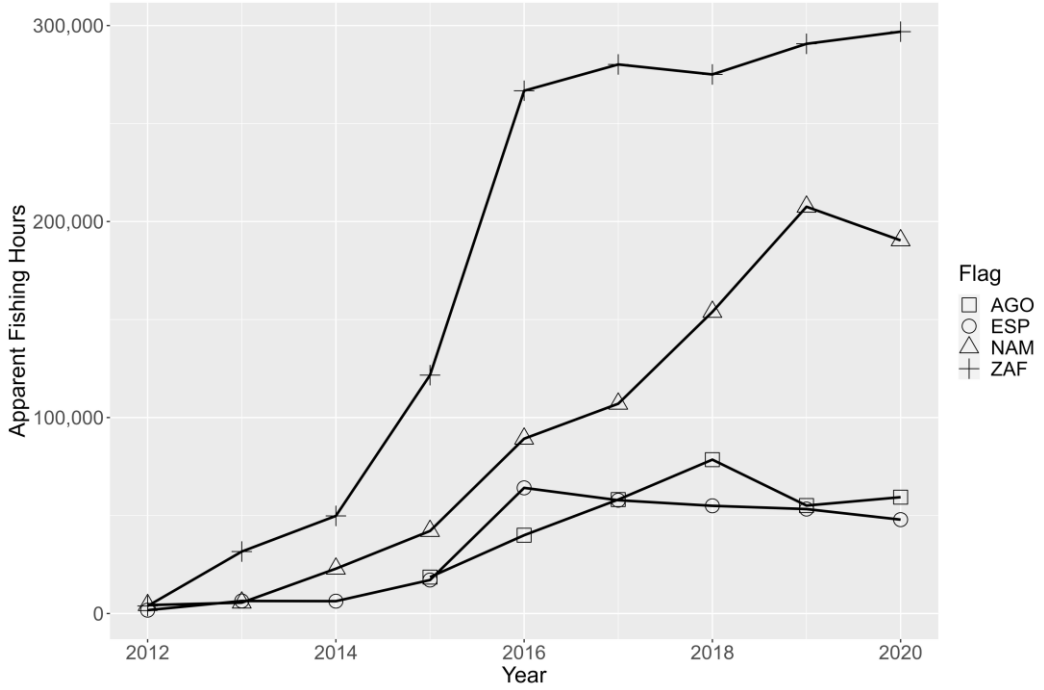
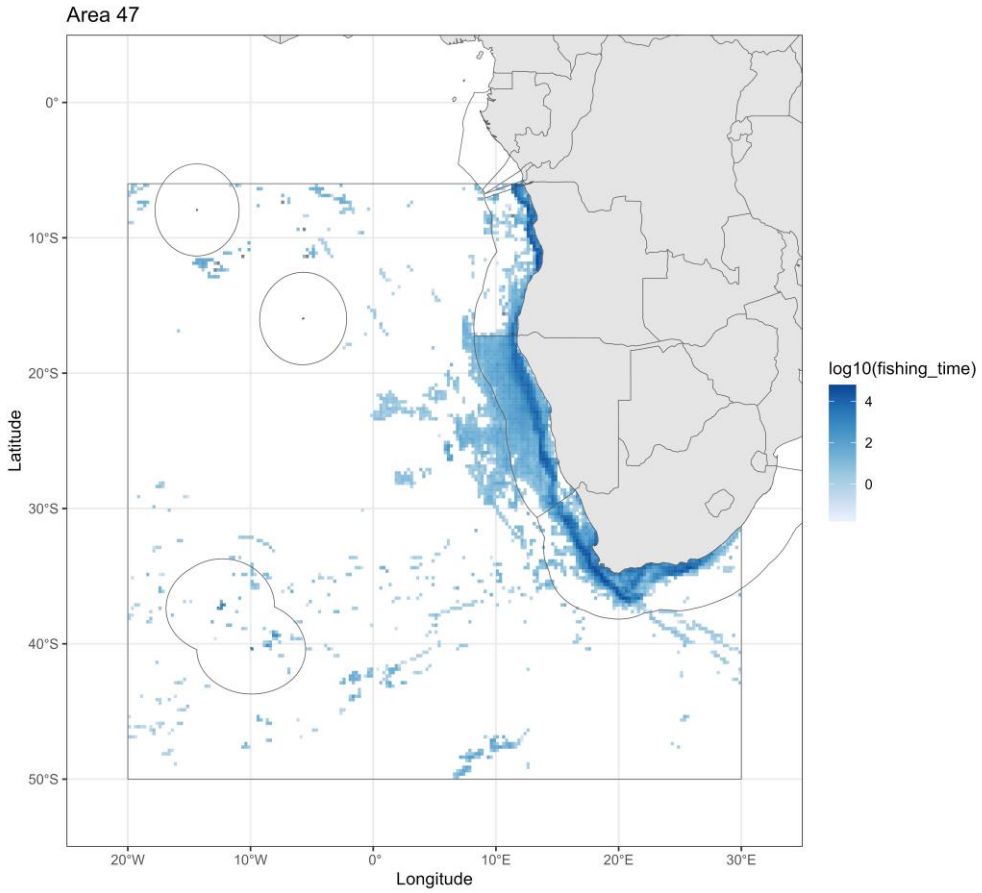


Table 10 - List of coastal states of Area 47 identified as containing EU vessels between 2012 and 2019.

Coastal states EEZs containing EU vessels	Full country name
AGO	Angola
GBR	United Kingdom (Overseas Territories)
NAM	Namibia

Coastal states EEZs containing EU vessels	Full country name
ZAF	South Africa

Figure 7 - Distribution and intensity of indicated hours of fishing effort by EU vessels across FAO Area 47 using GFW derived AIS data.



A full break down of hours spent fishing by all flag states in the EEZs of Area 47 coastal states containing EU flags can be found in Annex 8, including hours of fishing by gear type.

2.4 Data Requests

2.4.1 Calls to coastal States within FAO Areas 34, 47 and 41 for nationally compiled data

Due to EU sourced data containing only data for EU licenced vessels, and GFW data not containing a direct metric for catch or species (GFW uses estimated hours), data requests were made to relevant coastal State authorities that are situated within the three FAO major fishing areas. These requests were made in October 2022 and followed up one month later, giving ample time for respondents to ask questions. One coastal state (Falkland Islands) responded with the data requested, and provided data for 12 years, from 2010 to 2021. Data indicates jigging, longlining, and bottom trawling activity within their EEZs, from a total of 10 flag states, including the Falklands themselves. The other flag states are Sierra Leone, Taiwan, Vanuatu, Russia, Chile, Korea, Namibia, Spain, and the United Kingdom.

3 DESCRIPTION OF CONSERVATION STATUS, EXPLOITATION PATTERNS AND OTHER BIOLOGICAL INFORMATION

This chapter deals with the current conservation status and exploitation levels of stocks of the species targeted or caught as bycatch by EU distant water fleets. The first section (3.1) aims to address Goal 1 of this study's objectives, by developing a generic hierarchical framework for SMEFF requests with very limited scientific information. The framework enables the formulation of clear, generally applicable concepts including their operationalisation for the legally required scientific evaluation. The second section (3.2) addresses Goal 2 of this study demonstrating how the framework would work. The structured approach provided here ensures that the study is comprehensive and grounded in the current state of fisheries as engaged by EU vessels in third countries waters. The third section (3.3) focuses on assessment of the current conservation status and exploitation levels of the species and stocks identified in Chapter 2, where candidate fisheries, fleets, species, and stocks were identified.

The framework forms the basis for decision-making using the available data and information for the stocks concerned and determines the management advice, i.e. if fishing is to be permitted and under what conditions. The framework is consistent with the CFP and should be applicable to a variety of stocks and species, targeted and bycaught, across a range of fisheries and management bodies.

The framework will be used to implement the SMEFF Regulation by reviewing the fisheries and stocks for which a request has been made. This includes stocks which currently lack an assessment of conservation status. The framework adopts a tiered or hierarchical approach with three levels to assess fishing authorisation requests and to review implementation. Adopting a tiered approach ensures a systematic and comprehensive analysis, crucial to developing effective fisheries management and conservation policies. At Level 1, the decision is made whether a request can be granted, based on the information provided. If the request is granted, Level 2 sets the conditions under which the fishery will be monitored and may proceed. After three years of operation, the progress against the conditions will be reviewed. After 5 years, the fishery is required to move to Level 3, where a stock assessment is a necessary requirement for renewal of authorisation. The assessment may be conducted through a quantitative assessment or based on agreed indicators.

3.1 Hierarchical framework

The framework adopts a tiered or hierarchical approach with three levels to assess fishing authorisation requests and to review implementation of SMEFF requests. Adopting a tiered approach ensures a systematic and comprehensive analysis, crucial to developing effective fisheries management and conservation policies.

> **Level 1** – Risk assessment based on a Productivity and Susceptibility Analysis (PSA, Patrick *et al.*, 2010). This level will be conducted by scientists from national scientific institutes.
>
> **Level 2** - An initial assessment based on a quantitative stock assessment or agreed indicators, but without clearly defined decision rules and associated reference points. The Member States will submit a fishery management plan with the application to fish. In addition, a preliminary stock assessment will be performed by scientists from the national scientific institute. The main aim is to identify the data and knowledge gaps that prevent moving to Level 3. The plan will be reviewed by external scientists who will consider current risks and steps required to move to Level 3.
>
> **Level 3** – Quantitative or indicator-based assessment with reference points against which the impact of fishing can be assessed and clear decision rules in place. Update of the management plan and request for reauthorisation.

The framework reflects the available information, and helps to ensure risk equivalence, i.e. that a lack of knowledge should not permit higher risk. The methods to apply vary on a case-specific basis and will depend on the availability of data and information on the species, stocks and fisheries. Initially, a Productivity and Susceptibility Analysis (PSA) will be conducted at Level 1, which will identify the data needed to be collected at Level 2 to assess the stock at Level 3. The use of the framework will allow risk equivalence to be considered and a common set of diagnostics to be applied when conducting stock assessments by the scientists from national institute (e.g. Carvalho *et al.*, 2021). Risk equivalence will allow the benefit of improving knowledge and data in the future to be identified. Various methods can be applied with different assumptions, data, and information requirements. Methods include length-based indicators (Kell *et al.*, 2022 a), length-based, catch-only, and biomass dynamic production models (Winker *et al.*, 2018). In addition, cohort methods could be developed for short-lived species.

3.1.1 Level 1

Level 1 is a screening exercise based on a PSA, a form of ecological risk assessment (ERA, Gallagher, *et al.*, 2012) the objectives of which are to identify and prioritise, by species or fishing activity the risk of fishing to the stock. PSA has been used to conduct risk assessment across taxonomic classes (Kirby, 2006), including teleosts, sharks, sea turtles, seabirds, and marine mammals (Arrizabalaga *et al.*, 2011), by using comparable metrics such as L_{50}/L_{Max} (the length at maturity relative to the maximum size).

A variety of applications have been developed, to conduct an Ecological Assessment of Sustainable Impacts of Fisheries (EASIFISH, Griffiths *et al.*, 2018), estimate the Maximum Impact Sustainable Threshold (MIST, Clarke, 2017), and conduct a sustainability assessment for fishing effects (SAFE Zhou *et al.*, 2016). A main difference between individual frameworks is in the assumptions used to derive the estimates of productivity and reference points, and how uncertainty is treated. It is important that uncertainty is treated consistently across the levels of the framework to ensure risk equivalence, i.e. that a lack of data does not permit higher risk. A semi-quantitative approach is therefore used in Level 1, before moving to a quantitative approach at Level 2, based on life history parameters, this will allow priors to be developed in Level 3 for quantitative stock assessment.

Productivity and Susceptibility Analysis uses productivity and susceptibility attributes to provide a semi-quantitative assessment. Where, productivity is based on the biological characteristics of a

species or stock (Table 11), and susceptibility on the vulnerability of a species to a fishing activity (Table 12). The values in the table are for illustration and will need calibration for the different taxa, i.e. for teleosts compared to crustaceans. A novel aspect of the Hierarchical framework developed here is that in the PSA uncertainty about the data used is also considered (Table 13).

Table 11 - Productivity attributes and rankings are used to determine the vulnerability of stocks.

The values and attributes are based on Lucena-Frédou et al., (2017), and will need to be calibrated for a particular implementation.

Attribute	Ranking		
	High (3)	Moderate (2)	Low (1)
Maximum size (L_{max})	< 110 cm	110–200	> 200 cm
von Bertalanffy growth coefficient (k)	> 0.36	0.27–0.36	< 0.27
Size at first maturity (L_{50})	< 54	54–105	> 105
Maximum age (T_{max})	<8	8–14	> 14
L_{50}/L_{max}	< 0.51	0.51–0.55	> 0.55
Fecundity (*Fec*)	> 2.88	1.03–2.88	< 1.03

Table 12 - Susceptibility attributes and rankings used to determine the vulnerability of stocks.

The values and attributes are only examples (Lucena-Frédou et al., 2017) and will need to be calibrated for a particular implementation.

Attribute	Ranking		
	High (3)	Moderate (2)	Low (1)
Availability	> 50% of stock occurs in the area fished	25 to 50% of stock occurs in the area fished	< 25% of stock occurs in the area fished
Vertical overlap	> 50% of stock occurs in the depths fished	25 to 50% of stock occurs in the depths fished	< 25% of stock occurs in the depths fished
Discard Mortality	> 67%	33–67%	<33%
% adults > size at first maturity (L_{50})	> 95%	50–95%	< 50%
Management strategy	Management strategy Currently subject to several conservation and management	No specific regulations are in effect, but some indirect measures	No regulations are in effect

Attribute	Ranking		
	High (3)	Moderate (2)	Low (1)
	measures	are in place	
Instantaneous mortality (*Z*) / von Bertalanffy growth coefficient (*k*)	< 0.5	0.5–1.0	>1

Table 13 - Tiers of data quality used when evaluating the productivity and susceptibility of stocks.

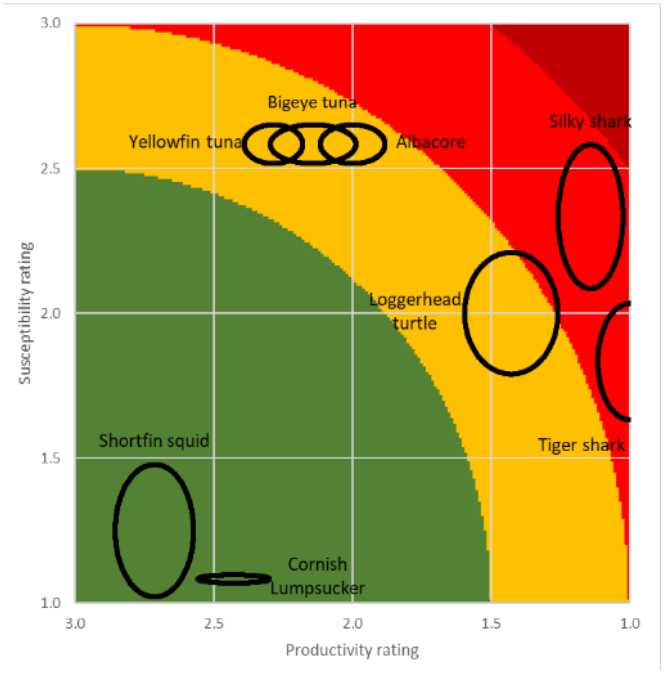
The values and attributes are examples (based on Lucena-Frédou et al., 2017) and will need to be calibrated for a particular implementation.

Attribute	Description	Example
Best data (1)	Data collected from the study stock and area, recent literature and appropriate stock assessment methods Parameters obtained by empirical relationships or on studies of the same species in adjacent area.	Information used in quantitative stock assessments
Good/adequate data (2)	Data collected from the study stock and area. Assessment	Recent time series of catch and effort data, or snapshots of length data for current period
Acceptable data (3)	Parameters obtained by empirical relationships or on studies of the same species in adjacent area.	No recent data, and parameters considered from other stocks
Limited data (4)	Expert opinion, i.e. from online databases	
No data (5)	Scores 5 and with no score for productivity and susceptibility	

An example of a multi-taxa PSA is shown in

Figure 8. The location of the black ellipses is based on the productivity (Table 11) and susceptibility (Table 12) attributes, and the ellipses represent uncertainty based on data quality (Table 13). If a stock is in the red zone, then this infers that the stock has low productivity (productivity-axis) and is potentially heavily impacted by fishing (susceptibility-axis). The PSA plot, therefore, for example, allows an assessment of the risk of overfishing a stock with low productivity and management to be considered. The impact of uncertainty and the benefit of reducing it can also be inferred from the size of the ellipses. The PSA will need calibration, so that different taxa can be compared. This could be done using data rich stocks, for example, by using quantitative stock assessments and performing a qualitative PSA, for different simulated data-poor datasets. If there are bycaught species in the fishery, then a PSA should also be conducted for those.

Figure 8 - Example of a multi-taxa PSA (Leach et al. 2023).



By default, the PSA is conducted using online databases via APIs (Application Programming Interfaces). Life history parameters are available from FishBase (Froese and Pauly, 2023) and SeaLifeBase (Palomares and Pauly, 2023) (https://cran.r-hub.io/web/packages/rfishbase/vignettes/tutorial.html), fishing effort distribution from Global Fishing Watch (https://github.com/GlobalFishing Watch/gfwr) and spatial and temporal distribution of a stock or species from Aquamaps https://github.com/raquamaps/raquamaps).

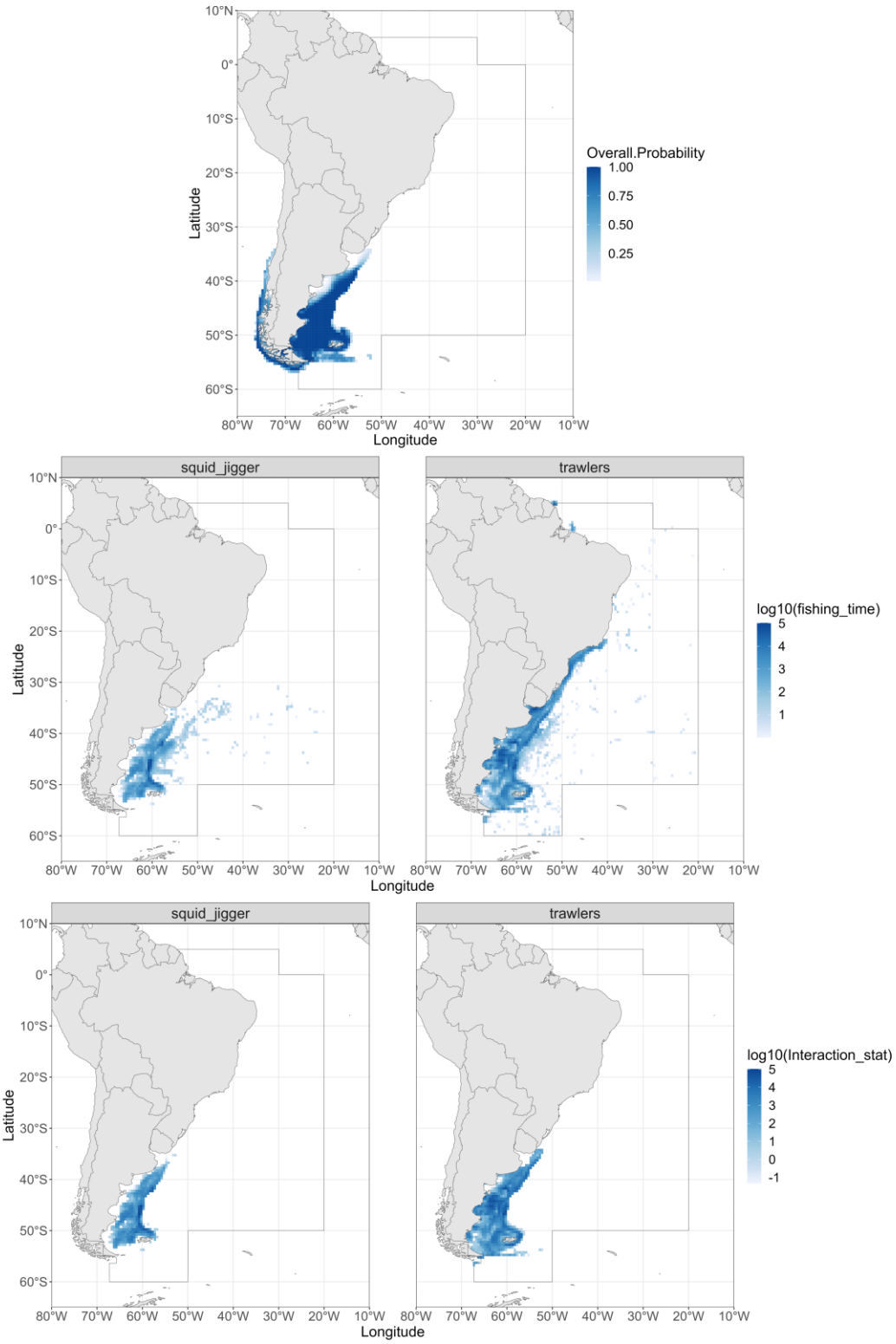
Fishbase and SeaLifeBase hold a variety of data on life histories, behaviour, and ecology. RFishBase (an R interface to FishBase; Boettiger *et al.*, 2012) allows data on life histories to be accessed and to generate model-based estimates of species preferences, i.e. environmental envelopes, derived from large sets of occurrence data from online collection databases, such as depth, water temperature, salinity, primary productivity, and association with coastal areas. Spatial and temporal fishing effort can be accessed using the Global Fishing Watch API, 'gfwr', which uses big data to track boats' movement and determines which vessels are fishing boats, what kind of fishing gear they are using and where they are fishing.

An example of how susceptibility can be derived from using web-based APIs (

Figure 9), as the product of availability (A), encounterability (E), selectivity (S), i.e. Susceptibility = A × E × S.

Figure 9. An example done for this study of comparing species overlap and fishing effort to estimate encounterability for a squid species.

Top: Species distribution of overall probability of encounter (Aquamaps data). Middle: 5 years of Global Fishing Watch data, faceted (left and right) to show the distribution of effort for the gear types that the species is susceptible to. Bottom: an overlap between the species distribution and the gears that species is susceptible to.



The risk equivalence approach in the hierarchical framework is designed to ensure that fishing pressure remains within safe limits, even in situations with limited stock and fisheries data. In terms

of roles and responsibilities, the framework outlines tasks for various parties involved in the assessment and management process. These parties include fishing operators, Member States, Member State scientists, independent scientists, and the European Commission. The tasks are designed to ensure that the authorisation process is thorough, transparent, and based on the best available scientific and policy information, promoting sustainable fishing practices that are in line with the CFP and other relevant environmental and fisheries management standards.

At Level 1, the fishing operator submits a formal request for fishing authorisation, which is then reviewed by the Member State or designated regulatory bodies. The Member State authority verifies the applicant's eligibility and compliance with CFP objectives and rules. The request is then evaluated by national scientific institutes or STECF for input on the possible impact of proposed fishing activities on stocks and ecosystems. Public comment may also be sought to gather additional input on the request. Based on the information collected, a decision is made to grant or deny the request. If granted, the fishery moves to Level 2, where conditions for the fishing operation are set, and the fishery is monitored to ensure sustainable practices.

In summary, the risk equivalence approach ensures sustainable fisheries management by maintaining consistent risks across stocks, even under data-limited conditions. The framework is adaptable and allows management measures to be adjusted based on the level of uncertainty as new data becomes available and the understanding of resource dynamics improves. The roles and responsibilities of various parties involved in the assessment and management process are clearly defined, ensuring a thorough, transparent, and science-based approach to fisheries management.

3.1.2 Level 2

Level 2 will identify potential limits and targets based on management objectives, e.g. related to achieving long-term high sustainable yields, with a low probability of stock collapse and impact on non-target species. The evaluation will also specify how the stock will be assessed relative to the limits and targets, and the associated data and knowledge requirements, to move to Level 3.

Life history parameters from Level 1 can be used to provide estimates of population growth rate (r) and natural mortality (M) that can be used to derive fishing mortality targets (F_{MSY}) and limits (F_{lim}), with estimates of uncertainty. For example, indices based on length data can also be used to develop indicators (Kell et al., 2022a). Before fishing commences, a fishery development plan will be prepared by the Member State. This will specify how an assessment will be conducted at Level 3 in five years' time, i.e. how to move on from a PSA to a quantitative assessment. This should consider that stocks may also be exploited by other fleets (national and/or other foreign fleets) and data from these fishing operations should be included as part of the stock assessment. The burden of proof is on the proposer. This will be reviewed by external experts who will review the current risk to the stock and how to move to Level 3 in year 5 to provide acceptable risk levels. The experts will set conditions, related to how the stock and fishery will be assessed.

3.1.3 Level 3

Level 3 will take the form of an implementation review with a stock assessment, to determine the status relative to reference points. To conduct an assessment, a variety of data sets and methods are potentially available. These are summarised in Figure 10 along with the hierarchical relationship between them. The methods to apply, on a case-specific basis, depend on the availability of data and information on the species, stocks, and fisheries. The use of the framework will allow risk equivalence to be considered and a common set of diagnostics to be applied (e.g. Carvalho *et al.*, 2021).

Risk equivalence will allow the benefit of improving knowledge and data in the future to be identified. Various methods can be applied with different assumptions, data, and information requirements. Methods include length-based indicators (Kell *et al.*, 2022 a), length-based, catch-only, and biomass

dynamic production models (Winker *et al.*, 2018). In addition, cohort methods could be developed for short-lived species.

The more information is available, the more precise the estimates of the stock relative to target and limit reference points. Therefore, if a management objective is to have a 95% probability of biomass being above a limit reference point ($B>B_{lim}$), then in the data-limited case, fishing mortality and yield will need to be reduced. There is therefore value in both information and control, i.e. better regulation of fishing effort, catch, or selectivity.

As an example, a simulation conducted for this study of the ratio of observed biomass to the biomass that would provide maximum sustainable yield (B/B_{MSY}) for a: 1) data-poor, 2) data-moderate and 3) data-rich assessment of the same stock which is currently being fished at a level consistent with maximum sustainable yield (F_{MSY}) (Figure 11). If the objectives are to ensure the stock is at B_{MSY} and there is a low probability (i.e. a less than 5% chance) that biomass is less than the biomass limit reference point ($B<B_{lim}$) then even though the stock is estimated to be at B_{MSY}, fishing will have to be reduced to ensure there is a high probability that $B>B_{lim}$. Therefore, there is a value, i.e. increase in yield of improving the quality of the assessment. Examples how such assessments maybe be conducted are provided in Annex 9.

Figure 10. Hierarchical assessment framework developed for SMEFF requests.

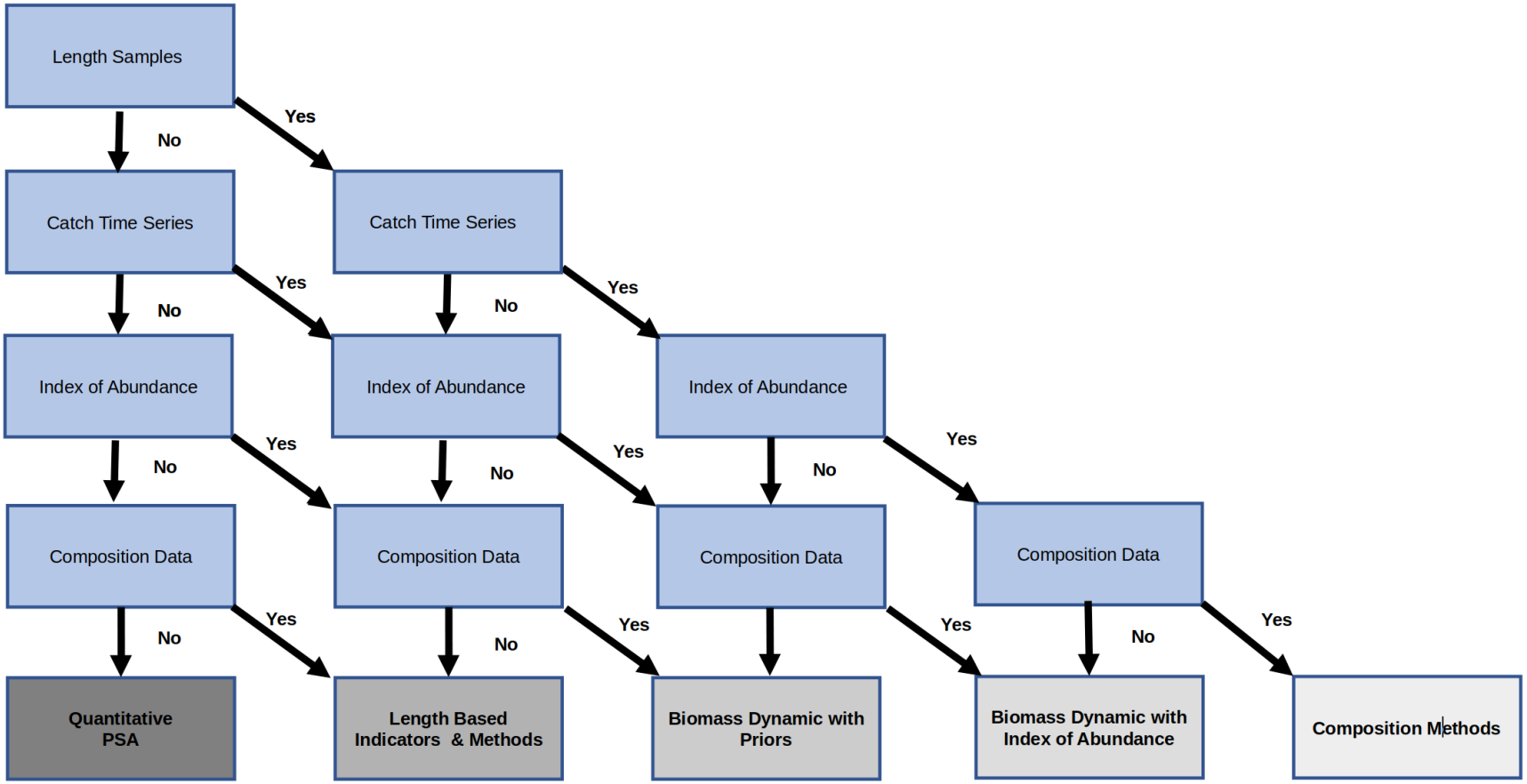
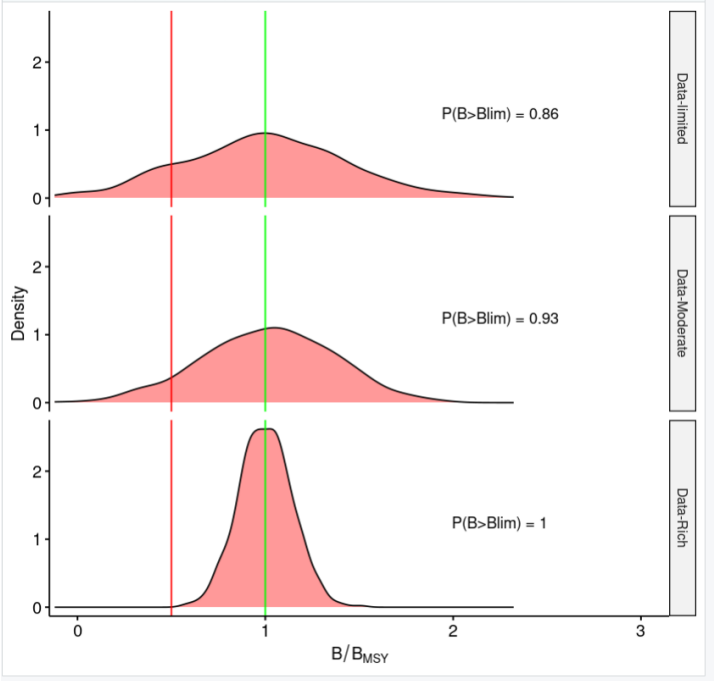


Figure 11 - Example simulation of estimates of B/BMSY for data-poor, moderate and rich stock assessments.

The red vertical line corresponds to Blim and the green line to BMSY.



3.2 Practical application of the framework

A hierarchical assessment and management framework based on risk equivalence will be used to assess fisheries sustainability based on conservation status, exploitation levels and other biological information. The burden of proof is on the proposer to show that the stock is and can be exploited within safe biological limits**.** To do this, there are three Levels with a responsibility on those exploiting the fishery to provide data and other evidence that fishing is sustainable.

Responsible Parties with roles:

- ***Fishing operator****:* the entity seeking fishing authorisation.
- ***Member State****:* Flag state of the fishing operator.
- ***Member State Scientists****:* Scientists nominated by Member State.
- ***Independent Scientist****:* Scientists not involved in the original assessment.
- ***European Commission****: DG MARE.*

3.2.1 Level 1

Level 1 represents the initial assessment phase, where a fishing authorisation request is evaluated to determine whether it can be granted.

Tasks and identification of the responsible parties: The tasks are designed to ensure that the authorisation process is thorough, transparent and based on the best available scientific and policy information. The goal is to promote sustainable fishing practices that are in line with the CFP and other relevant environmental and fisheries management standards.

1. **Submission of the request:**
    - **Task:** The fishing operator or their representatives submit a formal request for fishing authorisation, stating target species/stocks, season, area, and gears.
    - **Responsible Party:** Fishing operator.

2. **Initial Screening:**
    - **Task:** The Member State conducts a preliminary review to ensure that the request is complete and meets basic submission criteria.
    - **Responsible Party:** Member State or designated regulatory bodies.

3. **Eligibility check:**
    - **Task:** Member State authority verifies that the applicant and the fishing operation meet eligibility requirements, such as legal standing, compliance history, and adherence to relevant regulations.
    - **Responsible Party:** Member State or designated body.

4. **Compliance with CFP:**
    - **Task:** Evaluate the request to ensure that it aligns with the objectives and rules of the CFP, including sustainability principles and conservation measures.
    - **Responsible Party:** Member State, potentially in consultation with the European Commission.

5. **Evaluation of Documentation:**
    - **Task:** Review supporting documents, such as vessel details, target species, fishing gear, and area of operation, to ensure accuracy and completeness.
    - **Responsible Party:** Member State, potentially in consultation with the European Commission.

6. **Consultation with Scientific Institutes:**
    - **Task:** Contact national scientific institutes or STECF for input on the possible impact of proposed fishing activities on stocks and ecosystems.
    - **Responsible Party:** National scientific institutes or STECF.

7. **Public Comment (if applicable):**
    - **Task:** Provide an opportunity for public comment or stakeholder participation to gather additional input on the request.
    - **Responsible Party:** European Commission, with the participation of the public, NGOs, and other stakeholders.

8. **Risk Assessment for VMEs (for high seas):**
    - **Task:** Assess potential risks to VMEs and other sensitive habitats that may be affected by proposed fishing activities.
    - **Responsible Party:** National scientific institutes.

9. **Decision to Grant or Deny Request:**
    - **Task:** Decide based on the information collected, scientific advice, and policy considerations. If the request is granted, move to Level 2 to set the conditions for the fishing.

- **Responsible Party:** Member State after consulting the European Commission.

10. **Notification of Decision:**
    - **Task:** Communicate the decision to the applicant, providing the reasons for the decision and any conditions or next steps if the request is granted.
    - **Responsible Party:** Member State.

3.2.2 Level 2

Level 2 sets the conditions under which the fishery can proceed, following the initial granting of a fishing authorisation request at Level 1. This phase ensures that fishing activities are carried out in a sustainable manner and in compliance with regulatory requirements. These tasks are designed to operationalise sustainable management of fisheries by setting clear and enforceable conditions based on scientific evidence and stakeholder input. The aim is to balance the economic interests of the fishing industry with the need to preserve marine resources and ecosystems for future generations.

Tasks and identification of the responsible parties:

1. **Development of Fishing Conditions:**
    - **Task:** Define specific conditions for the fishing operation, which may include quotas, gear restrictions, bycatch limits, and areas or times of operation.
    - **Responsible Party:** Member State, potentially in consultation with the European Commission and in consultation with scientific bodies and stakeholders.

2. **Sustainability Assessment:**
    - **Task:** Conduct a preliminary assessment of the sustainability of the proposed fishing activities, considering the impact on target stocks, bycatch species, and ecosystems. Identify data and knowledge gaps and specify how an assessment at Level 3 will be conducted.
    - **Responsible Party:** National scientific institutes.

3. **Impact on VMEs (high seas):**
    - **Task:** Evaluate the potential impact of fishing activities on VMEs and other sensitive habitats, proposing mitigation measures if necessary.
    - **Responsible Party:** National scientific institutes.

4. **Stakeholder consultation:**
    - **Task:** Engage with stakeholders, including the fishing industry, environmental NGOs, and local communities, to gather input on the proposed conditions.
    - **Responsible Party:** Member State.

5. **Adaptation of Fishing Practices:**
    - **Task:** Require adjustments to fishing practices based on sustainability assessment and stakeholder feedback, such as modifying gear types or implementing bycatch reduction techniques.
    - **Responsible Party:** Fishing operators, under the guidance of the Member States in consultation with the European Commission.

6. **Monitoring and Reporting Requirements:**
    - **Task:** Establish requirements for monitoring catches, bycatch, and adherence to the set conditions, including reporting mechanisms.
    - **Responsible Party:** Fishing operators, with oversight from Member States in consultation with the European Commission.

7. Compliance with International Obligations:

- **Task:** Ensure that the conditions align with international agreements and obligations related to fisheries management and marine conservation.
- **Responsible Party:** Member States in consultation with European Commission, potentially in consultation with international bodies.

8. Licence Issuance:

- **Task:** Issue a fishing licence that formally sets out the conditions under which the fishery is authorised to operate.
- **Responsible Party:** Member State.

9. Education and Training:

- **Task:** Provide education and training to fishers and others on the conditions for sustainable fishing practices and compliance requirements and assessment methods.
- **Responsible Party:** Member State.

10. Establishment of Review Mechanisms:

- **Task:** Set up mechanisms for periodic review of the compliance of the fishery with the conditions and the effectiveness of the conditions in ensuring sustainability.
- **Responsible Party:** Independent scientists.

11. Communication of conditions:

- **Task:** Clearly communicate the set conditions to the fishing operators, including any penalties for noncompliance.
- **Responsible Party:** Member State.

3.2.3 Level 3

Level 3 represents the phase where a stock assessment is required for the renewal of fishing authorisation, typically after a fishery has been in operation for a set period, such as five years. This phase is critical to ensure the long-term sustainability of the fishery by evaluating the health of the fish stocks and the impact of fishing activities. It is also critical that the renewal of fishing authorisation considers up-to-date scientific evidence, and that fisheries management is adaptive, i.e., responds to changes in stock status and ecosystem health. The goal is to maintain fish stocks at sustainable levels and to minimise the negative impacts on marine ecosystems.

3.2.3.1 Risk equivalence in tiered stock assessment frameworks

The tiered framework applies risk equivalence across levels to ensure that fishing pressure remains within safe limits. At level 1, i.e., in situations lacking detailed stock and fisheries data, risk equivalence advocates for precautionary management measures. Therefore, it sets low fishing mortality levels to serve as a buffer against uncertainty and to safeguard stock sustainability. Risk equivalence also encourages improvements in data collection by providing economic incentives for research efforts aimed at reducing uncertainty and, hence, increasing harvest levels. Therefore, risk equivalence ensures sustainable fisheries management by maintaining consistent risks across stocks, even under data-limited conditions. The framework is adaptable and allows management measures to be adjusted based on the level of uncertainty as new data becomes available and the understanding of resource dynamics improves. Highlighting the importance of adaptive management and continuous data collection efforts.

This structured approach at different levels using the principle of risk equivalence ensures sustainable fisheries management by maintaining consistent risks in all stocks, even under data-limited conditions. It underscores the importance of adaptive management, ongoing data collection efforts, and the development of innovative assessment methods tailored to data-limited situations.

F- and B-based reference points: Reference points based on fish mortality and biomass to guide management decisions.
Maximum sustainable yield (MSY) and precautionary approach: Aim for sustainable harvest levels by setting catches low unless evidence permits an increase.
Level 1: Risk assessment: Use PSA for preliminary risk assessments.

I. **Inputs:** Basic life history parameters, susceptibility, and productivity data of the stock or species.
II. **Methods:** PSA focussing on the productivity of the stock/species and its susceptibility to fishing. Provides proxies for and with probability distributions.
III. **Outcomes:** Management plan that includes precautionary management measures in the absence of detailed data and how data will be collected to perform an assessment at Levels 2 and 3.

Level 2: Management plan: Details of how assessments should be performed based on the data collected during fishing, based on indicators or quantitative methods.

I. **Inputs:** catch, effort, and length data **with** biological samples, e.g., on length, age, and maturity.
II. **Methods:** Initial assessment based on indicators or quantitative methods. For example, evaluations of stock trends based on catch per unit effort (CPUE), or the use of length-based indicators (LBIs) to assess conservation of juveniles and large individuals and optimal yield (Kell *et al*., 2022).
III. **Outcomes:** Identifying data and knowledge gaps for progression to level 3 assessments.

Level 3: Quantitative or indicator-based assessment: Perform stock assessment using quantitative methods or indicators and the establishment of reference points and decision rules.

I. **Inputs:** Comprehensive data on catch, effort, size composition, and biological parameters.
II. **Methods:** Use of indicators to assess stocks relative to reference points.
III. **Outcomes:** Renewal of fishing authorisation based on assessment.

General approach across Levels
The same general approach is recommended across levels for consistency, following good practice principles for stock assessment**.**

I. **Select indicators:** Choose appropriate SMART indicators based on fishery characteristics and data availability.
II. **Define reference points and decision rules:** Establish benchmarks and rules for management actions.
III. **Evaluate the performance of the indicator:** Assess the effectiveness of indicators against defined reference points and benchmarks in identifying overfishing and stock recovery.
IV. **Implement management actions:** Adjust fishing practices based on assessment results to ensure sustainable fishing, using both mortality-based and biomass-based reference points.

3.2.3.2 Review Process

Structuring the review process across the three levels with clear objectives, dependencies, checklists, and reporting templates, will ensure a comprehensive, systematic, and transparent approach to sustainable fisheries management and the implementation of conservation policies. This framework facilitates the alignment of fishing activities with conservation objectives and regulatory requirements, promoting responsible and sustainable use of marine resources.

Level 1: Initial assessment
Objectives:

1. Evaluate the eligibility and preliminary sustainability of the fishing authorisation request.
2. Ensure compliance with legal and conservation standards.

Dependencies:

3. Submission of a comprehensive monitoring plan and a PSA.

Checklist for the European Commission:

4. ☐ Eligibility verification based on legal standing and compliance history.

5. ☐Evaluation of the monitoring plan and PSA documentation for sustainability and risk analysis.

Proformas for Member States:

6. Fishing Authorisation Request Form
7. Sustainability Assessment Form - Monitoring and Reporting template

Level 2: Management plan - ensuring sustainable fishing practices

Objectives:

8. Establish conditions under which the fishery may proceed, ensuring sustainability and compliance.
9. Conduct initial stock assessments or evaluations based on available data to identify gaps and prioritise management actions.

Dependencies:

10. Approval of the Level 1 assessment.
11. Development of specific fishing conditions such as quotas, gear restrictions, and bycatch limits.

Checklist for the European Commission:

12. ☐ Verification of the development and implementation of fishing conditions.
13. ☐ Review of sustainability assessment and impact on VMEs.
14. ☐ Confirmation of stakeholder participation and adaptation of fishing practices based on feedback.

Proformas for Member States:

15. Detailed management plan report template covering compliance, conditions, sustainability assessment findings, adaptations implemented, and action items for the next assessment.

Level 3: Quantitative or indicator-based assessment

Objectives:

16. Conduct a comprehensive stock assessment to evaluate the status of the fish stock and determine sustainable harvest levels.
17. Assess the broader ecological impact of the fishery and adjust management measures accordingly.

Dependencies:

18. Successful completion of assessments and conditions set in Levels 1 and 2.
19. Availability of detailed data on catch, effort, stock abundance and biological parameters.

Checklist for the European Commission:

20. ☐ Comprehensive review of stock assessment and data analysis.
21. ☐ Assessment of the impact of fisheries on the ecosystem and stakeholder engagement.
22. ☐ Determination and communication of sustainable harvest levels and management adjustments.

Proformas for Member States:

23. Full stock assessment reporting template including methodology, data collection and analysis, ecosystem impact review, stakeholder engagement summary, and management change implementations

3.2.3.3 Tasks and identification of the responsible parties:

1. Conduct stock assessment:

- **Task:** Carry out a comprehensive stock assessment to assess the status of the fish stocks exploited by the fishery.
- **Responsible Party:** Members-state scientists possibly in collaboration with independent scientists

2. Data collection and analysis:

- **Task:** Gather and analyse data on catch, effort, stock abundance, and biological parameters to inform stock assessment.
- **Responsible Party:** Member States to coordinate fisheries observers, research institutions, and the fishing industry.

3. Review of fishery impact on ecosystem:

- **Task:** Assess the broader ecological impact of the fishery, including effects on non-target species, habitats, and ecosystem structure.
- **Responsible Party:** Environmental agencies or specialised scientific bodies.

4. Stakeholder engagement:

- **Task:** Consult with stakeholders, including fishers, industry representatives, conservation groups, and local communities, to incorporate their knowledge and concerns into the evaluation process.
- **Responsible Party:** Member States.

5. Determination of sustainable harvest levels:

- **Task:** Use the results of the stock assessment to determine sustainable harvest levels and adjust management measures accordingly.
- **Responsible Party:** Members State scientists in conjunction with independent scientists.

6. Adjustment of fishing authorisation:

- **Task:** Based on the stock assessment, revise the conditions of the fishing authorisation to ensure continued sustainability, which may include changes in quotas, gear restrictions, or closed areas.
- **Responsible Party:** European Commission.

7. Peer review of stock assessment:

- **Task:** Subject the stock assessment to peer review by independent experts to validate the findings and recommendations.
- **Responsible Party:** Independent scientists.

8. Decision on renewal of authorisation:

- **Task:** After reviewing, decide whether to renew the fishing authorisation. Based on the results of the stock assessment and peer review.
- **Responsible Party:** Member State in consultation with the European Commission.

9. Communication of decisions and conditions:

- **Task:** Communicate the renewal decision and any new or adjusted conditions to fishing operators and stakeholders.
- **Responsible Party:** Member States.

10. Implementation of management changes:

- **Task:** Implement any changes to fisheries management as required by the renewal decision, including monitoring and enforcement of new conditions.
- **Responsible Party:** Member States in consultation with the European Commission.

11. Monitoring and compliance:

- **Task:** Establish ongoing monitoring to ensure compliance with the new conditions and to monitor the status of stocks and ecosystem.
- **Responsible Party:** Member States.

3.3 Conservation status

The following section provides an example of conducting a Level 1 analysis for the species specified in Table 14 to provide a conservation status. This begins with the productivity analysis, followed by the susceptibility analysis to produce the PSA. From the 30 species and area combinations caught by EU vessels in third countries presented in Table 1, a limited number of case studies were chosen aimed at showing differences across species to test the generic applicability of the framework. The criteria were based on providing a contrast across:

- Catch level (based on FAO reported catches 2015-2019)
- FAO Statistical Area
- Coastal waters and offshore
- Species type (finfish, crustaceans and cephalopods); and
- Data availability for stock assessment and assessment type.

The shortlist (Table 14) includes some instances of the same species across two or more geographic areas. These selections were made to reflect species in different areas which have varying levels of associated data, stock assessment, and associated fishing pressures (e.g. *Epinephelus aeneus* (White grouper), *Parapenaeus longirostris* (Deep-water rose shrimp) and *Chaceon maritae* (West African geryon)). Additions were made for specific cases where some misreporting may be occurring (e.g. *Macruronus magellanicus* and *Macrourus holotrachys*). This resulted in a shortlist of 14 stock-area combinations (developed in discussion with CINEA and DG-MARE). Stocks are categorised as targeted and bycaught; assessed and non-assessed, and the data availability defines the appropriate assessment methods, and management advice (Table 14).

It is worth noting that the data quality categories listed here are defined after Lucena-Frédou *et al.*, 2017 and are described in Table 13. The data categories for evaluating the productivity and susceptibility of stocks are divided into five tiers, representing data quality and availability. Tier 1 represents the highest data quality, with comprehensive and reliable information available for assessing both productivity and susceptibility attributes. This tier includes stocks with well-studied life history traits, high-quality catch and effort data, and robust stock assessment models. Tier 2 represents moderate data quality, with some information available for assessing productivity and susceptibility attributes. This tier includes stocks with some life history traits studied, reasonable catch and effort data, and stock assessment models with some uncertainty. Tier 3 represents low data quality, with limited information available for assessing productivity and susceptibility attributes. This tier includes stocks with poorly studied life history traits, limited catch and effort data, and stock assessment models with high uncertainty. Tier 4 represents the lowest data quality, with little to no information available for assessing productivity and susceptibility attributes. This tier includes data-poor stocks with very limited life history traits studied, little to no catch and effort data, and no stock assessment models available. Tier 5 is where no data are available. These data categories are essential for determining the appropriate assessment methods and management advice for each stock, as well as identifying data gaps and prioritizing research efforts to improve data quality and availability.

Table 14. Summary of species and area combinations selected.

Location	FAO Area	Species Code	Scientific name	English name	Data Quality	Target/bycatch
XIN	41	SQA	*Illex argentinus*	Argentine shortfin squid	1	Target
XIN	41	SQP	*Doryteuthis (Loligo) gahi*	Patagonian squid	1	Target
XIN	41	GRM	*Macruronus magellanicus*	Patagonian grenadier	2	Target
XIN	41	POS	*Micromesistius australis*	Southern blue whiting	1	Target
CSW	34	GPW	*Epinephelus aeneus*	White grouper	5	Bycatch
XIN	41	TOP	*Dissostichus eleginoides*	Patagonian toothfish	1	Target
CSW	34	OCC	*Octopus vulgaris*	Common octopus	2	Target
CSW	47	CGE	*Chaceon maritae*	West African geryon	3	Bycatch
CSW	34	DPS	*Parapenaeus longirostris*	Deep-water rose shrimp	5	Target
CSW	47	DPS	*Parapenaeus longirostris*	Deep-water rose shrimp	2	Target
CSW	34	CGE	*Chaceon maritae*	West African geryon	2	Bycatch
XIN	41	MCH	*Macrourus holotrachys*	Bigeye grenadier	5	Bycatch
CSW	47	GPW	*Epinephelus aeneus*	White grouper	No data	Bycatch
CSW	47	ARV	*Aristeus varidens*	Striped red shrimp	2	Target

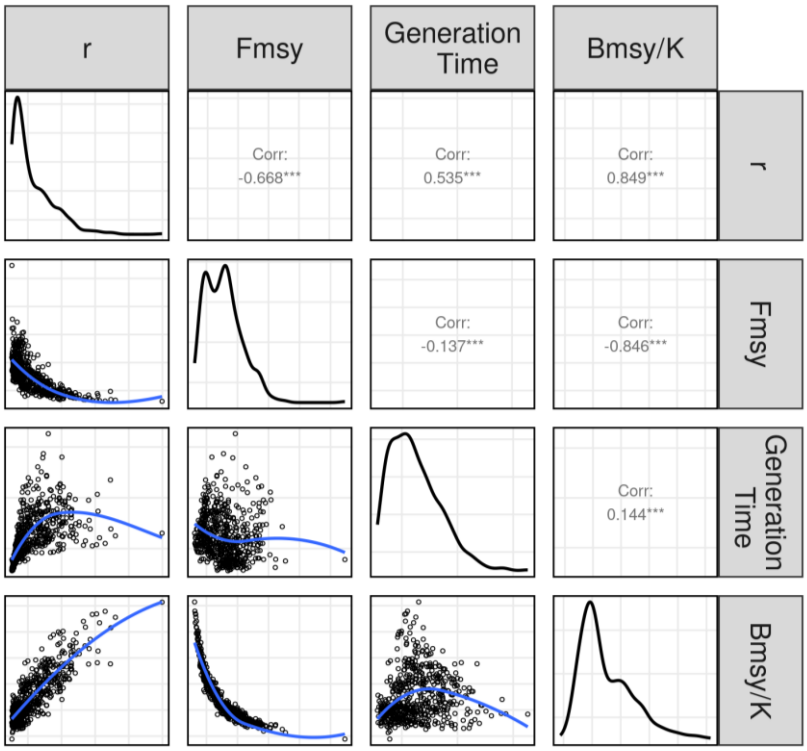
N.B. CSW refers to Coastal State Waters; XIN refers to High Seas. The data quality tiers are described in Table 163.

3.3.1 Productivity Analysis

This requires priors to be developed based on life history and the derivation of fishing mortality (F) reference points. Data were extracted from FishBase for the originally specified species. Population

growth rate (r), used as a prior in biomass dynamic assessment methods, derived using FishLife. The prior for population growth rate is compared to other derived quantities, such as the fishing mortality that would provide the maximum sustainable yield (F_{MSY}), generation time and the ratio of B_{MSY} to virgin biomass (Figure 12). Generation time indicates how quickly an individual can replace itself and provides a benchmark for rebuilding time. Relationships between parameters are shown in Figure 12, using parameters extracted from Fish Base, i.e. von Bertalanffy growth parameters ($L_{infinity}$, k) and length at maturity (L_{mat}), and the estimate of population growth rate.

Figure 12 - Pairwise scatter plots for population growth rate (r) prior, fishing mortality target (FMSY), generation time and the ratio of biomass target (BMSY) to virgin biomass.



The population growth rate (r) prior and derived quantities are summarised by species in Figure 13, the prior for r in

Figure 14 and the estimates of FMSY in

Figure 15. Limit reference points can be derived from F_{MSY} as F_{lim} = 1.5 F_{MSY} and F_{crash} = 2 F_{MSY}.

Figure 13 - Boxplots plots by for selected species for r prior, FMSY, generation time and the ratio of BMSY to virgin biomass.

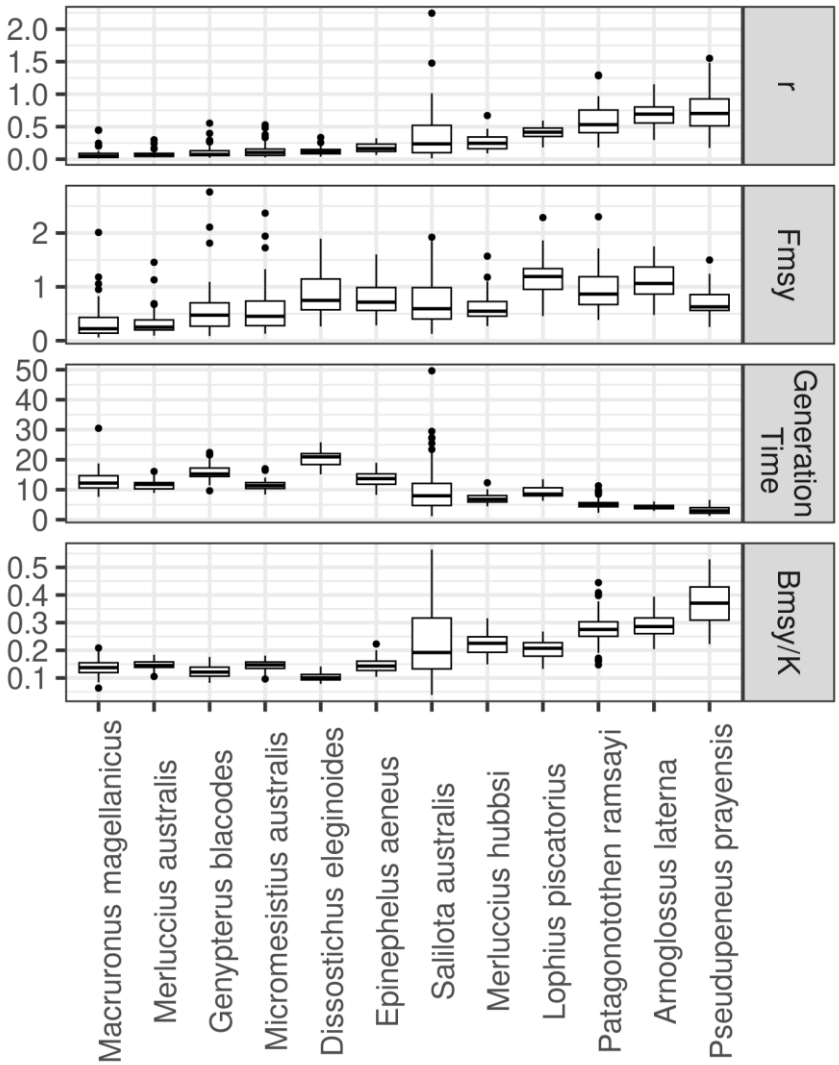


Figure 14 - Priors for population growth rate (r).

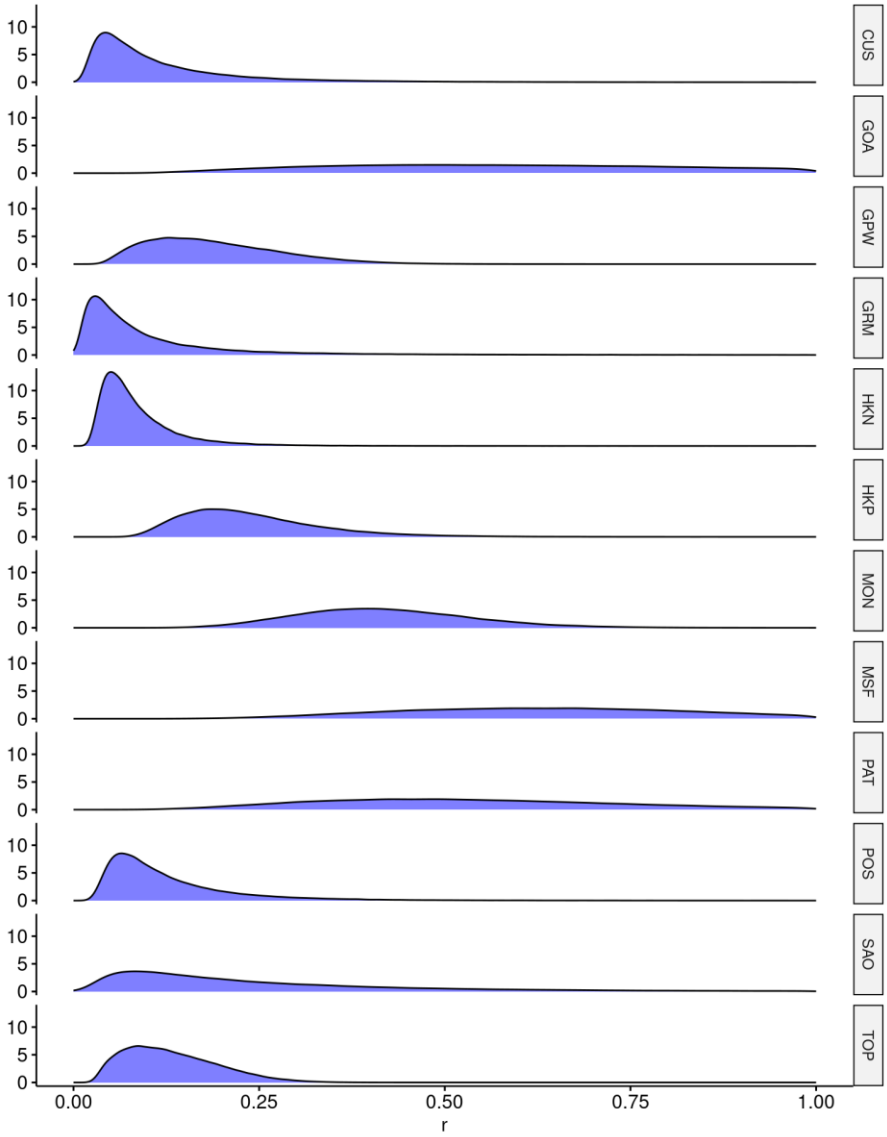
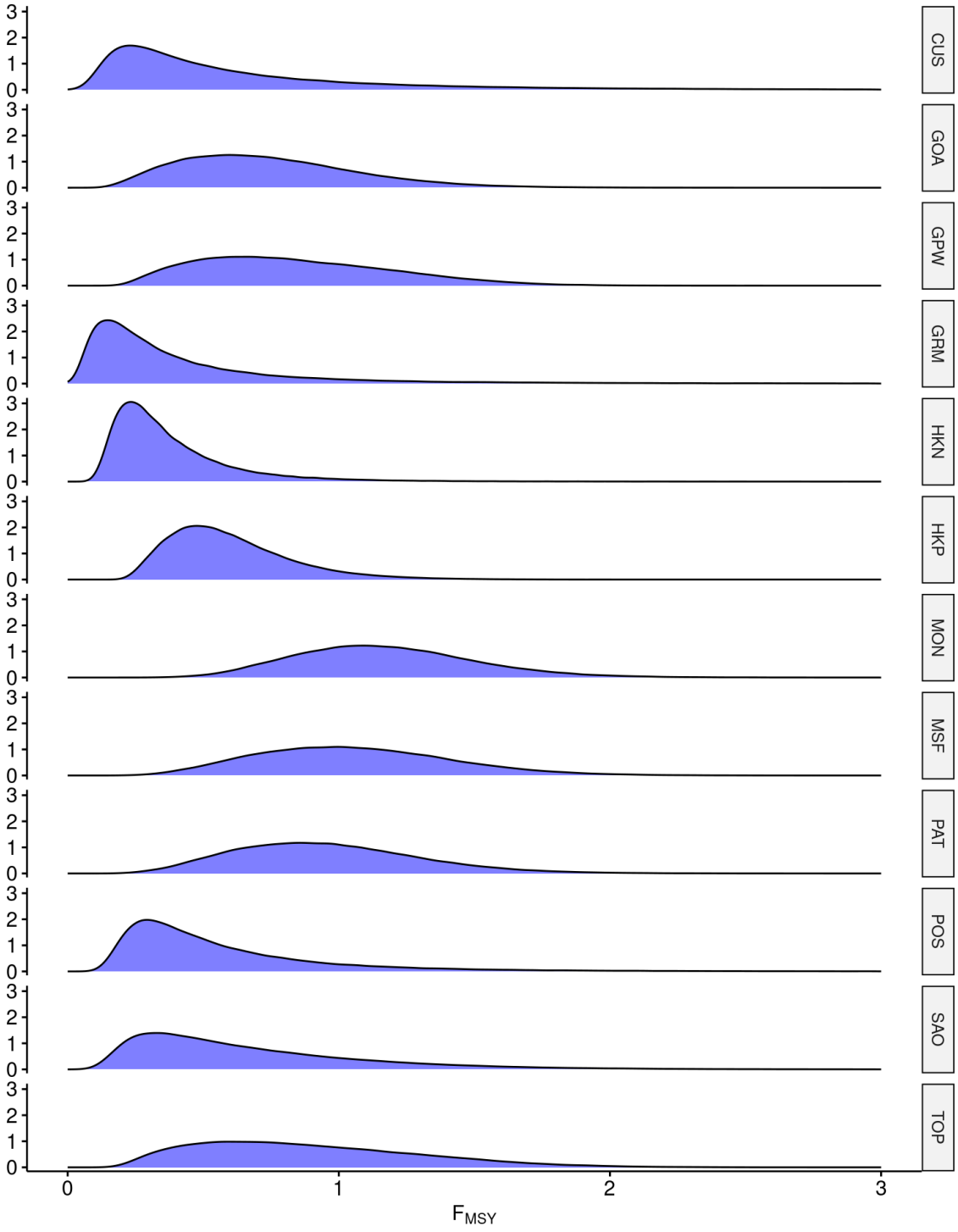


Figure 15 - Estimates of FMSY.



3.3.2 Susceptibility Analysis

The susceptibility of each stock to fishing was characterised according to 12 key parameters including the vertical overlap between fishing gear and the stock, seasonal migration of the stock and the desirability of value of the fishery. Each of these parameters is scored on a (low/medium/high) scale and the overall susceptibility is calculated.

The susceptibility of a stock or species is assessed by the response to twelve elicited questions that relate to catchability and management (Table 15). Susceptibility describes the probability of a species or stock being encountered and impacted by a fishery, based on attributes of a stock's range, habitat, behavioural responses and other characteristics that affect its catchability and post-capture survival. In addition, management attributes consider how the fishery is managed, as fisheries with conservative management measures are less likely to be overfished. A challenge is to make these attributes applicable across a wide range of species and fisheries. The tool uses 12 susceptibility (7 catchability and 5 management) attributes based on the system developed by NOAA (Patrick et al., 2009).

The susceptibility attributes' parameterisation relies on expert elicitation or literature review. In the next stage, aspects of catchability, such as a real overlap, will be automated using APIs to connect to online databases of fishing effort by gear (e.g. Global Fishing Watch) and species distribution maps (AquaMaps or other tailored online resources).

The data quality categorisation used in the tool is also based on that used by NOAA (Patrick et al., 2009). The same scoring system can be applied to expert elicitation for susceptibility attributes, where the scores relate to an expert's uncertainty in their elicited response. The NOAA methodology places expert opinion in data quality score 4 (Table 16), but we deviate from this given that experts with a high degree of knowledge and experience of a species or stock in a given area may be able to provide responses and judge the amount of uncertainty surrounding their choice of response as is done by many risk assessment panels such as Expert Working Groups at European and Mediterranean Plant Protection Organisations (EPPO), European Food Standards Agency (EFSA) and Great Britain Non-Native Risk Assessment Forum (GB-NNRAF).

Table 15. Susceptibility categorisation (Patrick et al., 2009).

Susceptibility attribute	**Low (1)**	Moderate (2)	High (3)
Spatial Overlap	< 25% of stock occurs in the area fished	25% to 50% of the stock occurs in the area fished	> 50% of the stock occurs in the area fished
Geographic concentration	Stock is distributed in > 50% of its total range	Stock is distributed in 25% to 50% of its total range	Stock is distributed in < 25% of its total range
Vertical overlap	< 25% of stock occurs in the depths fished	Between 25% and 50% of the stock occurs in the depths fished	> 50% of stock occurs in the depths fished
Seasonal migrations	Seasonal migrations decrease overlap with the fishery	Seasonal migrations do not substantially affect the overlap with the fishery	Seasonal migrations increase overlap with the fishery
Schooling/Aggregation and other behavioural responses	Behavioural responses decrease the catchability of the gear	Behavioural responses do not substantially affect the catchability of the gear	Behavioural responses increase the catchability of the gear (i.e. hyperstability of CPUE with schooling behaviour).
Morphology affecting capture	Species shows low selectivity to the fishing gear	Species show moderate selectivity to the fishing gear	Species show high selectivity to the fishing gear
Desirability/Value of the fishery	Stock is not highly valued or desired by the fishery (< 2$/kg; < $500K/yr landed; < 33% retention).	Stock is moderately values or desired by the fishery ($2 - $5/kg; $500K – $10,000K/yr landed; 33 – 66% retention).	Stock is highly valued or desired by the fishery (> $5/kg; > $10,000K/yr landed; > 66% retention).
Management strategy	Targeted stocks have catch limits and proactive accountability measures; non-target stocks are closely monitored.	Targeted stocks have catch limits and reactive accountability measures	Targeted stocks do not have catch limits or accountability measures; non-target stocks are not closely monitored.
Fishing rate relative to *M*	< 0.5	0.5 – 1.0	> 1
Biomass of spawners (SSB) or other proxies	B is > 40% of B0 (or maximum observed from time series of biomass estimates)	B is between 25% and 40% of B0 (or maximum observed from time series of biomass estimates)	B is < 25% of B0 (or maximum observed from time series of biomass estimates)
Survival after capture and release	Probability of survival > 67%	Probability of survival between 33% and 67%	Probability of survival is < 33%
Fishery impact to EFH or habitat in general for large non-targets	Adverse effects absent, minimal, or temporary	Adverse effects more than minimal or temporary but are mitigated	Adverse effects more than minimal or temporary and are not mitigated

N.B. Grey Red shaded cells indicate attributes associated with catchability and grey cells indicate attributes associated with management.

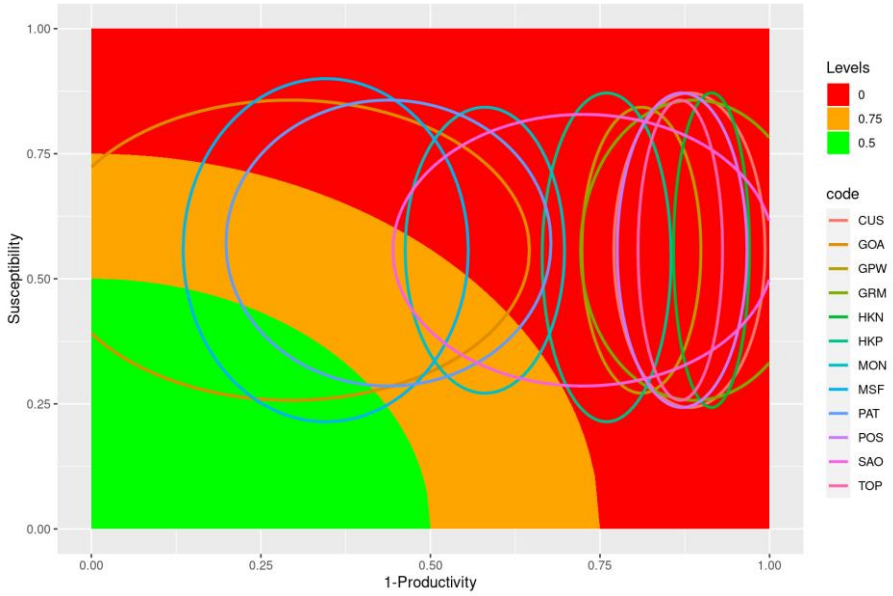
Table 16 - Data quality categorisation (Patrick et al., 2009).

Data quality score	Description	Example
1	(Best data) Information is based on collected data for the stock and area of interest that is established and substantial	Data rich stock assessment, published literature that uses multiple methods, etc.
2	(Adequate data) Information with limited coverage and corroboration, or for some other reason deemed not as reliable as Tier 1 data	Limited temporal or spatial data, relatively old information, etc.
3	(Limited data) Estimates with high variation and limited confidence and may be based on similar taxa or life history strategy.	Similar genus or family, etc.
4	(Very limited data) Expert opinion or based on general literature review from wide range of species, or outside of region.	General data – not referenced.
5	(No data) No information to base score on – not included in the PSA, but PSA but included in the DQI score.	

3.3.3 Productivity susceptibility analysis

Figure 13 presents the PSA Risk plot, where the ellipses represent the uncertainty. It shows that there is large uncertainty about susceptibility compared to productivity. This is because productivity is based on life history data and theory, for which the data is relatively good. However, data on fishing and spatial and temporal distribution of the target species is poor.

Figure 13 - PSA risk plot, based on the parameters extract for the selected case studies.



3.3.4 Interpretation

The results of a PSA analysis for a stock will return a risk level. This is not directly comparable to a conservation status as derived from a stock assessment but would give a clear indication if a stock could be exploited sustainably. Where a PSA risk assessment is in the red area of the risk plot, we would not recommend that fishing should take place. Where the PSA risk assessment is in the orange area of the risk plot, we would recommend that fishing may take place if all other checks are okay, but additional data may need to be collected and the PSA conducted again once new data have been added to the process. When the PSA risk assessment plot is in the green area, we would recommend that fishing is allowed to occur, where all other criteria have been met.

For those species where no stock assessment exists, we would recommend that a PSA is always conducted. For the SMEFF priority species that do not have a stock assessment, the following table format (see Table 17) would clearly demonstrate in lieu of the conservation status with the PSA risk level.

Table 17. Example summary table of PSA results.

FAO Area	Species Code	Scientific name	English name	Target / Bycatch	Demersal / Pelagic	PSA Risk Level
47	*OCC*	*Octopus vulgaris*	Common octopus	Target	Demersal	
34	*GPW*	*Epinephelus aeneus*	White grouper	Target	Demersal	
41	*MCH*	*Macrourus holotrachys*	Bigeye grenadier	Bycatch	Demersal	
34	*MWU*	*Mullus argentinae*	Argentine goatfish	Bycatch	Demersal	
47	*MON*	*Lophius piscatorius*	Angler (monk)	Bycatch	Demersal	

4 VME INDICATOR SPECIES

This chapter describes the structure of vulnerable marine ecosystems (VME) indicator species that are known or likely to occur in the high seas of FAO fishing Areas 34 and 41. Given that Area 47 is covered by SEAFO, it is excluded from this chapter. It is worth noting that under the Framework Contract EASME/EMFF/2019/014 for the "Provision of scientific advice for fisheries beyond EU waters", Specific Contract Nº 01 is a study on "Improving environmental sustainability of deep-sea fisheries with emphasis on the conservation of VMEs". The aim of the study was to assess and improve the scientific data and advice as well as relevant management measures, regarding the environmental sustainability of deep-sea fisheries and the protection of VMEs (Durán Muñoz *et al.* 2023). The study identified best practices to inform and strengthen EU policy choices, in particular, the context for EUs participation in RFMOs and Regional Fisheries Bodies (RFBs). The final report from the study is available at https://op.europa.eu/en/publication-detail/-/publication/8a9b0297-3b24-11ee-bd8d-01aa75ed71a1/language-en/format-PDF/source-290974875.

The assessment of the current study was therefore aligned to the VMEs study (Durán Muñoz *et al.* 2023) to ensure the two studies are complementary and avoid duplication.

4.1 FAO Area 34

There are no recent reports on fisheries in the high seas of Area 34 under the fisheries Committee for the Eastern and Central Atlantic (CECAF). However, there are underwater features that could potentially hold deep-sea fisheries in the CECAF area, as it is the case for several seamounts within the areas beyond national jurisdiction (ABNJ) which are potentially fishable including parts of the Mid-Atlantic Ridge, seamounts in the northern CECAF, Sierra Leone Rise and the Guinea seamount chain (FAO, 2017).

Catches of fisheries from the ABNJ areas of CECAF have been relatively low and only reported for a few isolated years. The earliest data in the FAO FishStat database for CECAF are from 2002, corresponding to alfonsinos (*Beryx spp*) fished by Portugal and Spain in FAO Statistical Areas 34.2.0, 34.4.2, and 34.4.1 (Tandstad, 2016; FAO, 2017).

Angola (FAO 47), which is included in the CECAF area of competence as a de facto situation, reported ABNJ catches for Patagonian toothfish (*Dissostichus eleginoides*) using longlines, deep-sea red crab (Chaceon spp) using pots, and alfonsino (*Beryx splendens*) and orange roughy (*Hoplostethus atlanticus*) catches using bottom trawls (mainly in an overlapping area with SEAFO) (FAO, 2017).

An experimental longline fishery for alfonsino was conducted by the Instituto Español de Oceanografía (IEO) on the high seas of the eastern central Atlantic Ocean, on four seamounts in the Sierra Leone Rise during seven months in 2001. Catches of commercial species obtained from the four vessels involved and for the study period were around 268 tonnes of commercial species, 90% corresponding to alfonsino (Ramos, 2001). Results showed that the high yields of alfonsino obtained in some of the seamounts could maintain a seasonal and strictly controlled longline fishery although the isolation of the zone and the risk of stock collapse in an area especially sensitive to overfishing should be considered. This fishery was not developed further by Spain.

The limited deep-sea fisheries operating in the CECAF ABNJ might be explained by their high-cost operations (FAO, 2017). The first discussions on the identification of VMEs within CECAF date back to 2016. At its 21st session, the Committee recommended CECAF members to respect the SEAFO VME closures in the overlapping area of competence between CECAF and SEAFO (FAO, 2016; Tandstad, 2016). Apart from this small area closed to bottom fishing in this overlapping jurisdiction SEAFO- CECAF, there are no other areas in CECAF that are closed to protect VMEs.

Very few high seas surveys relevant to the identification of VMEs have been carried out in CECAF waters. Some surveys using underwater cameras were carried out on high seas seamounts in the southern Azores region (Pakhorukov, 2008) and in the Sierra Leone Rise (Pakhorukov, 1999), but they were mainly focused on fish species. More recently, in January 2022, a survey was conducted in the Sierra Leona Ridge onboard the R/V Dr. Fridtjof Nansen, as a joint effort between the EAF-Nansen Programme and CECAF[4]. The aim was to collect data to document the distribution of VME indicator taxa and habitats, to elucidate environmental drivers regulating the distribution of VMEs and associated species and to assess the degree of human impact on these seamounts, among other complementary studies. Five seamounts of the Sierra Leone Rise were surveyed by ROV, i.e. the Annan, Falsos, Perdido, La Meseta and Rompetodo seamounts. All five seamounts appeared highly suitable for the colonization of VME indicator taxa and development of VME habitats. Identified VME indicator taxa included cold-water corals, sponges, stylasterids (hydrocorals) and xenophyophores. Identified VME habitats included coral gardens, sponge gardens, mixed coral and sponge gardens, cup coral fields, cold-water coral reefs, seapen fields and xenophyophore gardens. In conclusion, this survey identified, described, and mapped the distribution of VMEs at selected seamounts within the CECAF area, information that can be directly used to support management recommendations. Furthermore, collected data can serve as the basis for the prediction of VME habitats in a wider area of the eastern central Atlantic Ocean allowing further management considerations to be made.

4.2 FAO Area 41

The bottom fisheries of the southwest Atlantic were reviewed with information obtained from national questionnaires (Bensch *et al.,* 2009). It was noted that there is a general paucity of information about the high seas' fisheries in this region. FAO fisheries statistics, the main source of information, do not differentiate between high seas and national catches, but catches by vessels of non-South American countries are known to have been taken on the high seas. The main demersal fisheries are for Argentine hake and Argentine shortfin squid and are typically conducted with bottom trawls and jigs on sandy bottoms on the shelf flats.

There is no regional fisheries organisation that cooperatively manages the bottom fisheries of the high seas portion of the southwest Atlantic. The lack of a subregional or regional fisheries management organization means there are no internationally adopted conservation and management measures relating to the identification and management of VMEs in Area 41. In this region, only the European Union (Spain) has studied its bottom fishing footprint and unilaterally applied measures for the protection and conservation of VMEs. This includes mapping of the fishing footprint and the closure to bottom fishing in nine areas deeper than 400 metres to its flag vessels, due to the probability of the presence of VMEs. However, non-EU flagged vessels operate in this region, which to date have not yet implemented regulatory measures for the protection of VMEs. On the other hand, as there is no RFMO covering this region, there is also no scientific coordination to assess fishery resources in international waters.

The IEO and the General Secretariat of Fisheries of the Spanish Ministry of Agriculture, Food, and Environment, carried out between the years 2007 and 2010 a series of benthic surveys on the Patagonian shelf and adjacent slope in the southwest Atlantic under the ATLANTIS project (Portela *et al.*, 2012; del Rio *et al*, 2011; Muñoz *et al.*, 2012). The study area was located on the high seas, between latitudes 42° and 48°S east of Argentina and north of the Falklands/Malvinas Conservation Zone. It covered part of the continental shelf and upper slope and extended to a depth of 1,600 m on

[4] Findings from Nansen survey on the Sierra Leone Rise will support decision-making for the long-term protection of vulnerable ecosystems in the Central Atlantic (https://www.fao.org/in-action/eaf-nansen/news-events/detail-events/en/c/1476447/).

the middle slope. The main objectives of these campaigns were: i) the quantitative and qualitative description of the biotopes, ecosystems or communities identified as VMEs; (ii) the identification of the vulnerable organisms eventually found in the study area; and (iii) to assess the potential negative impact of bottom trawl fishing on them.

The ATLANTIS project swath-mapped for the first time, large areas of the Argentine Continental Margin (ACM) off the Argentinean EEZ from 41º30´S to 48ºS, obtaining full data coverage of the seafloor in this region between the outermost continental shelf and the middle slope down to 1600 m water depth contour (Portela *et al.*, 2012; del Rio et al, 2011; Muñoz *et al.*, 2012). This series of 13 multi-disciplinary research cruises carried out by the IEO in the High Seas Patagonian Shelf (HSPS) between the years 2007 and 2010 identified aggregations of cold-water corals at depths of between 400 and 1000 m, colonized by many other species (Durán Muñoz et al., 2012; Ríos et al., 2012; Portela *et al.*, 2015 a,b,c).To the north of the Falkland Islands Conservation Zone, the VMEs present and their associated substrate have been mapped and described in detail, mainly on the upper and mid-slope of the continental shelf, where cold water corals are found (López-Martínez *et al.*, 2011; Portela *et al.*, 2012; Muñoz *et al.*, 2012; FAO, 2016). In addition, VMEs have been identified and described in the southern Brazilian Sea, where extensive and continuous areas of deep coral reefs between 400 and 900 m depth have been recorded (CBD, 2012). High diversity coral garden communities between 300 and 500m depth, sponge aggregates between 250 and 1300 m depth and several deep marine rocky environments were found.

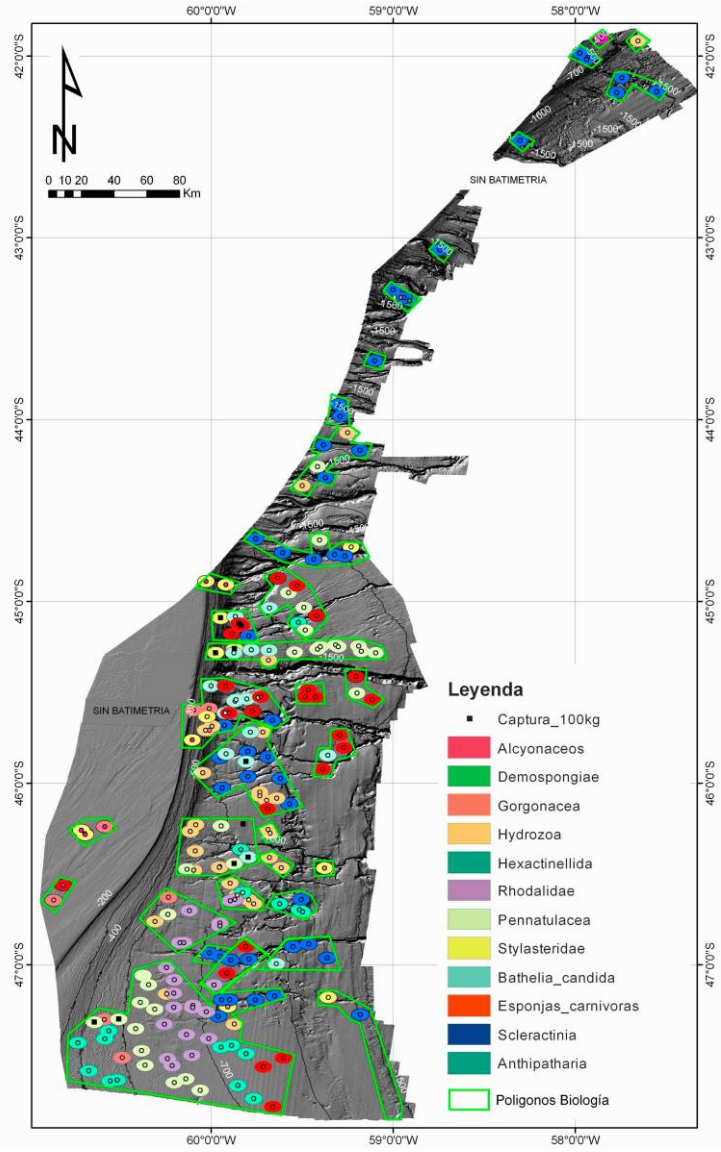
In general, the largest biomasses of cold-water corals were found between 400 and 1,000 m, sometimes in shallow areas with sandy substrates, forming both small aggregations and large reefs several metres high. The most frequent species is the colonial stony coral *Bathelia candida*, endemic to South American waters, which gives rise to complex three-dimensional structures that form habitats of enormous richness and biodiversity. Most *Bathelia candida* communities are formed by dead individuals, which have been colonised by other filter-feeding species, corals, sponges, molluscs, brachiopods, echinoderms, and crustaceans. In addition, other representative species of cold-water corals have been identified including: i) stony corals, developed on soft substrates, gravels or mollusc remains (e.g. *Flabellum* spp., *Javania* spp.), or on other colonial stony corals (e.g. *Desmophyllum dianthus*); and ii) soft corals, such as alcyonaceans and gorgonians, some of which also develop on stony corals. Reefs in the southern Brazilian Sea are mainly composed of five structuring species: hard white coral, white madrepore and other stony corals such as *Solenosmilia variabilis*, *Enallopsmmia rostrata a*nd *Dendrophyllia alternata* (CBD, 2012).

In the area north of the Falkland Islands Conservation Zone, VMEs are dominated by octocorals (colonies of different genus in the Primnoidae, Isidadade, Paragorgidae, Plexauridae, Acanthogorgidae families, among others), sponges, colonial scleractinia (*Bathelia candida*), hydrocorals (*Errina* spp., *Cheiloporidion pulvinatum, Sporadopora* sp., *Stylaster densicaulis*) and the Alcyonacea and Pennatulacea orders (see

Figure 14). Deep-water sponge aggregations are mainly formed by species belonging to the demosponge and hexactinellid classes, and generally coexist in the same locations as cold-water corals. The most important structuring sponges in the area are glass sponges (*Rosella* sp.), which provide a three-dimensional structure on which other species live, hunt, or find refuge from predators and ocean currents. On the other hand, although carnivorous demosponges usually colonise hydrothermal vents and abyssal zones, new species have been found in this area at depths shallower than 1,500 m.

Figure 14. Positions of all the organisms considered as vulnerable or sensitive according to the United Nations and OSPAR criteria, resulting from the research campaigns executed by the R/V Miguel Oliver (2007-2010) in the High Seas of the Patagonian Shelf.

Conservation areas surrounding these zones (light green boxes) are shown. Source: Del Río et al 2012.



Council Regulation (EC) Nº 734/2008 on the protection of vulnerable marine ecosystems from the adverse impacts of bottom fishing gears was adopted by the European Union in June 2008 following the adoption of UNGA Resolution 61/105. The Regulation establishes that the competent authorities of an EU Member State can only issue special fishing permits for the use of bottom fishing gears on the high seas if specific conditions are met. Member States are obliged to carry out an assessment of the potential impacts of the vessels intended fishing activities and can only issue a special fishing

permit after concluding that such activities were not likely to have significant adverse impacts on vulnerable marine ecosystems.

The concept “VME” is defined in Council Regulation (EC) Nº 734/2008 but not “VME indicator”, also a move-on rule is specified but the concept “encounter” is not clearly defined (lack of indicators and threshold levels) (Sacau et al., 2021a). For Spanish bottom trawlers fleet an encounter with VME indicator species, adopted by the General Secretariat for Fisheries, is defined as catch per haul of more than 7 kg of sea pens (Order Pennatulacea) and/or 60 kg of other live coral (Order Scleractinia, Order Alcyonacea, Order Gorgonacea, Family Stylasteridae, Order Antipatharia) and/or 300 kg of sponges. This is similar to the thresholds previously utilised by some RFMOs to establish encounters with VMEs, particularly NEAFC and NAFO.

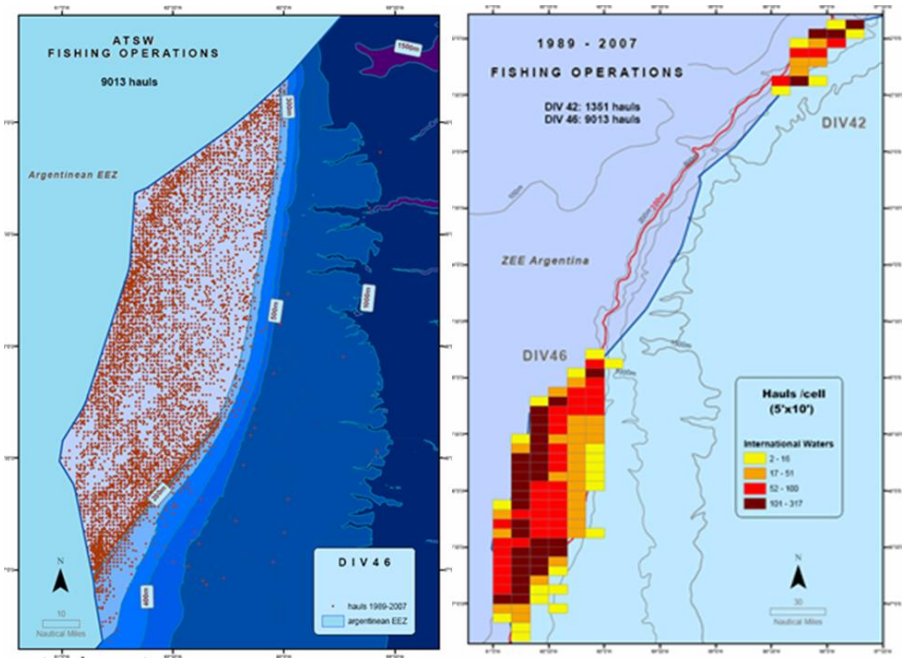
4.3 Spatial overlap of VMEs with current (and historic) fishing operations

The fishing fleet operating in the region operates solely under the regulations that apply to its flag country (FAO, 2020). The bottom fishing fleet in international waters of FAO Area 41 generally operates in shallow areas where the depth is less than 300 metres, mainly in FAO Subareas 3.1 and 3.2, beyond Argentina's EEZ and outside the Falklands Conservation Zones. However, the bottom longline fleet also operates at greater depths in the continental shelf area reaching international waters.

The main fisheries in this region are for Argentine hake, southern hake and Patagonian squid, which are caught by bottom trawling; and Argentine squid, which are currently caught by pelagic trawling and pot line. Currently, there is very little information on fishing effort in international waters of the Patagonian Shelf (Sacau *et al.*, 2021a). The fishing activities of Spanish trawlers in the high seas take place mainly between parallels 44ºS and 48ºS (Division 46S) and secondarily in the fishing grounds around parallel 42ºS (Division 42S) (Figure 17). The majority of fishing effort (99%) recorded between 1989 and 2007 has taken place in Division 46S, at depths of less than 300 metres In Division 42S, fishing is seasonal, and the target species is Argentine squid between 500 and 1,000 m depth.

Figure 15. Location of commercial hauls and fishery footprint (5’×10’) of the Spanish bottom trawl fleet on the HS of the Patagonian Shelf (1989-2007).

Source: Del Río et al., 2012.

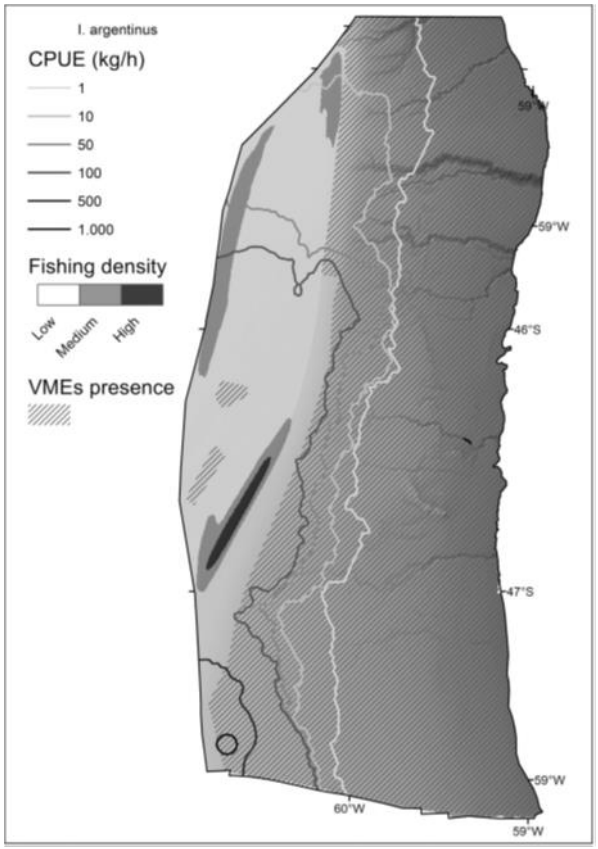


The vulnerable species groups, communities and habitats are mainly distributed beyond the 500 m depth contour. The presence of organisms considered as vulnerable is almost negligible in the fishing area. This fact is almost certainly due to bottom trawling operations of international fleets taking place in the study area for nearly 50 years. Also, the fishing grounds are far away from the geographical location of the main geomorphological features such as canyons, trenches, gas and fluid seepages observed in the middle slope, and identified as potential sites for VMEs. The current fishing activity from the Spanish fleet does not overlap deep-water VMEs. However, although the overlap of VMEs with current fishing operations was found to be almost negligible, it remained unknown whether this absence was a consequence of the impact of previous fishing activities. The displacement of the fishing fleet to target deep-sea species at greater depths, were the existence of VMEs has been observed, could have a negative impact on those ecosystems and the potential threat of such a fishing strategy should be assessed.

The abundance of the main target species and potential VME distribution (Vilela et al, 2018) showed potential overlaps between several commercial, or potentially commercial, species and VMEs in the HSPS. Higher abundances of *I. argentinus* were found in suitable trawling areas up to 700m depth. A change in the current *Illex* spatial fishing pattern could directly affect the northern and southern VME areas (Figure 16) which should be considered for any future management measure.

Figure 16 - Surveyed area of the HSPS during the PATAGONIA and ATLANTIS series of surveys performed between 2007 and 2010 by the IEO.

Source: Vilela et al., 2018.



NB: The study area limits to the west with the Argentinean EEZ border, to the east with the 1500 m bathymetric contour, and to the south with the Falklands Outer Conservation Zone (FOCZ). The fishing density (a) and CPUE (b) of Illex are represented in the figure legend. (a) The shaded area shows fishing density (low-white, medium-grey and high-black). (b) Likewise, the contour lines (colour scale lines from grey to black) represent the CPUE obtained in the ATLANTIS surveys that showed higher abundances of Illex located in suitable trawling areas up to 700 m in the southwest area. A changed in the current spatial fishing effort could affect the southern VME area.

5 HISTORICAL AND ONGOING SCIENTIFIC RESEARCH PROGRAMMES

This chapter describes the relevant previous and current EU and non-EU scientific research programmes both on the high seas and in the EEZs of coastal States in FAO areas 34, 41 and 47, that are not party to an SFPA with the EU or a RFMO. The aim is to provide the Commission with an understanding of the current and historical research landscape on species in areas where EU vessels fish or might fish in future. The specific objectives are:

1. To generate a database of scientific research programmes on the high seas which meet the eligibility criteria necessary for fishing vessel to comply with the requirements of Article 24(b) of the SMEFF Regulation (European Parliament, 2017);
2. Compile all information to describe each scientific research programmes identified; and

3. Use the information gathered to describe the important administrative and scientific aspects of the research programmes.

Prior to conducting a desk-based review of scientific research programmes, an analysis determining the species-area combinations of all SMEFF species in each of the three FAO areas was required. AquaMaps probability of occurrence data from FishBase (Froese and Pauly, 2023) was used to determine the distributions of each species with respect to EEZs and high seas boundaries in FAO areas 34, 41, and 47. Maps were produced for different species in each of the three FAO areas, this was then used to complete an occurrence matrix to guide the desk-based search for scientific research programmes. As a result, research programmes were identified from third countries not within the defined scope of this project, as it was deemed important to include information of transboundary stocks which may have useful stock status information which could be fed into future license assessments.

Searches were then performed online and through communication with the relevant RFMOs and coastal and flag States to identify what research was conducted for each species. Data sources included: i) scientific and grey literature; ii) governmental and inter-governmental information; and iii) high seas scientific research programme specific websites. The review noted those scientific research programmes that are “part of a research programme, including a scheme for data collection, organised by a scientific body”, which has been “validated by a scientific institute in the flag Member State”, according to which the requirements of Article 24(b) of the SMEFF Regulation. These programmes would meet the existing requirements, but other programmes were also noted, as these may be included as part of Chapter 6 where recommendations are made on scientific research programmes. It was noted that these existing programmes may meet the requirements of Article 24(b) given some support and modification.

Information on each of the scientific research programmes identified was compiled in a Microsoft Access database for ease of reference. This information included:

- Participants/contributors (e.g. scientific institute of the flag Member State involved);
- Objectives;
- Area of operation (i.e. geographical location);
- Species / fish stocks involved;
- Data collection protocols (length distributions, biological sampling, collection samples for laboratory analysis, etc); and
- Information on any existing national/international (EU and non-EU) fishery research programmes/surveys, including FIPs and relations with the EU MAP under the DCF.

The different research programmes were highlighted and the information on each programme compiled in a database of all relevant research programmes as well as an indication of whether it is fisheries dependant or independent. Fisheries dependent research programmes monitor the harvest of marine resources as they are caught and landed at ports (e.g. monitoring fishing directly on fishing vessels or conducting port sampling at common fisheries landing sites). These methods rely on the fisheries sector for their data collection. Fisheries independent research programmes are typically conducted without any reliance on the fisheries sector for data collection. These programmes typically conduct experimental fishing while sampling important habitat metrics (e.g. planktonic surveys and water temperature and oxycline etc.).

5.1 Results

5.1.1 FAO Area 34

FAO area 34 has the highest coverage of scientific research programmes, with port sampling the most frequently used in the region (Table 18). A breakdown of which countries conduct which type of research programme are provided for in Table 19.

Table 18 - Type and frequency of scientific research programmes found in countries of Area 34 and High Seas region.

Fisheries dependant or independent	Programme Type	Number of programmes
Dependant	Fisher Self-Sampling	1
Independent	Fisheries independent survey - Demersal	3
Independent	Fisheries independent survey - Pelagic	9
Dependent	Observer Programme	13
Dependent	Port Sampling	19
Independent	Underwater visual survey	1
	Total	**46**

Table 19 - Number of research programme types found by country for FAO Area 34.

Programme country	Fisher Self-Sampling	Fisheries independent survey - Demersal	Fisheries independent survey - Pelagic	Observer Programme	Port Sampling	Underwater visual survey
Benin				1		
Cabo Verde		1	1		2	
Cameroon					4	
Democratic Republic of Congo		1	1			
Côte d'Ivoire				1	3	
Equatorial Guinea					1	
Gabon			1	1		
Gambia			3		3	
Ghana			1	1	2	

Programme country	Fisher Self-Sampling	Fisheries independent survey - Demersal	Fisheries independent survey - Pelagic	Observer Programme	Port Sampling	Underwater visual survey
Guinea			1	1	1	
Guinea-Bissau			1	3	1	
Liberia			1	2	2	
Mauritania				3	2	1
Morocco		1		1		
Nigeria	1			1	3	
Senegal			4	1	3	1
Sierra Leone			2	1	2	
Togo				1		
Total	**1**	**3**	**16**	**18**	**29**	**2**

NB. Total number of programmes in this table for each country does not reflect totals listed under Table . This is due to double counting where a programme spans multiple countries.

The species that were found to be included within the scientific research programmes identified for Area 34 are displayed in Table 20. In total, 22 species were identified that were included within research programmes found in the area.

Table 20 - Species included within the identified scientific research programmes of Area 34 and High Seas region.

Scientific Name	Species ID
Aristaeomorpha foliacea	ARS
Aristeus antennatus	ARA
Aristeus varidens	ARV
Arnoglossus laterna	MSF
Chaceon maritae	CGE
Chaceon spp	GER
Dicologlossa cuneata	CET
Epinephelus aeneus	GPW
Lophius piscatorius	MON
Lophius spp	MNZ
Mullus argentinae	MWU
Mullus spp	MUX
Octopus vulgaris	OCC
Parapenaeopsis atlantica	GUS
Parapenaeus longirostris	DPS
Penaeus kerathurus	TGS
Penaeus notialis	SOP
Plesionika edwardsii	LKW
Plesiopenaeus edwardsianus	SSH
Pseudupeneus prayensis	GOA
Sepia officinalis	CTC
Todarodes sagittatus	SQE

5.1.2 FAO Area 41

Few scientific research programmes were found across FAO area 41 countries and high seas areas. In total, 14 programmes were identified across the region (Table 21). The most common of these being observer programmes. A breakdown of research programme type by country is provided in Table 22.

Table 21 - Type and frequency of scientific research programmes found in countries and High Seas region of Area 41.

Fisheries dependant or independent	Programme Type	No. programmes
Dependant	Fisher Self-Sampling	0
Independent	Fisheries independent survey - Demersal	6
Independent	Fisheries independent survey - Pelagic	2
Dependent	Observer Programme	5
Dependent	Port Sampling	1
Independent	Underwater visual survey	0
	Total	14

Table 22 - Number of research programme types found by country for FAO Area 41.

Programme Type	High Seas	Argentina	Brazil	Falkland Islands	Uruguay
Fisheries independent survey - Demersal	1	3		2	1
Fisheries independent survey - Pelagic			1		1
Observer Programme		2		2	1
Total	**1**	**5**	**1**	**4**	**3**

NB. Total number of programmes in this table for each country does not reflect totals listed. This is due to double counting where a programme spans multiple countries.

Species that were included within the scientific research programmes identified for Area 41 are displayed in Table 23. In total, 20 SMEFF species were identified to be included within research programmes found in the area.

Table 23 - Species included within the identified scientific research programmes of Area 41 and High Seas region.

Scientific Name	Species ID
Cirrhoscyllium japonicum	OPJ
Dissostichus eleginoides	TOP
Genypterus blacodes	CUS
Illex argentinus	SQA
Loligo gahi	SQP
Loligo spp	SQC
Loligo vulgaris	SQR
Macrourus holotrachys	MCH
Macruronus magellanicus	GRM
Merluccius australis	HKN
Merluccius hubbsi	HKP
Merluccius patagonicus	HVP
Merluccius spp	HKX
Micromesistius australis	POS
Patagonotothen ramsayi	PAT
Phycis blennoides	GFB
Phycis spp	FOX
Raja spp	SKA
Salilota australis	SAO
Sepiidae, Sepiolidae	CTL

5.1.3 FAO Area 47

Few scientific research programmes were found across FAO area 47 countries and high seas areas. In total, 19 programmes were identified across the region Table 24). The most numerous programme type found is demersal fisheries independent surveys. A breakdown of which countries conduct which type of research programme are provided for in Table 25.

Table 24 - Type and frequency of scientific research programmes found in countries and High Seas region of Area 47

Fisheries dependant or independent	Programme Type	No. programmes
Dependent	Fisher Self-Sampling	3
Independent	Fisheries independent survey - Demersal	6
Independent	Fisheries independent survey - Pelagic	2
Dependent	Observer Programme	6
Dependent	Port Sampling	2
Independent	Underwater visual survey	1
	Total	**20**

Table 25 - Number of research programme types found by country for FAO Area 47

Programme Type	Angola	Namibia	Saint Helena, Ascension and Tristan da Cunha	South Africa
Fisher Self-Sampling		1	1	1
Fisheries independent survey - Demersal	1	2		5
Fisheries independent survey - Pelagic	1			1
Observer Programme	1	1		4
Port Sampling		1		1
Underwater visual survey			1	
Total	**3**	**5**	**2**	**12**

NB. Total number of programmes in this table for each country does not reflect totals listed under Table 22. This is due to double counting where a programme spans multiple countries.

Table 26 - Species included within the identified scientific research programmes of Area 41 and High Seas region

Scientific Name	Species ID
Aristaeomorpha foliacea	ARS
Aristeus antennatus	ARA
Aristeus varidens	ARV
Arnoglossus laterna	MSF
Chaceon maritae	CGE
Chaceon spp	GER
Dicologlossa cuneata	CET
Epinephelus aeneus	GPW
Lophius piscatorius	MON
Lophius spp	MNZ
Mullus argentinae	MWU
Mullus spp	MUX
Octopus vulgaris	OCC
Parapenaeopsis atlantica	GUS
Parapenaeus longirostris	DPS
Penaeus kerathurus	TGS
Penaeus notialis	SOP
Plesionika edwardsii	LKW
Plesiopenaeus edwardsianus	SSH
Pseudupeneus prayensis	GOA
Sepia officinalis	CTC
Todarodes sagittatus	SQE

5.2 Administrative and scientific aspects of the identified research programmes

This section describes the research programmes found in each FAO area, as well as their administrative and scientific characteristics. These programmes are broadly split into fisheries dependent programmes and fisheries independent programmes.

5.2.1 FAO Area 34

Review of fisheries research programmes in FAO Area 34 shows a range of both fisheries-dependent and -independent research programmes. These have largely investigated the status of demersal finfish stocks throughout West Africa, with most of them occurring since the 1980s and 1990s and with few using data more recent than 2018. This is potentially a sign of administrative lag between data collection, analysis, and presentation.

Fisheries dependent programmes

The research programmes found in FAO 34 were predominantly fisheries dependent (33 of the 46 programmes). This is likely the result of relatively lower funding towards fisheries management across the coastal states of FAO Area 34 compared to those in other FAO areas. Fisheries

dependent sampling requires less funding and resources, with some methods such as self-sampling requiring little involvement from fisheries managers and regulators. Port sampling was seen widely across the area for both artisanal and industrial fleets (n = 19). Its economic efficiency makes it a useful tool for nations where funding for fisheries management is limited. These port sampling programmes were typically carried out by national marine research centres such as NIOMR in Nigeria (Abohweyere, 1989; Nwosu *et al.,* 2010), and Instituto do mar in Cabo Verde, as well as and governmental departments charged with fisheries management such as NaFAA in Liberia and the Department of Fisheries in the Gambia (Palomares *et al.,* 2020). However, some historical port sampling was foreign funded. For example, the Senegal Sustainable Fisheries Project sampled artisanal and industrial flatfish catches across Senegal and The Gambia between 1998 and 2011, with funding coming from USAID and the World-Wide Fund for nature (WWF) (DeAlteris *et al.,* 2012). This allowed the assessment of the Gambia sole stocks in the EEZ of both countries. This review largely found nationally funded stock assessments in FAO area 34 to be based on fisheries dependent data such as port sampling and fisheries observer programs. Other fisheries dependent data were applied to assess bycatch, catch and effort analysis (both spatial and temporal), and biological data on target species. Other stock assessments applying fisheries dependent data were carried out by or with CECAF (Cook *et al.,* 2021), the Regional Fisheries Board (RFB) associated with the area, and with data from the FAO. In some cases, NGOs such as Sea Around Us also supported these stock assessments (Palomares *et al.,* 2020).

Most of the 13 observer programs found throughout FAO area 34 collected data from industrial fleets, with only one programme in Mauritania, sampling artisanal effort and catches (Lemrabott *et al.,* 2023). Some of these programmes have been running for 30 years and are typically coordinated by marine and fisheries research centres or national fisheries agencies. However, across all programmes it appears as though reporting does not reflect this observer coverage, with observer reports being difficult to find and access online. In most cases, these programmes were found through research papers referring to them as a data source. Details surrounding funding, administration, and data sampling techniques in the programmes were not found in most cases. Observer coverage across FAO Area 34 seems to be improving, with a new programme beginning in Cabo Verde (BirdLife International, 2022). However, it is difficult to find resources indicating how these will be run and funded. Observer data validity in some FAO 34 countries could be brought into question as direct payment of allowances from fishers to observers does occur, thereby creating a conflict of interest on the part of the observer. This practice has been abolished in some countries such as Liberia and Sierra Leone, where licensing revenues fund observer programmes. Where there is a relative lack of transparency on funding, data collection protocols, and reporting, there should be less confidence in the outputs of these research programmes.

There are also several scientific observer programmes on EU fisheries developed in FAO 34 within SFPAs, both on demersal and small pelagics fleets, which are implemented through the EU Data Collection Framework (DCF).

Spain has three scientific observer programmes on three types of demersal fisheries: i) the Spanish observer programme on black hake trawlers in Morocco, Mauritania and Senegal, initiated by the IEO in 2003; ii) the Spanish observer programme on shrimper trawlers in Mauritania and Guinea-Bissau, implemented and coordinated by the IEO since 2010 and iii) the Spanish observer programme on cephalopod-finfish trawlers in Guinea-Bissau initiated by the IEO in 2015 (García-Isarch et al., 2020).

There have been several observer programmes on board the pelagic EU trawlers operating in FAO 34, based on the multi-lateral agreement between MS with small pelagic fisheries in the area (The Netherlands, Lithuania, Latvia, Poland, and Germany). First was coordinated by Corten Marine Research (CMR), that acted on behalf of the Dutch institute IMARES (currently WMR), which in turn was assigned responsibility to set up an observer programme on board all EU trawlers in Mauritania (García-Isarch et al., 2020). Since the last multilateral agreement was concluded, the Polish National Marine Fisheries Research Institute (NMFRI) has been the coordinator of the joint sampling programme for the data collection of pelagic trawlers in the CECAF waters (RCG-LDF, 2023).

Information from EU observers in West African countries with SFPAs in FAO 34 was inventoried for the period 2014 to 2018, giving a good overview of the amount and quality of the information collected (García-Isarch et al., 2020). This information is organized into three datasets, following the DCF requirements: a) Biological data (including specific composition and size frequency), by catch fraction, for stocks caught outside EU waters; b) Data needed to assess the impact of EU fisheries on marine ecosystems; c) Detailed data on the activity of EU fishing vessels outside EU waters.

In contrast to the DCF observer programmes, existing information from SFPAs observer programmes from coastal states analysed for the same period, showed that they usually only cover the observation of fishery related data, and so fall under Monitoring, Control and Surveillance (MCS), and do not include scientific tasks such as biological sampling, despite these being required by the SFPA-Protocols (García-Isarch et al., 2020).

Manuals for each of the four main EU fishery developed in West African waters of FAO 34 through SFPAs were standardized with main coastal state involved, being available for the shrimper trawlers (García-Isarch et al., 2022), black-hake trawlers (Fernández-Peralta et al., 2022); cephalopod-finfish trawlers (Perales-Raya et al., 2020) and pelagic trawlers (Laptikhovsky et al., 2020).

The state of play of the EU data collection through observers' programmes or other sampling programmes in the CECAF area (FAO 34) is analysed on an annual basis by the Regional Coordination Group on Long Distant Fisheries (RCG-LDF) (last in RCG-LDF, 2023).

Fisheries independent programmes

This study found 13 fisheries independent survey programmes across the 28 countries in FAO 34. The majority of these were implemented by foreign marine institutes in Europe, often via the EAF-Nansen Programme in association with a national institute from FAO area 34. The remaining programmes were completed by national institutes such as the Oceanographic Research Centre of Dakar – Thiaroye (CRODT) (Palomares *et al.,* 2020; Sarré *et al.,* 2018; Sheriff *et al.,* 2009).

The EAF-Nansen Programme is implemented by Norway's Institute of Marine Research with guidance from the UN FAO, using the research vessel R/V Fridtjof Nansen to collect data relating to marine resources in and around the seas of developing nations. Historically, much of this work has been completed in FAO Area 34. The first of these research cruises was an acoustic survey of small pelagic fish off the coasts of Senegal and the Gambia, beginning in 1981 (Sarré *et al.,* 2018). Further hydroacoustic surveys have been conducted by the programme throughout Gabon, Democratic republic of Congo, Gambia, Ghana, Sierra Leone, Liberia, Guinea and Guinea-Bissau (Sarré *et al.,* 2018; Sheriff *et al.,* 2009). The programme has also carried out research into demersal stocks as part of the Nansen Transboundary Demersal Survey which covered several countries in FAO area 47 and the Democratic Republic of Congo and Gabon (Axelsen and Johnsen, 2015; Bianchi, 1992). This used benthic trawls to assess the stock structure of several species including Senegalese hake *(Merluccius senegalensis)*, deep-water Cape hake *(Merluccius paradoxus)*, Kingklip *(Genypterus capensis)*, common Dentex *(Dentex dentex)*, and monkfish species *(Lophius spp)*. The Nansen programme is still operating in the area with R/V Dr Fridtjof Nansen and has worked with fisheries institutions and divisions in FAO area 34 such as INRH (Morocco), IMROP (Mauritania), CRODT (Senegal), CIPA (Guinea-Bissau), CNSHB (Guinea), and the Marine Fisheries Research Division in Ghana, among others.

Most of the independent programmes completed by organisations from FAO area 34 nations were from the research centre in Senegal, CRODT. CRODT has been completing surveys since 2004, using the R/V Itaf Deme to conduct pelagic acoustic surveys in the continental shelves off Senegal, The Gambia and Sierra Leone (Sarré *et al.,* 2018; Sheriff *et al.,* 2009). The programmes in Senegalese waters have been funded by a combination of the National Agricultural Credit Fund (CNCAS), the Economic Promotion Fund (FPE), and commercial banks. The administrative management of the vessel and seafarers has been carried out by the National Agency for Maritime Affairs (ANAM), with supervision from the governmental department of merchant shipping. Where

the research vessel has assessed stocks in other waters, funding likely comes from the government of those waters, but this was not verified (WARFP, 2023).

The fifth nationally run fisheries independent programme monitored cephalopod stock status in Moroccan waters. Running between 1998 and 2010, the Cephalopod Stock Status-monitoring program used bottom trawls to sample cephalopod stocks, particularly that of the Common Octopus *(Octopus vulgaris)*. This programme was completed by the Institute National de Recherche Halieutique (INRH) using their vessel the Charif Al Idrissi throughout Moroccan waters and led to findings relating to the abundances, distributions, and migration and spawning habits of various cephalopods (Dridi *et al.,*2022; Srairi *et al.,* 2023; Thiaw *et al.,* 2011).

5.2.2 FAO Area 41

Fisheries dependent programmes

A limited number of programme types were found in FAO area 41, with the majority being focused on demersal finfish and cephalopods. Observer programmes were the only fisheries dependant programme type found in the area; these are operational in all the major coastal fishing nations of Area 41 except Brazil.

All observer programmes found were in industrial fleets under the remit of national fisheries agencies. For example, the Falkland Islands Fisheries Department fund scientific observers in all their fisheries operating within the Falkland Inner Conservation Zone/ Falkland Outer Conservation Zone, as well as opportunistically on the high seas surrounding the Falkland Island waters. These scientific observers collect data on vessel position, catch/effort, mortality, biological factors, conversion factor, and seabird/mammal interaction (Falkland Islands Government, 2023).

Spain implemented in 1989 a national observer programme for monitoring of fishing activities and collection of scientific and commercial data by the Spanish fisheries operates both within the Falklands Islands Conservation Zone and in the High Seas (Portela and Sanchez, 2012). The IEO is the research organization under the Ministry of Science, Innovation and Universities, that conduct and coordinates the observer programme in collaboration which The General Secretariat for Fisheries (Ministry of Agriculture, Fisheries and Food). These scientific observers record in a haul-by-haul basis data on fishing activity, catch and discards of target and non-target species, effort, position, depth, biological information, and length frequency samples and collect biological samples such as otoliths, stomachs, gonads, etc, for further analysis in the laboratory.

Uruguay also has a national observer programme, the responsibly of which is with the National Directorate for Aquatic Resources (DINARA), which falls under the Ministry of Animal Husbandry, Agriculture and Fisheries (MGAP). Detailed information about DINARA's observer programme is scare, but some information is available in scientific reports and journal articles. These reports indicate the existence of DINARA's National Observer Program Onboard Tuna Fishing Vessels (PNOFA), with available data on the longline fishery dating back to 1998 (Passadore *et al.,* 2015; Forselledo *et al.,* 2017a; 2019). Whilst tuna species are not relevant to SMEFF, this data collection does demonstrate a level of national coordination and capacity to implement such research programmes.

Argentina's national observer programme has collected biological fisheries information from the commercial fleet in their waters since 1994. INIDEP's Biological-Fisheries Environment Information Acquisition Program (observer programme) assists other national research programs such as the Oceanographic-Fisheries Information Program, the Information, Operations and Technology Directorate and the INIDEP Directorate with development and administration of the Integrated Oceanographic Fisheries Information System, INIDEPs data repository (Favero *et al.,* 2013). CeDePesca, a non-profit organisation founded in 1997, implement six observer programmes in the region while being involved in several FIPs for hake, Hoki and toothfish fisheries (Monterey Bay Seafood Watch, 2018). One of these is a collaborative FIP for Patagonian toothfish with ESTREMAR,

NUEVA PESCANOVA, PESANTAR and SAN ARAWA (CeDePesca, 2023a). CeDePesca's role in this is to implement improved and responsible management within the fishery, with the end goal of becoming a certified sustainable fishery. Both CeDePesca's Argentine Hake and Argentine Hoki FIPs involve fisheries operating within the Argentine EEZ (CeDePesca, 2023b; 2023c). Regular and transparent updates are available on CeDePesca's website regarding these FIPs.

Fisheries Independent Programmes

This research identified six fisheries independent programmes in FAO Area 41. These were mostly implemented by coastal nations' fisheries agencies, except for one being carried out by IEO in the High Seas (Tingley *et al.,* 2016). The most well documented fisheries independent programmes found in Area 41 are those run by government agencies of the Falkland Islands (Trevizan *et al.,* 2023; Winter *et al.,* 2023), Argentina (Guissi *et al.,* 2002; Alberto *et al.,* 2022), and Uruguay (Forselledo *et al.,* 2017b).

One exemplary fisheries independent program is the Falklands February Ground Fish Survey (Trevizan *et al.,* 2023). This has been carried out by the Falkland Islands Fisheries Department (FIFD) since 2010, with ten surveys conducted consistently in February 2010, 2011, and 2015-2022. Originally initiated to assess indicator species such as rock cod, more recently these surveys have extended their scope to include other commercial and bycatch species. An additional two surveys have been added to the survey schedule during the austral winter to account for the increasing importance of the hake fishery. Survey reports contain biological information for numerous SMEFF species including Patagonian toothfish, Southern Hake and Southern blue whiting (Trevizan *et al.,* 2023). FIFD also conduct Falkland calamari (*Doryteuthis gahi*) assessment surveys immediately prior to the season opening to estimate available stock for the season (Winter *et al.,* 2023). These surveys, conducted every February since 2006 within the 'Loligo Box', supplement the finfish research survey by providing additional data for other species such as the Longtail Southern cod and Patagonian toothfish, both of which are SMEFF species.

INIDEP have conducted fisheries independent research cruises in Argentinian waters since 1987 (Giussi *et al.,* 2002; Alberto *et al.,* 2022). A series of these expeditions assessed the abundance of the Patagonian grenadier, *Macruronus magellanicus*. Although no surveys were carried out between 1988 and 1991, surveys took place on an almost yearly basis up to 2000. These were carried out by one of INIDEPs two research vessels at the time, the Capt. Oca Balda and Dr E. L. Holmberg. This review was unable to determine whether these surveys continued into the 21st century, however more recently INIDEP conducted a series of research cruises in relation to their Argentinian Squid jig fishery for *Illex argentinius*. Surveys took place in 2004, 2009, 2012 and 2019 and were carried out by the RV Dr. Eduardo L. Holmberg and the RV Dr. Víctor Angelescu, both of which belong to INIDEP. Despite INIDEP having their own research vessels and contributing significantly to fisheries research in the region, annual reports describing their fisheries independent programmes were not found during this review.

Fisheries independent surveys carried out in Uruguayan waters are carried out by DINARA. However, the only fisheries independent research cruises found in this review were longline surveys conducted onboard DINARA's R/V Aldebarán (Forselledo *et al.,* 2017b). These surveys were found to be related to species covered by ICCAT.

Both INIDEP and DINARA also collaborate under the authority of a commission, created by the signing of a bilateral treaty between Uruguay and Argentina. The Comisión Técnica Mixta del Frente Marítimo (CTMFM; Technical Commission of Rio de la Plata and it Maritime Front Treaty) is a commission established by the signing of the Treaty of the Rio de la Plata and its Maritime Front in 1973. It is the only regional fisheries organisation in the Southwest Atlantic recognised by the UN-FAO, and it facilitates research within the Argentinean–Uruguayan Common Fishing Zone. The CTMFM is responsible for the administration of fisheries resources in the commission area, while also coordinating joint research campaigns in the Common Fishing Zone treaty area. For example, the Commission makes requests to both countries to carry out annual campaigns using their own

national research vessels to implement the joint annual campaign plan. The only SMEFF species included in this programme is *M. hubbsi*, the Argentine hake (Lorenzo and Defeo, 2015). No onboard scientific observer programme was found for the Common Fishing Zone. However, reports indicate the use of annual fisheries independent surveys and CPUE/landings data in a hake stock assessment.

The Brazilian government began surveys off the northern Brazilian coast in 1996 with the inception of the Survey of the Living Resources in the Exclusive Economic Zone (REVIZEE) (Prado and Drew, 1999). These interdisciplinary surveys were conducted in all four regions of Brazil (Northern, Northeastern, Central and Southern) using the RV Oregon. This programme also developed two distinct projects, PROTUNA and PRODEMERSAL, which ran from 2000 to 2002 and 2002 to 2004 respectively, utilising bottom trawls and pelagic lines (Klautau *et al.,* 2020). Despite criticism of the programme's low amount of data on species of no commercial value, some species lists were published – however this review was unable to gain access to these materials.

Following UNGA recommendation and the FAO Deepwater Guidelines, IEO carried out a series of benthic surveys on the Patagonian shelf and on adjacent slopes on the High Seas. This project, called the ATLANTIS project, was jointly coordinated by IEO as the scientific coordinator, and the Spanish SGM (Ministry of Environment, Rural and Maritime Affairs) (Tingley *et al.,* 2016). The project's focus was on VMEs, their identification and description, and damage mitigation. The project's relevance to this section comes from its analysis of the abundance and distribution of commercial species in the area. Part of this project involved conducting a series of 13 surveys between 2007 and 2010 onboard the R/V Miguel Oliver with bottom trawl gear. Of these cruises, three were aimed at sampling stock abundance and biomass indices for the commercially important *Macrourus carinatus*, *M. hubbsi*, and *Illex argentinus*.

5.2.3 FAO Area 47

This review found FAO Area 47 to have more observer programmes and demersal fisheries independent surveys than all other programme types combined. Both fisheries dependant and independent programmes were found in the region, with the largest number of programmes identified in South Africa and Namibia. In total, nine fisheries independent programmes and ten fisheries dependant programmes were found.

Fisheries dependent research

A total of six observer programmes were identified in FAO Area 47. Of these, four were in South Africa - the South coast Rock Lobster observer programme; the KwaZulu-Natal prawn-trawl fishery observers; the Fishery-dependent survey of net-fishery; and Monitoring of boat-based line fishery (Hutchings et al., 2009; DEFF, 2020). All identified South African observer programmes are conducted and funded by the Department of Environment, Forestry and Fisheries in South Africa. Similarly, Namibia also conducts numerous observer programmes which are organised and conducted by the national Fisheries Observer Agency (FOA). Namibia deploys observers within all their licenced fisheries which target crab, hake, monkfish, lobster, sharks, swordfish, and tuna, employing a variety of fishing methods. The FOA reports that observer coverage across the fisheries varies from 99% for the midwater trawl fishery and 0% in the Line fishery and the swordfish fishery (FOA, 2021).

Furthermore, IEO has also developed a scientific observer programme onboard the Spanish shrimper fleet in waters off Angola. It was set up in 2018, under request of the Spanish Administration, following the need to obtain scientific information on the sustainability of the resources exploited through direct authorisations in Angolan waters, as established by the SMEFF regulation. The observer data collection protocol (García-Isarch et al., 2021) is standardised with those established for the same fleet in other West African countries with SFPAs (Mauritania and Guinea-Bissau), to meet the requirements of the European Data Collection Framework-DCF, in EU DC-MAP. The programme aims to carried out four observed trips by year, trying to cover all months

except January-February (closed season). However, the programme has had several problems to reach the desired coverage: apart from the COVID-related issues during 2020, there is a general lack of scientific observers willing to embark, discouraged by the hard work and living conditions on these vessels, with low incentives.

Three fisher self-sampling programmes were found in area 47. Each of these are conducted by national agencies or administrative bodies from the respective countries. These include the St. Helena Government (Saint Helena Government, 2014), Namibia's Ministry of Fisheries and Marine Resources (Paterson and Kainge, 2014), and South Africa's Department of Environment, Forestry and Fisheries (DEFF, 2020). An example of these is St. Helena's self-sampling programme where commercial, recreational, and sports fishers are required to fill in logbooks, including measurements from a portion of their catches (Saint Helena Government, 2014).

Port sampling was found in two countries in Area 47. Namibia's MFMR monkfish port sampling programme collected port samples from April 2014 to December 2019 from Walvis Bay port (Erasmus, 2021). This programme was used to supplement data collected by onboard observers due to a lack of experience and required equipment at sea. This programme has since ended with no clear documentation as to why. The second port sampling programme identified was found in a 2009 South African report indicating the presence of landing site observers for offshore trawl fisheries, Small pelagic species, Westcoast Rock Lobster, abalone, and linefish (Hutchings *et al.,* 2009). Whether or not these programmes continued was unclear, with no mention of port sampling in South Africa's Marine Fishery Resource status report other than for CPUE data at landing sites for the lobster fishery.

Fisheries independent research

Two fisheries independent pelagic surveys were identified in FAO Area 47. These are conducted by two different organisations – one nationally, by the Department of Environment, Forestry and Fisheries in South Africa (Hutchings *et al.,* 2009; DEFF, 2020), the other internationally through collaboration with the EAF-Nansen Programme (FAO, 2023). The pelagic survey conducted through the EAF-Nansen programme is part of their international effort to help developing countries improve their fisheries management. Conducted in 2017, their Transboundary Pelagic and Ecosystem Survey took transects from Angola to South Africa with the aim of mapping and assessing the main pelagic resources in the area while collecting biological species data (FAO, 2023). The results of this species composition survey were not found in this review. Other Nansen surveys have completed in the region since 1985 have collected data on *Sardinella aurita, S. maderensis, Sardinops ocellata, Decapterus rhonchus, Selene dorsalis, Chloroscombrus chrysurus,* and *Brachydeuterus auritus*. The most recent Transboundary Pelagic and Ecosystem Survey was completed in 2022, surveying Namibian and Angolan waters. These pelagic surveys have links with other programmes such as the GEF-funded Large Marine Ecosystem project and the regional RFMO, SEAFO.

The EAF-Nansen programme is also involved in demersal fisheries independent surveys in the region, with the most recent Nansen Transboundary Demersal survey being completed in 2019 (FAO, 2023; Bianchi, 1992; Axlesen and Johnsen, 2015). This 118-day survey researched hake abundance, distribution, fecundity, and juvenile identification, as well as the abundance of monkfish and Kingklip. Ecosystem-related research questions were also addressed to better inform an Ecosystem Approach to Fisheries (EAF) in the region. The first bottom trawl surveys in Angola were conducted in 1985, with survey season, design, and target species varying between 1985 and 2001. Over the years, data was collected on shrimp species *A. varidens*, *P. longirostris*, seabream *Dentex* spp. and hake *Merluccius* spp. Since 2000, survey design has been standardised across stations, season, and depth. In Namibia, a similar approach has been taken since 1997, with surveys being standardised to the warm season (January-March) with the main target species being hakes (*M. capensis* and *M. paradoxus)* (Axelsen and Johnsen, 2015).

The funding source for South Africa's pelagic fisheries independent surveys was not found in this review, but literature indicates that collaboration between international organisations, funds and

management bodies of South Africa's marine resources does occur (Hutchings *et al.,* 2009). For example, following a marked decline in Chokka squid (*Loligo reynaudii*) in 2013, an initiative titled Sustainable Oceans, Livelihoods and food Security Through Increased Capacity in Ecosystem research in the Western Indian Ocean (SOLSTICE-WIO) was launched. The four-year SOLSTICE project, funded by Global Challenge Research Fund, aimed to identify key environmental and anthropogenic factors that influence ecosystem dynamics on the Agulhas Bank (DEFF, 2020).

One application of Underwater Visual Surveys was found in Area 47, in St Helena between 2002 and 2019. This programme monitors abundance and diversity of marine life and is funded by the St Helena Government. The data from this may be used alongside catch data in the stock assessment of grouper. It was not found whether this programme is still in operation today (Riley *et al.,* 2020).

6 RECOMMENDATIONS FOR FUTURE SCIENTIFIC RESEARCH PROGRAMMES

The aim of this chapter is to draw on the results and findings of the previous Chapter (Chapter 5) to provide a set of minimum criteria for future scientific research programmes to ensure SMEFF compliance. In addition, this chapter also assess the potential needs and possibilities for setting up joint EU collaborative research programmes between Member States. These recommendations are based on a common structure related to the following elements:

- Data collection protocols (e.g. fisheries dependent versus fisheries independent data collection protocols);
- The feasibility of self-sampling done by the fishing operators;
- Data analysis requirements;
- Sampling coverage (e.g. temporal and spatial); and
- Key species for inclusion within the scientific research programmes.

The simplest and most cost-effective way to do this is to define a set of standards for the above elements. This could include a series of templates for a particular fishery type (e.g. demersal trawl), species type, VME type encountered, or other issues, for example longline fisheries south of 20°S would require mitigation measures to reduce incidental mortality of seabirds. The existing research programmes can then be compared against the criteria established as the minimum recommended through a gap analysis to see which elements are missing, or may need to be expanded, in terms of spatial or temporal coverage. For example, a species fished in several coastal states EEZs and on the High Seas, where an established fisher-based logbook data collection and observer programme only exists in one EEZ where fishing takes place could be extended spatially to cover fishing across the fishery. Existing programmes can be adapted for specific cases where required, but the basic requirements for stock assessment, VME protection are described in the following section, as well as recommendations for way in which improvements could be made.

This would ideally be a stepwise improvement, with programmes rising to the higher categories in a defined manner. Recommendations and improvements are identified and implemented at each stage, with the programme being adjusted based on the experiences learned from previous data collection sections.

6.1 Data collection protocols

Recommendations for stock assessment data requirements for each ICES assessment category are described in Table 27.

Table 27 - Summary recommendations for data improvements by ICES category.

ICES Category	Description	Recommendations
1	Full analytical assessments and forecasts are possible	To retain category 1 status: • Data quality and coverage improvements may only be required.
2	Analytical assessments possible, but forecasts treated qualitatively (as trends)	To move to category 1: • Modelling methods developed for the species targeted and data collected to populate models (and those caught as bycatch) that can provide forecasts.
3	Data on how fish abundance and/or biomass has changed over time (mostly from research vessel surveys) is used to provide advice	To move to category 2: • Modelling methods developed and data collected for the species targeted (and those caught as bycatch) that can provide forecasts (qualitative). Data required includes age/length at first capture, age/length at first maturity, fecundity, spawning and nursery areas, collection of advanced observer and survey data e.g. otolith or other aging material to populate age length keys.
4	Advice is given on the bases of specialised modelling methods that use time series of catch data	To move to category 3: • Vessel logbook data and observer data sufficient to provide estimates of abundance on a geospatial basis, i.e. identifying local depletions or stocks. • Fisher independent surveys conducted to provide estimates of fish abundance. • Gear selectivity analysed and impacts on target and bycatch species.
5	Only commercial landings data are available;	To move to category 4: • Catch and effort data from logbooks to be collected over long time series, minimum three years. • Observer programme data (minimum 10% coverage) and port inspection data (minimum 5% coverage) to verify and supplement logbook data. • Modelling methods appropriate to the species targeted (and those caught as bycatch) developed that utilise the time series catch and effort data. • Data for PSA collected: for all target and bycatch species including growth rate, size frequency data, length-weight data and selectivity estimates.
6	Only bycatch data are available	To move to category 5: • Catch and effort data in the form of logbooks from all commercial fishing vessels (and artisanal estimates) to be collected. • Logbook data to be completed by fishers. • Effort data to be haul by haul, if possible, with accurate time and position data verified against independent sources e.g. VMS or AIS. • Catch data to be to species level where possible and group level where not possible. Grouped data to be disaggregated from sampling by observers or port inspectors. • Data for PSA collected: for key target species including growth rate, size frequency data, length-weight data and selectivity estimates.

For the research programmes identified under Chapter 5, there are several specific recommendations that would be recommended in terms of data analysis. These are summarised in Annex 10.

6.2 Data analysis requirements

Recommendations for stock assessment data analysis requirements for each ICES assessment category are described in Table 28.

Table 28 - Summary recommendations for data analysis improvements by ICES category.

ICES Category	Description	Recommendations
1	Full analytical assessments and forecasts are possible	To retain category 1 status: • Stock assessment appropriate to the stock biology and fisheries management practices, including the provision of forecasting (either within year or for subsequent years). Analysis of catch, effort, biological (from observer data and fisheries surveys) and other data are full defined and feed into the stock assessment and management processes. Projections included in the assessment process e.g. $p(B/B_{MSY}>1$ in 20 years >= 0.5).
2	Analytical assessments possible, but forecasts treated qualitatively (as trends)	To move to category 1: • Stock assessment appropriate to the stock biology and fisheries management practices, forecasting (either within year or for subsequent years) should be included into the stock assessment process. Analysis of catch, effort, biological (from observer data and fisheries surveys) and other data are full defined and feed into the stock assessment and management processes. New data may be required to develop the forecasting process.
3	Data on how fish abundance and/or biomass has changed over time (mostly from research vessel surveys) is used to provide advice	To move to category 2: • Develop a fully analytical stock assessment that is appropriate to the stock biology and to the fisheries management processes already in place in the fishery (e.g. quota managed fisheries). Analysis of catch, effort, biological (from observer data and fisheries surveys) and other data are full defined and feed into the development of appropriate stock assessment and management processes. New data may be required to develop the stock assessment.
4	Advice is given on the bases of specialised modelling methods that use time series of catch data	To move to category 3: • Analysis of trends in existing catch and effort data, e.g. seasonality, geospatial changes in stock distribution (migration), juvenile distribution and spawning areas.
5	Only commercial landings data are available;	To move to category 4: • Analysis of totals and trends for fishery/stock. No actual assessment is conducted.
6	Only bycatch data are available	To move to category 5: • No analysis, purely data collection to improve data collected for target stock, if data are purely reported as bycatch for the target species

For the research programmes identified under Chapter 5, there are several specific recommendations that would be recommended in terms of data analysis. These are summarised in Annex 10.

6.3 Sampling coverage and sample size

Recommendations for stock assessment data quality in terms of sampling coverage and sale size are described in Table 29.

Table 29 - Summary recommendations for data quality improvements by categories described in Parker et al. (2009).

Category	Description	Recommendations
1	(Best data) Information is based on collected data for the stock and area of interest that is established and substantial	Continued monitoring of data quality and sampling to ensure high quality is maintained.
2	(Adequate data) Information with limited coverage and corroboration, or for some other reason deemed not as reliable as Tier 1 data	Monitoring of data quality to identify areas of limited quality or coverage and adjust data collection programme to remedy any issues identified.
3	(Limited data) Estimates with high variation and limited confidence and may be based on similar taxa or life history strategy.	Monitoring of data collected to identify issues with: High variation – Increased sampling Low confidence – Increase sampling, adjust training (e.g. species identification or specific training on sex, maturity, or diet). Missing data – Identify data gaps and add focussed elements to the data collection programme. Sample collection and storage improved e.g. gonad and stomach content analysis.
4	(Very limited data) Expert opinion or based on general literature review from wide range of species, or outside of region	Establish specific data quality requirements (sampling sizes and coverage rates) for key species and build into programme for key target and bycatch species. Identify requirements to sample VME and PET species. Improvement to observer training, tailored to critical parameters, e.g. length at first maturity or length-weight data.
5	(No data) No information to base score on – not included in the PSA, but included in the DQI score.	Establish base level data quality requirements and build into programme for key target and bycatch species, identify any VME or PET species. Establish alternative estimates based on likely values from similar species in related fisheries as a first point of reference. Good observer training to improve accuracy and precision of data. This will lead to better estimates of biological and fishery parameters, reducing variation.

For the research programmes identified under Chapter 5 there are several specific recommendations that would be recommended in terms of sampling coverage and sample sizes. These are summarised in Annex 10.

6.4 Programme recommendations

For the research programmes identified in Chapter 5, there are several specific recommendations, these are provided in full within Table 30. Table 30 provides an example of the structure and recommendations for *Illex argentinus* in FAO Area 41 Recommendations cover species and area combinations provided as priority species in

Table **1**. In cases where our desk-based research for research programmes yielded no programmes and/or assessments, “None found” is stated under the “programmes identified” column. This includes cases without any specific species/area data combination in EU/DG-MARE’s ACDR database between 2018 and 2022. Where the EU/DG-MARE hold more than 3 years of catch data for a species/area combination, the ICES category to base recommendations on, by default, would be classified an ICES category 2. This is based on minimum requirements for EU vessels to collect data in logbooks as they are obliged to under the Data Collection Framework (DCF), the now repealed FAR regulation and its replacement, the SMEFF regulation.

Table 30 - Example of recommendations made in Annex 11.

Programme types identified	FAO Area	Species (Code / Scientific Name)	Specific recommendations for data collection improvements	Specific recommendations for data analysis improvements	Specific recommendations for sample size and coverage improvements	Risk Indicator
Independent surveys, observer programmes, and 5 years of ACDR data	41	*SQA / Illex argentinus*	Category 1 To retain category 1 status: Data collection and quality currently meet category 1 requirements. Data quality and coverage improvements may only be required.	Category 1 To retain category 1 status: Stock assessment appropriate to the stock biology and fisheries management practices, including the provision of forecasting (either within year or for subsequent years). Analysis of catch, effort, biological (from observer data and fisheries surveys) and other data are full defined and feed into the stock assessment and management processes. Improvements to depletion model suggested due to straddling nature of South Patagonian Stock of Illex within the Falklands and neighbouring waters. Recommendation – Combination of depletion models across entire stock from Argentine, High Seas and Falkland Island waters.	Category 1 Continued monitoring of data quality and sampling to ensure high quality is maintained. Observer coverage should remain at least 5%.	
Observer programme and fisher self-sampling	47	*ARS / Aristaeomorpha foliacea*	Category 5 To move to category 4:	Category 5 To move to category 4: Analysis of totals and trends for fishery/stock. No actual	Category 5 Establish base level data quality requirements and build into programme for key	

Programme types identified	FAO Area	Species (Code / Scientific Name)	Specific recommendations for data collection improvements	Specific recommendations for data analysis improvements	Specific recommendations for sample size and coverage improvements	Risk Indicator
			• Catch and effort data from logbooks to be collected over long time series, minimum three years. • Observer programme data (minimum 10% coverage) and port inspection data (minimum 5% coverage) to verify and supplement logbook data. • Modelling methods appropriate to the species targeted (and those caught as bycatch) developed that utilise the time series catch and effort data. Data for PSA collected: for all target and bycatch species including growth rate, size frequency data, length-weight data and selectivity estimates. Programmes only in South Africa as part of an observer programme and fisher self-sampling, this research was not able to identify stock assessments in the Area 47 region. The existence of an observer programme suggests this would have at least a category of 4.	assessment is currently conducted. No ACDR data available for the region.	target and bycatch species, identify any VME or PET species. Establish alternative estimates based on likely values from similar species in related fisheries as a first point of reference. Good observer training to improve accuracy and precision of data. This will lead to better estimates of biological and fishery parameters, reducing variation.	

7 CURRENT PROCEDURAL AND ADMINISTRATIVE SET UP

The SMEFF Regulation requires that (i) for EU vessels fishing in third country waters under direct authorisations, the fisheries can only be authorized if the operator has provided a scientific evaluation demonstrating the sustainability of the planned fishing operations. Furthermore, the scientific evaluation is to be provided by either an RFMO, a regional fisheries body with scientific competence, or the third country or in cooperation with it. (ii) For EU vessels fishing on the high seas, outside the auspices of an RFMO, the fisheries can only be authorized if the planned fishing operations are in accordance with a scientific evaluation, demonstrating the sustainability of the planned fishing operations, provided or validated by a scientific institute in the flag Member State, or part of a research programme, including a scheme for data collection, organised by a scientific body (Council Regulation (EU) 2017/2403 (OJ L OJ L 347, 28.12.2017).

Further, the SMEFF Regulation requires that for both situations (i.e. 3rd country and high seas requests), the scientific protocol of the research, which will be required in any event, shall be validated by a scientific institute in the flag Member State. In both situations Member States must verify that their operators provide all the necessary information to demonstrate the fulfilment of these obligations. Once verified, the Member State must send the relevant information to the Commission for final assessment whether the conditions are fulfilled. If the information provided by the Member State is insufficient, the Commission may request further information and, where appropriate, may object to granting the authorisation (Council Regulation (EU) 2017/2403 (OJ L OJ L 347, 28.12.2017).

Further, the response times for the Commission services (i.e., either to request further information/justification to fulfil the eligibility criteria, to evaluate the sustainability of the planned fishing operations, or to object to the granting of the fishing authorization) are very short. The Commission must react within 10 working days (from the receipt of the request) for requests in third country waters, and 10 calendar days for requests on the high seas. For example, an initial reaction can take the form of asking the Member State to clarify information or to provide missing documents. After such clarifications, the Commission has either five calendar days (high seas) or 30 calendar days (third country waters) to formulate a reply (objection/non-objection) to the Member State (Council Regulation (EU) 2017/2403 (OJ L OJ L 347, 28.12.2017).

This chapter presents findings of a consultation with fishing operators, national scientific institutes, Member State authorities and the Commission that was undertaken to describe the status quo of the SMEFF procedures. The aim was to understand where there are bottlenecks and more importantly, suggestions on what could be done to improve the process of SMEFF authorisations. This would bolster a more uniform implementation of the SMEFF regulation by fishing operators, Member State and the Commission.

To gather information on the current procedures in place for evaluating the sustainability of SMEFF-relevant fishing operations, identify whether there are gaps, and provide recommendations on steps to resolve gaps, semi-structured interviews and focus group discussions were held. These involved key contacts in national authorities, national scientific institutes, and fishing operators from five Member State (Spain, France, Italy, Portugal, and Lithuania) in line with the fisheries descriptions (Chapter 2) and the Commission. After repeated requests, no one from France took part (Table 31).

The information gathered through the focus group discussions and interviews were summarised for the key issues under study including the procedures currently applied for SMEFF requests in the third country waters and high seas and recommendations on how the procedures could be improved.

Table 31 - Stakeholders that took part in the consultation during the study.

	Member State	Stakeholder	Method	Remarks
1	Spain	National authority	Focus group discussion	Discussions facilitated by IEO
		Fishing operators in Area 34 and 41	Focus group discussion	
2	Italy	National authority	Questionnaire	
		National scientific institute	Interview	
3	Portugal	National authority	Questionnaire	
4	Lithuania	National authority	Questionnaire	
5	European Commission	DG-MARE unit B3	Focus group discussion	

7.1 Coastal waters

In general, the fishing vessel operator planning to fish in third country waters pays and obtains a valid licence issued by the third country. After that, the fishing operator sends all the documents to their Member State national authority including a copy of the valid licence, proof of payment, copy of national legislation and other documents if necessary. Member State authority verifies the documents. In most cases relating to FAO area 34, vessels that apply are those that have been fishing in third country waters before, and therefore there are usually no problems with specific eligibility criteria for vessel authorisations (see articles 5 and 6 of the SMEFF Regulation).

For scientific evaluations to demonstrate sustainability of the fishing operations, the Member State authority usually obtains advice from scientists in their national institute. Findings show that there are issues with the timing and scheduling of these scientific evaluations. While the scientific evaluation needs to be carried out before the fishing operations start, there are several cases where the scientific evaluation is conducted when the vessel is already fishing. This was especially the case at the beginning of the SMEFF implementation, but the situation has been improving. Stakeholders indicated that this arises due to difficulties in obtaining scientific information from coastal States on time. Usually, stock assessment reports and fishery management plans should be provided by the coastal States and evaluated by scientists from the national research institute in the Member State. These reports tend to be supplied later than planned, and in many cases, they are not sent at all. This is because either the reports do not exist i.e. the assessment has not been done or they exist but are not for public sharing. Stakeholders therefore highlighted the difficulty in obtaining data and information from coastal States to allow the scientific research institutes to carry out the evaluation. Fishing operators from Area 34 and 41 especially emphasized the need to improve scientific information, either through scientific surveys or observer programmes.

7.2 High seas

For the high seas, when the fishing operator requests for an authorisation, the proposal includes the technical reports provided by scientists from the national research institute of the Member State. The operator therefore usually asks scientific experts from their national institute to provide a report so that they can attach it with the request forms and fishing licence and submit to the national authority. Stakeholders indicated that this is regularly done and there have been no problems so far.

7.3 The LICENCE system

All SMEFF authorisation documents for each request, including the scientific advice are uploaded on the LICENCE application. This application serves as a communication tool between the Member State and the Commission. If the Commission requests further information, a comment will be sent through the application. Before the LICENCE application became operational, Member State authorities used to discuss SMEFF requests with the Commission by email. While the LICENCE application is a valuable tool for document exchange, sometimes it is difficult to follow the traceability of the requests. In this regard, Member State authorities indicated that they find it useful if the Commission would notify them by e-mail (and not only through the LICENCE application) when relevant information is needed. Member State authorities stated that the LICENCE application is not very friendly for exchanging messages and sometimes information can be missed. They stated that especially during busy periods and considering the traceability difficulties experienced in the LICENCE application, it would be extremely important to use emails to communicate the progress of the authorisation. The current configuration of the application forces them to check each request every day after they submit, to verify if the Commission has any comments. Even though a notification system is established, the volume of requests (not only direct authorisations but also the other agreements and RFMOs requests) in the application makes it very difficult to track the comments, sometimes causing information to be lost and complicating the correct response.

In relation to the LICENCE application and scientific evaluation, even though it is difficult to predict future fishing operations, it could be useful to have an optional pre-notification option in the LICENCE application. This should be sent by the vessel operator as soon as they know they will be making a request for a fishery that could require a scientific assessment, but not yet having the third country documents (authorizations, payments and so on). This would enable the Member State authority to inform the Commission on aspects (such as vessels willing to access third country coastal waters EEZ, the type of vessel, target species) and, if needed, to anticipate the discussions.

For the high seas, one Member State authority indicated that the application requires information that some authorities find hard to obtain. For instance, for the Falkland Island one Member State authority indicated that it had problems with the proof of payment since it is rather hard to get as it is an arrangement between the vessel operator and local Falkland Island agents. The proof of payments changes significantly from time to time.

7.4 Declaration of catches and landings to the third country and EU

As with other authorisations such as SFPA agreements, once the vessel has been approved to start fishing activities, the Member State authority usually communicates with their surveillance and control unit, which is responsible for control of fishing activities. All the vessels, independently of the location of the fishing activity (third country waters under the framework of a fisheries agreement or under the framework of direct authorisations) must, as established in the Control Regulation, exchange data with the surveillance and control unit. The vessels are equipped with a vessel-monitoring system (VMS) so

the control unit can track the fishing activity in real time. In addition, the vessels must report all catch data and are equipped with the electronic reporting system (ERS). Cross checked data are provided to the Commission catch data base (ACDR, now ECR (effort and catch reporting), aggregated by month and species, by vessel except for high seas (only available by flag Member State in this case).

For FAO Area 41, fishing vessels in the Atlantic southwest in international waters are required to carry observers onboard when fishing. According to the Control Regulation, fishing vessels record all the data, both catches and discards, in their logbooks. Besides, under the Control Regulation, they must send sales notes after the landing is done, to the control and surveillance unit of the Member State. Regarding discards, the vessels do not have a lot of discards since there are no limits on quotas like in other waters where they fish under quota. However, as it is mandatory in the Regulation which stablishes Community control system for ensuring compliance with the rules of the CFP, any discarded catch must be recorded.

7.5 Scientific evaluations to demonstrate sustainability of fishing operations

The issue of scientific evaluations to demonstrate sustainability of the fishing operations under SMEFF caused the most debate during the focus group discussions. While some suggested that the overall timeline needs revising, others pointed out specific activities that need more time to be done properly. For instance, the 10 working days (from the receipt of the request to providing a response by the Commission) for requests in third country waters, and 10 calendar days for requests on the high seas needs lengthening to ensure all information contained in the request is properly evaluated.

Some Member State authorities feel that there should be flexibility on how the scientific evaluation is applied under SMEFF requests. They stated that in some cases, coastal States usually published management plans that include different fisheries obligations that the fishing industry must comply with. In addition, there is a close working relationship between scientists from Member State national institute and third country scientific authorities allowing for data sharing and similarity in approaches towards stock assessment. Further, the EU fleet has been fishing in some of those EEZs for a long period. Such historical fishing activities have allowed the collection of valuable data that are also usually discussed in different fora such as CECAF, where're at times, these are the only data available to complete the scientific assessment. Asking the fishing operator to pause fishing until the scientific evaluation is complete could compromise the continuity of historical data series. Further, where e.g. the CECAF data for a specific stock may not be very satisfactory, the stock situation could be due to the activities of other fleets. Pausing the EU fishing activity would not prevent exploitation of the resources by other fleets but would lead to the loss of historical data and scientific information. In such cases, some Member State authorities argued that it would make sense to allow the continuity of the fishing activities for a prudential time before a full scientific evaluation is done.

It was also suggested during the focus group discussions that scientists from national institutes should send their reports on scientific evaluations directly to the Commission instead of sending them to their Member State authorities. In some fishing areas of third countries, fishing permits are issued only based on scientific recommendations. Since the Commission is usually informed about such planned fisheries, it should ask copies of the reports for such recommendations directly from scientists. If the presented recommendations meet the criteria of sustainable fishing, after coordination with the third country, fishing should be allowed.

The subject of stock assessments made by CECAF was also raised by the fishing operators. Some fishing operators organized a workshop during the ICES Annual Science Conference that was held in Bilbao, Spain in September 2023. During this workshop, they indicated that they perceive there is a different treatment by the EU to the northern agreements compared to the southern agreements (West African SFPAs). They noticed there are many scientific shortcomings in CECAF, in part because CECAF is not a management organization and the assessments performed are often not updated. Many

of West African countries share their potential surplus, not only with their main partner, which is the EU, but also with other countries which is detrimental to the EU activity. The fishing operators therefore suggested to ICES that it should carry out assessments in this area, in the same way as it does for the Northern agreements. The IEO scientist participating in CECAF assessment WGs explained that, in her opinion, this is difficult to present unilaterally by the EU when the question affects waters of other countries and would therefore need to be agreed by the countries themselves. She added that currently scientists working in CECAF WGs have the training and the capacity to make good assessments and try other data limited methods. The problem could be due to CECAF not being keen to carry out new approaches due to data limitations, which is the main problem in the area. Otherwise, there are scientists with very good skills participating in CECAF assessment WGs. In summary, the IEO scientist does not perceive CECAF as scientifically low level in a way that assessments from West African fishing grounds should be performed by ICES. The relevant issues are that CECAF is not a fisheries management organization and that their recommendations are often not followed, as they are not binding.

8 SYNOPTIC ANALYSIS OF THE CONSERVATION STATUS AND EXPLOITATION PATTERN OF STOCKS

A decision tree framework has been developed for SMEFF requests to enable fishing operators to prepare and send requests to obtain fishing authorisation under the SMEFF Regulation. The framework has been designed in three phases, of which two would occur concurrently and would be conducted by the Member State authorities:

I. Initiation of the request by the fishing operator to **Member State's national administrators** to start the SMEFF authorisation process (Section 8.1)

II. MS national administrators requesting scientific advice from **Member State's science institute** (Section 8.2). The science institute would then be required to work through two decision trees, one based on stock assessments and the other based on VMEs.

III. Checks made by **DG-MARE** to ensure the process has been conducted fully and correctly (Section 8.3).

8.1 Decision tree for Member State National Administrator

This phase of the decision tree framework allows the relevant Member State national administration to verify key administrative aspects of each SMEFF request. The four key areas checked are:

- Eligibility (based on SMEFF regulation requirements, IUU compliance, correct licenses, etc)
- Scientific basis (stock assessment and VME assessment)
- Vessel and operator compliance history
- Relationship between the relevant Member State (and EU) and the coastal State

Operators should send their request/applications to Member State national administrators well in advance of the planned fishing operation, due to the number of checks required by both Member State and DG-MARE. Requests should be made ideally six months in advance of the planned fishing

operation. The decision tree framework for this first phase can be found in

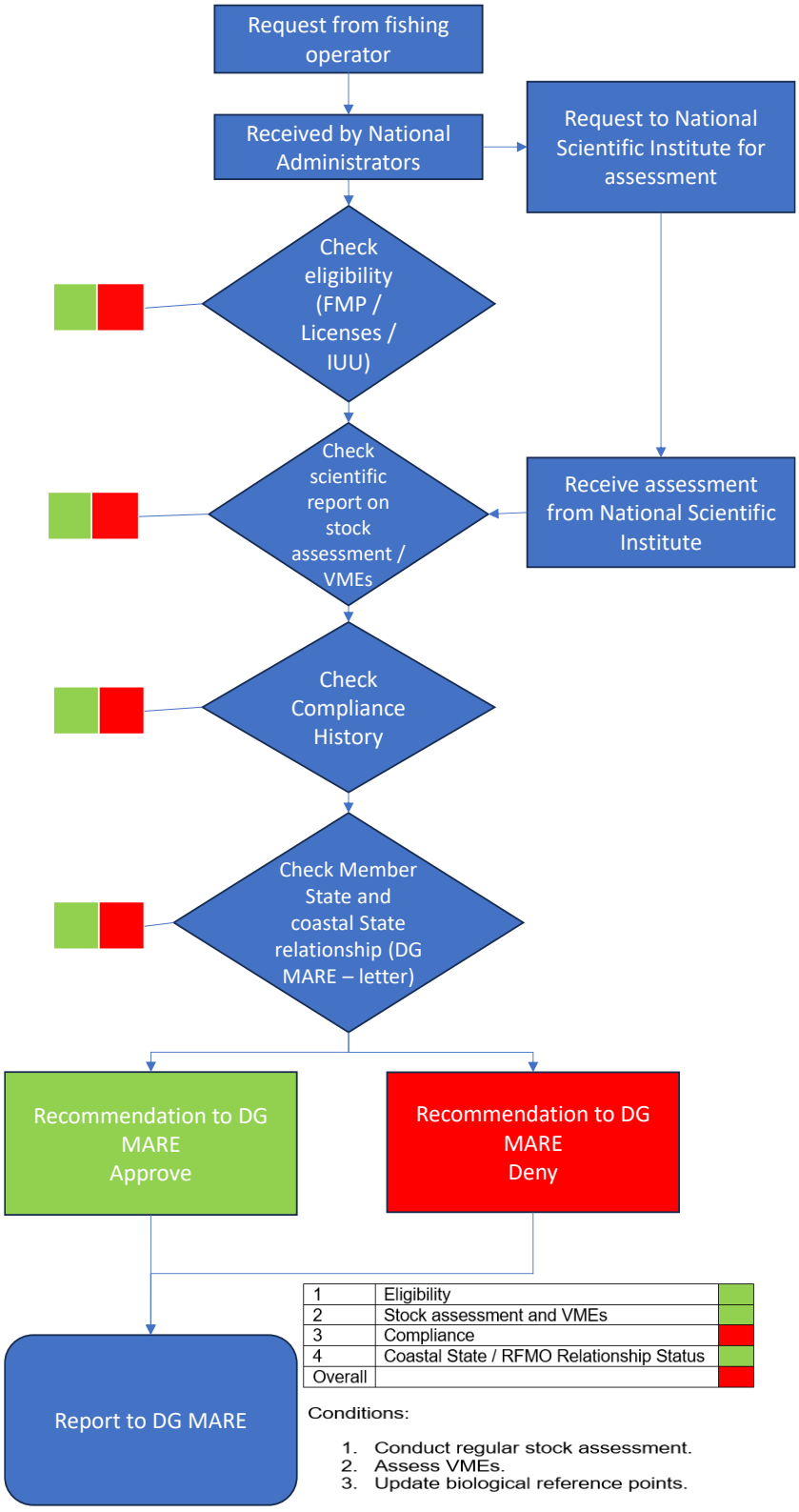
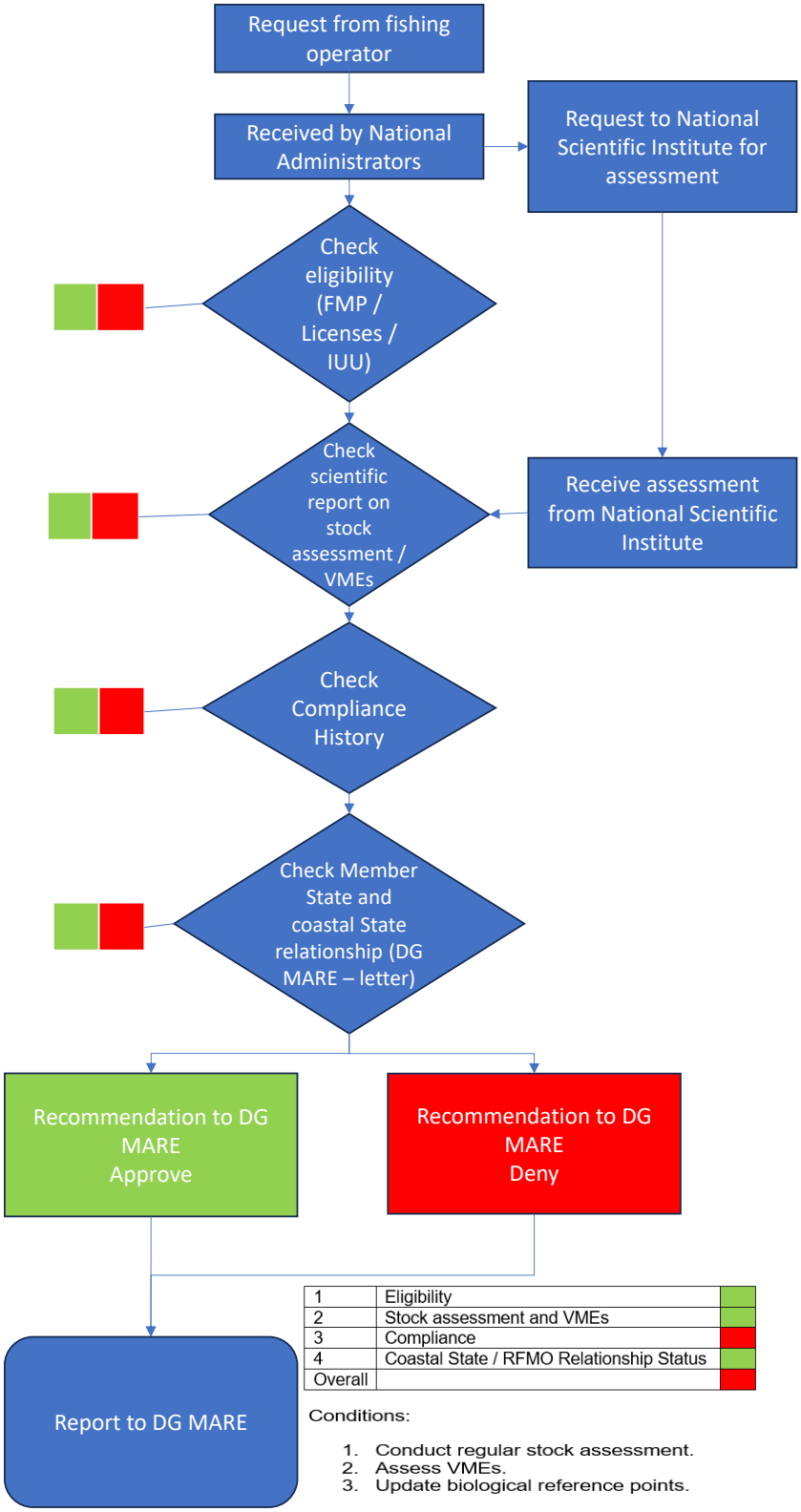


Figure 17 - Framework phase 1 – Member State National Administrators.



1) Request from fishing operator: The first step in the process is that the fishing operator submits a standardised request for a fishing authorisation under the SMEFF Regulation to the Member State national administrator.

2) National administrator receives request: After receiving the request from the fishing operator, the national administrator sends a request to their national scientific institute to assess both stock status

and VME implications (see Section 8.2) of the planned operation. Concurrently to the national science institute making scientific assessments, the National administrator move on to checking eligibility (3).

3) Check eligibility (Fishery Management Plans / Fishery regulations): The national fisheries administration should verify that the vessel(s) and operator(s) listed on the request for authorisation are eligible to apply for the fishery requested. This should match up to excess capacity highlighted in a fishery management plan or equivalent produced by a coastal State for a fishery that they manage or that there is a regionally managed fishery. The vessels would also need to be eligible to fish in that fishery (i.e. they have the appropriate gear, have the appropriate VMS and AIS provision, can carry observers or remote electronic monitoring (REM) where required to meet future control and compliance requirements and critically that there is excess capacity (effort or quota) to match or exceed the requested amount).

4) Receive assessment from national scientific institute: The report from the national scientific institution should be submitted with the original request for authorisation back to the national administrator who should then verify the administrative aspects of the request.

5) Check scientific report on stock assessment / VMEs: The Member State fisheries administration should verify that the following required elements for the target stock assessment and VMEs assessment have been conducted by the national scientific institute.

- Stock assessment conducted, $B_{Current} >= B_{MSY}$ and $F_{Current} <= F_{MSY}$ or PSA conducted.
- Main bycatch species have been identified and there have been no problems identified with the stock status of the bycatch species. NB: Some major bycatch species may require their own stock assessment or PSA to be conducted to allow the authorisation to fish to be approved.
- VME risks identified and assessed.

In cases where requests cover multiple species with contrasting stock assessment status (i.e. one is more vulnerable or has a greater volume of available biomass), the species with the smallest available catch will then act as a ‘choke’ species, and all fishing must stop when quota for that species is reached.

6) Check Compliance History: The national fisheries administration should verify that neither the owners, operators of masters of the vessels have a history of non-compliance.

The national fisheries administration should verify that the vessels listed on the request for authorization have a history of noncompliance whilst under the current ownership. Noncompliance that is highlighted for any previous owner can be noted but should not be used against the vessel at this time.

7) Check Member State and coastal State relationship (DG-MARE – letter): The national fisheries administration should verify whether the flag state of the vessel or vessels listed in the request for authorization has a relationship with the coastal State where the fishery will operate. For many fisheries, this will take the form of a letter identifying such relationship between DG-MARE and the coastal State as DG-MARE takes responsibility for these relationships.

8) Recommendation to DG-MARE (Approve / Deny): When all four areas listed above have been checked, the request can either be approved i.e. when all checks have been positive or denied where issues cannot be resolved. This can then be forwarded to DG-MARE for notification purposes and any additional checks that may be required e.g. to ensure there is no duplication in requests across Member States.

The national fisheries administration at this time may add additional conditions to the request for authorization. These may include for instance additional checks to ensure compliance such as a requirement to always carry an observer or alternatively to carry cameras or other REM devices.

8.2 Decision tree of national scientific institutes

This decision tree allows the relevant Member State national scientific institute to determine the sustainability of the fishery requested. Sustainability will depend on several factors including current stock status, VME interactions and status, current research programmes and data availability (both EU and from other interested parties, i.e. coastal States and other fishing nations) and an assessment of the suitability for a fishery. The request for fishing authorisation from the operator will, firstly be received and processed by the national administrator and subsequently, a request for an assessment passed to the fisheries institute for technical/scientific checks.

The checks that the scientific institute will be required to submit back to the national administrator are guided by two decision trees. The first is detailed in Figure 18 where the national scientific institute will work through a process that will explore the sustainability of the requested fishery in terms of stock assessments and stock status. The second is detailed in Figure 19 which contains the checks required to ensure reduction in significant adverse impacts (SAIs) on VMEs.

1) Receive request from Member State Administrator to National Scientific Institute for assessment: The national scientific institute will receive a request from the national administrator to assess the sustainability of the requested fishing operation. The national scientific institute will then assess the request by conducting several scientific checks looking into the overall sustainability of the requested fishing operation.

2) Does peer reviewed stock assessment of target species exist? One important aspect that the national scientific institute must check is the existence of a stock assessment. If the target species requested by the operator does have a stock assessment that covers the same geographical scope as the operator's request, then the national scientific institute can move on to the assessment and review stage of this process (5). Otherwise, if no stock assessment exists then the national scientific institute will need to move to 12.

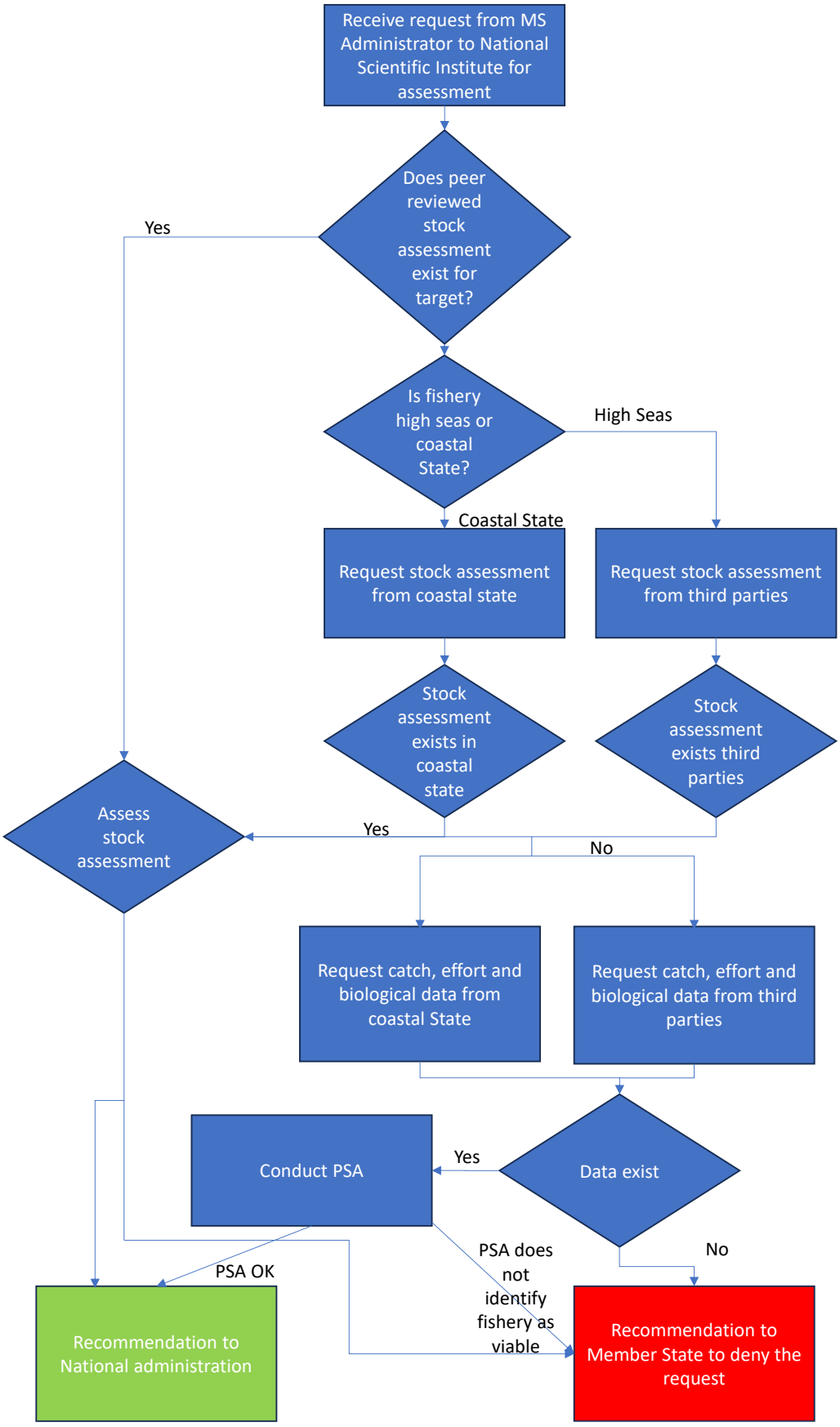
3) Is the fishery on the high seas or coastal State EEZ: A choice between a high seas fishery (including those cross-boundary with one of more EEZs) or one exclusively within the EEZ of one or more coastal States. In the case of a fishery in the waters of a third country, the national scientific institute should progress on to request stock assessment from coastal State (4). In the case of a high seas' fishery, the national scientific institute should progress on to stage 7 request stock assessment from third parties. In cases where the requested fishery crosses boundaries of both coastal states and high seas, then the national scientific institute should work through both 4 and7. Third countries may include relevant flag states identified through Chapter 2 that operate gear in the waters of the requested operation and that the target species is susceptible to (i.e. using the GFW data).

4) Request stock assessment from coastal State: A request for stock assessments of the target species should be submitted to the coastal State where the operator desires to conduct a fishing operation within its waters. After which progress to decision 5.

5) Stock assessment exists in coastal State: Should a stock assessment exist and is provided by the coastal State, or other source, then progression to stage 10 assess stock assessment can be made. In cases where no stock assessment exits, national scientific institute should progress on to either one of 7 or7, depending on whether the proposed fishing operation occurs in a costal State waters or high seas, respectively. In cases of cross-boundary operation requests, both requests may be issued.

6) Request catch, effort and biological data from coastal State: A request should be made to the coastal state by the national scientific institute to share any catch, effort and biological data of the requested target species of the operator. Depending on the outcome of the request, a decision stage is reached in 10.

Figure 18. Framework phase 2 – National Scientific institute (Target fish stocks).



7) Request catch, effort and biological data from third parties: A request should be made to relevant third parties by the national scientific institute to share any catch, effort and biological data of the requested target species of the operator. This should be facilitated by both the Member State national administration and DG-MARE through introduction letters and follow up. Depending on the outcome of the request, a decision stage is reached in 10. A third party in this case can be any entity that has data relevant to the target species including third party nations. Requests can also be made to flag states of third countries identified in Chapter 2 that operate gear in the waters of the request and that the target species is susceptible to.

8) Request stock assessment from third parties: A request for stock assessments of the target species should be submitted to any relevant third party whose area of competence overlaps with the operators requested fishing operation. This could be done directly by the national science institute to third country (science to science) where working relationships exist, or it could go through the national administrators and/or DG-MARE where the national science institute drafts a letter and passes it onto the Member State administrators/DG-MARE to request the data and information on their behalf. This could also include flag states identified as operating gear that the target species of the requested operation is susceptible to (i.e. Chapter 2's GFW descriptions and associated Annexes 6, 7, 8). After which progress to stage 10.

9) Stock assessment exists with third parties: A simple decision will be made based upon whether or not a stock assessment is provided by any relevant third party. In cases where the third party is able to share stock assessments for the target species, progression can be made to 10.

10) Assess stock assessment: Where a stock assessment exists for the target species stock, the national scientific institute will evaluate the assessment. The target stock status must be within sustainable biological limits, with excess capacity for the requested fishing operation to exploit. If this is not the case, and the fishery does not have excess capacity, or is in fact overfished, the national scientific institute must move to segment recommendation to the Member State to deny request (22). If the target stock is within safe biological limits ($B_{Current} >= B_{MSY}$ and $F_{Current} <= F_{MSY}$) then progress to 13.

11) Data exist: This decision step is a simple yes or no choice based on the existence of requested catch, effort and biological data for the target species of the fishing operation. Where data exists, national scientific institute can progress to 12 to conduct PSA. If no data are available, the national scientific institute should move to segment 22 recommendation to the National Administrator to deny request.

12) Conduct PSA: Where the requested data exists for the target species stock (but no stock assessment exists) then a PSA will be required. This step will be used to ensure that the risk to the stock is minimal, and based on a management objective of, for example, ensuring the stock is at B_{MSY} and there is a low probability (i.e. a less than 5% chance) that $SSB<B_{lim}$, a decision will need to be made to accept (21) or deny (22) the request.

13) VME assessment: An assessment of VMEs is also a requirement of the national scientific institute in the case of fisheries on the High Seas. A second decision tree will run in parallel to the one in Figure 18. This decision tree can be found in Figure 19. This decision tree has the same initial two steps as the stock assessment and then follows a similar process to the target fish stock assessment decision tree as outlined in the steps below.

14) Does a VME management plan exist? This first step in the VME decision tree checks if a current VME management plan is in place for the fishery concerned. Examples of this are the squid fisheries around the Falkland Islands, where there are concerns over the potential bycatch of pinniped seals and seabirds in trawl fisheries. Observers are deployed to monitor mitigation devise and record interactions.

Similarly, for demersal trawls in the high seas of SEAFO, there are several clearly designated existing bottom fishing areas, new fishing areas and VMEs closed areas are detailed in SEAFO CM 30/15 ([5]).

An ideal VME management plan should have the following elements:

- Encounter protocols with recording templates
- VME identification guides
- Clear management measures (e.g. closed seasons, closed areas, move on rules)
- RFMO or independently reviewed decision-making processes.

A coral and sponge taxa guide was developed by IEO and the Marine Science Faculty at the University of Vigo (Galicia, Spain), for use by scientific observers operating in the SEAFO Convention Area. ([6])

The Council Regulation (EC) N° 734/2008 on the protection of VMEs in the high seas from the adverse impacts of bottom fishing gears contains provisions on encounters with VMEs, area closures and an observer scheme for vessels which have been issued with a special fishing permit.

Unforeseen encounters with VMEs and move-on rule is set as defined below (EC Nº 734/2008):

1. Where, in the course of fishing operations, a fishing vessel encounters VMEs, it shall immediately cease fishing, or refrain from engaging in fishing in the site concerned. It shall resume operations only when it has reached an alternative site at a minimum distance of five nautical miles from the site of the encounter within the area foreseen in its fishing plan.
2. If another vulnerable marine ecosystem is encountered in the alternative site referred to in paragraph 1, the vessel shall keep relocating in accordance with the rules set out in that paragraph until a site is reached where no vulnerable marine ecosystems are found.
3. The fishing vessel shall report each encounter to the competent authorities without delay, providing precise information on the nature, location, time and any other relevant circumstances of the encounter.

Where a VME management plan exists, scientific institution staff should move to 16. In cases where a VME management plan does not exist, move to 15.

15) Request and assess VME management plan (identification, risk assessment and management measures): The national scientific institute should request the VME management plan or any constituent parts of the plan. The plan should subsequently be assessed for any implications it may have to the planned/requested fishing operation.

16) Does it meet the requirements of VME Regulation EC Nº 734/2008? The national scientific institute should then assess and decide whether the planned fishing operation meets the requirements of Council Regulation (EC) N° 734/2008 on the protection of VMEs in the high seas from the adverse impacts of bottom fishing gears. If the request does meet the requirements for VME Regulation (EC) N° 734/2008, then progress to 0. Where the request does not meet the Regulation, progress to 17.

17) Request VME identification processes, risk assessment and management measures from third parties: Where management plan for VMEs exists, but the planned fishing operation does not meet the requirements of VME Regulation, then data/information should be requested from third parties to allow an independent assessment of the likely level of VME interaction and loss.

18) Conduct independent VME risk assessment: Where the likelihood of VME interaction and potential loss is not clear, it is recommended that independent assessment of levels of VME interaction

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([5]) http://www.seafo.org/media/8933d489-854c-4c99-895e-66573c7010a4/SEAFOweb/CM/open/eng/CM30-15_pdf

([6]) http://www.seafo.org/Science/Coral-Sponge-Guide

and potential loss is conducted using all the information available from coastal States, third party States, RFBs and RFMOs for the region, given the proposed methods and areas of the Member State vessel(s).

Where VMEs risk is shown to be low or non-existent, the Member State should recommend the issue of the authorisation to fish (0), but with a condition to monitor and record all VME interactions and review these data on a regular basis. Where VME risks are deemed high then the recommendation should be to deny the authorisation to fish (22).

19) Data exist showing high level of risk: Where data exist in other assessments already, or the result of the independent assessment indicate a high level of VME risk, it would be recommended that a precautionary approach would lead to the request for a fishing authorisation to be denied (22), unless minimisation and mitigation measures can be agreed in a VMEs management plan.

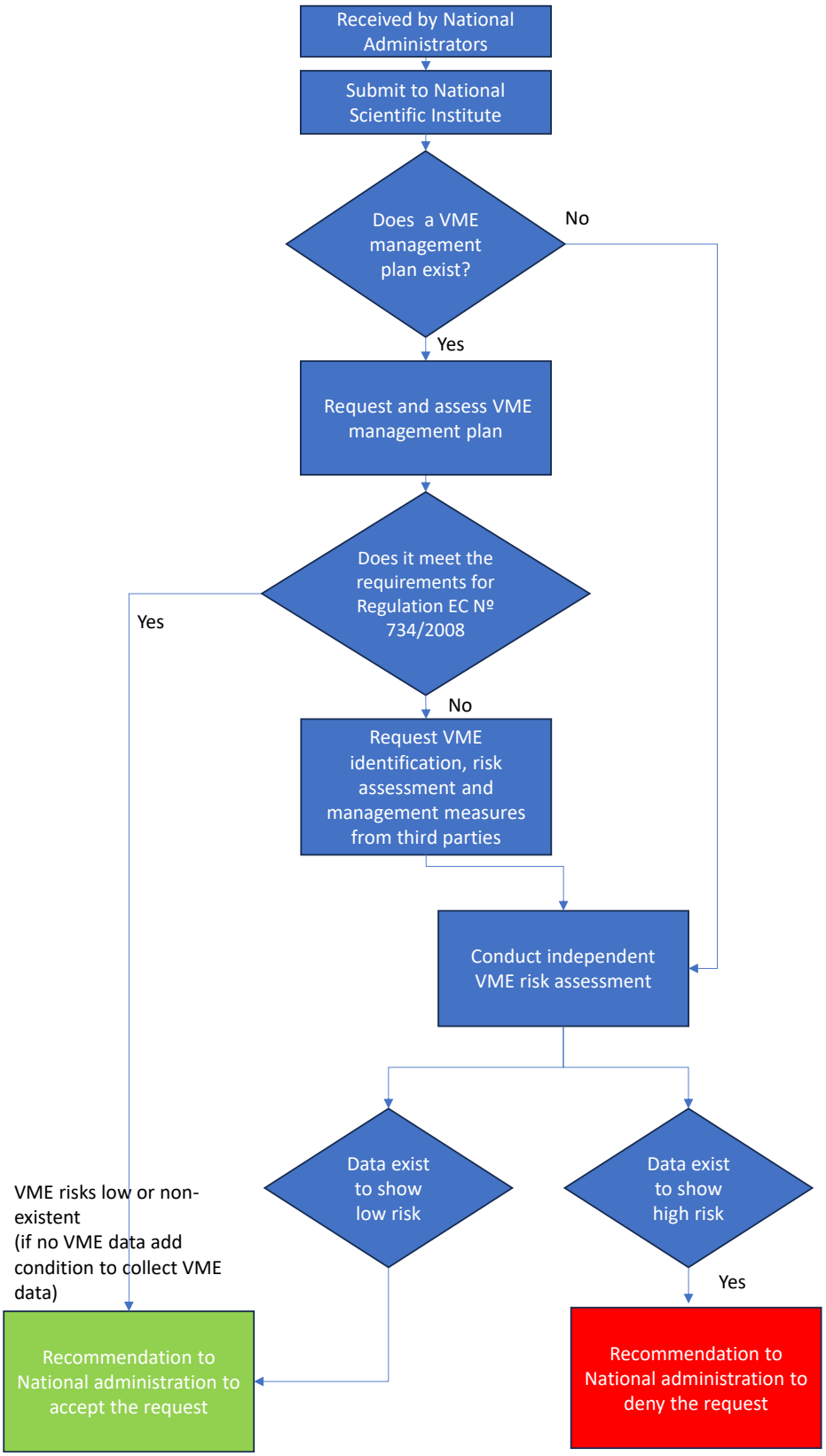
20) Data exist showing low level of risk: Where data exist in other assessments already, or the result of the independent assessment, indicate a low level of VME risk, move to 21.

21) Recommendation to National administration: Following a decision to recommend that an authorisation to fish should be issued, the national scientific institute may supplement the authorisation with additional conditions. These conditions may be wide-ranging but would be imposed to address identified concerns or meet data gaps identified in the stock assessment process. These conditions may for example require additional data to be collected on a specific species or stock to provide more data for the PSA. A common condition would be where there is an absence of VMEs data from a fishery that VMEs data are collected, including null reports to clearly document where no VMEs interactions occur (refer to Regulation EC No 734/2008).

22) Recommendation to Member State to deny the request: After working through the stock assessment decision tree there is an indication that the stock is in a poor condition, i.e. the stock assessment shows that the stock is overfished or that overfishing is currently occurring, or that the PSA indicates that the fishery would not be viable, it would be recommended following a precautionary approach to justify that the authorisation to fish is denied.

Similarly, after working through the VME decision tree, in the absence of a comprehensive VME management plan, i.e. minimising or mitigating risks to VMEs, or that the risk assessment indicates a high level of risk then there would be justification for a recommendation to deny the authorisation to fish.

Figure 19. Framework phase 2 – National scientific institute VMEs assessment.



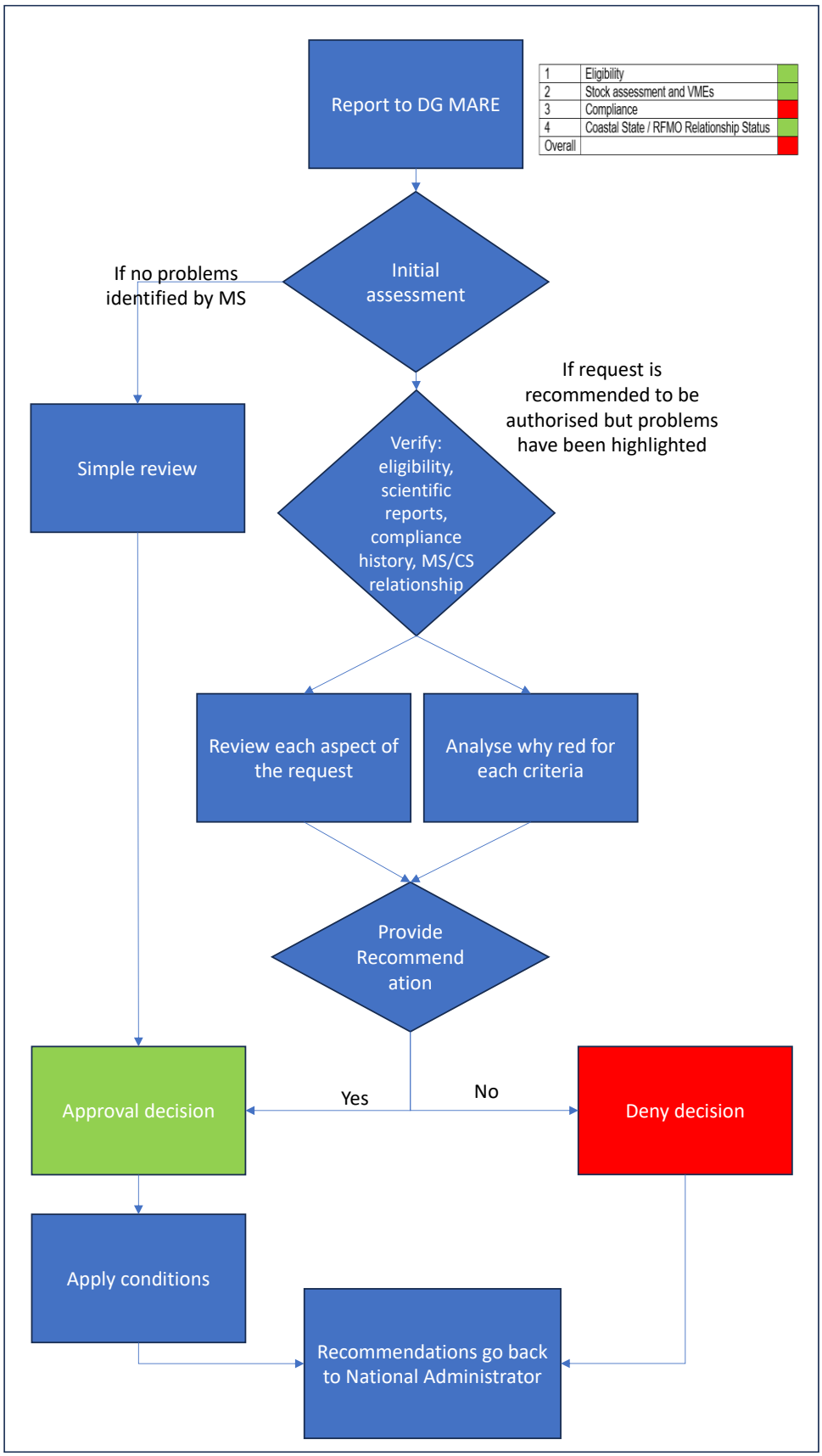
8.3 Decision tree for DG-MARE

DG-MARE will confirm or object to granting any request including advising Member State fisheries administrations on individual authorisations or authorisations overall from several Member States that may for example, both apply for the same stock at the same time. Individual applications may be within acceptable limits but if all authorisations were approved, then the EU overall may contribute to overexploitation of the stock. In these cases, DG-MARE should consider Annex 1 of Council regulation (EC) No. 1006/2008, that notes that the Commission shall take the following into account for the reallocation of fishing opportunities:

- the date of each of the requests received;
- the fishing opportunities available for reallocation;
- the number of requests received;
- the number of requesting Member States; and
- if fishing opportunities are fully or partly based on amounts of fishing effort or catches, the fishing effort expected to be deployed or the catches expected to be made by each of the vessels concerned.

The third part of the decision tree allows DG-MARE to have an overview of all SMEFF requests for fishing authorisations and to verify the eligibility of each request. The decision tree framework for this final phase can be found in Figure 20. Each step in the decision tree is detailed below.

Figure 20. Framework phase 3 – DG MARE



1) Initial Assessment

The initial assessment by DG-MARE will ensure that all requests and reporting by Member State are complete to allow the correct decisions to be made. At this point, DG-MARE will check for conflicting requests for the same fishery, ensuring there is no duplication in terms of requests or that the overall level requested by EU operators is within sustainable limits.

There are two possible outcomes of the initial assessment:

- Where there are no issues in principle with the authorisation to fish, the process can move to a simple review (2); and
- Where the Member State has recommended the authorisation to fish be approved but there are some problems and possible conditions to the authorisation. It is recommended that DG-MARE should verify (3) these specific elements in detail where required.

2) Simple Review

Where the Member State processing the request for authorisation to fish has indicated there are no issues with the application, it is suggested that a simple review is made by DG-MARE to verify the critical elements of the application only. Checks will be undertaken to verity:

- Relevant documents have been supplied;
- Relevant documents have been checked;
- For eligibility – vessels flagged in the Member State concerned, vessels are on the EU Fleet Register
- For stock assessment – Stock assessment exists, or PSA conducted, and excess capacity in the fishery has been clearly demonstrated for the stock concerned.
- For compliance – Vessels, owners or agents do not have any negative compliance indicators, e.g. IUU listed, current ongoing legal proceedings.
- For coastal State / RFMO relationship – Member State or EU has established fishing relations with coastal State or is a member of the relevant RFMO.

DG-MARE could suggest that the Member State add additional conditions to any approval to issue an authorisation to fish.

If concerns were raised during this process, DG-MARE may suggest additional conditions or recommendations that are deemed necessary to be added, e.g. enhanced data collection, requirements to carry an observer, remote electronic monitoring (REM) requirements etc. After the review has been conducted, the process moves to Approve (0) the decision of the Member State, noting that this is not binding.

3) Verify: eligibility, scientific reports, compliance history, Member State/Coastal State relationship

DG-MARE should at this stage simply be able to verify the four criteria (eligibility, scientific reports, compliance history and Member State/coastal State relationship) used by the national fisheries administrations. If the national fisheries administration has flagged any of the four criteria as a reason to deny authorisation, then DG-MARE should analyse these criteria in detail and verify that the authorisation should be denied (8). Where the national fisheries administration has indicated that any of the criteria are met it is recommended that a simple review of the submitted information is conducted (4).

4) Review each aspect of the request

This would follow the same procedure as outlined for individual aspects of the request.

5) Provide recommendation

Once DG-MARE has reviewed the information provided by the national fisheries administration, it would confirm the decision to agree with the initial Member State decision to approve (6) an authorisation, to recommend changing or augmenting the decision with additional conditions (7).

6) Approve

Once an authorisation has been shown to reach the required standard, DG-MARE can recommend that the relevant Member State notify the vessel operator and issue the authorisation. Any conditions that have been attached to the authorisation by DG-MARE or by the Member State and agreed with by DG-MARE, should be communicated with the authorisation.

7) Conditions

As noted previously, the Member State of the operator or DG-MARE may apply conditions to the authorisation. These should be communicated in detail to the operator and would become part of the requirement to renew the authorisation in subsequent years.

8) Deny

Where DG-MARE has raised concerns over any of the criteria that may lead to a decision to recommend to the Member State national administrator that they deny the authorisation. Clear reasons for the evaluation should be provided to the Member State (if generated by DG-MARE) and therefore the vessel operator for the denial (9).

9) Recommendations go back to National Administrator

For each request submitted to DG-MARE, a response to confirm approval or denial for that request should be submitted back to the relevant Member State who can forward it on to the operator. All recommendations with proposed conditions should have those conditions defined in full. All recommendations to deny an authorisation should have the reasons for denial detailed in full.

Table 32 proposes a timeline for SMEFF authorisations with details of when and how long specific activities/checks would be conducted by Member State national administrators, scientists from national research institutes and the Commission.

Table 32 - Proposed timeframe and workplan for SMEFF requests. Blue denotes admin steps, red denotes stock assessment, yellow denotes PSA, and purple denotes VMEs assessment.

	Month 1				Month 2				Month 3				Month 4				Month 5				Month 6			
STEP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
8.2 Decision tree for Member State National Administrator																								
8.2.1 Request from fishing operator																								
8.2.2 National administrator receives request																								
8.2.3 Check eligibility																								
8.2.4 Receive assessment from National scientific Institute																								
8.2.5 Check scientific report on stock assessment / VMEs																								
8.2.6 Check Compliance History																								
8.2.7 Check Member State and coastal State relationship (DG-MARE – letter)																								
8.2.8 Recommendation to DG-MARE (Approve / Deny)																								
8.3 Decision tree of national scientific institutes																								
8.3.1 Receive request from Member State Administrator to National Scientific Institute for assessment																								
8.3.2 Does peer reviewed stock assessment of target species exist?																								
8.3.3 Is fishery high seas or coastal State																								
8.3.4 Request stock assessment from coastal State																								
8.3.5 Stock Assessment Exists in coastal State																								
8.3.6 Request catch, effort and biological data from coastal State																								
8.3.7 Request catch, effort and biological data from third parties																								
8.3.8 Request stock assessment from third parties																								
8.3.9 Stock assessment exists third parties																								
8.3.10 Assess stock assessment.																								
8.3.11 Data exist																								

	Month 1				Month 2				Month 3				Month 4				Month 5				Month 6			
STEP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
8.3.12 Conduct PSA																								
8.3.13 VME assessment																								
8.3.14 Does a VME management plan exist?																								
8.3.15 Request and assess VME management plan																								
8.3.16 Does it meet Regulation (EC) No 734/2008?																								
8.3.17 Request VME identification processes, risk assessment and management measures from third parties																								
8.3.19 Data exist showing high level of risk																								
8.3.20 Data exist showing low level of risk																								
8.3.21 Recommendation to National Administration																								
8.3.22 Recommendation to Member State to deny the request																								
8.4 Decision tree for DG-MARE																								
8.4.1 Initial Assessment																								
8.4.2 Simple Review																								
8.4.3 Verify: eligibility, scientific reports, compliance history, Member State/Coastal State relationship																								
8.4.4 Analyse why red for each criteria																								
8.4.5 Review each aspect of the request																								
8.4.6 Provide recommendation																								
8.4.7 Confirm decision																								
8.4.8 Conditions																								
8.4.9 Object authorisation																								
8.4.10 Recommendations go back to National Administrator																								

9 Conclusions and recommendations

The main aim of this study is to facilitate an improved and more uniform implementation of the SMEFF Regulation by fishing operators, scientists from national institutes, Member State authorities, and the EC, including harmonisation with the VME Regulation for SMEFF requests on the high seas. Starting with a review of the candidate fisheries, fleets and stocks that may come under the SMEFF Regulation, the assessment considered ongoing and potential fisheries in FAO Areas 34, 41 and 47. A hierarchical framework was provided for data limited stocks to demonstrate how the requirements of the SMEFF Regulation could be fulfilled. Further, a review of the scientific research programmes within the geographic scope, relevant to comply with the requirements of the SMEFF Regulation, was performed. This leads to the provision of recommendations towards minimum criteria that concerned Member States need to include in future scientific research programmes. The findings were collated and used to develop decision trees to aid decision making for Member State fisheries administrators, scientists in national research institutes and the Commission.

The following conclusions and recommendations can be drawn from this assessment:

9.1 Conclusions

This report describes a **process to deliver robust scientific evaluations** and to feed into decision making for SMEFF requests. It proposes a framework that allows fisheries administrators and scientists in Member States to respond within a defined timeframe to requests for SMEFF fishing authorisations from fishing operators. The decision-making framework provides a standard process for all Member States to follow, and it provides a simple method for Member States and DG-MARE to demonstrate which fisheries should and should not be authorised.

Descriptions of **past, ongoing and potentially future fisheries relevant under the SMEFF regulation** are provided across FAO Areas 34, 41 and 47. The descriptions and associated data are provided to enable informed decisions to be made throughout the assessment of SMEFF requests. Where possible, species, gear and fishing effort are provided, alongside information of vessel flag State and coastal State to direct requests for additional data. Descriptions are based on four main data sets: 1) Landings of EU vessels, 2) vessel position data from Global Fishing Watch, 3) detailed landings, and 4) VMS information of the Spanish fisheries and landings data from coastal State's EEZs that were specifically requested from coastal State fisheries departments.

Decisions concerning approval or rejection of fishing authorisation requests should be based on an **assessment of the stocks by Member State fisheries scientists**. Where a stock assessment is available, authorisations should only be issued when the stock is in a good state with biomass above B_{MSY} and fishing effort lower than F_{MSY}. In the absence of a formal stock assessment, the study proposes to follow a risk-based approach. For these cases, a productivity susceptibility assessment should be carried out using data from various sources to assess if each stock can be exploited sustainably. Many of the species identified as 'SMEFF priority species' fall into this data-limited stocks category, i.e., having fewer than ten years of catch data, or no catch history at all. Without such a risk-based approach, a precautionary approach would recommend not authorising fishing to occur.

A key objective of this work was to ensure that the **data needed for authorisations** can be sourced from publicly available information or from data accessible through third parties. This approach aims to avoid the necessity for additional data collection, a process that could extend over several years and entail extra financial investments.

The potential for **interactions with VMEs** holds significant importance. Recognised VMEs in FAO areas 34 and 41 are identified, and precautions to prevent interaction with, and potential harm to, these delicate ecosystems described. In cases where VME interactions might occur in a fishery, it is recommended that authorisation for the fishery be withheld.

The level of scientific research in FAO Areas 34, 41, and 47 varies considerably, often falling short of the standards recommended for fisheries within EU waters. Numerous suggestions are proposed to improve data collection, analysis, coverage rates, and sample sizes for each stock. This comprehensive approach aims to incrementally enhance the overall data repository for each stock in terms of quantity, quality, and the types of data collected. Such improvements are intended to facilitate more sophisticated stock assessments, safeguard VMEs and ensure that European Union Member States' administrations have the most reliable information available for making decisions regarding fishing authorisations under the SMEFF Regulation.

9.2 Recommendations

The following recommendations are made from this study.

- The descriptions of regional fisheries and the data included in Annexes 1-6 provide pertinent information pertaining to combinations of (potential) SMEFF species and fishing areas. This data inventory can serve as a preliminary source for all stakeholders (i.e. fishing operators, administrators, scientists) to check against/verify, when preparing or dealing with SMEFF requests. It also facilitates highlighting where data is already available and/or where data requests to the relevant authority will be needed before starting a SMEFF request.
- Staff of national scientific institutes should be trained in PSA. It is important for scientists and other staff involved in preparing SMEFF authorisation requests to understand the broad concept of PSA, its data requirements and the online data sources that can be used to inform and feed into the PSA. At the same time, such a training also needs to cover understanding uncertainty, probability, and the risk that is inherent to the PSA process. These are important concepts to understand, as the conditions for authorising a SMEFF request should also ensure additional data collection during the licence period. These additional data should be used to reduce uncertainty in the PSA process, and ideally to improve future stock assessments. This is a very essential step that must not be undervalued in improving sustainable fisheries management.
- This study clearly suggests that the burden of proof is on the proposer of a SMEFF fishery. Therefore, it is crucial that the national scientific institute(s) are tasked to carry out the collection and reporting of the relevant, needed high-quality data. This will ultimately enable the progression from the first (very uncertain and data-limited) to the next, improved level of stock assessment.
- The study suggests a training for DG-MARE staff in RStudio, which is the most commonly used interface in R, i.e., the software used for the risk assessment process (developed by Posit)[7]. It is not feasible to use one single database for all the different data types, sources and stock assessments that are relevant for SMEFF requests. Therefore, using APIs and pre-established databases (such as FishBase / SeaLifeBase / aquamaps) means that the requirement for 'inhouse' databases is becoming less important. It is sufficient that the data exist somewhere and can be accessed remotely by the relevant scientific institutions. As a prerequisite for such a training, a basic understanding of running scripts and an ability to change limited numbers of parameters would be highly beneficial, since many processes and analyses require reproducibility of script/code-based tools, in particular R.

7 RStudio - https://posit.co/downloads/

- When assessing the potential for sustainability of a fishery under SMEFF, national scientific institutes and DG-MARE should assess species-gear combinations to determine the likelihood of interaction of the fishery with VMEs. If there are doubts, an independent assessment of levels of interaction with VMEs and potential VME loss should be conducted, using all the information available from coastal States, third party States and RFMOs, based on the methods proposed in this study. This should include pelagic VMEs that may include seabirds, pinnipeds, and cetaceans.
- All current and historic fisheries research programmes in FAO Areas 34, 41, and 47 that relate to SMEFF species and potential future SMEFF fisheries should be stored within a data repository. This should include a contact for each programme for potential data gathering that is required for stock assessment. Each programme should also be scored against the ICES guidance for data-limited stocks (ICES, 2012). The repository should be reviewed and updated on an annual basis via a systematic literature search.
- Alongside this data repository for fisheries research programmes, an API based interface could be developed to allow national scientific institutes, member state authorities, and DG-MARE to determine whether a potential fishery meets the requirements of Article 24(b) of the SMEFF Regulation.
- When a proposed SMEFF fishery is authorised, conditions for improved data collection should be stipulated to help inform and improve future sustainable management of that fishery. If a fishery is not authorised, recommendations should be made to improve the knowledge around the proposed fishery, its target species, and its interactions so that the fishery might meet SMEFF requirements in future. The conditions and recommendations should be proposed by the national scientific institute, before being verified by DG-MARE. Conditions and recommendations should aim at improving data collection protocols, requirements for data analysis, sampling coverage, and sample size.
- Given that fishing operators potentially need to act quickly and thus prefer short turnaround times, the administrative and scientific review process for SMEFF requests must balance scientific rigour with minimising administrative lag.
- This study recommends a six-month time frame for the SMEFF authorisation process. This includes sufficient time on the one hand for national scientific institutions to check the basis for a fishery approval, if it is based on a stock assessment or a PSA. On the other hand, this also provides sufficient time for the fisheries administrations to conduct the parallel checks relating to compliance, licensing and relationships with a third country. This also allows sufficient time (one month) for any additional verification to be conducted by DG-MARE.

References

Abohweyere, P.O. (1989). Stock assessment of the Threadfn (*Galeoides decadactylus*) from the Nigerian inshore waters. Nigerian institue for oceanography and marine research. Victoria Island, Nigeria. Technical paper no. 51.

Alberto, M.T., Saraceno, M., Ivanovic, M., Acha, E.M. (2022). Habitat of Argentine squid (*Illex argentinus*) paralarvae in the southwestern Atlantic. Marine Ecology Progress Series 688: 69-82.

Arrizabalaga, H., De Bruyn, P., Diaz, G.A., Murua, H., Chavance, P., de Molina, A.D., Gaertner, D., Ariz, J., Ruiz, J. and Kell, L.T. (2011). Productivity and susceptibility analysis for species caught in Atlantic tuna fisheries. Aquatic Living Resources 24(1):1-12.

Axelsen, B.E., Johnsen, E. (2015), An evaluation of the bottom trawl surveys in the Benguela Current Large Marine Ecosystem. Fisheries Oceanography 24: 74-87. DOI:10.1111/fog.12079.

Bensch, A., Gianni, M., Gréboval, D., Sanders, J.S., Hjort, A. (2009) Worldwide review of bottom fisheries in the high seas. FAO Fisheries and Aquaculture Technical Paper. No. 522, Rev.1. Rome, FAO. 145p.

BirdLife International. (2022). Establishment of the Cabo Verde fisheries observer program: A dream comes true. 14 November 2022. Available online at: www.birdlife.org/news/2022/11/14/establishment-of-the-cabo-verde-fisheries-observer-program-a-dream-comes-true, accessed 8 August 2023.

Bianchi, G. (1992). Study of the demersal assemblages of the continental shelf and upper slope off Congo and Gabon, based on the trawl surveys of the RV 'Dr Fridtjof Nansen'. Marine Ecology Progress Series 85: 9-23.

Boettiger, C., Lang, D.T., Wainwright, P.C. (2012). "rfishbase: exploring, manipulating and visualizing FishBase data from R". In: Journal of Fish Biology 81.6: 2030-2039. DOI: 10.1111/j.1095-8649.2012.03464.x.

Carvalho, F., Winker, H., Courtney, D., Kapur, M., Kell, L., Cardinale, M., Schirripa, M., Kitakado, T., Yemane, D., Piner, K.R., Maunder, M.N., Taylor, I., Wetzel, C.R., Doering, K., Johnson, K.F., Methot, R.D. (2021). A Cookbook for Using Model Diagnostics in Integrated Stock Assessments. Fisheries Research, 240, 105959.

CBD. (2012). Report of the Wider Caribbean and Western Mid-Atlantic Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas. Montreal, 30 April-5 May 2012. 241 pp. Available online at www.CBD.int/doc/meetings/mar/rwebsawcar-01/official/rwebsa-wcar-01-sbstta-16-inf-07-en.doc, accessed 2 August 2023.

CeDePesca. (2023a). Argentina Patagonian ~~Toothfish.~~toothfish. Fishery Improvement Project. Available online at cedepesca.net/proyectos/argentina-patagonian-toothfish/, accessed on 14 August 2023.

CeDePesca. (2023b). Argentine hake (Bottom trawl). Fishery Improvement Project – Prospective. Available online at cedepesca.net/proyectos/argentine-hake-bottom-trawl/, accessed on 14 August 2023.

CeDePesca. (2023c). Argentine hoki (Patagonian grenadier). Fishery Improvement Project – Prospective. Available online at cedepesca.net/proyectos/argentine-hoki/, accessed on 14 August 2023.

Clarke, S., 2017. Pacific-wide sustainability risk assessment of bigeye thresher shark (*Alopias superciliosus)*. Pacific-wide sustainability risk assessment of bigeye thresher shark (*Alopias superciliosus*). In: WCPFC Scientific Committee 13th Regular Session. WCPFC-SC13-2017/SA-WP-11(REV2), Rarotonga, Cook Islands.

Cook, R.M., Nyarko, B.K., Aggrey-Fynn, J., Acheampong, E., Asiedu, G. (2021). Assessment of Demersal Fish Stocks in Ghanaian and Adjacent Waters (November 16, 2021). One Ocean Hub Report Gh.3.03a.

Council of the European Union. (2008). Council Regulation (EC) No 734/2008 of 15 July 2008 on the protection of vulnerable marine ecosystems in the high seas from the adverse impacts of bottom fishing gears.

DeAlteris, J. Cessay, S., Jallow, A. (2012). The Gambian Sole Stock Assessment: Final Report. Gambia-Senegal Sustainable Fisheries Project (USAID/Ba Nafaa). Coastal Resources Center, University of Rhode Island, 21p.

DEFF (Department of Environment, Forestry and Fisheries). (2020). Status of the South African marine fishery resources 2020. Cape Town: DEFF.
Del Río, J.L., Acosta, J., Cristobo, J., Parra, S., Portela, J. Muñoz, A., Tel, E., Besada, V., Atlantis Group. (2011). Vulnerable Marine Ecosystems in international waters of the Southwest Atlantic and possible interactions with fishing activities. Atlantis Project, Vulnerable Marine Ecosystems in the Southwest Atlantic.

Del Río, J.L., Acosta, J., Cristobo, J., Portela, J.M., Parra, S., Tel, E., Viñas, L., Muñoz, A., Vilela, R., Elvira, E., Ibarrola, T., Pilar Ríos, P., Almón, B., Blanco, R., Murillo, J., Polonio, V., Fernández, J., Cabanas, J.M., Gago, J., González-Nuevo, G., Cabrero, A., Besada, V., Schultze, F., Franco, A., Bargiela, J. y García, X. (2012). Estudio de los Ecosistemas Marinos Vulnerables en aguas internacionales del Atlántico Sudoccidental. Temas de Oceanografía Nº 6. ISBN: 978-84-95877-24-6. Edita: Instituto Español de Oceanografía. Ministerio de Economía y Competitividad. 238 páginas.

Dridi, A., Srairi, A., Boumaaz, A., Bensbai, J., Mhamed, A. B., and Belghyti, D. (2022). Study of reproduction of the Common Octopus *Octopus vulgaris* in the South Atlantic area of Morocco (1998-2010)Bioflux 15: 2374-2387.

Durán Muñoz, P., Sayago-Gil, M., Murillo, F.J., Del Rio, J.L., López-Abellán, L.J., Sacau, M. and Sarralde, R. (2012). 'Actions taken by fishing Nations towards identification and protection of vulnerable marine ecosystems in the high seas: the Spanish case (Atlantic Ocean)'. Marine Policy, 36: 536-543.

Durán Muñoz, P., Sacau, M., Vidal-Liñán, L., Sarralde, R., Del Rio, J.L., Guijarro, B., Ordinas, F., Isarch, E.G., Martin-Sosa, P., Rodriguez, R., Rey, F.S., Moir Clark, J., Kell, L., Hunt, G., Mangi, S.C., (2023). Improving environmental sustainability of deep sea fisheries with emphasis on the conservation of Vulnerable Marine Ecosystems (VMEs) – Final report, Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2926/854134

Erasmus, V.N. (2021). Uncoupling the exploitation and climate change effects on the biology of Cape monkfish, Lophius vomerinus Valenciennes 1837 in Namibia. Rhodes University, South Africa.

European Parliament. (2013). Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC.

European Parliament. (2017). 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.

Falkland Islands Government, (2023). Fisheries Department Fisheries Statistics, Volume 27, 2022: 94pp. Stanley, FIG Fisheries Department.

FAO. (2016). Report of the twenty-first session of the Fishery Committee for the Eastern Central Atlantic, Dakar, Senegal, 20–22 April 2016. FAO Fisheries and Aquaculture Report No. 1166. Rome, Italy. 72 pp. Available online at http://www.fao.org/3/I6402Bi/i6402bi.pdf, accessed 1 August 2023.

FAO. (2017). Report of the Technical Workshop on Deep-sea Fisheries and Vulnerable Marine Ecosystems of the Eastern Central Atlantic, Dakar, Senegal, 8–10 November 2016. FAO Fisheries and Aquaculture Report No. 1184. Rome, Italy. Available online at http://www.fao.org/3/i7609b/i7609b.pdf, accessed 8 August 2023.

FAO. (2020). Regional bodies involved in the management of deep-sea fisheries. Available online at www.fao.org/in-action/vulnerable-marine-ecosystems/background/regional-fishery-bodies/en/, accessed 27 July 2023.

FAO. (2023). EAF-Nansen Programme, Research surveys. Available online at www.fao.org/in-action/eaf-nansen/survey-new/en/, accessed on 17 August 2023.

Favero M., Blanco, G., Copello, S., Pon, J.P.S., Patterlini, C., Mariano-Jelicich, R., Garcia, G., Beron, M.P. (2013). Seabird Bycatch in the Argentinean demersal longline fishery, 2001-2010. Endangered species research 19: 187-199.

Fernández-Peralta, L., Rey, J., Thiam, N. et al., 2022. Manuel à l'usage des observateurs scientifiques à bord des bateaux merlutiers dans les eaux d'Afrique occidentale.European Commission, Directorate-General for Maritime Affairs and Fisheries. Publications Office of the European Union. https://data.europa.eu/doi/10.2771/845807

FOA (Fisheries Observer Agency). (2021). Fisheries Observer Agency Annual Report 2020 – 2021. FOA, Windhoek.

Forselledo, R., Mas, F., Ortiz, M., Domingo, A. (2017a). Length-Length and Length-Weight relationships of swordfish, *Xiphias gladius*, caught by longliners in the Southwestern Atlantic Ocean. Collective Volume of Scientific Papers. ICCAT 74(3): 1151-1157.

Forselledo, R., Mas, F., Pons, M., Domingo, A. (2017b). Standardized CPUE of swordfish, *Xiphias gladius*, based on data gathered by the national observer program on board the uruguayan longline fleet (2001-2012). Collective Volume of Scientific Papers. ICCAT 74(3): 1140-1150.

Forselledo, R., Mas, F., Pons, M., Domingo, A. (2019). Standardized CPUE of bigeye tuna, *Thunnus obesus*, based on data gathered by the national observer program on board the Uruguayan longline fleet (2003-2012). Collective Volume of Scientific Papers. ICCAT 75(7): 1935-1945.

Froese, R., Pauly, D. Editors. (2023). FishBase. World Wide Web electronic publication. Available online at fishbase.mnhn.fr/search.php, accessed on 15 August 2023.

Gallagher, A.J., Kyne, P.M., Hammerschlag, N. (2012). Ecological risk assessment and its application to elasmobranch conservation and management. Journal of Fish Biology, 80(5):1727-1748.

García-Isarch, E., Duque-Nogal, V., Lassana, D., et al. 2022. Manuel à l'usage des observateurs scientifiques à bord des bateaux crevettiers dans les eaux d'Afrique occidentale. European Commission, Directorate-General for Maritime Affairs and Fisheries. Publications Office of the European Union. https://data.europa.eu/doi/10.2771/552235

García-Isarch, E., Duque-Nogal, V., Muñoz. E. y J.M. García Rebollo. 2021. Manual para observadores científicos a bordo de buques marisqueros españoles en aguas de la ZEE de Angola. Versión 2.0 (Marzo de 2021). Instituto Español de Oceanografía (IEO). Centro Oceanográfico de Cádiz. 81 pp.

García-Isarch, E., Duque-Nogal, V., Muñoz. E. y J.M. García Rebollo. 2021. Manual para observadores científicos a bordo de buques marisqueros españoles en aguas de la ZEE de Angola. Versión 2.0 (Marzo de 2021). Instituto Español de Oceanografía (IEO). Centro Oceanográfico de Cádiz. 81 pp.

García-Isarch, E., Clark, J.M., Fernández-Peralta, L., González-Lorenzo, J.G., Duque-Nogal, V., Corten, A., Rey. J., Young, S., Perales-Raya, C., Cervantes, A., Verver, S. 2020. Study on improvement for the analysis and exploitation of observer reports in EU fisheries from NW African waters. Final Report. Specific Contract No 12. Framework Contract. EASME/EMFF/2016/008. May – 2020. 190 pp. https://op.europa.eu/en/publication-detail/-/publication/18f4fe14-e745-11ea-ad25-01aa75ed71a1

Giussi, A. R., Hansen, J. E., Wöler, O. C. (2002). Estimated total abundance and numbers at age of longtail hake (*Macruronus magellanicus*) in the Southwest Atlantic during the years 1987-2000. Scientia Marina, 66(3), 283-291.

Global Fishing Watch. (2023). Available online at www.globalfishingwatch.org/, accessed on 17 August 2023.

Griffiths, S., Wallace, B., Swimmer, Y., Alfaro-Shigueto, J., Mangel, J.C., Oliveros-Ramos, R. (2020). Vulnerability status and efficacy of potential conservation measures for the east Pacific leatherback turtle (*Dermochelys coriacea*) stock using the EASI-Fish approach. In 10th Meeting of the IATTC Working Group on Bycatch, 7 May 2020, La Jolla, California, USA. Document BYC-10 INFB (Vol. 41).

Hobday, A.J., Smith, A.D.M., Stobutzki, I.C., Bulman, C., Daley, R., Dambacher, J.M., Deng, R.A., Dowdney, J., Fuller, M., Furlani, D., Griffiths, S.P., Johnson, D. , Kenyon, R., Knuckey, I.A., Ling, S.D., Pitcher, R., Sainsbury, K.J., Sporcic, M., Smith, T., Turnbull, C., Walker, T.I., Wayte, S.E., Webb, H., Williams, A., Wise, B.S., Zhou, S. (2011). Ecological risk assessment for the effects of fishing. Fisheries Research Volume 108(2-3): 372-384.

Hutchings, L., Augustyn, C.J., Cockroft, A., Van der Lingen, C., Coetzee, J., Leslie, R.W., Tarr, R.J., Oosthuizen, H., Lipinski, M.R., Roberts, M.R., Wilke, C., Crawford, R., Shannon, L.J., Mayekiso, M. (2009). Marine Fisheries monitoring programmes in South Africa. South African Journal of Science 105, May/June 2009.

ICES. (2012a). ICES Implementation of Advice for Data-limited Stocks in 2012 in its 2012 Advice. ICES CM 2012/ACOM 68. 42 pp. DOI: 10.17895/ices.pub.5322

Kell, L.T., Minto, C., Gerritsen, H.D. (2022a). Evaluation of the skill of length-based indicators to identify stock status and trends. ICES Journal of Marine Science 79(4): 1202-1216.

Kell, L.T., Sharma, R. and Winker, H., 2022b. Artefact and Artifice: Evaluation of the Skill of Catch-Only Methods for Classifying Stock Status. Frontiers in Marine Science, 9, p.762203.

Kirby D.S. (2006). Ecological risk assessment for species caught in WCPO tuna fisheries: inherent risk as determined by productivity-susceptibility analysis. WCPFC-SC2-2006/EB WP1, 24p.

Klautau, A. G. C. D. M., Cintra, I. H. A., Rotundo, M. M., Carvalho-Filho, A., Caires, R. A., Marceniuk, A. P. (2020). The deep sea teleost fish fauna of the Brazilian North Coast. Neotropical Ichthyology, 18, e200030.

Leach, A.W., Levontin, P., Holt, J., Kell, L.T., Mumford, J.D. (2014). Identification and prioritization of uncertainties for management of Eastern Atlantic bluefin tuna (*Thunnus thynnus*). Marine Policy 48:84-92.

Lemrabott, S.Y.C., El-Hacen, E-H. M., Piersma, T., Sall, A. A., Sidina, E., Mahmoud, L.Y.A., Olff, H., Van Leeuwen, A. (2023). Twenty years of monitoring reveal overfishing of bony fish stocks in the coastal national park Banc d'Arguin, in Mauritania. Aquatic Conservation: Marine and Freshwater Ecosystems 33(8): 833-844.

Laptikhovsky, V., Corten, A., García-Isarch, E., et al. 2022. Manuel à l'usage des observateurs scientifiques à bord des chalutiers pélagiques dans les eaux d'Afrique occidentale. European Commission, Directorate-General for Maritime Affairs and Fisheries. Publications Office of the European Union. https://data.europa.eu/doi/10.2771/317179

López-Martínez J, Muñoz A, Dowdeswell JA, Linés C, Acosta J (2011) Relict sea-floor ploughmarks record deep-keeled Antarctic icebergs to 45°S on the Argentine margin. Marine Geology 288, pp. 43-48. DOI: 10.1016/j.margeo.2011.08.002

Lorenzo, M. I., Defeo, O. (2015). The biology and fishery of hake (*Merluccius hubbsi*) in the Argentinean-Uruguayan Common Fishing Zone of the Southwest Atlantic Ocean. Hakes: 185–210.

Miethe, T., Reecht, Y., Dobby, H. (2019). Reference points for the lengthbased indicator lmax5 for use in the assessment of data-limited stocks. ICES Journal of Marine Science 76(7): 2125–2139.

Monterey Bay Seafood Watch. (2018). Argentine Red Shrimp. Seafood watch consulting researcher. September 2018. Available online at www.seafoodwatch.org/globalassets/sfw-data-blocks/reports/s/mba_seafoodwatch_argentine_red_shrimp_argentina.pdf, accessed August 17 2023.

Muñoz A, Cristobo J, Ríos P, Druet M, Polonio V, Uchupi E, Acosta J, Iglesias S, Portela J, Del Río JL, Parra S, Sacau M, Vilela R, Patrocinio T, Almón B, Elvira E, Jiménez P, Fontán A, Alcalá C, López V. (2012). Sediment drifts and cold-water coral reefs in the Patagonian upper and middle continental slope. Marine and Petroleum Geology 36: 70-78. https://doi.org/10.1016/j.marpetgeo.2012.05.008

Nwosu, F.M., Enin, U.I., Holzlöhner, S. (2010). Assessment of Artisanal Fishery Impacts on West African Croaker *Pseudotolithus elongatus* in the Cross River Estuary, Nigeria, Using Length-Based Models, North American Journal of Fisheries Management, 30(4): 860-865. DOI:10.1577/M10-011.1.

Palomares, M.L.D., Khalfallah, M., Woroniak, J, Pauly, D. (eds.). (2020). Assessments of marine fisheries resources in West Africa with emphasis on small pelagics. Fisheries Centre Research Reports 28(4): 5-17.

Palomares, M.L.D., Pauly, D. Editors. (2023). SeaLifeBase. World Wide Web electronic publication. Available online at www.sealifebase.ca/search.php, accessed 16 August.

Pakhorukov, N. (1999). Underwater observation on deepwater fish of the Atlantic Ocean in the region of the Sierra Leone Rise. Journal of Ichthyology, 39: 626–633.

Pakhorukov, N.P. (2008). Visual observations of fish from seamounts of the Southern Azores region (the Atlantic Ocean) Journal of Ichthyology, 48: 114-123.

Passadore, C., Domingo, A., Secchi, E.R. (2015). Analysis of marine mammal bycatch in the Uruguayan pelagic longline fishery operating in the Southwestern Atlantic Ocean. ICES Journal of Marine Science 72: 1637–1652. DOI:10.1093/icesjms/fsu250

Paterson, B., Kainge, P. (2014). Rebuilding the Namibian hake fishery: a case for collaboration between scientists and fishermen. Ecology and Society, 19(2): 49.

Patrick, W.S., Spencer, P., Ormseth, O., Cope, J., Field, J., Kobayashi, D., Gedamke, T., Cortés, E., Bigelow, K., Overholtz, W., Link, J., Lawson, P. (2009). Use of productivity and susceptibility indices to determine stock vulnerability, with example applications to six U.S. fisheries. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-101, 90 p.

Perales-Raya, C., González-Lorenzo, J.G., Brahim, K., Sotillo, B., Camara, A., 2020. Manuel à l'usage des observateurs scientifiques à bord des bateaux céphalopodiers dans les eaux d'afrique occidentale. Project "Study on improvement for the analysis and exploitation of observer reports in EU fisheries from NW African waters". Specific Contract No 12 (Framework Contract EASME/EMFF/2016/008).

Portela J., Acosta J., Cristobo J., Muñoz A., Parra S., Ibarrola T., Vilela T., Ríos P., Blanco R., Almón B., Tel E., Besada V., Viñas L., Polonio V., Barba M., Marín, P. (2012). Management Strategies to Limit the Impact of Bottom Trawling on VMEs in the High Seas of the SW Atlantic. In Cruzado A (ed) Marine Ecosystems, Chapter 9, 199-228p. DOI: 10.5772/34610

Portela, J.M and Sánchez Barba, M. (2012). Programa de observadores científicos en aguas del Atlántico Sudoccidental. Instituto Español de Oceanografía. Centro Oceanográfico de Vigo. http://hdl.handle.net/10261/329224

Portela, J.M., Acosta, J., Cristobo, J., Muñoz, A., Parra, S., Ibarrola, T., del Río, J.L., Ríos, P., Blanco, R., Almón, B., Tel, E., Besada, V., Viñas, L., Polonio, V., Barba, M., Marín, P. (2015a). Management strategies to limit the impact of bottom trawling on VMEs in the high seas of the SW Atlantic. In: Cruzado A (ed.) Marine Ecosystems, 199–228 pp. Rijeka, InTech. DOI: 10.5772/34610.

Portela, J.M., Cristobo, J., Ríos, P., Acosta, J., Parra, S., del Río, J.L., Tel, E., Polonio, V., Muñoz, A., Patrocinio, T., Vilela, R., Barba, M., Marín, P. (2015b). A first approach to assess the impact of bottom trawling over vulnerable marine ecosystems on the High Seas of the southwest Atlantic. In: Lo Y-H, Blanco SA, Roy S (eds.) Biodiversity in ecosystems - linking structure and function, 271–298 pp. Rijeka, InTech.

Portela, J.M., Cristobo, J., Ríos, P., Acosta, J., Parra, S., Del Río, J.L., Tel, E., Polonio, V., Muñoz, A., Patrocinio, T., Vilela, R., Barba, M., Marín, P. and Blanco, J.A. (Ed.). (2015c) A First Approach to Assess the Impact of Bottom Trawling Over Vulnerable Marine Ecosystems on the High Seas of the Southwest Atlantic Biodiversity in ecosystems - Linking Structure and Function, Rijeka, InTech, p. 28.

Prado, J., Drew, S. (1999). Research and development in fishing technology in Latin America. Food and Agriculture Organization of the United Nations. Brazil, Research programmes. FAO, Rome. Available online at www.fao.org/3/x2173e/x2173E03.htm#pro, accessed on 16 August 2023.

Ramos, A. (2001). Informe de la campaña 'PALGUINEA-2001'- Prospección por palangre de los recursos demersales profundos del Golfo de Guinea (elevación de Sierra Leona) (Acción Piloto de pesca experimental RAIAP-19/2000). Instituto Español de Oceanografía. 34 pp.

RCG LDF 2023. Regional Coordination Group for Long Distance Fisheries. 2023. 71 pp. https://www.fisheries-rcg.eu/wp-content/uploads/2023/09/2023_RCG-LDF_Report_final.pdf

Riley, A., Ball, J., Cowburn, B., Wright, S. (2020). St Helena – Grouper (*Epinephelus* adscenionis). CR071: Fisheries Advice – Management. Blue Belt Programme. Available online at www.sainthelena.gov.sh/wp-content/uploads/2021/02/STH-Grouper-fishery-advice-and-managment-summary-report-DRAFT-v-1.8.pdf, accessed August 16 2023.

Rios, P., Kelly, M., Vacelet, J. (2011). Cercicladia australis, a new carnivorous sponge with novel chelae from the Tasman Basin and the Argentine Patagonian Margin (Porifera, Cladorhizidae). Zootaxa 3131: 052-062.

Sacau, M., Durán Muñoz, P., Sarralde, R., Del Rio, J.L., Guijarro, B., Ordinas, F., Vidal-Liñán, L., Moir Clark, J., Kell, L., Hunt, G., Mangi, S.C. (2021). Improving environmental sustainability of deep sea fisheries with emphasis on the conservation of Vulnerable Marine 151 Ecosystems (VMEs). European Commission. Specific Contract No. 01 under Framework Contract No. EASME/EMFF/2019/014.

Deliverable 3: Review of existing and recommended criteria and methodologies for the establishment of historical and cumulative fishing footprints (Task 4 – Sub-task 4.1) 123 pp.

Sarré, A., Krakstad, J-O., Brehmer, P., Mbye, E.M. (2018). Spatial distribution of main clupeid species in relation to acoustic assessment surveys in the continental shelves of Senegal and The Gambia. Aquatic Living Resources 31: 9p. DOI: 10.1051/alr/2017049.

Sheriff, M.F., Seisay, M.B.D., Jalloh, K., Turay, I., Sei, S., Seilert, H. (2009). Regional Seminar on Mechanisms for Management of Shared Stocks of Small Pelagics in Northwest Africa. Co-management of the small pelagic fisheries in Sierra Leone. Dakar, Senegal. April, 2009.

Srairi, A., Driri, A., Mahmed, A. B., Boumaaz, A., and Belghyti D. Reproduction of the squid *Loligo vulgaris* off the South Atlantic coast of Morocco. Materials today proceedings 72(7): 3527-3535. DOI:10.1016/j.matpr.2022.08.256

Saint Helena Government. (2014). Marine life abundance and diversity surveys for long term monitoring. Environmental Management Division, Saint Helena Government, Jamestown. Available online at www.sainthelena.gov.sh/wp-content/uploads/2013/07/Marine-Life-Abundance-and-Diversity-Survey-for-Long-Term-Monitoring.pdf, accessed 16 August 2023.

Tandstad, M. 2016. Eastern Central Atlantic Ocean, in Thompson, A.B., et al. (eds.) Vulnerable Marine Ecosystems: Processes and Practices in the High Seas, FAO Fisheries and Aquaculture Technical Paper No. 595. Rome, Italy, pp 55-61. Available online at http://www.fao.org/3/i5952e/i5952e.pdf, accessed 3 August 2023.

Thiaw, M., Gascuel, D., Thiao, D., Thiaw, O. T., Jouffre, D. (2011). Analysing environmental and fishing effects on a short-lived species stock: the dynamics of the octopus *Octopus vulgaris* population in Senegalese waters. African Journal of Marine Science 33(2): 209-222.

Thorson, J. T., S. B. Munch, J. M. Cope, and J. Gao. (2017). Predicting life history parameters for all fishes worldwide. Ecological Applications. 27(8): 2262–2276

Tingley, G., del Río Iglesias, J. L., Cristobo, J. (2016). Southwest Atlantic Ocean. Vulnerable Marine Ecosystems: Processes and Practices in the High Seas, FAO Fisheries and Aquaculture Technical Paper No. 595 FAO (pp.69-75) Publisher: United Nations Food and Agriculture Organisation (UN FAO), Rome, Italy.

Trevizan T, Shcherbich Z, Büring T, Ramos JE, Nicholls R, Hoyer P, Amukwaya A, FournierCarnoy L, Piontek R. (2023). Cruise Report ZDLT1-2023-02. Groundfish survey. Fisheries Department, Directorate of Natural Resources, Falkland Islands Government. Stanley, Falkland Islands. 39p.

UN General Assembly. (1982). Convention on the Law of the Sea, 10 December 1982, available online at: https://www.refworld.org/docid/3dd8fd1b4.html, accessed on 16 August 2023.

Vilela, R., Conesa, D., del Río, J.L., López-Quílez, A., Portela, J. and Bellido. J.M. (2018). Integrating fishing spatial patterns and strategies to improve high seas fisheries management. Marine Policy, 94: 132-142.

West Africa Regional Fisheries Program (WARFP). (2023). Senegal. Available online at spcsrp.org/en/senegal, accessed 30 July 2023.

Winker, H., Carvalho, F. and Kapur, M., 2018. JABBA: just another Bayesian biomass assessment. Fisheries Research 204: 275-288.

Winter, A., Raczynski, M., Peruzzo, M. (2023). 2023 1st Pre-Season Assessment Survey. Falkland calamari (*Doryteuthis gahi*). Natural Resources – Fisheries. Falkland Islands Government. March 2023.

Zhou, S., Griffiths, S.P. Miller, M. (2009). Sustainability assessment for fishing effects (SAFE) on highly diverse and data-limited fish bycatch in a tropical prawn trawl fishery. Marine and Freshwater Research 60(6): 563-570.

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