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GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

Report of the twenty-third session of the

SCIENTIFIC ADVISORY COMMITTEE ON FISHERIES

FAO headquarters, Rome, Italy, 21–24 June 2022

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PREPARATION OF THIS DOCUMENT

This document is the final report adopted by the participants in the twenty-third session of the Scientific Advisory Committee on Fisheries of the General Fisheries Commission for the Mediterranean of the Food and Agriculture Organization of the United Nations held at FAO headquarters, Rome, Italy, from 21 to 24 June 2022.

ABSTRACT

The Scientific Advisory Committee on Fisheries (SAC) of the General Fisheries Commission for the Mediterranean (GFCM) held its twenty-third session in hybrid modality, from 21 to 24 June 2022. The session was attended by delegates from 20 Mediterranean contracting parties, 11 observers, as well as representatives of the Food and Agriculture Organization of the United Nations (FAO) Fisheries Division, the GFCM Secretariat and invited experts. The Committee reviewed the work carried out during the 2021–2022 intersession and endorsed the MedSea4Fish guiding document, which provides an implementation framework following the establishment of the programme at the forty-fourth session of the GFCM (online, November 2021). The Committee provided advice on the status of priority stocks and ecosystems and on potential management measures addressing key fisheries and vulnerable species in the Mediterranean, including for European eel and red coral. In line with the subregional approach, the Committee formulated advice focusing on: i) common dolphinfish (*Coryphaena hippurus*) and blackspot seabream (*Pagellus bogaraveo*) fisheries in the western Mediterranean; ii) small pelagic and bottom trawl fisheries exploiting demersal stocks, particularly European hake (*Merluccius merluccius*) and deep-water rose shrimp (*Parapenaeus longirostris*), in the central Mediterranean; iii) deep-water red shrimp, giant red shrimp and blue and red shrimp (*Aristaeomorpha foliacea* and *Aristeus antennatus*) fisheries in the eastern-central Mediterranean, including their interactions with vulnerable megafauna; iv) non-indigenous species in the eastern Mediterranean; and v) small pelagic and demersal fisheries in the Adriatic. The Committee also agreed on the technical soundness of a proposal for the establishment of a fisheries restricted area (FRA) in the Cabliers Coral Mound, reviewed and endorsed a proposal for a large-scale multiannual pilot study on trawl selectivity in the Strait of Sicily and reviewed the updated proposal from Libya to divide the Libyan coast (geographical subarea 21) into three marine subareas, to be submitted to the Commission. At the regional level, the Committee provided advice on the following: i) minimum conservation reference size for GFCM priority species; ii) spatial distribution of fishing effort, especially bottom trawl fisheries, to understand the spatial dynamics of specific fisheries and inform spatial management measures, including vulnerable marine ecosystems and other effective area-based conservation measures; and iii) ensuring and assessing the effectiveness of FRAs and establishing minimal standards for the monitoring of FRAs. With regard to recreational and small-scale fisheries, the Committee endorsed lists of species of importance and expressed support for a dedicated research programme for recreational fisheries. It also noted the importance of further enhancing the implementation of the Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea. The Committee discussed additional work in support of the GFCM, endorsing dedicated research programmes as well as other activities to enhance fisheries management in the region. Finally, the Committee agreed upon its workplan for 2022–2024.

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APPENDIXES

OPENING AND ADOPTION OF THE AGENDA

1. The twenty-third session of the Scientific Advisory Committee on Fisheries (SAC) of the General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organization of the United Nations (FAO) was held at FAO headquarters, Rome, Italy, in hybrid modality, from 21 to 24 June 2022. The session was attended by delegates from 20 Mediterranean contracting parties and 11 observers, as well as representatives of the FAO Fisheries and Aquaculture Division, the GFCM Secretariat and invited experts. The session was chaired by Mr Alaa El-Haweet, SAC Chairperson, with the support of the Vice-Chairpersons, Mr Mümtaz Tirasin and Mr Aleksandar Joksimovic. The adopted agenda is provided in Appendix 1, the list of participants in Appendix 2 and the list of documents in Appendix 3. On the basis of the discussions held, the Committee formulated the conclusions reported hereafter.

OVERVIEW OF INTERSESSIONAL ACTIVITIES OF RELEVANCE TO THE COMMITTEE

2. The Committee commended the numerous and varied activities that were carried out during the intersession despite continuing difficulties linked to the COVID-19 pandemic. The experts and stakeholders involved were praised for the considerable advances they made on many priority topics, particularly in relation to research programmes and scientific monitoring of fisheries activities using harmonized methodologies across the region, which were instrumental in improving data quality. The Committee took note of the need to redouble efforts towards improving scientific work and data quality and to increase the focus on the impacts of climate change, in line with the goals set by the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea (GFCM 2030 Strategy).

ENDORSEMENT OF THE MEDSEA4FISH DOCUMENT

3. The Committee examined the MedSea4Fish guiding document, which provides a clear implementation framework following the establishment of the programme at the forty-fourth session of the Commission (online, November 2021). It acknowledged the relevance given to national priorities and its alignment with the FAO Strategic Framework, particularly with regard to its Blue Transformation objectives already enshrined in the GFCM 2030 Strategy. It recognized MedSea4Fish's potential to raise capacity development within the GFCM to a new level by addressing fisheries and ecosystem monitoring and training with greater integration at the national, subregional and regional levels and by promoting infrastructure interventions as an additional response to countries' structural needs for sustainable change in fisheries management. The Committee appreciated the readiness of GFCM countries and partners to actively engage with and contribute to MedSea4Fish by providing facilities and expertise and/or through dedicated funding. In this regard, it took note of the expectations expressed by Albania, Egypt, Libya and Lebanon of support from MedSea4Fish, welcomed the scientific networks and tools made available to the programme by Algeria, Morocco, Tunisia and Türkiye (the latter having offered to host the non-indigenous species observatoire), and expressed gratitude to the European Union, which had already secured significant financial support for the launch of its first phase. With all the tools in place to move forward in operationalizing the programme and bringing about a concrete shift in the GFCM ambitions, the Committee unanimously endorsed the MedSea4Fish guiding document, which, owing to its flexible structure, will be regularly revised to maintain its relevance.

FORMULATION OF ADVICE ON MARINE LIVING RESOURCES AND FISHERIES MANAGEMENT

Overview of the status of fisheries, including the status of stocks and vulnerable species

4. The Committee noted – based on information transmitted by contracting parties and cooperating non-contracting parties (CPCs), including, as appropriate, through the SAC national

reports – that the Mediterranean accounted for 87.3 percent of fishing vessels and 60.8 percent of landings in the GFCM area of application. 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). In terms of fishing fleet, the Committee noted a significant increase in the number of vessels in Italy (16 percent) and Tunisia (15.2 percent), while in terms of catches among the major fishing countries in the Mediterranean Sea (annual catch > 50 000 tonnes), important decreases were highlighted for Croatia (-13 percent), Türkiye (-9.5 percent), Greece (-8.2 percent) and Spain (-9.5 percent). Finally, it took note of the large gaps in information from Libya and the Syrian Arab Republic, and some gaps in data from Israel, Lebanon and Montenegro.

5. The Committee detected that some of the changes observed, particularly in fleet capacity, were probably due to a combination of different data sources (namely the Data Collection Reference Framework [DCRF], FAO Statlant questionnaire and the SAC national reports) used along the time series. Italy attributed its unexpected increase of 16 percent in fleet capacity to the shift from using DCRF data in 2021 to SAC national report data in 2022, while Tunisia reminded the Committee that since it had placed a freeze on the issuance of new fishing licenses for the past ten years, its apparent vessel increase must also be due to reporting discrepancies (e.g. non-active vessels included in national reports). Additionally, with a view to facilitating the analysis of data submitted by Türkiye, the Committee proposed distinguishing between Mediterranean and Black Sea fishing activities in the DCRF "Task I – Global figures of national fisheries."

6. Despite the progress made, the Committee stressed the need to continue reinforcing the overall quality of fisheries information transmitted to the GFCM, including through dedicated technical assistance provided by MedSea4Fish. It also recommended working towards consolidating a systematic data validation system prior to relevant working group meetings or SAC sessions, as well as ensuring continuous communication between countries and the GFCM Secretariat in order to identify and correct issues and thus provide the best quality data in support of advice.

7. Recognizing the importance of monitoring fleet capacity and its evolution at the national and subregional levels, the Committee agreed on the importance of tracking changes and trends in the capacity of each CPC fleet. It also agreed that the GFCM Secretariat, taking into consideration differences in data requirements between DCRF Task IV.1-IV.2 (fleet register vessels) and the other DCRF fleet-related tasks (operating vessels), should address the identified shortcomings in fleet data reporting in order to improve the quality of the GFCM fleet register and other GFCM vessels lists.

8. The Committee 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, while 60 stocks were considered to be outside of safe biological limits, including European eel (*Anguilla anguilla*), which was assessed by the joint European Inland Fisheries and Aquaculture Advisory Commission/International Council for the Exploration of the Sea/GFCM Working Group on European eel (EIFAAC/ICES/GFCM WGEEL) and whose status remained critical. 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 (Appendix 4).

9. Praising the high assessment coverage for priority species, including several new assessments and many updated assessments in 2022, the Committee nevertheless stressed the need for additional efforts towards increasing the provision of quantitative advice. In this regard, the Committee underlined the crucial role of data quality, recognizing the benchmark process as an important tool to review and evaluate input data and, when needed, identify strategies for improving data collection with the support of MedSea4Fish. Round sardinella (*Sardinella aurita*) in the eastern Mediterranean offered a notable model to follow, as improved data collection and the application of data-limited assessment models, coupled with capacity building, had paved the way for future quantitative advice.

10. Notwithstanding improvements in the status of resources, the Committee noted with concern that the regional situation was still far from achieving the sustainability targets set by many recommendations and the GFCM 2030 Strategy, and stressed the need to speed up the implementation of efficient management measures addressing a larger number of fisheries and species. The Committee 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 stock status trends. In this respect, the Committee agreed on the need to increase scientific surveys-at-sea to better understand the relationships between the standing stock at sea and environmental factors as well as population trends. To this end, the Committee endorsed the establishment of a structured and tailored framework for management strategy evaluation that includes climate aspects, training and the compilation of relevant data and information for the construction of timelines that couple catch time series with important events relevant to the fishery or stock, as well as the application of an ecosystem approach to fisheries.

11. In line with discussions held at the subregional committees (SRCs), the Committee acknowledged the need to strengthen the submission of complete datasets to evaluate the effectiveness of implemented management measures/plans and to ensure the provision of timely detailed information on stock status as well as the need to publish all outputs of the working groups on stock assessment (WGSAs) (SAFs and STAR files in particular) prior to the SRCs.

12. The Committee recognized that once again, despite improvements, European hake (*Merluccius merluccius*) remained the priority species with overall higher overexploitation ratios ($F_{current}/F_{reference}$ between 1.24 and 11.53) in the Mediterranean. The Committee strongly suggested urgently planning for the recovery of European hake stocks at the regional level through a combination of measures (for example, effort reduction, spatial management, minimum conservation reference sizes and improved selectivity) that take into account the long life history of the species, the diversity and multispecies nature of the fleets catching European hake, and its different population components (juveniles and spawners).

13. The Committee highlighted the importance of obtaining better information and technical advice on the status of vulnerable species and related potential impacts of fisheries. In response to the provisions of GFCM recommendations adopted in 2021 on the mitigation of fisheries impacts for the conservation of vulnerable species in the Mediterranean, the Committee agreed to focus efforts on reinforcing data collection and mitigation within hotspot areas according to vulnerable species groups. Recalling the requests of GFCM Recommendations GFCM/44/2021/13 on the mitigation of fisheries impacts for the conservation of seabirds in the Mediterranean Sea, GFCM/44/2021/14 on the mitigation of fisheries impacts for the conservation of sea turtles, GFCM/44/2021/15 on the mitigation of fisheries impacts for the conservation of cetaceans and GFCM/44/2021/16 on additional mitigation measures for the conservation of elasmobranchs in the Mediterranean Sea and capitalizing on the preliminary findings of ongoing monitoring programmes in the region, such as the MedBycatch and depredation projects, the Committee underlined the need to implement pilot projects at the local level and test ad hoc technical mitigation measures.

Management of European eel

14. The Committee acknowledged the alarming status of European eel in the Mediterranean and across its entire distribution range, which remained critical and had reached its lowest critical recruitment levels ever recorded despite the transitional measures set out in Recommendation GFCM/42/2018/1 on a multiannual management plan for European eel in the Mediterranean Sea.

15. The Committee expressed deep satisfaction with the finalization of the research programme, which proposed clear scientific advice to prevent the species from going beyond a point of non-return, based on an impressive amount of information collected.

16. In line with the results obtained, the Committee highlighted the need to address all sources of anthropogenically induced mortality. First and foremost, immediate actions to advance management measures (with a priority on Mediterranean lagoons) for the improvement/maintenance of both habitats and migratory routes were advised. In terms of fisheries-related measures, the Committee welcomed the work performed by the research programme and took note of the two alternative management avenues proposed by the research programme to be applied across the entire distribution area of the species: i) a three-year pilot phase of zero-catches; or ii) a three-year closure of the silver eel fishery accompanied by a total ban for recreational fisheries and glass eel fisheries of three years; both of which would be followed by a recruitment assessment over one season.

17. However, acknowledging the importance of these traditional fisheries for fishers' livelihoods, and the potential socioeconomic impacts of implementing the proposed measures and recalling Recommendation GFCM/42/2018/1, the Committee proposed immediately strengthening the existing transitional measures in 2023 while continuing to work towards informing future long-term management measures for 2024. The Committee suggested aligning the current three-month closures with the effective migration periods of silver eel at the country level, based on the results of the research programme, as well as considering a total ban of glass eel fisheries and of recreational fisheries for all life stages.

18. In addition, the Committee agreed on a second phase of the research programme extending through 2023 that would inform discussions on long-term management measures, with the aim of: i) conducting a socioeconomic analysis of the proposed closures; ii) implementing standardized fishery-independent monitoring of all eel life stages coupled with long-term monitoring efforts for fishery-dependent data, involving fishers; iii) conducting stakeholder awareness activities; iv) working on modalities for compensation schemes for fishers; and v) conducting pilot studies in key sites (terms of reference in Appendix 14). The Committee endorsed the creation of a permanent GFCM Expert Group on European eel in the Mediterranean to consolidate the network of experts, ensure Mediterranean-wide coordination and provide mutual assistance in addressing stock-wide issues (Appendix 14).

19. With a view to consolidating the provision of information for management, including data collection on fishing effort, the Committee agreed on the need to revise DCRF TASK VII.6-EEL according to the proposal made by the research programme (roadmap in Appendix 14).

Management of red coral

20. The Committee discussed the status of red coral (*Corallium rubrum*) in the Mediterranean, noting that based on the precautionary principle and decreasing trends in the average diameter of harvested colonies, its population could be in a situation of overexploitation with some signs of deterioration in two of the main producers. The Committee noted the importance of improving the quality and completeness of data sent by CPCs, especially regarding the average diameter of harvested colonies and the percentage of undersized colonies – two parameters that are crucial for the assessment of the status of the stock – and recalled that the submission of those variables was compulsory. In this regard, it further urged the Commission to clarify any ambiguity in the wording of relevant recommendations so to ensure that countries systematically submit their red coral data inclusive of these variables.

21. The Committee advised carrying out an assessment of the current levels of illegal, unreported and unregulated (IUU) fishing in harvested and non-harvested areas through a collaboration between the Compliance Committee (CoC) Working Group on IUU fishing and the Working Group on Red Coral. The Committee also advised extending the deadline to 2024 (currently 2023) for the entry into force of a permanent catch documentation scheme in order give CPCs more time to test different measures and report the outcomes of their work. The Committee stressed the need to collect information on traceability mechanisms in effect at the CPC level, as well as on infractions and sanctions applied to

illegal red coral fishing activities, and to transmit them to the GFCM Secretariat in line with GFCM rules of confidentiality.

22. The Committee advised extending the research programme to 2023, including the use of remotely operated vehicles (ROVs) for scientific purposes, and suggested further addressing issues related to possible climate change effects on red coral growth and studying the feasibility of restoration options. The Committee took note of Algeria's request to extend the ROV survey to cover the whole Algerian coast in order to obtain better information in support of a potential future reopening of the fishery.

Management of western Mediterranean fisheries

23. The Committee reviewed the status of pelagic stocks in the western Mediterranean, noting that the common dolphinfish (*Coryphaena hippurus*) stock was considered, on a qualitative basis, to be sustainably exploited with an increasing trend in biomass over the last five years; that anchovy (*Engraulis encrasicolus*) in geographical subarea (GSA) 1 was considered sustainably exploited; and that the stocks of sardine (*Sardina pilchardus*) in GSAs 1, 3 and 4 were considered in overexploitation. The Committee also acknowledged the worrying status of most demersal resources in this subregion, noting the extremely high overexploitation rates of blackspot seabream (*Pagellus bogaraveo*), assessed in the Strait of Gibraltar (GSAs 1 and 3), and European hake. It suggested developing new measures for the recovery of hake, strengthening the existing management measures addressing blackspot seabream and implementing new measures for other priority species.

24. Recognizing that common dolphinfish was a species of relevance for both the western and central Mediterranean, the Committee highlighted the importance of ensuring compliance with existing measures while implementing the existing inspection scheme against IUU fishing and agreed to continue working on the research programme towards assessing the impacts of fish aggregating devices (FADs). In order to improve stock assessment, identified data gaps should be filled, in particular the entire series of effort data from Tunisia and Italy for the missing years. The Committee recalled that data should be provided on a monthly basis.

25. Considering the worrying status of blackspot seabream, the Committee suggested establishing a long-term management plan over eight years, starting with a three-year transitional phase where current measures should be maintained and strengthened while gathering scientific evidence towards the identification of long-term adaptive management measures. In line with the technical elements, the Committee agreed that work should continue through collaborative research towards better defining spatial and temporal closures to protect spawners and juveniles as well as improving ageing and biomass indices and following up on technical discussions on minimum conservation reference size and potential limitations to fishing effort, gear characteristics and catches (Appendix 5).

26. In light of the importance and current status of small pelagic stocks and fisheries in the subregion and the need to take action towards their improvement, the Committee underlined the need to strengthen biological sampling coverage and data collection in GSA 4 and to progress on the finalization of benchmarks for sardine in GSAs 1 and 4. The Committee also highlighted the importance of implementing appropriate national management measures while advancing towards the identification of region-wide management measures and a potential future management plan.

27. To enhance the advice for priority species and key shared stocks and fisheries, the Committee advised creating networks of experts from all countries involved and beyond, following the successful model of the expert network for the provision of advice on blackspot seabream. These networks should count on the support of dedicated actions launched by the subregional technical unit within the framework of MedSea4Fish.

28. The Committee welcomed the work done on the Cabliers Coral Mound Province fisheries restricted area (FRA) proposal and agreed on its technical soundness (Appendix 12). It also

acknowledged the importance of obtaining recent data in the region and proposed implementing a collaborative deep-water survey with the participation of scientists from the three concerned countries, for which preparatory discussions were ongoing. The Committee took note of Algeria's remark on involving all interested parties in the process of FRA implementation, including in data collection, exchanges of expertise and knowledge, and the involvement of the fishing sector. The Committee also noted the proposal of the European Union to first implement spatial measures in the core area in GSA 3 and to involve experts from Algeria in defining the appropriate management measures in Algerian waters in GSA 4.

Management of central Mediterranean fisheries

29. The Committee reviewed the status of stocks, in particular demersal stocks, in the central Mediterranean, noting that, despite some improvements, European hake in the Strait of Sicily was still considered overexploited ($B/B_{target} = 0.7$) and in overexploitation ($F/F_{ref} = 1.24$) and that the stock of deep-water rose shrimp (*Parapenaeus longirostris*) was still considered to be in overexploitation ($F/F_{ref} = 1.34$) with relatively low biomass.

30. Considering the status of demersal stocks in the subregion, the Committee endorsed updated technical elements towards the implementation of a long-term management plan for European hake, deep-water rose shrimp, red mullet (*Mullus barbatus*) and Norway lobster (*Nephrops norvegicus*) fisheries. The management plan would be designed in a stepwise manner over eight years, starting with a transitional period of two to three years in which a limited set of measures would be implemented while scientific evidence was gathered towards the identification of long-term adaptive management measures. Based on these technical elements, the Committee agreed that work should focus on efficient management measures, including determining an effort regime and identifying additional nursery areas and spatiotemporal restrictions to protect juveniles, as well as on technical measures to improve gear selectivity with the aim of optimizing deep-water rose shrimp yield while minimizing the impacts on European hake, also keeping in consideration the important issue of decarbonization of the fleet (Appendix 5).

31. Acknowledging the existence of fisheries targeting elasmobranchs in the central Mediterranean and recognizing that many sharks and rays had been and were currently impacted as incidental catch in a variety of fishing activities, the Committee agreed on the need to investigate the possible existence of shark nursery areas in the subregion. Activities should concentrate on the bluntnose sixgill shark (*Hexanchus griseus*) and the great white shark (*Carcharodon carcharias*), but also on other vulnerable shark and ray species in order to promote adequate management measures, in line with Recommendation GFCM/44/2021/16.

32. The Committee reviewed the updated proposal from Libya to divide the Libyan coast (GSA 21) into three marine subareas (i.e. GSA 21.1, GSA 21.2 and GSA 21.3), which included available data on fisheries and ecosystems, including a description of the variations in topography, ecosystems and fishing gears used, recalling that the Commission had requested potential comments from the SAC before re-discussing the proposal at its forty-fifth session. The Committee also noted the analysis of the potential implications of a new subdivision for data submission requirements and existing decisions (for example, requirements to report some information at the level of the new subareas or to amend some decisions to reflect the existence of new subareas). The Committee, especially the neighbouring countries, welcomed the proposal by Libya while taking note of the concern raised by Italy regarding these implications as well as its request for additional information on other potential impacts on existing management measures.

Management of central-eastern Mediterranean fisheries

33. The Committee acknowledged the status of deep-water red shrimp fisheries in the Strait of Sicily and the Ionian Sea, noting that the additional work performed on assessing the stock status of giant red shrimp (*Aristaeomorpha foliacea*) and blue and red shrimp (*Aristeus antennatus*) revealed that

the stocks were overexploited and/or in overexploitation. The Committee stressed the need to consolidate quantitative assessments by the end of the 2022–2023 intersession, including through the collection of additional information, notably on the origin of catches and from surveys-at-sea, as well as the need to consider the most appropriate stock units.

34. Considering the management opportunities that well-defined fishing grounds would provide for these fisheries and the potential effectiveness of some mitigation measures in establishing more selective fisheries, the Committee highlighted the importance of finalizing work towards determining fishing grounds and emphasized the need to investigate the use of novel technical measures, such as grids, to minimize the bycatch of vulnerable megafauna (notably sharks and rays) while maintaining the catch of target species.

35. The Committee endorsed the technical elements for deep-water red shrimp fisheries in the Strait of Sicily and the Ionian and Levant Seas (Appendix 5), including the possibility of a long-term multiannual management plan designed in a stepwise manner over eight years, starting with a three-year transitional period in which a restricted set of measures would be implemented while scientific evidence was gathered towards the identification of long-term adaptive management measures – including catch limits, minimum conservation reference sizes, spatial or spatiotemporal measures to protect juveniles and/or spawners and technical measures on selectivity.

Management of eastern Mediterranean fisheries

36. The Committee praised the work done towards the assessment and management of round sardinella in the eastern Mediterranean over the past five years, which had progressed from providing little and fragmented information to qualitative (precautionary) advice for two of the assessed sardinella stocks: in GSA 24 (in overexploitation with biomass within the target levels) and in GSAs 26 and 27 (Palestine) (overexploited and in overexploitation). The Committee also acknowledged the toolbox of management measures compiled by the Subregional Committee for the Eastern Mediterranean (SRC-EM). Nevertheless, considering the pending finalization of the benchmark assessment and the need for capacity building in data-limited management strategy evaluation, the Committee agreed to advance towards proposing elements for a future management plan in 2023 (roadmap in Appendix 14).

37. Acknowledging the growing prevalence of non-indigenous species (NIS) in the Mediterranean and the fact that the eastern Mediterranean was considered a NIS hotspot, the Committee proposed to develop and launch a pilot study in the subregion to consolidate an integrated monitoring platform for NIS, based on the elements in Appendix 10. Recognizing the importance given to NIS at the regional level in the GFCM 2030 strategy, and noting previous, ongoing and upcoming activities related to NIS (such as data collection through surveys-at-sea and the research programme on blue crabs [*Callinectes sapidus* and *Portunus segnis*]), the Committee proposed to investigate whether this pilot study could be considered a model to be exported to other subregions once the methodology is consolidated, building on the results obtained.

38. Considering the wealth of information and experience on NIS in many Mediterranean countries and the availability of Türkiye to host a NIS observatoire, the Committee considered the moment a great opportunity to create a Mediterranean-wide forum fostering regional discussions on best practices for the management of NIS.

Management of Adriatic Sea fisheries

39. The Committee noted the updated assessments on the status of European anchovy (biomass above reference points and in overexploitation) and sardine (overexploited and in overexploitation on a precautionary basis) based on year n-1 data, remarking the importance of advancing towards the finalization of the sardine benchmark assessment once pending issues are solved. The Committee underlined the crucial importance of providing data in a timely manner in April of each year to allow sufficient time to perform assessments based on year n-1 data by May; in this respect, a dedicated

session of the Working Group on Stock Assessment of Small Pelagic Species (WGSASP) involving experts from within and outside the subregion should be foreseen.

40. In view of the establishment of future yearly catch limits by single species, based on the best available scientific advice, the Committee endorsed a roadmap towards a quantitative management strategy evaluation (MSE) for small pelagic fisheries in the Adriatic Sea (Appendix 14) that would take into consideration socioeconomic factors. The roadmap foresees the organization of a technical meeting of the Working Group on the Assessment of Alternative Management Measures (WGMSE) after the finalization of the benchmark assessment for sardine, followed by stakeholder consultations aimed at providing advice to the SAC in 2023.

41. The Committee noted advances made towards the efficient management of Adriatic Sea demersal priority species – European hake, deep-water rose shrimp, common cuttlefish (*Sepia officinalis*) and common sole (*Solea solea*) – following the implementation of Recommendation GFCM/43/2019/5 on a multiannual management plan for sustainable demersal fisheries in the Adriatic Sea (geographical subareas 17 and 18). It acknowledged the improvements in fishing mortality and biomass of these species but nevertheless noted that fishing mortality levels were still far from those expected to achieve maximum sustainable yield (MSY). The Committee underlined the importance of providing quantitative advice for all key stocks, including the finalization of the benchmark assessment for red mullet (roadmap in Appendix 14) and an assessment of Norway lobster.

42. Recalling the Jabuka/Pomo pit FRA success story, which had resulted in improved biomass levels for priority species, the Committee stressed the importance of continuing to apply all measures foreseen within the management plan for demersal species to ensure an adequate reduction of fishing mortality for all key stocks, taking into account the specificities of countries such as Albania and Montenegro. With a view to enhancing the effectiveness of management measures, the Committee endorsed a tentative roadmap towards a quantitative MSE for demersal fisheries in the Adriatic Sea (Appendix 14).

43. Given the overexploitation status of the Adriatic stock of European hake, and taking into account a perceived increase of large hake in catches, the Committee agreed on the need to advance, in the context of the Working Group on Stock Assessment of Demersal Species (WGSAD), on evaluating the impacts of bottom longlines targeting spawners, towards incorporating these fleets into the current multiannual management plan, if deemed necessary. For example, specific spatial measures could be adopted to protect the spawning component of the European hake stock.

44. Considering the status of blue and red shrimp and giant red shrimp in GSAs 18 and 19 (in overexploitation, and in overexploitation with relative intermediate biomass, respectively), the Committee agreed on the importance of implementing management measures for these two species in GSA 18. Noting that deep-water red shrimp populations in GSA 18 were considered an extension of those in GSA 19, the Committee proposed two alternative options: i) including GSA 18 within the management plan for the Ionian Sea (GSAs 19, 20 and 21); or ii) envisioning ad hoc measures for GSA 18 only. The Committee recalled that further information on relevant ecosystem dynamics in these areas is expected after the launch of the planned pilot study on vulnerable bamboo coral (*Isidella elongata*) in the Adriatic.

45. The Committee recalled the importance of *Isidella elongata* at the regional level and the need to protect it from fishing activities. With a view to fulfilling the requirements of Resolution GFCM/44/2021/3 on a roadmap for the establishment of a fisheries restricted area in the southern Adriatic Sea (geographical subarea 18) and following consultations with relevant administrations, the Committee endorsed elements towards establishing a pilot study on the biology, ecology and distribution of *Isidella elongata* in the southern Adriatic, including insights into the overlap between *Isidella elongata* vulnerable marine ecosystems (VMEs) and the bottom trawl fishing footprint and an ad hoc socioeconomic study of the fleets operating in the area (Appendix 11), which would provide the basis for the future definition of new FRAs.

Additional advice at the regional level, including on the interactions between fisheries and marine ecosystems and environment

46. Underlining the importance of ensuring that exploited species have the opportunity to reproduce at least once in their life history and minimizing the bycatch of juveniles, the Committee agreed on the need to determine, adopt, implement and enforce a minimum conservation reference size (MCRS) for GFCM priority species. In accordance with Resolution GFCM/44/2021/2 on the definition of a minimum conservation reference size for priority stocks in the Mediterranean Sea, the Committee agreed to start working on the determination and/or revision of MCRS at the subregional level, considering different types of gear. The analysis should be based, *inter alia*, on information regarding the length at first maturity by sex (25 percent, 50 percent and 75 percent) coupled with the length at first capture and adapting gear selectivity to the MCRS. The Committee insisted on the possibility of revising in particular the current MCRS for European hake considering that the size at first maturity of males and females was generally larger than the current 20 cm total length enforced as MCRS in several GFCM decisions and regional management measures. The Committee suggested experts be contacted at the country level to begin the work starting from the provision of information on juveniles in all countries and a review of the scientific literature on the effects of climate change on growth and maturity, with the aim of discussing the first proposals at the WGSAs in 2023; it further underlined that MedSea4Fish could provide any technical assistance required.

47. Acknowledging that the GFCM database on sensitive benthic habitats and species provided a primary source of data for the formulation of objective and standardized advice on priority areas for spatial management, the Committee emphasized the need to keep feeding it with additional data, including from existing and new surveys-at-sea. In this context, the Committee endorsed a roadmap towards its future use and development (Appendix 14), which includes a data call in January every year and the development of an auditable and transparent framework for providing advice and performing quality checks.

48. In relation to VMEs, the Committee agreed to perform a complete analysis of the spatial distribution of bottom trawl fishing effort to understand the spatial dynamics of specific fisheries and effectively inform spatial management while taking into account all available sources of information (for example, VMS [vessel monitoring system], AIS [automatic identification system] and satellite data). The first step of the analysis would comprise the implementation of an updated roadmap guiding the work of analysing the overlap between VMEs and the deep-water red shrimp fishery in the central-eastern Mediterranean (Appendix 14). The Committee underlined that this roadmap would provide information on fishing activities below 600 m, which would in turn facilitate an initial assessment of the potential impacts of changing the depth limits of the GFCM 1000 m FRA. This assessment should be compared with the potential impacts of an alternative adaptive approach that identifies selective closures based on the historical fishing footprint of the bottom trawl fishery and the distribution of VMEs, taking into account subregional differences in fisheries and involving stakeholders.

49. The Committee praised the work done to address the issue of other effective area-based conservation measures in relation to fisheries in the Mediterranean. Taking into account the interest expressed by CPCs and their need to discuss internally, the Committee agreed that the GFCM should provide support to CPCs on an ad hoc basis, while further activities would be contingent on the outcomes of future discussions among CPCs, including within the GFCM annual session.

50. The Committee agreed on the need to implement FRAs in connection with other management measures (e.g. effort limits, catch limits and selectivity measures) and, when possible, within the context of multiannual management plans. The Committee also stressed the importance of ensuring and assessing the effectiveness of FRAs and endorsed minimal standards for the monitoring of FRAs (Appendix 13), which include both guidelines for the development of scientific monitoring plans and a toolkit for monitoring, control and surveillance.

ISSUES RELATED TO THE PROVISION OF ADVICE

Recreational fisheries

51. Recognizing the socioeconomic relevance of the recreational fisheries sector and its potential impact on several priority species, the Committee stressed the need to continue monitoring this activity. The Committee reviewed the proposal for a recommendation on recreational fisheries, which remained pending at the forty-fourth session of the GFCM and endorsed a revised list of species of importance for recreational fisheries (Appendix 7) that takes into account national and subregional specificities and is based on the criteria endorsed by the SAC at its twenty-second session (online, June 2021), i.e. dealing with priority species for DCRF, commercial species, NIS, species of social interest, species of conservation concern, etc. The Committee highlighted that this list should be flexible and adaptive to potentially include other species according to changes in fishing activities and behaviours and should guide the collection and analysis of data to support the provision of advice on the management of this sector. In light of the overexploitation status of many priority commercial species, the Committee underlined the need to identify solutions to mitigate the pressure of recreational fishing on these species.

52. The Committee expressed support for a dedicated research programme on recreational fisheries and endorsed related key elements (Appendix 9), including the identification of the target population of recreational fisheries, the collection of data on catches, fishing effort and expenditures, the storage of the data in a dedicated database, and an assessment of the impacts of recreational fisheries.

Small-scale fisheries

53. Acknowledging the diversity of national scenarios and the overall socioeconomic importance of the small-scale fisheries (SSF) sector, the Committee agreed that a common framework was needed to support the analysis of the status of marine resources targeted by SSF and of the partial impacts of small-scale fisheries on select species at the subregional and regional levels. To this end, it endorsed a proposed list of species (Appendix 6) that would serve as a basis for the collection and analysis of SSF data and support the provision of advice on the management of these fisheries. This list could be updated according to subregional specificities. Given the importance of the sector in the region, the Committee advised starting to assess the status of the main species targeted by SSF based on this list.

54. Recognizing the need to strengthen the resilience of the SSF sector, the Committee noted the importance of further enhancing the implementation of the Regional Plan of Action for small-scale fisheries in the Mediterranean and the Black Sea (RPOA-SSF), prioritizing actions on participatory mechanisms, value chains, technology and innovation, interactions with vulnerable species, data collection and monitoring and control, following a gender-sensitive approach and engaging youth. To this end, the Committee agreed on the need to monitor the implementation of the RPOA-SSF at different levels, including at the national level, and take into account inputs from relevant stakeholders, on the basis of the monitoring framework as agreed by the SRCs.

Monitoring programmes and data analysis

55. Recognizing the significant efforts deployed and the results obtained within the frameworks of several monitoring programmes conducted in the region – on discards, incidental catch of vulnerable species, depredation and the implementation of scientific surveys-at-sea – the Committee agreed on the need to advance on analysing the data collected therein in order to provide advice on a number of topics (e.g. stock assessment, identification of hotspots of vulnerable species and VMEs, identification of areas of high concentration of marine litter, etc.) and on the identification, testing and implementation of efficient mitigation measures, when relevant and then presenting the results to the relevant working groups. To this end, the Committee proposed establishing a working group to coordinate the analysis of data and information collected in the context of relevant monitoring programmes, as per the terms of reference included in Appendix 14. Progress in the application of technical selectivity measures to mitigate discards (for example, to reduce captures of juveniles in commercial fisheries), incidental catch

of vulnerable species and depredation would be addressed by the existing Working Group on Fishing Technology (WGFiT).

Selectivity of bottom-trawl fisheries

56. The Committee reviewed and endorsed the proposal, prepared in collaboration with the World Wildlife Fund (WWF), for a large-scale multiannual pilot study on trawl selectivity in the Strait of Sicily (Appendix 8). The project, building on previous experiences and similar studies, should test different selectivity measures (such as the use of a 90º turned mesh panel on the trawl net codend and of selective grids in the standard net extension) and compare them with commercial fishing gear (such as the 40 mm square mesh size) in order to assess their effectiveness in reducing the impacts of trawling on hake and deep-water rose shrimp juveniles. The Committee stressed the need to assess the immediate biological impacts of the tested selectivity measures on fish stocks and to understand the viability of the tested measures in the short, medium and long term and recommended engaging stakeholders throughout all implementation phases.

FAO (SOFIA) estimates of the status of stocks in the Mediterranean and the Black Sea

57. Regarding the ongoing FAO methodological update to reporting on the state of world fish stocks within the State of World Fisheries and Aquaculture (SOFIA) and the outcomes of a dedicated meeting to test the methodology in the Mediterranean and the Black Sea, the Committee expressed its interest, but highlighted the need for further explanation of the proposed methods. In this respect, the Committee suggested that a detailed concept note be presented to CPCs, also suggesting that technical aspects could be discussed within the WGSAs, in advance of further discussions at the next session of the SAC.

WORKPLAN FOR 2022–2024

Regional issues

<u>Stock assessment and strengthened advice</u>

- Compile relevant information and consolidate networks of experts, including external experts, on the assessment of priority species towards increasing the coverage of assessment and increasing the number of stocks with quantitative advice (fishing mortality and/or biomass) with respect to reference points, towards effectively supporting management.

- Finalize the benchmark assessments of sardine in GSAs 17–18, red mullet in GSAs 17–18 and round sardinella in GSAs 24–27, launch a benchmark for deep-water rose shrimp in the Adriatic Sea and central Mediterranean (GSAs 12–16, 17, 18, 19 and 20) and organize relevant data preparation.

- Continue supporting the regular collection of socioeconomic data, including for the small-scale segment, and support plans to address socioeconomic needs as well as the integration of socioeconomic data into management discussions.

- Conduct training activities to strengthen capacity at the subregional level on new stock assessment models and management strategy evaluation, including on the use of socioeconomic models and data-limited methods across a number of assessment models, as well as on model diagnostics and model selection and the standardization and estimation of surveys-at-sea information.

- Develop a methodology for the determination and/or revision of MCRS for GFCM priority species at the subregional level and by fishing gear in order to preserve the stocks of priority species.

Data collection and quality indicators

- Continue working on the implementation of quality indicators for all fisheries data transmitted through the DCRF online platform (including data that have been recently included in the platform in line with the DCRF harmonization process) and ensure the implementation of streamlined quality summary outputs as arising from the DCRF technical consultation.

- Keep the DCRF manual up-to-date and complete the release of data transmission tools on the DCRF online platform for those reporting requirements that have been harmonized with the DCRF but are not yet included on the platform.

- Implement, in advance of expert groups and SAC sessions, a validation system for the data received in order to better support the formulation of advice, while ensuring constant coordination with national focal points.

- Conduct a pilot study aimed at tracking changes and trends in the capacity of each CPC fleet.

Small-scale fisheries, including priority actions for the implementation of the RPOA-SSF

- Enhance the scientific monitoring of SSF activities, particularly the compilation of information for the assessment of agreed priority species by subregion, in addition to carrying out, by 2023, the second phase of socioeconomic surveys, including those along the SSF value chain.

- Implement the activities planned within the framework of the SSF Forum, paying close attention to the priorities highlighted in the RPOA-SSF, in particular gender, participatory processes, vulnerable species and youth engagement.

- Advance on the implementation of activities within the RPOA-SSF and launch a methodology to assess the implementation of the RPOA-SSF at the national level, in view of an in-depth update of the monitoring process by the new (Working Group on Small-Scale Fisheries) WGSSF.

Recreational fisheries

- Progress in the ongoing pilot studies on recreational fisheries data collection and provide technical assistance to additional countries interested in setting up recreational fisheries data collection.

- Improve data collection and promote awareness campaigns on the incidental catch of vulnerable species (i.e. sharks and rays, sea turtles, seabirds) in recreational fisheries.

- Strengthen the Working Group for Recreational Fisheries (WGRF) network of recreational fishing associations, federations and other stakeholder groups with a view to facilitating their engagement in the work of the WGRF and supporting bottom-up initiatives.

- Assess the impacts of recreational fisheries on the sector’s priority species.

European eel

- Revise the DCRF Task VII.6-Eel based on the proposal of the research programme.

- Implement a second phase of the research programme concentrating on socioeconomic analyses, the development of long-term standardized monitoring and stakeholder awareness, as well as pilot studies in key sites.

- Coordinate with other organizations such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on the Conservation of Migratory Species and Wild Animals (CMS), EIFAAC, ICES and the United Nations Environment Programme/Mediterranean Action Plan (UNEP/MAP).

- Perform an assessment of the effectiveness of the management measures in Recommendation GFCM/42/2018/1, as well as of suitable catch limits or effort measures, minimum sizes, appropriate technical measures (e.g. mesh and hook sizes) and other possible measures resulting in selectivity improvements.

Red coral

- Continue implementing the research programme on red coral, incorporating Egypt.

Blue crabs

- Continue implementing the research programme on blue crabs, incorporating Italy.

Spatial management

- Foresee and implement scientific monitoring plans to assess the effectiveness of all FRAs, including their socioeconomic effects, according to the proposed scientific monitoring minimal standards; particular reference is made to assessing the effectiveness and possible expansion of the FRAs in the Strait of Sicily in protecting spawners of key species.

- Execute the roadmap towards the future use and development of the GFCM database on sensitive benthic habitats and species and organize training activities on its use.

- Work towards a complete analysis of the spatial distribution of bottom trawl fishing effort, starting with the implementation of the updated roadmap to analyse the overlap between VMEs and the deep-water red shrimp fishery in the central-eastern Mediterranean.

- Launch an activity to compile information on fishing activity between 600 m and 1000 m towards a potential rediscussion of the 1000 m FRA.

- Continue working towards the identification and proposal of priority essential fish habitat (EFH) and/or areas hosting VMEs for which spatial and/or temporal measures could be implemented.

Monitoring programmes

- Continue supporting key regional activities including:

    - the implementation of scientific surveys-at-sea (both demersal and pelagic-acoustic), socioeconomic surveys, and discard monitoring activities, using harmonized methodologies and aiming for best possible coverage;

    - the implementation of incidental catch of vulnerable species and depredation monitoring programmes, in line with relevant existing and upcoming methodologies for data collection, continuing the previous work carried out within the MedBycatch and depredation projects and in cooperation with relevant partners in the region, expanding the areas to be covered;

    - mapping areas with a high risk of incidental catch for vulnerable species;

- establishing pilot projects addressing the priority groups of species highlighted in recently adopted recommendations as well as those emanating from the results of ongoing research projects such as MedBycatch;

- testing the efficacy of selective devices and mitigation measures that could improve the selectivity of fishing gear, reducing discards, mitigating incidental catch of vulnerable species and depredation, as well as other impacts on vulnerable marine ecosystems and commercial shark species;

- working towards the identification of alternatives for the decarbonization of the fishing industry;

- the implementation of further DNA metabarcoding trials in data collection and analysis, taking advantage of different monitoring programmes (e.g. scientific surveys-at-sea and discards);

- the implementation of the GFCM pilot project on marine litter using an experimental gear expanding the trials in other areas;

- exploring opportunities to provide technical assistance to countries that have not, to date, advanced on improving selectivity in their national fisheries; and

- monitoring NIS across the Mediterranean, including through the establishment of the Observatoire.

Advances towards an adaptation strategy for climate change

- Continue the work towards technical advice on the impacts of climate change on fisheries and potential mitigation actions, incorporating climate-related variables in the assessment of the status of resources, when relevant.

Subregional issues

Western Mediterranean

- In the context of blackspot seabream fisheries:

    - Continue biological sampling in both Morocco and European Union-Spain.

    - Organize technical workshops to: i) standardize catch per unit efforts and assess the use of a unique combined index; ii) harmonize otolith readings through an otolith exchange to obtain agreed age-length keys; and iii) test current and alternative assessment models.

    - Explore the possibility of an experimental scientific survey-at-sea.

    - Provide technical information for the adoption of additional management measures and work towards filling current gaps in scientific knowledge, according to the updated technical elements.

    - Provide technical assistance to Algeria with regard to collecting relevant information in GSA 4.

- In the context of dolphinfish fisheries:
    - Continue implementing the research programme on common dolphinfish, including organizing workshops for: i) coordinating pilot field studies; ii) analysing and preparing the data for stock assessment; and iii) training on stock assessment and management strategy evaluation methods (Appendix 14).
- In the context of small pelagic fisheries:
    - Continue improving the quality of advice, including through the improvement of data collection, the integration of survey data and the use of statistical catch at age methods.
    - Organize an expert meeting to provide guidance on possible harmonization of management measures already in place and discuss other management measures aimed at preserving small pelagics in the Alboran Sea (Appendix 14).
- Implement pilot project(s) on gear selectivity to assess the biological impacts of technical selectivity measures on fish stocks and the potential for stock recovery, taking into consideration the characteristics of the fisheries in the subregion and in each country.
- In relation to the Cabliers Coral Mound Province, coordinate interested countries, i.e. Algeria, Morocco, and European Union-Spain and relevant partners, in organizing a deep-water survey coordinated by the GFCM Secretariat with the involvement of external experts to determine appropriate management measures for the area.
- Integrate the final results of the Transboran project into the assessment of priority stocks for the western Mediterranean, including though a session within the WGSAs.

<u>Central Mediterranean</u>

- In the context of European hake, deep-water rose shrimp, red mullet and Norway lobster fisheries:
    - Confirm the persistence of identified nursery grounds in the southern Strait of Sicily, including through additional information and new surveys.
    - Further investigate the contribution of deep-water gillnet and longline fisheries to fishing mortality-at-age of the European hake stock.
    - Provide technical information in support of the adoption of additional management measures and work towards filling current gaps in scientific knowledge according to the updated technical elements.
- Investigate the existence of shark nursery areas in the subregion.
- Implement the pilot study on selectivity in trawl fisheries in the Strait of Sicily.

<u>Central-eastern Mediterranean</u>

- In the context of deep-water red shrimp fisheries:
    - Annually assess the status of deep-water red shrimp stocks towards providing quantitative advice.
    - Finalize the workplan for the determination of fishing grounds using all data available and perform an overlap analysis of the distributions of the two species.

- Provide technical information in support of the adoption of additional management measures and work towards filling current gaps in scientific knowledge according to the updated technical elements.

- Perform an assessment of alternative management scenarios in a data-limited context.

- Implement the roadmap to guide the work needed to analyse the overlap between VMEs and deep-water red shrimp fishing grounds.

- Provide information (e.g. electronic logbooks [ERS], VMS and logbooks) to allow for the estimation of catches by GSA of origin.

- Investigate the usefulness of grids for the minimization of bycatch of vulnerable megafauna.

Eastern Mediterranean

- Review and enhance data collection efforts for priority species in the eastern Mediterranean towards improving input data for stock assessment.

- Draft technical elements for the management of round sardinella in the eastern Mediterranean.

- Organize training on data-limited MSE applicable to round sardinella and/or deep-water red shrimp in the eastern Mediterranean.

- Continue supporting the implementation of an exploratory demersal trawl survey in Lebanon.

- Launch a pilot study on NIS in the eastern Mediterranean, consolidating an integrated monitoring platform for these species (NIS Observatoire) and expanding the preliminary local ecological knowledge study previously carried out.

Adriatic Sea

- Compile relevant information on priority species, in particular for Norway lobster and red mullet in GSAs 17–18, towards fulfilling the requirements of existing recommendations and providing quantitative advice on stock status.

- Launch and implement a pilot study to underpin the biology and ecology of *Isidella elongata* in GSA 18 and implement the roadmap towards the establishment of a southern Adriatic FRA.

- Implement pilot project(s) on fishing gear selectivity to assess the biological impacts of technical selectivity measures on fish stocks and the potential for stock recovery, taking into consideration the characteristics of the fisheries in the subregion and in each country.

- In the context of demersal fisheries:

  - Evaluate the impacts of the longline sector on the stock of European hake, including through the analysis of partial mortality by fleet within the context of the WGSAD.

  - Update and revise the tentative roadmap towards a quantitative MSE for demersal fisheries.

- In the context of small pelagic fisheries:

  - Perform a quantitative MSE for small pelagic fisheries according to the agreed roadmap.

MEETINGS

Meeting	Modality/Place and Dates
Working group on stock assessment for demersal species (WGSAD)	Hybrid - FAO HQ, Rome, Italy November–December 2022
Working group on stock assessment for small pelagic species (WGSASP)	Hybrid - FAO HQ, Rome, Italy November–December 2022
Workshop on data collection and submission, including a session on fishing capacity	TBD January 2023
Meeting on decarbonization of the fishing industry	TBD February 2023
Working Group on the Assessment of Alternative Management Measures (WGMSE)	Hybrid, TBD March 2023
Working group on vulnerable marine ecosystems and essential fish habitats (WGVME-EFH)	Hybrid, TBD March 2023
Subregional Committee for the central Mediterranean (SRC-CM)	Hybrid, TBD April 2023
Subregional Committee for the western Mediterranean (SRC-WM)	Hybrid, TBD April 2023
Subregional Committee for the eastern Mediterranean (SRC-EM)	Hybrid, TBD May 2023
Session of the WGSASP on small pelagics in the Adriatic Sea	Hybrid, TBD May 2023
Subregional Committee for the Adriatic Sea (SRC-AS)	Hybrid, TBD May 2023
Working Group on the analysis of fisheries monitoring data (WGANALYSIS)	Hybrid, TBD June 2023
Twenty-fourth session of the SAC	In person - Lebanon July 2023
Working Group on Fishing Technology (WGFiT)	TBD 2024

58. Draft terms of reference for selected meetings are available in Appendix 14. Meeting modality is indicative and subject to the decision by the Commission. The Committee stressed its desire to return to scheduling meetings in-person as often as possible, while taking into account the advantages of hybrid sessions in reducing the carbon footprint and involving more experts. Not indicated in the above table are data preparation meetings, meetings organized in the context of research programmes, joint projects and/or meetings in relation to field activities.

NEXT SESSION

59. The Committee took note of the renewed invitation kindly made by the delegation of Lebanon to host the twenty-fourth session, if conditions and meeting modalities permit and subject to final confirmation by relevant authorities.

ADOPTION OF THE REPORT

60. The report, including its appendices, was adopted on 24 June 2022.

Appendix 1

Agenda

1. Opening and adoption of the agenda
2. Overview of intersessional activities of relevance to the SAC
3. Endorsement of the MedSea4Fish document
4. Formulation of advice on marine living resources and fisheries management
5. Issues related to the provision of advice
6. Workplan for the Committee for 2022–2024
7. Any other matter
8. Date and place of the next session
9. Adoption of conclusions, recommendations and workplan

Appendix 2

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Appendix 3

List of documents

GFCM:SAC23/2022/1	Provisional agenda and timetable
GFCM:SAC23/2022/2	Executive report of SAC intersessional activities, recommendations and work plan (available in English and French)
GFCM:SAC23/2022/3	Technical elements for the management of key fisheries (available in English only)
GFCM:SAC23/2022/4	Elements towards concept notes for research programmes/pilot projects on priority topics (available in English only)
GFCM:SAC23/2022/5	Draft updated concept note on a pilot study for selectivity of bottom trawl fisheries exploiting demersal stocks in the Strait of Sicily (available in English only)
GFCM:SAC23/2022/6	Draft list of species of interest for small-scale and recreational fisheries (available in English only)
GFCM:SAC23/2022/7	Background document on the Libyan proposal to divide GSA 21 (available in English only)
GFCM:SAC23/2022/8	Proposal for a fisheries restricted area in the Cabliers Coral Mound Province in the Alboran Sea (GSAs 3 and 4) (available in English only)
GFCM:SAC23/2022/9	Minimal standards for the monitoring of fisheries restricted areas (available in English only)
GFCM:SAC23/2022/10	MedSea4Fish: Capacity development for sustainable fisheries management in the Mediterranean – final draft document
GFCM:SAC23/2022/11	Scientific advice stemming from the GFCM research programme on European eel
GFCM:SAC23/2022/Inf.1	List of documents (available in English and French)
GFCM:SAC23/2022/Inf.2	List of participants
GFCM:SAC23/2022/Inf.3	Report of the forty-fourth session of the General Fisheries Commission for the Mediterranean (online, 2–6 November 2021)
GFCM:SAC23/2022/Inf.4	Report of the twenty-second session of the Scientific Advisory Committee on fisheries (online, 22–25 June 2021) (available in English and French)
GFCM:SAC23/2022/Inf.5	National reports to the SAC by contracting parties
GFCM:SAC23/2022/Inf.6	Report of the Subregional Committee for the Adriatic Sea (SRC-AS) (online, 17–20 May 2022)
GFCM:SAC23/2022/Inf.7	Report of the Subregional Committee for the Eastern Mediterranean (SRC-EM) (online, 10–13 May 2022)
GFCM:SAC23/2022/Inf.8	Report of the Subregional Committee for the Western Mediterranean (SRC-WM) (online, 19–22 April 2022)
GFCM:SAC23/2022/Inf.9	Report of the Subregional Committee for the Central Mediterranean (SRC-CM) (online, 11–14 April 2022)

GFCM:SAC23/2022/Inf.10	Report of the CoC-SAC seminar on GFCM Fisheries Restricted Areas (online, 25 March 2022)
GFCM:SAC23/2022/Inf.11	Report of the Working group on vulnerable marine ecosystems and essential fish habitats (WGVME-EFH) (online, 22–24 March 2022)
GFCM:SAC23/2022/Inf.12	Report of the benchmark assessment for sardine and anchovy in GSA 16 (online, 14–18 March 2022)
GFCM:SAC23/2022/Inf.13	Conclusions and recommendations of the benchmark session for the assessment of red mullet in the Adriatic Sea (online, 14–18 March 2022)
GFCM:SAC23/2022/Inf.14	Report of the Working group on small-scale fisheries (WGSSF) (online, 10 March 2022)
GFCM:SAC23/2022/Inf.15	Report of the Working group on recreational fisheries (WGRF) (online, 8–9 March 2022)
GFCM:SAC23/2022/Inf.16	Report of the Working group on red coral (WGREDCORAL) (online, 28 February – 1 March 2022)
GFCM:SAC23/2022/Inf.17	Report of the Working group on the management of European eel (WKMEASURES-EEL) (online, 23–25 February 2022)
GFCM:SAC23/2022/Inf.18	Report of the Working Group on Stock Assessment of Demersal Species (WGSAD) session on the assessment of deep-water red shrimp (online, 8–10 February 2022)
GFCM:SAC23/2022/Inf.19	Report of the Working group on stock assessment of demersal species (WGSAD) (online, 17–29 January 2022)
GFCM:SAC23/2022/Inf.20	Report of the Working group on stock assessment of small pelagic species (WGSASP) (online, 17–22 January 2022)
GFCM:SAC23/2022/Inf.21	Draft report of the research programme on European eel (*Anguilla anguilla*)
GFCM:SAC23/2022/Inf.22	Results of the application of fisheries data quality indicators on the DCRF online platform
GFCM:SAC23/2022/Inf.23	Mitigating dolphin depredation in Mediterranean and Black Sea fisheries: methodology for data collection (final draft)
GFCM:SAC23/2022/Dma.1	Manual of the GFCM Data Collection Reference Framework (DCRF) – 2018, version 22.1 (available in English and French)
GFCM:SAC23/2022/Dma.2	FAO. 2021/2022. *The Regional Plan of Action for small-scale fisheries in the Mediterranean and the Black Sea (RPOA-SSF)* (available in Arabic, English, French and Spanish)
GFCM:SAC23/2022/Dma.3	FAO. 2021/2022. *GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea*. (available in Arabic, English, French and Spanish)
GFCM:SAC23/2022/Dma.4	GFCM, ACCOBAMS, FAO, SPA/RAC, IUCN-Med, Birdlife International, MEDASSET. 2022. *Med Bycatch – Working together to reduce bycatch in the Mediterranean*. FAO, Rome. (available in Arabic and English)

Appendix 4

Status of Mediterranean stocks

Table 1. Scientific advice on the status of demersal stocks assessed by the Working Group on Stock Assessment of Demersal Species in 2022

#	GSA	Species	Methodology	Current levels	Reference points	Quantitative status	Stock status	Scientific advice	WG comments
1	1,5,6,7	*Merluccius merluccius*	a4a	Fc = 1.94, Bc = 1401	F0.1 = 0.44	F/Fref = 4.41	In overexploitation, with relatively low biomass	Reduce fishing mortality; Partial F and STF available	Basis for advice. Updated assessment
2	1	*Merluccius merluccius*	XSA	Fc = 1.37, Bc = 305.6	F0.1 = 0.23	F/Fref = 8.08	In overexploitation, with relatively low biomass	Reduce fishing mortality; STF available	Complementary advice. Updated assessment
3	1,3	*Merluccius merluccius*	XSA	Fc = 1.5, Bc = 199	F0.1 = 0.17	F/Fref = 8.8	In overexploitation, with relatively low biomass	Reduce fishing mortality	Complementary advice. Basis for advice for GSA 3. Updated assessment
4	4	*Merluccius merluccius*	VIT	Fc = 1.06	F0.1 = 0.24	--	Possibly in overexploitation	Reduce fishing mortality	Precautionary advice. Updated assessment.
5	5	*Merluccius merluccius*	a4a	Fc = 1.4, Bc = 68	F0.1 = 0.32	F/Fref = 4.39	In overexploitation, with relatively low biomass	Reduce fishing mortality; STF available	Complementary advice. Updated assessment
6	6	*Merluccius merluccius*	a4a	Fc = 1.73, Bc = 729	F0.1 = 0.15	F/Fref = 11.53	In overexploitation, with relatively low biomass	Reduce fishing mortality	Complementary advice. Updated assessment
7	8,9,10,11.1 ,11.2	*Merluccius merluccius*	a4a	Fc = 0.50, Bc = 4690	F0.1 = 0.16	F/Fref = 3.13	In overexploitation, with relatively high biomass	Reduce fishing mortality; Partial F and STF available	Benchmark update
8	1	*Parapenaeus longirostris*	a4a	Fc = 1.21,	F0.1 = 0.7	F/Fref = 1.73	In overexploitation, with relatively high	Reduce fishing	Updated assessment

#	GSA	Species	Methodology	Current levels	Reference points	Quantitative status	Stock status	Scientific advice	WG comments
				Bc = 157			biomass	mortality; STF available	
9	3	*Parapenaeus longirostris*	BioDyn and LCA/Yield per Recruit	Fc = 1, Bc = 554	F0.1 = 0.65, B0.1 = 535, BMSY = 486	--	Possibly in overexploitation and biomass above reference point	Reduce fishing mortality	Precautionary advice. Updated assessment
10	4	*Parapenaeus longirostris*	VIT	Fc = 1.67	F0.1 = 0.72	--	Possibly in overexploitation	Reduce fishing mortality	Precautionary advice. Updated assessment
11	5	*Parapenaeus longirostris*	XSA	Fc = 1.7, Bc = 79	F0.1 = 0.82	F/Fref = 2.07	In overexploitation, with relatively high biomass	Reduce fishing mortality; STF available	Updated assessment
12	6	*Parapenaeus longirostris*	XSA	Fc = 1.27, Bc = 282	F0.1 = 0.79	F/Fref = 1.6	In overexploitation, with relatively high biomass	Reduce fishing mortality	Updated assessment
13	9,10,11.1,11.2	*Parapenaeus longirostris*	a4a	Fc = 1.58, Bc = 1960	F0.1 = 1.29	F/Fref = 1.22	In overexploitation, with relatively low biomass	Reduce fishing mortality; STF available	Updated assessment
14	1,3	*Pagellus bogaraveo*	Gadget	Fc = 0.2, Bc = 241	Fmsy = 0.26, Blim = 264	F/Fref = 0.78, B/Blim = 0.91	Overexploited with a low fishing mortality	Reduce fishing mortality and/or implement a recovery plan	Benchmark update
15	1	*Mullus barbatus*	a4a	Fc = 1.88, Bc = 165	F0.1 = 0.29	F/Fref = 6.48	In overexploitation, with relatively low biomass	Reduce fishing mortality	Updated assessment
16	6	*Mullus barbatus*	a4a	Fc = 1.57, Bc = 1171	F0.1 = 0.31	F/Fref = 5.06	In overexploitation, with relatively high biomass	Reduce fishing mortality	Updated assessment

#	GSA	Species	Methodology	Current levels	Reference points	Quantitative status	Stock status	Scientific advice	WG comments
17	7	*Mullus barbatus*	a4a	Fc = 0.624, Bc = 483	F0.1 = 0.456	F/Fref = 1.369	In overexploitation, with relatively high biomass	Reduce fishing mortality; STF available	Updated assessment
18	9	*Mullus barbatus*	a4a	Fc = 0.37, Bc = 1950	F0.1 = 0.52	F/Fref = 0.71	Sustainably exploited, with relatively high biomass	Not to increase fishing mortality; STF available	Updated assessment
19	10	*Mullus barbatus*	a4a	Fc = 0.31, Bc = 1449	F0.1 = 0.4	F/Fref = 0.78	Sustainably exploited, with relatively high biomass	Reduce fishing mortality STF available	Updated assessment
20	5	*Mullus surmuletus*	a4a	Fc = 0.47, Bc = 342	F0.1 = 0.24	F/Fref = 1.97	In overexploitation, with relatively intermediate biomass	Reduce fishing mortality; STF available	Revised assessment with a new M vector
21	1	*Aristeus antennatus*	a4a	Fc = 0.69, Bc = 287	F0.1 = 0.42	F/Fref = 1.64	In overexploitation, with relatively intermediate biomass	Reduce fishing mortality; STF available	Updated assessment
22	2	*Aristeus antennatus*	XSA	Fc = 0.77, Bc = 166	F0.1 = 0.46	F/Fref = 1.68	In overexploitation, with relatively intermediate biomass	Reduce fishing mortality; STF available	Updated assessment
23	5	*Aristeus antennatus*	a4a	Fc = 1.16, Bc = 128	F0.1 = 0.32	F/Fref = 3.61	In overexploitation, with relatively low biomass	Reduce fishing mortality; STF available	Updated assessment
24	6	*Aristeus antennatus*	a4a	Fc = 2.17, Bc = 242	F0.1 = 0.35	F/Fref = 6.2	In overexploitation, with relatively low biomass	Reduce fishing mortality	Updated assessment
25	9,10,11.1,11.2	*Aristeus antennatus*	a4a	Fc = 1.2, Bc = 271	F0.1 = 0.261	F/Fref = 4.6	In overexploitation, with relatively low	Reduce fishing mortality; STF available	Updated assessment

#	GSA	Species	Methodology	Current levels	Reference points	Quantitative status	Stock status	Scientific advice	WG comments
							biomass		
26	9,10,11.1,11.2	*Aristaeomorpha foliacea*	a4a	Fc = 0.98, Bc = 445	F0.1 = 0.46	F/Fref = 2.13	In overexploitation, with relatively low biomass	Reduce fishing mortality; STF available	Updated assessment
27	5	*Nephrops norvegicus*	a4a	Fc = 0.16, Bc = 46	F0.1 = 0.23	F/Fref = 0.69	Sustainably exploited, with relatively intermediate biomass	Not to increase fishing mortality; STF available	New assessment
28	6	*Nephrops norvegicus*	a4a	Fc = 0.57, Bc = 372	F0.1 = 0.15	F/Fref = 3.8	In overexploitation, with relatively low biomass	Reduce fishing mortality	Updated assessment
29	9	*Nephrops norvegicus*	a4a	Fc = 0.15, Bc = 1255	F0.1 = 0.30	F/Fref = 0.5	Sustainably exploited, with relatively high biomass	Not to increase fishing mortality; STF available	Updated assessment
30	18,19	*Aristaeomorpha foliacea*	a4a	Fc = 0.62, Bc = 285	F0.1 = 0.45	F/Fref = 1.38	In overexploitation, with relatively intermediate biomass	Reduce fishing mortality	Revised assessment
31	20	*Merluccius merluccius*	a4a	Fc = 0.38, Bc = 2551	F0.1 = 0.204	F/Fref = 1.86	In overexploitation, with relatively high biomass	Reduce fishing mortality	Updated assessment. STF available. Request for benchmark.
32	22	*Merluccius merluccius*	a4a	Fc = 0.4, Bc = 20234	F0.1 = 0.236	--	Possibly in overexploitation	Reduce fishing mortality	Revised assessment. Qualitative advice due to missing data and poor cohorts consistency
33	20	*Mullus barbatus*	a4a	Fc = 0.32, Bc = 792	F0.1 = 0.29	F/Fref = 1.1	In overexploitation, with relatively high biomass	Reduce fishing mortality	Updated assessment. STF available. Request for benchmark.

#	GSA	Species	Methodology	Current levels	Reference points	Quantitative status	Stock status	Scientific advice	WG comments
34	22	*Mullus barbatus*	a4a	Fc = 0.25, Bc = 8196	F0.1 = 0.26	F/Fref = 0.96	Sustainably exploited, with relatively high biomass	Do not increase fishing mortality	Revised assessment. Total catches and catch numbers revised. STF available.
35	24	*Mullus barbatus*	CMSY in addition to LBB, LBSPR and LIME	Fc = 0.32	Fmsy = 0.377	--	Possibly in sustainable exploitation	Not increase fishing mortality	Updated assessment
36	12,13,14,15,16	*Parapenaeus longirostris*	XSA	Fc = 1.13, Bc = 10102	F0.1 = 0.84	F/Fref = 1.34	In overexploitation with relatively low biomass	Reduce fishing mortality	Updated assessment
37	17,18,19	*Parapenaeus longirostris*	a4a	Fc = 1.62, Bc = 3238	F0.1 = 0.7	F/Fref = 2.31	In overexploitation, with relatively high biomass	Reduce fishing mortality	Updated assessment. STF available. Request for benchmark.
38	17	*Sepia officinalis*	CMSY	Fc = 0.21, Bc = 9196	Fmsy = 0.18, Bmsy = 25415	F/Fref = 1.17, B/Btar = 0.36	Overexploited and in overexploitation	Immediate action to ensure reduction in fishing mortality	Revised assessment. Priors in the model were changed
39	17	*Squilla mantis*	SS3	Fc = 0.26, Bc = 5834	F40 = 0.33, SSB40 = 6314	F/Fref = 0.79, B/Btar = 0.92	Overexploited with low fishing mortality	Reduce fishing mortality and/or implement a recovery plan	Updated assessment. STF available. Request for benchmark.
40	12,13,14,15,16	*Merluccius merluccius*	ss3	Fc = 0.36, Bc = 4885	Fmsy = 0.29, Bmsy = 7021	F/Fref = 1.24, B/Btar = 0.7	overexploited and in overexploitation	Immediate action to ensure reduction in fishing mortality	Updated benchmark assessment
41	19	*Merluccius merluccius*	a4a	Fc = 0.29, Bc = 1593	F0.1 = 0.154	F/Fref = 1.86	In overexploitation with relatively high biomass	Reduce fishing mortality	Updated benchmark assessment
42	17,18	*Merluccius merluccius*	ss3	Fc = 0.41,	Fmsy = 0.167, Bpa = 2453, Blim	F/Fref = 2.47, B/Bthre =	In overexploitation	Reduce fishing mortality	Request for a new

#	GSA	Species	Methodology	Current levels	Reference points	Quantitative status	Stock status	Scientific advice	WG comments
				Bc = 3983	= 1858	1.62, B/Blim = 2.14			benchmark/interbenchmark session.
43	12,13,14	*Mullus barbatus*	XSA	Fc = 1.47, Bc = 2518	F0.1 = 0.47	F/Fref = 3.13	In overexploitation, with relatively high biomass	Reduce fishing mortality	Updated benchmark assessment
44	15	*Mullus barbatus*	XSA	Fc = 0.58, Bc = 25	F0.1 = 0.295	F/Fref = 1.95	In overexploitation, with relatively low biomass	Decrease fishing mortality	Revised model; asked for an update of benchmark assessment. Suggested as basis of advice
45	16	*Mullus barbatus*	XSA	Fc = 0.31, Bc = 1916	F0.1 = 0.34	F/Fref = 0.81	Sustainably exploited, with relatively intermediate biomass	Not increase fishing mortality	Update of benchmark assessment
46	19	*Mullus barbatus*	XSA	Fc = 0.75, Bc = 423	F0.1 = 0.4	F/Fref = 1.87	In overexploitation with relatively intermediate biomass	Reduce fishing mortality	Updated benchmark assessment
47	17	*Solea solea*	SS3	Fc = 0.19, Bc = 3038	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	Reduce fishing mortality and/or implement a recovery plan	The reference points are expressed in relative terms as 40% of B0 (Btarget) and the F that brings the stock to Btarget. Moreover, both reference points are the median of the model ensemble and therefore the absolute value will change when updating the model.
48	18	*Eledone cirrosa*	CMSY-BSM	Fc = 0.38, Bc = 2	Fmsy = 0.491, Bmsy = 1.89	F/Fref = 0.77, B/Btar = 1.13	Sustainably exploited, with relatively high biomass	Do not increase fishing mortality	Updated assessment. STF available. Request for benchmark.
49	25	*Mullus surmuletus*	SAM	Fc = 1.09, Bc = 99	F0.1 = 0.31	NA	Possibly in overexploitation	Reduce fishing mortality	New assessment

#	GSA	Species	Methodology	Current levels	Reference points	Quantitative status	Stock status	Scientific advice	WG comments
50	25	*Serranus cabrilla*	AMSY			F/Fmsy = 0.69, B/Bmsy = 1.28	Sustainably exploited, with high biomass	Do not increase fishing mortality	New assessment
51	25	*Pagellus acarne*	CMSY++	Fc = 0.239, Bc = 75.1	Fmsy = 0.227, Bmsy = 112	F/Fref = 1.05, B/Bref = 0.667	Overexploited and in overexploitation	Immediate action to ensure reduction in fishing mortality	New assessment
52	18,19	*Aristeus antennatus*	XSA*, a4a, SPiCT	--	--	--	In overexploitation	Reduce fishing mortality	New assessment. Validated providing qualitative advice based on XSA (sexes combined). Benchmark session suggested to further explore input data and modeling approaches
53	12-16, 21	*Aristaeomorpha foliacea*	AMSY, BSM, JABBA	--	--	--	In overexploitation and overexploited	Reduce fishing mortality	New assessment. Validated providing qualitative advice based on all three methods. Improvement of catch reconstruction for the Italian fleet. Benchmark session suggested to further explore input data and modeling approaches
54	17 and 18	*Mullus barbatus*	Previous validated advice; standardized MEDITS biomass index; L95 of the LFDs of the MEDITS survey	--	--	--	In overexploitation	Reduce fishing mortality	Benchmark not finalized. Qualitative precautionary advice based on previous validated advice; ICES method for category 3 stocks using the standardized MEDITS biomass index (GSAs 17 and 18); L95 of the LFDs of the MEDITS survey (GSAs 17 and 18) under the median value for the time series (1996–2020) since 2011

Source: elaborated by the author.

Table 2. Scientific advice on the status of small pelagic stocks assessed by the Working Group on Stock Assessment of Small Pelagic Species in 2022

#	GSA	Species	Methodology	F/F_{MSY} *(E)	B/B_{MSY} $^{*}B/B_{pa}$ $^{**}B/B_{lim}$	Stock status	Scientific advice	WG comments
1	1	*Engraulis encrasicolus*	a4a	--	--	Sustainably exploited	Do not increase fishing mortality	The assessment was performed with a4a. Owing to the fact that biological sampling of catches was not carried out in 2020, the LFDs used in the assessment were reconstructed using an average of 2017–2019 data. The model was found to be stable and robust to changes in settings. Nevertheless, owing to the fact that it estimated very low values for recruitment and SSB in the initial part of the time series (driven by the absence of a biomass index) and low values of F in the terminal years (related to the high abundance of anchovy), the assessment was **validated** providing **qualitative advice**. The stock was found to be **sustainably exploited** and the advice is to not increase fishing mortality. Future work should concentrate on further exploring the a4a model and attempting the use of the MEDITS survey in addition to the MEDIAS survey.
2	1	*Sardina pilchardus*	a4a	--	--	In overexploitation	Reduce fishing mortality	The assessment was carried out with a4a and was considered **validated** providing **qualitative advice**. Based on the results, the stock is considered in overexploitation with very low SSB and recruitment in the final year. The advice is to reduce fishing mortality on a precautionary basis. The suggestion was to explore new models in order to advance to the provision of quantitative advice and evaluate the use of the MEDITS survey (as an auxiliary dataset) in addition to the MEDIAS survey
3	3	*Sardina pilchardus*	a4a	F/Fmsy = 2.77	--	In overexploitation	Reduce fishing mortality	Updated benchmark assessment. The spring survey was not carried out in 2020. The assessment was an update of the benchmark model, using the spring survey only, but owing to the lack of 2020, it resulted in a peculiar F trajectory. The assessment was considered robust enough to be **validated** providing **quantitative advice**. Based on the results, the stock is considered **in overexploitation**. The advice is to reduce fishing mortality. Owing to the peculiar F trajectory with the spring survey alone, an alternative model using spring and autumn surveys was also tested.

#	GSA	Species	Methodology	F/F_{MSY} *(E)	B/B_{MSY} *B/B_{pa} **B/B_{lim}	Stock status	Scientific advice	WG comments
								The WG proposed a new benchmark be carried out in the near future to include the use of both surveys.
4	4	*Sardina pilchardus*	VIT, LBSPR, Catch-curve	--	--	Sustainably exploited	Do not increase fishing mortality	Improvements were made towards the estimation of M and an in-depth analysis of the length composition by quarter was carried out. VIT, LBSPR and catch-curves were applied on 2016–2019 to provide advice. All methods provided the same perception of the stock. The stock assessment was accepted as **qualitative** advice. The stock is **sustainably exploited** and the advice is not to increase fishing mortality on a precautionary basis. The stock assessment would benefit from an improvement in data collection with a consequent area-specific re-estimation of the growth parameters.
5	6	*Engraulis encrasicolus*	a4a			In overexploitation	Reduce fishing mortality	The stock was assessed using an a4a model with the 3-plus group and changing the k value in the F submodel compared to 2021. The assessment was considered **validated** providing **qualitative advice**. Based on the results, the stock is considered in overexploitation ($F_{current}$ = 1.01 and $SSB_{current}$ = 39 642 tonnes). The advice is to reduce fishing mortality on a precautionary basis.
6	6	*Sardina pilchardus*	a4a	F/Fref = 1. 72	--	In overexploitation	Reduce fishing mortality	Updated benchmark assessment. No biological data were available for catches in 2020, so they were reconstructed using the previous three years. The stock was assessed using a4a. The assessment was considered **validated** providing **quantitative advice**. Based on the results, the stock is considered in overexploitation (Fcur = 0.81) with very low SSB and recruitment in the final year. The advice is to reduce fishing mortality.
7	7	*Engraulis encrasicolus*	a4a	F/Fmsy = 0.05	B/B_{pa} = 0. 63	Sustainably exploited	Do not increase fishing mortality	Updated benchmark assessment: **revised model settings**. The survey was carried out with a delay of 74 days in 2020 and this was accounted for by correcting the data using the von Bertalanffy growth function and adjusting for the selectivity of the survey. The stock was assessed using a4a with revised settings (qmodel and srmodel) compared to the benchmark assessment settings because the benchmark settings revealed an unrealistic trajectory of F for a stock whose fishery is low. It was proposed to **validate** this

#	GSA	Species	Methodology	F/F_{MSY} *(E)	B/B_{MSY} *B/B_{pa} **B/B_{lim}	Stock status	Scientific advice	WG comments
								model **providing quantitative advice.** Based on the results, the stock is considered sustainably exploited (F/Fmsy = 0.05) with relatively low biomass (total biomass cur = 17 643 tonnes). The advice is not to increase fishing mortality. **The WGSASP suggests this model be retained for advice.**
8	7	*Sardina pilchardus*	Two-stage biomass model	F/Fmsy = 0.05	B/B_{pa} = 3. 41	Sustainably exploited and ecologically unbalanced	Do not increase fishing mortality	Updated benchmark assessment. The survey was carried out with a delay of 74 days in 2020 and this was accounted for by correcting the data using the von Bertalanffy growth function and adjusting for the selectivity of the survey. Advice was provided based on the two-stage biomass model and taking into account the environmental effects of diminished food in the area on growth (trends in fish length and condition). The assessment was **validated providing quantitative advice**. Based on the results, the stock is sustainably exploited (SSB cur = 48 978 tonnes) and ecologically unbalanced. The advice is to not increase fishing mortality. Future work should concentrate on assessing this stock with a statistical catch-at-age and/or integrated model.
9	9	*Engraulis encrasicolus*	SPICT	F/Fmsy = 0.35	B/Bmsy = 1.48	Sustainably exploited	Evaluate potential fishing opportunities	A SPICT model was used for the assessment, updating the 2021 assessment. The assessment was considered validated with **quantitative** advice. The stock is **sustainably exploited** and the advice is to evaluate potential fishing opportunities. The use of age-structured models was suggested for the future.
10	9	*Sardina pilchardus*	SPICT	F/Fmsy = 0.19	B/Bmsy = 1.49	Sustainably exploited	Evaluate potential fishing opportunities	A SPICT model was used for the assessment, updating the 2021 assessment. The assessment was considered validated with **quantitative** advice. The stock is **sustainably exploited** and the advice is to evaluate potential fishing opportunities. The use of age-structured models was suggested for the future.
11	20	*Engraulis encrasicolus*	SPiCT	--	--	Sustainably exploited	Do not increase fishing mortality	The assessment was carried out using a SPiCT model. Several runs were performed, testing different priors, and the assumption of overexploitation status of the stock in the past was made. The message resulting from the converging runs agreed on a sustainable level of exploitation, but the

#	GSA	Species	Methodology	F/F_{MSY} *(E)	B/B_{MSY} $^{*}B/B_{pa}$ $^{**}B/B_{lim}$	Stock status	Scientific advice	WG comments
								uncertainty produced was high. For this reason, the assessment was considered **validated** providing **qualitative** advice**.** The stock is considered **sustainably exploited** and the advice is not to increase fishing mortality on a precautionary basis. Trials were performed to include data from 1998 and 1999 further evaluation was deemed necessary. The suggestion for future work is to 1) further explore SPiCT using different values for the priors, 2) explore other modelling approaches preferably age structure models and 3) continue working on the use and the reconstruction of past survey data.
12	20	*Sardina pilchardus*	SPiCT	--	--	In overexploitation	Reduce fishing mortality	No survey was carried out in 2020. A SPiCT model was used to assess the stock, as in 2021. Several runs were performed, testing different priors. All of them indicated a situation of overexploitation, however the lack of information in the early part of the time series suggested to validate the assessment providing **qualitative** advice. The stock was deemed **in overexploitation** and the advice is to reduce fishing mortality on a precautionary basis. Trials were performed to include data from 1998 and 1999 which resulted in better fits, but it was deemed premature to consider these runs, which nevertheless provided the same perception of the stock. The suggestion for future work is to: i) further explore SPiCT using different values for the priors; ii) explore other modelling approaches preferably age structure models; and iii) continue working on the use and the reconstruction of past survey data.
13	22	*Engraulis encrasicolus*	a4a*, SAM*, SPiCT	--	--	In overexploitation	Reduce fishing mortality	A4a, FLSAM and SPiCT models were run. A re-estimation of 2019 surveys was performed based on additional information on eggs and larvae, which resulted in much higher biomass. and a significantly more stable a4a model. A4a and SAM models revealed a stock in overexploitation while SPiCT a sustainably exploited stock. Taking this into consideration, the group agreed to **validate** the assessment with **qualitative** advice based on a4a and SAM. The stock was considered **in overexploitation** and the advice is to reduce fishing mortality. Future work should concentrate on: i) re-evaluating all input data thoroughly; and ii)

#	GSA	Species	Methodology	F/F_{MSY} *(E)	B/B_{MSY} *B/B_{pa} **B/B_{lim}	Stock status	Scientific advice	WG comments
								exploring alternative models such as LIME or an integrated model (SS3) to accommodate the fragmented nature of the input data.
14	22	*Sardina pilchardus*	a4a*, SPICT, FLSAM	--	--	In overexploitation	Reduce fishing mortality	A4a, FLSAM and SPiCT models were run. The comparison between a4a and FLSAM results was consistent in terms of message given, but not in terms of values. In all the runs, the lack of continuous surveys in the recent period largely influenced the assessment and caused uncertainties in the estimated parameters. The lack of catch-at-age data in a given period of years in the a4a model amplified the effect of the lack of surveys. This was more apparent in the behaviour of the retrospective. The FLSAM was more stable in terms of the retrospective. Thus, further work should focus on the thorough pre-evaluation of input data to reduce uncertainties. Sensitivity analysis on the reconstructed part of the time series would give further insight on the reliability of the FLSAM model. Currently, due to the high uncertainty in the retrospective the assessment was considered **qualitative**. The stock is **in overexploitation** and the advice is to reduce fishing mortality.
15	24	*Sardinella aurita*	LBSPR	--	--	In overexploitation with biomass within target	Reduce fishing mortality	Round sardinella in GSA 24 was assessed using LBSPR with an extra year of data and a significant additional amount of work compared to that presented during the benchmark (not yet concluded). Owing to uncertainties and the need to perform more work, the assessment was **validated** to provide **qualitative advice**. The stock was considered **in overexploitation with biomass within target** and an improving SPR over the years. The advice was to reduce fishing mortality on a precautionary basis. A roadmap guiding future work was agreed.
16	26 + 27 (Palestine)	*Sardinella aurita*	LBSPR/VIT/ LIME	--	--	In overexploitation and overexploited	Reduce fishing mortality	Round sardinella in GSAs 26 and 27 (Palestine) was assessed using LBSPR, VIT and LIME with two extra years of data and a significant additional amount of work compared to that presented during the benchmark (not yet concluded). Trials were also carried out to improve LBSPR performance by merging years and introducing uncertainty on life history parameters – this significantly reduced the

#	GSA	Species	Methodology	F/F_{MSY} *(E)	B/B_{MSY} *B/B_{pa} **B/B_{lim}	Stock status	Scientific advice	WG comments
								variability of outcomes, especially in terms of F/M. All trials and models revealed consistent results and a stock in overexploitation. Owing to the need to perform more work, the assessment was **validated** to provide **qualitative advice**. The stock as considered **overexploited and in overexploitation** and the advice is to reduce fishing mortality on a precautionary basis. A roadmap guiding future work was agreed.
17	5, 10, 12, 13, 14, 15, 16, 19	*Coryphaena hippurus*	Multifleet multiannual generalized depletion model (MMAGD)	--	--	Sustainably exploited	Do not increase fishing mortality	The stock was assessed with a multifleet multiannual generalized depletion model (MMAGD) using five fleets, comprising considerable advances on the preliminary model presented in 2021, including the use of the results of the MMAGD to fit two population dynamics models (surplus production and Beaverton and Holt and Ricker stock-recruitment models). Owing to several uncertainties associated to the model (reconstruction of Tunisian data from the Italian fleet and high standard error associated with the estimation of a potential harvest rate), the assessment was **validated** providing **qualitative** advice. The stock was deemed **sustainably exploited** and the advice is not to increase fishing mortality on a precautionary basis.
18	16	*Sardina pilchardus*	a4a	$F/F_{E0.4}$=2.78	--	<u>In overexploitation</u>	Reduce fishing mortality	The stock was assessed using an a4a model. The assessment was considered **benchmarked and validated providing quantitative advice**. Based on the results, the stock is considered in overexploitation (Fcur= 1.28, SSB cur= 683 tonnes) with very low SSB being at the lowest level of the time series. The advice is to reduce fishing mortality. Future work should concentrate on the improvement of the commercial catch sampling, continuation of the implementation of the survey in GSAs 10 and 19, as migration/movement of the stocks is likely and this would improve the perception of the stock by the survey. In this context, for the next benchmark session the whole Sicilian area should be considered both in terms of catches and surveys.

#	GSA	Species	Methodology	F/F_{MSY} *(E)	B/B_{MSY} *B/B_{pa} **B/B_{lim}	Stock status	Scientific advice	WG comments
19	16	*Engraulis encrasicolus*	a4a	$F/F_{E0.4}$=1.55	--	In overxploitation	Reduce fishing mortality	Advice was provided based on an a4a model. The assessment was considered **benchmarked and validated providing quantitative advice**. Based on the results, the stock is in overexploitation (Fcurr=0.697, SSB cur=3780.3 tonnes). Considering the reduction of the catches in 2020 and the increasing trend observed in acoustic biomass estimates, the group acknowledged a possible improvement in the overall status of this stock. Future work should concentrate on the improvement of the commercial catch sampling, continuation of the implementation of the survey in GSAs 10 and 19, as migration/movement of the stocks is likely and this would improve the perception of the stock by the survey. In this context, for the next benchmark session the whole Sicilian area should be considered both in terms of catches and surveys.
20	17 and 18	*Sardina pilchardus*	a4a	--	--	Overexploited and in overexploitation on a precautionary basis	Reduce fishing mortality	Based on the information available and on precautionary basis, the status of sardine did not show any improvements from previous assessment, and a further reduction on biomass could be excluded, therefore the stock should continue to be considered overexploited and in overexploitation. The experts recommend the input data for the assessment be available in time before the meetings in order to produce all the analyses needed to generate an adequate assessment. The also experts recommended to discuss the assessment in a dedicated session of WGSASP with the presence of experts from the region and beyond, in order to have an accurate discussion among stock assessment experts
21	17 and 18	*Engraulis encrasicolus*	FLSAM	F/F_{MSY} 0 1.15	B/Blim = 1.45 B/Bpa = 1.10	Biomass above reference points and in overexploitation	Reduce fishing mortality	The experts recommend the input data for the assessment be available in time before the meetings in order to produce all the analyses needed to generate an adequate assessment. The also experts recommended to discuss the assessment in a dedicated session of WGSASP with the presence of experts from the region and beyond, in order to have an accurate discussion among stock assessment experts

Source: elaborated by the author.

Appendix 5

Technical elements for the management of key fisheries

Appendix 5/A

Updated technical elements for the management of European eel (*Anguilla anguilla*) in the Mediterranean Sea

PROPOSED BY THE WORKING GROUP ON THE MANAGEMENT OF EUROPEAN EEL

Introduction

The critical status of European eel (*Anguilla anguilla*) in its entire distribution range, including the Mediterranean Sea, has been acknowledged for approximately a decade now. The most recent assessment of the resource – the joint European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC) / International Council for the Exploration of the Sea (ICES) / GFCM Working Group on European eel (WGEEL) in 2021 – revealed the lowest levels in recruitment ever recorded. This stimulated a series of actions over the years towards the assessment and management of this species that culminated in the first technical elements for the management of European eel in the Mediterranean Sea being endorsed at the twentieth session of the Scientific Advisory Committee on Fisheries (SAC) (Morocco, June 2018). These, in turn, triggered, in the same year, the adoption of Recommendation GFCM/42/2018/1 on a multiannual management plan for European eel in the Mediterranean. Under the premises of the precautionary approach, Recommendation GFCM/42/2018/1 established a set of transitional management measures to immediately adjust fishing mortality levels and reduce the risk that the stock biomass would drop to extremely low levels while preparing the grounds for a future long-term multiannual management plan. The recommendation also provided the GFCM Secretariat with terms of reference to support the implementation of a research programme on European eel in the Mediterranean Sea, with the aim of collecting, collating and analysing all available data to provide the scientific basis for the establishment of long-term management measures. The research programme started in September 2020 and ended in February 2022 and analysed an impressive quantity of information providing the scientific basis for both future actions and the management discussions carried out by the Working Group on the management of European eel (WGMEASURES-EEL) in 2022.

Scope

Measures adopted on the basis of these technical elements should:

- cover all Mediterranean geographical subareas (geographical subareas 1–27);
- address all fishing activities (targeted, incidental and recreational catches) in all marine waters;
- include all life stages of European eel; and
- envisage measures to be applied on a precautionary basis (as well as other adaptive measures based on future advice on the evolution of the state of resources and fisheries).

Objectives

Following Decision GFCM/36/2012/1 on guidelines on a general management framework and presentation of scientific information for multiannual management plans for sustainable fisheries in the GFCM area of application, and in line with the proposals of the WGMEASURES-EEL, these updated technical elements provide advice on additional transitional measures and potential measures to be adopted in the future, with an appraisal of each considered measure, towards providing and maintaining high long-term yields and guaranteeing a low risk of stock collapse.

Management measures, including an appraisal of issues, implementation and potential developments

General notes:

- Some of these measures could be implemented on a short-term, trial basis to understand their effectiveness, under pilot projects/actions.
- All considered measures should be accompanied by an analysis of their socioeconomic impact.

Category	Measure	Issues	Implementation	Development
Catch/effort restrictions	30% reduction of the fishing effort or catches over three years (10%/year)[2]	•Difficult to translate into F reduction •Poor information on catch and effort	•Need to analyse the implementation	
	Zero-catches	•Best solution for stock recovery •Worst solution from social point of view at least in the short term	•Compensation scheme for fishers and involve fishers in the collection of information	
			•Ensure continued monitoring; involve fishers •Needs to be implemented in parallel with measures that ensure escapement of silver eel	•Trial over 1–2 life cycles (10–20 years) and evaluate
	Catch limits	•Difficult to determine without an assessment/ requires a lot of time to implement •Should be based on estimates of F which require an assessment	•Requires a lot of time for effective implementation •Requires strict control, monitoring and legislative regulations	
	Effort reduction	•Difficult to translate into F reduction •Quantification of effort is fraught with difficulties because of diverse and small-scale fishery, and difficulties in inter-site comparison	•Additional and higher quality data required to assess and determine the appropriate level of effort reduction	
Spatial restrictions	Fisheries restricted areas	•Discuss and determine common criteria for the identification of priority areas: stock-related reasons/habitat-related reasons	•Establish pilot areas for the implementation of a closure for X number of years, conduct eel monitoring and involve fishers •Consider how to upscale findings to wider area	•Consider habitat and eel quality indicators in future selection of sites to protect sites that maximize spawner

[2] The annual three-month closure should be re-evaluated in light of the dynamics of the different life staged and climate change and the results of the research programme. Current implementation of the measure should be re-evaluated.

Category	Measure	Issues	Implementation	Development
		•Evaluation of the protection would need a biomass evaluation for the area	•Consider compensation •Consider involvement of fishers •Budgetary implications for adequate implementation and monitoring, control and surveillance	quality to enhance reproductive success
	Rotational closures	•Rotational closure of priority sites to fisheries for stages other than glass eel (e.g. 50% of areas one year, remaining 50% the next)	•Consider compensation •Consider involvement of fishers	
		•Discuss and determine common criteria for the identification of priority areas: stock-related reasons/habitat-related reasons		
		•Risk of displacement of effort		
Temporal restrictions	Annual three-month closure[3] consistent with trophic movements of yellow eel and migration patterns	•Climate change may cause shifts in the migration season •If in the right period, this equates to the closure of the silver eel fishery •Risk of displacement of effort •Migration period changes from site to site •Depending on the timing, it will affect different life stages: recommendation needs to be more specific •Chosen timing should be effective	•Simple to implement and control to protect silver eel •Compensation scheme •Ensure continued monitoring; involve fishers •Needs to be implemented in parallel with measures that ensure escapement of silver eel	•Use rotation area closure instead •Have a one-month open season instead •Set a wider period (e.g. Sept–Feb) within which to choose the three months •Set a fixed season everywhere (e.g. Dec–Feb): it will allow some protection in most sites and complete in others

[3] The annual three-month closure should be re-evaluated in light of the dynamics of the different life stages and climate change and the results of the research programme. Current implementation of the measure should be re-evaluated.

Category	Measure	Issues	Implementation	Development
Life-stage related measures	Silver eel escapement/releases		•Cooperation between fishers and scientist and involvement of fishers in monitoring/assisted migration •Compensation scheme	•Protection of silver eel runs over a fixed period everywhere as a large-scale experiment then evaluate effect on recruitment; needs to be applied at stock-wide level
	Glass eel ban	•Very low levels of recruitment •Recruitment of an endangered species requires protection •Issues related to farm demand for seed •Potential high risk of illegal, unreported and unregulated fishing	•Ensure implementation of standardized monitoring; involve fishers •Requires strict enforcement •Compensation scheme	•Requires protection of other stages as well
Fishery-related restrictions	Ban on recreational fisheries	•Should be considered a stock-wide measure given the critical state of the resource •Difficult to quantify the effect, although recreational fisheries catches are in some areas equivalent to commercial catches leading to potential positive impact •Difficult to control	•To be considered in the context of a revision of the gear used	
Habitat-related restrictions	Habitat enhancement (improving water quality, improving connectivity)	•Pathogens and pollutants are particular problems that may have an effect on recruitment by affecting the ability to complete the spawning migration	•Implementation on a case- by-case basis •Encourage monitoring programmes •In general, under competence of environmental authorities, budget implications, impossibility for big dams	
	Avoid eel transfers between sites to avoid pathogen contamination of pathogen free sites		•Difficult to control	

Category	Measure	Issues	Implementation	Development
Technical measures	Minimum landing sizes	•Difficult to translate into F reduction especially if there is no effort control •Eel only reproduces once •May be useless if there is no effort control	•Needs to be implemented with other measures, e.g. for better protection of silver eel	
	Maximum landing sizes	•Protects very big individuals that contribute disproportionately to spawning	•Needs to be implemented with other measures	
	Gear dimensions and layout	•Gear dimension and layout are relevant measures to address escapement and should be considered as effort control	•Difficult implementation at regional level owing to the diversity of gear and small-scale fisheries	
	Gear measures, e.g. mesh and hook sizes	•Mesh and hook size related to minimum landing size	•Difficult implementation at regional level owing to the diversity of gear and small-scale fisheries	
Trade-related	Ensure traceability	•Difficult to quantify the seed needs for aquaculture •Traceability beyond borders is difficult – take inspiration from examples of best practice	•Collaboration with the Information System for the Promotion of Aquaculture in the Mediterranean (SIPAM) which needs to start collecting data •Collaboration with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	

PROPOSED BY THE TWENTY-THIRD SESSION OF THE SCIENTITIC ADVISORY COMMITTEE ON FISHERIES

In line with the results obtained by the GFCM research programme on European eel in the Mediterranean Sea, the twenty-third session of the SAC (FAO headquarters, Rome, Italy, June 2022) highlighted the need to address all sources of anthropogenically-induced mortality. First and foremost, immediate actions targeting the advancement of habitat-related measures (with Mediterranean lagoons as a priority) for habitat improvement/maintenance were advised. In terms of fisheries-related measures, the Committee welcomed the two alternative management avenues proposed by the research programme, to be applied across the entire distribution area of the species: i) a three-year pilot phase of zero-catches; or ii) a three-year closure of the silver eel fishery accompanied by a total ban for recreational fisheries and glass eel fisheries for three years, both followed by a recruitment assessment over one season.

Acknowledging the importance of these traditional fisheries for fisher livelihoods and the potential socioeconomic impacts of implementing the proposed measures, and recalling Recommendation GFCM/42/2018/1, the SAC proposed to immediately strengthen the existing transitional measures in 2023 while continuing to work towards informing future long-term management measures for 2024. The SAC suggested to align the current three-month closures with the effective migration periods of silver eel at the country level, based on the results of the research programme, as well as considering a total ban of glass eel fisheries and of recreational fisheries for all life stages

Appendix 5/B

Updated technical elements for the management of fisheries of blackspot seabream (*Pagellus bogaraveo*) in the Strait of Gibraltar (geographical subareas 1 and 3)

Introduction

The first technical elements for the management of fisheries of blackspot seabream (*Pagellus bogaraveo*) in the Strait of Gibraltar were endorsed at the twentieth session of the Scientific Advisory Committee on Fisheries (SAC) (Morocco, June 2018) and updated at the following session (Egypt, June 2019). These elements served as the basis for the adoption of Recommendation GFCM/43/2019/2 on a management plan for the sustainable exploitation of blackspot seabream in the Alboran Sea (geographical subareas 1 to 3).

The Recommendation requested that countries adopt transitional precautionary management measures in 2020 and 2021 as well as fleet management measures. It also requested that the SAC provide improved advice on the fishery by 2021, as well as evaluate the effectiveness of the measures adopted so far, with the objective of facilitating the adoption of long-term management measures by the forty-fifth session of the GFCM.

Some of the technical work requested, both at country level and within the framework of the SAC has been affected by the COVID-19 pandemic, with the twenty-second session of the SAC and the forty-fourth session of the Commission being postponed one year and finally held in June and November 2021, respectively. The forty-fourth session of the Commission adopted a new recommendation – Recommendation GFCM/44/2021/4 on a management plan for the sustainable exploitation of blackspot seabream in the Alboran Sea (geographical subareas 1 to 3), amending Recommendation GFCM43/2019/2 – to extend the provisions of the previous recommendation until the end of 2022, with the request that at its forty-fifth session in 2022, upon receipt of advice from the SAC, the GFCM shall adopt long-term measures allowing for the achievement of the sustainable exploitation of blackspot seabream.

These updated technical elements contain the technical comments endorsed by the SAC in 2021, as well as the updated information on the status of the stock together with new technical comments provided at the Subregional Committee for the western Mediterranean (SRC-WM) in April 2022, in reply to the requests from the GFCM.

Status of advice in response to requests from the GFCM

Characteristics of the fishing gear, *inter alia*, the characteristics of the fixed nets and the number, type and size of the hooks used in handlines and longlines	Provided in updated technical elements (2019)
Deployed fishing effort and catch of commercial fishing fleets as well as an estimate of recreational fisheries catch	Provided in updated technical elements (2019)
Conservation and management reference points with a view to ensuring a low risk of stock collapse as well as the sustainability of fisheries, in line with the maximum sustainable yield (MSY) objective	Estimated in a dedicated benchmark exercise (finalized online in 2020)
Socioeconomic effects of alternative management scenarios, including input/output and/or technical measures	Pending
Possible spatio-temporal closures aimed at ensuring the sustainability of the stock and of the fisheries exploiting it	Pending
Potential impacts of recreational fisheries on the conservation status of blackspot seabream	Pending

Updated technical elements from work carried out from 2021 to 2022

Status of stock

Since the last SRC-WM (online, February 2021), the stock was assessed in January 2022 with the results shown in the last row of Table 1. The trends of landings, effort and catch per unit effort, as well as the assessed biomass and fishing mortality are included in Figures 1 to 6. Furthermore, short term forecasts are provided for different scenarios of reduction of fishing mortality (F) in Tables 2 and 3.

Table 1. Results of assessment of blackspot seabream in geographical subareas 1 and 3

	Reference points		**B/Bmsy**	**F/Fmsy**
	Average from several non-statistical models (2019)		**0.19**	**2.72**
	GADGET	**Benchmark 2019**	B^*/B_{lim} = **0.99**	**1.0**
	GADGET	**Updated benchmark 2021**	B^*/B_{lim} = **0.98**	**1.88**
	GADGET	**Updated benchmark 2022**	B^*/B_{lim} **= 0.91**	**0.78**

*Females biomass equivalent to SSB

Source: elaborated by the author.

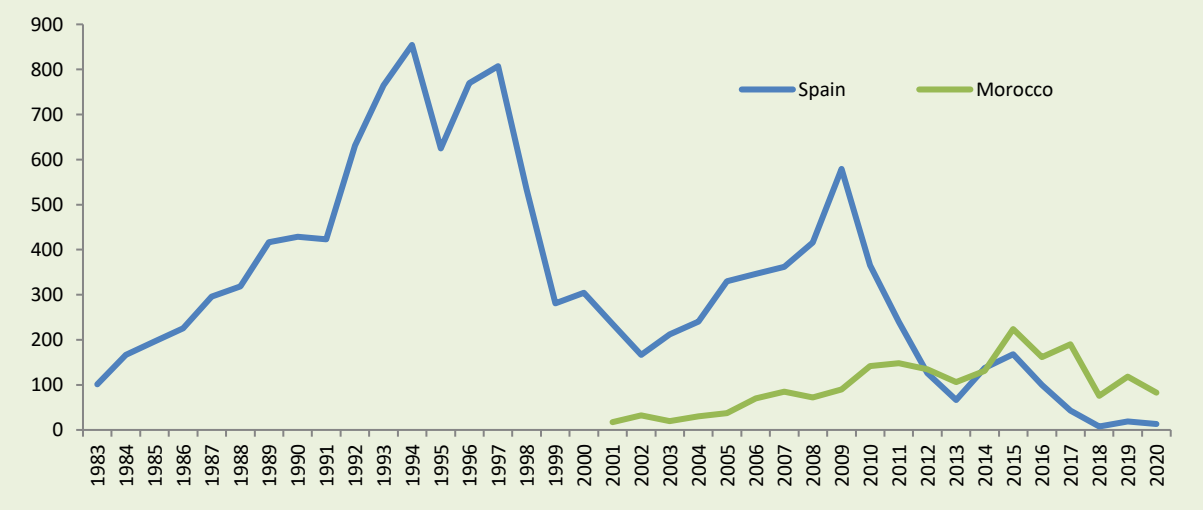


Figure 1. Landings of blackspot seabream (1983–2020) in European Union–Spain and Morocco
Source: elaborated by the author.

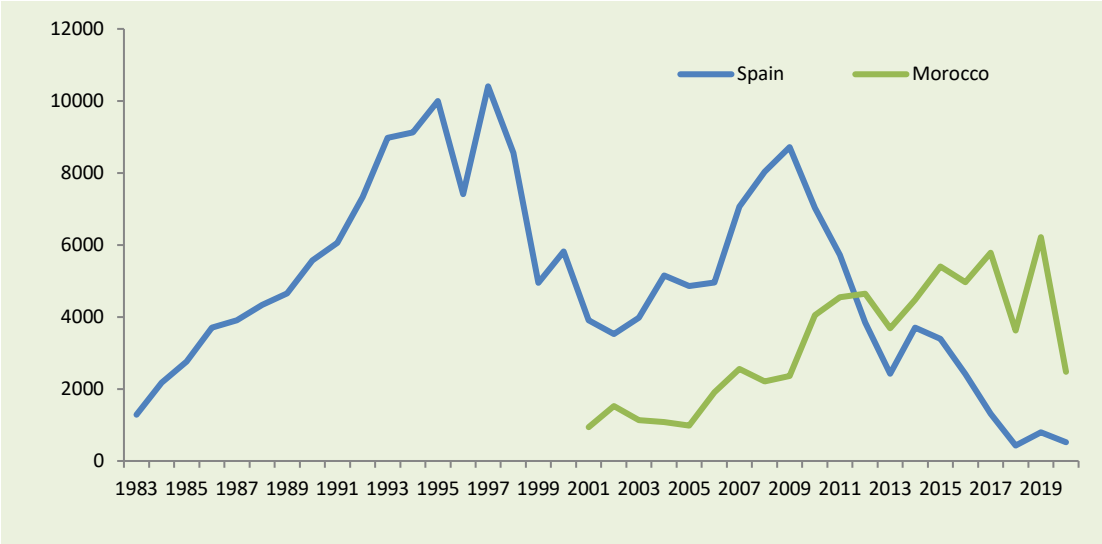


Figure 2. Effort (number of days) for blackspot seabream (1983–2020) in European Union–Spain and Morocco
Source: elaborated by the author.

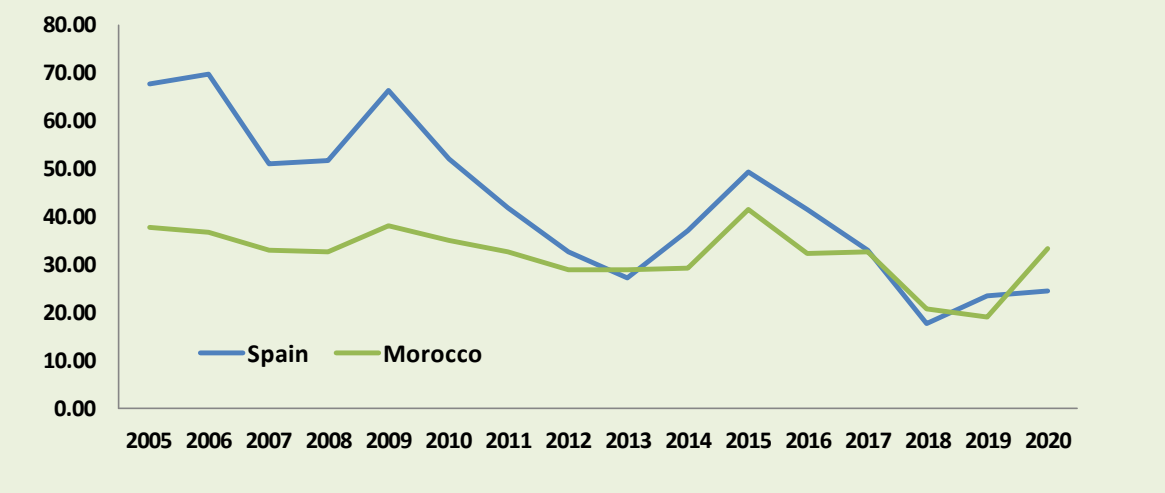


Figure 3. Catch per unit effort of blackspot seabream (1983–2020) in European Union–Spain and Morocco
Source: elaborated by the author.

MODEL OUTPUTS

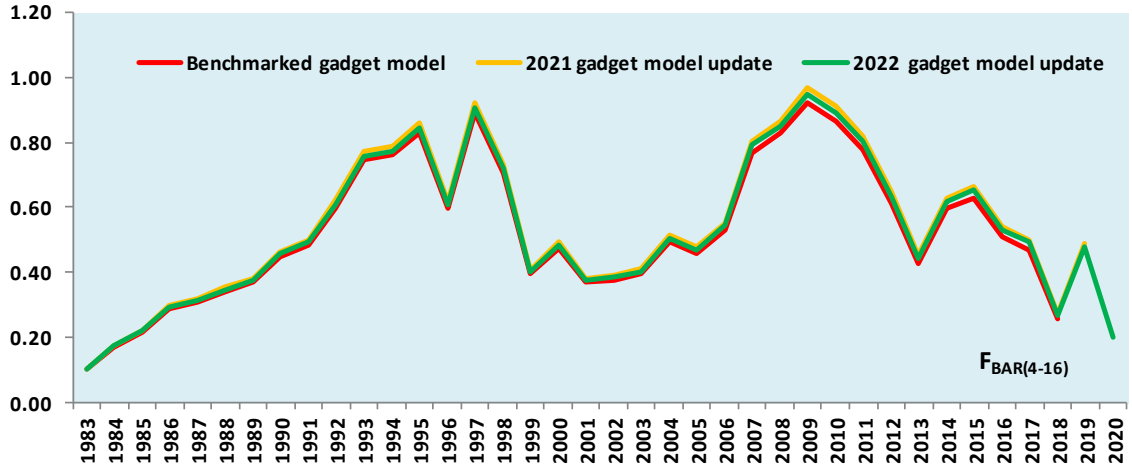


Figure 4. Fishing mortality estimates from the GADGET. Comparison of the outputs from the benchmark assessment (red line), last year's update (orange line) and this year's assessment (green line)
Source: elaborated by the author.

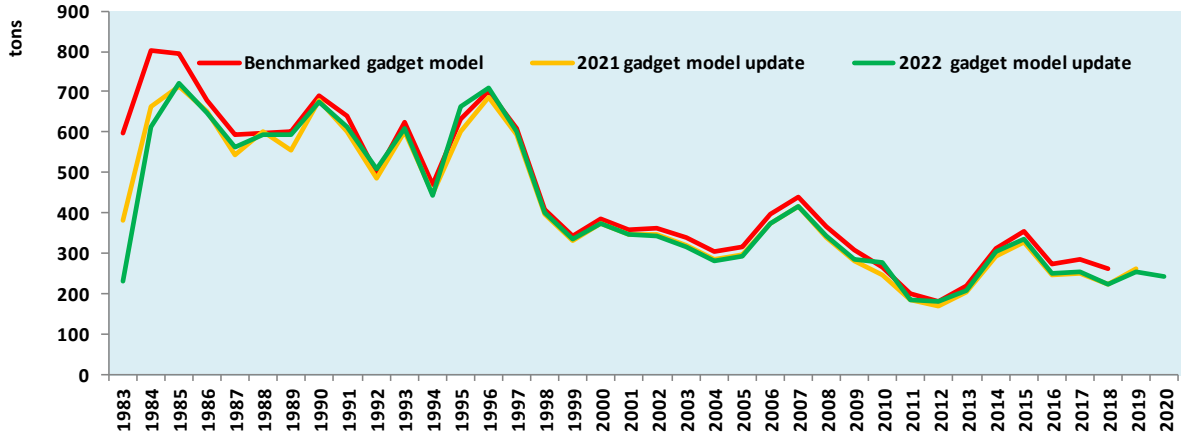


Figure 5. Biomass (females) estimates from the GADGET. Comparison of the outputs from the benchmark assessment (red line), last year's update (orange line) and this year's assessment (green line)
Source: elaborated by the author.

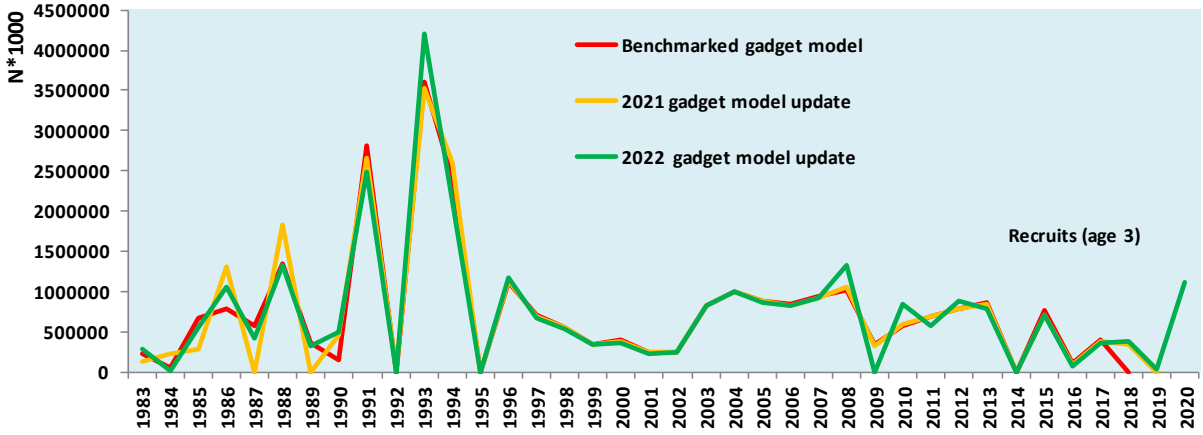


Figure 6. Recruitment estimates from the GADGET. Comparison of the outputs from the benchmark assessment (red line), last year's update (orange line) and this year's assessment (green line)
Source: elaborated by the author.

Table 2. Blackspot seabream target fishery of the Strait of Gibraltar (geographical subareas 1 and 3): assumptions made for the intermediate (2021) and forecast (2022) years

	Value	Sources
F_{2021}	0.20	from assessment model
Catches 2021	164	Estimated landings from $F_{4\text{-}16}$ (2020)
$R_{(2020\text{-}2021)}$	342976	Geom. mean (2010-2019 except 2014)
SSB2021	261	from assessment model
SSB_{2022}	376	

Source: elaborated by the author.

Table 3. Blackspot seabream target fishery of the Strait of Gibraltar (geographical subareas 1 and 3): short-term forecast according to different harvest rate (and corresponding fishing mortality) scenarios

Rationale	HR	Fbar	Rec. 2021	Fsq 2021	Catch 2020	Catch 2022	SSB 2021	SSB 2023	SSB_2021-2023 (%)	Catch_2020-2022 (%)
Zero catch	0.00	0.00	342976	0.20	98	0	261	594	128	-100
HRmsy	0.15	0.25	342976	0.20	98	196	261	454	74	100
HRpa	0.20	0.33	342976	0.20	98	252	261	411	57	158
HRlim	0.31	0.52	342976	0.20	98	361	261	327	25	269
Status quo	0.12	0.20	342976	0.20	98	160	261	481	84	64
Different scenarios	0.02	0.03	342976	0.20	98	29	261	583	123	-71
	0.04	0.07	342976	0.20	98	57	261	561	115	-42
	0.06	0.10	342976	0.20	98	84	261	540	107	-15
	0.08	0.13	342976	0.20	98	110	261	520	99	12
	0.10	0.17	342976	0.20	98	136	261	500	92	38
	0.20	0.33	342976	0.20	98	252	261	411	57	158
	0.30	0.51	342976	0.20	98	352	261	334	28	259
	0.40	0.68	342976	0.20	98	437	261	269	3	346
	0.50	0.86	342976	0.20	98	508	261	215	-18	418
	0.60	1.04	342976	0.20	98	566	261	170	-35	478
	0.70	1.22	342976	0.20	98	615	261	133	-49	527
	0.80	1.40	342976	0.20	98	654	261	103	-61	567
	0.90	1.58	342976	0.20	98	685	261	79	-70	599
	1.00	1.76	342976	0.20	98	710	261	60	-77	624

Source: elaborated by the author.

Technical discussion on management measures

Scope	Main area of distribution of blackspot seabream in the Strait of Gibraltar (subsection of GSAs 1–3)
Species	Blackspot seabream
Sectors	All commercial fleets involved (Spain and Morocco). Also recreational fisheries when targeting this resource
Gear	Longlines and handlines
General objective	Maintain F for blackspot seabream within agreed precautionary reference points in order to reach and maintain as soon as possible a fishing mortality level consistent with the MSY.
Duration	8 years
Transitional period	3 years
Long-term measures	All transitional period measures that have worked and others based on advice of scientists and the SAC
General comments	During the transition period, current measures should continue to be implemented, while work shall be undertaken to identify additional measures for the long time period

Existing management measures: Recommendation GFCM/44/2021/4

Category	Management measure	European Union–Spain	Morocco	Development	Notes
Catch restrictions	Maintain catches at the average level exerted in 2010–2015	Adopted		Catch limit for the long term management to be defined, taking into account most recent best available scientific advice	
Effort restrictions	Decrease effort by 20 percent of that exerted in 2010–2015 except those contracting parties and cooperating non-contracting parties (CPCs) have already reduced their fishing effort by more than 20 percent	Adopted	Adopted	Further discussions are needed to agree on a common effort reduction	
Technical measures	Minimum conservation reference size of 30 cm with flexibility of 10 percent expressed in volume or numbers. Encourage fishers to release into the sea unharmed animals smaller than the size	Adopted (33 cm)	Adopted (30 cm) with flexibility of 10 percent expressed in numbers	Further discussions are needed to agree on a common size	
Fleet management	Each CPC shall establish a register of the fishing vessels authorized to catch blackspot seabream with longlines and handlines.	Adopted	Adopted		
Monitoring, control and surveillance	All vessels above 12 m length overall authorized to catch blackspot seabream under the scope of this recommendation shall be equipped with a vessel monitoring system (VMS) or any other geolocation system allowing control authorities to track their activity at all times during the fishing trips.	Adopted	Adopted		

Category	Management measure	European Union–Spain	Morocco	Development	Notes
Control and enforcement	Each CPC shall designate ports in which to land blackspot seabream under the scope of this recommendation. Update of this list should be provided to the GFCM Secretariat no later than 28 or 29 February of each year	Adopted			
Control and enforcement	Prior notification at least four hours before arrival: a) estimated time of arrival; b) external identification number and name of the fishing vessel; and c) estimated live weight retained on board	Adopted	Adopted		
Control and enforcement	Each CPC shall establish a mechanism to ensure that vessels actively fishing blackspot seabream declare all commercial blackspot seabream daily catches and bycatch, irrespective of the live weight of the catch. CPCs shall also endeavour to record or estimate recreational catch.	Adopted	Adopted		
Control and enforcement	Each CPC shall establish a programme based on risk analysis, in particular to verify the landings and validate the logbooks.	Adopted	Adopted		
Control and enforcement	It shall be prohibited to transship blackspot seabream at sea	Adopted	Adopted		

Existing management measures: additional national measures

	European Union–Spain	Morocco	Notes
Technical measures	Technical characteristics of the authorized fishing gear Ministerial Order AAA/1589/2012, of 17 July, establishes a regulation for the fisheries of blackspot seabream (*Pagellus bogaraveo*) with the gear of *voracera* in the Strait of Gibraltar, amended by Ministerial Order AAA/55/2016, of 26th January		
Effort management	Close census of fishing vessels with historical records of catches Ministerial Order AAA/1589/2012, of 17 July, establishes a regulation for the fisheries of blackspot seabream (*Pagellus bogaraveo*) with the gear of *voracera* in the Strait of Gibraltar, amended by Ministerial Order AAA/55/2016, of 26 January		
Effort management	Maximum number of fishing days/year/vessel (180), five days authorised per week, with a non-fishing period of 48 continuous hours. Ministerial Order AAA/1589/2012, of 17th July, establishes a regulation for the fisheries of blackspot seabream (*Pagellus bogaraveo*) with the gear of *voracera* in the Strait of Gibraltar, amended by Ministerial Order AAA/55/2016, of 26th January		
Minimum conservation reference size	Ministerial Order APA/24/2021, of 19 January, that establishes specific control measures for landings of blackspot seabream (*Pagellus bogaraveo*) caught with longliners, *voracera* and handlines in Alboran Sea and area regulated by Order AAA/1589/2012, of 17 July establishes new requirements of Recommendation GFCM/43/2019/2 for vessel authorizations, designated ports, previous notification, catch records and landing declarations, VMS or geolocation systems for vessels > 12m	Minimum landing size (30 m). Arrêté du ministère de l'Agriculture, de la pêche maritime, du développement rural et des eaux et forêts n 2191-20 du 20 hija 1441 (10 aout 2020) modifiant et complétant l'arrête n 1154-88 du 20 safar 1409 (3 octobre 1988) fixant la taille marchande minimale des espèces pêchés dans les eaux maritimes marocaines	

Additional potential measures to be included in the management plan

	Recommendations by previous SRC-WM	European Union–Spain	Morocco		Notes
Spatial-temporal restrictions	Areas of juvenile aggregations and the best period according to the biological cycle of the species will be investigated to propose potential spatio-temporal closures	Work in progress	Work in progress	To be discussed and incorporated in the long-term management plan	Discuss the areas to be protected for juveniles and agree on a common temporal restriction to protect spawning period
Catch restrictions	Fishing quota	Adopted by European Union–Spain, to be revised by both parties	Work in progress		A transitional catch limit, without prejudice to the long term-allocation key
Gear restrictions			Work in progress		Regulate the number and size of the hooks
Reduction of fishing capacity					
Measures to address recreational fisheries			Recreational fishing is negligible in Morocco		To be discussed
Control and enforcement					Maintain existing measures and discuss new measures if appropriate
Scientific monitoring					
Working group					To analyse and define the management scenarios
Update minimum conservation reference size					To be discussed

Appendix 5/C

Updated technical elements for the management of the demersal fishery in the Strait of Sicily

Scope of the management plan

The management plan should cover the Strait of Sicily – geographical subareas (GSAs) 12, 13, 14, 15 and 16.

The plan should address, possibly, all fishing activities, including recreational fisheries.

The plan should include European hake (*Merluccius merluccius*), deep-water rose shrimp (*Parapenaeus longirostris*), red mullet (*Mullus barbatus*), striped red mullet (*Mullus surmuletus*) and Norway lobster (*Nephrops norvegicus*).

The plan should last 8 years and envisage to be rolled out in a stepwise manner starting with a transitional period (2–3 years) during which at least all existing efficient measures should be implemented while gathering scientific support and information towards the identification of long-term adaptive management measures based on the best available annual scientific advice on the evolution of the state of resources and fisheries.

Updated status of demersal stocks in the Strait of Sicily

GSA	Species	Ref. year	Method	Current levels	Reference points	Quantitative status	Stock status	Scientific advice
12, 13, 14, 15, 16	*Merluccius merluccius*	2020	ss3*	Fc = 0.36, Bc = 4885	Fmsy = 0.29, Bmsy = 7021	F/Fref = 1.24, B/Btarget = 0.7	Overexploited and in overexploitation	Immediate action to ensure reduction in fishing mortality
12, 13, 14, 15, 16	*Parapenaeus longirostris*	2020	XSA	Fc = 1.13, Bc = 10102	F0.1 = 0.84	F/Fref = 1.34	In overexploitation with relatively low biomass	Reduce fishing mortality
12, 13, 14	*Mullus barbatus*	2020	XSA*	Fc = 1.47, Bc = 2518	F0.1 = 0.47	F/Fref = 3.13	In overexploitation, with relatively high biomass	Reduce fishing mortality
15	*Mullus barbatus*	2020	XSA*	Fc = 0.54, Bc = 25	F0.1 = 0.295	F/Fref = 1.83	In overexploitation, with relatively low biomass	Reduce fishing mortality
16	*Mullus barbatus*	2020	XSA*	Fc = 0.31, Bc = 1916	F0.1 = 0.42	F/Fref = 0.74	Sustainably exploited, with relatively intermediate biomass	Not increase fishing mortality
15, 16	*Mullus surmuletus*	2012	XSA, Y/R	Fc = 0.78	F0.1 = 0.19	F/Fref = 4.1	In overexploitation	Reduce fishing mortality
15, 16	*Nephrops norvegicus*	2012	a4a	Fc = 0.15	F0.1 = 0.2	F/Fref = 0.7	Sustainably exploited	Not increase fishing mortality

Objectives

Following Decision GFCM/36/2012 on guidelines on a general management framework and presentation of scientific information for multiannual management plans for sustainable fisheries in the GFCM area of application, the regional plan should consider *inter alia* the following options:

- maintain and/or to restore, to the extent possible, the stock size of harvested species at least at levels which can produce the maximum sustainable yield;

- reduce fishing mortality (effort regime, catch limits);
- increase spatio-temporal protection measures;
- guarantee a low risk of stocks falling outside safe biological limits;
- ensure protection of biodiversity to avoid undermining ecosystem structure and functioning; and
- eradicate illegal, unreported, unregulated (IUU) fishing, through an adequate governance system, including fishing authorization system and a reporting scheme of catches and discards.

Operational objectives

The plan should define, for each agreed objective, specific operational objectives that have practical interpretation, can clearly describe expected outcomes and can be measured with indicators. For example, the following operational objectives could be applied:

- maintain the biomass of target species above agreed precautionary biological reference points ($B > B_{pa}$ and $F < F_{ref}$);
- maintain indicators of stock status and fishing pressure (according to the table on alternative indicators and reference points) at levels which ensure the sustainability of the fishery;
- control fishing mortality (F) through the application of quantities (of effort and/or catch) determined on the basis of annual scientific advice. It could be a combination of fishing effort regime and catch limits;
- establish a fleet registry of active vessels; and
- decrease discards of commercial and non-commercial species, by means of technical measures.

However, these operative objectives can be adapted in the future to accommodate any additional scientific evidence provided.

Indicators and reference points

When analytical assessments are available, regular (annual) scientific advice should be provided, based, if possible, on both indicators of biomass and exploitation, and for each indicator, ideally target, threshold and limit (e.g. Ftgt, Fthr, Flim) reference points should be defined. When only one indicator is available, there should be clear advice to explore the possibility of having indicators for both biomass and exploitation.

In situations where stock biomass is used as indicator of status of the stock, the following reference points could be used:

- B_{lim}: a biomass level which is considered undesirable and which management actions should avoid with high probability;
- B_{pa}: a threshold level of biomass established to reduce the probability that the limit reference point will be exceeded; and
- B_{msy}: as a target reference point.

In situations where F is used as an indicator of fishing pressure, F0.1 (defined as the F rate at which the slope of the yield-per-recruit curve is only one-tenth the slope of the curve at its origin) can be used as a proxy for FMSY. If possible, F0.1 should be complemented with an additional estimate of Flim (e.g. from an independent Blim estimate) and Fthr should be defined in relation to Flim. In that case

FMSY will be considered as a target. Alternatively, if only F0.1 is available, it will be considered as Funique.

For species/GSAs covered by the management plan without analytical assessments and/or reference points, efforts should be made to have those analytical assessments and adequate reference points as soon as possible. The following indicators and reference points could be used in the meantime.

Indicator of stock abundance*	**Reference point**
Standardized index from scientific surveys (when available)	- Historical level - Trend (e.g. increase by x percent per year)
Standardized catch per unit effort data from the fishery, taking into account changes in exploitation pattern, in catchability and availability of the resource.	- Historical level - Trend (e.g. increase by x percent per year)
Indicator of stock status	**Reference point**
Mean body size in the catch (CL), assuming that selectivity pattern is kept constant and data are comparable from year to year.	CL > CLm; CLm = minimum conservation size
Indicator of fishing pressure	**Reference point**
Fleet size (by operational units as defined by GFCM Task 1)	- Historical level - Trend (e.g. decrease by x percent per year)
Fishing effort (accounting for capacity and activity, including vessel tonnage, power and days at sea)	- Optimal effort to reach maximum sustainable yield - Historical level - Trend (e.g. decrease by x percent per year)

Concerning the objective of ensure protection of biodiversity to avoid undermining ecosystem's structure and functioning, the following indicators and references points could be used:

Indicator	**Reference point**
Discard rate (percent)	- Historical - Trend (percent change over time)
Bycatch of protected/endangered species	- Historical - Trend (percent change over time)
Area of sensitive habitats under protection	- Historical - Trend (percent change over time)

Fisheries management measures

The management plan should include a first transitional period (2–3 years) during which at least all existing efficient measures should be implemented while gathering scientific support and information towards the identification of long-term adaptive management measures based on annual future advice on the evolution of the state of resources and fisheries.

In order to reach the objectives of the management plan, and without prejudice to stricter measures adopted nationally, countries should consider the management measures for demersal fisheries in the Strait of Sicily contained in Table 1. The table provides additional information of the issues identified for each measure, as well as implementation requirements, future developments and salient notes.

Decision rules

The management plan will include decision rules with pre-agreed measures to be adopted under different conditions of the stock in relation to agreed biological reference points. The specific technical measures to be adopted under each stock status scenario are to be defined in appropriate national and sub-regional working groups, taking into account the socioeconomic impacts of the proposed measures.

Scientific monitoring

The GFCM Scientific Advisory Committee on Fisheries (SAC) should be responsible for providing regular advice on status of stocks and economic indicators of fisheries, as well as for advice on alternative management measures under the hat of the WGMSE according to the terms of reference endorsed by the GFCM at its forty-fourth session (online, November 2021).

Adequate and periodic scientific monitoring of fisheries (including socioeconomic indicators) and exploited stocks at national level should be ensured so that the SAC will be in a position to provide scientific advice.

Research priorities to improve the assessment and management of fisheries

The list of research priorities should be organized based on the measures implemented:

- Identify minimum conservation reference size (MCRS) by species and subregion during the transitional period in the context of Resolution GFCM/44/2021/2 on the definition of a minimum conservation reference size for priority stocks in the Mediterranean Sea to be then applied in the long term plan for all species covered.

- Conduct research towards the identification of new fisheries restricted areas (FRAs) and/or expansion of existing FRAs (e.g. east of Adventure bank), including the continuation of existing surveys-at-sea as well as the monitoring of new areas (e.g. the shelf and slopes at the borders of the Malta plateau). In particular, the continuation of the scientific surveys in GSAs 12, 13 and 14 towards confirming European hake nursery areas – the Gulf of Hammamet and the Gulf of Tunis – as potential temporary or permanent FRAs.

- Continue efforts to map vulnerable marine ecosystems (VMEs) towards their protection for trawling.

- Assess whether the ban on fishing within established and new FRAs could be applied to longliners and gillnets.

- Increase the understanding of the spawning and recruitment periods and peaks of relevant species towards aiding the determination of appropriate spatiotemporal measures, through an analysis of all available information: fishery independent (surveys-at-sea) and fishery-dependent – Data Collection Framework (DCF) / Data Collection Reference Framework (DCRF), including biological sampling – as well as from the scientific literature.

- Implement the pilot project on selectivity in the Strait of Sicily.

- Assess the socioeconomic impact of the management plan (the assessment of socioeconomic impact of the proposed management measures should be carried out prior to and during the implementation of the management plan).

- Improve the assessment of the status of associated species taking into account the multi-species characteristics of the fisheries.

- Advance in the application of the assessment of alternative management measures, including socioeconomic aspects

Fisheries monitoring, control and surveillance

To ensure compliance with the measures to be adopted in the management plan, the following actions are to be implemented:

- Establish a permanent international inspection scheme.

- Concerned parties should make efforts to implement GFCM recommendations related to monitoring, control and surveillance (MCS), including those listed below:

    - vessel information submitted to GFCM Regional Fleet Register;

    - record of fishing vessels larger than 15 m authorized to fish in the GFCM area of application;

    - satellite-based vessel monitoring system (VMS) required for vessels > 15 meters authorized to fish in the GFCM area of application;

    - required submission of data on vessels engaged in IUU fishing (IUU Vessel List); and

    - required logbook for vessels exceeding 15 m authorized to fish in GFCM area of application. Logbook shall register quantities of each species caught and kept on board, above 50 kg in live weight.

- Strengthen national capacities for fisheries MCS.

- Concerned parties are responsible for implementing the adopted management measures in their jurisdictional waters and by vessels flying their flag beyond national jurisdiction.

- Develop a specific mechanism for MCS in areas beyond national jurisdictions covered by the management plan.

- Improve the collection of fisheries statistical data, including social and economic data.

Revision of the plan

The status of European hake, deep water rose shrimp and red mullet stocks in the Strait of Sicily shall be evaluated annually maintaining as much as possible the same methodology and relative settings, and benchmark assessments revising stock assessment methods and input data shall be performed every three years. For Norway lobster and striped red mullet, assessments shall be developed in view of having consolidated advice on stock status at the end of the transitional period towards a yearly assessment thereafter.

The contents of the management plans should be periodically reviewed in order to accommodate changes in the fisheries system. Comprehensive roadmaps will be provided by the SAC for the assessment and management of the fishery.

<u>To be done by concerned parties</u>

Management action should be taken based on stock status and fishery conditions (socioeconomic indicators) and according to the decision rules and management tools described.

Table 1. Appraisal of management measures for the management of the demersal fishery in the Strait of Sicily

DESIGN OF THE MANAGEMENT PLAN	
Scope	GSAs 12, 13, 14, 15, 16
Species	European hake, deep-water rose shrimp, red mullet, striped red mullet and Norway lobster
Sectors	Commercial fishing and recreational fisheries
Gear	Bottom otter trawls; for the long-term measures also longliners and gillnets
General objective	Maximum sustainable yield
Duration	8 years
Transitional period	2–3 years
Long-term measures	All transitional period measures that have worked and others based on advice of scientists and the SAC
General comments	Retain all current management measures considered effective.

Source: elaborated by the author.

Category	Management measure	Issues	Implementation	Development	Notes
Effort/catch control	Establishment of an effort regime and/or catch limits	There is a phenomenon of hyperstability in the relationship between effort and F driven by increased catchability over time and the accuracy of effort data and this is why measures based on fishing effort may require drastic changes (reduction) because in order to have a nominal reduction in F you need to have a dramatic decrease in effort. An effort regime should be implemented in combination with other measures. Catch limits are a solution to be evaluated at the technical level because of the multispecies nature of the fishery.	The key mechanism to control F with yearly quantities determined on the basis of annual scientific advice. It could be a combination of fishing effort regime and catch limits – to be reflected upon. For effort there is a need to plan on the key measure to control (capacity, number of days at sea, engine power). The effort regime is a good tool and should be very specific considering gear and fleet segments; to be implemented in combination with other measures (FRAs, improved selectivity and MCRS).	Reflect on how to regulate the effort for longliners and netters: could be regulated in terms of declaring a priori where they fish, e.g. bottom longliners fish deep for hake in some seasons (spring for maybe two months in spawning aggregations of hake); could establish a limit on capacity and then refine measures; investigate the option of catch limits for certain species (e.g. deep-water rose shrimp fishery is dominated by deep-water rose shrimp and catch limits could be evaluated using scientific data on this fishery)	In the western Mediterranean, the effort regime is combined with other measures and recently with a catch limit on deep-water red shrimp comprising a multiannual management plan adopting a mixed approach for the reduction of F. What is better also depends on the specific characteristics of the fleet and the target species.
Fishing capacity			Each CPC should ensure the balance between fishing capacity and fishing opportunities; in the transitional period there should be a freeze the fishing capacity	There should be the possibility for development plans for new fisheries to be validated by the SAC and endorsed by GFCM. The CPCs can use the proposed minimum elements for guiding the preparation of national fleet development plans for the deep-water red shrimp fisheries endorsed by the twenty-first SAC as a guide	

Category	Management measure	Issues	Implementation	Development	Notes
Technical measures	MCRS		In combination with other measures: selectivity improvement, FRAs	Reflection needed on MCRS by species and subregion during the transitional period in the context of Resolution GFCM/44/2021/2 to be then applied in the long-term plan for all species covered	Current MCRS: European hake in GFCM area of application: 20 cm TL; deep-water rose shrimp in European Union: 20 mm CL; red mullet in European Union: 11 cm TL. Reflection needed for European hake regarding the basis for the establishment of the MCRS depending on the selectivity of the gear exploiting it (Reproduction-based: size at first maturity, range L25–L50; critical size based on highest catch at size)
	Improvement of selectivity		In combination with other measures: effort/catch limits, FRAs, MCRS	Pending the results of the pilot project	
Spatial restrictions	Existing FRAs		In combination with other measures: effort reduction, MCRS and selectivity improvement	Assess whether the ban on fishing within the FRA could be applied to longliners and gillnets	Need to identify new nursery areas based on MEDITS: Gulf of Hammamet, Gulf of Tunis.
	Existing FRAs			Investigate whether the east of Adventure Bank FRA can be expanded to include the spawning aggregations; implement scientific	

Category	Management measure	Issues	Implementation	Development	Notes
				monitoring plans in the northern FRAs	
	New FRAs to protect European hake nursery areas	Nurseries potentially identified in the Gulf of Tunis and the Gulf of Hammamet but additional surveys are needed in GSAs 12, 13 and 14 in 2022 to confirm the persistency of the juvenile aggregations. This will allow to also delimit the areas and decide on the timing (permanent vs temporal) in the future		Possibility of testing spatiotemporal closures (e.g. for three months during the recruitment peak) in some of these areas as a means to test the measure in view of the establishment of long term measures; assess whether the restriction could be applied to longliners and gillnets; roadmap should be developed to identify permanent FRAs to protect essential fish habitats and VMEs especially in the southern Strait of Sicily	Need to understand recruitment dynamics in terms of peaks of recruitment; need to continue surveys and also use information from literature, DCF/DCRF (including biological sampling) to determine the spawning peaks.
	Foresee buffer areas for FRAs				
	Identify areas where discards of European hake and/or deep-water rose shrimp below the MCRS or juveniles are high.				

Category	Management measure	Issues	Implementation	Development	Notes
Spatiotemporal restrictions	Temporal FRA in Mammellone bank	The Mammellone bank is already protected at national level and has issues related to IUU which should be solved			
Temporal restriction	Ban on fixed gear in spawning period to protect large hake	Need to determine whether there is enough information on the spawning peak			
	Ban on bottom trawl fisheries between the coast and the 200 m depth isobath in GSA 14 (Gulf of Gabès). Applicable every year 1 July – 30 September.				
Control	Fishing authorization			Reflect on whether these should be foreseen for other gear as well; reinforce sanctions as infringements of temporal and spatial measures are considered IUU and they should foresee the return to port; there is a need to reflect in depth on the impact of foreign fleets in the Strait of Sicily	

Category	Management measure	Issues	Implementation	Development	Notes
	Mechanism to ensure authorized vessels record all their catches of European hake and/or deep-water rose shrimp				
	Designate landing ports and for each the permitted landing and transhipping times and places				
	Ensure inspection coverage during all landing and transhipping times and at all landing and transhipping places.				
	The CPCs engage to cooperate on the fight against IUU, in particular through sharing information and gathering intelligence to				

Category	Management measure	Issues	Implementation	Development	Notes
	fight against IUU fishing activities and organized crime				
	VMS	It is extremely important that functioning VMS is carried by all		Implement a pilot project for the centralization of data concerning VMS in relation to FRAs in the Strait of Sicily (Compliance Committee)	
	Inspection scheme			The international inspection scheme – Recommendation GFCM/41/2017/8 on an international joint inspection and surveillance scheme outside the water under national jurisdiction in the Strait of Sicily (geographical subareas 12 to 16) – currently in place should become permanent and linked to the new management plan	
Adaptive management	Scientific monitoring to define alternative additional measures to be included in the long-term plan				

Appendix 5/D

Updated technical elements for the management of bottom trawling fisheries for deep-water red shrimps (*Aristaeomorpha foliacea* and *Aristeus antennatus*) in the central–eastern Mediterranean (geographical subareas 12–16; 19–27)

Scope of the management plan

The management plans should cover the Strait of Sicily – geographical subareas (GSAs) 12, 13, 14, 15 and 16 – and the Ionian Sea – GSAs 19, 20 and 21.

The plan should address commercial fisheries.

The plan should include blue and red shrimp (*Aristeus antennatus*) and giant red shrimp (*Aristaeomorpha foliacea*).

The plan should last 8 years and envisage to be rolled out in a stepwise manner starting with a transitional period (2–3 years) during which at least all existing efficient measures should be implemented while gathering scientific support and information towards the identification of long-term adaptive management measures based on future advice on the evolution of the state of resources and fisheries.

Updated status of deep-water red shrimp stocks in the Strait of Sicily and the Ionian Sea

GSA	Species	Ref. year	Method	Current levels	Reference points	Quantitative status	Stock status	Scientific advice
18,19	*Aristaeomorpha foliacea*	2020	a4a	Fc = 0.62 Bc = 285	F0.1 = 0.45	F/Fref = 1.38	In overexploitation, with relatively intermediate biomass	Reduce fishing mortality
18,19	*Aristeus antennatus*	2020	XSA*, a4a, SPiCT				In overexploitation (qualitative advice)	Reduce fishing mortality
12–16, 21	*Aristaeomorpha foliacea*	2020	AMSY, BSM, JABBA				In overexploitation and overexploited (qualitative advice)	Reduce fishing mortality

Objectives

Following Decision GFCM/36/2012 on guidelines on a general management framework and presentation of scientific information for multiannual management plans for sustainable fisheries in the GFCM area of application, and in line with the proposals of the Working Group on Vulnerable Marine Ecosystems (WGVME), the regional plan should consider *inter alia* the following options:

- maintain and/or restore, to the extent possible, the stock size of harvested species at least at levels which can produce the maximum sustainable yield;
- reduce fishing mortality (catch limits);

- increase spatio-temporal protection measures;

- ensure protection of biodiversity to avoid undermining ecosystem structure and functioning; and

- eradicate illegal, unreported, unregulated (IUU) fishing, through an adequate governance system, including fishing authorization system and a reporting scheme of catches and discards.

Operational objectives

The plan should define, for each agreed objective, specific operational objectives that have practical interpretation, can clearly describe expected outcomes and can be measured with indicators. For example, in relation to the objective of "guarantee a low risk of stocks falling outside safe biological limits" the following operational objectives could be applied:

- maintain the biomass of target species above agreed precautionary biological reference points ($B > B_{pa}$ and $F < F_{0.1}$);

- maintain indicators of stock status and fishing pressure (according to the table on alternative indicators and reference points) at levels which ensure the sustainability of the fishery; and

- introduce minimum conservation reference size (MCRS) for the two species.

In relation to the objective of ensuring protection of biodiversity to avoid undermining the ecosystem's structure and functioning, the following operational objectives could be applied:

- establish a fleet registry of active vessels;

- map historical fishing footprint and the overlap with vulnerable marine ecosystems (VMEs) following the recommendations of the Working Group on Vulnerable Marine Ecosystems and Essential Fish Habitats (WGVME-EFH) in 2022;

- decrease discards of commercial and non-commercial species, by means of technical measures; and

- prevent significant adverse impacts of bottom trawling fisheries by minimizing their overlap with sensitive habitats and VMEs.

However, these operative objectives can be adapted in the future to accommodate any additional scientific evidence provided.

Indicators and reference points

When the analytical assessments are available, the advice should be based, if possible, on both indicators of biomass and exploitation, and for each indicator ideally target, threshold and limit (e.g. Ftgt, Fthr, Flim) reference points should be defined. When only one indicator is available, there should be clear advice to explore the possibility of having indicators for both biomass and exploitation.

In situations where stock biomass is used as indicator of status of the stock, the following reference points could be used:

- B_{lim}: a biomass level which is considered undesirable and which management actions should avoid with high probability;

- B_{pa}: a threshold level of biomass established to reduce the probability that the limit reference point will be exceeded; and

- Bmsy: as a possible target reference point.

In situations where fishing mortality (F) is used as an indicator of fishing pressure, F0.1 (defined as the F rate at which the slope of the yield-per-recruit curve is only one-tenth the slope of the curve at its origin) can be used as a proxy for FMSY. If possible, F0.1 should be complemented with an additional estimate of Flim (e.g. from an independent Blim estimate) and Fthr should be defined in relation to Flim. In that case FMSY will be considered as a target. Alternatively, if only F0.1 is available, it will be considered as Funique.

Pending the availability of stock biomass and F estimates, and the identification of appropriate reference points for some species/GSAs, the following indicators and reference points could be used.

Indicator of stock abundance*	**Reference point**
Standardized index from scientific surveys (when available)	- Historical level - Trend (e.g. increase by x% per year)
Standardized catch per unit effort (CPUE) data from the fishery, taking into account changes in exploitation pattern, in catchability and availability of the resource	- Historical level - Trend (e.g. increase by x% per year)
Indicator of stock status	**Reference point**
Mean body size in the catch (CL), assuming that selectivity pattern is kept constant and data are comparable from year to year	- CL > CLm; CLm = minimum conservation size
Indicator of fishing pressure	**Reference point**
Fleet size (by operational units as defined by GFCM Task 1)	- Historical level - Trend (e.g. decrease by x% per year)
Fishing effort (accounting for capacity and activity, including vessel tonnage, power and days at sea)	- Optimal effort to reach maximum sustainable yield (MSY) - Historical level - Trend (e.g. decrease by x% per year)

Concerning the objective of ensure protection of biodiversity to avoid undermining ecosystem's structure and functioning, the following indicators and references points could be used:

Indicator	**Reference point**
Discard rate (percent)	- Historical - Trend (percent change over time)
Bycatch of protected/endangered species	- Historical - Trend (percent change over time)
Area of sensitive habitats under protection	- Historical - Trend (percent change over time)

Fisheries management measures

The management plan should include a first transitional period (2–3 years) during which at least all existing measures should be implemented while gathering scientific support and information towards the identification of long-term adaptive management measures based on future advice on the evolution of the state of resources and fisheries.

In order to reach the objectives of the management plan, and without prejudice to stricter measures adopted nationally, countries should consider the management measures for deep-water red shrimp in the Strait of Sicily and the Ionian Sea contained in Table 1. The table provides additional information of the issues identified for each measure, as well as implementation requirements, future developments and salient notes.

Decision rules

The management plan will include decision rules with pre-agreed measures to be adopted under different conditions of the stock in relation to agreed biological reference points. The specific technical measures to be adopted under each stock status scenarios are to be defined in appropriate national and sub-regional working groups, taking into account the socioeconomic impacts of the proposed measures.

Scientific monitoring

The Scientific Advisory Committee on Fisheries (SAC) of the GFCM should be responsible for regular (annual) advice on status of stocks and economic indicators of fisheries, as well as for advice on alternative management measures under the hat of the WGMSE according to the terms of reference endorsed by the forty-fourth annual session of the GFCM (online, November 2021).

Adequate and periodic scientific monitoring of fisheries (including socioeconomic indicators) and exploited stocks at national level should be ensured so that the SAC will be in a position to provide scientific advice.

Research priorities to improve the assessment and management of fisheries

Urgent data requirements to be provided by contracting parties and cooperating non-contracting parties (CPCs)

To be made available by the meeting in July 2022:

- vessel monitoring system (VMS) data;
- electronic reporting system (ERS); and
- logbooks.

The list of research priorities should be organized based on the measures implemented:

- provision of quantitative advice on the status of the stocks;
- quantification of catches by their GSA of origin making use of all available information provided by CPCs (logbooks, ERS, VMS);
- mapping of the fishing footprint, based on the previously exploited areas making use of an array of data sources including principally VMS but also automatic identification system (AIS) and satellite information;
- update of MEDISEH models on spawning and juvenile aggregations using new data (already carried out for GSA 19);
- development and implementation of a pilot project on the selectivity of deep-water red shrimp;
- investigation of the drivers of the increase in the catch of juveniles: stock-related or market-related;
- work during the transitional period on the overlap between deep-water red shrimp fisheries and VMEs according to the roadmap endorsed by the twenty-second session of the SAC (online, June 2021) and updated by the WGVME-EFH 2022 towards establishing protection areas;
- collection of scientific background that would allow the determination of a minimum conservation reference size for each of the species, by adding the two species to the list of species covered by Resolution GFCM/44/2021/2 on the definition of a minimum conservation reference size for priority stocks in the Mediterranean Sea;
- assessment of the biological, economic and social implications of implementing several management scenarios to restore or maintain the species population above levels that can produce MSY and towards evaluating the effectiveness of the measures already applied; and
- investigation into a catch documentation scheme.

Fisheries monitoring, control and surveillance

To ensure compliance with the measures to be adopted in the management plan, the following actions are to be implemented:

- Establish a permanent international inspection scheme extending the current international inspection scheme for the Strait of Sicily demersal fishery to the Strait of Sicily deep-water red

shrimp fishery and developing a new ad hoc international inspection scheme for the deep-water red shrimp fishery in Ionian Sea.

- Concerned parties should make efforts to implement GFCM recommendations related to monitoring, control and surveillance (MCS), including those listed below:
    - vessel information submitted to GFCM regional fleet register;
    - record of fishing vessels authorized to fish the key species;
    - satellite-based VMS required for vessels > 10 m;
    - required submission of data on vessels engaged in IUU fishing (IUU vessel list); and
    - required logbook for vessels exceeding 15 m authorized to fish in the GFCM area of application; logbook shall register quantities of each species caught and kept on board, above 50 kg in live weight.
- strengthen national capacities for fisheries MCS;
- concerned parties are responsible for implementing the adopted management measures in their jurisdictional waters and by vessels flying their flag beyond national jurisdiction;
- develop a specific mechanism for MCS in areas beyond national jurisdictions covered by the management plan; and
- improve the collection of fisheries statistical data, including social and economic data.

Review of the management plan

The status of giant red shrimp and blue and red shrimp stocks in the Strait of Sicily and the Ionian Sea shall be evaluated annually maintaining as much as possible the same methodology and relative settings, and benchmark assessments revising stock assessment methods and input data shall be performed every three years.

The contents of the management plans should be periodically reviewed in order to accommodate changes in the fisheries system. Comprehensive roadmaps will be provided by the SAC for the assessment and management of the fishery.

<u>To be done by concerned parties</u>

Management action taken based on stock status and fishery conditions (socioeconomic indicators) and according to the decision rules and management tools described**.**

Table 1. Appraisal of management measures for the management of bottom trawling fisheries for deep-water red shrimps (*Aristaeomorpha foliacea* and *Aristeus antennatus*) in the Strait of Sicily (GSAs 12, 13, 14, 15 and 16) and the Ionian Sea (GSAs 19, 20 and 21)

DESIGN OF THE MANAGEMENT PLAN		
	Strait of Sicily	**Ionian Sea**
Scope	GSAs 12, 13, 14, 15 and 16	GSAs 19, 20 and 21
Species	*Aristeus antennatus* and *Aristaeomorpha foliacea*	*Aristeus antennatus* and *Aristaeomorpha foliacea*
Sectors	Commercial	Commercial
Gear	Bottom otter trawl	Bottom otter trawl
General objective	MSY in a given timeframe	MSY in a given timeframe
Duration	8 years	8 years
Transitional period	2–3 years	2–3 years
Long-term measures	All transitional period measures that have worked and others based on advice of scientists and the SAC.	All transitional period measures that have worked and others based on advice of scientists and the SAC.
General comments	Annual advice linked to a mechanism to manage F with catch limits	Annual advice linked to a mechanism to manage F with catch limits
	Retain all current management measures considered effective.	Retain all current management measures considered effective.

Source: elaborated by the author.

Category	Management measure	Issues	Implementation	Development	Notes
Map operational objective	Maintain F for key species within agreed precautionary reference points, with a view to achieving or maintaining fishing mortality at MSY level		Need to identify a timeline for reaching MSY		
Reduction of fishing mortality	Catch limits			Considering the fishery is targeted it could be a good candidate for catch limits	Experience in the western Mediterranean MAP that has a specific catch limit for deep-water red shrimp, based on simulations using scenarios of catch limits and not only fishing effort
Scientific monitoring	The CPCs and the SAC shall facilitate the collation of existing relevant data and the collection of additional relevant data (including research survey data) and organise adequate workshops	Crucial aspect for these fleets based on instruments that national administrations have in place to monitor fleets and catches (VMS, ERS and logbook information) not currently available	The origin of catches to be determined on the basis of urgently required data from CPCs through CFP (VMS, ERS, logbooks)		To be made available for the meeting in July?
Fleet management	Lists of authorised vessels actively fishing for the key species				
	Fishing capacity		Each CPC should ensure the balance between fishing capacity and fishing opportunities; in the transitional period there should be a freeze the fishing capacity	There should be the possibility for development plans for new fisheries to be validated by the SAC and endorsed by the GFCM. The CPCs can use the proposed minimum elements for guiding the preparation of national fleet development plans for the deep-water red shrimp fisheries endorsed by	

Category	Management measure	Issues	Implementation	Development	Notes
				the twenty-first SAC as a guide	
	Improvement of fishing pattern			Important to have maps of fishing grounds, the number of vessels in the fishing grounds towards improving the fishing pattern.	
Spatial restrictions	Spatial protection of nursery or spawning grounds	Decision to be taken on whether to protect spawning or juvenile aggregations in light of the fact that the fishing season is March-September	Fishing in interdicted areas should be considered IUU.	Develop and implement a pilot project on the selectivity of deep-water red shrimp.	
Spatiotemporal restrictions	Spatiotemporal restrictions for the protection of juveniles	More for *Aristaeomorpha foliacea* as juveniles of *Aristeus antennatus* are already protected by their depth distribution (work done by MEDISEH); Juveniles of *Aristaeomorpha foliacea* are mainly present in spring (April–May)	Fishing during interdicted periods should be considered IUU	Temporal restriction to fishing in November–April to protect juveniles	Advocated by fishers

Category	Management measure	Issues	Implementation	Development	Notes
	Protection of spawning grounds in the peak season		Fishing in interdicted areas and periods should be considered IUU.	Update the MEDISEH models: important spawning aggregations in the south of Malta in the Strait of Sicily and in GSA 19 for *Aristeus antennatus* and *Aristaeomorpha foliacea*, and for *Aristaeomorpha foliacea* these were very concentrated in south of Malta area and overlapping with *Aristeus antennatus*. Overlapping the two shows clear hotspots. This may indicate spatiotemporal measures for the summer period.	The update of MEDISEH is also being carried out for GSA 19 with more recent time series using the same model used in MEDISEH. Medunits project also identified cold and hot spots of overlap between species distribution and effort that can be very useful; protection of *Aristaeomorpha foliacea* spawners can also protect *Aristeus antennatus* juveniles.
Protection of VMEs	Implementation of allowed fishing grounds and strict rules or prohibition of exploratory fishing outside			Work during the transitional period on the overlap between deep-water red shrimp fisheries and VMEs according to the roadmap endorsed by the twenty-second SAC and updated by the WGVME-EFH 2022 towards establishing protection areas; trawling to be allowed in those fishing grounds previously established, based on the fishing footprint; fishing outside these established fishing grounds should adhere to strict exploratory fishing rules.	

Category	Management measure	Issues	Implementation	Development	Notes
Technical measures	Improvement of selectivity using grids to avoid catching juveniles	The number of categories of commercial catch has increased which means that the fishery has started targeting the smaller specimens (problem related to the stock? Or to the market?)		Towards an ecolabel to improve the value of products	
	MCRS for both species			Reflection needed on the determination of MCRS by species and subregion during the transitional period with a need to add *Aristaeomorpha foliacea* and *Aristeus antennatus* to the work requested to the SAC in the context of Resolution GFCM/44/2021/2	
Effort management	Communicate to the GFCM Secretariat the list of all their authorized vessels actively fishing for the key species				
	Any fishing vessel not included in the abovementioned list shall not be allowed to fish for, retain on board or land any quantity of the key species greater than 3 percent of the total live weight catch retained on board				

Category	Management measure	Issues	Implementation	Development	Notes
	Cap on fleet capacity or fishing effort at levels authorized and implemented during recent years for the exploitation in the Strait of Sicily of the key species				
	The CPCs shall promptly notify changes to authorized fishing fleets for key species.				
	Adequate mechanisms for the recording of each fishing vessel in a national fleet register, for the recording of vessel catches and fishing effort via the logbook and, remote sensing as well as for the monitoring of fishing vessel activities and landings via catch and effort sampling surveys				
IUU	The CPCs shall establish a mechanism to ensure that vessels actively fishing in the Ionian Sea declare all catches and bycatch of the key species, irrespective the volume of the catch.				
	The obligation to declare catches shall apply irrespective of the volume of the catch.				

Category	Management measure	Issues	Implementation	Development	Notes
	The CPCs shall communicate to the GFCM Secretariat a map of the fishing grounds exploited by their fishing vessels authorized to catch the key species. Such map shall be prepared using the VMS data transmitted to CPCs by their authorized vessels.			This is very relevant on having a VMS fully implemented in a database for all fleets. Very detailed VMS info should be available for both areas.	
	Designated landing points where the landings by vessels actively fishing for key species shall take place.				
	Permanent international inspection scheme		Extend the current international inspection scheme for the Strait of Sicily demersal fishery to the Strait of Sicily deep-water red shrimp fishery; develop a new ad hoc international inspection scheme for the deep-water red shrimp fishery in the Ionian Sea	Issue to be raised at the Compliance Committee to see if it is possible to duplicate or amend the current permanent scheme for the demersal fishery in the Strait of Sicily for the deep-water red shrimp fishery, including in the Ionian Sea	
MCS	All vessels above 10 m length overall actively fishing for the key species shall be equipped with VMS or any other geopositioning system allowing control authorities to track their activities.	A level playing field should be ensured.	All authorised vessels fishing for key species should be equipped with VMS.		
	All the catches of key species shall be indicated in the logbook irrespectively of the live weight of the catch.				

Appendix 5/E

Updated technical elements for the management of bottom trawling fisheries for deep-water red shrimps (*Aristaeomorpha foliacea and Aristeus antennatus*) in the Levant Sea (geographical subareas 24, 25, 26 and 27)

Scope of the management plan

The management plans should cover the Levant Sea – geographical subareas (GSAs) 24, 25, 26 and 27.

The plan should address commercial fisheries.

The plan should include blue and red shrimp (*Aristeus antennatus*) and giant red shrimp (*Aristaeomorpha foliacea*).

The plan should last 8 years and envisage to be rolled out in a stepwise manner starting with a transitional period (2–3 years) during which at least all existing efficient measures should be implemented while gathering scientific support and information towards the identification of long-term adaptive management measures based on future annual advice on the evolution of the state of resources and fisheries.

Updated status of deep-water red shrimp stocks in the Levant Sea

GSA	Species	Ref. year	Method	Current levels	Reference points	Quantitative status	Stock status	Scientific advice
26	*Aristaeomorpha foliacea*	2020	VIT, LBSPR	Preliminary, not validated, assessments consistently revealed both stocks to be in overexploitation.				
26	*Aristeus antennatus*	2020	VIT, LBSPR					

Objectives

Following Decision GFCM/36/2012 on guidelines on a general management framework and presentation of scientific information for multiannual management plans for sustainable fisheries in the GFCM area of application, and in line with the proposals of Working Group on Vulnerable Marine Ecosystems (WGVME), the regional plan should consider *inter alia* the following options:

- maintain and/or restore, to the extent possible, the stock size of harvested species at least at levels which can produce the maximum sustainable yield;
- reduce fishing mortality (effort regime in the transitional period working towards catch limits in the longer term);
- increase spatio-temporal protection measures;
- ensure protection of biodiversity to avoid undermining ecosystem structure and functioning; and
- eradicate illegal, unreported, unregulated (IUU), through an adequate governance system, including fishing authorization system and a reporting scheme of catches and discards.

Operational objectives

The plan should define, for each agreed objective, specific operational objectives that have practical interpretation, can clearly describe expected outcomes and can be measured with indicators. For example, in relation to the objective of "guarantee a low risk of stocks falling outside safe biological limits" the following operational objectives could be applied:

- Maintain the biomass of target species above agreed precautionary biological reference points ($B > B_{pa}$ and $F < F_{0.1}$).

- Maintain indicators of stock status and fishing pressure (according to the Table on alternative indicators and reference points) at levels which ensure the sustainability of the fishery.

- Introduce a minimum conservation reference size (MCRS) for the two species.

In relation to the objective of "ensuring protection of biodiversity to avoid undermining ecosystem's structure and functioning", the following operational objectives could be applied:

- Establish a fleet registry of active vessels.

- Map historical and potential fishing grounds and the overlap with vulnerable marine ecosystems (VMEs) following the recommendations of the Working Group on Vulnerable Marine Ecosystems and Essential Fish Habitats (WGVME-EFH) 2022.

- Decrease discards of commercial and non-commercial species, by means of the use of technical measures.

- Prevent significant adverse impacts of bottom trawling fisheries by minimizing their overlap with sensitive habitats and vulnerable marine ecosystems.

However, these operative objectives can be adapted in the future to accommodate any additional scientific evidence provided.

Indicators and reference points

When the analytical assessments are available, the advice should be based, if possible, on both indicators of biomass and exploitation, and for each indicator, ideally target, threshold and limit (e.g. Ftgt, Fthr, Flim) reference points should be defined. When only one indicator is available, there should be a clear advice to explore the possibility of having indicators for both biomass and exploitation.

In situations where stock biomass is used as indicator of status of the stock, the following reference points could be used:

- B_{lim}: a biomass level which is considered undesirable and which management actions should avoid with high probability;

- B_{pa}: a threshold level of biomass established to reduce the probability that the limit reference point will be exceeded; and

- Bmsy: as a possible target reference point.

In situations where fishing mortality (F) is used as an indicator of fishing pressure, F0.1 (defined as the F rate at which the slope of the yield-per-recruit curve is only one-tenth the slope of the curve at its origin) can be used as a proxy for FMSY. If possible F0.1 should be complemented with an additional estimate of Flim (e.g. from an independent Blim estimate) and Fthr should be defined in relation to

Flim. In that case FMSY will be considered as a target. Alternatively, if only F0.1 is available, it will be considered as Funique.

Pending the availability of stock biomass and F estimates and the identification of appropriate reference points for some species/GSAs, the following indicators and reference points could be used.

Indicator of stock abundance*	**Reference point**
Standardized index from scientific surveys (when available)	- Historical level - Trend (e.g. increase by x% per year)
Standardized catch per unit effort (CPUE) data from the fishery, taking into account changes in exploitation pattern, in catchability and availability of the resource	- Historical level - Trend (e.g. increase by x% per year)
Indicator of stock status	**Reference point**
Mean body size in the catch (CL), assuming that selectivity pattern is kept constant and data are comparable from year to year	- CL > CLm; CLm = minimum conservation size
Indicator of fishing pressure	**Reference point**
Fleet size (by operational units as defined by GFCM Task 1)	- Historical level - Trend (e.g. decrease by x% per year)
Fishing effort (accounting for capacity and activity, including vessel tonnage, power and days at sea)	- Optimal effort to reach maximum sustainable yield (MSY) - Historical level - Trend (e.g. decrease by x% per year)

Concerning the objective of ensure protection of biodiversity to avoid undermining ecosystem's structure and functioning, the following indicators and references points could be used:

Indicator	**Reference point**
Discard rate (percent)	- Historical - Trend (percent change over time)
Bycatch of protected/endangered species	- Historical - Trend (percent change over time)
Area of sensitive habitats under protection	- Historical - Trend (percent change over time)

Fisheries management measures

The management plan should include a first transitional period (2–3 years) during which at least all existing measures should be implemented while gathering scientific support and information towards the identification of long-term adaptive management measures based on future advice on the evolution of the state of resources and fisheries.

In order to reach the objectives of the management plan, and without prejudice to stricter measures adopted nationally, countries should consider the management measures for deep water red shrimp in the Levant Sea contained in Table 1. The table provides additional information of the issues identified for each measure, as well as implementation requirements, future developments and salient notes.

Decision rules

The management plan will include decision rules with pre-agreed measures to be adopted under different conditions of the stock in relation to agreed biological reference points. The specific technical measures to be adopted under each stock status scenarios are to be defined in appropriate national and subregional working groups, taking into account the socioeconomic impacts of the proposed measures.

Scientific monitoring

The GFCM Scientific Advisory Committee on Fisheries (SAC) should be responsible for regular (annual) advice on status of stocks and economic indicators of fisheries, as well as for advice on alternative management measures under the umbrella of the Working Group on the Assessment of Alternative Management Measures (WGMSE) according to the terms of reference endorsed by the forty-fourth session of the GFCM (online, November 2021).

Adequate and periodic scientific monitoring of fisheries (including socioeconomic indicators) and exploited stocks at national level should be ensured so that the SAC will be in a position to provide scientific advice.

Fishery-dependent data collection should be improved, including knowledge on the origin of catches

Research priorities to improve the assessment and management of fisheries

<u>Urgent data requirements to be provided by contracting parties and cooperating non-contracting parties (CPCs)</u>

To be made available by the meeting in July 2022, when existent:

- vessel monitoring system (VMS) data;
- electronic reporting system (ERS); and
- logbooks.

<u>The list of research priorities should be organized based on the measures implemented</u>

- Provide annual advice on the status of the stocks.
- Improve catch and effort data and quantify catches (and their length–frequency distributions) by their GSA of origin making use of all available information provided by CPCs (logbooks, ERS, VMS).
- Enhance and expand surveys-at-sea.

- Map the fishing grounds, based on the previously exploited areas making use of an array of data sources including principally VMS but also automatic identification system (AIS) and satellite information.

- Identify hotspots of both species as well as nursery areas.

- Work during the transitional period on the overlap between deep-water red shrimp fisheries and VMEs according to the roadmap endorsed by the twenty-second session of the SAC and updated by the WGVME-EFH in 2022 towards identifying unexploited areas to be protected.

- Collect scientific background that would allow the possible future determination of a MCRS for each of the species in the eastern Mediterranean, taking into consideration the possible effect of warming seas and climate change, by adding the two species to the list of species covered by Resolution GFCM/44/2021/2 on the definition of a minimum conservation reference size for priority stocks in the Mediterranean Sea.

- Assess the biological, economic and social implications of implementing several management scenarios to restore or maintain the species population above levels that can produce MSY and towards evaluating the effectiveness of the measures already applied, through bioeconomic modelling and management strategy evaluation (MSE).

- Investigate a catch documentation scheme.

- Engage stakeholders in the discussion on management measures.

Fisheries monitoring, control and surveillance

To ensure compliance with the measures to be adopted in the management plan, the following actions are to be implemented:

- Develop an ad hoc permanent international inspection scheme for the deep-water red shrimp fishery in Levant Sea.

- Concerned parties should make efforts to implement GFCM recommendations related to monitoring, control and surveillance (MCS), including those listed below:

    - vessel information submitted to GFCM Regional Fleet Register;

    - record of fishing vessels authorized to fish the key species;

    - satellite-based VMS required for vessels >10 m;

    - required submission of data on vessels engaged in IUU fishing (IUU Vessel List);

    - required logbook for vessels exceeding 15 m authorized to fish in GFCM area of application – logbook shall register quantities of each species caught and kept on board, above 50 kg in live weight;

- Strengthen national capacities for fisheries MCS.

- Concerned parties are responsible for implementing the adopted management measures in their jurisdictional waters and by vessels flying their flag beyond national jurisdiction.

- Develop a specific mechanism for MCS in areas beyond national jurisdictions covered by the management plan.

- Improve the collection of fisheries statistical data, including social and economic data.

- Each CPC is to report results of MCS in terms of compliance to measures to scientific experts so to allow to understand the effects of compliance on the status of the stocks and the effectiveness of the management plan.

Review of the management plan

The status of giant red shrimp and blue and red shrimp stocks in the Levant Sea shall be evaluated annually maintaining as much as possible the same methodology and relative settings, and benchmark assessments revising stock assessment methods and input data shall be performed every 3 years.

The contents of the management plans should be periodically reviewed in order to accommodate changes in the fisheries system. Comprehensive roadmaps will be provided by the SAC for the assessment and management of the fishery.

To be done by concerned parties

Management action taken based on stock status and fishery conditions (socioeconomic indicators) and according to the decision rules and management tools described

Table 1. Appraisal of management measures for the management of bottom trawling fisheries for deep-water red shrimp in the Levant Sea (GSAs 24, 25, 26 and 27)

DESIGN OF THE MANAGEMENT PLAN	
	Levant Sea
Scope	GSAs 24, 25 26 and 27
Species	Blue and red shrimp and giant red shrimp
Sectors	Commercial
Gear	Bottom otter trawls
General objective	MSY in a given timeframe
Duration	8 years
Transitional period	2–3 years
Long-term measures	All transitional period measures that have worked and others based on advice of scientists and the SAC
General comments	Annual advice linked to a mechanism to manage F with catch limits
	Retain all current management measures considered effective.

Source: elaborated by the author.

Category	Management measure	Issues	Implementation	Development	Notes
Map operational objective	Maintain fishing mortality for key species within agreed precautionary reference points, with a view to achieving or maintaining fishing mortality at MSY level.	These provisions are currently not met owing to the issues related to data.	Need to identify a timeline for reaching MSY		
Reduction of fishing mortality	Catch limits	Given the uncertainty and doubts on catches in the eastern Mediterranean, a catch limit has to be considered with extreme caution in the Levant sea – there are places where it is difficult to estimate catches.	The implementation of a catch limit should take advantage of the transitional period to collect more information and be implemented in the LT phase	Considering the fishery is targeted it could be a good candidate for catch limits.	Experience in the western Med MAP that has a specific catch limit for deep-water red shrimp, based on simulations using scenarios of catch limits and not only fishing effort.
Reduction of fishing mortality	Effort regime		To be implemented in the transitional period while working towards a catch limit.		
Scientific monitoring	The CPCs and the SAC shall facilitate the collation of existing relevant data and the collection of additional relevant data (including research survey data) and organize adequate workshops.	Crucial aspect for these fleets based on instruments that national administrations have in place to monitor fleets and catches (VMS, ERS and logbook information) not currently available.	The origin of catches to be determined on the basis of urgently required data from CPCs through CFP (VMS, ERS, logbooks).	Foresee bilateral agreements between countries to facilitate data collection and sampling of catches that will make the sampling of catches of vessels fishing outside their GSA of origin easier.	To be made available for the meeting in July 2022.

Category	Management measure	Issues	Implementation	Development	Notes
Fleet management	Lists of authorized vessels actively fishing for the key species		Link to the compulsory VMS on board	Possibility of linking the release of the authorization to the compulsory adoption of AIS as a complementary method which will also be useful for scientific monitoring purposes – European Fisheries Control Agency's (EFCA's) system of controlling with AIS and VMS could be used as an example.	This will give better information on catch and effort especially if in combination with a limit to the access of fishing grounds.
	Fishing capacity	Complicated to implement a freeze in fishing capacity because there are no specific licenses but just authorizations at national level – so there may be issues when deep-water red shrimp is caught as bycatch.	Each CPC should ensure the balance between fishing capacity and fishing opportunities; in the transitional period there should be a freeze the fishing capacity.	There should be the possibility for development plans for new fisheries to be validated by the SAC and endorsed by the GFCM. The CPCs can use the proposed minimum elements for guiding the preparation of national fleet development plans for the deep water red shrimp fisheries endorsed by the twenty-first session of the SAC as a guide.	
Spatiotemporal restrictions	Spatio-temporal restrictions for the protection of juveniles	Relevant to *Aristaeomorpha foliacea*, as juveniles of *Aristeus antennatus* are already protected by their depth distribution (work done by MEDISEH); juveniles of *Aristaeomorpha foliacea* are mainly present in spring	Fishing during interdicted periods should be considered IUU. Spatial protection of nursery areas should be modulated over time.	Temporal restriction to fishing in November–April to protect juveniles in nursery grounds.	

Category	Management measure	Issues	Implementation	Development	Notes
		(April–May) and there is a gradient of size with depth with smaller individuals in shallower depths.			
	Protection of spawning grounds in the peak season	The measure was discussed and in the eastern Mediterranean it is not clear where spawning grounds are. Not a good measure for the time being, but may be a development for the future once new information is available			
Temporal restrictions	Closed season	Makes sense for international waters but is difficult to implement in national waters and the decision should lie with the local authorities (trawlers fishing in national waters can also target other species depending on where they fish).	Implement this in the transitional phase. October/December–March each year, to be decided		

Category	Management measure	Issues	Implementation	Development	Notes
Spatial restrictions / protection of VMEs	Protection of unexploited deep-water fishing grounds	Need to have good maps of fishing grounds with respect to species hotspots to identify unexploited areas.	Maintain current fishing grounds and limit the exploitation to these grounds with strict rules for exploratory fishing and the establishment of VME encounter protocols.	Work during the transitional period on the overlap between deep-water red shrimp fisheries and VMEs according to the roadmap endorsed by the twenty-secondsession of the SAC and updated by the WGVME-EFH in 2022 towards establishing protection areas; trawling to be allowed in those fishing grounds previously established; fishing outside these established fishing grounds should adhere to strict exploratory fishing rules.	
Spatial restrictions	Limit access to fishing grounds to authorized vessels	Need to have good maps of fishing grounds with respect to species hotspots to identify unexploited areas – difficult to implement in areas where deep-water red shrimp fishing grounds overlap with mixed fisheries and where the depth profile is steep (e.g. Antalya Bay): need stakeholder involvement and consultation and could use depth as a driving criterion to restrict the fishery.	Could use depth as a driving criterion to restrict the fishery – VMS would be needed for control and used in combination.		This will improve the collection of data on catch and effort – including these rules also implicitly means that fishers need to decide what they are fishing – in conditions of developing fisheries there is the possibility to find deep-water red shrimp in shallower areas, but when the fishery becomes established, the deep-water red shrimp diminish in abundance in shallower waters and then the fishery becomes a real deep-water fishery:

Category	Management measure	Issues	Implementation	Development	Notes
					when you see trawlers in deep-water you can be sure that they are targeting deep-water red shrimp.
Technical measures	Improvement of selectivity using grids/turtle excluder devices to avoid catching juveniles/vulnerable species		To be investigated during the transitional period taking advantage of studies being carried out elsewhere.		
	MCRS for both species	Difficult to implement a MCRS in the eastern Mediterranean especially in areas were deep-water red shrimp fisheries overlap with other fisheries – should be achieved by controlling the market/retail/consumer rather than the fishery – there is a gradient of size with depth with smaller individuals in shallower depths which suggest MCRS could be good.	In combination with spatiotemporal measures for the protection of nursery areas	Reflection needed on the determination of MCRS by species and subregion during the transitional period with a need to add *Aristaeomorpha foliacea* and *Aristeus antennatus* to the work requested to the SAC in the context of Resolution GFCM/44/2021/2.	

Category	Management measure	Issues	Implementation	Development	Notes
Effort management	The CPCs shall communicate to the GFCM Secretariat for the first time, no later than a given date, the list of all their authorized vessels actively fishing for the key species.				
	Any fishing vessel not included in the abovementioned list shall not be allowed to fish for, retain on board or land any quantity of the key species greater than 3 percent of the total live weight catch retained on board.	Implementation is difficult and the effect may be dumping any higher quantities of deep-water red shrimp.	Implementation should be coincident with a limitation of fishing activity to deep-water red shrimp fishing grounds using a depth criterion as the delimitation, which requires the use of VMS and/or AIS for control.		AIS has limits (including the fact it is not compulsory) but has the advantage of not being linked to the availability of information through governments and could comprise a good additional source of information.
	The CPCs shall promptly notify the GFCM Secretariat of any addition to, deletion from and/or modification of the authorized fishing fleets for key species.				

Category	Management measure	Issues	Implementation	Development	Notes
	The GFCM Secretariat shall maintain and update the list of fishing vessels authorized to fish for the key species and publish it on the GFCM website.				
	Each CPC shall ensure the set-up of adequate mechanisms for the recording of each fishing vessel in a national fleet register, for the recording of vessel catches and fishing effort via the logbook and, remote sensing as well as for the monitoring of fishing vessel activities and landings via catch and effort sampling surveys				
IUU	The CPCs shall establish a mechanism to ensure that vessels actively fishing in the Levant Sea declare all catches and bycatch of the key species, irrespective the volume of the catch.				

Category	Management measure	Issues	Implementation	Development	Notes
	The obligation to declare catches shall apply irrespective of the volume of the catch.				
	The CPCs shall communicate to the GFCM Secretariat a map of the fishing grounds exploited by their fishing vessels authorized to catch the key species. Such map shall be prepared using the VMS data transmitted to CPCs by their authorized vessels.			Reliant on having a VMS fully implemented in a database for all fleets. Very detailed VMS info should be available.	
	Designated landing points where the landings by vessels actively fishing for key species shall take place.				
	Permanent international inspection scheme		Develop a new ad hoc international inspection scheme for the deep-water red shrimp fishery in Levant Sea, by creating a working group to discuss this development.	Issue to be raised at the Compliance Committee (CoC) to see if it is possible to duplicate or amend the current permanent scheme for the demersal fishery in the Strait of Sicily for the deep-water	Can be a good opportunity to also get information on catches.

Category	Management measure	Issues	Implementation	Development	Notes
				red shrimp fishery, including in the Levant Sea.	
MCS	All vessels above 10 m length overall actively fishing for the key species shall be equipped with VMS or any other geopositioning system allowing control authorities to track their activities.	A level playing field should be ensured.	All authorized vessels fishing for key species should be equipped with VMS.	This should complement a measure limiting fisheries to known fishing grounds using depth as a criterion for the identification of fishing grounds.	
	Ensure VMS data are provided as needed to scientific experts.		This will be required for the determination of fishing grounds.		Notwithstanding that there are also other methods of the determination of fishing grounds (e.g. multi-criteria decision analysis)
	All the catches of key species shall be indicated in the logbook irrespectively of the live weight of the catch.				
Participatory approach	Stakeholder consultations on measures should always take place.				

Appendix 6

List of priority species for small-scale fisheries

Background

Usually, the collection of biological parameters for all species of commercial interest of small-scale fisheries (SSF) may be difficult to achieve for obvious and practical reasons (i.e. technical cost, human resources). For this reason, following the conclusions of the Working Group on Small-Scale Fisheries (WGSFF) (online, March 2022), and the inputs received during the last GFCM Subregional Committees (SRCs), it was requested to identify and work towards a consolidated list of priority species for SSF. The SRCs have also revised and agreed on the selected criteria to identify the list of priority species, and agreed that the Secretariat, based on official data submitted through the Data Collection Reference Framework (DCRF) platform, should compile and perform a preliminary analysis, providing a tentative list of the main important SSF species for GFCM subregions. It was agreed that once finalized, the list should then be submitted for considerations of the Scientific Advisory Committee on Fisheries (SAC) to ensure adequate data collection and the organization of technical activities in support of management.

The SRCs, also underlined that this list should not be considered static/permanent, but flexible enough to permit the inclusion of other species according to changes in fishing activities and fishing behaviour.

Methodology

Based on the official data submitted by contracting parties and cooperating non-contracting parties (CPSs) through the DCRF online platform (in line with Recommendation GFCM/41/2017/6 on the submission of data on fishing activities in the GFCM area of application), a weighting procedure, by landing (tonnes per species) and economic values (value per species), has been applied to identify the commercial species contributing to SSF for around 70 percent of both total landing and total value. To carry out this exercise, the values of the most recent official submissions (last two or three years depending on the CPCs) have been used. All species belonging to the top 70 percent share (cumulative percentage) have been selected as priority for landing criteria. The same cumulative process has been repeated for the economic value, and the species in the top 70 percent, whether or not they coincide with the previous top 70 percent (i.e. by landing), have been added to the selection. Priority species, as already identified in DCRF group 1 and group 2, not selected either by landing or by value, but which could be important for SSF, have been added in a second stage to the selection. Following the above exercise, the GFCM Secretariat has therefore prepared the following lists of priority species for SSF by GFCM subregion.

<u>General notes</u>

Endangered species and non-indigenous species for which conservation criteria and/or their impact on the ecosystem should be further investigated, by subregion, can be added to the lists included in this document. .

Several large and medium pelagic species relevant for SSF have been selected in preparing these lists. As suggested from the SRCs, the cooperation between the GFCM and the International Commission for the Conservation of Atlantic Tunas (ICCAT), to collect data and to properly manage those species, should be reinforced and eventually discussed under the umbrella of the joint ICCAT/GFCM Working Group on medium pelagics.

Finally, monitoring SSF, the incidental catch of vulnerable species (i.e. marine mammals, seabirds, sea turtles, sharks and rays) should be always collected and reported.

Western Mediterranean			
Species	**Selected for landing (L), value (V) and/or as GFCM-DCRF priority species (P) in the subregion**	**DCRF G1**	**DCRF G2**
Octopus vulgaris	L-V-P		X
Mullus spp.	L-V-P	X	
Merluccius merluccius	L-V-P	X	
Trachurus spp.	L-P	X	X
Pagellus spp.	L-P		X
Lophius spp.	L-P		X
Sepia officinalis	L-V		
Parapenaeus longirostris	V-P	X	
Aristeus antennatus	V		
Anguilla anguilla	P	X	
Boops boops	P		X
Eledone cirrhosa	P		X
Engraulis encrasicolus	P	X	
Raja asterias	P		X
Raja clavata	P		X
Scomber japonicus	P		X
Scomber scombrus	P		X
Sardina pilchardus	P	X	
Seabirds, sea turtles, marine mammals, sharks and rays*			

Note: in grey are DCRF priority species not selected either by landing or by value, but which could be important for SSF in the subregion.

*Any vulnerable species included in Annex II (endangered or threatened species) and Annex III (species whose exploitation is regulated) of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention).

Central Mediterranean			
Species	**Selected for landing (L), value (V) and/or as GFCM-DCRF priority species (P) in the subregion**	**DCRF G1**	**DCRF G2**
Merluccius merluccius	L-V-P	X	
Sepia officinalis	L-V		
Thunnus alalunga	L-V		
Sarda sarda	L-V		
Boops boops	L-V-P		X
Octopus vulgaris	L-V-P		X
Mullus barbatus	L-V-P	X	
Xiphias gladius	L-V		
Mullus surmuletus	L-V		X
Coryphaena hippurus	L-V-P	X	
Sardina pilchardus	L-P	X	
Spicara smaris	L		
Engraulis encrasicolus	L-P	X	
Mugilidae	L		
Lepidopus caudatus	L		
Euthynnus alletteratus	L		
Trachurus spp.	L		
Pagellus erythrinus	L-V-P		X
Diplodus sargus	V		
Pagrus pagrus	V		
Palinurus elephas	V		
Scorpaena scrofa	V		
Sparus aurata	V		
Anguilla anguilla	P	X	
Parapenaeus longirostris	P	X	
Diplodus annularis	P		X
Lophius budegassa	P		X
Raja asterias	P		X
Raja clavata	P		X
Scomber japonicus	P		X
Scomber scombrus	P		X
Seabirds, sea turtles, marine mammals, sharks and rays*			

Note: in grey are DCRF priority species not selected either by landing or by value, but which could be important for SSF in the subregion.

*Any vulnerable species included in Annex II (endangered or threatened species) and Annex III (species whose exploitation is regulated) of the Barcelona Convention.

Adriatic Sea			
Species	**Selected for landing (L), value (V) and/or as GFCM-DCRF priority species (P) in the subregion**	**DCRF G1**	**DCRF G2**
Merluccius merluccius	L-V-P	X	
Mullus barbatus	L-V-P	X	
Squilla mantis	L-V-P	X	
Sepia officinalis	L-V-P	X	X
Parapenaeus longirostris	L-V-P	X	
Nassarius mutabilis	L		
Mugilidae	L		
Merlangius merlangus	L		
Eledone moschata	L-V-P		X
Solea solea	L-V-P	X	
Penaeus kerathurus	L-V		
Nephrops norvegicus	L-V-P	X	
Eledone cirrhosa	L-V-P		X
Sardina pilchardus	L-P	X	
Mytilus galloprovincialis	L		
Octopus vulgaris	L-V-P		X
Loligo vulgaris	V		
Sparus aurata	V		
Anguilla anguilla	P	X	
Engraulis encrasicolus	P	X	
Boops boops	P		X
Pagellus erythrinus	P		X
Spicara smaris	P		X
Seabirds, sea turtles, marine mammals, sharks and rays*			

Note: in grey are DCRF priority species not selected either by landing or by value, but which could be important for SSF in the subregion.

*Any vulnerable species included in Annex II (endangered or threatened species) and Annex III (species whose exploitation is regulated) of the Barcelona Convention.

Eastern Mediterranean			
Species	**Selected for landing (L), value (V) and/or as GFCM-DCRF priority species (P) in the subregion**	**DCRF G1**	**DCRF G2**
Sepia officinalis	L-V		
Boops boops	L-V-P		X
Sardinella spp.	L-P	X	
Sardina pilchardus	L-V-P	X	
Merluccius merluccius	L-V-P	X	
Octopus vulgaris	L-V-P		X
Mullus barbatus	L-V-P	X	
Mullus surmuletus	L-V-P		X
Pagellus erythrinus	L-V-P		X
Mugilidae	L-V		
Sparus aurata	L-V		
Sarda sarda	L-V		
Pagrus pagrus	L-V		
Engraulis encrasicolus	L-P	X	
Xiphias gladius	L-V		
Euthynnus alletteratus	L		
Solea solea	L-V-P		X
Scomber japonicus	L-P		X
Diplodus sargus	L-V		
Spicara smaris	L-P		X
Dicentrarchus labrax	V		
Penaeus kerathurus	V		
Scorpaena scrofa	V		
Anguilla anguilla	P	X	
Siganus luridus	P		X
Siganus rivulatus	P		X
Trachurus trachurus	P		X
Seabirds, sea turtles, marine mammals, sharks and rays*			

Note: in grey are DCRF priority species not selected either by landing or by value, but which could be important for SSF in the subregion.

*Any vulnerable species included in Annex II (endangered or threatened species) and Annex III (species whose exploitation is regulated) of the Barcelona Convention.

Appendix 7

List of priority species for recreational fisheries

Background

The collection of recreational fisheries (RF) data is limited in many countries and the lack of reliable estimates of catches has led to the exclusion of RF data from stock assessments, with implications for fisheries management. The GFCM Scientific Advisory Committee on Fisheries (SAC) highlighted the potential issues posed by this lack of data, particularly for stocks which are overexploited by commercial fisheries and for which RF might be an additional component of fishing mortality.

In 2021, the experts of the GFCM Working Group on Recreational Fisheries (WGRF) discussed the main species addressed by RF in the Mediterranean and Black Sea. In view of focusing future work to improve advice on the scope and impacts of RF, the WGRF (online, February 2021) agreed to identify a list of species for which RF monitoring should be performed.

In 2022, the experts of the GFCM WGRF recalled that the final list of species to be addressed by a future recommendation should ensure coverage of GFCM priority species when they are caught by RF, considering subregional specificities, and prioritizing commercial and conservation concern species. For these species, the collection of a set of minimum biological data (i.e. total length and/or individual weight) should be ensured. The WGRF (online, March 2022), acknowledging the difficulty to collect information on some non-indigenous species, recognized the importance of collecting qualitative and quantitative information on such species, in particular those that are already included in the GFCM priority species list, in order to monitor their spatial distribution. The subregional committees (SRCs) have also revised and agreed on the selected criteria to identify the list of priority species, and agreed that the Secretariat, should incorporate all these suggestions providing a final list of the main important RF species for GFCM subregions.

It was agreed that once finalized, the list should then be submitted for considerations to the SAC to ensure adequate data collection and the organization of technical activities in support of management.

The SRCs, also underlined that this list should not be considered static/permanent, but flexible enough to permit the inclusion of other species according to changes in fishing activities and fishing behaviour.

Methodology

The WGRF 2021 noted that the GFCM already prepared a list of priority species through its Data Collection Reference Framework (DCRF) and hence it was agreed that there was first a need to assess which, if any, of these species were present in RF. The WGRF experts examined the DCRF priority species list and identified those species for which RF may have an impact. It was noted that particular attention should be paid to assessing the impacts of RF on all shark and ray species. However, based on the studies presented in different countries, it was agreed that an important number of key species targeted by RF were not included within the current list of DCRF priority species. The group therefore agreed that an additional list of the main RF species needed to be compiled. The WGRF experts agreed on the following criteria for identifying this list of species: 1) species with a high volume of landings from RF (by shore, boat and/or underwater fishing); 2) species with an important social impact for RF (e.g. quality of recreational fishing experience, preference of fishers, etc.); 3) species with an important economic impact for RF (e.g. species driving tourism, etc.); 4) species at risk of overexploitation and/or for which a steep decrease in abundance has been observed; 5) species of conservation interest (e.g. endangered, vulnerable); 6) non-indigenous species; and 7) main species of commercial interest for RF (by volume and by value). Based on best available information and the above criteria, through a consultative exercise after the meeting, the WGRF experts compiled a potential list of the main species of interest to RF in each subregion for further study. Following the above exercise and based also on

the inputs of the recent SRCs, the GFCM Secretariat has therefore prepared the following lists of priority species for RF by GFCM subregion.

To the identified lists, and for each GFCM subregion, can also be added species for which conservation criteria (i.e. endangered species) and/or their impact on the ecosystem (i.e non-indigenous species) should be further investigated. Finally, incidental catch of vulnerable species (i.e. marine mammals, seabirds, sea turtles, sharks and rays) should always be monitored and reported.

Western Mediterranean			
Species	**Selected for criteria[a]**	**DCRF G1**	**DCRF G2**
Dentex dentex	1-2-3-4-5-7		
Dicentrarchus labrax	1-2-3-4-5-7		
Epinephelus marginatus	1-2-3-4-5-7		
Seriola dumerili	2-3-7		
Sparus aurata	1-2-3-4-5-7		
Anguilla anguilla		x	
Lagocephalus sceleratus		x	
Mullus barbatus		x	
Pagellus bogaraveo		x	
Pterois miles		x	
Boops boops			x
Mullus surmuletus			x
Octopus vulgaris			x
Pagellus erythrinus			x
Scomber japonicus			x
Scomber scombrus			x
Sepia officinalis			x
Trachurus mediterraneus			x
Trachurus trachurus			x
Sharks and rays[b]			
Seabirds, sea turtles, marine mammals[c]			

[a] The criteria are: 1) species with a high volume of landings from RF (by shore, boat and/or underwater fishing); 2) species with an important social impact for RF (e.g. quality of recreational fishing experience, preference of fishers); 3) species with an important economic impact for RF (e.g. species driving tourism); 4) species at risk of overexploitation and/or for which a steep decrease in abundance has been observed; 5) species of conservation interest (e.g. endangered, vulnerable); 6) non-indigenous species; and 7) main species of commercial interest for RF (by volume and by value).

[b] Any species of sharks and rays caught during RF activity.

[c] Vulnerable species included in Annex II (endangered or threatened species) and Annex III (species whose exploitation is regulated) of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention).

Central Mediterranean			
Species	**Selected for criteria[a]**	**DCRF G1**	**DCRF G2**
Dentex dentex	1-2-3-4-5-7		
Dicentrarchus labrax	1-2-7		
Diplodus sargus	1-2-7		
Epinephelus spp.	1-2-3-4-5-7		
Anguilla anguilla[b]		x	
Coryphaena hippurus		x	
Lagocephalus sceleratus		x	
Mullus barbatus		x	
Pterois miles		x	
Boops boops			x
Diplodus annularis			x
Mullus surmuletus			x
Octopus vulgaris			x
Pagellus erythrinus			x
Scomber scombrus			x
Sepia officinalis			x
Sphyraena sphyraena			x
Trachurus trachurus			x
Sharks and rays[c]			
Seabirds, sea turtles, marine mammals[d]			

[a] The criteria are: 1) species with a high volume of landings from RF (by shore, boat and/or underwater fishing); 2) species with an important social impact for RF (e.g. quality of recreational fishing experience, preference of fishers); 3) species with an important economic impact for RF (e.g. species driving tourism); 4) species at risk of overexploitation and/or for which a steep decrease in abundance has been observed; 5) species of conservation interest (e.g. endangered, vulnerable); 6) non-indigenous species; and 7) main species of commercial interest for RF (by volume and by value).

[b] Recreational fishing of European eel is prohibited in Greece by Decree 142/1971.

[c] Any species of sharks and rays caught during RF activity.

[d] Any vulnerable species included in Annex II (endangered or threatened species) and Annex III (species whose exploitation is regulated) of the Barcelona Convention.

Adriatic Sea			
Species	**Selected for criteria[a]**	**DCRF G1**	**DCRF G2**
Dicentrarchus labrax	1-2-3-4-5-7		
Sparus aurata	1-2-7		
Anguilla anguilla		x	
Coryphaena hippurus		x	
Lagocephalus sceleratus		x	
Mullus barbatus		x	
Pterois miles		x	
Sepia officinalis		x	
Boops boops			X
Octopus vulgaris			X
Pagellus erythrinus			X
Loligo spp.[b]			
Todarodes sagittatus[b]			
Todaropsis eblanae[b]			
Sharks and rays[c]			
Seabirds, sea turtles, marine mammals[d]			

[a] The criteria are: 1) species with a high volume of landings from RF (by shore, boat and/or underwater fishing); 2) species with an important social impact for RF (e.g. quality of recreational fishing experience, preference of fishers); 3) species with an important economic impact for RF (e.g. species driving tourism); 4) species at risk of overexploitation and/or for which a steep decrease in abundance has been observed; 5) species of conservation interest (e.g. endangered, vulnerable); 6) non-indigenous species; and 7) main species of commercial interest for RF (by volume and by value).

[b] Additional species requested by the Subregional Committee for the Adriatic Sea.

[c] Any species of sharks and rays caught during RF activity.

[d] Any vulnerable species included in Annex II (endangered or threatened species) and Annex III (species whose exploitation is regulated) of the Barcelona Convention.

Eastern Mediterranean			
Species	**Selected for criteria[a]**	**DCRF G1**	**DCRF G2**
Diplodus sargus	1-2-7		
Epinephelus spp.	1-2-3-4-5		
Anguilla anguilla		x	
Coryphaena hippurus		x	
Lagocephalus sceleratus		x	
Mullus barbatus		x	
Pterois miles		x	
Boops boops			x
Mullus surmuletus			x
Octopus vulgaris			x
Pagellus erythrinus			x
Scomber japonicus			x
Siganus luridus			x
Siganus rivulatus			x
Sharks and rays[b]			
Seabirds, sea turtles, marine mammals[c]			

[a] The criteria are: 1) species with a high volume of landings from RF (by shore, boat and/or underwater fishing); 2) species with an important social impact for RF (e.g. quality of recreational fishing experience, preference of fishers); 3) species with an important economic impact for RF (e.g. species driving tourism); 4) species at risk of overexploitation and/or for which a steep decrease in abundance has been observed; 5) species of conservation interest (e.g. endangered, vulnerable); 6) non-indigenous species; and 7) main species of commercial interest for RF (by volume and by value).

[b] Any species of sharks and rays caught during RF activity.

[c] Any vulnerable species included in Annex II (endangered or threatened species) and Annex III (species whose exploitation is regulated) of the Barcelona Convention.

Appendix 8

Pilot study for the selectivity of bottom trawl fisheries exploiting demersal stocks in the Strait of Sicily (June 2022)

The pilot study is available at the following link:

https://gfcm.sharepoint.com/:b:/g/SAC/EVF8wHyJ1hVOhyY5UZFtcBABJ6ftMxu6GCg0gFDMFbJFXA

Appendix 9

Elements towards a regional research programme on recreational fisheries

Background

Recreational fisheries (RF) are an important socioeconomic component of coastal life and communities in the Mediterranean and the Black Sea, but standard monitoring programmes based on statistically robust sampling designs are not regularly implemented in most countries.

The GFCM *Handbook for data collection on recreational fisheries in the Mediterranean and the Black Sea* provides a harmonized methodological framework that is currently being tested in five pilot studies: Algeria, Italy, Lebanon, Tunisia and Black Sea Türkiye.

The first meeting of the Working Group on Recreational Fisheries (WGRF) (online, February 2021) highlighted the importance of continuing to strengthen marine recreational fisheries data collection in all countries of the region, with a view to better characterizing the sector and improving the provision of advice based on sound data.

At its forty-fourth session (online, November 2021), the GFCM discussed a proposal for a recommendation on marine recreational fisheries that included the need to strengthen scientific information through a research programme in accordance with recent GFCM practice (i.e. research programmes launched for select priority species).

Objectives of the research programme

The aims of this research programme are to:

1. Identify the target population of marine recreational fishers in each contracting party and cooperating non-contracting party (CPC), including all relevant fishing modalities and all types of fishing gear.

2. Collect marine recreational fisheries data on catches, fishing effort and expenditures using the statistical universe identified in Point 1 by prioritizing a probability sampling methodology.

3. Store biological and economic marine recreational fisheries data in a dedicated database.

4. Assess the impacts of marine recreational fisheries on the region's main commercial stocks and on the environment.

5. Engage marine recreational fisheries stakeholders in the overall process in order to close the gap between decision-making and practice.

Work packages

Work packages (WPs) are designed to address the main priorities of the research programme in line with its main objectives, with a view to the sustainable management of RF.

WP 1: Collect data (i.e. catches, effort and socioeconomic variables) following the methodology described in the GFCM *Handbook for data collection on recreational fisheries in the Mediterranean and the Black Sea*. The first step will be to focus on developing a complete understanding of the methodology while being flexible enough to make customizations as required. Setting up a simple but effective sampling strategy will allow CPCs to move forward to more advanced survey techniques in due course.

WP 2: Once data have been collected and stored in a dedicated database, they should be analysed and generalized to describe the total population. Data quality checks and the necessary data treatments will be carried out. Subsequently, data analysis will include the integration of biological data into the assessment of the status of priority species and the analysis of socioeconomic characteristics of RF by subregion and basin.

WP 3: Engaging stakeholders is vital for delivering a successful survey and, ultimately, for the sustainable management of RF. When properly achieved, stakeholder engagement can help to develop credibility and trust between researchers, decision-makers and fishers. The aim of this WP is to involve relevant stakeholders in identifying potential management measures that could be jointly promoted and developed in collaboration with scientists and policy makers.

Implementation of the programme

The programme should cover a range of interested countries in both the Mediterranean and the Black Sea.

There should be an overall programme coordinator, and for each participating country the following contribution is foreseen:

- a national coordinator; and
- required support to ensure the collection of existing and new data on national RF and existing management measures.

Appendix 10

Elements towards a pilot study on non-indigenous species in the eastern Mediterranean

Background

Stemming from the priorities of the Regional Sea Conventions in 2017 and 2018, the GFCM Secretariat and the Secretariat of the United Nations Environment Programme/Mediterranean Action Plan (UNEP/MAP) joined efforts to establish a subregional pilot study for the eastern Mediterranean on non-indigenous species (NIS) in relation to fisheries, to revise available information from all sources and to analyse it in a harmonized way using simple indicators. Following discussions held at the GFCM subregional committees in 2018, where the central and western subregions also expressed an interest in participating in a similar monitoring programme, the Scientific Advisory Committee for Fisheries (SAC) endorsed, at its twentieth session (Morocco, June 2018), the subregional monitoring plan for NIS in relation to fisheries, which foresaw its application across all subregions.

To further this work, at its twenty-first session (Egypt, June 2019), the SAC invited countries to share information on ongoing activities related to the monitoring and/or management of NIS towards advancing on the creation of a NIS Observatoire in the Mediterranean Sea. Acknowledging the growing prevalence of NIS in the Mediterranean, the twenty-second session of the SAC (online, June 2021) agreed on the need to launch in-depth reflection, as well as a dedicated research programme to, *inter alia*, consolidate an Observatoire with the aim of integrating all available information, foster engagement between relevant actors at the Mediterranean level, improve understanding of the interactions of NIS with receiving ecosystems and investigate effective management through fisheries management tools and/or nature-based solutions.

Finally, Target 1 ("Fisheries and ecosystems: healthy seas and productive fisheries") of the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea aims to achieve productive sustainable fisheries and to contribute to ensuring healthy ecosystems by tackling the sustainability of fisheries from a broad perspective, integrating social, economic and environmental principles, with the objective of reaching exploitation at maximum sustainable yield while addressing the conservation of biodiversity. In the specific case of NIS, the achievement of Target 1 is supported by an expected output (Output 1.4) that seeks to prevent and mitigate threats to fisheries and the marine environment, including plastic pollution, climate change and the expansion of NIS. In particular, the first four items of the action plan of Output 1.4 read as follows:

- Continue the work initiated towards the establishment of an integrated monitoring platform and monitoring plan for NIS in the eastern Mediterranean and expand it to other GFCM subregions.

- Collect data on NIS, including through local ecological knowledge (LEK) studies and participatory mapping.

- Starting from the eastern Mediterranean, experiment fisheries management actions, also within marine protected areas, to understand and mitigate the impacts of NIS on receiving ecosystems (including native commercial species), with the aim of maintaining their ecological integrity and resilience.

- Organize dedicated expert meetings to compile and analyse data on NIS.

Additional work on NIS within the GFCM includes a research programme on the two NIS species of blue crabs, *Callinectes sapidus* and *Portunus segnis*, in the Mediterranean Sea following the adoption of the final concept note by the GFCM in 2021 in response to Recommendation GFCM/42/2018/7 on a regional research programme on blue crab in the Mediterranean Sea. Eleven countries have adhered and four eastern Mediterranean countries, namely Cyprus, Egypt, Greece and Türkiye were among the

partners that nominated focal points; the official launch is planned for 2022. The two research programmes are foreseen to interact and exchange data and information.

Elements

In light of the above elements, and considering both the extensive information collected and foreseen to be collected through the GFCM monitoring activities (e.g. surveys-at-sea, incidental catch of vulnerable species and discards monitoring programmes), as well as the important results emerging from a five-day training course on the application of the LEK-1 protocol (LEK to reconstruct historical changes) in the eastern Mediterranean organized by the FAO-Eastmed project in 2021, which featured practical field data collection and a one-day session on data exploration, elaboration and visualization, the development of a research programme to advance and complement the work already done is proposed, including the following basic elements.

Work Package 1 – Coordination, networking, dissemination, and sustainability

1.1 The objective of work package (WP) 1 is to ensure the successful completion of the project goals on time and within the limits defined by the budgetary framework and quality standards. This WP will oversee administrative management and ensure scientific/technical coordination and monitoring. The dedicated team will oversee:

- administration and coordination of available human and budgetary resources;
- monitoring and control of the workplan;
- preparation of detailed workplans;
- coordination and monitoring of the work among the WP leaders;
- compilation and issuing of reports;
- arrangement of project-level meetings and issuing of minutes; and
- clear and swift communication between the research programme and the GFCM Secretariat.

1.2 A network of scientific experts and key stakeholders from each participating country will be created under the coordination of the GFCM Secretariat to ensure cross-border and long-lasting scientific collaboration in the eastern Mediterranean through the involvement of all concerned parties. This will allow for the testing and implementation of harmonized actions aimed at regularly monitoring and managing the issue of NIS, according to the tasks described in WPs 2, 3, 4 and 5.

1.3 Dissemination of project outcomes and outputs will be assured within the newly created network, including among stakeholders and the general public. This will be achieved by:

- presenting the initiatives in concerned fora;
- using GFCM dissemination channels;
- creating a dedicated webpage/portal that will centralize/provide links to already existing digitalized information (e.g. Marine Mediterranean Invasive Alien Species database (MAMIAS), http://www.mamias.org/) and information arriving from the WP3 on LEK;
- producing communication materials, including a short video documentary on LEK activities in the eastern Mediterranean to be used for dissemination activities and stakeholder engagement; and

- organizing restitution meeting(s).

1.4 The sustainability of the project's outcomes will be ensured through the consolidation of the webpage/portal aimed at supporting the use of LEK 2 protocol on interviewing local experts to monitor climate-related changes on a regular basis (see WP3). This platform will facilitate methodological transfers within the network of scientific experts, building the basis for the establishment of a permanent Observatoire on NIS in the eastern Mediterranean with the potential to be extended to other subregions.

Work Package 2 – Collation and analysis of available information, and possible implementation of country-based pilot studies

2.1 Collation and analysis of all available information on NIS stemming from monitoring activities in the eastern Mediterranean, including from:

- grey and key scientific literature;
- expert knowledge on the status of target species (e.g. from GFCM stock assessment working groups);
- surveys at sea (e.g. from GFCM and European surveys-at-sea);
- catches and landings;
- Data Collection Reference Framework (DCRF) database;
- discards (e.g. from the GFCM discard monitoring programme);
- incidental catch of vulnerable species monitoring programme;
- LEK;
- other sources of information (e.g. documented by citizens); and
- the research programme on blue crabs in the Mediterranean, where relevant.

Results of other initiatives will also be collated and analysed, including the study on DNA metabarcoding to investigate biotic aspects of fisheries catches to be executed by the GFCM in collaboration with the Department of Biology of the University of Rome Tor Vergata. The study on DNA metabarcoding aims at assessing the accuracy of the eDNA metabarcoding approach to reconstruct the composition of catches obtained from bottom-trawl fishing vessels. 3D-printed hollow perforated spherical probes (called metaprobes) are placed inside the fishing nets and work as a container for rolls of gauze that capture DNA from the surrounding environment during fishing operations. This study is based on the matching that has already been demonstrated to a large degree between community composition inferred from eDNA metabarcoding of the dense water draining from the net codend (slush) and the composition revealed by visual sorting of the catches, both qualitatively and quantitatively. In light of these promising results, this activity may provide further details on eastern Mediterranean species assemblages, including NIS, and serve as an early detection system for new species and significant changes in NIS abundance

2.2 Based on the information collated (WP1), the preliminary results of the application of LEK protocols (WP3.1) and national priorities, country-specific case studies could be designed to address specific issues, including fisheries management actions, also within marine protected areas, to understand and mitigate the impacts of NIS on receiving ecosystems (including native commercial species).

Work Package 3 – Testing LEK protocols over the span of a whole year in eastern Mediterranean countries to set an effective and long-term participatory strategy on NIS monitoring in collaboration with local fishers and relevant stakeholders.

3.1 Implementing the LEK-1 protocol to reconstruct historical changes in species distribution and abundance at the local, national and subregional scale.

- Training – the LEK-1 methodology will be transferred to the network of experts and scientists established and coordinated through WP1. The training will be carried out through theoretical and practical sessions (including guided field surveys and assisted data analysis). A complete toolkit with all the training materials (LEK-1 booklet, video-tutorials, materials to carry out the interviews and data reporting and Excel templates for data visualization) will be made available.

- Implementation of LEK-1 in the eastern Mediterranean – expert scientists will be engaged in the implementation of the LEK-1 protocol at the local level, in collaboration with local fishers in each participating country.

- Data will be collected by each team according to a standard procedure to be used at both the local/national and sub-regional scales. Data will finally be collated into a single collaborative database.

- The whole dataset will be employed to provide results to be presented at both the local-national and subregional levels. Further uses of the dataset are related to feedback to be sent to local stakeholders, according to the dissemination activities described in WP1.2.

3.2 Setting and testing the LEK-2 methodology to monitor climate-related changes on a regular basis, with particular application on NIS, including:

- consolidation of the monitoring strategy and protocol. This will be done in a specific workshop organized by the GFCM Secretariat with all participating parties;

- development and dissemination of training materials;

- final training on LEK-2 protocol;

- implementation of LEK-2 in the participating countries, data collection and validation; and

- collation of the collaborative LEK-2 database and data elaboration.

3.3 Consolidating a LEK monitoring strategy in the eastern Mediterranean.

- Final workshop: the results of both LEK-1 and LEK-2 will be presented by each participating country at a specific workshop organized by the GFCM Secretariat. During the same meeting, the coordination team will present the results obtained at the subregional level. Potential challenges and lessons learned will be discussed among all the partners.

- The results of the LEK activities, along with the feedback of the final workshop, will be summarized in a technical paper on the LEK monitoring strategy for NIS in the eastern Mediterranean.

Work Package 4 – Data analysis

The results of WP2 and WP3.1 will be jointly analysed to provide summaries of indicators by species and distribution/hotspot maps over time.

Work package 5 – Proposal of technical recommendations for management by species

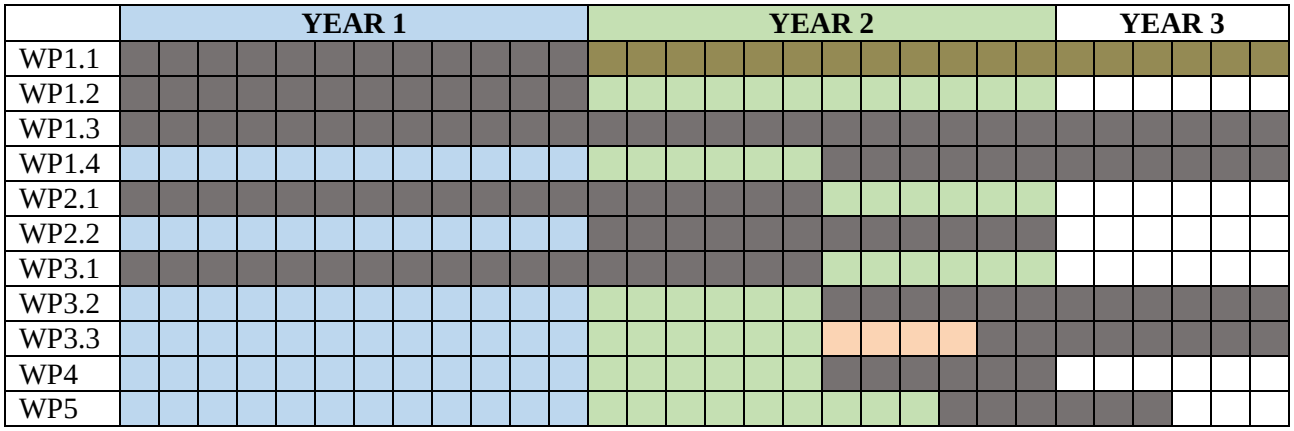
Implementation

The work will be guided by previous work, notably by the subregional monitoring plan on NIS in relation to fisheries

Proposed timeline

- Twenty-third session of the SAC (FAO headquarters, Rome, Italy, June 2022): development and endorsement of a concept note incorporating comments from participants.
- June–November 2022: further development of the concept note, definition of a budget and consultations with interested countries.
- November 2022–February 2023: planning of the work, appointment of a coordinator and establishment of teams at the country level.
- March 2023–February 2025: execution of the work.
- April–June 2024: presentation of preliminary results at the Subregional Committee for the eastern Mediterranean (SRC-EM) and the SAC.
- February–April 2025: finalization of the report.
- April–June 2025: presentation of final results at the SRC-EM and the SAC.

Provisional Gantt chart



Appendix 11

Elements towards a pilot study on the biology, ecology and distribution of bamboo coral (*Isidella elongata*) in the southern Adriatic

Institutional context

In response to Resolution GFCM/43/2019/6 on the establishment of a set of measures to protect vulnerable marine ecosystems formed by cnidarian (coral) communities in the Mediterranean Sea , the first version of a concept note on a pilot study on the biology, ecology and distribution of *Isidella elongata*, bamboo coral, in the southern Adriatic was drafted by Pierluigi Carbonara (COISPA, Italy), Giovanni Chimienti (University of Bari, Italy) and Anna Nora Tassetti (IRBIM-CNR, Italy) and presented at the Working Group on vulnerable marine ecosystems and essential fish habitats (WGVME-EFH) (online, March 2022). The concept note emerging from the WGVME-EFH was then discussed at the Subregional Committee for the Adriatic Sea (SRC-AS) and further amended according to the inputs received. A summary of the main points discussed during the SRC-AS is provided in Annex 1 of this document. The final agreement was to further expand this version of the concept note along the lines indicated by the SRC-AS discussions and to present a final version of the concept note at the twenty-second session of the Scientific Advisory Committee on Fisheries (SAC) (online, June 2021) for endorsement.

Background

The bamboo coral *Isidella elongata* (Esper, 1788) is an alcyonacean (family Isididae) dwelling on soft bottoms at depths ranging between 115 and 1650 m (Chimienti *et al*., 2019a). This species is considered near-endemic to the Mediterranean Sea (Grasshoff, 1989). It can form extensive aggregations of colonies, called coral gardens or coral forests (Chimienti *et al*., 2019b; FAO, 2009), representing a true facies of the bathyal mud biocoenosis (sensu Pérès and Picard, 1964). *Isidella elongata* facies are mostly found at depths greater than 500 m (Chimienti *et al*., 2019a).

Isidella elongata plays an important ecological role as a habitat former, particularly in cases of large aggregations of colonies, increasing the three-dimensional habitat complexity of the otherwise flat bathyal bottom. This habitat is relevant for its rich diversity of associated fauna, including several fishes and crustaceans that use it as a feeding and refuge area. The presence of *Isidella elongata* facies influences the availability of resources and has important implications for benthopelagic food webs (Buhl-Mortensen *et al*., 2010; Mastrototaro *et al.*, 2017; Maynou and Cartes, 2012; Carbonara *et al*., 2020).

Because of their co-occurrence with species of high commercial value (e.g. giant red shrimp [*Aristaeomorpha foliacea*], blue and red shrimp [*Aristeus antennatus*] and Norway lobster [*Nephrops norvegicus*]), *I. elongata* populations are highly affected by bottom-fishing activities across the Mediterranean basin, as reported in several areas (e.g. the Catalan Sea, the Balearic Sea, the Strait of Sicily, the Ionian Sea, Sardinia and the Tyrrhenian Sea) (Maynou and Cartes, 2012; Lauria *et al*., 2017; Mastrototaro *et al.*, 2017; Carbonara *et al*., 2020; Carpenteri *et al*., 2021). Trawlers can cause direct physical damage (Maynou and Cartes, 2012) or have an indirect impact due to alterations of the hydrodynamic and sedimentary conditions, such as sediment resuspension (Piskaln *et al*., 1998; Purser, 2015), which expose non-retractile polyp colonies to additional damage (Maynou and Cartes, 2012). In addition, its slow growth, recovery rates and recruitment and long lifespan (Andrews *et al*., 2002; Roark *et al*., 2006) are peculiar life history traits that further compromise the resilience of *I. elongata* to such perturbations. For this reason, *I. elongata* has been listed as ‘‘Critically Endangered’’ in the Red List of Threatened Species by the International Union for Conservation of Nature (IUCN) (Otero *et al*., 2017). Despite the increasing interest in deep-dwelling VMEs (FAO, 2009, 2018), the number of *Isidella elongata* facies currently known is particularly limited, including in particular areas, such as the Adriatic Sea and the central-eastern Mediterranean basin (Chimienti *et al*., 2019a). More recently, Carbonara *et al*. (2020) reported the occurrence of an *Isidella elongata* facies in the southern Adriatic

Sea, which represented the fishery least impacted among the different study areas (i.e. Sardinian Sea, south-central Tyrrhenian, southern Adriatic and north-western Ionian). The *Isidella elongata* facies of the Otranto Channel was then identified (Carbonara *et al*., 2020). In addition, the European Union Marine Strategy Framework Directive has recognized that several fragile deep-sea habitats need protection (MSFD, 2008), and *Isidella elongata* facies have also been recognized as potential VMEs by the GFCM (FAO, 2009). Moreover, this species has been included among the ‘‘Deep Water Engineering benthic invertebrate assemblages’’ in the ‘‘Dark Habitats Action Plan’’ of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) (UNEP-MAP-RAC/SPA, 2015).

A comparison between assemblages characterized by the presence of *I. elongata* and those without *I. elongata* showed significantly higher biodiversity and biomass associated with *Isidella elongata* facies, confirming that the presence of this species enhances biodiversity (Carbonara *et al*., 2020).

No studies on *I. elongata* age and growth have been published to date. However, a low growth rate has been reported for congeneric species. Age and growth estimates using ^{14}C have indicated maximum *Isidella* spp. ages of 75–126 years in the Gulf of Alaska (Roark *et al*., 2005). For *Isidella tentaculum*, Andrews *et al*. (2009) estimated a slow growth rate of 0.1 mm/year and a long lifespan of about 50 years in the Gulf of Alaska. These data indicate an impact recovery period ranging from a few decades to one century for *Isidella elongata* facies. However, to fully understand the recovery potential and long-term population dynamics, more information is needed on the growth rate and ages of *I. elongata* in the Mediterranean Sea.

Based on the frequent coexistence of *Isidella elongata* facies with several commercial species and considering the lack of detailed information on fauna associated with *Isidella elongata* facies and anthropogenic impacts, as well as potential bycatch, the twenty-second session of the SAC endorsed the creation of a pilot project on the biology and ecology of this species.

This need initially emerged at the forty-fourth annual session of the GFCM (online, November 2021), at which Resolution GFCM/44/2021/3 on a roadmap for the establishment of a fisheries restricted area in the southern Adriatic Sea (geographical subarea 18) was adopted. This resolution determined that the GFCM Secretariat, with the support of relevant experts, should launch, in 2022, a pilot project to better understand the biology and ecology of *I. elongata* in the Adriatic Sea and insights into the overlaps between *Isidella elongata* VMEs and bottom trawl fishing footprints with a view to providing the elements for the future definition of one or several new fisheries restricted area(s) (FRA[s]). In addition, the same resolution outlined the technical actions required to advance towards complying with the requirements of Recommendation GFCM/43/2019/5 on a multiannual management plan for sustainable demersal fisheries in the Adriatic Sea (geographical subareas 17 and 18), including an ad hoc socioeconomic survey covering the fleets operating in the area.

Proposed activities

On the basis of the information above and the data collected to date, actions and data that must be collected and performed under the umbrella of the pilot project on the *Isidella* VME towards advancing in meeting the requirements of Resolution GFCM/44/2021/3 were identified during the WGVME-EFH and complemented by discussions at the SRC-AS in 2022. This proposal provides further expanded elements for the finalization of the concept note guiding the work to be performed under the umbrella of the pilot project, as outlined below.

Work package 1 – Creation of a network of scientific experts and key stakeholders

Establishment of a network of scientific experts and key stakeholders towards ensuring cross-border scientific collaboration for the identification of potential VMEs and related potential spatial management measures in the southern Adriatic, including in-country stakeholder consultations in Albania, European Union-Italy and Montenegro. The aim of this work package (WP) will be to ensure

full participation of all concerned parties towards the establishment of a common course of action and the retrieval of all required information for a comprehensive analysis in WPs 2, 3, 4 and 5 below.

This WP is foreseen to start in July 2022 and be well advanced by January 2023.

Work package 2 – remotely operated vehicle survey

Task 2.1 – Performance of the remotely operated vehicle survey in geographical subarea 18

Performance of a remotely operated vehicle (ROV) survey to collect data both on the presence and on the condition of the colonies, at least in non-trawled areas. The newly collected data emerging from the ROV survey will be used to complement and update the analysis performed in WP3.

For a successful ROV survey at target depths (up to at least 800 m), calm seas and appropriate weather conditions are essential. For this reason, the ROV survey is foreseen to be organized ad hoc during the summer, by August 2023 at the very latest. Should there be the opportunity to take advantage of existing programmed surveys before then, the completion of the ROV survey could take place earlier. Calm seas are a prerequisite for the successful implementation and completion of an ROV survey. Consequently, it is not appropriate to plan ROV surveys in the Otranto Channel during the winter, and a certain amount of flexibility will have to be factored into such planning.

It is foreseen that the survey will be carried out using a sampling design based on depth (and if information is available, also on the spatial distribution of fishing effort) with a minimum of five ROV transects carried out at depths of 500–800 m over a period of ten days.

The ROV will be equipped with all the tools used in deep-sea exploration and monitoring, including a high-resolution camera, appropriate lights, underwater sonar and navigation systems, positioning, laser beams for size reference and a manipulator arm to collect samples (see WP4).

Task 2.2 Analysis of data emerging from the remotely operated vehicle survey in geographical subarea 18

Video analysis will be carried out using image-analysis software. A maximum of 60 working days will be required for the analysis of the data emerging from the ROV survey. The time of completion for this task will depend on when the survey will be performed, on the actual number of transects performed and on what is found on the seabed. In the worst-case scenario, assuming the survey takes place in August 2023 and all foreseen transects are carried out, the analysis will be finished by January 2024 at the latest.

Video transects will allow for description of the marine community observed. Video analysis will also allow for the assessment of the population structure of the *I. elongata* population by combining the use of lasers and imaging techniques in order to gain insights into the conservation status of this species in the study area.

Work package 3 – Analysis of available data

Task 3.1 – Presence and distribution of Isidella elongata *facies*

Collation of all available data (e.g. MEDITS and ROV data, information from literature) to perform a spatio-temporal analysis of the presence and distribution of *Isidella elongata* facies in geographical subarea (GSA) 18. In these analyses, existing data will be updated with new information emerging from WP2.

This task will include a validation of the areas of high probability of *Isidella elongata* presence in GSA 18 emerging from the modeling exercises.

In particular, data from trawl survey (MEDITS) and data from ROV will be used with the aim of completing a picture of the presence and consistency of *Isidella* facies. Indeed, the MEDITS data will come from trawlable grounds, while the ROV will come from non-trawled and deeper areas. Both sources of information will be used to identify the presence and consistency of *Isidella elongata* facies with different modeling approaches (e.g. GAM, Maxent) in order to obtain a picture as precise as possible of bamboo coral in the southern Adriatic.

Preliminary results for this task are foreseen to be available by January 2023 and the finalization of the task will depend on the availability of the results from the ROV survey carried out under WP2.

Task 3.2 – Essential fish habitats

Collation, analysis and mapping of all available information on EFH in GSA 18 (e.g. giant red shrimp spawners and recruits, blackmouth catshark [*Galeus melastomus*] spawners and blue and red shrimp spawners).

In Carbonara *et al.* (2020), a first overlap analysis between the *Isidella elongata* facies distribution and EFH was done on based on the *Isidella elongata* hot-spot probability map and the EFH identified in MEDISEH (2013). Thus, the first step will be to update the EFH using the MEDITS data collected so far (1994–2021) with the same approach of MEDISEH (2013). Then, using the outputs of Task 3., the overlap analysis between the *Isidella elongata* facies distribution and EFHs of key species, as well as of giant red shrimp, blackmouth catshark and blue and red shrimp will be refined/updated.

Results for this task are foreseen to be available no later than January 2024.

Task 3.3 – Fishing footprint

Investigation of the footprint and spatial-temporal evolution of bottom-contact fisheries in GSA 18 using the best available information.

Task 3.3.1. Analysis of data from vessel monitoring systems and automated identification systems

The basis of the analysis foresees the integrated analysis of vessel monitoring systems (VMS), automated identification systems (AIS) and satellite data related to the vessels operating in GSA 18.

The subtask will also include an analysis of the quality of the data used by linking to available vessel registries and underlining data gaps.

This subtask is foreseen to be finalized no later than December 2023. However, the time required for the completion of this sub-task will depend on the type of information available and when it will be made available to experts for analysis, in particular:

- VMS data – number of years available, format available (raw vs aggregated data), resolution of data available and timing of the provision of data. A deadline for the provision of VMS data should be agreed upon before finalizing the timeline;
- AIS data – number of years available;
- satellite data (e.g. SAR Sentinel-1 imagery) – number of years available. It will be used to integrate and cross-validate VMS/AIS information on fishing activities; and
- possibly logbook data, with the format and availability to be decided and agreed upon.

Task 3.3.2 – Local ecological knowledge

Additional complementary information will be used to integrate the information available under Task 3.3.1 through the inference of the historical evolution of the fishery as emerging from a local ecological knowledge (LEK) study. The aim of the study will be to reconstruct historical changes in the fishing activity of all fleets operating in the areas. Techniques such as the LEK-1 protocol[4] are foreseen to be used as a guiding protocol to interview local stakeholders to trace back changes that may have occurred in the bottom-contact fishery in GSA 18. Based on this, ad hoc questionnaires will be developed in collaboration with relevant national administrations and distributed to the stakeholders identified in WP1. This subtask is foreseen to be completed by September 2023.

Task 3.4 – Overlap analysis

Analysis, based on the results of Tasks 3.1, 3.2 and 3.3, to quantify and evaluate the overlap between *Isidella elongata* facies, essential fish habitats and the bottom-contact fisheries footprint in space and time. The finalization of this task will be subject to the finalization of tasks 3.1, 3.2 and 3.3 and is foreseen for no later than February 2024.

Work package 4 – Age and growth of *Isidella elongata*

Analysis of the ages and growth of *Isidella elongata* is foreseen to fully understand the recovery potential and long-term population dynamics of the species with a view to future management.

Although age and growth are missing from the *I. elongata* data, congeneric species have been found to have a slow growth rate (Roark *et al*., 2005; Andrews *et al*., 2009). In the Gulf of Alaska, it was estimated that the lifespan for *Isidella* spp. was 75 to 126 years, with a slow growth rate ranging between about 0–0.05 mm of radial basal diameter per year (Roark *et al*., 2005; Andrews *et al*., 2009). Thus, from the perspective of *I. elongata* VME conservation, this trend of decline could be a dangerous warning sign due to the slow growth of *Isidella* sp. (Andrews *et al*., 2009). This biological characteristic of *Isidella* sp. corals means that the recovery of areas impacted by fishing can take a very long time, ranging from a few decades to a century (Roark *et al*., 2005). Specific studies on the growth and age of *I. elongata* have not yet been carried out and should be implemented as soon as possible not only for the purpose of biological and ecological knowledge, but also to inform the conservation of this species (Carbonara *et al*., 2020).

This task is foreseen to be completed in April 2023, with the results presented at the SRC-AS in 2023.

Work package 5 – Towards effective spatial management in GSA 18

Task 5.1 – Implementation of an ad hoc socioeconomic survey and analysis covering the fleets operating in the area

This subtask will be developed by the GFCM Secretariat in collaboration with relevant national administrations and stakeholders with a foreseen completion date of March–April 2024

Task 5.2 – Stakeholder consultations

Stakeholder consultations are foreseen throughout all steps of the project, from the planning of certain activities to the consideration and discussion of both preliminary and final results. The stakeholders to be involved will be identified under WP1 in collaboration with national administrations.

Task 5.3 – Considerations for possible spatial management

[4] https://mpa-engage.interreg-med.eu/monitoring-protocols/our-philosophy-and-monitoring-protocols/lek-1-exploring-local-ecological-knowledge-to-reconstruct-historical-changes/

Discussions under this task will be based on the results of work done under WPs 2–4 and 5.1 with the aim of discussing and proposing potential new FRA(s) in GSA 18 and presenting the results to the SRC-AS in 2024. Final discussion is to take place at a dedicated meeting before the SRC-AS in 2024.

Proposed timeline

Consultations among parties for the finalization of the concept note	May–June 2022
Start of pilot project	July 2022
Mid-project targets	Presentation of progress and preliminary results at the SRC-AS in 2023
End of pilot project	Presentation of final results at the SRC-AS in 2024

WP/Task		**Proposed timing**
WP 1 Creation of a network		January 2023
WP 2 ROV survey and analysis		
Task 2.1	ROV survey	No later than August 2023
Task 2.2	Data analysis	No later than January 2024
WP 3 Analysis of available data		
Task 3.1	Presence and distribution of *Isidella elongata* facies	Preliminary results: January 2023 Final results: depending on ROV survey
Task 3.2	Essential fish habitats	No later than January 2024
Task 3.3	Fishing footprint	
	Task 3.3.1: Analysis of VMS/AIS data, including an assessment of data quality	Depending on the availability of VMS data and number of years available, no later than December 2023
	Task 3.3.2: Local ecological knowledge	September 2023
Task 3.4	Overlap analysis	No later than March 2024 with preliminary results presented at the SRC-AS in 2023
WP 4 Age and growth of *Isidella elongata*		April 2023
WP 5 Towards effective spatial management in GSA 18		
Task 5.1	Ad hoc socioeconomic survey and analysis	July 2022–March/April 2024
Task 5.2	Stakeholder consultations	Foreseen throughout all steps of the project, from the planning of certain activities to the consideration and discussion of both preliminary and final results
Task 5.3	Towards effective spatial management	Final discussion to take place at a meeting before the SRC-AS in 2024 and presentation of final results at the SRC-AS in 2024

Proposed partners

WP/Task		**Scientific partners/responsible person**	**National administration partners/focal points**
WP 1 Creation of a network		COISPA IRBIM-CNR Albanian scientific expert(s) to be identified	To be decided by countries
WP 2 ROV survey and analysis			
Task 2.1	ROV survey	COISPA Giovanni Chimienti Albanian scientific expert(s) to be identified	To be decided by countries
Task 2.2	Data analysis	Giovanni Chimienti Albanian scientific expert(s) to be identified	
WP 3 Analysis of available data			
Task 3.1	Presence and distribution of *Isidella elongata* facies	COISPA Giovanni Chimienti Albanian scientific expert(s) to be identified	To be decided by countries
Task 3.2	Essential fish habitats	COISPA Albanian scientific expert(s) to be identified	
Task 3.3	Fishing footprint		
	Task 3.3.1: Analysis of VMS/AIS data, including an assessment of data quality	IRBIM-CNR Albanian scientific expert(s) to be identified	To be decided by countries
	Task 3.3.2: Local ecological knowledge	IRBIM-CNR Albanian scientific expert(s) to be identified	
Task 3.4	Overlap analysis	COISPA IRBIM-CNR Albanian scientific expert(s) to be identified	
WP 4 Age and growth of *Isidella elongata*		COISPA Giovanni Chimienti Albanian scientific expert(s) to be identified	
WP 5 Towards effective spatial management in GSA 18			
Task 5.1	Ad hoc socioeconomic survey	Coordinated by the GFCM Secretariat Albanian scientific expert(s) to be identified Italian scientific expert(s) to be identified	To be decided by countries
Task 5.2	Stakeholder consultations	Coordinated by the GFCM Secretariat with national administrations	
Task 5.3	Towards effective spatial management	All partners	

Appendix 12

Proposal for a fisheries restricted area in the Cabliers coral mound province in the Alboran Sea (geographical subareas 3 and 4)

The fisheries restricted area proposal is available at the following link:

https://gfcm.sharepoint.com/:b:/g/SAC/EUPmdlS0fZpDqUggxtt9KmYB-WVPwBUF-0r-jtbtB4b63Q

Appendix 13

Minimal standards for the monitoring of fisheries restricted areas

Preparation of this document

Acknowledging the importance of the existing 11 fisheries restricted areas (FRAs) for the sustainability of fisheries and the protection of crucial ecosystems and life stages (juveniles in particular), the forty-fourth session of the General Fisheries Commission for the Mediterranean (GFCM) (online, November 2021) discussed a proposal from the European Union for a recommendation on minimum management standards in FRAs. The objective of this proposal was to create a standard toolbox with common measures and features applicable to FRAs, including closures, buffer zones and scientific monitoring, as well as monitoring control and surveillance. The GFCM decided to keep the proposal pending and revisit it at its forty-fifth session following additional inputs by the Scientific Advisory Committee on Fisheries (SAC) and the Compliance Committee (CoC).

This document includes the inputs provided by the Working Group on Vulnerable Marine Ecosystems and Essential Fish Habitats (WGVME-EFH) (online, 22–24 March 2022) and the CoC/SAC Seminar on GFCM fisheries restricted areas (SemFRA) (online, 25 March 2022).

Background

On the basis of the conclusions of the forty-fourth session of the GFCM, the WGVME-EFH included in its agenda a discussion on existing scientific monitoring plans in FRAs and provided advice on the minimum requirements for a scientific monitoring of FRAs.

In particular, the WGVME-EFH revised the work previously done by the Working Group on Marine Protected Areas (WGMPA) (FAO headquarters, Rome, Italy, February 2019), which prepared an initial proposal for minimum requirements for monitoring plans for FRAs oriented towards the protection of EFH, VMEs, or both, based on the work done for the scientific plan of the Jabuka/Pomo Pit FRA in 2017. The working group also considered that full compliance with monitoring, control and surveillance (MCS) would be the most fundamental aspect towards ensuring the effectiveness of the FRA with respect to its primary conservation objectives.

In addition to this, and on the basis of a dedicated questionnaire addressing the experience of GFCM contracting parties and cooperating non-contracting parties (CPCs) in implementing the different FRAs in the GFCM area of application, including on MCS measures and control tools towards more effective compliance, the SemFRA addressed the following objectives: i) identify challenges and difficulties faced by CPCs in implementing the FRAs; ii) share experiences on the management and control of the FRAs; and iii) identify minimum conservation measures and MCS standards towards an improved FRA network in view of enhancing the level playing field in the region. The conclusions of the SemFRA and the main elements for the development of the GFCM FRA toolkit were approved by the fifteenth session of the Compliance Committee (Cyprus, May 2022) following the advice of the Working group on Vessel Monitoring Systems and related control systems (WGVMS) (Cyprus, May 2022). The WGVMS emphasized the usefulness of the toolkit and its relevance in enhancing monitoring, including in the context of the future GFCM regional VMS and related control systems and the importance of facilitating consultations at the national and regional levels among all relevant stakeholders to promote awareness in the role that FRAs could play to support the sustainability of commercial fisheries and the preservation of marine ecosystems.

The main elements for the development of the GFCM FRA toolkit, as proposed by the SemFRA, are included in Annex 1 below, while the integrated guidelines for the development of scientific monitoring plans for FRAs, as proposed by the WGVME-EFH, are included in Annex 2.

Appendix 13/Annex 1

Main elements for the development of the GFCM fisheries restricted areas toolkit

- Coherent measures, among which a network of fisheries restricted areas (FRAs), including the establishment of scientific monitoring plans according to a common approach and tailored to the conservation objective of the FRAs (vulnerable marine ecosystems and/or essential fish habitats) as proposed by the Working Group on Vulnerable Marine Ecosystems and Essential Fish Habitats (WGVME-EFH) in 2022;

- scientific advice and data made available for the identification of new FRAs;

- delimitation of the FRA, taking into consideration restriction levels and buffer zones;

- consultative process **for the establishment of FRAs**:

    - national level with administrations, scientists, fishers and non-governmental organizations;

    - regional level (among countries and with the relevant actors);

- consultative process **after the establishment of FRAs**:

    - continue the participative process for the implementation of the measures and monitoring of the FRA, with data and information sharing with relevant stakeholders;

- develop monitoring, control and surveillance leveraging innovative technologies taking into consideration the subregional approach in line with the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea:

    - vessel monitoring system/automated identification systems ensuring transmission intervals coherent with monitoring and control needs;

    - geofencing mechanisms under predetermined conditions where applicable and needed;

    - remote electronic monitoring including through ancillary tools (drones, sat imagery);

    - progressive use of machine learning and related tools to bolster traditional control procedures; and

    - inspection procedures and cooperation among institutions involved;

- data requirements for the management and control of the FRAs (authorized vessel list for the FRAs, infringements, etc.) and improved transparency in line with GFCM data confidentiality rules; and

- regular evaluation and efficiency of the current measures of the FRAs at national level and GFCM level.

Appendix 13/Annex 2

Integrated guidelines for the development of scientific monitoring plans for GFCM fisheries restricted areas

The design of the scientific monitoring plans should be in line with the main objective(s) of the fisheries restricted area (FRA), and provide suggestions for the main two groups of objectives:

- the protection of essential fish habitats (EFH-FRAs); and
- the protection of vulnerable marine ecosystems (VME-FRAs).

When a particular FRA combines different objectives, a combination of monitoring approaches is expected, taking into account the relative importance of the different objectives and potential tradeoffs. For VME-FRAs, the presence of a comprehensive monitoring plan will enable the FRA in question to be used as a reference site for the evaluation adjacent areas.

Baseline information should ideally be provided in the FRA proposal; however, for older FRAs, a first more comprehensive monitoring effort would comprise the baseline on the state of the habitats protected by the FRA particularly for VME-FRAs, regarding the ecological characteristics of these sites against the good environmental status criteria from the Marine Strategy Framework Directive, or similar, as well as in terms of other human activities having an adverse impact.

The scientific monitoring plan for EFH-FRAs, as per the experience with the Jabuka/Pomo Pit FRA, should include:

- regular collection of direct observations of the status of priority stocks, with a focus on the stocks mentioned in the objective of the FRA, by means of surveys-at-sea;
- regular collection of fisheries-related data, in accordance with the Data Collection Reference Framework, ensuring the collection of comprehensive data on the stocks mentioned in the objective of the FRA;
- comprehensive socioeconomic data collection aimed at assessing the effects of changes in the volume of landings in socioeconomic variables of the fisheries affected by the FRA;
- annual monitoring, at least for GFCM priority species; and
- a plan to prepare and provide regular advice on the status of fisheries (including fisheries resources mentioned in the objective of the FRA, and the socioeconomic assessment of the fisheries involved) through the existing expert groups (e.g. the working groups on stock assessments and Workshop on the assessment of management measures) and including local ecological knowledge from fishers' direct experiences and perceptions of the effect of the FRA on involved fisheries.

The scientific monitoring plan for VME-FRAs should:

- be designed for the characteristics (biological and ecological) of the benthic habitat subject to the protection measure;
- only employ non-destructive methods, such as those relying on the use of remote tools like remotely operated vehicles or other imaging methods; and
- include monitoring every two to five years, depending on the features of the FRA/species and the availability of data prior to its establishment.

Appendix 14

Terms of reference, workplans and guidelines for select activities

Appendix 14/A

Terms of reference for the second phase of the research programme on European eel (*Anguilla anguilla*) in the Mediterranean

The twenty-third session of the Scientific Advisory Committee on Fisheries (FAO headquarters, Rome, Italy, June 2022) agreed on the implementation of a second phase of the research programme on European eel in the Mediterranean according to the following preliminary terms of reference:

I. Based on the consistent amount of information gathered by the research programme, postulating that Mediterranean lagoons are the most important habitat for eel, the second stage of the research programme should aim at validating the data collected in the first phase and improve some aspects to better understand the drivers of the population, by doing field work on the three stages of the life cycle at specific key sites, with the involvement of fishers:

   i. Identify and select the key habitats and sites to be sampled as part of the second phase of the research programme.

   ii. Develop and implement a common monitoring scheme for each life stage or alternative schemes to be evaluated on a comparative basis, foreseeing a standardized procedure for this field work and future monitoring, also taking into account the efforts being done in the area of the International Council for the Exploration of the Sea.

   iii. Carry out work in the field in selected key sites to gather data for the validation of statistical and management models.

   iv. Analyse emerging information towards identifying potential future management strategies, e.g. total allowable catch.

II. Perform a socioeconomic study on eel fisheries in the Mediterranean.

III. Conduct stakeholder awareness activities.

IV. Work on modalities for compensation schemes for fishers.

Appendix 14/B

Terms of reference of the GFCM expert group on European eel in the Mediterranean (EGEMed)

The creation of the GFCM expert group on eel in the Mediterranean (EGEMed) will address the following issues:

- Consolidate and expand the network of scientists and focal points fostered by the GFCM research programme on European eel in the Mediterranean.

- Coordinate all work to be done on eel at the Mediterranean level towards addressing common priorities, including the revision of the Data Collection Reference Framework, the contribution of the Mediterranean to the Joint European Inland Fisheries and Aquaculture Advisory Commision/International Council for the Exploration of the Sea/General Fisheries Commission for the Mediterranean Working Group on Eels (EIFAAC/ICES/GFCM WGEEL) and the direction to be taken during a potential second phase of the research programme.

- Identify and address the needs of countries with regards to technical assistance.

- The EGEMed should be composed of eel experts, both scientific and administrative, from the research programme as well as experts from various countries. The detailed composition of the EGEMed, and the roles of the different experts, should be further discussed and agreed upon at its first meeting.

- The EGEMed should provide a forum to ensure the further development and inclusion of the junior scientists involved in the research programme in the aim of ensuring the consolidation of expertise into the future.

Appendix 14/C

Terms of reference for the revision of the Data Collection Reference Framework TASK VII.6-EEL

In line with chapter 16 of the GFCM research Programme on European eel in the Mediterranean (RP), the following changes to Task VII.6-Eel of the Data Collection Reference Framework (DCRF) are proposed:

A. Proposal for amending Recommendation GFCM/41/2017/6 on the submission of data on fishing activities in the GFCM area of application

The proposed amendment to the Annex 1 of the recommendation here reported below (new fields in green, deleted fields in red, unchanged fields in black, P = private, S = semi-private):

DCRF DATA FIELDS (Biological information - European eel)	MANDATORY (X)	DATA CONFIDENTIALITY STATUS*
Quarterly data (Jan-Mar; Apr-Jun, Jul-Sept, Oct-Dec) submitted on an annual basis	X	P
Habitat	X	P
Site	X	P
Number of fishers (by site)	X	S
Gear type	X	P
~~Mesh size~~		~~S~~
~~Fishing days~~	~~X~~	~~S~~
~~Average number of "gear units" per day per fisherman~~	~~X~~	~~S~~
Total catch of silver eel (by gear type)	X	P
Total catch of yellow eel (by gear type)	X	P
~~Total catch of silver and yellow eels~~	~~X~~	~~P~~
Total catch of glass eel (by gear type)	X	P
Stocking lifestage	X	P
Stocking (kg/year)	X	P
Fishing effort	X	S

* Chapter 9 "Data confidentiality and access policy" of the DCRF manual

B. Proposal for amending the DCRF manual

The proposed amendments to appendix "H.2 - Gear types for the European eel fishery" of the DCRF manual are here reported in green (unchanged fields in black):

Gear types	Gear code
Barrier	BAR
Eel longlines	ELL
Fence	FEN
Fishing rod	FRD
Glass eel net	GEN

Gear types	Gear code
Gillnets	GLN
Non-specific net	NTS
Pots and traps	EPO
Pound net	PON
Shore lift net	SLN
Snigging	SNI
Spear fishing	SPF
Traps fyke nets	FYK
Umbrella	UMB
Other	OTH

The new proposed field “Fishing effort” will imply the addition to the DCRF manual of the following new reference table about the fishing effort by European eel gear type:

Gear type	Fishing effort parameters
Barrier	Total dimensions
	Number of rooms
	Room dimensions
	Minimum grid size
	Landing/fishing operation
	Effective number of fishing days/month
	Number of days of opening/month
Eel pot	Total number of used pots/licenses
	Distance between two pots
	Mesh size
	Soak time per fishing operation
	Number of fishing operations/day
	Number of fishing days/trip
	Number of licenses
	Landing/trip

Gear type	Fishing effort parameters
Fyke nets + Fences	Minimum mesh opening
	Number of pockets (codends)/gear
	Pockets dimensions (diameter, length)
	Number of gears/licenses
	Total gears dimensions
	Landing/effective fishing operation
	Soak time
	Number of licenses
Longline	Total number of used hooks/license
	Distance between two hooks
	Hook size
	Soak time per fishing operation
	Number of fishing operations/day
	Number of fishing days/trip
	Number of licenses
	Landing/trip

C. Proposal for inclusion of European eel in in DCRF Task VII.I Stock assessment input data

Given the relevance of the European eel species in the Mediterranean region, the implementation of the DCRF Task VII with a dedicated system for European eel assessment-related input data (DCRF Task VII.1 Stock assessment input data) is proposed. This system should rely on specific monitoring (survey) to provide additional data both concerning biological variables, collected on a consistent basis with standardized methodologies and specific indicators of recruitment, as well as yellow eel standing stock and escapement.

Proposed timeline of events

1. National focal points of the RP to provide written comments on Chapter 16 of the research programme on the DCRF revision proposal before the joint European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC) / International Council for the Exploration of the Sea (ICES) / GFCM Working Group on Eels (WGEEL) 2022, also taking advantage of the upcoming joint EIFAAC/ICES/GFCM WGEEL data call to further reflect on needs and congruencies. The Secretariat would liaise with focal points to agree on a deadline and send reminders close to the date of the deadline.

2. Presentation of DCRF revision proposal to the joint EIFAAC/ICES/GFCM WGEEL 2022, taking into account the comments of the national focal points and in particular regarding the challenges associated to fishing effort. This would serve to identify and avoid duplicity of

efforts, taking into account procedures and methodologies agreed upon at the joint EIFAAC/ICES/GFCM WGEEL.

3. Organization of the first meeting of the Expert Group on Eel in the Mediterranean (EGEMed), with the following objectives and terms of reference:

    - Decide the components of the expert group with an agreement of the scientific partners to be involved at country level in coordination with national focal points and clarify the roles of the different experts. This should also foresee the participation of countries involved in eel fisheries but not participating in the RP.

    - Start the process of appraising in detail the proposed DCRF revision and agree on a roadmap towards its finalization and implementation.

    - Identify the needs of countries with regards to technical assistance and how to address them, e.g. through MedSea4Fish.

Appendix 14/D

Roadmap towards a management plan for round sardinella (*Sardinella aurita*) in the eastern Mediterranean

The twenty-third session of the Scientific Advisory Committee on Fisheries (SAC) (FAO headquarters, Rome, Italy, June 2022) agreed to advance towards proposing elements for a future management plan in 2023, according to the following steps outlined below:

1. Finalization of the benchmark assessment

The Working Group on Stock Assessment of Small Pelagic Species (WGSASP) (online, January 2022), based on discussions held at the 2021 benchmark session and during recent FAO-EastMed meetings, discussed and agreed on a roadmap for the improvement of the round sardinella (*Sardinella aurita*) assessment in geographical subareas (GSAs) 24, 26 and 27, towards the future finalization of the benchmark.

A summary of the discussions held will be included in the final WGSASP report.

The roadmap seeks to guide the way towards improving both the input data and the diagnostics of the assessment models used, identifying actions to be carried out for short-, medium- and long-term improvement.

A. Short-term actions to improve diagnostics of current length-based assessments and perception of the stock and move to quantitative advice

- Run a number of different assessment models for the same stock and compare outcomes (already partially done) and investigate how the assumptions of each method are met, for example:
    - LBSPR;
    - VIT;
    - LIME;
    - catch curves; and
    - other?
- Introduce uncertainty into the assessments, for example:
    - LBSPR: introduce uncertainty from life histories;
    - VIT: translate the sensitivity on terminal F into an uncertainty that can be incorporated in the assessment; and
    - LIME: may require a shorter time-step to work better.
- Merge different years together to improve the fit of the models to length data, as well as reduce uncertainty.

Timeline: work on achieving these goals in view of the next assessment for round sardinella.

B. Medium-term actions to improve assessments and stock status

- Identification of a set of multiple indicators that could complement current assessments in reaching a conclusion on stock status and advice. Possible indicators to discuss include:
    - Stock indicators:
        - Discuss the possibility of deriving a recruitment index from length data.
        - Keep improving age reading, trying to include more large animals or larger animals as well as smaller ones.
        - Obtain information that can be used for the estimation of growth parameters independent of the fishery to reduce uncertainty around age 0.
        - Continue working on the estimation of growth and M in a standardized manner among countries.
    - Environmental indicators
        - Identify appropriate environmental indicators that could also contribute to understanding changes in availability of the stock.
    - Fisheries indicators
        - Gather detailed effort information such as number of fishing days and number of vessels.
        - Investigate the possibility of deriving a catch per unit of effort (CPUE) index (this will need standardization and the information on the fleet to perform).
        - Investigate possible empirical indicators such as from local ecological knowledge (LEK).

Way forward: The group agreed to organize a meeting in the first half of 2022 to discuss possible indicators, their benefits and the feasibility of obtaining information on them, as well as a timeline for each. In order to be able to prioritize actions adequately, this meeting should take place in conjunction with the one proposed for Point 3 of this roadmap.

Timeline: Organize a meeting in the first half of 2022 and make a detailed plan for advancing on the decisions taken.

C. Long-term actions to improve assessments and stock status

The improvement of the length data collected from the fishery and from other sources was discussed in detail.

The group agreed that the detailed evaluation of the length samples collected from the fishery would have to continue in view of determining the optimal number of representative samples required. This work should also include simulation testing towards determining this optimum. Issues discussed included adequate coverage of months, gear, ports and possibly fishing grounds. It was acknowledged that this optimum may differ according to the different fishing dynamics in GSA. In particular, the difficulties related to the sampling of smaller individuals from the auctions in Egypt and Gaza, as well as larger individuals in Lebanon, were highlighted, leading the group to underline the importance of collecting samples through onboard observers as well as additional information on the population through scientific surveys.

Way forward: The group agreed to organise a meeting in the first half of 2022 to discuss length sampling. In order to prioritize actions adequately, this meeting should take place in conjunction with the one proposed for Point 2 of this roadmap.

Timeline: Organize a meeting in the first half of 2022 and make a detailed plan for advancing on the decisions made.

2. **Capacity building on data limited management strategy valuation (MSE)**

3. **Implementation of data-limited MSE starting from the measures in Table 1**

4. **Discuss management options at the subregional committee (SRC) in 2023**

Table 1. Toolbox of management measures for round sardinella in the eastern Mediterranean

Scope Eastern Mediterranean subregion

Species Small pelagics–round sardinella

GSAs 22 to 27

Adopted Specific regulation was issued

Planned Text in the recommendation's section of the 2013 report of the Subregional Technical Workshop on Fisheries Multiannual Management Plans for the Western, Central and Eastern Mediterranean

Cat.	Measure	EGY	EU-CYP	EU-GRE	LEB	ISR	PAL	SYR	TÜR	Issues	Implementation	Development	Implementation level	Notes
Temporal restriction	Temporal closure (protecting spawning season and/or shallow waters)	Adopted		Adopted	Adopted: there is a season but most of the time not fully respected by consumer and trade	Spawning season in spring time			Adopted: it is not allowed to catch fish by using purse seine between 15 April and 31 August in GSA 22, and between 15 April and 15 September in GSA 24. Fishing with Alamana nets is	How to stop the demand for small fish rather than the supply? In Türkiye they are not applicable to SSF (only trawlers and PS) also only valid in national waters. Also, temporal restrictions are not designed for a particular species so they may be			Partially implemented in Egypt and Lebanon with high catches of small fish, also because of cultural, trade and market demands. In Türkiye it is the only reliable management tool; spawning period actually coincides with the closure time	

Cat.	Measure	EGY	EU-CYP	EU-GRE	LEB	ISR	PAL	SYR	TÜR	Issues	Implementation	Development	Implementation level	Notes
									prohibited between 15 April and 15 May. This is the measure that works best in Türkiye	mismatched with spawning				
Technical measures	Minimum landing size		No small individuals can be found so biology saves the day in the absence of a MCRS - leaflets on "size does matter"	Minimum catch (and market) size for *S. aurita*. is 10 cm (Royal Decree from 26-1-1954)					Adopted: Minimum landing size is 11 cm for sardine	Small sized sardine is very marketable so need to understand how to stop demand rather than supply– difficult to implement– it is difficult for the untrained eye to separate round sardinella from other species so it is tricky to bring a particular size limit for one	Minimum size should be implemented at the market/consumer/retail level (demand)	Implementation of the measure at the market/retail level– develop an awareness campaign on why undersized fish should not be consumed/bought	Partial	Should be at least 13cm for sardinella – Subregional Technical Workshop on Fisheries Multiannual management plans (2013) suggested 15cm

Cat.	Measure	EGY	EU-CYP	EU-GRE	LEB	ISR	PAL	SYR	TÜR	Issues	Implementation	Development	Implementation level	Notes
										species when there are many more similar ones difficult to distinguish– this is a problem for control				
Spatial restriction	FRAs. Areas, depth and/or habitats restricted to operate purse seines		50m depth/ 500m from coast	Adopted	Adopted	500m min. distance from coast + large marine reserves			Adopted: it is forbidden to catch fish by purse seine nets in shallow waters from a depth of 24m from the shore					
Gear features	Mesh size	Adopted	Yes	Adopted		10 mm to be enlarged	Adopted							
Gear features	Gear dimensions and operation	Adopted	Yes	Adopted	Adopted	Small vessels (11m LOA) + small gear			Adopted: using purse seine nets with a net depth of more than 164 meters are prohibited	Türkiye: conflicts between fishing methods used and lights attract smaller fishes				

Cat.	Measure	EGY	EU-CYP	EU-GRE	LEB	ISR	PAL	SYR	TÜR	Issues	Implementation	Development	Implementation level	Notes
Fishing effort	Reduction and/or control of fishing capacity (considering fleet movement across GSAs and between Atlantic and Mediterranean)	Adopted				Number of vessels and licences are less than 20 vessels; only 6 are active and the number of licenses is frozen			No new licence may be issued for any new fishing vessel					
MCS	VMS		All vessels so very easy to control		Pilot study in 2017; this year try toimplement VMS trials on sardine vessels				Adopted: fishing vessels with a length of 12m and above must be fitted with a Fishing VMS and kept in working condition					

Source: elaborated by the author.

Appendix 14/E

Roadmap towards a quantitative management strategy evaluation for small pelagic fisheries in the Adriatic Sea

The GFCM has requested that management strategy evaluation (MSE) should be used when possible to evaluate the performance of alternative management strategies in addressing either specific objectives as stated in dedicated recommendations, or else generic GFCM objectives, such as restoring and maintaining the stocks' population above levels which can produce the maximum sustainable yield (MSY). In particular, for small pelagic fisheries in the Adriatic Sea, the newly adopted recommendation foresees that the GFCM shall establish yearly catch limits by single species, for 2024–2029 or 2025–2029, based on the outcomes of a management strategy evaluation carried out during the transitional period (2022–2023 or 2022–2024) to be endorsed by the Scientific Advisory Committee on Fisheries (SAC) in 2023 or 2024.

On the basis of previous work and the discussions held during its last session, the twenty-third session of the SAC (FAO headquarters, Rome, Italy, June 2022) suggested the following elements for a roadmap to advance on a quantitative MSE for the small pelagic fishery in the Adriatic. The suggested timeline is to be implemented after the finalization of the benchmark for sardine, expected by November 2022.

1. **A meeting of the Working Group on the Assessment of Alternative Management Measures (WGMSE) (December 2022)**

This expert meeting will evaluate possible models and assumptions to perform MSE, taking into account all previous work performed, in particular the recent advances made by the Scientific, Technical and Economic Committee for Fisheries (STECF) on anchovy. The whole process will be as inclusive as possible; in particular, stock assessors will be fully involved in the work, allowing for transference of expertise as well as capacity development.

The discussion shall take into account that the current assessment is carried out by species, and that the recommendation request yearly catch limits by species, while it also mentions the need to take into account the mixed nature of the fisheries and the nature of stock dynamics.

The meeting will discuss and agree on the way forward in terms of:

- Available data by species
    - fishery data;
    - socioeconomic data;
    - environmental data; or
    - other
- MSE models to be considered, taking into account previous work as well as the feasibility of their implementation, and in particular the following:
    - the possibility of using a variety of assumptions and/or modelling frameworks, so to check the robustness of the results to different approaches;

- the possibility of using models and/or configurations capable of investigating multispecies interactions and incorporating relevant environmental drivers, such as climate drivers;

- and the integration of socioeconomic drivers and their impact on the outcomes (both economically and biologically).

- Management measures to be tested

  - The starting point should be the existing management framework provided by Recommendation GFCM/44/2021/20 on a multiannual management plan for the sustainable exploitation of small pelagic stocks in the Adriatic Sea (geographical subareas 17 and 18) that foresees the following harvest control rules (HCR) be tested:

    - a fixed Fmsy strategy HCR based on Fmsy or Fmsy proxy and Bpa;

    - a fixed Fmsy HCR coupled with effort and catch-based management that will ensure a low probability of SSB to fall below Blim (5% probability), including the scenarios agreed at the WKMSE 2017[5];

    - a Bescapement HCR, based on an optimal level of Bescapement and, if necessary, Fcap; or

    - any other HCR proposed by the WGMSE

- performance statistics to be used;

- the evaluation of the impact of the different HCR on the socioeconomic aspects of the concerned fleets and related industries; and

- the inclusion of stakeholders should be foreseen in all steps of the MSE process (see point 2).

2. Stakeholder consultations (January 2023)

Organize in-country/subregional stakeholder consultation meetings including all involved countries to gain an understanding of stakeholder views on the possible alternative management measures to be tested within the MSE process, including existing measures at the GFCM and national level as well as potential additional ones that could be of interest.

The outcomes of these meetings will inform the technical work to be performed and decided under points 1 and 3 of this roadmap.

3. MSE work (February 2023–May 2023)

Based on the decisions taken during the WGMSE meeting (point 1) and on the outcomes of stakeholder consultations (point 2), the modelling and simulation work will be performed by a network of scientists working together towards the same common goal. This work is foreseen to be adaptive, tracking specific difficulties encountered towards the additional goal of establishing a more generally applicable

[5] Recommendation GFCM/42/2018/8 on further emergency measures in 2019−2021 for small pelagic stocks in the Adriatic Sea (geographical subareas 17 and 18)

quantitative MSE process at the Mediterranean level. The final runs of the MSE will be performed based on the updated assessments provided in May 2023.

4. Presentation of results (SRC–AS 2023; SAC 2023)

Preliminary results will be presented to stakeholders in a simplified manner and feedback used to further refine the modelling work.

Final results will be presented at the SRC-AS for discussion and the provision of advice to the SAC.

Notes on the timeline: In case of delays in the finalization of the benchmark, efforts should be made for its finalization in time for the SRC in 2023, and this roadmap would be delayed by several months, reporting final results to the SRC-AS and SAC in 2024 instead of 2023.

Appendix 14/F

Roadmap towards the finalization of the benchmark for red mullet (*Mullus barbatus*) in the Adriatic Sea (geographical subareas 17 and 18)

Given the amount of work performed, and in view of ensuring a benchmarked assessment providing a stable perception of the stock, the group suggested to keep working on the input data and the models and finalize the benchmark during the next intersession for the consideration of the twenty-fourth session of the Scientific Advisory Committee on Fisheries (SAC).

Data (March–November/December 2022)

- Recover any available data on length frequency distribution (LFDs) of catches/landings/discards prior to the data collection form (DCF) (2002).
- Obtain the GRUND survey indexes and length frequency distributions for geographical subarea (GSA) 17.
- Recover the Croatian Mediterranean International Trawl Survey (MEDITS) data for 1996–2001.
- Keep working on the MEDITS standardization, including of the LFDs (start work in May 2022).
- Explore the possibility of harmonizing the otolith reading among involved institutes.

Modelling (January – March 2023)

- Finalize the a4a assessment including detailed diagnostics.
- Further improve the SS3 single area, combined sex model discussed during the benchmark.
- Further explore the development of SS3 multiarea/quarterly models.

Proposed timeline:

- Data preparation: November/December 2022
- Benchmark: March 2023

Appendix 14/G

Tentative roadmap towards a quantitative management strategy evaluation for demersal fisheries in the Adriatic Sea

The GFCM has requested that management strategy evaluation (MSE) should be used when possible to evaluate the performance of alternative management strategies in addressing either specific objectives as stated in dedicated recommendations, or else generic GFCM objectives, such as restoring and maintaining the stocks' population above levels which can produce the maximum sustainable yield (MSY).

The timeline of the roadmap is to be agreed upon and confirmed on the basis of additional work performed on pending quantitative assessments of key demersal species in the 2022/2023 intersession, taking into account that enough time to deliver the results by the SRC-2026 should be granted. Roadmap revisited, updated and finalized with new information at the next session of the Subregional Committee for the Adriatic Sea (SRC-AS) in 2023.

On the basis of previous work and the discussion held during its last session, the twenty-third session of the Scientific Advisory Committee on Fisheries (SAC) (FAO headquarters, Rome, Italy, June 2022) suggested the following elements for a roadmap to advance on a quantitative MSE for the demersal fishery in the Adriatic:

1. **Stakeholder consultations (TBD)**

Organize in-country stakeholder consultation meetings in all involved countries to gain an understanding of stakeholder views on the possible alternative management measures to be tested within the MSE process, including existing measures at GFCM and national levels as well as potential additional ones that could be of interest.

The outcomes of these meetings will inform the technical work to be performed and decided under point 2 of this roadmap.

2. **A meeting of the Working Group on the Assessment of Alternative Management Measures (WGMSE) (TBD)**

This meeting will be technical and discuss the way forward in terms of:

- Available data
    - fishery data;
    - socioeconomic data;
    - environmental data; or
    - other.

Discuss the results of the stakeholder consultations in light of the available data and objectives pursued.

- MSE models to be considered, taking into account previous work as well as the feasibility of their implementation, and in particular the following:
    - Using different assessment models for the different key species may prevent the use of a common model to implement an MSE.

- Modelling approaches used in the past (FLR-MSE) and those currently being tested under different projects (e.g. BEMTOOL and agent-based modelling) could serve as a starting point for discussions and could be further developed and/or complemented with additional information.

- Recalling past MSE efforts on small pelagics that had been addressed using different modelling frameworks that provided different results, it would be important to use different models to test the same measures in order to gain insights on whether the outputs are dependent on the model used or reflect the management actions.

- Investigate the possibility of using models capable of investigating multispecies interactions and incorporating climate drivers should be considered in the MSE process.

- Integrating socioeconomic drivers and their impact on the outcomes (both economically and biologically).

- Management measures to be tested:

  - The starting point should be the existing management framework at both GFCM and national levels, to be complemented by the outcomes of the stakeholder consultations under point 1.

  - The work should include an assessment of the effects of existing fisheries restricted areas (FRAs) and those of potential new ones.

3. Management strategy evaluation work (TBD)

Based on the outcomes of stakeholder consultations (point 1) and on the decisions taken during the WGMSE meeting (point 2), the modelling and simulation work will be performed by a network of scientists working together towards the same common goal. This work is foreseen to be adaptive, tracking specific difficulties encountered towards the additional goal of establishing a more generally applicable quantitative MSE process at the Mediterranean level.

4. Presentation of results (TBD)

Preliminary results will be presented to stakeholders in a simplified manner and feedback used to further refine the modelling work (TBD).

Ongoing work and preliminary results will be presented to the SRC-AS (TBD).

Final results will be presented at the SRC-AS in 2026 for discussion and the provision of advice to the SAC in 2026.

Appendix 14/H

Roadmap towards the future use and development of the GFCM database on sensitive benthic habitats and species

Based on discussions held at the Working Group on Vulnerable Marine Ecosystems and Essential Fish Habitats (WGVME-EFH), the following actions should be undertaken towards the future use and development of the database for the provision of objective and uniform advice on priorities for the spatial management of vulnerable marine ecosytstems (VMEs) and associated management measures in the GFCM area of application:

1. Expand the spatial and species coverage of the information contained in the database, integrating information from the southern portion of the Mediterranean.

2. Work on the information included in the database as a result of the data call and address the pending issues to be solved as identified in the webinar organised for the launch of the database in 2020, including:

   - type of data
     - qualitative (P/A – including surveyed absences) and quantitative (abundance or biomass per square metre) data: metadata must be good;
     - what units to use; data should be coherent to ensure the analysis consistency with the identified methods or come up with a composite index (e.g. North-East Atlantic Fisheries Commission) and/or a weighting system;
   - coverage: from a spatial point of view, ultimately advice should be coherent with coverage;
   - quality of data
     - metadata on sources and methods of collection will be important;
     - quality assurance and quality control processes?; and
     - development of a weighting system indicating the level of trust.
   - level of aggregation:
     - if a grid-based approach is used this will be important: how big should the rectangles in the grid be;
     - how should data be aggregated within each grid? Based on data (e.g. mean, centroid) and/or on an index as in ICES;
   - methodology of analysis
     - grid-based vs clustering or both;
     - kernel density; C-square;
     - methods allowing the analysis/combination of data from different sources; and
     - multivariate methods analysing more than one species.

3. Based on the above, develop an auditable and transparent framework for providing advice that would need to be validated by the Scientific Advisory Committee on Fisheries (SAC), including through a quality control process that involves networks of experts interacting with whoever is analysing specific datasets and the formulation of sign-off reports demonstrating the process.

4. Organize capacity-building activities on the use of the database to facilitate future work and ensure full use of the database's current tools, as well as identifying potential new ones.

5. The data call is to be issued well in advance of the meeting (foreseen for January every year) in future years, in order to allow time for data analysis. Work towards the inclusion of linkages with environmental layers as well as the overlap with the spatial distribution of fishing effort and possibly with information on other sources of significant adverse impact towards integrated spatial management and facilitating modelling approaches based on the data contained in the database.

Appendix 14/I

Updated roadmap to analyse the overlap between vulnerable marine ecosystems and the deep-water red shrimp fishery

Based on the draft roadmap endorsed by the twenty-second Scientific Advisory Committee on Fisheries (SAC) (online, June 2021) and considering the discussions held during the Working Group on Vulnerable Marine Ecosystems and Essential Fish Habitats (WGVME-EFH), the roadmap was updated as follows:

1. Finalize the work foreseen in section 2 of the proposed work plan for the assessment of stock status and the determination of fishing grounds for deep-water red shrimp stock and fisheries in the eastern-central Mediterranean (deeper than 400 m) that highlights effort and distribution of EFHs in order to overlap with available vulnerable marine ecosystem (VME) data, including a distinction between no trawl areas and areas where fishing is not detected and based on more detailed information on fishing activity through the use for example of vessel monitoring system (VMS) data, the outputs of the multiple-criteria decision analyses performed in geographic subareas (GSAs) 24, 25 and 26 as well as possible additional information.

2. Work to fill the gaps for deep-water red shrimp fisheries in waters shallower than 400 m.

3. Compile and review the Mediterranean Data Collection Reference Framework (DCRF) data to better understand bycatch and discards from other deep-water fishing grounds.

4. Establish linkages between the distribution of VME indicator species and the fishing grounds/vessel activity, based on the new data contained in the GFCM database on sensitive benthic habitats and species and including an information stemming from modelling analyses.

5. Present the information gathered and data gaps to the Subregional Committee for the Eastern Mediterranean (SRC-EM), Subregional Committee for the Central Mediterranean (SRC-CM) and the SAC in 2023 so as to provide inputs for preparing additional management measures (including move-on rules, level of scientific observer coverage, fishing restrictions and no-take zones).

Appendix 14/J

Terms of Reference for an expert meeting on the management of common dolphinfish in the Mediterranean Sea

In response to Recommendation GFCM/43/2019/1 on a set of management measures for the use of anchored fish aggregating devices in common dolphinfish fisheries in the Mediterranean Sea, and building on advances from ongoing activities, in particular the research programme and the International Scheme of Inspections at Sea, an **expert meeting on the management of common dolphinfish** shall take place in 2023 to provide technical elements for the discussion towards the adoption of long-term multiannual management plans for dolphinfish fisheries in the Mediterranean Sea. Taking into account the regional nature of the fishery, which expands across Mediterranean subregions, the meeting should include experts from both research institutes and administrations from all interested countries, ensuring a good geographical coverage.

The proposed terms of reference for this meeting include:

- appraisal of the outcomes of the research programme, as well as of the experience and information gathered through the International Scheme of Inspections at Sea;

- appraisal of the effectiveness of existing management measures, identification of gaps and needs;

- draft technical elements towards a possible revision of the transitional measures and a long-term multiannual management plan for consideration of the Scientific Advisory Committee on Fisheries (SAC); and

- elaborate a roadmap towards the implementation of the proposals, including those stemming from the research programme considered viable.

Appendix 14/K

Terms of reference for an expert meeting on the management of small pelagics in the Alboran Sea

Taking into account the importance of small pelagic fisheries (mainly sardine across the Alboran Sea and anchovy in the northern part of the region) both in terms of volume of catches but also socioeconomic importance, and building on advances made both in the adoption of national management measures and in the scientific knowledge of these fisheries, an expert meeting **on the management of small pelagics in the Alboran Sea** shall take place in 2023 to analyse the state of the art of these fisheries and discuss management priorities and potential ways towards enhanced sustainability of these fisheries.

The proposed terms of reference for this meeting include:

- collation of all the national management measures in place;
- collation of scientific information related to:
    - spatial distribution of spawning and nursery areas;
    - life history traits of the species; and
    - stock definition, including from the results of the TRANSBORAN project;
- identification of management priorities for these fisheries, potential for harmonization across countries and geographical scope for the implementation of subregional management measures; and
- elaboration of a roadmap towards the implementation of the proposals.

Appendix 14/L

Terms of reference for the Working Group on the analysis of fisheries monitoring data (WGANALYSIS)

- Review ongoing monitoring programmes in the area and provide a platform to exchange experiences and best practices.
- Share and jointly analyse the most recent data and information gathered during the different monitoring activities and identify gaps.
- Advance towards the identification of a list of common indicators to measure the impact of discards and of incidental catch of vulnerable species on main fisheries.
- Advance towards the identification of scientific information related to life history traits of the main commercial species.
- Discuss key aspects in sampling and analysis of collected data.
- Encourage the use of data (e.g. survey data, discards data) in the assessment process.
- Propose possible mitigation/management proposals where and if necessary.
- Address data collection and related needs to ensure regular and harmonized monitoring programmes.

This report presents the outcomes of the twenty-third session of the Scientific Advisory Committee on Fisheries of the General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organization of the United Nations (FAO). During the session, the Committee reviewed the work carried out during the 2021–2022 intersession and endorsed the MedSea4Fish guiding document. The Committee provided advice on the status of priority stocks and ecosystems and on potential management measures addressing key fisheries and vulnerable species in the Mediterranean, including i) common dolphinfish (*Coryphaena hippurus*) and blackspot seabream (*Pagellus bogaraveo*) fisheries in the western Mediterranean; ii) small pelagic and bottom trawl fisheries exploiting demersal stocks, particularly European hake (*Merluccius merluccius*) and deep-water rose shrimp (*Parapenaeus longirostris*), in the central Mediterranean; iii) deep-water red shrimp, giant red shrimp and blue and red shrimp (*Aristaeomorpha foliacea* and *Aristeus antennatus*) fisheries in the eastern-central Mediterranean, including their interactions with vulnerable megafauna; iv) non-indigenous species in the eastern Mediterranean, and v) small pelagic and demersal fisheries in the Adriatic. The Committee also agreed on the technical soundness of a proposal for the establishment of a fisheries restricted area (FRA) in the Cabliers Coral Mound, reviewed and endorsed a proposal for a large scale multiannual pilot study on trawl selectivity in the Strait of Sicily and reviewed the updated proposal from Libya to divide the Libyan coast (geographical subarea 21) into three marine subareas. At the regional level, the Committee provided advice on: i) minimum conservation reference size for GFCM priority species; ii) spatial distribution of fishing effort; and iii) ensuring and assessing the effectiveness of FRAs and establishing minimal standards for the monitoring of FRAs. With regard to recreational and small-scale fisheries, the Committee endorsed lists of species of importance and expressed support for a dedicated research programme for recreational fisheries. The Committee discussed additional work such as further enhancing the implementation of the Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea, dedicated research programmes, as well as other activities to enhance fisheries management in the region. Finally, the Committee agreed upon its workplan for 2022–2024.

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