DELIVERABLE 6.9

Report on performance of existing management plans

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SEAWISE

Executive summary

The SEAwise project works to deliver a fully operational tool that will allow fishers, managers, and policy makers to easily apply Ecosystem Based Fisheries Management (EBFM) in their fisheries. This SEAwise report evaluates the current state of affairs on ecosystem based fisheries management, including an overview of regional fisheries management measures in place and an evaluation of its effectiveness in terms of its achievement of policy objectives. The evaluation considers a selection of objectives representing ecological, social and economic sustainability dimensions from the two main policy frameworks, CFP and MSFD, for which the achievement of objectives may be compromised by fishing and that are likely to benefit from EBFM. For the purposes of SEAwise we consider EBFM from the perspective of a social-ecological system and work from the assumption that EBFM advances through an adaptive management process consisting of subsequent assessment and management cycles resulting in EBFM plans. A management strategy consists of a policy instrument and a management measure. We deliberately distinguish between the two because the former operates in the social system and is the mechanism (mainly dependent on the governance) to get the fisheries management measures, supposed to mitigate the fisheries impacts in the ecological system, implemented.

Most of the main policy objectives covering ecological, social and economic sustainability were not achieved. The recently proposed Nature restoration law concluded that management measures aimed at restoring biodiversity of other species have largely been ineffective (EC 2022b). This conclusion was largely based on evaluations of species and habitats listed under the Habitat Directive and a formal assessment of the success in attaining other MSFD objectives is generally not possible due to lack of agreed thresholds (and indicators in some cases).

The objectives stated in the CFP, MSFD and associated documents for a fisheries related aspects are often not supported by agreed estimated indicators, particularly for social aspects and ecosystem effects of fishing. Where indicators have been developed, there are often no agreed thresholds. Together, this either limits an evaluation of whether objectives are attained to specific elements such as fishing pressure, fished stock biomass and status of species assessed under the habitat directive or necessitates a high degree of expert judgement with the associated lack of transparency and reproducibility. There are, however, positive changes occurring. The measures aimed at reducing fishing mortality over the past 20 years have been highly effective in reversing the trend of overfishing in most of the EU waters. Nevertheless, they have not succeeded in restoring stocks to levels capable of producing MSY.

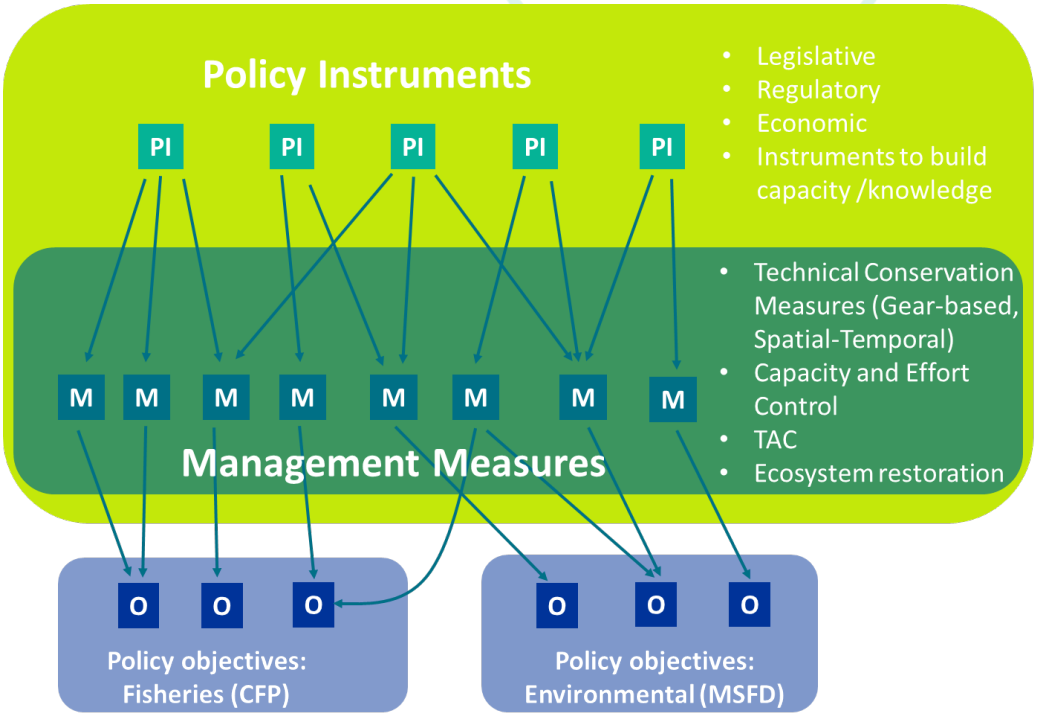

Illustration of how an EBFM plan consists of management strategies which, in turn, can be considered a combination of policy instruments (I) and management measures (M) contributing to the achievement of policy objectives (O).

Contents

1. SEAwise background

The SEAwise project works to deliver a fully operational tool that will allow fishers, managers, and policy makers to easily apply Ecosystem Based Fisheries Management (EBFM) in their own fisheries. With the input from advice users, SEAwise identifies and addresses core challenges facing EBFM, creating tools and advice for collaborative management aimed at achieving long-terms goals under environmental change and increasing competition for space. SEAwise operates through four key stages, drawing upon existing management structures and centered on stakeholder input, to create a comprehensive overview of all fisheries interactions in the European Atlantic and Mediterranean. Working with stakeholders, SEAwise acts to:

- Build a network of experts - from fishers to advisory bodies, decision makers and scientists - to identify widely-accepted key priorities and co-design innovative approaches to EBFM.
- Assemble a new knowledge base, drawing upon existing knowledge and new insights from stakeholders and science, to create a comprehensive overview of the social, economic, and ecological interactions of fisheries in the European Atlantic and Mediterranean.
- Develop predictive models, underpinned by the new knowledge base, that allow users to evaluate the potential trade-offs of management decisions, and forecast their long term impacts on the ecosystem.
- Provide practical, ready-for-uptake advice that is resilient to the changing landscapes of environmental change and competition for marine space.

The project links the first ecosystem-scale impact assessment of maritime activities with the welfare of the fished stocks these ecosystems support, enabling a full-circle view of ecosystem effects on fishing productivity in the European Atlantic and Mediterranean. Drawing these links will pave the way for a whole-ecosystem management approach that places fisheries at the heart of ecosystem welfare. In four cross-cutting case studies, each centred on the link between social and economic objectives, target stocks and management at regional scale SEAwise provides:

- Estimates of impacts of management measures and climate change on fisheries, fish and shellfish stocks living close to the bottom, wildlife bycatch, fisheries-related litter and conflicts in the use of marine space in the Mediterranean Sea,
- Integrated EBFM advice on fisheries in the North Sea, and their influence on sensitive species and habitats in the context of ocean warming and offshore renewable energy,
- Estimates of effects of environmental change on recruitment, fish growth, maturity and production in the Western Waters,
- Key priorities for integrating changes in productivity, spatial distribution, and fishers' decision-making in the Baltic Sea to create effective EBFM prediction models.

Each of the four case studies will be directly informed by expert local knowledge and open discussion, allowing the work to remain adaptive to change and responsive to the needs of advice users.

1.1 The role of this deliverable

This deliverable is the first step towards identifying management strategies that can contribute to achieving objectives of the European fisheries legislation to manage human activities under an ecosystem approach (Common Fisheries Policy (CFP; European Commission 2013); Marine Strategy Framework Directive (MSFD; European Commission 2008, 2017, 2022a)). A typical management strategy is a policy instrument for the implementation of a management measure to mitigate a specific fishing impact. The policy instruments include legislative instruments (e.g. conservation laws); regulatory instruments (e.g. setting targets or standards to maintain a certain level of environmental quality, bans or permits); or Economic instruments (e.g., tariffs, taxes and charges). Management measures consist of e.g. catch or habitat quota, technical measures or Marine Protected Areas (MPAs). A comprehensive list of management strategies scoping possible policy instruments and management measures by region is compiled in this deliverable by combining outcomes of previous projects with input from the stakeholder consultations described in deliverable 1.9. The present deliverable further identifies the performance of the base-line management for comparison with later proposed plans. The evaluation focuses on the effectiveness of current management (Does the plan achieve the desired targets?).

1.2 Contributors

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1.3 Glossary of terms, acronyms and abbreviations

GLOSSARY OF TERMS

Term	Description
Ecosystem	An ecological system composed of biological communities of interacting organisms and their physical environment. Humans are an integral part of an ecosystem.
Ecosystem-based Fisheries Management	Here we distinguish between the concept of Ecosystem-based Fisheries Management (EBFM) and the actual implementation of an Ecosystem-based Fisheries Management, as there can be many different configurations depending on the context. We have not adopted any specific definition but work from a suite of common principles that drive the implementation of an EBFM.
Fishery	"A group of vessel voyages targeting the same (assemblage of) species and/or stocks, using similar gear, during the same period of the year and within the same area" (ICES, 2003). The commercial fisheries correspond to a unity of gear type, target species (group), area and time of the year, and can therefore be expected to have the same (or sufficiently similar) impacts on the ecosystem and its different components. A fishery is the basic unit to which management measures apply. A fishery may consist of several métiers.
Instrument	An intervention in the governance arrangements covering the advisory and decision-making process, typically through policies, which is intended to facilitate the implementation and/or enforcement of management measures.
Management measure	"Management measures are the specific elements of fisheries control which are embodied in regulations and which become a focus for surveillance activities." (FAO 1995). In the context of the social-ecological system that is at the basis of EBFM, we define measures as operating solely in the ecological system where they mitigate the impact of fishing on the ecosystem including all its relevant components and aspects.
Management Strategy	The combination of a policy instrument and a management measure. The policy instrument is the means to implement the measure.

Management Plan	An internally consistent combination of different management measures and policy instruments aimed at achieving a selection of policy objectives for a specific ecosystem and its socio-economic/institutional context.
Métier	"Part of the activity of a fishing fleet taking place in a given area, with a specific gear and targeting a specific (assemblage of) species" (ICES, 2003). For practical reasons, the métier definition chosen for this work was the Data Collection Framework (DCF) métiers used by Member States for reporting landings data.

LIST OF ABBREVIATIONS

Term	Description
CFP	Common Fisheries Policy
DCF	Data Collection Framework
EBFM	Ecosystem-Based Fisheries Management
GES	Good Environmental Status
GFCM	General Fisheries Commission for the Mediterranean
GSA	Geographical Sub Area
HELCOM	Baltic Marine Environment Protection Commission
ICES	International Council for the Exploration of the Sea
ITQ	Individual Transferrable Quota
LO	Landing Obligation
MAP	Multi-Annual Plan
MCRS	Minimum Conservation Reference Size
MPA	Marine Protected Area
MS	Member State (of the European Union)
MSC	Marine Stewardship Council
MSFD	Marine Strategy Framework Directive
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
STECF	Scientific, Technical and Economic Committee for Fisheries
TAC	Total Allowable Catch
UNEP-MAP	United Nations Environment Programme Mediterranean Action Plan

2. Approach

This report evaluates the current state of affairs on EBFM (i.e. to set a baseline), including an overview of regional fisheries management measures in place and an assessments of its effectiveness in terms of its achievement of policy objectives. This baseline can then be applied to evaluate the potential improvements of any future regional EBFM plans that will be devised as part of SEAwise. The future evaluation may apply specific outcome criteria for effectiveness, efficiency and equity. For this report, only the effectiveness criterion and the two main policy frameworks, i.e. CFP and MSFD are considered.

2.1 CFP and the implementation of EBFM

The Commission's understanding is that the ecosystem approach to fisheries (EBFM) is about ensuring goods and services from living aquatic resources for present and future generations within meaningful ecological boundaries (EC, 2008, 2013). EBFM is also one of the core objectives of the GFCM 2030 Strategy (in particular with Target 1, 2, 3 and 4) that will step up efforts in the implementation of existing policy frameworks.

In the complex EU fisheries context, integrative policies such as the Marine Strategy Framework Directive require a cross-sectoral approach to marine management. Fisheries management measures that contribute to achieving good environmental status (GES) need to be further developed and implemented.

A key point from the EU Communication on EBFM is to keep direct and indirect impacts of fisheries within bounds in relation to healthy marine ecosystems and ecologically viable fish populations. The main and first task of fisheries management is therefore to reduce or maintain the overall fishing pressure in sustainable levels. The main instrument to regulate this in Europe are the long-term management plans (MAPs).

This approach follows the adaptive five-step EBFM implementation process (Fig 2.1.1) from EC-CINEA (2022).

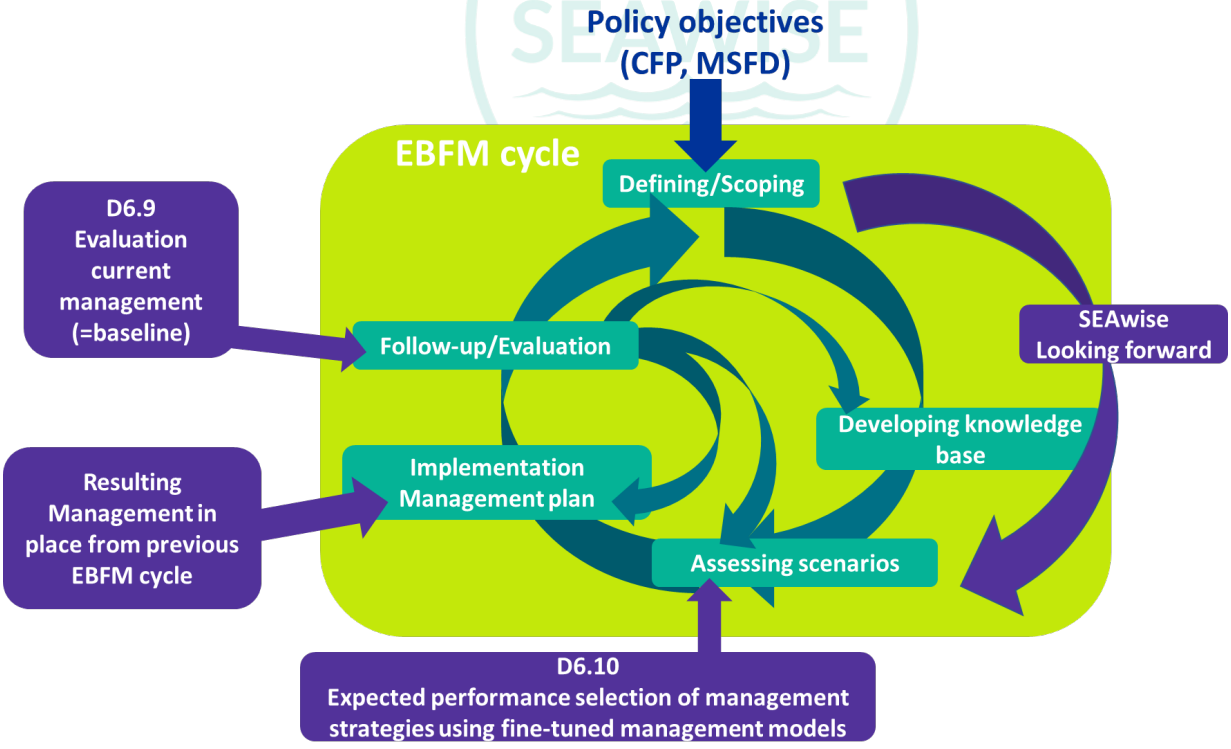

Figure 2.1.1. The adaptive five-step EBFM implementation process and an indication of how this report fits in that process. Note that even though the current management in place was not the result of a formal EBFM cycle we have treated it as such.

1. **Defining** the frame for EBFM, starting with its aim to achieve specific policy objectives or societal goals within the social and environmental context and include the legal setting. Note that these objectives and societal goals are often understood to refer to the state of the ecosystem and the fishing opportunities but may also involve social or economic objectives/goals. This is the focus of the present report as well as the SEAwise scoping consultations.
2. **Developing** the evidence base (which may include scientific and other types of knowledge, e.g. fisher knowledge) driven by the policy objectives or societal goals to be achieved, the relevant fisheries and potential EBFM measures. This requires an understanding of the interaction of specific fisheries with the ecosystem and how this may be mitigated through specific measures. The evidence base is developed in SEAwise through scoping consultations and systematic reviews of social and economic issues, stock productivity, ecosystem effects of fishing and spatial aspects of fish and fisheries.
3. **Assessing** and weighing the EBFM alternative scenarios using the evidence base and appropriate tools. This is the focus for SEAwise work on Management Strategy modelling and communication. This results in a scientific advice that proposes preferred management and policy approaches.
4. **Implementing** a specific EBFM plan based on informed decision-making guided by best practices. This plan is an internally consistent combination of different management strategies (i.e. measures and policy instruments) aimed at achieving a selection of policy objectives for a specific ecosystem and its socio-economic/institutional context.
5. **Follow-up** which basically consists of an assessment of the state of affairs pertaining to the implementation of the EBFM plan. This includes both the EBFM process, i.e. the preceding stages, as well as its performance in achieving the specific policy objectives or societal goals.

These five stages represent one EBFM cycle - which we assume commenced more or less at the time the EC Communication (2008) – and we have now completed the first cycle. The current step involves the follow-up, evaluating the performance in achieving the specific policy objectives. This should provide the basis to advance into the next cycle of the adaptive EBFM process. As part of SEAwise we will go through this next cycle and develop the knowledge base and assess various scenarios to guide the next cycle implementation step. This activity will culminate in Deliverable 6.10.

2.2 Design of an EBFM plan

In a simple depiction an EBFM plan consists of an internally consistent selection of management strategies (i.e. not interfering with one another's performance) aimed at achieving clear policy objectives reflecting sustainable fisheries (CFP, GFCM 2030 Strategy) and ecosystem conservation goals (MSFD, Bird & Habitat Directives). A management strategy consists of a policy instrument and a management measure. We distinguish between the two because the former operates in the social system and is the mechanism (mainly dependent on the governance) to get the fisheries management measures, aiming to regulate the fisheries impacts in the ecological system, implemented.

The present report focuses on management measures but also provide a tentative typology for the policy instruments:

- Regulatory policy instruments. These include all (inter-) national legislation.
- Economic policy instruments such as pricing mechanisms (e.g. tariffs, taxes and charges, trading of permits), payments, or liability schemes. These specifically include Individual Tradeable Quota (ITQs) or subsidies for alternative gears.
- Policy Instruments involving information, awareness-raising, and public engagement. Eco-labelling (e.g. Marine Stewardship Council, MSC) would fall under this category as it specifically includes EBFM objectives in their certification process.

- Policy instruments initiating monitoring and research that is aimed at improving the knowledge base (e.g. the DCF).
- Policy instruments aimed at the regional or local governance arrangements such as co-management, self-management or results-based management.

Note this typology is not intended to be exhaustive but should provide enough information to distinguish the policy instrument from the actual management measures when evaluating the current management in place.

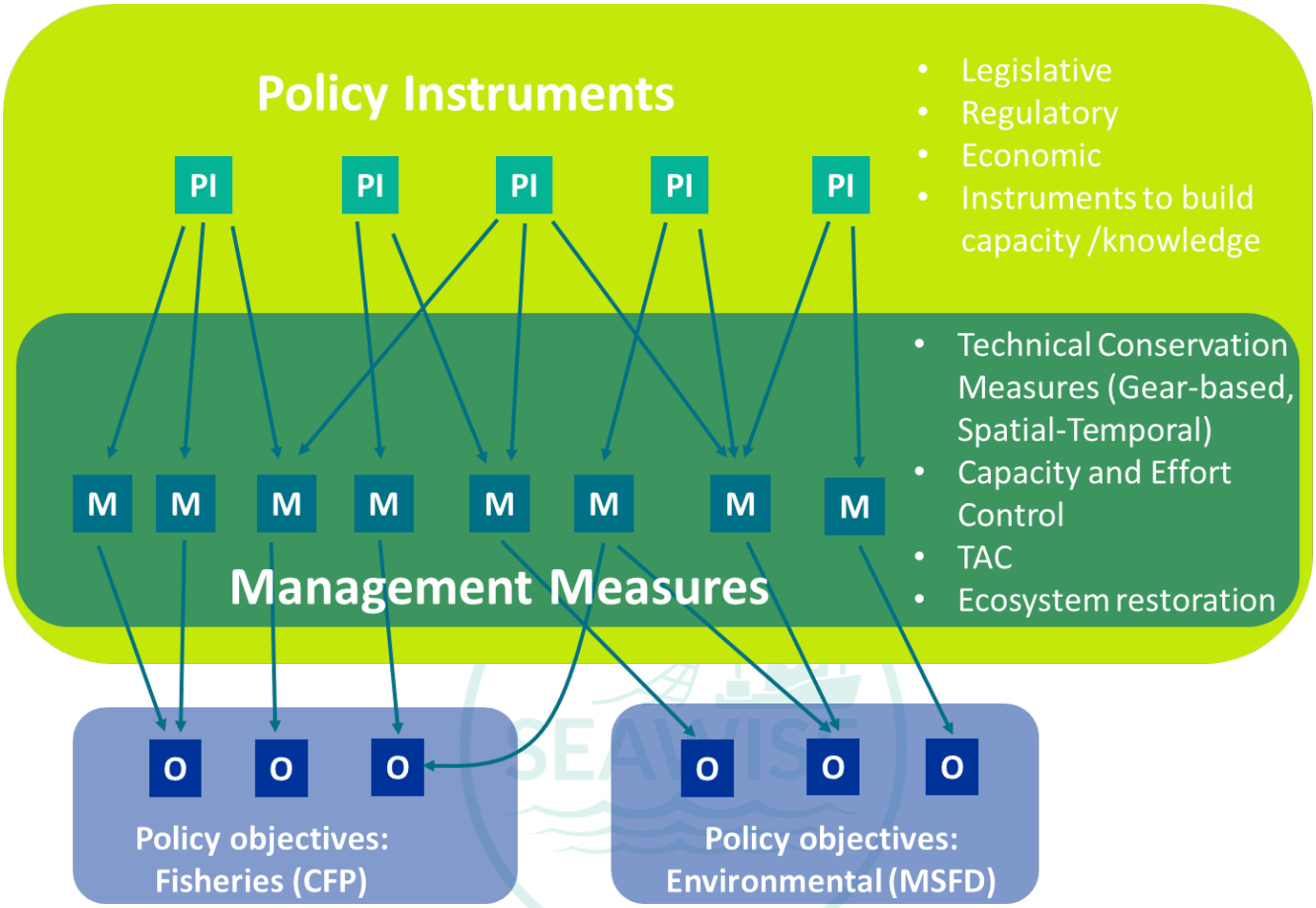

Figure 2.1.2. Illustration of how an EBFM plan consists of management strategies which, in turn, can be considered a combination of policy instruments (I) and management measures (M) contributing to the achievement of policy objectives (O).

3. Identification of management measures

3.1 Management measures identified by stakeholder scoping

The by far most frequently mentioned management measure by both stakeholders and scientists, in all regions except the Baltic Sea, was spatial management. Limits to total allowable catches (TAC) was the second most frequently mentioned, followed by control and enforcement, Landing obligation, co-management, technical measures, Brexit, OECM (other effective conservation measures) and culling. Culling was only mentioned in the Baltic Sea and Brexit only in the North Sea and Northwestern Waters. The stakeholder scoping methods and results are described in detail in the SEAwise report on scoping consultations.

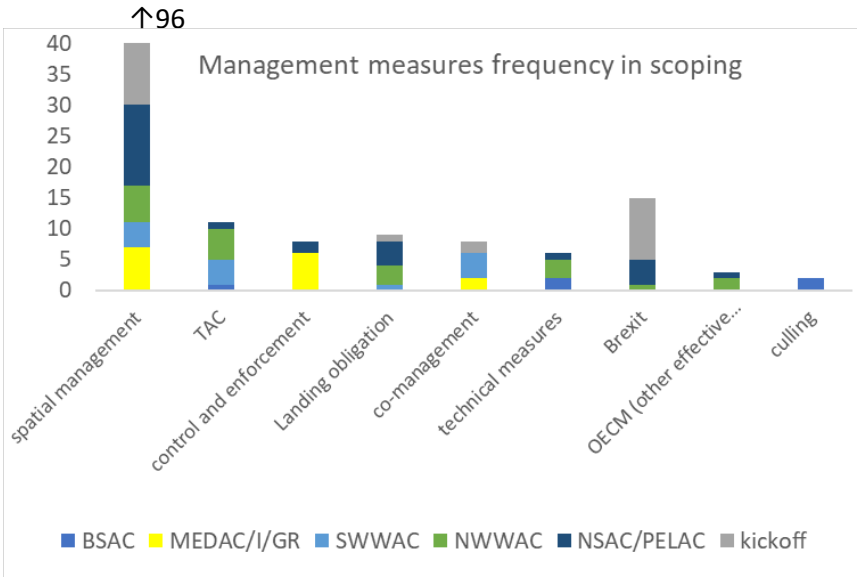

Figure 3. Frequency of different management measures in the stakeholder scoping. OECM: Other effective area-based conservation measures.

3.2 Identification of management measures implemented in EU waters

For an identification of management measures that have been implemented in EU waters as part of fisheries management the typology of management measures from EC-CINEA (2022) was adopted. This typology is based on a review of the scientific and grey literature coupled with interviews with key stakeholders in the relevant Member States or representing European fisheries. This typology was then applied to identify the types of management measures (with specific examples from the SEAwise case studies) relevant for EBFM in the main EU waters and for which an appropriate knowledge base needs to be developed as part of the SEAwise project (and beyond). This typology of measures with regional examples can be found in Table 1.

Level 3	Level 4	Implementation Details and Examples
Level 1: Input measures		
	Level 2: Technical Conservation Measures	
Gear based measures aimed at size selectivity	Mesh size	120mm is the base mesh size in the North Sea and 90mm in the Skagerrak and Kattegat (+ top panels in certain fisheries). However; the technical measures regulation Annex V allows several derogations with smaller mesh sizes for directed fisheries on certain species (e.g., 80mm for sole and Nephrops and <20% of cod, saithe and haddock in the catch). How to define directed fisheries exactly is under debate for years (especially for the mixed demersal fisheries). Codend of trawl mesh size of 40 mm (square) or 50 diamond are the baseline in the Mediterranean, the latter is authorised after specific evaluations. The minimum mesh size for coastal nets is 20mm.
	Mesh configuration	E.g., Nephrops fisheries in Skagerrak and Kattegat can use square meshes instead of diamond meshes and can then use 70mm instead of 90mm. T90 meshes are also allowed. E.g. Belgian otter trawls in Celtic Sea with >20% landed haddock, 100 mm T90 codend
	Square mesh panels or cylinders	To be used when fishing e.g., for Nephrops or sole in the North Sea according to Annex V part B of the technical measures regulation. E.g. Belgian otter trawls in Celtic Sea with >20% landed haddock, 110 mm codend with 120 mm square mesh panel1.
Gear based measures aimed at species selectivity or avoiding sensitive species	Bycatch reduction devices	E.g., sieve nets in the brown shrimp fisheries
	Sorting grids	E.g., sorting grids to be used in Nephrops and Pandalus fisheries according to the technical measures regulation.
	Separator panels	E.g., SELTRA panels. Mandatory for certain exemptions from the landing obligation. Separator trawls in Scotland.
	Benthos release panels	e.g., Dutch/Belgian beam trawlers, mandatory for certain exemptions from the landing obligation.
	Longline circle hooks	
	Gillnet Pingers	
Spatial and/or Temporal measures	No-take zones	Will be implemented via the Green Deal and Biodiversity Strategy. In some windfarms (e.g., in Germany) or other areas and infrastructure fishing is currently forbidden. In the Mediterranean: in Italy the zone A of Jabuka-Pomo pit in the Adriatic Sea, Zone A of the Bari canyon (GSA18) (both GFCM Recommendations); National Marine Park of Zakynthos (Greece National)
	Protected areas with limited access	Examples: Natura 2000 sites (in many areas management not yet implemented). Areas for the protection of North Sea cod in recent TAC and quota regulations. Plaice box in Annex VC of the technical measures regulation. In the Mediterranean : in Italy Zone B and C of Jabuka-Pomo pit in the Adriatic Sea; Zone B Bari canyon (GSA18); Lophelia reef off Capo Santa Maria di Leuca Fishery Restricted Area. Amvrakikos Gulf (FRA for bottom trawls and purse seines) in Greece

	Closed seasons	E.g., seasonal closures to protect spawning cod (e.g. Trevose box in the Celtic Sea) In the Med: In Greece trawls: are not allowed to operate 4,5 months during the year between May and October and between 24-31 December and 24-31 May. Small scale coastal fleet: not allowed to target European hake during February each year (i.e. the number of individuals of hake per catch should not exceed 20%). Bottom trawls have an extended closed period in Kerkyraikos Gulf, Corinthiakos Gulf and Patraikos Gulf (8 months instead of 4,5); in Italy in the Adriatic the closed season for trawlers is 40 days (August mid-September), in the western Ionian 1 month (September) likewise in other Italian areas Trawls: are not allowed to operate less than 3 miles from coast (4 miles in the Adriatic sea) or below 50m depth, and in any case not less than 1.5miles from the coast or over 1000m depth. Trawling is not allowed over Posidonia fields and coralligenous landscapes. In Greece a large number of spatio-temporal restrictions exist. Approximately 27,8% of the eastern Ionian Sea is subject to spatiotemporal restrictions.
	Real-time closures	Possible based on technical measures regulation, but uptake is limited
	Move on rules	Possible based on technical measures regulation, but uptake is limited
Level 1: Input measures		
	Level 2: Capacity and Effort control	
Fishing capacity control	Decommissioning	E.g., national programs based on national action plans to reach balance between capacity and fishing opportunities. In Italy decommissioning has been in place for almost a decade, the fleet has been reduced
	Entry restriction on the number of fishing licences	Fixed number of fishing licences is in place since long time both in Greece and Italy
	Capacity ceilings	National ceilings of vessel capacity (gross tonnage (GT)) and engine power (kW) respecting the requirements set out in Article 22 of Regulation 1380/2013.
Fishing effort control for active gears	Total Allowable Effort	Based on the cod management plan from 2008 effort limits in kW-days were set. However, the effort regime has been abandoned with the implementation of the landing obligation. Effort regime is in place in the Mediterranean and recently it has been combined with catch limits in the western Mediterranean and in the Adriatic sea
Restrictions for passive gears	Gillnets and Trammel nets	E.g., prohibition (with derogations) to deploy any bottom set gillnet, entangling net and trammel net at any position where the charted depth is greater than 200 m. In the Med. for nets the maximum allowed thickness of nets is 0.5mm for gillnets and trammel nets. Trammel nets and gillnets cannot exceed 4m and 10m in vertical length accordingly. If used in combination the maximum vertical

		length is 10m. The total length of gillnets or trammel nets cannot exceed 6,000m per fishing boat.
	Longline	Longlines: 1,000 hooks per fisher or 5,000 per boat (bottom lines)
	Traps and Pots	
Total Allowable Catch		Main management measure in the North Sea, Western Waters and Baltic Sea. Controls landings, but not total catch Catch limits recently introduced in the western Mediterranean and in the Adriatic sea
Landing Size Control		MCRS defined in Annex V part A of the technical measures regulation (Reg (EU) 2019/1241) In Greece national law regulates also minimum sizes for a few more species (e.g. Boops boops, Lophius spp., Octopus vulgaris)
Discard Ban / Landing Obligation		In the Mediterranean de minimis exemptions for disproportionate costs are applied
Habitat restoration	Artificial reefs	Windfarms may be developed so that they perform as artificial reefs
Stock enhancement	Restocking schemes	Eel stock enhancement

4. Identification of specific policy objectives and an evaluation of their achievement

The effectiveness of the combined management measures in each of the EU marine regions was assessed through an evaluation of the achievement of a selection of policy objectives representing ecological, social and economic sustainability in the CFP and MSFD.

4.1 CFP objectives in the Northeast Atlantic

SEAwise evaluated the temporal development in fishing mortality and stock biomass of ICES and ICCAT assessed stocks in the Northeast Atlantic according to both the CFP and 2022 MSFD guidance (EC 2022a) of using 6 year averages of F/FMSY and B/MSYBtrigger (Figure 4a, b and c). The analysis only include those stocks for which the assessment provides time series estimates of fishing mortality and biomass and reference points exists (e.g. category 1 or category 2 stocks in ICES). The analysis will be delivered to OSPAR for use in the 2023 assessment of Environmental Status. While only the Bay of Biscay is very close to having all stocks fished at or below F_{MSY} (10 out of 11), the development is positive in all subregions except the Azores with increasing proportions of stocks being fished at or below F_{MSY} over the past 20 years (Figure 4a, b and c). The development in stock size has not responded positively and the proportion of stocks below MSYBtrigger or B_{MSY} has not shown a long term improvement (Figure 4b). The stocks which are still fished at fishing mortalities exceeding F_{MSY} in the North Sea are predominantly stocks with a biomass below MSYBtrigger or B_{MSY}, placing these stocks at double jeopardy from reduced recruitment and unsustainable fishing mortalities (64% of stocks fished at F greater than FMSY). The Celtic Sea has 45% of the stocks that are fished above F_{MSY} having a biomass below MSYBtrigger or B_{MSY}. In the Bay of Biscay, only one stock has a biomass below MSYBtrigger or B_{MSY} and a fishing mortality above F_{MSY}.

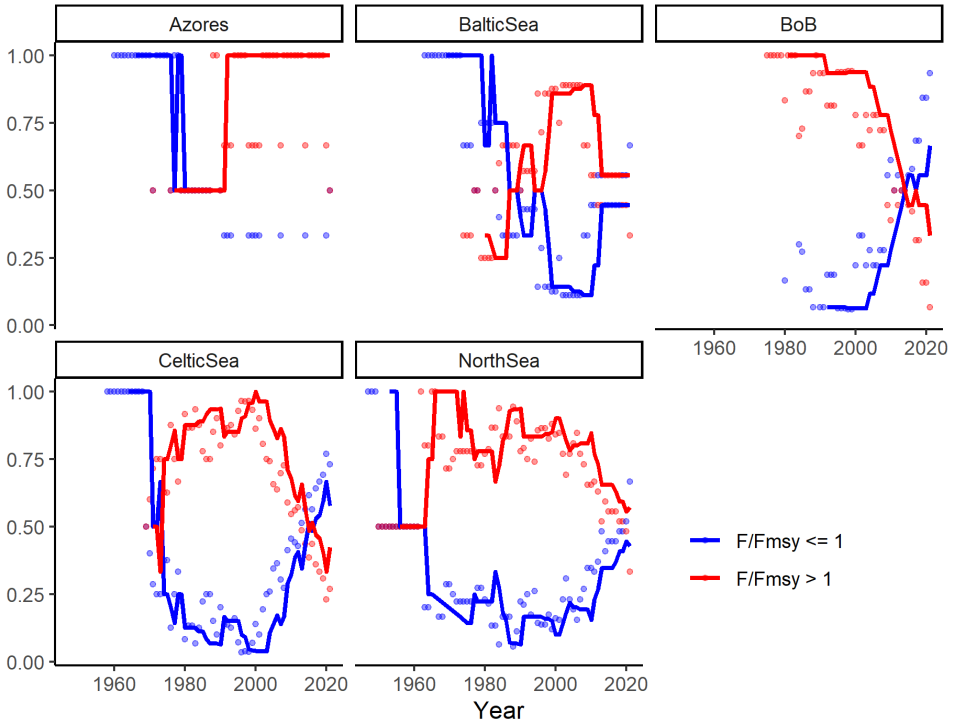

Figure 4a. Proportion of stocks fished at or below F_{MSY} (blue) and above F_{MSY} (red) in different regions of the Northeast Atlantic. BoB= Bay of Biscay. Points represent annual values (indicator defined as target in the CFP) and lines 6-year averages (indicator defined as limit in MSFD D3). Note that the number of stocks included early in the time series is less than in more recent years.

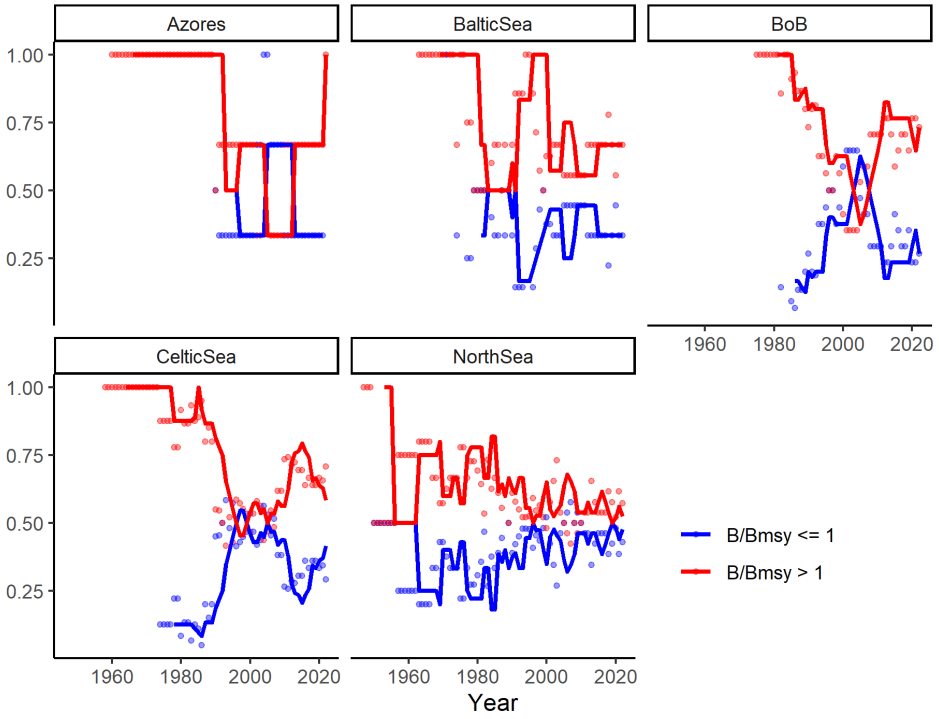

Figure 4b. Proportion of stocks with stock size at or above MSY Btrigger (ICES) or B_{MSY} (ICAAT) (blue) and below MSY Btrigger (ICES) or B_{MSY} (ICAAT) (red) in different regions of the Northeast Atlantic. BoB= Bay of Biscay. Points represent annual values (indicator defined as limit or target in the CFP) and lines 6-year averages (indicator defined as limit in MSFD D3). Note that the number of stocks included early in the time series is less than in more recent years.

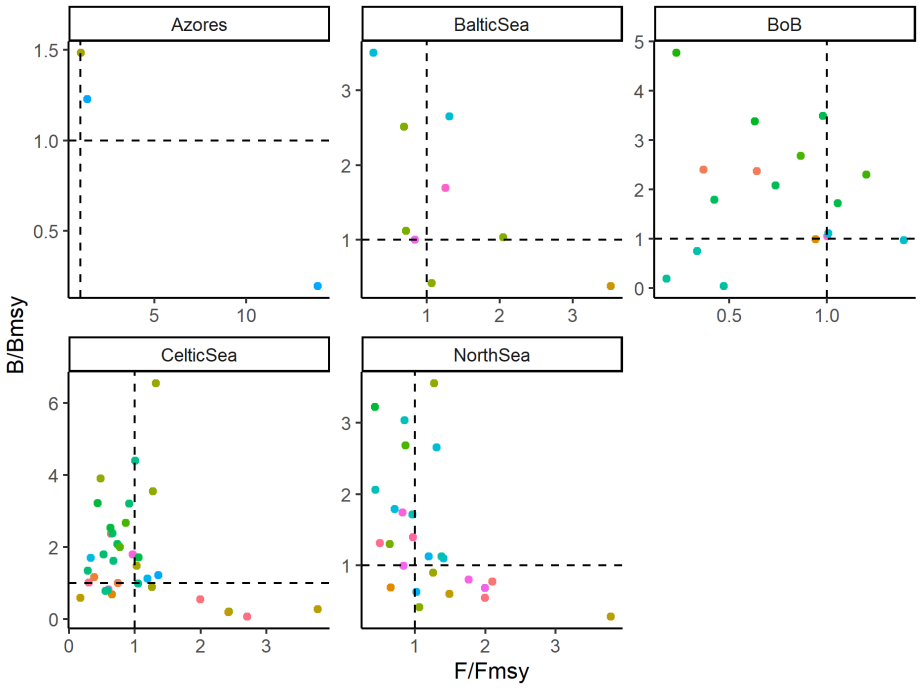

Figure 4c. Stock size relative to MSY Btrigger (ICES) or B_{MSY} (ICAAT) as a function of F/F_{MSY} at the most recent assessment. BoB= Bay of Biscay. The CFP requires that measures are taken to reduce fishing mortality when stock size is below MSYBtrigger or B_{MSY}, though the required measure is not specified. Hence, points for stocks managed according to the CFP requirements are either placed to the right of the vertical hatched line and above the horizontal hatched line (stock size healthy, stock fished at or below F_{MSY}) or to the right of the vertical hatched line and below the horizontal hatched line (stock size not healthy, stock fished below F_{MSY} to allow recovery).

In the Northeast Atlantic, a large number of fleet segments still rely on stocks that are overfished in relation to F_{MSY} (67% of fleet segments in 2019) and/or take a larger amount of catches from stocks that are at risk (48% of fleet segments in 2019) (Table 4.2). Overall, 73% of the fleet segments with available information had in 2019 a ratio between Current Revenue and Break-Even Revenue of larger or equal to one (Table 4.2). This indicates that the objective of the CFP to reach a balance between capacity and fishing opportunities has not been reached. The implementation of the landing obligation did not lead to a major reduction of discards so far, possibly partly due to the high number of exemptions, and compliance to the landing obligation is low (Table 4.2). This clearly indicates a failure in reaching the objective of eliminating discards where possible. It is also so far not possible to link trends in selectivity to certain management measures like the implementation of the landing obligation. Although not in focus, the landing obligation constitutes an example of low efficiency in fisheries management.

Table 2. Indicators and achievements for CFP objectives with indicators across case studies

Indicator	Target/Limit value or envisaged trend	Indicator value (and trend) or qualitative judgement	Target/trend/Threshold internationally agreed? (yes/No)
Objective: Balance between Capacity and fishing opportunities			
Proportion of fleet segments with sustainable harvest indicator (SHI) <=1	100%	For the 135 fleet segments in area 27 for which the SHI indicator in 2019 may be considered meaningful to assess balance or imbalance, accounted for 65% of the total value of the landings in 2019 provided by MS, and were as follows[1]: 33% (45 segments) may be in balance with their fishing opportunities; 67% (90 segments) may not be in balance with their fishing opportunities. For 21 (16%) segments, an increasing (deteriorating) trend was assessed for SHI while a decreasing (improving) trend was observed for 42 (31%) segments. A further 61 (45%) segments had no clear trend, 1 segment had a null/flat trend and no trend could be ucalculated for the remaining 10 (7%) segments.	Yes
Proportion of fleet segments not relying on catches from stocks at risk. Stocks at risk (SAR) indicator = 0	100%	SAR indicator was available for 282 fleet segments in area 27, of which 136 segments (48%) may not have been in balance with their fishing opportunities in 2019. 52% did not rely on stocks at risk. According to the criteria in the 2014 Commission guidelines, EWG 21-16 notes that the SAR results indicate that[1]: • 1 segment with 13 stocks-at-risk, • 3 segments with 10 stocks-at-risk, • 1 segment with 8 stocks-at-risk, • 5 segments with 7 stocks-at-risk, • 3 segments with 5 stocks-at-risk, • 10 segments with 4 stocks-at-risk, • 15 segments with 3 stocks-at-risk, • 25 segments with 2 stocks-at-risk,	Yes

		• 73 segments with 1 stock-at-risk.	
Proportion of fleets with ratio between Current Revenue and Break-Even Revenue (CR/BER) >1	100%	The number of fleet segments for which the *CR/BER* indicator in area 27 is available is 223. According to the criteria in the 2014 Commission guidelines the Expert group notes that the CR/BER indicator values for the 223 fleet segments for which balance/out of balance was calculated indicate that[1]: 73% (163 segments) may be in balance with their fishing opportunities. 27% (60 segments) may not be in balance with their fishing opportunities; An increasing trend for *CR/BER* was assessed for 70 (31%) fleet segments while a decreasing trend was observed for 122 (55%) segments. A further 23 (10%) fleet segments had no clear trend and no trend could be calculated for the remaining 8 (4%) segments.	Yes
Objective: Gradually eliminate discards			
Level of discards in mixed fisheries	Decreasing (compared to 2015)	Advice by STECF and ICES indicates that levels of unwanted catches remain high in many mixed demersal fisheries in EU waters (between 20-30% in the Greater North Sea, Celtic Seas and Bay of Biscay & Iberian Coast)[2].	Yes
Level of control and enforcement of the landing obligation	Increasing	The findings of the audits launched by the Commission in 2020 show that the Member States audited have not adopted the necessary measures to ensure effective control and enforcement of the landing obligation and significant undocumented discarding of catches by operators. This is corroborated by other reports, including 3 compliance evaluations carried out by the European Fisheries Control Agency (EFCA).[2]	Yes

[1] Scientific, Technical and Economic Committee for Fisheries (STECF) – Assessment of balance indicators for key fleet segments and review of national reports on Member States efforts to achieve balance between fleet capacity and fishing opportunities (STECF-21-16). Publications Office of the European Union, Luxembourg, 2021.

[2] COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Towards more sustainable fishing in the EU: state of play and orientations for 2023. COM(2022) 253 final

4.2 CFP objectives in the Mediterranean

Management aimed at MSY was evaluated using the latest CFP monitoring report (STECF 22-01) and the latest outcomes of the Scientific Advisory Committee (SAC) (SAC 2022) of GFCM that endorses the stock assessments in the Mediterranean. The analysis conducted by STECF 22-01 is focused on stocks for which estimates of fishing mortality, biomass and biological reference points are available at the beginning of 2019 (see table 3). According to STECF 22-

01 during the period 2003-2009 the number of stock assessments available in the Mediterranean increased from 20 up to 34, then remained stable but with a decrease in 2020. Changes in the number of assessments over time influenced the analyses, the results should thus be interpreted with caution.

In the Mediterranean and Black Sea assessments, a proxy for F_{MSY}, $F_{0.1}$, is commonly used. As $F_{0.1}$ is less than F_{MSY}, this results in a higher ratio of $F/F_{0.1}$ than would be the case for F/F_{MSY}. STECF 22-01 estimated a slightly decreasing trend of this ratio since 2015, from 2.12 to 1.94, which suggests a small improvement toward more sustainable exploitation. Trends by ecoregion (Western and Central Mediterranean) displayed a similar improvement, however due to the low number of stocks, trends of the indicators could not be estimated for the Eastern Mediterranean. The trend in the SSB indicator (SSB/SSB_{2003}) showed an increase since 2014, confirming a shift toward more sustainable exploitation though uncertainty was high. The analysis by ecoregion revealed a decreasing trend from 2003 to 2014 followed by increases in the Central Mediterranean and (since 2011) in the western Mediterranean. A retrospective analysis carried out on the two indicators resulted in consistent trends with a decrease of the fishing mortality, but with a F/F_{MSY} close to 2 in recent years, hence considerably exceeding the target. The advice coverage estimated for the Mediterranean and the Black Sea is 0.26.

The analysis carried out at GFCM level (SoMFi; FAO 2020) revealed distinct improvements with the percentage of overexploited stocks decreasing from 88 percent in 2012 to 75 percent in 2018, as had the average overexploitation ratio, from 2.9 to 2.4. In addition, the percentage of stocks with high biomass had increased from 23 percent to 46 percent.

SAC 2022 acknowledged that out of the 77 stocks for which a stock assessment was validated in 2022, 17 were considered to be sustainably (or possibly sustainably) exploited and 60 stocks were considered to be outside safe biological limits (Tables 4 and 5). Comparing the 2022 assessments with those performed in 2021, the Committee also noted, despite the prevalence of stocks in overexploitation, a two-fold increase in the number of sustainably exploited stocks and an improvement in the status of 23 stocks. Pertaining to the geographical scope of SEAwise Mediterranean study, only one stock out of the 9 listed in the table 3 was assessed as sustainably exploited.

The SAC also recognized the impact of other factors unrelated to fisheries – such as climate change – in influencing the status of marine resources in the region and underlined the importance of assessing the effectiveness of implemented management measures and their contributions to improve stock status.

In the Mediterranean Sea however many stocks remain overfished and/or outside safe biological limits, a situation that requires conservation efforts towards reaching the MSY objective by 2025 for EU and shared stocks (COM (2022) 253 final). In particular, using the instruments of the EU West Med MAP, the GFCM MAPs (Recommendations regarding 5 MAPs if the ones on eel and red coral are excluded) and the new GFCM 2030 Strategy with its targets 1 on EBFM, target 2 on compliance and enforcement, target 4 on the social dimension and target 5 on capacity development (https://www.fao.org/gfcm/en/).

New measures were recently introduced in the Mediterranean through MAPs. The European Council adopted maximum catch limits for the most overfished deep-water shrimps and effort ceilings for longliners in the western MAP. Further, a GFCM long-term management plan for small pelagics in the Adriatic was agreed to provide high long-term yields consistent with MSY, with reduced catch limits in 2022 for anchovies and sardines, and a freeze of capacity for pelagic trawlers and purse seiners. The GFCM also decided to implement a MAP for demersal stocks in the Adriatic establishing a maximum capacity limit for both bottom and beam trawlers, to achieve the MSY target in 2026 for all key stocks.

SAC 2022 based on the national reports remarked that small-scale vessels continued to represent the predominant fleet segment group in number in all four Mediterranean subregions (79.5 percent on average), whereas the “purse seiners and pelagic trawlers” group remained responsible for the largest share of total landings in the Mediterranean Sea (45.7 percent).

The current management approach to highly migratory species in the Mediterranean concerns bluefin tuna (*Thunnus thynnus*), swordfish (*Xiphias gladius*), and albacore (*Thunnus alalunga*). The 2018-2020 recovery plan (Recommendation 2017-07) provides an increase of the annual TAC for bluefin tuna stock. A 15-year recovery plan was implemented for swordfish in 2017. A TAC of 6 966 tonnes for swordfish for the year 2019 was identified. The TAC has been reduced since 2018, to achieve a reduction of 15% in five years. Swordfish is among the most valuable commercial species in the Mediterranean Sea (STECF 21-08).

The results of analyses on the balance indicators in 2019 (Table 6) for the whole Mediterranean were from STECF 21-16. The sustainable harvest indicator SHI could be estimated and meaningfully assessed for 43 fleet segments and among these 31 segments were out of balance and 12 in balance with their fishing opportunities. For many fleet segments, the indicator could not be assessed meaningfully because its values were based on stocks that comprise less than 40% of the total value of landings by those fleet segments. The situation of SHI trend was improving for 19 segments, and deteriorating for 5. Null or no clear trend could be observed for 5 segments. The difficulty in estimating such indicators, as SHI, is partly attributable to the multispecies nature of the Mediterranean fisheries, for which a large variety of species contribute significantly to the landings' value.

According to the economic indicator CR/BER, the majority of fleet segments (65%) were in balance with their fishing opportunities in 2019 and the trend of the indicator appeared to be improving. These outcomes highlight that the objectives of the CFP have not been reached in the Mediterranean. The implementation of the landing obligation (LO) is still limited, though there are some sign of improvement in the western Mediterranean. Enforcement of control are limited and compliance low, very likely as effect of the "de minimis" mainly for the disproportionate cost exemptions that actually allowed to continue the previous operative fishing practices.

The economic and social dimensions (see table 7) are here assessed using the Annual Economic Report (AER 2021), because no separate overview of the social dimensions was available. Regional analyses are a baseline to provide the assessment of economic performance of the CFP.

The Mediterranean fleet accounted for 58% of all EU vessels and 46% of the EU employment (FTE) in 2019. The Mediterranean fleet also contributed to 10% of the EU landings in weight and 30% in value. Most Member State's fleets were totally dependent on the Mediterranean basin for their primary fishery production.

Italy, Spain, Croatia, and Greece had the largest number of active vessels of Large-scale Fishing (LSF) in the region with numbers of 3 991, 1 002, 88, and 816 active vessels, respectively. LSF vessels generated, by far, the highest landed weight (85% of the total) and 74% of the landed value.

In 2019, the main species (by weight) were pilchard (sardine, 89 788 tonnes), followed by European anchovy (71 752 tonnes), European hake (16 578 tonnes), striped Venus (15 953 tonnes) and deep-water rose shrimp (12 880 tonnes). By value, the most landed species were anchovy (EUR 159 million), bluefin tuna (EUR 129 million), hake (EUR 125 million), sardine (EUR 106 million), deep-water rose shrimp (EUR 90 million) and common octopus (EUR 75 million).

Regarding the economic performance in 2019, after several years of continued improvement since 2015, the Mediterranean fleet (excluding Greece) reached a point of stagnation. The revenue was estimated at EUR 1.82 billion, including Greece, decreasing by 8% compared to 2018.

As regards the social dimension, employment (measured as FTE) has decreased by about 12% relative to 2018, with more than half of the employment created by the small-scale fishing fleet (SSCF) that represents 79.2% of the total fleet by the number of vessels and 56.6% of the employment (51.3% of the FTE). Countries with higher share of the SSCF are Greece 32%, Italy 20%, and Croatia 16%. The Mediterranean SSCF generated 27.1% of the revenue (EUR 493 million) in 2019.

Although over 76.8% of the effort (fishing days) was deployed by the SSCF, these vessels landed only 14.6% by weight and 25.5% by value. SSCFs are however important from a social point of view. In 2019, 35 270 fishers were directly employed in the Mediterranean SSCF, corresponding to 22 543 FTEs. The majority of them are family-based

enterprises. Two Member States represented major employers: Greece with 12 595 FTEs and Italy with 6 119 FTEs. Also, in some Member States (e.g., Greece and Cyprus), women play a crucial role in many SSCFs, often through unpaid labour. The SSCF in the Mediterranean follows a decreasing trend in terms of active vessels and employment.

The AER reports the following drivers as main factors that may have negatively affected the fleet performance in the region:

- Stock status: Mediterranean fisheries are typically mixed fisheries and many of the stocks under assessment are reported as overexploited.
- The marine resources and ecosystems of this region have come under increasing pressure in recent years, with in addition, an increase in effort and capacity of non-EU fleets (FAO, 2020).
- SSCF is losing social and economic importance at local level, despite contributing to environmental sustainability by using fishing gears with a relatively low impact on the marine environment and stocks,
- energy efficiency is not improved due to low investments in technical innovation.

Factors that may have contributed to an improved situation include:

- Moderate decrease in fuel prices resulting in slightly lower energy costs, especially for pelagic fisheries and trawlers (it should be noted that this factor was evaluated in 2019 and will drastically change in the current year).
- Increase of the EU quota for bluefin tuna: this impacted positively on the profitability of purse seiners and long-liners involved in tuna fisheries.
- High average prices: in particular, the SSCF sold at higher prices compared to the LSF thanks to shorter fish supply chain, direct sales to end consumers and to restaurants

Table 3. Stock status for all stocks from the analysis of STECF 22-01. Columns refer to ecoregion, last year for which the estimate was obtained, stock code and description, value of F/FMSY ratio (F ind), if F is lower than FMSY (F Status), if the stock is inside safe biological limits (SBL) (for both indicators FPA and BPA), and if the stock has F below FMSY and SSB above BMSY (F≤FMSY & SSB≥BMSY).

Region	EcoRegion	Year	Stock	Description	F ind	F	SBL
FAO37	Central Med.	2019	ane_17_18	European anchovy in GSA 17, 18	1.18	N	-
FAO37	Central Med.	2019	dps_12_13_14_15_16	Deep-water rose shrimp in GSA 12, 13, 14, 15, 16	1.38	N	-
FAO37	Central Med.	2019	dps_17_18_19	Deep-water rose shrimp in GSA 17, 18, 19	2.27	N	-
FAO37	Central Med.	2019	hke_12_13_14_15_16	European hake in GSA 12, 13, 14, 15, 16	1.72	N	-
FAO37	Central Med.	2019	hke_17_18	European hake in GSA 17, 18	2.65	N	-
FAO37	Central Med.	2019	hke_17_18	European hake in GSA 17, 18	2.65	N	-
FAO37	Central Med.	2019	hke_19	European hake in GSA 19	2.46	N	-
FAO37	Central Med.	2019	hke_22	European hake in GSA 22	5.48	N	-
FAO37	Central Med.	2019	hke_20	European hake in GSA 20	1.84	N	-
FAO37	Central Med.	2019	mts_17_18	Spottail mantis squillid in GSA 17, 18	1.76	N	-
FAO37	Central Med.	2019	mut_15	Red mullet in GSA 15	1.28	N	-
FAO37	Central Med.	2019	mut_16	Red mullet in GSA 16	1.07	N	-
FAO37	Central Med.	2019	mut_17_18	Red mullet in GSA 17, 18	1.91	N	-
FAO37	Central Med.	2019	mut_20	Red mullet in GSA 20	1.18	N	-
FAO37	Central Med.	2019	nep_17_18	Norway lobster in GSA 17, 18	0.68	Y	-
FAO37	Eastern Med.	2019	mut_22	Red mullet in GSA 22	0.30	Y	-
FAO37	Western Med.	2019	ara_01	Blue and red shrimp in GSA 01	5.78	N	-
FAO37	Western Med.	2019	ara_06_07	Blue and red shrimp in GSA 06, 07	3.91	N	-
FAO37	Western Med.	2019	ara_09_10_11	Blue and red shrimp in GSA 09, 10, 11	3.20	N	-
FAO37	Western Med.	2019	ars_09_10_11	Giant red shrimp in GSA 09, 10, 11	1.65	N	-
FAO37	Western Med.	2019	dps_06	Deep-water rose shrimp in GSA 06	1.71	N	-
FAO37	Western Med.	2019	dps_09_10_11	Deep-water rose shrimp in GSA 09, 10, 11	0.86	Y	-
FAO37	Western Med.	2019	hke_01_05_06_07	European hake in GSA 01, 05, 06, 07	4.31	N	-
FAO37	Western Med.	2019	hke_08_09_10_11	European hake in GSA 08, 09, 10, 11	3.22	N	-
FAO37	Western Med.	2019	mur_05	Sur mullet in GSA 05	0.52	Y	-
FAO37	Western Med.	2019	mut_01	Red mullet in GSA 01	2.51	N	-
FAO37	Western Med.	2019	mut_06	Red mullet in GSA 06	3.19	N	-
FAO37	Western Med.	2019	mut_07	Red mullet in GSA 07	1.35	N	-
FAO37	Western Med.	2019	mut_09	Red mullet in GSA 09	1.59	N	-
FAO37	Western Med.	2019	mut_10	Red mullet in GSA 10	1.03	N	-
FAO37	Western Med.	2019	nep_06	Norway lobster in GSA 06	2.25	N	-
FAO37	Western Med.	2019	nep_09	Norway lobster in GSA 09	0.74	Y	-
FAO37	Western Med.	2019	pil_01	European pilchard(=Sardine) in GSA 01	4.34	N	-
FAO37	Western Med.	2019	pil_06	European pilchard(=Sardine) in GSA 06	2.54	N	-

Table 4 Status of demersal stocks assessed by the Working Group on stock assessment of demersal species (WGSAD) in 2021 (Scientific Advisory Committee –SAC Report 2022). GSA=Geographical Sub Area.Fref is referred to the reference point reported in the pertinent column. NA=Not Available. MAP=Multiannual Management Plan. The cells highlighted in grey are related to the stocks pertinent to the SEAwise Mediterranean Case Study.

N	GSA	Species	Reference Points	Quantitative Status	Stock Status
1	1,5,6,7	*Merluccius merluccius*	F0.1 = 0.44	F/Fref = 4.41	In overexploitation, with relatively low biomass
2	1	*Merluccius merluccius*	F0.1 = 0.23	F/Fref = 6.52	In overexploitation, with relatively low biomass
3	1,3	*Merluccius merluccius*	F0.1 = 0.17	F/Fref = 8.8	In overexploitation, with relatively low biomass
4	4	*Merluccius merluccius*	F0.1 = 0.24	--	Possibly in overexploitation
5	5	*Merluccius merluccius*	F0.1 = 0.32	F/Fref = 4.39	In overexploitation, with relatively low biomass
6	6	*Merluccius merluccius*	F0.1 = 0.15	F/Fref = 11.53	In overexploitation, with relatively low biomass
7	8,9,10,11.1,11.2	*Merluccius merluccius*	F0.1 = 0.16	F/Fref = 3.13	In overexploitation, with relatively high biomass
8	1	*Parapenaeus longirostris*	F0.1 = 0.7	F/Fref = 1.73	In overexploitation, with relatively high biomass
9	3	*Parapenaeus longirostris*	F0.1 = 0.65, B0.1 = 535, BMSY = 486	--	Possibly in overexploitation and biomass above reference point
10	4	*Parapenaeus longirostris*	F0.1 = 0.72	--	Possibly in overexploitation
11	5	*Parapenaeus longirostris*	F0.1 = 0.82	F/Fref = 2.07	In overexploitation, with relatively high biomass
12	6	*Parapenaeus longirostris*	F0.1 = 0.79	F/Fref = 1.6	In overexploitation, with relatively high biomass
13	9,10,11.1,11.2	*Parapenaeus longirostris*	F0.1 = 1.29	F/Fref = 1.22	In overexploitation, with relatively low biomass
14	1,3	*Pagellus bogaraveo*	Fmsy = 0.26, Blim= 264	F/Fref = 0.78, B/Blim = 0.91	Overexploited with a low fishing mortality
15	1	*Mullus barbatus*	F0.1 = 0.29	F/Fref = 6.48	In overexploitation, withrelatively low biomass
16	6	*Mullus barbatus*	F0.1 = 0.31	F/Fref = 5.06	In overexploitation, with relatively high biomass
17	7	*Mullus barbatus*	F0.1 = 0.456	F/Fref = 1.369	In overexploitation, withrelatively high biomass
18	9	*Mullus barbatus*	F0.1 = 0.52	F/Fref = 0.71	Sustainably exploited, with relatively high biomass
19	10	*Mullus barbatus*	F0.1 = 0.4	F/Fref = 0.78	Sustainably exploited, with relatively high biomass
20	5	*Mullus surmuletus*	F0.1 = 0.24	F/Fref = 1.97	In overexploitation, withrelatively intermediate biomass
21	1	*Aristeus antennatus*	F0.1 = 0.42	F/Fref = 1.64	In overexploitation, with relatively intermediate biomass
22	2	*Aristeus antennatus*	F0.1 = 0.46	F/Fref = 1.68	In overexploitation, with relatively intermediate biomass
23	5	*Aristeus antennatus*	F0.1 = 0.32	F/Fref = 3.61	In overexploitation, with relatively low biomass
24	6	*Aristeus antennatus*	F0.1 = 0.35	F/Fref = 6.2	In overexploitation, with relatively low biomass
25	9,10,11.1,11.2	*Aristeus antennatus*	F0.1 = 0.261	F/Fref = 4.6	In overexploitation, with relatively low biomass
26	9,10,11.1,11.2	*Aristaeomorpha foliacea*	F0.1 = 0.46	F/Fref = 2.13	In overexploitation, with relatively low biomass

27	5	*Nephrops norvegicus*	F0.1 = 0.23	F/Fref = 0.69	Sustainably exploited, with relatively intermediate biomass
28	6	*Nephrops norvegicus*	F0.1 = 0.15	F/Fref = 3.8	In overexploitation, with relatively low biomass
29	9	*Nephrops norvegicus*	F0.1 = 0.30	F/Fref = 0.5	Sustainably exploited, with relatively high biomass
30	18,19	*Aristaeomorpha foliacea*	F0.1 = 0.45	F/Fref = 1.38	In overexploitation, with relatively intermediate biomass
31	20	*Merluccius merluccius*	F0.1 = 0.204	F/Fref = 1.86	In overexploitation, with relatively high biomass
32	22	*Merluccius merluccius*	F0.1 = 0.236	--	Possibly in overexploitation
33	20	*Mullus barbatus*	F0.1 = 0.29	F/Fref = 1.1	In overexploitation, with relatively high biomass
34	22	*Mullus barbatus*	F0.1 = 0.26	F/Fref = 0.96	Sustainably exploited, with relatively high biomass
35	24	*Mullus barbatus*	Fmsy = 0.377	--	Possibly in sustainable exploitation
36	12,13,14,15,16	*Parapenaeus longirostris*	F0.1 = 0.84	F/Fref = 1.34	In overexploitation with relatively low biomass
37	17,18,19	*Parapenaeus longirostris*	F0.1 = 0.7	F/Fref = 2.31	In overexploitation, with relatively high biomass
38	17	*Sepia officinalis*	Fmsy = 0.18, Bmsy = 25415	F/Fref = 1.17, B/Btar = 0.36	Overexploited and in overexploitation
39	17	*Squilla mantis*	F40 = 0.33, SSB40 = 6314	F/Fref = 0.79, B/Btar = 0.92	Overexploited with low fishing mortality
40	12,13,14,15,16	*Merluccius merluccius*	Fmsy = 0.29, Bmsy = 7021	F/Fref = 1.24, B/Btar = 0.7	overexploited and in overexploitation
41	19	*Merluccius merluccius*	F0.1 = 0.154	F/Fref = 1.86	In overexploitation with relatively high biomass
42	17,18	*Merluccius merluccius*	Fmsy = 0.167, Bpa = 2453, Blim = 1858	F/Fref = 2.47, B/Bthre = 1.62, B/Blim = 2.14	In overexploitation
43	12,13,14	*Mullus barbatus*	F0.1 = 0.47	F/Fref = 3.13	In overexploitation, with relatively high biomass
45	15	*Mullus barbatus*	F0.1 = 0.295	F/Fref = 1.83	In overexploitation, with relatively low biomass
46	16	*Mullus barbatus*	F0.1 = 0.42	F/Fref = 0.74	Sustainably exploited, with relatively intermediate biomass
47	19	*Mullus barbatus*	F0.1 = 0.4	F/Fref = 1.87	In overexploitation with relatively low biomass
48	17	*Solea solea*	F40 = 0.238, SSB40 = 4160.3, Blim = 2080	F/Fref = 0.81, B/Btar = 0.73, B/Blim = 1.46	Overexploited with low fishing mortality
49	18	*Eledone cirrosa*	Fmsy = 0.491, Bmsy = 1.89	F/Fref = 0.77, B/Btar = 1.13	Sustainably exploited, with relatively high biomass
50	25	*Mullus surmuletus*	F0.1 = 0.31	NA	Possibly in overexploitation
51	25	*Serranus cabrilla*		F/Fmsy = 0.69, B/Bmsy = 1.28	Sustainably exploited, with high biomass
52	25	*Pagellus acarne*	Fmsy = 0.227, Bmsy = 112	F/Fref = 1.05, B/Bref = 0.667	Overexploited and in overexploitation
53	18,19	*Aristeus antennatus*	--	--	In overexploitation
54	12-16, 21	*Aristaeomorpha foliacea*	--	--	In overexploitation and overexploited
55	17-18	*Mullus barbatus*	--	--	In overexploitation

Table 5. Status of small pelagic stocks assessed by the Working Group on stock assessment of small pelagic species (WGSASP) in 2021 (Scientific Advisory Committee –SAC Report 2022). GSA=Geographical Sub Area.Fref is

referred to the reference point reported in the pertinent column. NA=Not Available. MAP=Multiannual Management Plan. The cells highlighted in grey are related to the stocks pertinent to the SEAwise Mediterranean Case Study.

N	GSA	Species	F/FMSY; *(E)	B/BMSY; *B/Bpa; **B/Blim	Stock status
1	1	Engraulis encrasicolus	--	--	Sustainably exploited
2	1	Sardina pilchardus	--	--	In overexploitation
3	3	Sardina pilchardus	F/Fmsy = 2.77	--	In overexploitation
4	4	Sardina pilchardus	--	--	Sustainably exploited
5	6	Engraulis encrasicolus			In overexploitation
6	6	Sardina pilchardus	F/Fref = 1.72	-	In overexploitation
7	7	Engraulis encrasicolus	F/Fmsy = 0.05	B/Bpa = 0.63	Sustainably exploited
8	7	Sardina pilchardus	F/Fmsy = 0.05	B/Bpa = 3.41	Sustainably exploited and ecologically unbalanced
9	9	Engraulis encrasicolus	F/Fmsy = 0.35	B/Bmsy = 1.48	Sustainably exploited
10	9	Sardina pilchardus	F/Fmsy = 0.19	B/Bmsy = 1.49	Sustainably exploited
11	20	Engraulis encrasicolus	--	--	Sustainably exploited
12	20	Sardina pilchardus	--	--	In overexploitation
13	22	Engraulis encrasicolus	--	--	In overexploitation
14	22	Sardina pilchardus	--	--	In overexploitation
15	24	Sardinella aurita	--	--	In overexploitation with biomass within target
16	26 + 27 (Palestine)	Sardinella aurita	--	--	In overexploitation and overexploited
17	5, 10, 12, 13, 14, 15, 16, 19	Coryphaena hippurus	--	--	Sustainably exploited
18	16	Sardina pilchardus	F/FE0.4=2.78	--	In overexploitation
19	16	Engraulis encrasicolus	F/FE0.4=1.55	--	In overxploitation
20	17-18	Sardina pilchardus	--	--	Overexploited and in overexploitation on a precautionary basis
21	17-18	Engraulis encrasicolus	F/FMSY 0 1.15	B/Blim = 1.45; B/Bpa = 1.10	Biomass above reference points and in overexploitation

Scientific Advisory Committee (SAC) 2022. Twenty-third session. https://gfcm.sharepoint.com/SAC/Report/Forms/AllItems.aspx?id=%2FSAC%2FReport%2F2022%2FFinal%20report%2FSAC23%5FReport%5Fbefore%20editing%2De%2Epdf&parent=%2FSAC%2FReport%2F2022%2FFinal%20report&p=true&ga=1

Table 6. Indicators and achievements for CFP objectives in the Mediterranean (balance indicators).

Indicators	Target/Limit value or envisaged trend	Indicator value (and trend) or qualitative judgement	Target/trend/Threshold internationally agreed? (yes/No)
Obejctive: Balance between Capacity and fishing opportunities[1]			
Proportion of fleet segments with sustainable harvest indicator (SHI) <=1	100%	For the 43 fleet segments (ot of 158), for which the SHI indicator may be considered meaningful, accounted for 35% of the total value of the landings in 2019 and were as follows: 8% (12 segments) may be in balance with their fishing opportunities; 72% (31 segments) may not be in balance with their fishing opportunities. for 12% (5 segments), an increasing (deteriorating) trend was assessed for 44% (19 segments) a decreasing (improving) trend was observed 9% (4 segments) segments had no clear trend, 2% (1 segment) showed a flat trend for 33% (14 segments) no trend could be calculated.	Yes
Proportion of fleet segments not relying on catches from stocks at risk. Stocks at risk (SAR) indicator = 0	100%	SAR indicator was available for 143 fleet segments, of which 66 segments may not have been in balance with their fishing opportunities in 2019. According to the criteria in the 2014 Commission guidelines, EWG 21-16 notes that the SAR results indicate that there were: •1 segment with 4 stocks-at-risk, •3 segments with 3 stocks-at-risk, •16 segments with 2 stocks-at-risk, •46 segments with 1 stock-at-risk.	Yes
Proportion of fleets with ratio between Current Revenue and Break-Even Revenue (CR/BER) >1	100%	The CR/BER indicator is available for 139 fleet segments. According to the criteria in the 2014 Commission guidelines EWG notes that the CR/BER indicator values for the 139 fleet segments for which balance/out of balance was calculated indicate that: 65% (90 segments) may be in balance with their fishing opportunities. 35% (49 segments) may not be in balance with their fishing opportunities; An increasing trend for CR/BER was assessed for 54 (39%) fleet segments while a decreasing trend was observed for 36 (26%) segments. A further 15 (11%) segments had no clear trend and no trend could be calculated for the remaining 34 (24%) segments.	Yes

Obejctive: Gradually eliminate discards[2]			
Level of discards in mixed fisheries	Decreasing (compared to 2015)	There are signs of improvement in the West Mediterranean: discard ratios are decreasing and L50s are increasing for species included in the Western Mediterranean MAP. Although there are some signs of improvement in other areas as well, the trends are not always clear[3]; STECF Plenary 22-01.	Yes
Level of control and enforcement of the landing obligation	Increasing	No reports were transmitted to the European Commission by 4 out 8 countries, 2 reports were transmitted with delay.[2]	Yes

[1] Scientific, Technical and Economic Committee for Fisheries (STECF) – Assessment of balance indicators for key fleet segments and review of national reports on Member States efforts to achieve balance between fleet capacity and fishing opportunities (STECF-21-16). Publications Office of the European Union, Luxembourg, 2021.

[2] COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Towards more sustainable fishing in the EU: state of play and orientations for 2023. COM(2022) 253 final

[3] Spedicato et al. 2021. Synthesis of the Landing Obligation Measures and Discard Rates for the Mediterranean and the Black Sea. 2021.CINEA study. Final Report 73 pp. DOI:10.2926/237700

Table 7. CFP objectives, indicators and achievements in the Mediterranean Sea. LSF: large-scale fishing fleet, SSF: small-scale fishing fleet

Indicators	Target/Limit value or envisaged trend	Indicator value (and trend) or qualitative judgement	Target/trend/Threshold internationally agreed? (yes/No)
Obejctive: progress in achieving MSY			
Proportion of assessed stocks that are fished at or below F_{MSY}	100%	29 stocks with relevant information available exceeded F_{MSY} in the Mediterranean Sea in 2020[2]. Five stocks were assessed to have a fishing mortality (F) not exceeding F_{MSY}[1]. This gives a proportion of approximately 15% of assessed stocks that are fished at or below F_{MSY} in 2020. In 2022 (SAC, 2022) this percentage increased to 22%. There is an increasing trend in the number of stocks fished at or below F_{MSY} in recent years.	Yes
Proportion of assessed stocks within safe biological limits	100%	The trend in the SSB indicator (SSB/SSB2003) showed an increase since 2014, though uncertainty was high.	Yes
Average Fcurrent/F_{MSY} over all assessed stocks	<=1	NA	No
Ratio SSB/SSB_{2003}	>=1	NA	No

Objective: Economic and social dimension of the CFP			
Gross profit/net profit	Increasing	The Mediterranean fleets made almost EUR 520 million in gross profit, a decrease of 3% compared to 2018. There was a decreasing trend of gross profit from 2009 to 2013 and then an increasing trend in gross profit from 2013 to 2018; the value of 2019 was stable compared to 2018[2]. The net profit was EUR 292 million (decreased by 5% compared to 2018). Net profit shows very similar trend as gross profit over time[2].	No
Average wages (for SSCF and LSF separately)	Increasing	Employment in the Mediterranean fishing fleet (including Greece) in 2019 was estimated at 62 357 jobs (43 908 FTEs). Employment (measured as FTE) has decreased by about 12% relative to 2018. More than half of the employment is created by the SSCF; 35 270 jobs corresponding to more than 56% of total jobs (22 542 FTEs) corresponding to almost 52% of total FTEs. The average employment per vessel is about 1.7. Annual average wages and salaries in 2019 for fishers in the SSCF and LSF were EUR 9 640 and EUR 18 198, respectively. Average wages in the LSF decreased by 3% relative to 2018. In the SSCF, average wages remained relatively stable compared to 2018. Average wages of LSF decreased between 2010 to 2014 and then slightly increased. Average wage observed for SSCF was quite stable[2]	No
Amount of landings/Value of landings	Stable/increasing	The weight and value of landings generated by the regional fleet (including Greece) in 2019 amounted to approximately 408 332 tons (-7% compared to 2018) and EUR 1.78 billion (-9% compared to 2018), respectively. Landing in weight had a quite stable trend, while landing in value decreased until 2013 and then increased. The revenue (income from landings and other income) generated by the Mediterranean fleet in 2019 was over EUR 1.8 billion. Revenues decreased until 2013 and then increased. [2]	No
Ratio landings weight and value SSCF / LSF	Increasing	The SSCF in the Mediterranean represents 79.2% of the total fleet by the number of vessels. Over 76.8% of the effort (fishing days) was deployed by the SSCF, these vessels landed only 14.6% by weight and 25.5% by value. SSCFs are important from a social point of view with 56.6% of the employment.[2]	No

[1]Scientific, Technical and Economic Committee for Fisheries (STECF) – Monitoring of the performance of the Common Fisheries Policy (STECF-Adhoc-22-01). EUR 28359 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51702-3, doi:10.2760/566544, JRC129080

[2] Scientific, Technical and Economic Committee for Fisheries (STECF) - The 2021 Annual Economic Report on the EU Fishing Fleet (STECF 21-08), EUR 28359 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-40959-5, doi:10.2760/60996, JRC126139.

4.3 CFP objectives in the North Sea

Overall, the objectives set out in the CFP have not been reached in the North Sea fisheries, although there some advancement toward achievement was observed (Table 3). For economic and social objectives conclusions are mainly based on data until 2019 because the Corona Pandemic and the energy crisis has likely deteriorated the economic and social situation independent of fisheries management.

With regard to effectiveness of the management in place, the situation improved in the North Sea towards achieving ecological CFP objectives (Table 8). The number of stocks that are harvested at levels in line with achieving MSY increased since 2003 (59% in 2020) and the average F/F_{MSY} ratio over all assessed stocks is close to that in 2020. However, there is still a marked number of stocks where fishing mortality exceeds F_{MSY} and/or outside safe biological limits. Therefore, the current management was not successful in reaching the ecological objectives set out in the CFP but was successful in improving the situation since the implementation of the new CFP in 2013.

For economic and social objectives hardly any thresholds are agreed and therefore trends over time are examined rather than status relative to agreed thresholds. Landings remained stable since 2008 and gross profit in 2019 was at the same level as in 2013 (Table 8). This indicates that the economic situation for fleets in the North Sea had not improved over time, although there was an increasing trend in gross profit from 2008 to 2016. In 2019 the North Sea fleets made 410 million in gross profit.

Social indicators can look at many different aspects. Only a few easy to find indicators from the Annual Economic Report were selected for this baseline study to describe the effectiveness of current management in reaching social objectives. For the final deliverable in month 36 new indicators proposed within SEAwise will be added to describe the situation. In addition, no thresholds or limits have been agreed so far thus preventing a proper evaluation of the achievement of social objectives.

Employment (measured in Full Time Equivalents FTEs) increased between 2010 to 2018 in North Sea fleets but decreased by 18% in 2019 compared to 2018 (Table 8). Wages per FTE increased over the years between 2008 and 2019, however, considerably more in the large scale fleets (>50%) than in the small scale fleets (15%). This despite that the average wages in the large scale fleet are already nearly twice as high as in the small scale fleet. Also in terms of landings and value of landings, the small scale fleets only play a marginal role although they are responsible for one third of the fishing effort in the North Sea. Therefore, there is only limited advancement towards the achievement of social objectives. Especially the role of the small scale fleet in future fisheries management for the North Sea with regard to equity as one of the performance criteria must be the topic of further development in order to be addressed by subsequent assessments.

According to the AER 2021 the overall changes have been mostly driven by the large scale fleet, whereas the trends for the small-scale fleet in the North Sea are less clear. Factors that may have contributed to an overall deteriorated situation between 2018 and 2019 include: i) Decrease of TAC of important stocks, e.g. North Sea herring (-40%), mackerel (-20%), blue whiting (-20%), cod (-35%), plaice (-12%). II) Decrease in both landings and prices of common shrimp. III) Stable fuel prices added no further burden on the sector in 2019. Brexit, the Corona Pandemic and the energy crisis have further deteriorated the economic situation of fishing fleets after 2019.

Table 8. CFP objectives, indicators and achievements in the greater North Sea. LSF: large-scale fishing fleet, SSCF: small-scale fishing fleet

Indicators	Target/Limit value or envisaged trend	Indicator value (and trend) or qualitative judgement	Target/trend/Threshold internationally agreed? (yes/No)
Objective: progress in achieving MSY			
Proportion of assessed stocks that are fished at or below F_{MSY}	100%	Nine stocks with relevant information available exceeded F_{MSY} in the greater North Sea in 2020[2]. 13 stocks were assessed to have a fishing mortality (F) not exceeding F_{MSY}[1]. This gives a proportion of 59% of assessed stocks that are fished at or below F_{MSY} in 2020. There is an increasing trend in the number of stocks fished at or below F_{MSY} since 2003 (41% in 2003)	Yes
Proportion of assessed stocks within safe biological limits	100%	In 2020 there are 5 stocks with relevant information available which are assessed to be outside safe biological limits in the greater North Sea[1]. Seven stocks are inside safe biological limits. This gives a proportion of 58% of assessed stocks within safe biological limits in 2020. There is an increasing trend since 2003 (25% in 2003)	Yes
Average Fcurrent/F_{MSY} over all assessed stocks	<=1	The average of the ratio Fcurrent/F_{MSY} in the greater North Sea in 2020 is 1.04[1]. There is a decreasing trend over the years (1.57 in 2003).	No
Ratio SSB/SSB_{2003}	>=1	Average ratio B/B2003 was slightly higher than 1 in 2020 (1.13)[1].	No
Objective: Economic and social dimension of the CFP			
Gross profit/net profit	Increasing	The fleets made about EUR 410 million in gross profit in 2019, an estimated 19% decrease compared to 2018[2] There was an increasing trend in gross profit from 2008 to 2016. Since then gross profit has decreased again to a level in 2019 close to the level in 2013 (Figure 3.5 in [2]). Net profit shows very similar trends over time (Figure 3.5 in [2])	No
Average wages (for	Increasing	Wages per FTE decreased by 5% in the LSF from 2018 to 2019. There was a trend between 2008 and 2019 where the wages per FTE increased by	No

SSCF and LSF separately)		58%. In 2019, the average wage in the LSF was estimated at EUR 68 900.[2] In the SSCF there was an overall increase (15%) between 2008 and 2019. Between 2018 and 2019 the average wage per FTE for the SSCF increased by 7.8%, being EUR 38 300.[2]	
Amount of landings/Value of landings	Stable/increasing	In 2019, the weight and value of landings generated by the fleet amounted to approximately 828 million tonnes and EUR 895 million, respectively. Landings in 2019 in weight decreased sharply by about 22% compared to 2018, and the value of the landings decreased almost by the same amount (-17%).[2] Overall there is no trend in landings since 2008 (Figure 3.8 in [2])	No
Ratio landings weight and value SSCF / LSF	Increasing	Even though the share of the number of small-scale vessels is more than 50% and the effort is about one third of the total days-at-sea in the NSEA, their economic contribution as well as their share of the landed weight is marginal. The LSF landed 98% of the total weight and 94% of the total value.[2]	No

[1]Scientific, Technical and Economic Committee for Fisheries (STECF) – Monitoring of the performance of the Common Fisheries Policy (STECF-Adhoc-22-01). EUR 28359 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51702-3, doi:10.2760/566544, JRC129080

[2] Scientific, Technical and Economic Committee for Fisheries (STECF) - The 2021 Annual Economic Report on the EU Fishing Fleet (STECF 21-08), EUR 28359 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-40959-5, doi:10.2760/60996, JRC126139.

4.4 CFP objectives in the Western waters

This section summarizes the status of the stocks for which time series of biomass and fishing mortality estimates are available based on the latest CFP monitoring report (STECF 22-01). The economic dimensions were assessed using the Annual Economic Report (AER 2021), while no separate overview of the social dimensions was found.

Assessment of fish stock management at MSY is specified in Article 50 of the Common Fisheries Policy (CFP, Regulation (EU) No 1380/2013). It requires an annual report by the Commission to the European Parliament and the Council on the progress on achieving maximum sustainable yield and on the status of fish stocks. This progress is reported by STECF 22-01, and separately sets out results for the NE Atlantic, the Mediterranean & Black Seas. It is used as the baseline CFP evaluation for this report, by selecting the Ecoregion-specific evaluations from the STECF 22-01 report (STECF, 2022). The analysis is focused on stocks with a TAC in 2017, and for which estimates of fishing mortality, biomass and biological reference points are available. STECF 22-01 concluded that a reduction in overall exploitation rate and an increase in biomass of NE Atlantic stocks was achieved over the period 2003-2020, but many stocks remain overfished and/or outside safe biological limits. The CFP objective to ensure that all stocks are fished at or below F_{MSY} in 2020 has not been achieved. The stock status was summarized for all stocks in the CFP monitoring analysis (STECF 22-01) (Table 9 and 10). Five out of 11 stocks are within safe biological limits in the Southwestern Waters (SWW) case study, while one stock (sole in 8ab) is not and the five remaining stocks have limited information. 6 out of 15 stocks in the Northwestern waters (NWW) case study are within safe biological limits, while five stock were not and four stocks had no information. In the SWW 10 out of 11 stocks were exploited at or below F_{MSY}, while in the NWW 10 out of 14 stocks achieved the objective of being fished at or below F_{MSY} in 2020. The

category 1 stocks of seabass and sardines (bss.27.4bc7ad-h, bss.27.8ab, pil.27.8abd, pi.27.8c9a) were not included, because they were not in the agreed sampling frame of the STECF 22-01 report.

The AER (2021) provides a comprehensive overview of the structure and economic performance of EU member states fishing fleets. Regional analysis are performed and will be used to provide a baseline for the assessment of economic performance of the CFP. The Western waters case study comprises two regions: the North Western Waters (NWW) and the Southern Western Waters (SWW). The regions are larger than the SEAwise WW case study regions. The AER NWW cover the Atlantic ICES areas 5, 6 and 7. The AER SWW covers the Atlantic zone running from the tip of Brittany in the North, to the Strait of Gibraltar in the south and including the outermost regions of Madeira, the Azores and the Canary Islands (ICES areas 8, 9 and 10, and the COPACE divisions 34.1.1., 34.1.2, 34.2.0). The fleets account for 2542 active fishing vessels with 7049 FTE in 2019. Blue whiting, Atlantic mackerel and horse mackerel are the three main landed species. TACs increased for several important stocks such as haddock and anglerfish, and fish prices largely remained stable or slightly increased, for Common sole and Norway lobster. Overall fleets were profitable, though with a reduction of 8% in Gross Value Added (GVA) and 20% in gross profits from 2018 to 2019. The highest gross and net profits were generated for France (63 million EUR), Ireland (45 million EUR), Denmark (20 million EUR) and Spain (16 million EUR). SWW member states include Spain, France and Portugal, generating 99% of the revenues in 2019. The fleet was profitable in 2019 in a similar way as to 2018, with 1.2 billion EUR revenues and GVA at 708 million EUR. The number of vessels is dominated by the small-scale fishing fleet (61%), while the landings are mostly realised by the large fishing fleet (88% in weight, 76% in value). TACs decreased for important stocks such as hake, blue whiting and mackerel, and also for sardine which is of particular importance in the region. Fish prices reduced generally, while fuel prices increased. 2021 AER data do not include the United Kingdom.

The AER reports the following drivers as main factors of a positive contribution to the economic performance in the NWW: (i) Recovery of some stocks, e.g. the biomass of most herring stocks has increased, and the Northern hake stock biomass continues to be high; (ii) increased TACs for a number of stocks and maintaining of fish prices; (iii) stable fish prices generally and higher average prices for some important species e.g. Common sole and *Nephrops*. Economic performance in the region was hampered by (i) an overall decrease in landed weight by 7%; (ii) increased energy costs and use; (iii) a decrease in average wage of the LSF; (iv) TAC reductions for mackerel and (v) large impact of the Trade and Cooperation Agreement, and high dependency on the United Kingdom waters for a number of Member States, including Ireland, France, Spain, Belgium, the Netherlands and Germany. The main drivers that hampered economic performance in the SWW are (i) decreased TACs for a number of stocks (mackerel, hake and blue whiting), lower average prices for European anchovy and chub mackerel and increase in fuel prices resulting in higher energy costs, especially for pelagic fisheries.

Table 9. Stock status from 2020 in the Southwestern Waters SWW case study (ICES Divisions 8abcd in the Bay of Biscay and the Iberian waters Ecoregion) (STECF 22-01). The column SBL is Y (Yes) or N (No) or - (unknown) if the stock is inside safe biological limits (SBL) for both F_{PA} and B_{PA} and when $F \leq F_{MSY}$ and $SSB \geq B_{MSY}$. The stock ane.27.8 is managed under a management plan and does not have an estimate of F/FMSY, its F status is calculated as a biomass trigger point over the stock size.

Stock	Description	F/F_{MSY}	$F<F_{MSY}$	SBL
ane.27.8	Anchovy (*Engraulis encrasicolus*) in Subarea 8 (Bay of Biscay)	NA	Y	-
ank.27.8c9a	Black-bellied anglerfish (*Lophius budegassa*) in divisions 8.c and 9.a (Cantabrian Sea. Atlantic Iberian waters)	0.39	Y	-
ldb.27.8c9a	Four-spot megrim (*Lepidorhombus boscii*) in divisions 8.c and 9.a (southern Bay of Biscay and Atlantic Iberian waters East)	0.56	Y	Y
meg.27.7b-k8abd	Megrim (*Lepidorhombus whiffiagonis*) in divisions 7.b-k. 8.a-b. and 8.d (west and southwest of Ireland. Bay of Biscay)	0.72	Y	Y

meg.27.8c9a	Megrim (*Lepidorhombus whiffiagonis*) in divisions 8.c and 9.a (Cantabrian Sea and Atlantic Iberian waters)	0.61	Y	Y
mon.27.78abd	White anglerfish (*Lophius piscatorius*) in Subarea 7 and divisions 8.a-b and 8.d (Celtic Seas. Bay of Biscay)	0.83	Y	Y
mon.27.8c9a	White anglerfish (*Lophius piscatorius*) in divisions 8.c and 9.a (Cantabrian Sea and Atlantic Iberian waters)	0.35	Y	Y
nep.fu.2324	Norway lobster (*Nephrops norvegicus*) in divisions 8.a and 8.b. Functional Units 23-24 (northern and central Bay of Biscay)	0.64	Y	-
nep.fu.25	Norway lobster (*Nephrops norvegicus*) in Division 8.c. Functional Unit 25 (southern Bay of Biscay and northern Galicia)	0.17	Y	-
nep.fu.31	Norway lobster (*Nephrops norvegicus*) in Division 8.c. Functional Unit 31 (southern Bay of Biscay and Cantabrian Sea)	0.44	Y	-
sol.27.8ab	Sole (*Solea solea*) in divisions 8.a-b (northern and central Bay of Biscay)	1.15	N	N

Table 10. Stock status from 2020 in the Northwestern Waters (NWW) case study (ICES Divisions 7aefghk in the Celtic Seas Ecoregion) and the Iberian waters (STECF 22-01). The column SBL is Y (Yes) or N (No) or - (unknown) if the stock is inside safe biological limits (SBL) for both F_{PA} and B_{PA} and when $F \leq F_{MSY}$ and $SSB \geq B_{MSY}$.

Stock	**Description**	**F/F_{MSY}**	**$F<F_{MSY}$**	**SBL**
cod.27.7e-k	Cod (*Gadus morhua*) in divisions 7.e-k (eastern English Channel and southern Celtic Seas)	3.97	N	N
had.27.7a	Haddock (*Melanogrammus aeglefinus*) in Division 7.a (Irish Sea)	0.23	Y	Y
had.27.7b-k	Haddock (*Melanogrammus aeglefinus*) in divisions 7.b-k (southern Celtic Seas and English Channel)	0.89	Y	Y
her.27.irls	Herring (*Clupea harengus*) in divisions 7.a South of 52°30'N. 7.g-h. and 7.j-k (Irish Sea. Celtic Sea. and southwest of Ireland)	0.09	Y	N
her.27.nirs	Herring (*Clupea harengus*) in Division 7.a North of 52°30'N (Irish Sea)	0.76	Y	Y
nep.fu.14	Norway lobster (Nephrops norvegicus) in Division 7.a. Functional Unit 14 (Irish Sea. East)	0.23	Y	-
nep.fu.15	Norway lobster (*Nephrops norvegicus*) in Division 7.a. Function Unit 5 (Irish Sea. West)	0.58	Y	-
nep.fu.19	Norway lobster (*Nephrops norvegicus*) in divisions 7.g and 7.h. Functional Units 20 and 21 (Celtic Sea)	0.26	Y	-
nep.fu.22	Norway lobster (*Nephrops norvegicus*) in divisions 7.f and 7.g. Functional Units 22 (Celtic Sea. Bristol Channel)	0.26	Y	-
ple.27.7a	Plaice (*Pleuronectes platessa*) in Division 7.a. (Irish Sea)	0.22	Y	Y
sol.27.7a	Sole (Solea solea) in Division 7.a (Irish Sea)	0.65	Y	N
sol.27.7e	Sole (Solea solea) in Division 7.e (western English Channel)	0.89	Y	Y
sol.27.7fg	Sole (Solea solea) in divisions 7.f and 7.g (Bristol Channel. Celtic Sea)	1.07	N	Y
whg.27.7a	Whiting (*Merlangius merlangus*) in Division 7.a (Irish Sea)	3.47	N	N
whg.27.7b-ce-k	Whiting (Merlangius merlangus) in divisions 7.b-c and 7.e-k (southern Celtic Seas and eastern English Channel)	1.09	N	N

Table 11. CFP objectives, indicators and achievements. BOB: Bay of Biscay and Iberian waters, CS: Celtic Seas. LSF: large-scale fishing fleet, SSCF: small-scale fishing fleet

Indicators	International agreement on indicator (Yes/No)	Indicator value (and trend) or qualitative judgement	Reference
Objective: progress in achieving MSY			
Number of stock assessments available to compute F/F_{MSY} (CFP performance indicator)	Yes	Number of stocks with assessment is slightly increasing BOB: 12 (2003) -> 13 (2020) CS: 21 (2003) -> 25 (2020)	STECF 22-01
Number of stocks by year where fishing mortality exceeded F_{MSY}	Yes	Number of stocks where $F>F_{MSY}$ is decreasing BOB: 9 (2003) -> 1 (2020) CS: 14 (2003) -> 6 (2020)	STECF 22-01
Number of stocks by year where fishing mortality was equal to, or less than F_{MSY}	Yes	Number of stocks where $F\leq F_{MSY}$ is increasing BOB: 3 (2003) -> 12 (2020) CS: 7 (2003) -> 20 (2020)	STECF 22-01
Number of stocks outside safe biological limits	Yes	Number of stocks outside SBL is decreasing BOB: 5 (2003) -> 1 (2020) CS: 12 (2003) -> 6 (2020)	STECF 22-01
Number of stocks inside safe biological limits	Yes	Number of stocks inside SBL is increasing BOB: 1 (2003) -> 5 (2020) CS: 2 (2003) -> 8 (2020)	STECF 22-01
Number of stocks with $F>F_{MSY}$ or $SSB<B_{MSY}$	Yes	BOB: 5 (2003) -> 3 (2020) CS: 4 (2003) -> 3 (2020)	STECF 22-01
Number of stocks with $F\leq F_{MSY}$ or $SSB\geq B_{MSY}$	Yes	BOB: 1 (2003) -> 3 (2020) CS: 6 (2003) -> 11 (2020)	STECF 22-01
Trend in F/F_{MSY}	Yes	Trend in F/F_{MSY} is decreasing BOB: 1.56 (2003) -> 0.50 (2020) CS: 1.91 (2003) -> 0.9 (2020)	STECF 22-01
Trend in SSB (relative to SSB in 2003)	Yes	Trend in SSB relative to 2003 BOB: 1 (2003) -> 2.54 (2020) CS: 1 (2003) -> 1.27 (2020)	STECF 22-01
Trend in recruitment relatively to recruitment 2003	Yes	Trend in Recruitment relative to 2003 BOB: 1 (2003) -> 1.73 (2020) CS: 1 (2003) -> 1.27 (2020)	STECF 22-01
Objective: Economic CFP dimension			
Fishing effort	Yes	NWW: decrease from 2008 to 2009, stable 2009-2019 SWW: decrease between 2008-2014	AER 2021
Landings (weight and value: revenue); fish prices	Yes	NWW: fluctuations in landed weight and revenues are small ($\leq$ 3%) SWW: landed weight was stable in 2008-2014, decreased between 2017-2019. Value decreased since 2017; anchovy landings decreased (-6%); prices increased (+19%). Octopus landings increased (+13%); prices decreased (-17%). 1.2 billion EUR	AER 2021 (p114-115; 125-126)
Total employment, total and by fleet (large LSF and small fleets SSCF)	Yes	NWW: 7037 FTE in 2019 (France 2791 FTE > Ireland 2379 FTE > Spain 1424 FTE) SWW: 22800 FTE with a decreasing trend (-12%) in engaged crew from 2008 till 2019 (Spain 60% > Portugal 30% > France 9%)	AER 2021 (p114; 125)
Average wage for a FTE by fleet (large and small fleets)	Yes	NWW: 35000 EUR for SSCF (increasing trends), 56900 EUR for LSF (decreasing trend) SWW: increasing trends for SSCF (in 2019 +17% compared to the average of previous 10 years); fluctuating trend for	AER 2021 (p114; 125)

		LSF (in 2019 +6% compared to the average of previous 10 years)	
Total GVA + GVA per FTE (=labour productivity) by large & small fleets and by fleet segments, trends 2018>2019	Yes	NWW: 54493 EUR for SSCF (10% decrease), 82560 for LSF (9% decrease); total GVA of 542 million EUR, decrease of 8% from 2019 to 2018 SWW: 708 million EUR (GVA)	AER 2021 (p114-115)
Gross profit, total and by fleet segments	Yes	NWW: 173 million EUR, decrease of 19% from 2019 to 2018 SWW: 178 million EUR	AER 2021 (p115)
Net profit	Yes	NWW: 84 million EUR, decrease of 18% from 2018-2019 SWW: profitable (2019), 95 million EUR (8% profit margin)	AER 2021 (p115; 126)
Fuel prices	Yes	NWW: Increasing trend, with an average prices of 0.51 EUR/L	AER 2021 (p115)
Fuel consumption	Yes	NWW: Increasing trend (+14%)	AER 2021 (p115)
Fleet segments	-	NWW: 81 segments, 24 operated 80% in the NWW	AER 2021 (p123)

4.5 CFP objectives in the Baltic Sea

Overall, the objectives set out in the CFP have not been reached in the Baltic Sea fisheries (Table 12). For economic and social objectives conclusions are mainly based on data until 2019 because the Corona Pandemic and the energy crisis has likely deteriorated the economic and social situation independent of fisheries management. The number of stocks that are harvested at levels in line with achieving MSY increased but is still high (37% in 2020). Therefore, the current management was not successful in reaching the ecological objectives set out in the CFP and improvements in the proportion of stocks having stock sizes within safe biological limits are not observed.

For economic and social objectives thresholds have yet to be agreed. While gross profit in has fluctuated without a trend in later years, net profit increased (Table 7). This indicates that the economic situation for fleets in the Baltic Sea had improved slightly over time. In 2019 the Baltic Sea fleets made 54.2 million in gross profit.

No thresholds or limits have been agreed so far thus preventing a proper evaluation of the achievement of social objectives.

Wages per FTE of SSCF have remained stable over the years between 2008 and 2019 whereas the LSF wages have increased. It should be noted that the average wages in the large scale fleet are almost three times as high as in the small scale fleet. The small scale fleets only play a marginal role in terms of landed weight and value (7% and 23%, respectively).

Table 12. CFP objectives, indicators and achievements in the Baltic. LSF: large-scale fishing fleet, SSCF: small-scale fishing fleet

Indicators	Target/Limit value or envisaged trend	Indicator value (and trend) or qualitative judgement	Target/trend/Threshold internationally agreed? (yes/No)
Objective: progress in achieving MSY			
Proportion of assessed stocks that are fished at or below F_{MSY}	100%	Three stocks with relevant information available exceeded F_{MSY} in the Baltic in 2020[1]. Five stocks were assessed to have a fishing mortality (F) not exceeding F_{MSY}[1]. This gives a proportion of 63% of assessed stocks that are fished at or below F_{MSY} in 2020. There is an increasing trend in the number of stocks fished at or below F_{MSY} since 2003 (13% in 2003)	Yes
Proportion of assessed stocks within safe biological limits	100%	In 2020 there are three stocks with relevant information available which are assessed to be outside safe biological limits in the Baltic[1]. Five stocks are inside safe biological limits. This gives a proportion of 63% of assessed stocks within safe biological limits in 2020. There is an increasing trend since 2003 (25% in 2003)	Yes
Average Fcurrent/F_{MSY} over all assessed stocks	<=1	The average of the ratio Fcurrent/F_{MSY} in the Baltic in 2020 is 1.14[1]. There is a decreasing trend over the years (1.51 in 2003).	No
Ratio SSB/SSB_{2003}	>=1	Average ratio B/B2003 was slightly lower than 1 in 2020 in the Baltic (0.97)[1]. This indicates that on average across stocks no recovery of SSB has taken place.	No
Objective: Economic and social dimension of the CFP			
Gross profit/net profit	Increasing	The EU fleets made about EUR 54.2 million in gross profit in 2019, an estimated 6.7% decrease compared to 2018[2] There was overall a stable trend in gross profit with minor fluctuations from 2008 to 2019 (Figure 3.21 in [2]). In contrast, net profit shows an increasing trend over time (Figure 3.21 in [2])	No

Average wages (for SSCF and LSF separately)	Increasing	For the SSCF, the overall average wage per FTE increased by 1.0% in 2019 compared to 2018, thus being EUR 9 976 Euro in 2019[2]. Average wages per FTE in the LSF decreased by 0.5% between 2018 and 2019 and was EUR 28 566 in 2019. There is an increasing trend in average wage per FTE for the LSF between 2008 and 2019 (Figure 3.20 in [2]). For the SSCF average wage per FTE remained at the level of 2009.	No
Amount/value of landings	Stable/increasing	The weight and value of landings was approximately 624 767 tonnes and EUR 200 million in 2019[2]. Landings (by weight) from the Baltic declined between 2009 and 2012, followed by a slight increase in 2013 and further increase after 2014. However, from 2018 to 2019 the weight of landings decreased with 7.2% and stayed below the amount of landings from 2008 (Figure 3.19 in [2]). Conversely, landings by value increased steadily from 2009 to 2013, decreased significantly in 2014 (due to slump in the price for small pelagic species) and had still not entirely recovered in 2019 following a reduction from 2018 to 2019 with 3.6% (Figure 3.19 in [2])	No
Ratio landings weight and value SSCF / LSF	Increasing	Even though the share of the number of small-scale vessels is 92%, their economic contribution as well as their share of the landed weight is small. The LSF landed 93% of the total weight and 77% of the total value.[2]	No

[1]Scientific, Technical and Economic Committee for Fisheries (STECF) – Monitoring of the performance of the Common Fisheries Policy (STECF-Adhoc-22-01). EUR 28359 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51702-3, doi:10.2760/566544, JRC129080

[2] Scientific, Technical and Economic Committee for Fisheries (STECF) - The 2021 Annual Economic Report on the EU Fishing Fleet (STECF 21-08), EUR 28359 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-40959-5, doi:10.2760/60996, JRC126139.

5. MSFD objectives in selected EU waters

Here we provide an overview of the achievement of those MSFD objectives that are likely to be impacted by fishing, (i.e. D1 Biodiversity, D3 Commercial fish and shellfish, D4 Foodweb functioning, D6 Seafloor integrity and D10 on Marine litter) in the Baltic Sea, North Sea, Western waters and the Mediterranean. This assessment is based on indicators as they have been put forward in the respective marine regions. Often agreed thresholds were not available except where these are already agreed under the Water Framework Directive, the Habitat Directive or the Common Fisheries Policy (Table 13).

5.1 MSFD objectives for descriptor 3 in the Northeast Atlantic

The recent MSFD guidelines (EC 2022a) combines the requirement of compatibility between MSFD assessments of stock status and pressure and the Multiannual Plans of the CFP and their use of F_{MSY} ranges by evaluating the status of fishing pressure and biomass on average over 6 year periods, consistent with the MSFD assessment periods. This differs from the STECF reports, which address annual development in fishing mortality and biomass and hence inherently lead to a high proportion of failures to meet reference levels. As the reference points F_{MSY} is used as target and as reference level at the same, even when the stock is well managed and fishing mortality may exceed F_{MSY} up to half the time.

Using the MSFD approach, 21% of the stocks are at too low biomass and too high fishing mortality (Figure 4, top left quadrant of the figure). A further 13% of the stocks are at too low biomass but have a reduced fishing mortality to facilitate rebuilding (bottom left quadrant of the figure). Among the stocks above stock biomass reference levels, a third are fished above FMSY on average in the most recent 6 years. In total, 44% of the stocks met the objectives of having a biomass greater than MSYBtrigger and a fishing mortality at or below FMSY on average. A further 13% of the stocks meet the objective of reducing fishing mortality to facilitate rebuilding. Hence, in total, 57% of the stocks can be considered to meet the stated objectives while 43% of the stocks do not. The status of all stocks relative to reference points is available here.

5.2 Achievement of objectives in the North Sea

Biodiversity (descriptor 1) assessments have been completed for a few bird and marine mammal species as well as sensitive fish species assessments by OSPAR. Only part of the species-specific objectives for GES (based on OSPAR criteria) are currently achieved (e.g., harbour porpoise in the North Sea, 11 of 20 assessed bird species). Sensitive fish species have not achieved the objective of showing recovery in the North Sea (table 13).

GES of descriptor 3 (commercially exploited fish and shellfish) has only been achieved for about half the stocks which, even though there is no agreed percentage of stocks, suggests that the objective is not achieved though improvements were observed (see figure 4) .

Most aspects of food webs (descriptor 4) have not been assessed yet (table 3). Only the size distribution of individuals across the trophic guilds has been assessed by OSPAR and the OPSAR criteria have not been met for the North Sea region.

For seafloor integrity (descriptor 6), benthic habitat condition has been assessed by OSPAR in relation to thresholds (table 3). OSPAR concluded that for coastal habitats in relation to nutrient and/or organic enrichment' criteria have been met in 89% of assessed areas for benthic invertebrates and 74% of the area for macrophytes/angiosperms. An ICES assessment on the physical disturbance (D6C2) on benthic habitats (ICES, 2019) shows that 54.5% of the North Sea ecoregion is disturbed by abrasion primarily caused by fishing. As there is no agreed threshold it is unclear if this compromises the achievement of GES for the seafloor.

Marine litter has been monitored but e.g., concentrations have not been assessed against thresholds so far. Only for D10C3 (Litter in biota (ingested)) OSPAR concluded that the criteria have not been met for Fulmar in the North Sea (table 13).

5.3 Achievement of MSFD objectives in the Western waters

OSPAR's intermediate assessment for biodiversity was completed for biodiversity (MSFD Descriptor 1) for marine mammals, marine birds, fish communities and sensitive fish species. Indicators that were agreed and/or assessed were accessed on the OSPAR website on 22 September 2022 (https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/introduction/what-assessed/).

Marine mammals[1] assessment (biodiversity descriptor 1) were agreed and assessed for abundance and distribution of coastal bottlenose dolphins, and cetaceans, and a pilot assessment on the abundance and distribution of killer whales in the Celtic Seas and the Bay of Biscay and for the grey seal pup production in the Celtic Seas. Harbour porpoise bycatch was not agreed and assessed in the Celtic Seas and the Bay of Biscay, neither was the seal abundance and distribution in the Celtic Seas.

Biodiversity assessment of birds[2] (descriptor 1) included marine bird abundance and breeding success, and was agreed in the Celtic Seas and the Bay of Biscay, but only assessed in the Celtic Seas. Breeding failure was frequent and widespread (2010-2015) in the Celtic Seas. Bird abundance has not been considered healthy since the mid-2000s, i.e. more than a quarter of the non-breeding abundance of species that visit the Celtic Seas during migration and/or during winter was below the baseline set in 1992.

Biodiversity assessment of fish communities[3] (descriptors 1 and 4) that were agreed and assessed in the Celtic Sea are recovery of sensitive fish species and a pilot assessment of mean maximum length of fish. The latter indicators was also agreed as candidate in the Bay of Biscay and Iberian coast. The decline of abundance of sensitive fish species has been halted, but significant recovery is only apparent for a limited number of sensitive fish species in the Celtic Seas and the Greater North Sea. Recovery in the proportion of large fish in the demersal fish community is evident only in the northern part of the Celtic Seas, not in the south or west.

GES of commercially exploited fish and shellfish (Descriptor 3) has improved, although MSY has not been achieved for all stocks (see CFP indicators).

Food web indicators[3] (descriptor 4) that were agreed and assessed in the Celtic Seas and the Bay of Biscay included pilot assessment of production of phytoplankton and size composition in fish communities. The typical length of the demersal fish assemblage shows a mixed pattern with decreases near the Irish coast of the Irish Sea and in the Clyde area, but increases to the south of Ireland, Isle of Man, Sea of the Hebrides, and The Minch. The pelagic fish assemblage generally shows no long-term change at the sub-regional level. In the Bay of Biscay and the Iberian coast, the typical length increased partly due to long-term increases in northerly sub-divisions in shelf waters to the west of France. There are generally no trend in the pelagic fish assemblage, except for decreases in northerly sub-divisions in shelf waters to the west of France. Mean Trophic Level in the Bay of Biscay showed no apparent change in overall food web structure over recent decades, though there were some signs of increased biomass of predators.

The indicators for seafloor integrity (descriptor 6) that have been agreed and assessed in the Celtic Seas and the Bay of Biscay included condition of benthic habitat communities (coastal habitats in relation to nutrient and/or organic enrichment), pilot assessment of changes in plankton diversity and extent of physical damage to predominant and

[1] https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/biodiversity-status/marine-mammals/
[2] https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/biodiversity-status/marine-birds/
[3] https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/biodiversity-status/fish-and-food-webs/

special habitats. The Water Framework Directive (WFD) status for benthic invertebrates is good to high in most intertidal and subtidal sediments, in response to the (direct or indirect) effects of nutrient and/or organic enrichment. The WFD status for macroalgae and angiosperms is good to high along the Spanish coast. No data were available along the French coast. The status was mostly good to high in the northern Western waters study area. Extent of physical damage to predominant and special habitats was assessed for the period 2010–2015, and showed evidence of physical disturbance in approx. 86% of the grid cells in the Greater North Sea and Celtic Seas, of which 58% of areas show relatively high levels of disturbance. Physical disturbance data were incomplete for the Bay of Biscay and the Iberian coast.

Litter[4] (MSFD descriptor 10) was assessed as beach litter (abundance, composition and trends), and comprised on average 434 items in the Celtic Seas, and 365 items in the Bay of Biscay and Iberian coast, of which 15-20% were nets and ropes. No thresholds were set so far. Composition and spatial distribution of litter on the seafloor is the second indicator. Higher amounts of litter are found in the Eastern Bay of Biscay and the Southern Celtic Seas than in the northern Greater North Sea and Celtic Seas.

5.4 Achievement of objectives in the Baltic Sea

Biodiversity (descriptor 1) assessments have not completed for birds by HELCOM whereas the marine mammal assessment by HELCOM has shown that grey seals are not meeting thresholds for GES. For sensitive coastal fish, perch and flounder are assessed by HELCOM but did not meet the thresholds (table 3).

GES of descriptor 3 (commercially exploited fish and shellfish) has not been achieved for all stocks although the situation has improved (see figure 4).

Most aspects of food webs (descriptor 4) have not been assessed yet (table 13). In the Baltic Sea, the indicator 'Abundance of coastal fish key functional groups' met the threshold for coastal piscivores for more than 75% of the areas and for coastal meso-predators in less than 50% of the areas.

For seafloor integrity (descriptor 6), benthic habitat condition has been assessed by HELCOM and the threshold met in 10 of 11 areas in the Baltic Sea (table 13).

Marine litter in the Baltic Sea has so far been monitored but e.g., concentrations have not been assessed against thresholds so far. A recent pilot assessment demonstrates that the proposed threshold of no significant increase is not met for fisheries related litter and other plastic litter in the Baltic Sea (Rindorf et al., unpublished results).

5.5 Achievement of objectives in the Mediterranean Sea

The Reports of the Commission to the European Parliament and the Council on the implementation of the MSFD (COM(2020) 259 final; SWD(2020) 61 final) underline that biodiversity loss was not halted during the first MSFD cycle . The biodiversity of marine ecosystems is still vulnerable and the good state of habitats and species is not secured. In Mediterranean some marine populations and groups of species of elasmobranchs (e.g. around 40%) are declining and many are data deficient. At least 87% of the commercially exploited fish and shellfish species are overfished, though there has been some progress, notably with the adoption of the first ever multiannual plan for the western Mediterranean Sea, which may lead to an effort reduction of up to 40%.

Status of birds from the Mediterranean Sea is unclear with most of the data coming from North-western areas. Trends in the critically endangered Balearic shearwater suggest marked declines. In general, cetacean populations

[4] https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/marine-litter/

are either in unknown or not good status. In the Mediterranean Sea, there is some evidence of declining numbers of fin whales and common dolphins. Fin whale abundance in the Western Mediterranean was estimated as 3,500 in the mid-1990s, but more recent estimates in 2017 suggested 460 individuals. The first estimate, however, includes individuals entering the Mediterranean from the Atlantic Ocean, while the second estimate refers only to the Mediterranean residents (UNEP-MAP).

Cephalopods and reptiles are too poorly monitored (e.g. 33% of the reports on marine turtles under the Habitats Directive were in unfavourable conservation status and 67% unknown). On the other hand, examples of stabilisation or recovery include monk seals in parts of the Mediterranean Sea. The distribution of monk seal in the Mediterranean remains stable or expanding, though it is still endangered and systematic monitoring is needed to assess overall status (UNEP-MAP)

While the overall state of marine food webs cannot yet be fully assessed, there are examples of trophic guilds showing deteriorating trends over time. There are examples of marine communities that do not occur at the proper abundance to retain their full productive capacity, as observed for many commercial fish and shellfish stocks. There is a decrease of forage fish and demersal fish, and an increase of invertebrates, with 41% drop of top predators.

Seabed habitats are under significant pressure from the cumulative impacts of demersal fishing, coastal developments and other activities. According to UNEP-MAP, assessment of Mediterranean seabed habitats is mainly qualitative due to the lack of ground-truth data and standardized monitoring for most of offshore habitats. This includes the lack of baseline data at the regional scale for many habitats exposed to abrasion by bottom-trawling fisheries. This has so far restricted the ability to identify a sustainable condition for habitats under continuously high-pressure levels. However, the extent of special habitats are under threat and in decline. In the eastern Mediterranean however benthic habitat condition (Descriptor 6 Criterion 5) was at a level that ensures Good Environmental Status (Anonymous, 2021a).

In terms of data availability, the data needed to assess status is inadequate for most assessed species. Wider and more regular fish stock assessments should be performed.

Further, for many indicators do not have agreed reference points and for several criteria, especially the secondary ones, information is scant or not available (Anonymous, 2021a).

There are over 1,200 marine non-indigenous species in Europe's seas and their cumulative number is still increasing, although the rate of introduction seems to have decelerated during the last decade. The larger number of these species is occurring in the Mediterranean Sea (EEA, 2019).

Marine litter is one of the main issue, though with sub-regional large differences and single use plastics dominate in the Mediterranean. Concentrations of micro-litter in the Mediterranean Sea are high, different surveys report concentrations above 105 particles/km², up to 4x105 particles/km². Ingestion of plastic by marine species is widespread and 85% of the turtles assessed in the Mediterranean Sea had ingested litter. In the eastern Mediterranean marine litter in the marine environment (Descriptor 10 Criterion 1) was at safe levels in 74% of the stations sampled in eastern Ionian Sea (Anonymous, 2021a).

Table 3: MSFD Descriptors and indicators

MSFD indicators are derived from the recently published guidance (https://circabc.europa.eu/ui/group/326ae5ac-0419-4167-83ca-e3c210534a69/library/d2292fb4-ec39-4123-9a02-2e39a9be37e7/details). The indicators included are those with direct (catch, bycatch, habitat impact, litter derived from fishing) and indirect (changes in food abundance and food webs) link to fishing. HELCOM and OSPAR assessments available at http://stateofthebalticsea.helcom.fi/biodiversity-and-its-status/ and https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/, both accessed July 6th 2022.

Criteria	Indicators	Threshold defined?	Has the objective been linked to fishing? (yes/no/ partly)	Has the objective been assessed ? (yes/no/ partly)	Has the objective been met? (yes/no/partly)	Which mgt measure attributed to this?	Overall effectiveness (per descriptor)
Descriptor 1: Biological diversity is maintained.							
D1C1 and D1C3 Biodiversity – birds	Species specific indicators 42dentifie for D1C1 (bycatch) and D1C3 (demography) both with very sparse data. Not available for Med	Thresholds for D1C1 and D1C3 available for selected species in the HELCOM and OSPAR area. Data for D1C1 insufficient to assess status and D1C3 can only be assessed for a few species.	Yes, through bycatch (D1C1) and removal of forage fish (D1C3) for selected species. Not available for Med	Not by HELCOM D1C3 Assessed by OSPAR. No assessment by HELCOM. Not available for Med	In the greater North Sea and Celtic Sea, D1C3 was met for 11 of 20 assessed species and 14 of 20 assessed species, respectively. Failures were mostly among birds feeding on shallow small pelagic fish like sandeel. Failure may be related to changes in forage fish productivity. Not available for Med	Unclear but other publications have shown that biomass of small pelagics below 1/3 of the virgin biomass increases the risk of failure. Avoiding biomass below a specified level is an objective in management of commercially fished	

						small pelagics Not availabl e for Med	
D1 Biodive rsity – mamm als	Species specific indicators 43dentifie for D1C1 (bycatch)(d ata quality low for most species in OSPAR and HELCOM areas, and D1C3 (demograp hy) (data 43dentifie for HELCOM and seals in the OSPAR area). Indicators available for D1C2 (Abundanc e) and D1C3 (Demograp hy). Data of abundance is limited to certain species and available locally for certain areas (Dendrinos et al., 2020; Frantzis & Alexiadou, 2020).	Thresholds for D1C1 and D1C3 (grey seals in the HELCOM only) available for selected species in the HELCOM, OSPAR and Black Sea area. Not agreed for the Med.	Yes through bycatch (D1C1).	Yes for D1C1 for harbour porpoise in the Greater North Sea area and Celtic Seas, and D1C3 for grey seals in the Baltic.	OSPAR criteria met for harbour porpoise in the Greater North Sea and partly met for Celtic Seas. D1C3 for grey seals not met in the HELCOM area.	D1C1: Use of pingers on set nets in selecte d areas. D1C3: manage ment of fisherie s with objectiv e to avoid low biomas s.	

	Data on demography available only for M. monachus (Dendrinos et al., 2020).						
D1 Biodiversity – reptiles	Indicators are imported from the Habitat directive In the Med Indicators available for D1C2 (Abundance), D1C3 (Demography) and D1C4 (Distribution) for C. caretta (e.g.Panagopoulou et al., 2020).	Thresholds to be developed.	Yes through bycatch (D1C1).				
D1 Biodiversity – fish	Indicators of D1C2 available for perch and flounder in the HELCOM area for coastal fish. These species are not considered sensitive to fishing (WKABSENS 2021). No species specific indicators 44dentifie in OSPAR and	Trend-based thresholds agreed for D1D2 in the HELCOM and OSPAR areas (halt further decline in both areas, population recovery also considered in the OSPAR areas). Thresholds not agreed for D1C1 and D1C3. Threshold for D1C1 in the Med	Yes through catch and bycatch (D1C1).	Yes for D1C2 of perch and flounder in the HELCOM area and for sensitive species in the Greater North Sea and Celtic Sea (sensitive fish, halt further decline), sensitive species have not			

	HELCOM for D1C1, but information 45dentifie from ICES. No species specific indicators 45dentifie for D1C3. In the Med Indicators for D1C1 (Bycatch) available for 16 species in the eastern Med (Anonymous, 2021a).			achieved 45dentif in the North Sea but has achieved this in the Celtic Seas. Yes for D1C1 for 16 species.in the eastern Med			
D1 Biodiversity – cephalopods	No agreed indicators 45dentifie.		Yes through catch and bycatch (D1C1).				
D1 Biodiversity – pelagic habitats	Indicators for phyto- and zooplankton biomass, communities and diversity used in OSPAR and HELCOM. Indicators for pelagic habitat under develomen t at EU level. Indicators for D1C6 (Pelagic habitas).	Thresholds set for 45dentified45on biomass and zooplankton abundance in the OSPAR areas and for phytoplankton mean size and total stock, chlorophyll-a and cyanobacterial bloom index in HELCOM. No thresholds set for the GES at national or Mediterranean level. Evaluation of the results based on expert judgement.	Possibly food web impacts (D4) and impacts on fish productivity (D3, D1C3 fish)	Med. Yes for phytoplakton and zooplankton.	Med. Yes for phytoplakton and zooplankton.		

	Indicators for phytoplankton and zooplakton biomass, communities and diversity. (Anonymous, 2021a)						
Descriptor 3: Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of healthy stock.							
D3C1 Fishing mortality	F	Yes, for species where FMSY has been estimate.	Yes, by selective removal.	Yes, see under CFP	Yes, see under CFP		
D3C2 Spawning biomass	SSB	Yes, for species with quantitative assessment	Yes, by selective removal.	Yes, see under CFP	Yes, see under CFP		
D3C3	Not agreed at present	Not agreed	Yes, by selective removal.				
Descriptor 4: All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.							
D4C1 Diversity of the trophic guild.	Indicators of diversity within guilds 46dentifi but not yet assessed in OSPAR and HELCOM. Indicators for species composition and relative abundance of phytoplankton, micro meso-zooplankton & nekton. (Anonymous, 2021a)	Not agreed Eastern Med. Thresholds referred to the planktonic food web are in an investigational and non-operational development stage. No thresholds for nekton.	Yes, by selective removal.				

D4C2 Balance of abundance between trophic guilds.	Indicators of biomass within guilds 47dentifi but not yet assessed in OSPAR. In HELCOM, the indicator 'Abundance of coastal fish key functional groups ' is used for coastal fish. Med. Indicators for total biomass of nekton (demersal predators & small pelagic fish). (e.g. Anonymous, 2021a)	Agreed for HELCOM 'Abundance of coastal fish key functional groups.' Med. No thresholds	Yes, by selective removal.	Yes for HELCOM 'Abundance of coastal fish key functional groups'	Threshold met for coastal piscivores for more than 75% of the areas and for coastal mesopredators in less than 50% of the areas.		
D4C3 Size distribution of individuals across the trophic guild.	Indicators of size distribution assessed in OSPAR include Typical length, Mean Trophic level, Proportion of large fish and mean maximum length.	Agreed for Proportion of large fish.	Yes, by selective removal.	Yes for all four indicators in the OSPAR area.	Proportion of large fish has not met the threshold.		
D4C4 Productivity of the	Indicators have been 47dentifi but not yet	Not agreed	Yes, by selective removal.				

trophic guild	assessed in OSPAR and HELCOM.						
Descriptor 6: Seafloor integrity							
D6C1 Physical loss of seabed.	Indicator defined as area lost.	Not agreed	Yes, by benthic impact of demersal gear on vulnerable habitat forming biota (VMEs)			Closure of 48dentified areas with vulnerable habitat forming biota to fishing. (VMEs) in EU waters	
D6C2 Physical disturbance to the seabed.	OSPAR uses the indicator 'Extent of Physical Damage to Predominant and Special Habitats.' ICES: Total disturbance footprint (%)	Not agreed. But…. ICES. 2022. Workshop to scope assessment methods to set thresholds (WKBENTH2). ICES Scientific Reports. 4:70. 99 pp. http://doi.org/10.17895/ices.pub.20731537	Yes, by benthic impact of demersal gear.	Assessed but not in relation to threshold.			
D6C3 Adverse effects from physical disturbance on benthic habitats (spatial extent).	Defined as the area adversely affected (D6C2). "Longevity" of benthic community is used as a sensitivity index of community to the effects of fishing on different bottom types,	Not agreed	Yes, by extent of benthic impact of demersal gear.				

	substrates and depths. (Anonymous, 2021a)						
D6C4 Benthic habitat extent (Extent of habitat loss from anthro-pogenic pressures)	Defined as the area lost (D6C1)	Not agreed	Yes, by benthic extent of impact of demersal gear.				
D6C5 Benthic habitat condition (extent of adverse effects from anthro-pogenic pressures, WFD assessments can be used here).	HELCOM uses the indicator 'State of the soft-bottom macrofauna community'. OSPAR uses the indicators 'Assessment of Coastal Habitats in relation to Nutrient and/or Organic Enrichment' and 'Diversity in subtidal Habitats of the Southern North Sea.' The following indicators were used: diversity indices N (number of individuals	Thresholds exist for the HELCOM indicator and the OSPAR indicator 'Assessment of Coastal Habitats in relation to Nutrient and/or Organic Enrichment'. No threshold for diversity in the southern North Sea. Med. Thresholds same as in water framework directive.	Yes, by extent of benthic impact of demersal gear.	Yes for the three indicators in the HELCOM / OSPAR areas.	Threshold met in 10 of 11 areas in the Baltic Sea OSPAR 'Coastal Habitats in relation to Nutrient and/or Organic Enrichment' met in 89% of assessed areas for benthic invertebrates and 74% of the area for macrophytes/angiosperms.		

	), S (number of species), H' (Shannon-Wiener), J' (Pielou's evenness), d (Margalef), and the BENTIX biotic index (Simboura & Zenetos, 2002) applied to the assessment of the ecological status of the coastal waters. (Anonymous, 2021a)						
Descriptor 10: Properties and quantities of marine litter do not cause harm to the coastal and marine environment.							
D10C1 Litter in the marine environment	Litter on the coastline. Amount of litter on the seabed (trend assessment) Med. Litter on the seabed: litter density (n/km2) & quality composition of litter. (Anonymous, 2021a)	Specific limits per category suggested. No further increase suggested Med. For litter density thresholds based on UNEP (2015).	Yes, by addition of fisheries related litter	OSPAR and HELCOM assess temporal development in litter on the coastline and have pilot assessments on litter on the seafloor. Not assessed in relation to thresholds.			

D10C2 Micro-litter in the environment	Further development needed.	No further increase. Med. not agreed	Yes, by addition of fisheries related litter.				
D10C3 Litter in biota (ingested)	Amount of artificial polymer material and single use plastic litter ingested by Fulmar (OSPAR region II), sea turtles (OSPAR regions III, IV and V) and loggerhead turtle (Mediterranean sea) (trend assessment).	Specific limit available for Fulmar. Others are under development.	Yes, by addition of fisheries related litter.	Yes, in the OSPAR region (Fulmars).	Threshold not met for fulmars in the North Sea.		
D10C4 Adverse effects on species	To be developed.	To be developed.	Yes, by addition of fisheries related litter.				

6. Effectiveness of current management towards attaining identified objectives

6.1 Management measures implemented in EU waters

A comprehensive inventory of the implemented fisheries management measures in the EU waters is lacking and as a way forward we adopted the database of management measures and policy instruments collated as part of the project on the implementation of ecosystem-based approaches applied to fisheries management under the CF (EU-CINEA, 2022) together with input from the stakeholder scoping. As concluded previously by STECF and EU-CINEA, the large variety of management measures and their concurrent implementation means that it is not possible to identify which of the measures are effective. It is notable that the implementation and development of measures under HELCOM, OSPAR, and UNEP-MAP are not aligned.

6.2 Performance of specific management measures

It is difficult to assess the performance of specific management measures as these do not occur in isolation and the fisheries and ecosystem components that are targeted are also impacted by the consequences of other measures. Therefore, we have chosen to assess if the combined management measures (what could be considered to represent the EBFM plan) resulted in achieving the policy objectives. There are, however, evaluations of certain management measures in specific EU waters. Examples are provided below.

A selection of technical measures was evaluated for the Celtic Sea using the STECF report (STECF, 2021) and the subsequent comments from the North Western Waters Advisory Council (NWWAC) to the report. STECF (2021) evaluated the effect of a catch limit of 20% haddock in otter trawl fisheries and a seasonal closure (the Trevose cod closure). The >20% catch limit for haddock was assessed as the most appropriate measure to limit cod catches. Conversely, the cod closures was found not to be effective as it does not appear to protect areas with the highest densities of cod. STECF recommendations were criticised by the NWWAC with three take-home messages. First, NWWAC calls for consistency in technical measures, and questions the request to implement a new technical measure (the raised fishing line). Second, NWWAC request an evaluation of the existing cod closure in the Celtic Sea instead of a displacement of the closure. And third, NWWAC request harmonising technical measures between UK and the EU. Overall, new technical measures are not desired by stakeholders, and require substantial scientific underpinning and consultation with stakeholders.

In 2017, GFCM adopted the recommendation GFCM/41/2017/3 on the establishment in the Adriatic Sea of the Jabuka/Pomo Pit FRA. This action was supported also by Italian and Croatian fishers. The Jabuka/Pomo Pit is a nursery for both European hake and Norway lobster. Therefore, the establishment of an FRA is expected to improve the exploitation pattern of both stocks. In addition, the Pomo Pit FRA is likely to determine a strong increase of SSB of the Norway lobster. The GFCM Sub Regional Committee of the Adriatic Sea in the 2021 session pointed out that, three years after the establishment of the Jabuka/Pomo Pit FRA (which surface presents 2-3% of the Adriatic Sea) and the establishment of the no-take zone (1% of the Adriatic Sea surface), significant recovery of resources were estimated. This provides some evidence for the conservation potential of closed areas. In the last GFCM session a new Recommendation GFCM/44/2021/2 was adopted for the Jabuka/Pomo pit FRA.

6.3 Overall performance of fisheries management in EU waters

The assessment of the overall performance of fisheries management in relation to a objectives stated in the CFP and MSFD in relation to ecological, social and economic sustainability, showed that most objectives are not achieved. However, there are positive changes occurring. The measures aimed at reducing fishing mortality over the past 20 years have been highly effective in reversing the trend of overfishing in most of the EU waters. However, they have not succeeded in restoring stocks to levels capable of producing MSY, likely due to a combination of sustained overfishing (21% of the stocks in the NEA are fished above F_{MSY} though their biomass is below MSY Btrigger) and reduced productivity, as observed in Northeast Atlantic cod stocks. In the Mediterranean Sea, many stocks remain overfished and/or outside safe biological limits, a situation that requires conservation efforts towards reaching the MSY objective by 2025 for EU and shared stocks (COM(2022) 253 final), though recently some signs of improvements were observed. In particular, the instruments of the EU West Med MAP and the GFCM MAPs (Recommendations regarding 5 MAPs) that introduced new measures, such as catch limits, are expected to contribute toward recoveries. The main challenge remains the improvement of the exploitation pattern that requires increasing selectivity of trawl gears, also searching for a trade-off between different technical solutions that take the fisheries peculiarities into account (e.g. STECF 21-13).

Management measures aimed at restoring biodiversity of other species was concluded by the recently proposed Nature restoration law to have largely been ineffective (EC 2022b). This conclusion was however largely based on evaluations of species and habitats listed under the Habitat Directive and a formal assessment of the success in attaining other MSFD objectives is generally not possible due to lack of agreed thresholds (and indicators in some cases). The CFP and MSFD and associated documents (Multiannual plans and guidance for the MSFD) state clear objectives for a variety of fisheries related aspects. However, these objectives are often not supported by agreed estimated indicators, particularly for social aspects and ecosystem effects of fishing. Where indicators have been developed, there are often no agreed thresholds. Together, this either limits an evaluation of whether objectives are attained to specific elements such as fishing pressure, fished stock biomass and status of species assessed under the habitat directive or necessitates a high degree of expert judgement with the associated lack of transparency and reproducibility.

In some areas, indicators are established at national or sub-regional level, e.g. in Italy the indicators were estimated at the Western, Central, and Adriatic sub-regions that correspond with the geographical scale adopted at GFCM level. However, scaling these local assessments to regional assessments is not straight forward and requires further efforts to integrate the estimates of such indicators at Mediterranean sub-regional scale to align these indicators with the ones of the CFP.

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