ISSN XXXX-XXXX

European Commission

JRC SCIENCE FOR POLICY REPORT

Scientific, Technical and Economic Committee for Fisheries (STECF) - Evaluation of economic indicators and closure areas in the western Mediterranean. (STECF-23-01)

Edited by Cecilia Pinto, Ralf Doering, Sven Kupschus, Andrea Pierucci

2023

Joint Research Centre

EUR 28359 EN

Contact information
Name: STECF secretariat
Address: Unit D.02 Water and Marine Resources, Via Enrico Fermi 2749, 21027 Ispra VA, Italy
Email: jrc-stecf-secretariat@ec.europa.eu
Tel.: +39 0332 789343

EU Science Hub
https://joint-research-centre.ec.europa.eu

JRCXXXXXX

EUR 28359 EN

PDF	ISBN 978-92X-XX-XXXXX-X	ISSN 1831-9424	doi:XX.XXXX/XXXXXX	KJ-AX-2xxxxx-C
STECF		ISSN 2467-0715		

Luxembourg: Publications Office of the European Union, 2023

How to cite this report: Scientific, Technical and Economic Committee for Fisheries (STECF), *Evaluation of economic indicators and closure areas in the western Mediterranean. (STECF-23-01).* Cecilia Pinto, Ralf Doering, Sven Kupschus, Andrea Pierucci, Publications Office of the European Union, Luxembourg, 2023, doi:XXXXXXXX, JRCXXXXXXX.

Authors:

STECF advice:

Bastardie, Francois; Borges, Lisa; Casey, John; Coll Monton, Marta; Daskalov, Georgi; Döring, Ralf; Drouineau, Hilaire; Goti Aralucea, Leyre; Grati, Fabio; Hamon, Katell; Ibaibarriaga, Leire; Jardim, Ernesto; Jung, Armelle; Ligas, Alessandro; Mannini, Alessandro; Martin, Paloma; Moore, Claire; Motova, Arina; Nielsen, Rasmus; Nimmegeers, Sofie; Nord, Jenny; Pinto, Cecilia; Prellezo, Raúl; Raid, Tiit; Rihan, Dominic; Sabatella, Evelina; Sampedro, Paz; Somarakis, Stylianos; Stransky, Christoph; Ulrich, Clara; Uriarte, Andres; Valentinsson, Daniel; van Hoof, Luc; Velasco Guevara, Francisco; Vrgoc, Nedo.

EWG-23-01 report:

Pinto, Cecilia; Döring, Ralf; Accadia, Paolo; Bastardie, Francois; Billet, Norbert; Bitetto, Isabella; Certain, Gregoire; Drouineau, Hilaire; Garriga Panisello, Mariona; Gourguet, Sophie; Grati, Fabio; Kupschus, Sven; Lehuta, Sigrid; Mannini, Alessandro; Merzéréaud, Mathieu; Phan, Tuan Anh; Pierucci, Andrea; Russo, Tommaso; Sabatella, Evelina Carmen; Stefani, Matteo; Tassetti, Anna Nora; Viva, Claudio

CONTENTS

1.1 Abstract

Commission Decision of 25 February 2016 setting up a Scientific, Technical and Economic Committee for Fisheries, C(2016) 1084, OJ C 74, 26.2.2016, p. 4–10. The Commission may consult the group on any matter relating to marine and fisheries biology, fishing gear technology, fisheries economics, fisheries governance, ecosystem effects of fisheries, aquaculture or similar disciplines.

This report is the 10th of a suite of STECF EWG reports dedicated to the evaluation of the implementation of the Western Mediterranean Sea Multi-Annual management Plan (hereafter, MAP), following EWG reports 18-09, 18-13, 19-01, 19-14, 20-13, 21-01, 21- 13, 22-01 and 22-11.

The group was requested to continue the development of socio-economic indicators to be used in the evaluation of management measures for the West Med MAP in both West Med management units (EMU1 and EMU 1) (TOR1). Two roadmaps were discussed, a short term approach and a long term approach which would consider the expansion of all the mixed-fisheries bio-economic models to both management units. As a first step, the group focused on the proposal of harmonizing the economic indicators across the models implemented (TOR2). The group was than requested to further develop the approach implemented during EWG 22-01 to identify persistence hotspots of the six target species of the West Med MAP using scientific survey data (MEDITS) in combination to commercial spatial data (VMS joined with logbooks), to test existing and additional closure areas (TOR 3). The group was also requested to revise Article 8 of the 2023 fishing opportunities for the West Med MAP (COUNCIL REGULATION (EU) 2023/195), which lists the compensation mechanisms that MSs can implement within the West Med MAP to obtain additional fishing days in 2023 (TOR 4).

For TOR 1 a roadmap was discussed and proposed on how to organise the work on socio-economic assessments for the West Med MAP in 2023. The EWG suggests that here should be a three-step process: a scoping exercise (done with EWG 23-01), a meeting with stakeholders in the middle of the year to discuss their perception of the socio-economic consequences of measures of the West Med MAP and the running of scenarios during EWG 23-11 with results from socio-economic assessments.

The EWG notes that the modellers have only the five-day meeting in September to run scenarios. Therefore, it would be crucial for the success of the assessments that the 6 scenarios provided by DG Mare for the EWG 22-11 and with some adjustments for EWG 23-01 will not change for EWG 23-11. It is crucial because those scenarios are already implemented in the models and the implementation of new scenarios would take a lot of time. The EWG proposes to run a few additional scenarios with only one measures to separate impacts of certain measures from the six scenarios where a mixture of measures is included. This would hopefully allow to give an indication what additional efforts may be necessary to reach MSY (in 2025 but also beyond in case the objective is not reached by 2025) and when gains from the implementation of the West Med Plan could be expected.

The EWG observes that modelers need to put in additional effort and resources to improve the models for an improved assessment of the West Med MAP. The models were not originally developed for the assessment of the West Med MAP and only cover parts of the area of the Western Mediterranean. Such an improvement of the models could also include work to provide longer-term socio-economic assessments of measures where modelers need to take additional assumptions into account.

The EWG notes that it would be beneficial if modelers receive a basic list of assumptions for key economic variables before the EWG 23-11 meeting in September. In 2022, for example, the increased fuel costs were an important factor

regarding the economic performance of the fleets. In 2023 fuel costs have decreased but there are other cost categories with a substantial increase.

The EWG concludes that DG Mare should not change the 6 provided scenarios substantially before the EWG 23-11 meeting in September. This would allow the modelers to run the models during the meeting and provide the socio-economic results.

The EWG concludes that STECF and DG Mare should further discuss how resources could be provided to modelers to improve the applied models.

The EWG concludes that the chairs of EWG 23-01 and 23-11 will provide a list of assumptions for the implementation of the models regarding key variables for the socio-economic assessments (short- and long-term).

For TOR 2 the EWG discussed what variables and indicators the applied models include and provide. From that discussion a list of indicators was developed for which modelers will be able to provide results in the EWG 23-11 report.

The EWG concludes that a list of indicators is provided for which EWG 23-11 will present results in autumn 2023.

For TOR 3 the EWG notes that new closure areas for 2023 were implemented only by Spain (EMU 1) (Orden APA/80/2023). All closures areas implemented under the West Med MAP are described to allow testing if their implementation would reduce the catches of juveniles and adults of the six target species of the MAP by 15-25%.

The EWG notes that the methodology followed to prioritise, developing and updating closure areas based on their conservation value on the basis of existing closures, proposed closures from EWG 22-01 and new proposals developed by EWG 23-01 based on updated MEDISEH layers is similar to the one used during EWG 22-01. Updated MEDISEH layers were used for priority species (ARA, MUT and HKE) in combination with old MEDISEH layers for other species and distribution maps of commercial effort from EWG 22-01. Calculation of the percentage of the trawlable GSA area closed to fishing is higher in EMU 1 than EMU 2, therefore the estimation of additional closure areas on top of the existing ones foccused on this management unit. Additional closure areas to test were based on persistence hotsposts from survey data and from areas of high effort in order to impact directly on the reduction of fishing mortality.

The EWG notes that the exisiting and additional closures could be tested only in EMU 2 and GSA 7 as for GSA 1, 5 and 6 the extension of the spatially-explicit model ISIS-Fish is not complete yet and it is still limited to a single species (HKE).

The EWG notes that closure areas in GSA 7 were tested with two different methods. A static method comparing effort distribution data before and after the closures implementation in 2020, and a dynamic method applying ISIS-Fish. The first method showed how the establishment of the spatio-temporal closure imposed a strong seasonal constraint to the fishing effort in the Gulf of Lions, and that the fishermen community responded quite well to the new rule, although vessels increased their fishing effort along the closure border, with a typical « fishing the line » pattern, especially in the fall. The second model showed that introducing an additional closure did not improve the rebuilding of the hake stock, while changing the closures from seasonal to permanent suggested the strongest effect.

The EWG notes that in EMU 2 that temporal closures for the whole fleet reduce global effort while additional spatial closures increase effort towards coastal areas (depths <200m) specifically for fleet segments <18m. Fishing mortality instead is reduced for all species by the introducion of additional closures, specifically those targeting high effort areas, although Fmsy is reached only for ARS and DPS and for already underexploited stocks (MUT 10 and NEP).

The EWG concludes that provided that the area in GSA 7 have been chosen according to juvenile hake catch, we can expect that, given the strong observed response of the fishermen community, the closure in GSA7 has the potential to positvely impact the hake recruitment in the long run. Still, two years of implementation remains a short time-scale to observe strong changes in a long-lived stock. More time, observations and analysis will be necessary in the future to further quantify the efficiency of these closures.

The EWG concludes that no positive effects on the stocks biomasses are observed in EMU 2 indipendently of the scenarios applied.

For TOR 4, the EWG notes that both definitions of "juveniles" and "spawners" are not clearly stated in the Regulation (95/2023) making a bit challenging the evaluation of the criterions. A similar consideration could be done for the term "catch reduction" which is never specified whether it should be considered in number or weight.

The EWG could not fully understand if the compliance with the criterions in term of results achieved would be evaluated at some point in the process.

The EWG reports that for point a) the literature suggests that the requested threshold of at least 25% of reduction in hake juveniles seems not achievable.

For point b) only for Blue and red shrimps the introduction of a 50mm square mesh size seems to lead to the decrease of specimens below 25mm CL at least of 25%.

However, for vessels targeting Blue and red shrimps in EMU2, this is a mixed fisheries targeting also Giant red shrimp and it is not applicable to have two different size thresholds for the two species. The EWG suggested that the criterion should be revised providing just one size threshold, ideally selecting the one proposed for blue and red shrimps.

According to the IMPLEMED results the same conclusion of point a) can be shared with point c) when a grid of 20mm space bar is used.

For point d) EWG cannot find any clear evidence or results which corroborate the fact that specific closures could lead to a reduction in juveniles and spawners at the level requested by the criterion.

Point e) refers to an increase of the MCRS for hake (26cm TL) which if not linked with some additional technical measures should just lead to an increase of discards of hake and, likely, black market.

For point f), the EWG agreed the temporal closures implemented by Spain and France under the West Med MAP are following the criterion.

The EWG concludes that considering the available knowledge and the analysis done during the meeting only the requests based on point b) and point f) could be considered fully in compliance with what the criterion stated, for point d) there weren't enough information to be fully evaluated if it is feasible or not while the others criterion seems to be not corroborated by the available literature.

1.2 SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES (STECF) - Evaluation of economic indicators and closure areas in the western Mediterranean. (STECF-23-01)

1.3 Background provided by the Commission

In adopting the western Mediterranean multi-annual management plan (West Med MAP), Member States agreed to implement several management measures, such as fishing effort reduction, closure areas and maximum catch limits, to secure the achievement of MSY by 1 January 2025 for all demersal stocks in the western Mediterranean.

The work of the STECF expert working group will continue building on the previous evaluations by STECF expert working groups to focus on the socio-economic aspects of the management scenarios. Building on the work done in previous EWGs of the West Med MAP (e.g. EWG 20-13, 21-13 and 22-11) and the expertise built on the preparation of the Annual Economic Report, the EWG could look at a number of key socio-economic indicators (mentioned in the TORs of EWG 22-11): including indicators related to gross profit and the employment in FTE. These are important elements for the socio-economic analyses of the MAP management measures.

[Placeholder: Depending on data, the STECF expert working group could also look into new proposal stemming from Member States for the delineation of additional closure areas.

Regarding closure areas, Article 11.1, alternatively Article 11.2, aims at protecting juveniles of European hake. All three concerned Member States adopted Article 11.3 and agreed to establish additional closure areas by 17 July 2021 and on the basis of best available scientific advice, where there is evidence of a high concentration of juvenile fish, below the minimum conservation reference size, and of spawning grounds of demersal stocks, in particular for the target stocks of the West Med MAP. In addition, France and Spain adopted in December 2020 targets of capture reductions of demersal stocks and committed to reduce between 15% and 25% the capture of juveniles and spawners in each GSA.

STECF PLEN 19-03, PLEN 20-01 and STECF EWG 21-01 have reviewed the proposals of closures (placement and period) submitted in 2020 and 2021 by the 3 Member States and determine their efficiency to protect juveniles of hake (as planned in Article 11.2) and juveniles and spawners of all six target demersal species included in the West Med MAP (as planned in Article 11.3).

However, in view of Article 11.4, the closure areas should be reviewed for Member States to update the closure areas based on STECF advice.

1.4 Request to STECF

STECF is requested to review the report of the STECF Expert Working Group meeting, evaluate the findings and make any appropriate comments and recommendations, especially in view of the preparation of EWG 23-11.

1.5 STECF comments

EWG 23-01 met online from 27 of February to 3 of March 2023. EWG 23-01 was the tenth such STECF EWG dedicated to the evaluation of the implementation of the Western Mediterranean Sea Multi-Annual Management Plan (West Med MAP)[1]. This

[1] Regulation (EU) 2019/1022 of the European Parliament and of the Council of 20 June 2019 establishing a multiannual plan for the fisheries exploiting demersal stocks in the western Mediterranean Sea and amending Regulation (EU) No 508/2014. OJ L172, 26.6.2019, p.1.

plan refers to the Western Mediterranean geographical subareas (GSA) adjacent to EU member states Spain, France and Italy: GSAs 1, 2, 5, 6, 7, 8, 9, 10 and 11, grouped into two spatial units EMU (Effort Management Units) - EMU1 for GSAs 1 to 7 and EMU2 for GSAs 8 to 11.

STECF considers that the EWG adequately addressed the TORs and has the following specific comments on the four ToRs addressed by EWG 23-01.

ToR 1 - Development of socio-economic indicators

STECF notes that a roadmap for the economic assessment of the impacts of the West Med MAP was discussed in the EWG and a three-step process to carry out a future assessment was suggested:

1. A scoping exercise with representatives of the Member States which took place during the EWG 23-01.
2. A meeting with stakeholders in the middle of 2023 to discuss their perception and experience of the socio-economic consequences of measures of the West Med Plan. This will help in the conditioning of the different models.
3. Carry out the socio-economic assessments during EWG 23-11 (see also ToR 7.5 of this report with the draft ToRs for EWG 23-11).

Regarding the stakeholder consultation in step 2, STECF notes that it may be preferable to do this by conducting a few semi-structured interviews with stakeholders instead of having a meeting with a larger group. This will be discussed and finalised with the Secretariat of the MEDAC.

STECF notes that for EWG 23-11, it is suggested to keep essentially the same scenarios as those assessed in EWG 22-11. Changes to the scenarios should be kept to a minimum due to the lack of time that the modelers have to condition the models for any new or amended scenarios.

Additionally, EWG 23-01 suggested running additional scenarios where only one of the management measures applied within the West Med MAP will be tested at the same time (e.g., fishing days reduction). This will provide an indication of what additional efforts beyond those currently in place may be necessary to reach MSY in 2025 in line with the MAP and what the likely contribution of each single measure would be to the overall plan implementation.

STECF notes, that in an attempt to account for current economic instability, all model scenarios require common assumptions regarding key economic variables such as the evolution of fuel price, and other variable and fixed costs (e.g., interest rates).

ToR 2 - Harmonization of the economic indicators provided.

STECF notes that EWG 23-01 discussed the variables to include in the various models and drafted a list of indicators for EWG 23-11 to consider. The list of variables and indicators are provided in annexes 1 and 2 of the EWG 23-01 report.

STECF notes that given there are differences in the indicators that each model can produce and to harmonise the list of indicators, some adaptations to the models will be required. STECF further notes that two different indicators exist for employment (number of employees and/or Full Time Equivalent FTE) in the two models producing economic indicators (IAM and BEMTOOL); However, the BEMTOOL model cannot simultaneously compute both employment indicators without changes to the code.

STECF notes that part-time employment in the Mediterranean fishing fleet is a characteristic of this region (AER, 2022). Therefore, even if FTE is a more harmonised and comparable indicator for employment, total employment should also be retained as an indicator given the preponderance of part-time employees in the Mediterranean. Therefore, efforts should be made by the modelers to retain both in the final list of indicators.

STECF further notes that ISIS-Fish does not provide any economic analysis and SMART has only a very limited economic module.

STECF notes, that all models predict landings and variable costs dynamically, although prices are only updated with landings in BEMTOOL (the other models can in principle handle the change in prices, but this capability is not implemented yet, specifically for the West Med MAP).

STECF notes that none of the models simulate capacity dynamics. This affects the long-term (up to 2030) projection of the number of vessels and so, the projection of the evolution of employment. Therefore, STECF observes that the current state of development of the models implies that they are more robust to assess the short-term (up to 2025) impacts of any management measure rather than longer-term impacts (2025-2030, and beyond).

ToR 3 - Review the existing and proposed closures.

STECF notes that, together with the reduction of fishing activity, Regulation (EU) 2019/1022 (West Med MAP) prescribes technical measures to be adopted to contribute to the achieving of fishing stocks at MSY by 2025. In particular, Article 11(1) of the West Med Plan specifies that for 3 months each year, trawling shall be prohibited within six nautical miles from the coast except in areas deeper than 100 m depth. Article 11 contains a number of conditions relating to these closed areas as follows:

- The 3 months of closure shall be determined by each Member State and shall apply during the most relevant period, determined on the basis of the best available scientific advice.
- Member States may derogate from Article 11(1) establishing other closure areas, on the basis of best available scientific advice. Those closures shall account for a reduction of at least 20% of catches of juveniles of European hake.
- Member States were required to implement closures by 17 July 2021 in areas with evidence of high concentration of juvenile fish below minimum conservation reference size, and on the spawning grounds of demersal stocks specified by the West Med MAP.

Beyond the existing closures, STECF notes that in 2023, new closed areas were implemented only by Spain (EMU 1 except GSA 7). STECF further notes that EWG 23-01 could only test the impact of the existing closures in EMU 2 and GSA 7. For GSAs 1, 5 and 6 (EMU 1), the extension of the spatially-explicit model, ISIS-Fish, has not been completed and it is still limited to a single species (European hake).

STECF observes that the closure areas in GSA 7 were tested with two different methods - a static method comparing effort distribution data before and after the implementation of the closures in 2020, and a dynamic method applying ISIS-Fish.

STECF notes that the static method showed how the establishment of the spatio-temporal closure created a strong seasonal constraint to fishing effort in the Gulf of Lions with a decrease in fishing effort within the closed area. However, vessels increased their fishing effort along the border of the closed area, potentially mitigating the benefit of the closure. Overall, the static model results indicate that the implemented closures have the potential to result in increased recruitment of hake in the longer-term.

STECF notes that the simulation made with the ISIS-Fish model shows that introducing a smaller permanent closure within the existing temporal closure did not lead to an increase in overall biomass or the biomass of hake recruited into the stock. However, STECF observes that making the closures permanent rather than seasonal, is expected to provide an increase in overall and the biomass of hake recruited into the stock.

STECF notes that in EMU 1 the reduction in landings for French fleet due to the application of the closures was around 5%, while the results for the Spanish fleets are inconclusive, given that the model only simulated a small part of the Spanish fishery.

For EMU 2, STECF notes that the introduction of temporal closures for the whole fleet (monthly fishing prohibitions) would reduce effort. Introducing additional spatial closures corresponding to persistent hotspots and high effort areas, would increase effort towards coastal areas (depths <200m) specifically for fleet segments <18m. However, fishing mortality is expected to reduce for all species by the introduction of fishing bans and/or additional closures, specifically those targeting high effort areas. Notwithstanding these reductions in F, Fmsy would only be reached for giant red shrimp and deep-water rose shrimp and for stocks already being exploited below Fmsy – red mullet in GSA 10 and *nephrops*.

ToR 4 - Criterion listed in Article 8 and their use.

EWG 23-01 reviewed the criteria listed in Article 8 of Council Regulation (EU) 2023/195[2] which gives a right to Member States to request a quota of fishing days equal to 3.5% of the baseline value (average between 2015-2017) be added to the current (2023) yearly fishing opportunities established in the Regulation (EU) 2023/195 under the West Med MAP for each fleet segment. This additional quota would be given to the fleet segment depending to which segment the chosen criterion is applied to. STECF was asked to comment on the effectiveness of each of these criteria:

Criterion A) "*Vessel uses a trawl net with a 45 mm square mesh codend in order to reduce by at least 25% catches of the juveniles of hake*".

STECF observes that according to the literature review made by the EWG, the requested threshold of at least 25% of reduction in hake juveniles catches for a vessel using a trawl net with a 45 mm square mesh codend does not seem to be achievable using this gear alone.

Criterion B) "*The vessel uses a trawl net with a 50 mm square-mesh codend for deep-water fisheries in order to reduce by at least 25 % catches of blue and red shrimps with a carapace length (CL) of less than 25 mm in GSAs 1, 2, 5, 6, 7, 8, 9, 10 and 11 and to reduce by at least 25 % catches of giant red shrimps with a CL of less than 35 mm in the geographical subareas 8, 9, 10 and 11*."

STECF observes that according to the EWG findings, the introduction of a 50mm square mesh size could lead to a decrease of at least 25% of blue and red shrimp less than 25mm CL. STECF further notes that the EWG could not find any selectivity studies on Giant red shrimp to formulate any conclusion for this species.

Criterion C) "*The vessel uses a regulated highly selective gear, the technical specifications of which result in, according to the scientific study by STECF, a reduction of at least 25 % of catches of juveniles of all demersal species or at least 20 % of catches of spawners of all demersal species compared to 2020, such as a sorting grid with 20 mm spacing*."

[2] Council Regulation (EU) 2023/195 of 30 January 2023 fixing for 2023 the fishing opportunities for certain stocks and groups of fish stocks applicable in the Mediterranean and Black Seas and amending Regulation (EU) 2022/110 as regards the fishing opportunities for 2022 applicable in the Mediterranean and the Black Seas. OJ L 28, 31.1.2023, p. 220–248.

STECF observes that according to the literature review made by the EWG, the requested threshold of at least 20% of reduction in catches of spawners of all demersal species compared to 2020 does not seem achievable with this measure.

Criterion D)" The *Member State concerned has established temporary closure areas in order to reduce by at least 25 % catches of juveniles of all demersal species or by at least 20 % catches of spawners of all demersal species*."

STECF observes that the EWG could not find any clear evidence or results which corroborate the fact that specific temporary closures could lead to a reduction of at least 25 % of catches of juveniles of all demersal species or by at least 20 % of catches of spawners of all demersal species.

Criterion E) "*The Member State concerned has adopted a new minimum conservation reference size for hake of at least 26 cm, in order to progressively reach the length at first maturity*."

STECF agrees with the EWG finding that an increase of the MCRS for hake to 26cm TL without being linked to effective additional technical measures would likely lead to an increase of unwanted catches of hake, without any positive benefits to the hake stock.

Criterion F) "*The Member State concerned has set a closure of at least four continuous weeks for fishing activities with trawlers in the areas and periods recognized as important, on the basis of the best available scientific advice, for the protection of spawners of hake stocks. Such areas shall also account for spatial patterns of spawners' distribution, including depths from 150 m to 500 m. The periods of the temporary fishing closure shall be from February to March and from October to November*."

STECF observes that according to the EWG findings the temporal closures implemented by Spain and France under the West Med MAP meet the criterion.

1.6 STECF conclusions

ToRs 1 and 2.

STECF concludes that concluding dedicated interviews of individual stakeholders by the EWG 23-11 chairs ahead of the EWG could help define the main assumptions to be used in the bioeconomic models.

STECF concludes that the scenarios to be investigated by EWG 23-11 should be defined well in advance of the EWG 23-11. Additionally, a list of assumptions for the implementation of the models regarding key variables for the socio-economic assessments, should be provided prior to the meeting by the EWG chairs. These two elements will help to save time for modelers to focus on assessing the economic and social consequences of the MAP.

STECF concludes that due to the specific socio-economic characteristics of the Mediterranean fishing fleet, engaged crew and FTE indicators provide different information when assessing the social impacts of the MAP. therefore, it would be advisable to calculate both employment indicators.

STECF concludes that EWG 23-11 should primarily focus on the economic impact of the different management measures in the short-term (3 years). STECF concludes that longer-term (up to 2030) comparisons of scenarios can be performed with the current models, but since they do consider capital dynamics to project changes in capacity and employment, these projections shall be interpreted with caution.

STECF concludes that the conditioning of one single model handling EMU 1 and EMU 2 as proposed by PLEN 22-03, will take at least one year to complete, and will need adequate financial and manpower resources to support the development work needed.

ToR 3

STECF agrees with EWG 23-01 that in GSA7, considering the observed level of effort reduction in the closed areas, the closures have the potential to increase the overall biomass of the hake stock in the long run.

STECF concludes that two years of implementation is still a very short period to determine whether the anticipated recruitment increases for hake have been realised. It should be noted that available STECF assessments of European hake currently show a low fishing mortality for juvenile age classes. Therefore, the protection of juveniles will not necessarily reduce the fishing effort on this species.

STECF concludes that no positive effects on the stock biomasses are observed in EMU 2 independently of the scenarios applied. It should be noted that the model used to evaluate spatial closures in EMU 2 is limited to an evaluation of stock development as it does not account for the evolution of the population.

ToR 4

STECF concludes that considering the available knowledge and the analyses carried out during the EWG, only the requests based on criteria "b" and "f" of Article 8 of the Council Regulation (EU) 2023/195 could be considered to satisfy the stated criterion.

STECF concludes that for criterion "d" there was insufficient information for an evaluation. The remaining criteria do not seem to have been fulfilled.

TOR 1. STECF is requested to continue the development of socio-economic indicators to be used in the evaluation of management measures for the West Med MAP in both West Med management units.

For this, it should be discussed how to further improve the estimation of current socio-economic indicators and how far a socio-economic assessment would be possible by, this could be done by conducting a scoping exercise with the development of a roadmap.

STECF should investigate if in 2023 it could be feasible for the EWG to provide improved economic information on the changes in the short period (i.e., one/two years, i.e. until 2025 the legal deadline of MSY achievement) in profitability due to estimated future effort levels for trawlers.

STECF is also requested to discuss as part of the roadmap a longer-term approach to further estimate socio-economic indicators to evaluate the management measures in the West Med MAP. This includes the possibility to expand the bio-economic models to the whole area. The models should then also include a spatial component to assess distributional effects of implemented management measures. Those models should allow the socio-economic assessment of measures following from the West Med MAP and to show trade-offs between different management measures.

TOR 2.

For the harmonization of the economic indicators provided by the models applied to evaluate the West Med MAP STECF is requested to:

- provide a matrix of model assumptions for the economic component of the models
- propose a list of indicators those models shall provide for the second EWG meeting in 2023.

TOR 3. [*depending on submission of new closure areas*]
Based on new proposals for additional closures to be submitted by Member States, EWG 23-01 is requested to review the existing closures and the proposed additional closures (i.e. terms of placement and period). In view of the objectives set in Article 11 of the West Med MAP, STECF is requested to estimate their efficiency to protect juveniles and spawning aggregations of the demersal species covered by the West Med MAP, using the models used in previous EWG for the West Med MAP. The additional closures should result in a reduction of between 15% and 25% in the total catch, if possible looking at juveniles and spawners separately, of each stock covered by the MAP. For each GSA, in case the closures proposed by Member States are not meeting this criterion, the EWG is requested to propose recommendations for designing alternative closures based on information collected during an ad-hoc contract to update MEDISEH results and based on criteria such as, but not limited to, bathymetry, depth, type of substrate, stock seasonality, establishment of a buffer area etc. STECF is also asked to comment on possible fishing effort displacement arising from the proposed additional closures. Finally, STECF is asked to conclude whether the objectives of Article 11 have been met by each concerned Member State.

TOR 4. [*if not feasible during the EWG, ToR would be asked again in Spring Plenary*]

In view of Article 8 of the Fishing Opportunities Regulation for Mediterranean and Black Seas for 2023 [publication in Official Journal on 31 January 2023], and based on the information collected in STECF PLEN 22-03 for ToRs 6.4 and 6.7, STECF is requested to:

- review each of the criterion listed in Article 8 and its use by the concerned Member States in 2022 and 2023;
- compare the existing temporary closures set to help the hake stocks recover and determine the optimal characteristics of temporary

closures to protect hake, if possible looking in particular at spawners, in each GSA of the West Med in terms of duration of closures, bathymetry etc.;

- provide an advice on additional criteria that could speed up the recovery of hake stocks in the West Med.

1.7 Contact details of STECF members

[1] - Information on STECF members' affiliations is displayed for information only. In any case, Members of the STECF shall act independently. In the context of the STECF work, the committee members do not represent the institutions/bodies they are affiliated to in their daily jobs. STECF members also declare at each meeting of the STECF and of its Expert Working Groups any specific interest which might be considered prejudicial to their independence in relation to specific items on the agenda. These declarations are displayed on the public meeting's website if experts explicitly authorized the JRC to do so in accordance with EU legislation on the protection of personnel data. For more information: http://stecf.jrc.ec.europa.eu/adm-declarations

Name	**Affiliation**[1]	Email
Bastardie, Francois	Technical University of Denmark, National Institute of Aquatic Resources (DTU-AQUA), Kemitorvet, 2800 Kgs. Lyngby, Denmark	fba@aqua.dtu.dk
Borges, Lisa	FishFix, Lisbon, Portugal	info@fishfix.eu
Casey, John	Independent consultant	blindlemoncasey@gmail.com
Coll Monton, Marta	Consejo Superior de Investigaciones Cientificas, CSIC, Spain	mcoll@icm.csic.es
Daskalov, Georgi	Laboratory of Marine Ecology, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences	Georgi.m.daskalov@gmail.com
Döring, Ralf	Thünen Institute [TI-SF] Federal Research Institute for Rural Areas, Forestry and Fisheries, Institute of Sea Fisheries, Economic analyses Herwigstrasse 31, D-27572 Bremerhaven, Germany	ralf.doering@thuenen.de
Drouineau, Hilaire	Inrae, France	hilaire.drouineau@inrae.fr

Name	**Affiliation**[1]	Email
Goti Aralucea, Leyre	Thünen Institute of Sea Fisheries - Research Unit Fisheries Economics, Herwigstrasse 31, D-27572 Bremerhaven, Germany	leyre.goti@thuenen.de
Grati, Fabio	National Research Council (CNR) – Institute for Biological Resources and Marine Biotechnologies (IRBIM), L.go Fiera della Pesca, 2, 60125, Ancona, Italy	fabio.grati@cnr.it
Hamon, Katell	Wageningen Economic Research, The Netherlands	katell.hamon@wur.nl
Ibaibarriaga, Leire	AZTI. Marine Research Unit. Txatxarramendi Ugartea z/g. E-48395 Sukarrieta, Bizkaia. Spain.	libaibarriaga@azti.es
Jardim, Ernesto	Marine Stewartship Council MSC, Fisheries Standard Director FSD, London	ernesto.jardim@msc.org
Jung, Armelle	DRDH, Techopôle Brest-Iroise, BLP 15 rue Dumont d'Urville, Plouzane, France	armelle.jung@desrequinsetdeshommes.org
Ligas, Alessandro	CIBM Consorzio per il Centro Interuniversitario di Biologia Marina ed Ecologia Applicata "G. Bacci", Viale N. Sauro 4, 57128 Livorno, Italy	ligas@cibm.it; ale.ligas76@gmail.com
Mannini, Alessandro	CNR IRBIM Ancona, Largo Fiera della Pesca, 260125 Ancona ITALY	alessandro.mannini@irbim.cnr.it
Martin, Paloma	CSIC Instituto de Ciencias del Mar Passeig Marítim, 37-49, 08003 Barcelona, Spain	paloma@icm.csic.es
Motova -Surmava, Arina	Sea Fish Industry Authority, 18 Logie Mill, Logie Green Road, Edinburgh EH7 4HS, U.K	arina.motova@seafish.co.uk
Moore, Claire	Marine Institute, Ireland	claire.moore@marine.ie
Nielsen, Rasmus	University of Copenhagen, Section for Environment and Natural Resources, Rolighedsvej 23, 1958 Frederiksberg C, Denmark	rn@ifro.ku.dk

Name	Affiliation[1]	Email
Nimmegeers, Sofie	Flanders research institute for agriculture, fisheries and food, Belgium	Sofie.Nimmegeers@ilvo.vlaanderen.be
Pinto, Cecilia (vice-chair)	Università di Genova, DISTAV - Dipartimento di Scienze della Terra, dell'Ambiente e della Vita, Corso Europa 26, 16132 Genova, Italy	cecilia.pinto@edu.unige.it
Prellezo, Raúl (vice-chair)	AZTI -Unidad de Investigación Marina, Txatxarramendi Ugartea z/g 48395 Sukarrieta (Bizkaia), Spain	rprellezo@azti.es
Raid, Tiit	Estonian Marine Institute, University of Tartu, Mäealuse 14, Tallin, EE-126, Estonia	Tiit.raid@gmail.com
Rihan, Dominic (chair)	BIM, Ireland	rihan@bim.ie
Sabatella, Evelina Carmen	National Research Council (CNR) – Institute for Research on Population and Social Policies (IRPPS), Corso S. Vincenzo Ferreri, 12, 84084 Fisciano, Salerno, Italy	evelina.sabatella@cnr.it
Sampedro, Paz	Spanish Institute of Oceanography, Center of A Coruña, Paseo Alcalde Francisco Vázquez, 10, 15001 A Coruña, Spain	paz.sampedro@ieo.csic.es
Somarakis, Stylianos	Institute of Marine Biological Resources and Inland Waters (IMBRIW), Hellenic Centre of Marine Research (HCMR), Thalassocosmos Gournes, P.O. Box 2214, Heraklion 71003, Crete, Greece	somarak@hcmr. gr
Stransky, Christoph	Thünen Institute [TI-SF] Federal Research Institute for Rural Areas, Forestry and Fisheries, Institute of Sea Fisheries, Herwigstrasse 31, D-27572 Bremerhaven, Germany	christoph.stransky@thuenen.de
Ulrich, Clara	IFREMER, France	Clara.Ulrich@ifremer.fr

Name	Affiliation[1]	Email
Uriarte, Andres	AZTI. Gestión pesquera sostenible. Sustainable fisheries management. Arrantza kudeaketa jasangarria, Herrera Kaia - Portualdea z/g. E-20110 Pasaia – GIPUZKOA (Spain)	auriarte@azti.es
Valentinsson, Daniel	Swedish University of Agricultural Sciences (SLU), Department of Aquatic Resources, Turistgatan 5, SE-45330, Lysekil, Sweden	daniel.valentinsson@slu.se
van Hoof, Luc	Wageningen Marine Research Haringkade 1, Ijmuiden, The Netherlands	Luc.vanhoof@wur.nl
Velasco Guevara, Francisco	Spanish Insitute of Oceanography - National Research Council, Spain	francisco.velasco@ieo.csic.es
Vrgoc, Nedo	Institute of Oceanography and Fisheries, Split, Setaliste Ivana Mestrovica 63, 21000 Split, Croatia	vrgoc@izor.hr

REPORT TO THE STECF

EXPERT WORKING GROUP ON Evaluation of economic indicators and closure areas in the western Mediterranean. (EWG-23-01)

Virtual meeting, 27th February-3rd March 2023

This report does not necessarily reflect the view of the STECF and the European Commission and in no way anticipates the Commission's future policy in this area

1 INTRODUCTION

This report is the 10th of a suite of STECF EWG reports dedicated to the evaluation of fishing effort regime (now also catch limit regime) in the Western Mediterranean Sea.

The first EWG in June 2018 (STECF 18-09) addressed a number of issues related to managing fisheries with fishing effort regimes. Building on a review of previous experiences worldwide, the report highlighted the main and well known concern that catchability estimates (relationship between fishing effort and fishing mortality) are imprecise and vary systematically since fishers will tend to increase their efficiency in order to maintain their historical catch and revenue levels in spite of effort reductions. This was corroborated by quantitative analyses of differences in catch efficiency between fishing trips using tripbased data from Italy and Spain, differences that are only little explained by features such as vessel size or fishing area. Also, a study was presented monitoring continuous increase in gear size (width, opening, twin trawl etc) in the Mediterranean, highlighting a potential for further increase in fishing efficiency that may counteract the expected effect of effort reduction. Finally, a comparison of the completeness and consistency of the various datasets on catch and effort by fleet segments available at the JRC was performed, highlighting a number of gaps.

The second EWG in October 2018 (STECF 18-14) built further on these results. The relationship between fishing effort and fishing mortality, aggregated at the level of fleet segment and year, was analysed for a number of the MAP stocks using the available time series of stock assessment. This relationship was shown to be never linear, and in most cases it cannot even be detected in the time series. This means that a reduction of fishing effort will not translate by a similar reduction of fishing mortality at least in the first years of implementation. Secondly, the trips analyses were extended to new data from France, showing similar results as for Italy and Spain. Finally, a first review of existing bioeconomic mixed fisheries models in the Western Med was conducted. Considering that many models were potentially available but that none of them was directly operational for the purpose of the MAP, a 2 years road map was agreed to improve the availability and use of such models.

Accordingly, the third EWG in March 2019 (STECF 19-01) focused uniquely on updating and improving mixed-fisheries models. Several models of various complexity were presented and tested for the two regions (EMU1 & and EMU2). Good progresses were achieved but the most important issue left was the need to develop a single combined model for EMU1 including data from both Spain and France together, instead of the existing models by GSA. In addition, the EWG listed numerous other issues and future questions regarding data and models' dimensions (e.g. stock definition, inclusion of other species than the MAP species etc).

The fourth EWG in October 2019 (STECF 19-14) was the continuation of this work, progressing further on these issues in order to have models and datasets fully operational for providing mixed-fisheries advice on the MAP. In particular, a first version of a combined IAM model for EMU1 was presented, including both Spanish and French fleets but including only hake data. Two models were run in parallel for EMU 2 (BEMTOOL and SMART), providing different insights on future development. During the EWG 19-14, specific focus was also given to how to simulate closed areas in the bioeconomic models to evaluate their potential impact in the medium-term.

The fifth EWG in October 2020 (STECF 20-13) was largely an update of STECF 19-14 regarding models and scenarios (see ToRs). The models were updated with the most recent assessment data (from STECF EWG 20-09) and FDI effort data (from STECF 20-10) and extended to cover some of the gaps previously identified (mainly for EMU 1), and a number of scenarios were run. Additional issues were though considered. In 2020, the West Med MAP has been implemented since January 1st, through Regulation (EU) 2019/1022, with fishing opportunities in terms of maximum allowable fishing effort in fishing days fixed for 2020 in Council Regulation (EU) 2019/2236. The EWG compared the reference levels used for fishing effort quotas and discussed the implications of the sometimes large discrepancies observed between scientific and policy data.

The sixth EWG in March 2021 (STECF EWG 21-01) explored the datasets on the trawl fleets exploiting demersal stocks to estimate the conversion factors between fleet segments to ensure that effort swaps will not lead to an undesirable increase in fishing mortality. The EWG highlighted the need to have data at fishing trip (VMS data) level when estimating conversion factors. The impact of recreational fishery on the stocks covered by the Western Mediterranean Multi-Annual Plan was found to be negligible. The EWG also assessed the proposals for additional closure areas for 2021 received from Spain, but had no time nor data to propose alternative closure areas for EMU 1 and 2.

The seventh EWG held the last week of September 2021 (STECF EWG 21-13) was partially an update of STECF 20-13 and partially an update of STECF 21-01. The models were updated with the most recent assessment data (from STECF EWG 21-11) and FDI effort data (from STECF 21-12) and extended (compared to last year) to run scenarios accounting for alternative selectivity and introduction of TACs. The EWG updated the F-E relationships and estimated conversion factors at metier and stock level. In 2021, the second year of the West Med MAP has been implemented since January 1st, through Regulation (EU) 2021/90, setting fishing opportunities in terms of maximum allowable fishing effort in fishing days for 2021. This year as well the EWG compared the reference levels used for fishing effort quotas and found large discrepancies between scientific and policy data, the implications were discussed during the EWG.

The eighth EWG held the first week of March 2022 (STECF EWG 22-01) was a technical exercise to improve the mixed-fisheries modelling frameworks in preparation of future EWGs. The EWG focused on the evaluation of two specific management measures considered in the western Mediterranean MAP: maximum catch limits (MCLs) and closure areas. In order to evaluate these measures in isolation from others considered in the western Mediterranean management plan, effort reductions applied in 2022 following Regulation (EU) 2022/110 were not considered during EWG 22-01. MCLs on ARA and ARS (following Regulation (EU) 2022/110) and on HKE and existing closure areas were evaluated. EWG 22-01 evaluated the possibility of defining additional closure areas with the available data and highlighted numerous limitations in the process.

The ninth EWG held the last week of September 2022 (STECF EWG 22-13) was partially an update of STECF 21-13. The models were updated with the most recent assessment data (from STECF EWG 22-09) and FDI effort data (from STECF 22-10) and extended (compared to last year) to run scenarios accounting for effort reductions of trawlers, longliners and netters at the same time. Additionally vessel number reduction was considered as well. No additional closure areas from the existing ones were considered and MCLs were accounted only for ARA and ARS stocks. An increase in selectivity was accounted for as well. All management scenarios were run twice under two different economic regimes during projections: the first with fuel price fixed as the average price estimated for 2022, the second one with fuel price increased by 120% from 2023 onwards. The EWG updated the F-E relationships and estimated F by GSA and by gear for all stocks. In 2022, the third year of the West Med MAP has been implemented since January 1st, through Regulation (EU) 2022/110, setting fishing opportunities in terms of maximum allowable fishing effort in fishing days and in 22 terms of the maximum catch limits (MCLs) for 2022. This year as well the EWG compared the reference levels used for fishing effort quotas and found large discrepancies between scientific and policy data, the implications were discussed during the EWG.

This 10th EWG hels the last week of February 2023 (STECF EWG 23-01) was partially dedicated to continue the development of socio-economic indicators to be used in the evaluation of management measures for the West Med MAP in both West Med management units. Two roadmaps were discussed, a short term approach and a long term approach which would consider the expansion of all the mixed-fisheries bio-economic models to both management units. As a first step, the EWG focused on the proposal of harmonizing the economic indicators across the models implemented in order to make projections comparable for the next EWG. The second half of the EWG was partially an update of the technical exercise held during EWG 22-01 on the evaluation of closure areas in EMU 1 and 2. New closure areas for 2023 were submitted solely by Spain. The EWG tested the effect of existing and additional closure areas in EMU 2 (GSA 9, 10, 11) and GSA 7 but not GSA 1, 5 and 6. Finally the EWG revised Article 8 of the 2023 fishing opportunities under the West Med MAP (COUNCIL REGULATION (EU) 2023/195), which lists the compensation mechanisms that MSs can implement within the West Med MAP to obtain additional fishing days in 2023.

1.1 Terms of Reference for EWG-23-01

Background provided by the Commission

In adopting the western Mediterranean multi-annual management plan (West Med MAP), Member States agreed to implement several management measures, such as fishing effort reduction, closure areas and maximum catch limits, to secure the achievement of MSY by 1 January 2025 for all demersal stocks in the western Mediterranean.

The work of the STECF expert working group will continue building on the previous evaluations by STECF expert working groups to focus on the socio-economic aspects of the management scenarios. Building on the work done in previous EWGs of the West Med MAP (e.g. EWG 20-13, 21-13 and 22-11) and the expertise built on the preparation of the Annual Economic Report, the EWG could look at a number of key socio-economic indicators (mentioned in the TORs of EWG 22-11): including indicators related to gross profit and the employment in FTE. These are important elements for the socio-economic analyses of the MAP management measures.

[Placeholder: Depending on data, the STECF expert working group could also look into new proposal stemming from Member States for the delineation of additional closure areas.

Regarding closure areas, Article 11.1, alternatively Article 11.2, aims at protecting juveniles of European hake. All three concerned Member States adopted Article 11.3 and agreed to establish additional closure areas by 17 July 2021 and on the basis of best available scientific advice, where there is evidence of a high concentration of juvenile fish, below the minimum conservation reference size, and of spawning grounds of demersal stocks, in particular for the target stocks of the West Med MAP. In addition, France and Spain adopted in December 2020 targets of capture reductions of demersal stocks and committed to reduce between 15% and 25% the capture of juveniles and spawners in each GSA.

STECF PLEN 19-03, PLEN 20-01 and STECF EWG 21-01 have reviewed the proposals of closures (placement and period) submitted in 2020 and 2021 by the 3 Member States and determine their efficiency to protect juveniles of hake (as planned in Article 11.2) and juveniles and spawners of all six target demersal species included in the West Med MAP (as planned in Article 11.3).

However, in view of Article 11.4, the closure areas should be reviewed for Member States to update the closure areas based on STECF advice.

Request to the STECF

TOR 1. STECF is requested to continue the development of socio-economic indicators to be used in the evaluation of management measures for the West Med MAP in both West Med management units.
For this, it should be discussed how to further improve the estimation of current socio-economic indicators and how far a socio-economic assessment would be possible by, this could be done by conducting a scoping exercise with the development of a roadmap.
STECF should investigate if in 2023 it could be feasible for the EWG to provide improved economic information on the changes in the short period (i.e., one/two years, i.e. until 2025 the legal deadline of MSY achievement) in profitability due to estimated future effort levels for trawlers.
STECF is also requested to discuss as part of the roadmap a longer-term approach to further estimate socio-economic indicators to evaluate the management measures in the West Med MAP. This includes the possibility to expand the bio-economic models to the whole area. The models should then also include a spatial component to assess distributional effects of implemented management measures. Those models should allow the socio-economic assessment of measures following from the West Med MAP and to show trade-offs between different management measures.

TOR 2.
For the harmonization of the economic indicators provided by the models applied to evaluate the West Med MAP STECF is requested to:
- provide a matrix of model assumptions for the economic component of the models
- propose a list of indicators those models shall provide for the second EWG meeting in 2023.

TOR 3. [*depending on submission of new closure areas*]
Based on new proposals for additional closures to be submitted by Member States, EWG 23-01 is requested to review the existing closures and the proposed additional closures (i.e. terms of placement and period). In view of the objectives set in Article 11 of the West Med MAP, STECF is requested to estimate their efficiency to protect juveniles and spawning aggregations of the demersal species covered by the West Med MAP, using the models used in previous EWG for the West Med MAP. The additional closures should result in a reduction of between 15% and 25% in the total catch, if possible looking at juveniles and spawners separately, of each stock covered by the MAP. For each GSA, in case the closures proposed by Member States are not meeting this criterion, the EWG is requested to propose recommendations for designing alternative closures based on information collected during an ad-hoc contract to update MEDISEH results and based on criteria such as, but not limited to, bathymetry, depth, type of substrate, stock seasonality, establishment of a buffer area etc. STECF is also asked to comment on possible fishing effort displacement arising from the proposed additional closures. Finally, STECF is asked to conclude whether the objectives of Article 11 have been met by each concerned Member State.

TOR 4. [*if not feasible during the EWG, ToR would be asked again in Spring Plenary*]
In view of Article 8 of the Fishing Opportunities Regulation for Mediterranean and Black Seas for 2023 [publication in Official Journal on 31 January 2023], and based on the information collected in STECF PLEN 22-03 for ToRs 6.4 and 6.7, STECF is requested to:

- review each of the criterion listed in Article 8 and its use by the concerned Member States in 2022 and 2023;
- compare the existing temporary closures set to help the hake stocks recover and determine the optimal characteristics of temporary closures to protect hake, if possible looking in particular at spawners, in each GSA of the West Med in terms of duration of closures, bathymetry etc.;
- provide an advice on additional criteria that could speed up the recovery of hake stocks in the West Med.

2 IMPROVEMENT OF SOCIO-ECONOMIC ASSESSMENTS

DG MARE has requested STECF with additional work on socio-economic indicators and improvements in socio-economic assessment of the West Med Plan. This was included in the TOR for EWG 23-01 and divided in two TOR:

- Technical work on harmonization of indicators and an overview on model assumptions and capabilities (TOR 2, see Section 3 of this report).
- Process oriented discussion on how to improve the socio-economic assessments including elaborations on possibilities to compare results for short- vs. long-term assessments.

For TOR 1 the EWG proposes a possible process of improved socio-economic assessments with a roadmap for the year 2023 and beyond. In the past STECF has analyzed socio-economic impacts of long-term management plans for many fisheries in other parts of EU waters (e.g. STECF 2012). For those assessments STECF developed a protocol (STECF, 2010). For improvements in the socio-economic assessments of the West Med MAP the EWG used the protocol to develop the following roadmap.

2.1 Roadmap for 2023

Step 1a: Scoping Exercise for 2023 (EWG 23-01)

It is important to define in a first step what shall be analysed by whom and when. For EWG 23-01 this was to prepare the work of the modelers in the second EWG 23-11 later in the year. The EWG 23-01 was requested to discuss improvements of the socio-economic assessments. Important factors of improvements would be a harmonization of the model outcomes regarding socio-economic indicators. As this was part of TOR 2 the outcome of this discussion is described in detail in Section 3.

The socio-economic assessments need to consider the economic framework for the fishing sector in the Member States. This includes, for example, the payment of subsidies. In 2022 all MSs supported the fishing sector for increasing costs due to the Ukraine war and following from that increasing fuel costs. However, following the implementation of the West Med MAP MSs may have implemented or plan to implement mitigation measures to mitigate negative socio-economic effects. The EWG, therefore, organized a meeting with representatives of the three MSs to discuss already existing and possible mitigation measures. The following list was presented and discussed with the MSs:

- Permanent cessation: reduction of the number of vessels with the help of decommissioning schemes.
- Temporary cessation: Implementation of a funding scheme to pay fishers to stay in ports to reduce overall fishing effort.
- Investments on board: Vessel owners could react to lower catch possibilities by investing in, for example, fuel saving engines. This would lower fuel costs for the vessel and may in the longer run improve profitability.
- Compensation measures: The West Med MAPs includes a provision to compensate fishing companies with extra fishing days for the employment for more selective fishing gears.

As result of the meeting the chairs of EWG 23-01 will provide an internal document to the modelers to discuss before the EWG 23-11 how those mitigation measures may be applied in the models. For example, all MSs will use permanent cessation as an instrument, and this is also already part of the scenarios DG MARE provided for the EWG. Temporary cessations are not that popular in the MSs as fishers receive only a fraction of the possible income they could have from fishing (usually only costs are more or less covered).

DG MARE provided the EWG with 6 scenarios which are basically the same presented to EWG 22-11 last September.

Table 2.1.1: Proposed scenarios for EWG 23-01

Scenario	Trawler effort reduction**	Longliner effort reduction**	Netter effort reduction**	Combined catch limits for ARA and ARS	Spatio-temporal closures*	Selectivity measures	Reduction in trawler number
A (-5%)	2023: -5% 2024: -5% onwards: -5% (until MSY is reached)	2023: -5% 2024: -5% onwards: -5% (until MSY is reached)	2023: -5% 2024: -5% onwards: -5% (until MSY is reached)	2023: -5% 2024: -5% 2025: MSY level	Same as in 2020-2021	Æ	2023: -5% 2024: -5%
B (-7,5%)	2023: -7,5% 2024: -7,5% onwards: -7,5% (until MSY is reached)	2023: -7,5% 2024: -7,5% onwards: -7,5% (until MSY is reached)	2023: -7,5% 2024: -7,5% onwards: -7,5% (until MSY is reached)	2023: -7,5% 2024: -7,5%	Same as in 2020-2021	2023: 50% of all 3 MS fleet with more selective gear (45mm square mesh for coastal fleet and 50mm square mesh for deep-water fleet) 2024: 100% of all 3 MS fleet with more selective gear	2023: -5% 2024: -5%
C (-10%)	2023: -10% 2024: -6,5%	2023: -10% 2024: -10%	2023: -10% 2024: -10%	2023: -10% 2024: -10%	Same as in 2020-2021	Æ	2023: -5% 2024: -5%
D (MS-specific)	Annual -8% effort reduction in Italy	Annual -8% effort reduction in Italy	Annual -8% effort reduction in Italy	Catch limits transition path to MSY calculated by EWG 22-09	Same as in 2020-2021	2023: 50% of Spanish fleet with more selective gear (45mm square mesh for coastal fleet and 50mm square mesh for deep-water fleet) 2024: 100% of Spanish fleet with more selective gear	*** (see above)
E (All-in)	2023: -16,5% 2024: Æ	2023: proportional to partial fishing mortality by gear (see EWG 21-01)	2023: proportional to partial fishing mortality by gear (see EWG 21-01)	Catch limits transition path to MSY calculated by EWG 22-09	2023: permanent closure areas	Æ	***

F (Status quo)	2023: Æ 2024: Æ	2023: Æ 2024: Æ	2023: Æ 2024: Æ	2023: Æ 2024: Æ	Same as in 2020-2021	Æ	Æ

Those scenarios combine several management measures and were to a certain extent already applied by the modelers for EWG 22-11. It would be beneficial for the work of the modelers to be able to run this list of scenarios as it is now or with only minor adjustments of percentages etc.

Table 3.1.1 in Section 3.1 shows the ability of the models to run those scenarios. It was discussed that the modelers should also run additional scenarios with only one management measure. The results of those runs would be treated differently to the results for the original six scenarios. It is obvious that, first, the modelers shall run those scenarios which are closer to reality - and that would be the six scenarios provided by DG Mare. However, it could be, secondly, interesting to run some scenarios with only one measure as in case it is unclear whether MSY will be reached in 2025 additional efforts may be necessary to achieve it (e.g. put in place additional temporary cessations to further reduce effort). That would give an indication what additional effort reduction may be necessary to reach MSY. It will also be helpful regarding the longer-term assessments as modelers can do sensitivity analyses with, for example, testing different levels of effort reduction so that it could be possible to give an indication when economic gains could be expected in the future and, therefore, may be able to compare short-term losses with possible long-term gains.

The MEDAC-Secretariat provided the EWG with several documents from the MEDAC focus group on the West Med Map. Those documents include mainly information the focus group provided to specific questions from DG MARE. The EWG 23-11 participants will use those documents as background documents for the model runs. It could be that they include information to set some of the assumptions in the models and are, therefore, part of this scoping exercise (opinion of stakeholders). However, it could be beneficial to set up a meeting with the MEDAC focus group before September 2023 to discuss specifics with the representatives of the fishing sector. The chairs will discuss with MARE during the STECF plenary meeting in March 2023 whether a meeting with the MEDAC focus group should be done in preparation of EWG 23-11.

Step 1b: Possibilities of Long-term assessments up to 2030

In parallel to the scoping exercise for socio-economic assessments EWG 23-01 also discussed the possibilities for assessment of longer-term effects of the implementation of the West Med MAP. Since the start of the implementation process in 2020 measures were introduced to reduce fishing pressure by limiting fishing effort, closure of areas or improvement of selectivity. After three years it is still not obvious whether those measures will be sufficient to reach the management objective of MSY for all stocks in 2025. It seems more realistic that they will not be sufficient and 2023 and 2024 additional measures may be necessary. It should be taken into account that stock assessments are only available with data up to 2021 at the moment (these will be updated with 2022 data in September) and socio-economic data are only available up to 2020 at the moment (these will be available up to 2021 in September).

DG MARE requested that possibilities for a longer-term assessment up to 2030 should be discussed. The comparison of possible effects of the implementation of measures over a longer time period may provide results when MS may be able to expect gains from the implementation of the West Med Map. When could there be a possibility to increase effort to generate higher catches and improve the socio-economic situation of the fishing fleet.

The models applied for the assessment of the West Med Plan (BEMTOOL, ISIS, IAM and SMART) can all run scenarios over more years than just 2023 and 2024. The problem will be, however, that in the easiest case all variables will be kept constant which is over a longer time period quite unrealistic. Most of the cost components of the fishing fleet will not stay the same and assumptions on the development of e.g. fuel costs have to be made. Modelers can run sensitivity analyses to assess how important different levels of costs have on the overall result.

In EWG 22-11 the participants started to compare the bio-economic models also regarding their biological component. There is, for example, the question which stock-recruitment relationship models shall implement in their models.

As it is expected that for at least some of the stocks MSY will not be reached by 2025 the models can run a few extra scenarios from 2025 onwards with only one management measure. That would allow to assess at which point the additional measures would lead to the reaching of the objective. To give an example, in case the modelers include additional effort reductions via temporary cessation, this may result in achieving MSY in 2026 or 2027. The level of those additional reductions could be assessed and what additional socio-economic impacts that may have. With achieving MSY, however, stocks may increase in the following years and the modeling results reveal first socio-economic gains.

The following description of the models include details regarding short-comings of multi-year assessments of which assumptions will be necessary to assess socio-economic impacts over a longer time period.

ISIS

ISIS-Fish can be ran for multiple years, and project hake stock dynamics (age structure) and associated catches. However several assumptions made for short term forecast will need to be revised in long-term runs.

On the biological part,

- recruitment is a major one, it is currently assumed constant, which prevent seeing the propagation of the benefits of the measure through time. Assumptions are needed but would be easily implemented in the model once available.
- Spatial distribution of hake is also assumed constant in projection, it is difficult to foresee how it could change in the future according to changes in fishing patterns and possibly rebuilding of protected habitats. The work needed to improve that aspect, really depends on the assumptions to implement (forcing is easy, dynamic redistribution requires a big effort).

On the fleet dynamic part,

- all catchability parameters are assumed constant in time (gear efficiency, targeting intensity, fleet efficiency, fish vulnerability), while it is expected that at least fleet efficiency could increase with time (due to skipper 's skill and technological improvements). Once assumptions are agreed it is easily implemented.
- Fishing strategies (allocation of effort over gear and zones) are also likely to evolve in response to management. These reactions are currently forced according to a priori defined rules that would need to be checked against observations and made more subtle and dynamic. Depending on the sophistication of the fleet behaviour model, this would require a substantial effort.

- Fleet size and total effort only evolves according to management and would possibly need to account for economic profitability. Same as above.
- For static species it is assumed a constant VPUE (per month and cell), this assumption would need to evolve to reflect the expected evolution of these stocks' status and their prices.
- All costs are assumed constant, see other model comments on this aspect.

These evolutions could either be accounted for by developing dynamic modules for the parameters (when possible) or by running alternative scenarios. The latter is easier although developing the assumptions requires research work, it is often easier to implement. The former is demanding both for the development of the dynamic module (depending on the level of sophistication) and for its implementation and certainly requires additional resources.

IAM

Shortcomings of multi-year assessments and necessary assumptions

The IAM model can be run over a long time period. It will take into account the evolutions of the biomasses of the dynamic stocks (i.e. the assessed stocks), accounting for uncertainty in their recruitments. And those biomass evolutions will be reflected in the catches and landings predictions of the dynamic stocks by the different fleet segments. However, with the current implementation of the IAM model, all technological and economic parameters will be constant each year. The model will therefore not take into account changes in parameters that are likely to occur over a longer period of time, for example:

- potential increase in technological efficiency, that could be reflected in the model in changes over the year of the catchability parameters;
- changes in fuel prices, so energy costs estimations might not be well estimated in longer time simulations;
- future evolution of other variable costs (i.e. like changes linked to inflation);
- no elasticity of prices are taken into account, so fish prices are constant;
- changes in fishing behavior related to the implementation of management measures (change of zone, of target species, of gears, etc.);
- changes in the biomasses of species that are not dynamically modelled. For the moment, the LPUE (i.e. landings per unit effort) is constant, so if the biomasses of these species change, this will not be reflected in the model. For instance, if some economically important species increase, this will not be reflected in the economic indicators, which will therefore be underestimated.

It should be noted that some of these changes could be taken into account by running alternative fuel price scenarios, for example, as was done in EWG 22-11. This is possible, but will take more time to run, and therefore cannot be added to the work of a weekly group.

Necessary assumptions

To improve, for example, the estimation of the fuel cost in the simulations over a longer period of time, certain assumptions have to be made. As the fuel price is an exogenous variable, it cannot be estimated endogenously in the model, so external work on likely evolution of the fuel price is needed.

This requires some work from the modelling team, but also from other experts; and some of the scenarios should be common to the different models.

IAM possible improvement

If alternative scenarios (for instance in fuel price) are to be run, we do not need to change the structure of the IAM model. This will only require to have the parameters for the scenario to run (i.e. changes in fuel price for instance), and will take some extra time to run.

However, other changes, including feedbacks between the different variables in the model, would require changes to the structure of the model, which cannot be done with the resources currently available to the IAM team. It might be important, for example, to include some changes in fishing behaviour related to profitability, and/or changes in stock biomasses.

BEMTOOL

Shortcomings of multi-year assessments

BEMTOOL can be ran for multiple years. The model can project the stocks of several species as European hake, red mullet, deep-water rose shrimp, Norway lobster, giant red shrimp and blue and red shrimp stock dynamics (age/length structure) using different types of SRR and then project the associated catches. However, several assumptions could need to be revised in long-term runs to improve the robustness of results.

The following shortcomings are referred to the current configuration of the model for the Western Mediterranean MAP and not for BEMTOOL in general.

On the biological part,

- a.1) For red mullet and blue and red shrimp endorsed quantitative stock assessments were not available during STECF EWG 22-11; however, the stock assessment of these two stocks have been presented and accepted during the last GFCM WGSAD and are expected to be updated to 2022 and available for the second 2023 Western Med MAP meeting.
- a.2) Recruitment and reference points: for the 7 stocks the decisions made during the EWG 22-09 on recruitment, reference points and short term forecast have been followed for the scenarios. In particular, for all the stocks, except hake, a geometric mean was used for the projections, as suggested by EWG 22-09. For deriving the uncertainty on SRR for stochastic runs, Eqsim was used during EWG 22-11, on the basis of assumptions made in EWG 22-09. It would be worth to have the uncertainty directly derived from the stock-recruitment relationship identified in EWG on stock assessment.
- a.3) Spatial distribution of the 7 stocks is also assumed constant in projection although it could change in the future according to changes in fishing patterns and possibly rebuilding of protected habitats. The work needed to improve this aspect, really depends on the assumptions to implement. The development of a spatial component for BEMTOOL is foreseen, under the H2020 SEAwise project (https://seawiseproject.org/). This component will simulate stock spatial distribution change and fleet distribution spatial re-allocation.

On the fleet dynamic part,

- b.1) in the last EWG, fleet catchability was assumed constant in time (e.g. gear efficiency, fleet efficiency, fish vulnerability), while it is expected that fleet efficiency could possibly change with time (e.g. due to skipper's skill and technological improvements). The improvement in fleet efficiency has been explored in past EWGs through hyperstability functions based on non-linear effort-fishing mortality functions estimated on DCF data. Although was not considered in EWG 22-11, this can be easily implemented in the next EWG.
- b.2) Fishing strategies: in the EWG 22-11 implementation of the model, the effort re-allocation from the deep-water and mixed métiers to the demersal one is considered when the catch limit of red shrimps is exhausted. Spatial closures have been also simulated implicitly, tuning the fleet selectivity (informed by an ad hoc analysis based on Global Fishing Watch effort data and MEDISEH results on nursery areas). A behavioural component is also implemented in BEMTOOL, but not used in the EWG 22-11 configuration of WestMed MAP; by using this option, it is possible to mimic a fleet reaction in terms of increase/decrease (capped by pre-defined bounds) of fishing days and vessels, according to the increase/decrease of profit (e.g. CR/BER). The behavioural module can be easily parameterized, once estimated and agreed the coefficients representing the thresholds trigging the fleet reaction on the basis of historical data on economic indicators trend respect to increase/decrease of fishing vessels/fishing days. On this aspect, a further development of a spatial component is foreseen, under the H2020 SEAwise project (https://seawiseproject.org/), to spatially mimicking the effort re-allocation according to socio-economic considerations. This work is expected to be completed by 2024. Depending on the sophistication of the fleet behaviour model required for WestMed MAP, this would require a substantial effort for the parameterization.
- b.3) The other species (not target) are included in the model only in terms of landings and revenues; both are assumed to vary proportionally with the landing and revenues of the target stocks. More sophisticated models are available in BEMTOOL and could be implemented in WestMed MAP case study (even different models by fleet segment and metier), after a further exploration of the DCF data (not yet completed due to time constrains).
- b.4) Fuel price is considered constant in the projections; the coefficients (not the costs, that vary following the effort and annual GT) of all economic sub-models are based on historical economic data and are assumed constant for forecast years.

Some of these aspects can be easily considered in the second 2023 WestMed MAP meeting (e.g. exploration of alternative configurations of the functions already implemented in BEMTOOL), while other aspects (e.g. the ones related to the spatial component, points a.3 and b.2) would need more time and resources for the parameterization.

To tackle for point b.4, for example, sensitivity analysis on alternative fuel price scenarios, as was done in EWG 22-11, could be run.

Necessary assumptions

To improve, for example, the estimation of the fuel cost in the simulations over a longer period of time, certain assumptions have to be made. As the fuel price is an exogenous variable, it cannot be estimated endogenously in the model, so additional work on likely evolution of the fuel price is needed. Similar considerations are valid for hyperstability models and for behavioural component (already implemented in BEMTOOL).

These would require some work from the modelling team in preparation to the weekly meeting.

BEMTOOL possible improvements

If alternative scenarios (for instance in fuel price, hyperstablity) have to be run, it would not be necessary to change the structure of the BEMTOOL model. This will only require to have the parameters for the scenario to run (i.e. changes in fuel price for instance) at least two weeks before the meeting, and will take some extra time to run.

Other changes, like the implementation of the spatial component is already ongoing in SEAwise H2020 project and is expected to be completed by 2024. However, the parameterization of the spatial sub-model would require ad hoc work to be carried out, which cannot be done with the resources currently available to the BEMTOOL team.

SMART

Shortcomings of multi-year assessments

SMART is devised to predict the effects of new exploitation patterns (determined by different management options) on the stocks. This approach is essentially based on the estimation of spatial and temporal LPUE, which are then combined with fishing footprint. It works well for short-term forecasts in which the "shock" determined by the entry into force of the management scenarios is the key topic. However, in its present form, SMART is not able to update the spatial and temporal LPUE according to the SSB of the stocks. In this way, the predictions returned by SMART are less reliable over long period of times. The core team of SMART is working on this specific aspect in order to overcome this limitation and a new version of the model is planned by the summer 2023.

Necessary assumptions

In SMART we do not need to assume stability of economic parameters (fuel price, salaries, prices at market of the different species), although the model is not devised to predict/optimise these parameters. The main assumption of SMART is related to the stability of the fishing capacity (number and characteristics of the fleets). However, considering that SMART allows to estimate the economic performance of each vessel, it is technically easy to identify, year by year, the subset of vessels with negative performances (negative profits) and adapt the fishing capacity accordingly.

Participants of EWG 23-01 proposed a common database for the STECF assessments of the West Med PLAN. The database should include background documents, datasets modelers can apply or documents with information what assumptions modelers should apply for e.g. the development of fuel costs. With such a database it could be easier for modelers to harmonize the outcome of the models and to work on improvements of the models. JRC could be a possible host of such a database.

In preparation of EWG 22-11 the EWG chairs will discuss with DG MARE how preparatory work can be conducted to allow the modelers to assess some of the longer-term impacts of the implementation of measures. This may include analyses of the effects of some of the mitigation measures on certain fleet segments and, for example, governmental support for the fishing sector. MS plan to provide the fishing sector again with some payments to cover increasing costs due to the war in Ukraine. The chairs of EWG 23-01 and 23-11 will provide the modelers with a list of assumptions for the longer-term assessments.

Step 2: Stakeholder meeting as preparatory meeting for EWG 23-11

For EWG 23-01 MEDAC provided some background documents from the focus group on the West Med Plan. In preparation of EWG 23-11 the EWG chairs should organize with MEDAC a meeting with the focus group. At that meeting modelers could present results from the EWG 22-11 meeting. Stakeholders can then react on the results and provide the EWG with important background information how the fleets reacted on the measures implemented under the West Med Plan. In the past those kinds of meetings often revealed that some of the assumptions in the models were not realistic. Fishing companies may have to pay their crew extra money to keep them on board (as income from landings fall under a certain threshold). This was, for example, the case when reductions in landings in the flatfish fishery in the North Sea led to low wages and the necessity that vessel owners had to pay a minimum to keep the crew on board (STECF 2008).

Step 3: Run of the available models

As in previous years the participants in the assessment of the West Med Map evaluations are not able to do the assessments in preparation of the EWG in September. The modelers are only able to run the models during the meeting. As described it is, therefore, necessary to do some preparatory work in case models should also assess longer-term impacts (e.g. clarify assumptions, prepare a list of additional scenarios with one measure, define range of variable values for sensitivity analyses (e.g. levels of fuel prices)). With this preparatory work the modelers can start running the models at the beginning of EWG 23-11.

Step 4: EWG 23-11 meeting with presentation of results in the report on the 2023 assessments

The model results will then be included in the report of EWG 23-11 and the advice of STECF for 2023. This would include the results from a biological perspective but also improved socio-economic assessments taking the outcome of EWG 23-01 on harmonization of the indicators and the list of proposed common indicators into account.

Step 4b: EWG 23-11 meeting regarding short- vs. long-term assessments

In the report of EWG 23-11 also results of the longer-term assessments will be provided. The EWG should also, depending on the results, try to assess short- vs. longer-term impacts and what we have learned about possible long-term gains from the implementation of the West Med Map.

Step 5: Improvement of models and expansion to the whole area

Already in the past STECF discussed with DG Mare possibilities for an improvement of the models applied in the West Med MAP EWGs. The conclusion was that extra effort and resources will be necessary to work on the models which were not developed to specifically assess the effects of the implementation of the West Med Map (see also TOR 2).

The EWG experts were and are only able to work on West Med Map issues during the two EWG meetings per year. For an improvement of the models extra effort between meetings will be necessary. In the following descriptions the modelers provide information on possible improvements of the models and about the possibility to expand the model to the whole area.

ISIS

Further developments which require additional resources:

- Inclusion of the other species of the plan. In a first step, red mullet, that is an economically important species that is caught simultaneously with hake.
- Inclusion of a fleet dynamics module to dynamically predict fisher's response to management (effort reallocation over space and/or métiers, adjustment of fleet size).
- More work is needed regarding hake spatial distribution and movement. It is a crucial aspect of spatial closure assessment that can dramatically affect the evaluation of measure efficiency. At minimum a sensitivity analysis of alternative assumptions would be of interest.
- Any sensitivity/uncertainty analysis takes a lot of computing time

Expansion to EMU2

The expansion of ISIS-fish is technically feasible and the model is spatialized, so it would allow keeping track of the impact in the different GSAs. However, it is not possible with current resources and requires someone dedicated to the developments for at least 18 months as well as good communication and exchanges with the experts from EMU2.

IAM

Further development:

- Improvement in economic indicators outputs: one full week work (possible to do it before EWG 23-11, with the resource in person that we already have)
- Improvement in estimations on how other species (i.e. non-modelled / assessed species) are taken into account in the revenues part : need approximately 2 months full-time work (if not from someone in the IAM team, as it includes time to take over the subject; for IAM team will need less time, but do not have the time unfortunately).
- Improvements in longer time period simulations: fuel assumptions, elasticity on prices, etc.: 4 to 8 months full time (according to what we do: use of parameters from other work, new work/estimations, new data collection, etc.)
- Sensitivity analyses: need time to work on that, time that the IAM team does not have. Difficult to assess in terms of time (depends on what is asked for).
- Inclusion of a fleet dynamics module to dynamically predict fisher's response to management (effort reallocation over métiers, adjustment of fleet size): need substantial time.

Expansion to EMU2

The expansion of IAM to EMU2 is technically feasible, however it is not possible with the actual resource that we have. We need someone full time working for appr. 18 months on that and exchanging with Spanish and Italian modelling and expert teams, especially experts on EMU2.

BEMTOOL

Possibilities for improvement of the models (time and necessary effort/resources)

Improvement in economic indicators outputs: 2 full weeks work (possible to do it before EWG 23-11). This would include the implementation of FTE and revision of labour costs sub-model, integrating a minimum wage.

- Split of PGP fleet segment by métier (gill-nets, trammel nets and longlines) and improvement in the estimations on how other species (i.e. non-modelled / assessed species) are taken into account in the revenues part: need approximately 1 month full-time work.
- Parameterization of behavioural component (as in the current version of the model): need approximately 1 month full-time work.
- Parameterization of spatial component for EMU 2: 8 to 10 months full time (according to what can be made available to be included in the model: spatial distribution layers, AIS/VMS data, etc…).
- Sensitivity analyses on additional economic sub-model scenarios (e.g. fuel costs): 1 week full-time work.
- Investigation of the formation of ex-vessel price for the stocks managed by the West Med MAP to possibly include the results in the price dynamic component (2 weeks full-time work).
- Refining of labour costs component, including a minimum wage and alternative functions to estimate them(2 weeks full-time work).

Possibilities to expand the model to the whole area?

Some work already done within an ad hoc contract in 2022, implementing BEMTOOL model in EMU1 for deep-water fleets, could be used as a basis to expand BEMTOOL to the whole area. This work should be importantly improved:

- including the actual socio-economic data for Spanish fleet by GSA, if made available (in the ad hoc contract they were derived according to the effort and capacity FDI data);
- refining the effort spatial analysis with FDI spatial data and VMS data and integrating eventually the new results of the ad hoc contract on MEDISEH update;
- including other target stocks and demersal fleets to make more robust the economic projections and provide an overview on a wider range of stocks.

One expert full time working on that for appr. 6 months and exchanging with Spanish and French modelling and expert teams would be needed.

On the other hand, one expert full time working for approximately 18 months would be needed to parameterize the whole model, including the spatial component (for which the implementation is ongoing and expected to be completed by 2024) of BEMTOOL for the whole area.

SMART

Possibilities for improvement

There are <u>four</u> main aspects to be addressed in order to improve and fully develop SMART:

- Spatial and temporal LPUE should be modelled as a function of SSB or other proxies of stock size. In its present form, SMART does not account for changes in the LPUE (e.g. increase related to stock recovery or decrease related to stock depletion). However, modelling the relationship between SSB and LPUE is challenging since it is largely debated in the scientific community. Potential costs: 1-month full time.

- Spatial and temporal LPUE should be estimated also for other gears. This issue will be probably fixed soon since a new methodology to estimate fishing effort for static gears (e.g. longliners or netters) is now available (Henriques et al., under review). Considering that VMS and/or AIS and logbook data are available for these fleets, it should be possible to integrate this component of the fishing effort in SMART.Potential costs: 1-week full time.
- For some specific applications, it would be important to integrate the fishing footprint of small-scale vessels (i.e. vessels without VMS/AIS). This can be done using the estimated fishing footprint according to Russo et al., 2019 and other similar approaches. Potential costs: 1-week full time.
- The fishing capacity (i.e. the structure of the active fleet operating in the case study area) should be make dynamic, according to the performance of the different vessels in terms of revenues, costs and profits. Considering that SMART already returns these economic indicators, it should be feasible to develop this aspect. Potential costs: 1-week full time.

Possibilities to expand the model to the whole area?

If all the data needed are make available and their coverage of the fisheries are adequate, SMART can be expanded to the whole area as it is.

3 HARMONIZATION OF THE ECONOMIC INDICATORS PROVIDED BY THE MODELS APPLIED TO EVALUATE THE WEST MED MAP

3.1 Presentation and comparison of the model assumptions for the economic component of the models

STECF 22-11 considered that it would be helpful if further effort was put into the development of the different bio-economic models used within the EWGs to ensure they report the same economic indicators and specific reference points. This would facilitate the evaluation of the economic results produced from the different simulated scenarios. The process of harmonizing the economic indicators started from an overview of the different models applied in the 2 EMUs and a comparison of the assumptions for the economic component.

EWG 23-01 drafted 3 matrices and considered that the actual application of the models in the context of the West Med MAP should be presented in those tables as a starting point for further improvements.

The **first matrix (model implementation overview)** is aimed at summarizing and presenting the main characteristics of the models in terms of: category (simulation or optimization), temporal/spatial scale. The matrix also informs if a stochastic or deterministic approach is applied for the economic indicators provided by the models. The stocks and the fleet segments included in the models are also indicated.

The **second matrix (model assumptions for the economic components)** is used to describe which components are included in the models and how they have been implemented. The different components (Prellezo R., 2010)[3] reported in the table are:

I[st] component: **fleet and effort dynamic**. Effort levels and fleet size are determined in the scenarios to be simulated by the models. However, this component may inform if the model activates or not a behavioural component that could be useful to simulate the reaction to changes in particular in spatial or temporal management measures. Also, this component, if present in the models, could be used to simulate the effects of some mitigation measures applied by MSs.

II[nd] component: **price dynamic**. This part of the table should inform if constant or variable prices are used by the models and, in the latter case, to describe the elasticity functions and coefficients. As demonstrated by a recent work[4] (Maynou, 2022), price flexibilities should be taken into account in the application of bioeconomic models for management advice, where prices are usually assumed constant. Another relevant information is the data source used to feed this component, if for instance commercial categories of the landings are considered.

III[rd] component: **costs dynamic**. The first point to be illustrated is if costs are differentiated by the fisheries managed by the West Med MAP. In particular, the source for the economic data is the AER data call where data are reported by fleet segments; therefore, it is relevant to compare the approach used in each model to disaggregate the economic data by fishing activity (for instance DTS in OTB_DEF, OTB_DWS and OTB_MDD). Other information to be provided for each model refer to the costs structures and the specific functions used to simulate the different cost categories.

IV[th] component: **the landings dynamic**. Few stocks are included in the biological component of the models, that is the stocks under the West Med MAP and those for which biological data are available. This component should then inform on the approaches used to incorporate in the models the landings of other species making up the total catch.

These tables are complemented by a further specifications of input variables and data sources for the four models and the equations used for the calculation of the economic results.

The matrices and tables with the model implementation overview and the model assumptions for the economic components of each model (IAM, ISIS-fish, BEMTOOL and SMART) are reported in Annex 1.

Finally, the **third matrix** (Table 3.1.1) informs for each model/scenario if results would be available during EWG 23-11 or if there any technical issues that will prevent running the scenario. Table 3.1.1 is based on scenarios requested during EWG 22-11 which should be modified only partially for EWG 23-11.

Table 3.1.1 Running of the scenarios during EWG 23-11 and foreseen drawbacks.

Model/Scenario	ISIS-Fish	BEMTOOL	IAM	SMART
A (-5%)	Yes	Yes	Yes	Yes

[3] Prellezo, R., Accadia, P., Andersen, J., Andersen, B. S., Buisman, E., Little, A., Nielsen, J. R., Poos, J. J., Powell, J., & Röckmann, C. (2010). Existing bioeconomic models review. In IIFET 2010 Montpellier Proceedings (pp. 1-12)

[4]Francesc Maynou, Sale price flexibilities of Mediterranean hake and red shrimp, Marine Policy, Volume 136, 2022, 104904, ISSN 0308-597X, https://doi.org/10.1016/j.marpol.2021.104904.

B (-7,5%)	Yes	Yes	Yes	Yes
C(-10%)	Yes	Yes	Yes	Yes
D (MS-specific)	Yes	Yes	Yes	Yes
E (All-in)	Yes	Yes	Yes	Yes
F (Status quo)	Yes	Yes	Yes	Yes

3.1.1 *Results*

The model implementation overview and the comparison of the assumptions for the economic components are aimed at:

- formulating a wiser interpretation of the economic results provided by the models for each scenario;
- improving the overall approach of multi-modelling within the West Med MAP by encouraging the alignment of the assumptions and data sources;
- informing if it will be possible to run all the foreseen scenarios during the EWG 23-11 or if specific actions should be implemented.

The EWG concluded that several limitations are present that should be improved to allow a more appropriate simulation of the economic and social results. Some components like the price dynamics and the behavioural aspects linked with effort/fleet dynamics are essential in the long-term perspective to proper assess the socio-economic impacts of the plan. In a context of constant variables or no behavioural reactions to management measures the long-term results cannot be properly assessed.

The EWG considered that the following points would benefit for further discussion and model improvements:

- the disaggregation of variable costs at the métier level. In BEMTOOL, the fuel costs, the other variable costs and the labour costs are disaggregated at métier level following the methodology to disaggregate economic variables by activity developed in SECFISH project[5] and described in Bitetto et al. (2022). This methodology allows to take into account the difference in the variable costs associated to the activity of each métier as well as the difference in the labour costs as depending on the revenues and, thus, indirectly by the métier. The SECFISH methodology is highly data demanding as it is based on individual vessel costs, effort and revenues data, to derive the relationships between costs and transversal variables[6]. The results obtained in SECFISH project were referred to the Italian fleet and, thus, it was possible to apply these results to EMU2 in BEMTOOL in the previous EWGs. In addition to the SECFISH project, the ISSG of RC_Econ on an alternative approach to the segmentation is aimed at providing a closer link between segments and fisheries. The EWG suggests that these methodological developments should be considered in future implementation of the models and also in EMU1. Nevertheless, the application of the SECFISH methodology to individual vessel data (if available) or alternative approaches would be needed, in order to integrate variable costs by metier in the bio-economic models in EMU1. It should be noted that these

[5] MARE/2016/22-SI2.768889,https://datacollection.jrc.ec.europa.eu/docs/regional-grants

[6] Bitetto I, Malvarosa L, Berkenhagen J, Spedicato MT, Sabatella E, Doring R (2022) Reconciling the economic and biological fishery data gathered through the European Data Collection Framework: A new R-tool. PLoS ONE 17(3): e0264334. https://doi.org/10.1371/journal.pone.0264334

implementations to other models would require data that are currently not available, or even do not exist; as well as significant time for data analysis.

- In most of the models under analysis, price dynamics are simulated to be constant and do not include elasticity functions. This is considered a limitation in particular for long term scenarios. Indeed, a recent work[7] showed that losses in revenue would be much less than the losses projected with constant prices when simulating sale price for scenarios of reduced landings, in line with fishing at maximum sustainable levels. Similarly, higher landings resulting from rebuilt stocks would yield lower revenues from these stocks because of the generally negative flexibilities. EWG concludes that the formation of ex-vessel price for the stocks managed by the West Med MAP should be investigated and results be included in the price dynamic component of the models.
- The comparison of the assumptions of the economic components, also highlighted that the simulation of labour costs differs among models. While a "crew share" approach is used by all the models, there is no unique approach to manage the case of negative RTBS ("what is left to share", i.e. revenues minus exploitation costs) that could result from several scenarios in particular in the short period. The EWG suggests that an investigation should inform on the minimum crew wage established by national rules within the national labour agreements of the sector. This minimum wage could then be introduced in the models as a lower threshold for the crew wage functions.
- Another area of heterogeneity refers to simulation of revenues from the landings for non dynamic species (i.e. "static species"). For these species, revenues are simulated proportionally to the changes on effort considering a constant LPUE (i.e. Landings per unit of effort) or are assumed to vary proportionally to the landings of the target stocks. Considering that the revenues from "static species" may represent a relevant part of the total revenues, EWG suggests to better investigate this part of the models. A dependency analysis (carried out for example in EMU2 for BEMTOOL in the previous EWGs) on the percentage of the landing represented by the target stocks for the different fleet could be considered a starting point for this investigation.
- Most models currently assume constant fishing behaviour (effort distribution among métier is constant, no entry-exit of the fleet apart from those dictated by management measures). In the longer term, it is likely that fishers will react to drastic changes in the regulation and modify their activity and/or fleet structure. This should be accounted for in simulations and requires important modelling efforts.

3.2 List of indicators to be provided for the second EWG meeting in 2023

The selection of economic and social indicators to be produced by the models as a result of the simulations, started from analyzing the ones listed in the TORs for the EWG 22-11. In addition, indicators applied within the "balance" fleet report were reviewed.

The final list of indicators suggested by the EWG are the following:

- Gross Value Added (GVA)
- Gross profit

[7] Maynou F., Sale price flexibilities of Mediterranean hake and red shrimp, Marine Policy, Volume 136, 2022, 104904, ISSN 0308-597X, https:/ doi.org/10.1016/j.marpol.2021.104904

- Gross profit margin
- Employment: Engaged crew and FTEs
- Labour productivity (GVA/FTE)
- Average salary (Crew cost/FTE)
- CR/BER

For each indicator, the EWG produced an information sheet (see below) to specify the following points: justification for its selection, definition, interpretation, thresholds and formula. These specifications are derived from previous STECF WGs if present (references used are reported in the tables).

Gross Value Added (GVA)	
Justification	Gross value added, gross profit and net profit represent the main profitability indicators.
Definition	Net output of a sector after deducting intermediate inputs from all outputs. It is a measure of the contribution to gross domestic product (GDP) made by an individual producer, industry or sector (STECF, 2022a).
Interpretation	A change in the GVA of a fleet segment indicates a change in the contribution that the fleet segment gives to the health of an economy and economic growth at both national and local level. GVA can be also interpreted as the remuneration of the following factors of production: labour, capital and entrepreneurship.
Thresholds	No specific threshold is generally defined for GVA. However, to apply a traffic light visualization of indicators outcomes, thresholds can be identified with the minimum and the average values of the indicators along the baseline period.
Formula	GVA = Income from landings + other income – energy costs – repair costs – other variable costs – non variable costs (STECF, 2022a).

Gross Profit (GPR)	
Justification	Gross value added, gross profit and net profit represent the main profitability indicators.
Definition	The normal profit after accounting for operating costs, excluding capital costs. Also referred to as gross cash flow, i.e. the flow of cash into and out of a sector or firm over a period of time (STECF, 2022a). GPR can be also interpreted as the remuneration of the following factors of production: capital and entrepreneurship.
Interpretation	Changes in the GPR of a fleet segment indicate a change in the remuneration of capital and entrepreneurship. A reduction in the expected remuneration of these factors of production can determine a situation of economic unsustainability of the investment in the sector.
Thresholds	No specific threshold is generally defined for GPR. However, to apply a traffic light visualization of indicators outcomes, thresholds can be identified with the minimum and the average values of the indicators along the baseline period.
Formula	GPR = Income from landings + other income – crew costs – unpaid labour - energy costs – repair and maintenance costs – other variable costs – non variable costs (STECF, 2022a).

Gross Profit Margin	
Justification	Gross profit margin indicates the normal profitability of a firm and is of most interest to fishers as it represents the share of income they are left with at the end of the year. For managers, it may be used as an indication of the viability of an industry in terms of its

	commercial profitability by measuring the share of cash coming in and out of an industry (STECF, 2022a).
Definition	It is a measure of profitability that can be used to analyse how efficiently a sector is using its inputs to generate profit. It is calculated as the ratio between gross profit and revenue and is expressed as a percentage (STECF, 2022a).
Interpretation	A high gross profit margin indicates that the sector has a low-cost operating model; reflects efficiency in turning inputs into outputs. A low percentage value can indicate a low margin of safety, i.e. a higher risk that declines in production or increases in costs may result in a net loss, or negative profit margin (STECF, 2022a).
Thresholds	>10% - High - Profitability is good and segment is generating a good amount of resource rent 0-10% - Reasonable - Segment is profitable generating some resource rents <0% - Weak - The segment is making losses; economic overcapacity. (STECF, 2022a)
Formula	Gross profit margin= ratio between gross profit (GPR) and revenue.

Employment: Engaged crew and FTEs	
Justification	The number of people employed, in terms of both total number and full time equivalent (FTE), represents the main indicator of the social dimension and its relevance.
Definition	Engaged crew is the total number of persons who have worked onboard the vessel, irrespective of the total number of hours (Guidance Document for the Fishing Fleet[8]). FTE is the number of crew converted into full time equivalent jobs (FTE) (Guidance Document for the Fishing Fleet).
Interpretation	FTE is the unit of measurement that equates to a person working full time, based on the national reference level for the working hours of crew members on board the vessel (excluding rest time) and for the hours of work at shore. An indicator equal to or greater than the higher threshold value implies a situation of maintenance of the current employment levels. An indicator lower than the minimum value implies a negative and very impactful situation in terms of social impact.
Thresholds	No specific threshold is generally defined for employment indicators. However, to apply a traffic light visualization of indicators outcomes, thresholds can be identified with the minimum and the average values of the indicators along the baseline period.
Formula	Engaged crew and FTE definition and methodology are reported in the Guidance Document for the Fishing Fleet.

Labour productivity (GVA/FTE)	
Justification	Labour productivity can be used as a measure of economic growth, competitiveness, and living standards within a sector. Labour productivity may also provide an indicator of worker's wellbeing or living standards, assuming that increases in productivity are matched by wage increases
Definition	Labour productivity - defined as output per unit of labour. Calculated as GVA (measure of output) by full-time equivalent (FTE) employment (unit of labour input).

[8] https://datacollection.jrc.ec.europa.eu/guidelines/socioeco/fleet

Interpretation	An increase in labour productivity indicates that a unit of input labour is producing more output or that the same amount of output is being produced with fewer units of labour.
Thresholds	No specific threshold is generally defined for GVA/FTE. However, to apply a traffic light visualization of indicators outcomes, thresholds can be identified with the minimum and the average values of the indicators along the baseline period.
Formula	Labour productivity = ratio between gross value added (GVA) and full time equivalent (FTE).

Crew costs per FTE	
Justification	The cost of labour for FTE represents an important indicator of social sustainability, as it offers a reference of the average salary received by the crew.
Definition	The crew cost per FTE is a proxy of the average salary for a person working full time on the vessel.
Interpretation	A value equal to or greater than the higher threshold value is considered a positive situation. On the other hand, an indicator lower than the minimum threshold outlines a critical and therefore negative situation.
Thresholds	No specific threshold is generally defined for the crew costs per FTE. However, to apply a traffic light visualization of indicators outcomes, thresholds can be identified with the minimum and the average values of the indicators along the baseline period.
Formula	Crew costs per FTE = ratio between labour cost and full time equivalent (FTE).

Current revenues on break-even revenues (CR/BER)	
Justification	Current revenues on break-even revenues is one of the most used indicator to know if profitability is enough to consider the economic activity sustainable along the time.
Definition	CR/BER gives an indication of the short-term profitability of the fleet/fleet segment (or over/under capitalised). The ratio of current revenues to break-even revenues (BER) measures the economic capacity of the fleet segment needed to continue fishing on a daily basis. Break-even revenues correspond to the revenues necessary to cover both fixed and variable costs, which are therefore neither such as to entail losses nor to generate profits. Current revenues are given by the total revenues deriving from landings. The ratio calculation provides a short to medium term analysis of financial profitability, as it indicates how close the current revenues of a fleet are to the revenues needed for the fleet to break even (STECF, 2022b).
Interpretation	A ratio equal to or greater than one indicates the generation of a profit sufficient to cover variable, fixed and capital costs, which shows that the segment is profitable and potentially undercapitalized. A value much lower than the unit outlines a situation of insufficient financial profitability. A negative value indicates that variable costs alone are higher than current revenues, which in turn indicates that the greater the generation of income, the greater the losses (STECF, 2022b).
Thresholds	>1 - High - Profitability is good 0.9-1 – Intermediate condition <0.9 - Weak – Profitability is negative
Formula	CR/BER = ratio between current revenue (CR) and break-even revenue (BER)

	where CR = income from landings + other income BER = fixed costs / (1-[variable costs / current revenue]) In which: Fixed costs = other non-variable costs + annual depreciation + opportunity cost of capital And, Variable costs = crew wage + unpaid labour + energy costs + repair costs + other variable costs (STECF, 2022b).

The EWG also discussed how economic and social indicators should be provided and it was suggested to use the "traffic light" approach. This method (Caddy, 1998) is able to supply an immediate view of fisheries performance attributing a colour to each indicator value according to the lower and upper thresholds. Figure 3.2.1 is an example of possible output.

		Scenario A	Scenario B	Scenario C	Scenario D
GVA (in €)	GSA10_DTS_VL0612	180733	116529	-204	100606
	GSA10_DTS_VL1218	-922425	-1408287	-3310214	-2546966
	GSA10_DTS_VL1824	-1544859	-4856147	-5747506	-6585531
	GSA10_DTS_VL2440	249666	-739465	-773317	-906643
	GSA10_PGP_VL0012	29618336	25814825	29306115	23280869
	GSA10_PGP_VL1218	279573	-5536686	-5362498	-6377153

Figure 3.2.1 – Example of presentation of the economic and social indicators through the traffic light approach

Regarding the thresholds, they are presented in order to identify the lower and upper levels to be used in the traffic light approach. However, EWG considered that these thresholds should be tested and their use should be decided after the actual running of the models in the next EWG. Also, a discussion with stakeholders on the suggested thresholds could improve their definition and interpretation.
Finally, in view of actually implementing the use of the indicators, the EWG compiled a table with the indication of the indicators that are already provided by each model, not available or that can be provided for the next EWG. This table also informs on the fleet segments for which the indicators will be possible to be provided for each model. The table is presented in Annex 2.

4 CLOSURE AREAS

The western Mediterranean Sea is one of the most developed sub-regions in terms of fisheries in the Mediterranean Sea. It accounts for around 22% of landings, 33% of revenues and 21% of the officially reported Mediterranean fishing fleet (FAO, 2020).

The Regulation (EU) 2019/1022 of the European Parliament and of the Council of 20 June 2019, establishing a Multiannual Plan for the fisheries exploiting demersal stocks in the western Mediterranean Sea, is aimed at the conservation and sustainable exploitation of demersal stocks in the western Mediterranean Sea, mainly based on regulation of fishing effort.

This Regulation applies to the following stocks: blue and red shrimp (*Aristeus antennatus*), deep-water rose shrimp (*Parapenaeus longirostris*), giant red shrimp (*Aristaeomorpha foliacea*), European hake (*Merluccius merluccius*), Norway lobster (*Nephrops norvegicus*), and red mullet (*Mullus barbatus*), that represent the most important species in the western Mediterranean demersal fisheries.

Together with the reduction of fishing activity in terms of reduction of fishing days to reverse the current overfishing state for most of the demersal resources, some technical measures are adopted to contribute to achieve the MAP objective to move the stocks to MSY within 2025.

In particular, in the Article 11(1), the Plan **provides that trawling shall be prohibited within six nautical miles from the coast except in areas deeper than 100 m depth during three months each year**. Those three months of closure shall be determined by each Member State and shall apply during the most relevant period, determined on the basis of the best available scientific advice.

The Article 11(2) provides that Member States may derogate from Article 11(1) establishing other closure areas, on the basis of the best available scientific advice. Those closures shall account for a reduction of at least 20% of catches of juveniles of European hake.

According to the **Article 11(3)**, Member States were required to implement closures by 17 July 2021 in areas with evidence of **high concentration of juvenile fish, below minimum conservation reference size, and spawning grounds of demersal stocks** covered by the West Med MAP. Moreover, European Council, statement 5415/1/21 Rev1, stipulated that "the additional closures should result in a reduction of between 15% and 25% in the by catch of juveniles and spawners of each stock covered by the WMMAP" (the term "by catch" used in the literal sentence from the joint statement, was interpreted as catch in the analysis carried out by STECF)." As such, implemented closures should protect both juveniles and spawners of species.

The following section is mostly based on shapefiles made by the experts to translate the national decrees describing the implemented closures (basically, table of coordinates) into GIS spatial objects suitable for any spatial analysis, including comparisons with existing knowledge on species spatial distribution. The experts support the initiative to have a formal European spatial database of marine closures, such as an EMODnet layer or European Environment Agency dataset (https://emodnet.ec.europa.eu/en).

4.1 Implementation of closure areas in EMU 1 since 2020

In order to accomplish objectives established by WMMAP in Article 11, MS have adopted spatial closures as a tool to manage demersal fishing resources. In most GSAs in EMU1, Article 11.2 has been adopted and so Article 11.1 derogated. At the moment, only Spain has submitted closure areas responding to Article 11.3.

In France two zones in GSA 7 were closed for bottom trawling for 8 and 6 months, whereas in GSA 8 as Article 11.1 was adopted the 6 miles/100 m isopleth has been closed for 3 months (*Arrêté du 20 décembre 2019, NOR: AGRM1936906A*) [2]. These management measures were evaluated by STECF in PLEN 19-03 [3]. Besides closures adopted in response to WMMAP there are also other three permanent closures in GSA7 between approximately 100 and 300 m depth where any fishing activity is forbidden and a temporal closure encompassing depth from 150 to 275 meters (see Table 4.1.1).

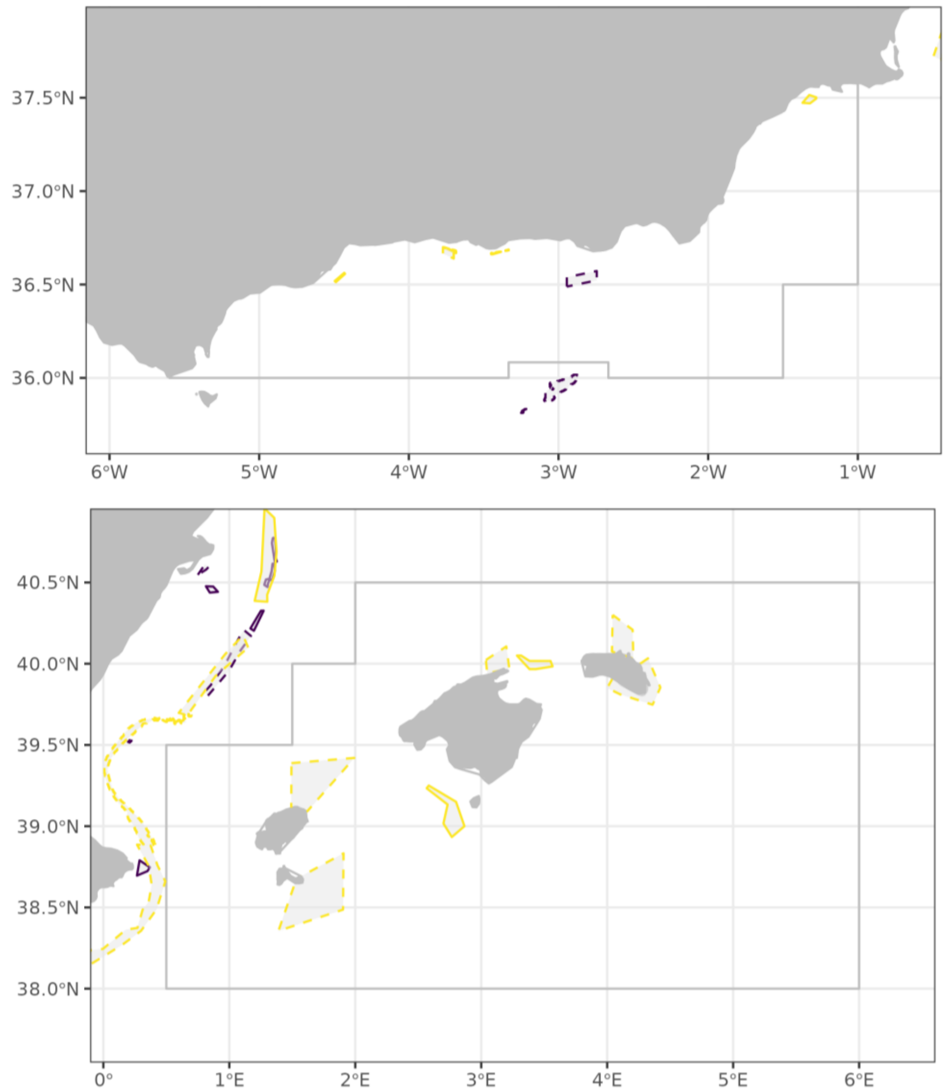
A distinct strategy has been implemented for Spain where areas implemented are smaller and distributed throughout the fishing grounds. In all GSAs (1, 2, 5 and 6) Article 11.2 was adopted by designing several temporal and permanent areas published in *Orden APA/423/2020 of 18 May, BOE no. 142* [4], which was complemented by several successive decrees (*Orden APA/753/2020 [5], Orden APA/1397/2021 [6], Orden APA/799/2022 [7], Orden APA/80/2023* [8 - Table 4.1.11 and Figure 4.1.1). In 2023, one-month long closures have been implemented almost all along the coast (*Orden APA/80/2023*) to fulfil with the criterion defined in the WMMAP to grant compensatory fishing days (Table 4.1.1 and Figure 4.1.2).

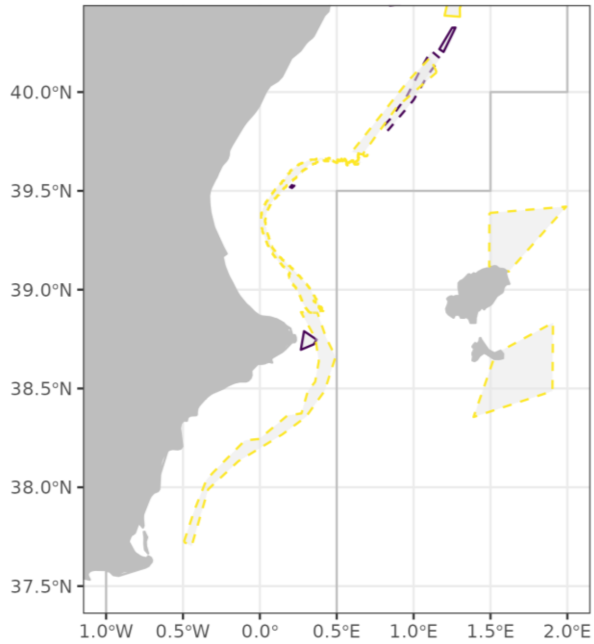
Table 4.1.1 Summary of the closure areas implemented in the Western Mediterranean by adopting the WMMAP legislation in EMU1 GSAs. Areas affecting trawlers activity established before the WMMAP are also considered. Decree stands for the decree defining the closure or its latest modification. Note that some Spanish closures areas were implemented in Orden APA/80/2023 across multiple GSAs, and they were assigned to the EMU with which they have the largest intersection.

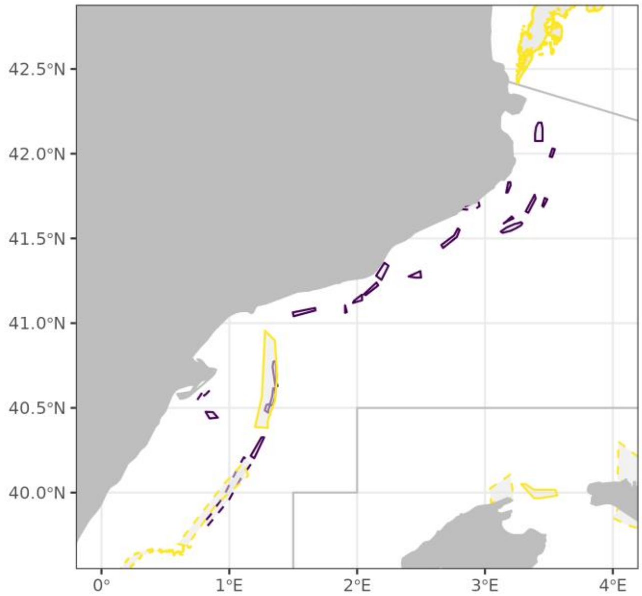
***Depending on the area fishing activity can be prohibited for all gears. It should also be considered that in some areas the extension of a closure can also include depths under 50 m.**

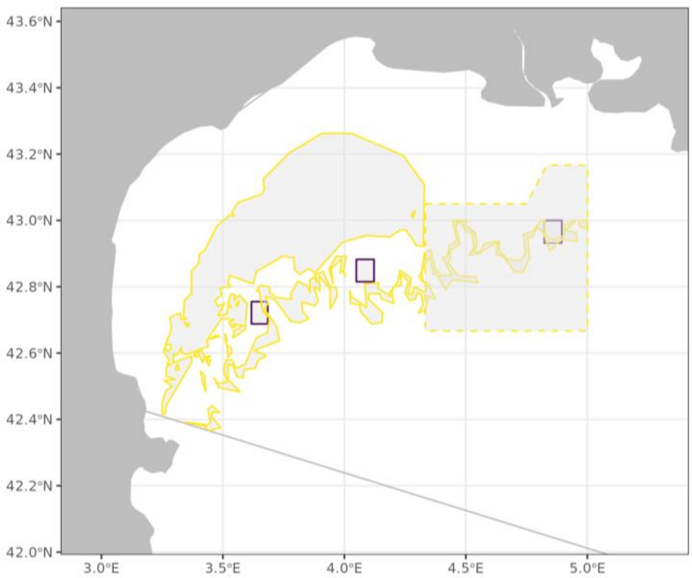
	Decree	Time closing	Fleets	Nº areas	Managed area
GSA1	Orden APA/753/2020	Temporal	All	6	40 km^2
	Orden APA/1397/2021	Permanent	Trawlers	1	99 km^2
	Orden APA/1397/2021	Temporal	Trawlers	1	24 km^2
	Orden APA/80/2023	Temporal	Trawlers	2	16951 km^2
GSA2	Orden APA/753/2020	Permanent	Trawlers	1	<100m depth (133 km^2)
	Orden APA/80/2023	Temporal	Trawlers	1	1133 km^2
GSA5	Orden APA/753/2020	Temporal	All	2	384 km^2
	Orden APA/1397/2021	Temporal	Trawlers	3	2577 km^2
	Orden APA/799/2022	Temporal	All	2	489 km^2
	Orden APA/80/2023	Temporal	Trawlers	4	5758 km^2
GSA6	Orden APA/753/2020	Temporal	Trawlers	1	374 km^2
			All	1	507 km^2
		Permanent	Trawlers	1	15 km^2
			All	2	60 km^2
	Orden APA/1397/2021	Permanent	All	12	239 km^2

	Orden APA/799/2022	Temporal	Trawlers	2	1400 km^2
		Permanent	Trawlers	2	261 km^2
			All	6	160 km^2
	Orden APA/80/2023	Temporal	Trawlers	14	26824 km^2
GSA7	AGRM1936906A	Temporal	Trawlers	2	5200 km^2
	AGRM1733988A	Temporal	All	1	626 km^2
	AGRM1733988A	Permanent	All	3	130 km^2




40.0°N
39.5°N
39.0°N
38.5°N
38.0°N
37.5°N
1.0°W
0.5°W
0.0°
0.5°E
1.0°E
1.5°E
2.0°E


42.5°N
42.0°N
41.5°N
41.0°N
40.5°N
40.0°N
0°
1°E
2°E
3°E
4°E


43.6°N
43.4°N
43.2°N
43.0°N
42.8°N
42.6°N
42.4°N
42.2°N
42.0°N
3.0°E
3.5°E
4.0°E
4.5°E
5.0°E

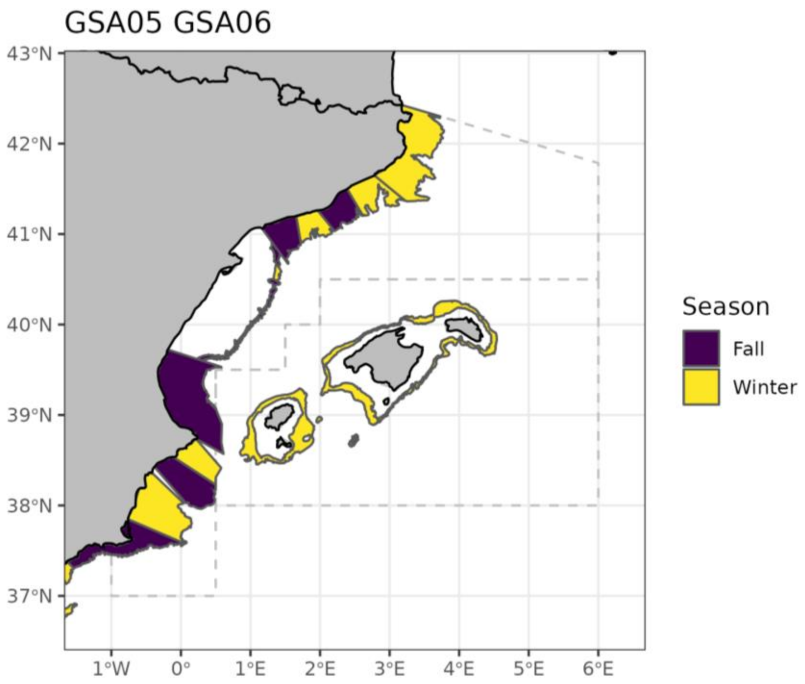


Figure 4.1.1. French and Spanish closures in EMU1, following article 11 of WMMAP (purple: permanent, yellow: temporal, solid line: all gears, dashed line: trawl-ban).

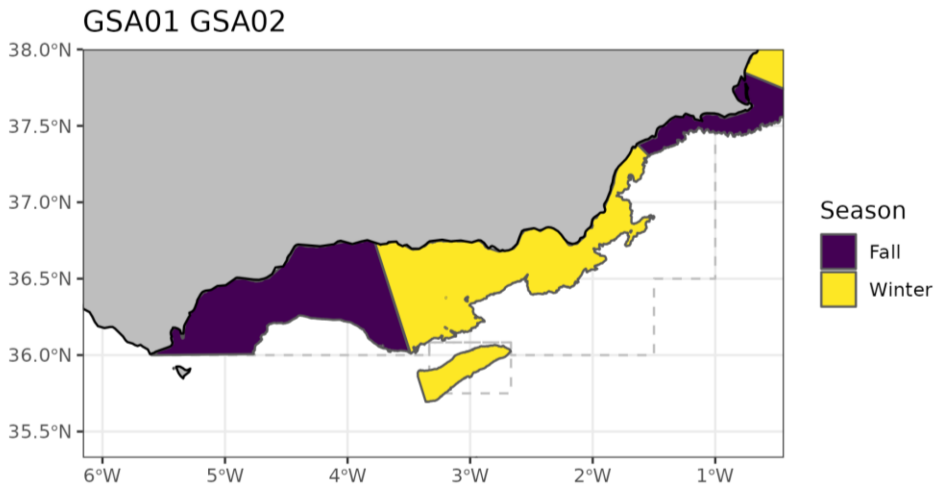


Figure 4.1.2: Maps of the new one-month Spanish trawl-ban enforced in the decree Orden APA/80/2023. The winter closure starts in February or March while the fall closure starts in October or November. Grey dashed lines consist int the border of the GSAs.

List of legal document

[1] Regulation (EU) 2019/1022 of the European Parliament and of the council of 20 June 2019 establishing a multiannual plan for the fisheries exploiting demersal stocks in the Western Mediterranean Sea and amending Regulation (EU) No 508/2014

[2] Arrêté du 20 décembre 2019 portant modification de l’arrêté du 28 février 2013 portant adoption d’un plan de gestion pour la pêche professionnelle au chalut en mer Méditerranée par les navires battant pavillon français. NOR : AGRM1936906A

[3] Scientific, Technical and Economic Committee for Fisheries (STECF) – 62nd Plenary Meeting Report (PLEN-19-03). Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-14169-3, doi :10.2760/1597, JRC118961

[4] Orden APA/423/2020, de 18 de mayo, por la que se establece un plan de gestión para la conservación de los recursos pesqueros demersales en el mar Mediterráneo.

[5] Orden APA/753/2020, de 31 de julio, por la que se modifica el Anexo III de la Orden APA/423/2020, de 18 de mayo, por la que se establece un plan de gestión para la conservación de los recursos pesqueros demersales en el mar Mediterráneo.

[6] Orden APA/1397/2021, de 10 de diciembre, por la que se modifica el Anexo III de la Orden APA/423/2020, de 18 de mayo, por la que se establece un plan de gestión para la conservación de los recursos pesqueros demersales en el mar Mediterráneo.

[7] Orden APA/799/2022, de 5 de agosto, por la que se modifica el Anexo III de la Orden APA/423/2020, de 18 de mayo, por la que se establece un plan de gestión para la conservación de los recursos pesqueros demersales en el mar Mediterráneo.

[8] *Orden APA/80/2023, de 30 de enero, por la que se modifica el Anexo III de la Orden APA/423/2020, de 18 de mayo, por la que se establece un plan de gestión para la conservación de los recursos pesqueros demersales en el mar Mediterráneo.*

4.2 Implementation of closure areas in EMU 2 since 2020

France:

In France, with the adoption of Article 11.1 the 6 miles/100 m isobath around Corsica has been closed for 3 months in GSA 8 (*Arrêté du 20 décembre 2019, NOR: AGRM1936906A* - Figure 4.2.1). These management measures were evaluated by STECF in PLEN 19-03.

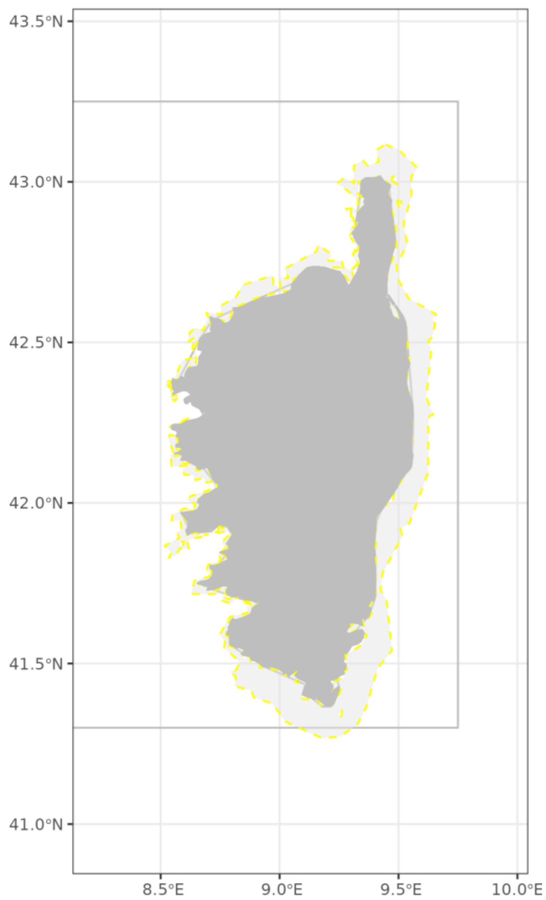


Figure 4.2.1. French closure in GSA 8 following article 11 of WMMAP (purple: permanent, yellow: temporal, solid line: all gears, dashed line: trawl-ban)

Italy:

In Italian GSAs 9, 10 and 11, on the basis of available scientific knowledge, the government asked to apply Paragraph 2 of Art. 11, e.g. the closure of specific areas in order to pursue the objective of reducing at least 20% of catches of juveniles of European hake. In fact, important nursery areas of hake are distributed in the three GSAs from 100 to 300 m depth, and characterized by high spatio-temporal stability. In particular, ten Fishery Restricted Areas (FRAs) were implemented in the Ligurian and the Tyrrhenian Seas - covered by Reg. EU 1022/2019 in GSA 9, 10 and 11 - to protect Essential Fish Habitats (EFH) and to reduce the catch of undersized hake. The location of these FRAs take into account the results reported in the previous document prepared by the Italian Administration, and examined by the 62nd Plenary Meeting of STECF (STECF, 2020a).

These FRAs, in which the use of any towed gear (i.e., "divergent trawls", "rapid trawls", "divergent twin nets", "pelagic trawls with pairs", "divergent pelagic trawls" and "dredges pulled by vessels") is prohibited, have been identified in the Annex 1 of the **Decree of the General Director of Fisheries (MiPAAF) Prot. No 9045689 of 6 August 2020.**

The geographical location of the FRAs is reported below.

https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/15871

4.2.1 *Fishery Restricted Areas in **GSA 9** to protect Hake Juveniles, according to the Italian Decree of 6 August 2020*

Argentario (50 Km^2, from 160 to 220 m depth)

Latitude	Longitude
42.3333 N	10.8333 E
42.3833 N	10.8333 E
42.3333 N	10.7333 E
42.3833 N	10.7333 E

North Tuscany (107 km^2)

Latitude	Longitude
43.8167 N	9.8 E
43.8333 N	9.85 E
43.7 N	9.9667 E
43.6667 N	9.8833 E

Capraia (145 km^2)

Latitude	Longitude
43.22597 N	10.01694 E
43.25438 N	10.12259 E
43.15000 N	10.18333 E
43.12331 N	10.07653 E
43.22597 N	10.01694 E

4.2.2 *Fishery Restricted Areas in **GSA 10** to protect Hake Juveniles, according to the Italian Decree of 6 August 2020*

Gulf of Gaeta (125 km^2, from 100 to 200 m depth)

Latitude	Longitude
41.1322 N	13.4511 E
41.0864 N	13.6325 E
41.0225 N	13.6083 E
41 0686 N	13.4269 E

Gulf of Patti: 150 km^2, the sea area delimited by the line connecting Cape Milazzo and Cape Calavà (from coastline to 500 m depth)

Gulf of Castellammare: 250 km^2, the sea area delimited by the line connecting Cape Rama and Torre dell'Uzzo (from coastline to 200 m depth).

Sorrentine Peninsula Area (196 km^2)

Latitude	Longitude
40.35701 N	14.59957 E
40.34901 N	14.75355 E
40.21391 N	14.74194 E
40.22181 N	14.59058 E
40.35701 N	14.59957 E

Area facing Amantea: between the coastline and the line connecting the following coordinates: 188 km^2

Latitude	Longitude
38.92968 N	16.02349 E
38.92293 N	16.14812 E
38.77169 N	16.13715 E
38.77321 N	16.01086 E
38.92968 N	16.02349 E

4.2.3 *Fishery Restricted Areas in **GSA 11** to protect Hake Juveniles, according to the Italian Decree of 6 August 2020*

Asinara (269 km^2)

Latitude	Longitude
41.2773 N	8.7727 E
41.2773 N	8.9873 E
41.1427 N	8.9873 E
41.1427 N	8.7727 E
41.2773 N	8.7727 E

Buggerru (619 km^2)

Latitude	Longitude
39.50 N	8.04 E
39.50 N	8.28 E
39.23 N	8.28 E
39.23 N	8.04 E
39.50 N	8.04 E

4.3 Definition of new closure areas in EMU 1 and 2 following EWG 22-01

In the context of the WestMed Map, Members states were required to implement closures areas to protect juveniles of hakes (article 11.2), and to protect concentrations of juveniles and spawners of demersal stocks and reduce catches (article 11.3). The successive STECF assessments of Member states proposals, and recommendations for designing closures are summarized in EWG STECF 22-01.

STECF (EWG 21-01 and PLEN 21-02) were asked to delineate new closure areas if the ones submitted by MS do not accomplish with the objectives established. In this point STECF stressed that designing new closure areas is not a straightforward process as many factors are at play and insist on the need of considering juveniles and spawning aggregations distributions is a key requirement for new delineations. As a conclusion, in PLEN 21-02 (p.33) [5], STECF suggests a roadmap for identifying and testing the effects of closure areas: *"a) define recruits and spawners (a number of assumptions can be made to identify thresholds for these two categories); b) estimate the distribution of recruits and spawners densities using several modelling approaches depending on species and area; c) identify hotspots (i.e., areas with higher density) of recruits and spawners (e.g., by means of survey data and sampling onboard); d) verify the spatial and temporal persistency/stability of such hotspots; e) evaluate the importance of each area in a multispecies context by analysing the spatial overlap among the persistent hotspots (areas including* *nurseries and spawning aggregations for multiple species should be ranked as highly priority areas); f) define a number of closure areas scenarios prioritizing areas with overlapping hotspots and gradually increasing their spatial extensions; g) verify the effect of such scenarios (closure areas) in reducing juveniles and spawners in catches along with effort redistribution (e.g., ideally through a dynamic modelling). Following this roadmap, it could be possible to optimize spatial management objectives for demersal fisheries by identifying the precise location and extension of closure areas achieving a given reduction of juveniles and spawners in catches."*

In 2022, EWG 22-01 was tasked to provide evidence of a high concentration (named hereafter "hotspots") of juvenile fish and of spawning grounds of demersal stocks, in particular for the target stocks of the West Med MAP (EC Reg 2019/1022, Article 1). Hence, EWG 22-01 developed a hotspots' seascape based on the best available science in the area (STECF, 2022). The identification of high concentration areas for the harvested resources in the Western Mediterranean requires the analysis of spatial data on abundance and density distribution, which can be obtained by sampling the populations in space and time as a basis for applying statistical models to infer the distribution in non-sampled areas (e.g. Colloca *et al.*, 2013; Alglave *et al.*, 2022, ad-hoc contracts 2191, 2192, 2301 and 2302). In a second step, the persistence of these high concentration areas is analysed by overlapping annual density distribution throughout the years as done during (STECF, 2022).

4.3.1 *Survey data: MEDISEH shapefiles*

Nursery areas and spawning aggregations of hake, red mullet, Norway lobster, deep-water rose shrimp, giant red shrimp, and spawning aggregations of blue and red shrimps were calculated in the framework of the MEDISEH Project (DG MARE Specific Contract No 2 SI2.600741 ; Giannoulaki et al., 2013). MEDISEH analases were based on MEDITS bottom trawl survey data 1994-2010 and outcomes are available as shapefiles for a total of 11 species-life stage combinations. The EWG was provided with results from two ad-hoc contracts (n. 2301 and n. 2302) updating the MEDISEH analyses and modeling nursery and spawning aggregations of red mullet, nursery areas of hake and spawning grounds of blue and red shrimp, for a total of 4 species-life stage combinations.

These updated shapefiles were obtained on the basis of the MEDITS bottom trawl survey data for the period 1994–2021. MEDITS survey is carried out in EU Mediterranean waters in spring - summer (May-August, mainly for the Italian GSAs (9-10-11) - it was performed in late summer-fall; WP, 2019) to gather data on benthic and demersal fish and shellfish in a wide depth range, from 10 to 800 m depth (MEDITS-handbook, 2017). In the Western Mediterranean, given the timing of the MEDITS survey (second and third quarters), it is likely that the resulted habitat mapping cannot be considered as fully representative of the actual distribution of nurseries and spawning areas (Colloca et al., 2013).

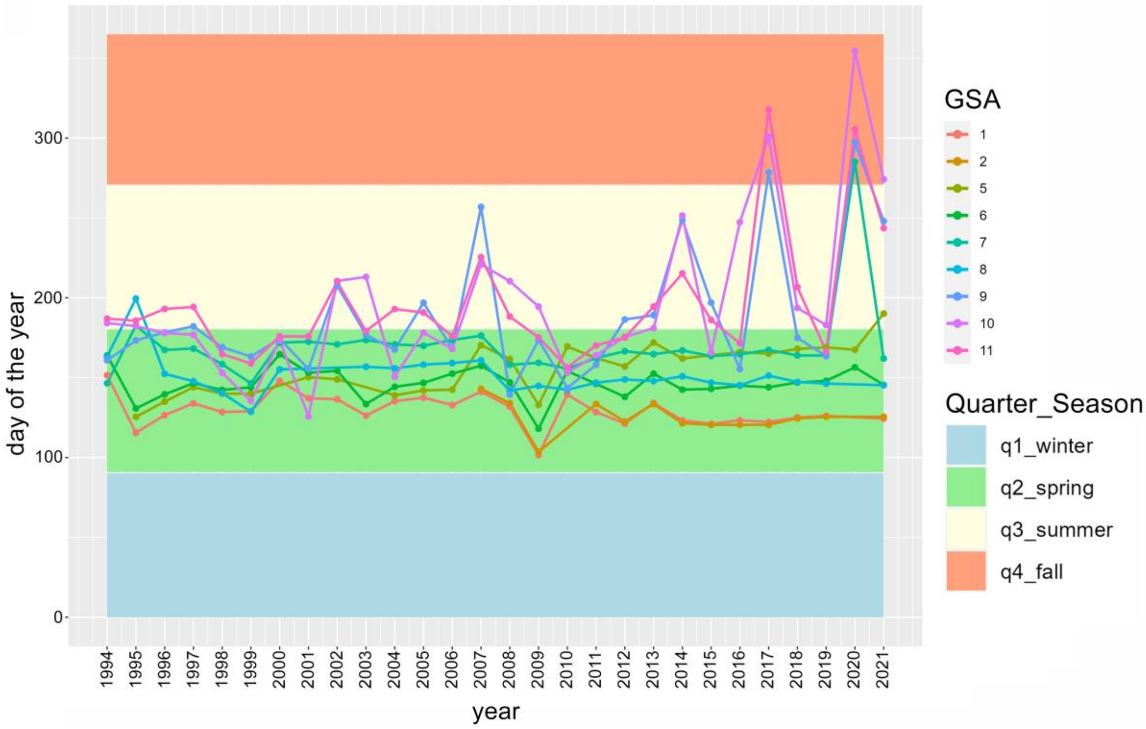


Figure 4.3.1 MEDITS survey timing (the average day of the year the survey takes place) over 1994 to 2021 and per GSA

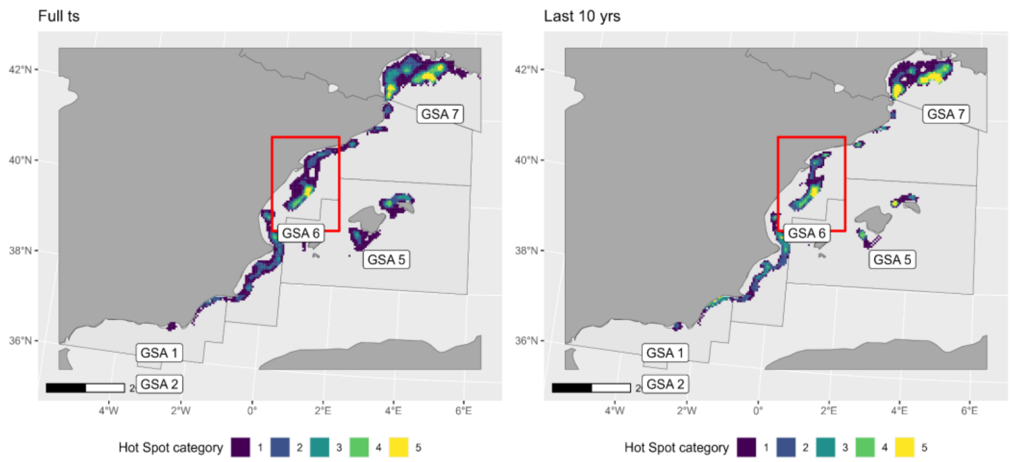
Recruits were considered as juveniles specimens entering the exploitable stage of its lifecycle, and the Von Bertalanffy growth equation was applied to identify the size at which individuals born in the same year of the sampling could have grown up to the moment of the observation. For this purpose, the t0 parameter was adjusted in line with the stock specific settings applied in the respective assessments. Parameters of the Von Bertalanffy growth curves were retrieved from the most updated available stock assessment reports. In analogy to the available stock assessment, it was applied (or not) a t0 correction for those species spawning in summer. Spawners were considered as the mature part of a stock responsible for reproduction, and the observed maturity stage at the moment of sampling was adopted as criteria to identify this life stage. In case of European hake, Red mullet, and Norway lobster, the target stage was MEDITS stage 3. For crustaceans other than Norway lobster the target stage corresponds to MEDITS stages 2c/2d. The growth parameters that were adopted in the ad-hoc to identify recruits and spawners in each GSA were derived from the most updated available stock assessment reports.

Density indices (n.km^{-2}) by year both for recruits and spawners, MEDITS station, GSA and species were calculated by using the JRC MEDITS R script (Mannini, 2020) and the related TA, TB and TC tables.

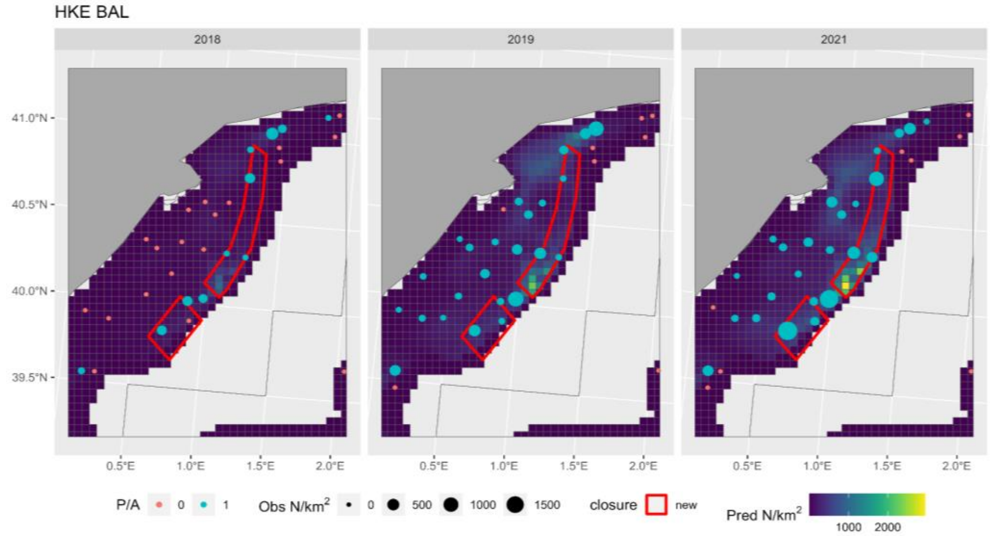
Zero-altered (or hurdle) models using static/dynamic environmental covariates - with a binomial presence-absence model (i.e., binomial(link = "logit")) and another model for the positive catches only with a Gamma observation distribution and a log link (i.e., Gamma(link = "log")) - were implemented by fitting the 2 components separately and combining the predictions. The R package sdmTMB (Anderson *et al.*, 2022) has been used for implementing geostatistical and spatiotemporal GLMMs using TMB for model fitting and INLA to set up SPDE matrices. Models were fitted by using a tringulated mesh to approximate the continuos random fields, and specifying the settings for spatial and spatiotemporal effects in each model component. To locate and classify nurseries and spawning aggregations based on the SDM output, annual density spatial hot-spots were identified through the Getis' G statistic (Getis and Ord, 1992) with a radius of 2.5 - 5.0 km and Z values greater than the 90° percentile by year.

This approach was applied separately in each of the 3 defined subareas (Balearic, Tyrrhenian, and Sardinia) and for each year of the time series to spatially locate clusters of recruits and spawners displaying a significantly higher density. Finally, an index of persistence (PI) was calculated to measure the relative persistence of annual nurseries and spawning aggregations in each GSA (see Colloca et al., 2015) and categorized in 5 levels - (0-20%] ; (20-40%]; (40; 60%]; (60;80%] and (80-100%] - which are specific for each model (species/lifestage/area) and linked to the sampling years the specific model used.

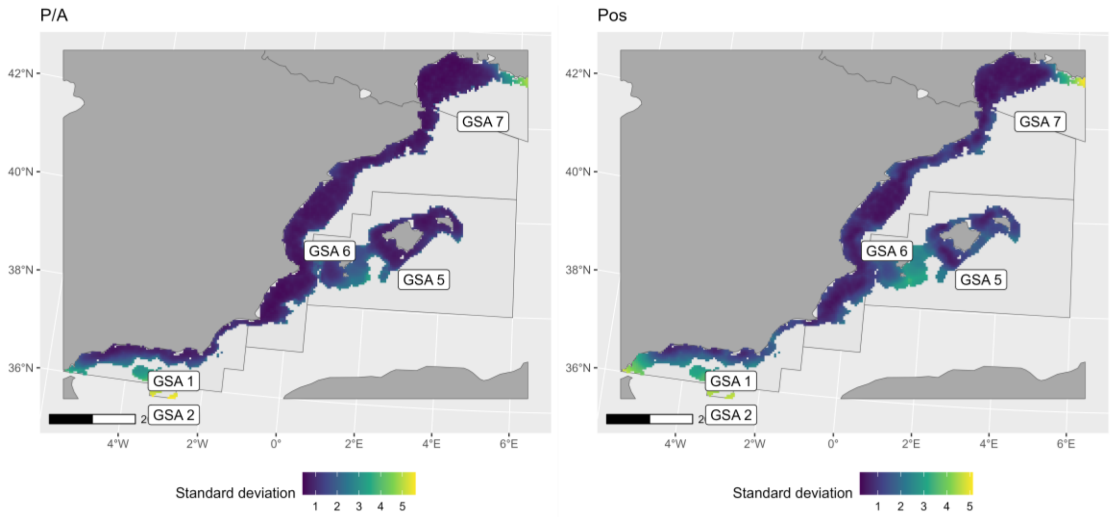
Figure 4.3.2 shows an example taken from the ad-hoc study outcomes showing the most persistent hotspots that were mapped in the Balearic subarea (red square indicating the close-up views on 2 closure areas proposed by EWG 22-01 and related model predictions' uncertainty. In the future the identification of the hotspots could be improved by preventively selecting grid cells defined with high levels of predictions and limited uncertainty levels.



a



b



c

Figure 4.3.2. Persistent hot spot areas for HKE recruits at Balearic subarea level considering the whole time series (left) and only the last 10 years (right); (b) Related close up views with the Balearic model predictions, 2 of the new closures proposed during EWG 22-01, and MEDITS data; (c) Model uncertainty for the Presence/Absence and Positive catch models (left and right, respectively).

Figures 4.3.3-5 show the spatial distribution of juveniles and spawners of Red mullet, juveniles of European hake, and spawners of Blue and red shrimp from the 4 updated MEDISEH shapefiles, as they were thresholded (PI1>=20%) to be used in the procedure for assessing and evaluating existing closures (Section 4.3.3).

Here we indeed identified hotspots on annual maps and selected the spatial persistence higher than 20% (i.e. a hotspot is assumed persistent if found at least 1/5 time over the entire survey periods, which are model-specific).

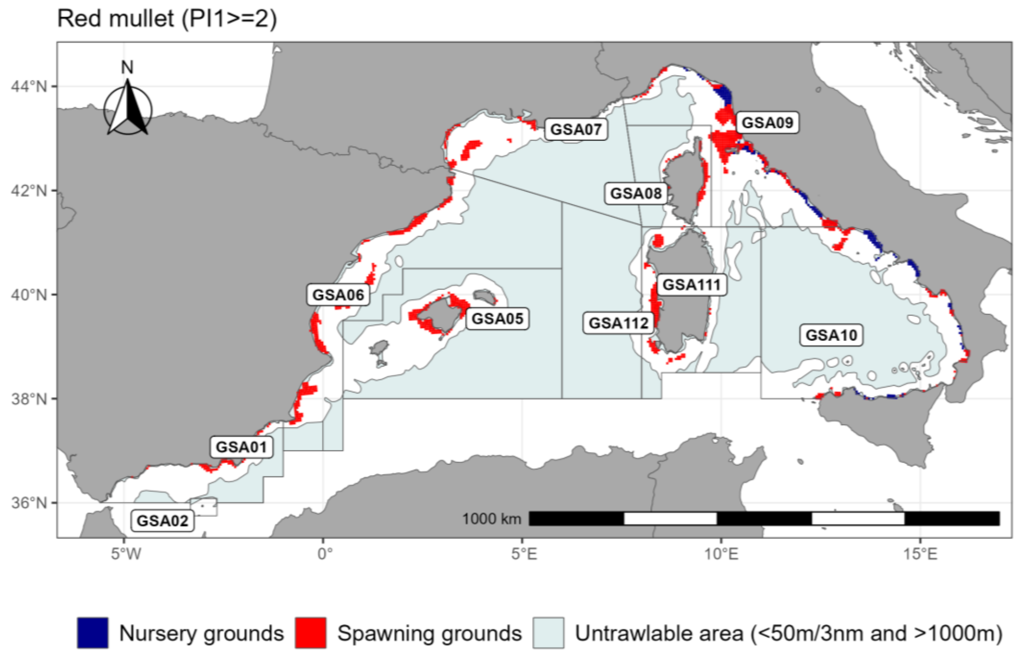


Figure 4.3.3. Spatial distribution of juveniles and spawners' hotspots of red mullet (MUT) from updated MEDISEH shapefiles. PI1 refers to the temporal persistence class >20%.

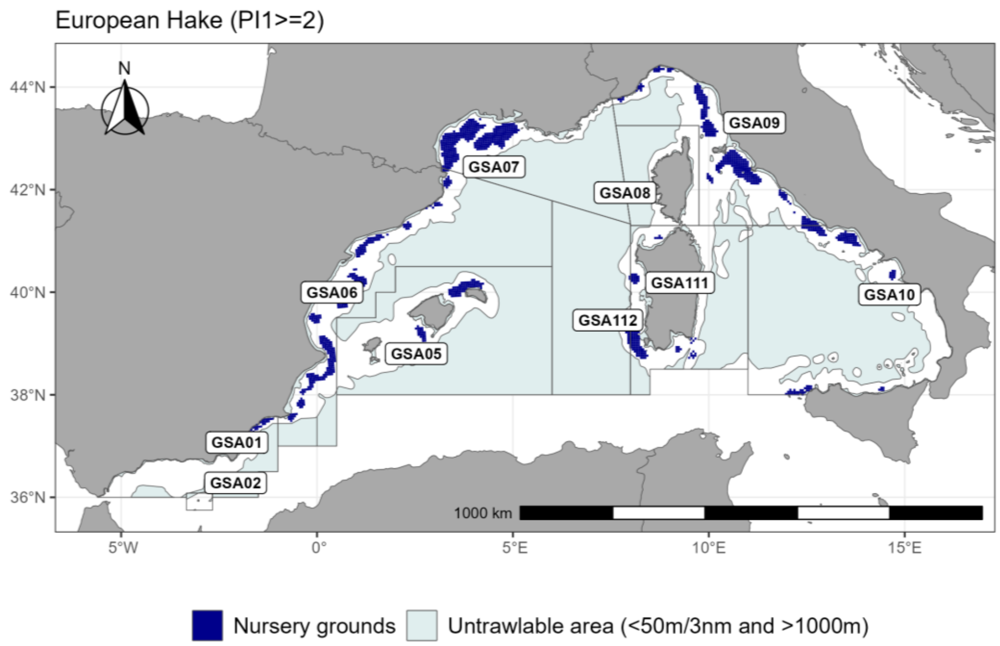


Figure 4.3.4. Spatial distribution of juveniles' hotspots of European hake (HKE) from updated MEDISEH shapefiles. PI1 refers to the temporal persistence class >20%.

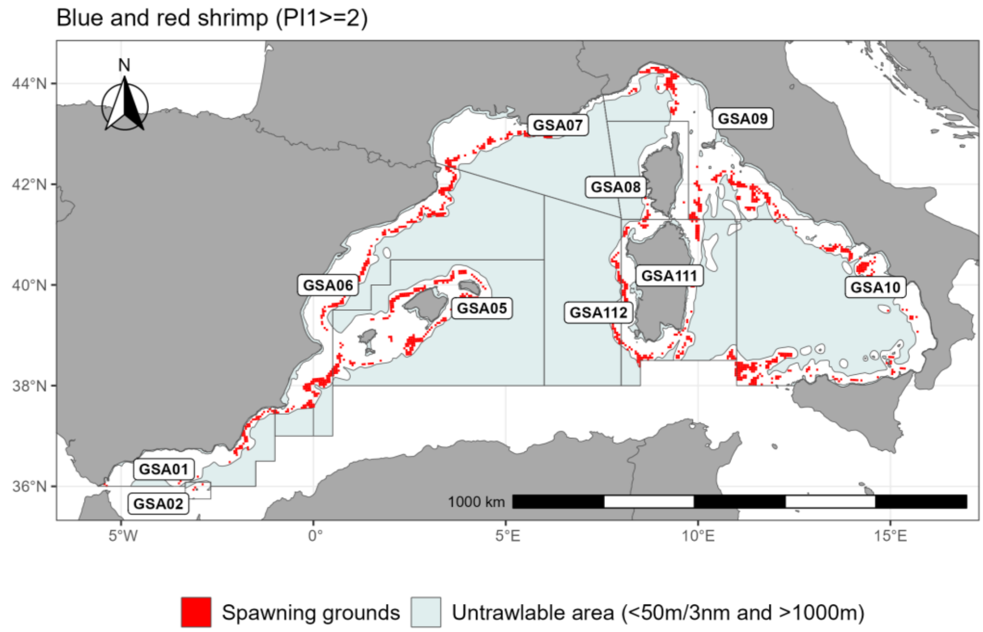


Figure *4.3.5*. Spatial distribution of juveniles' hotspots of blue and red shrimp (ARA) from updated MEDISEH shapefiles. PI1 refers to the temporal persistence class >20%.

4.3.2 *Commercial data coupled to survey data (blue and red shrimp only)*

During EWG 22-01 species distribution and possible persistence of hotspot areas over the years were mapped using scientific surveys and commercial data on the basis of two *ad hoc* contracts (n. 2191 and n. 2192, respectively). Both data sources have different advantages that could complement to identify suitable areas. Scientific surveys following standardised procedures aim to provide large-scale consistent estimates of species density across the area of interest, but often they lack the fine-scale spatial and temporal information necessary to delineate hot-spots. In contrast, commercial data usually lack consistent estimates of abundance across broad regions, but provide higher spatial and temporal resolution locally. For the commercial data log-book information was linked to position data (VMS/AIS) at the trip level. The two complimentary data sets were integrated using spatial modelling approaches to provide additional option for hotspot based closures. Following EWG 22-01, EWG 23-01 considered these particularly useful where there was concern that survey data did not cover the seasonal pattern of distribution appropriately as surveys are temporally restricted.

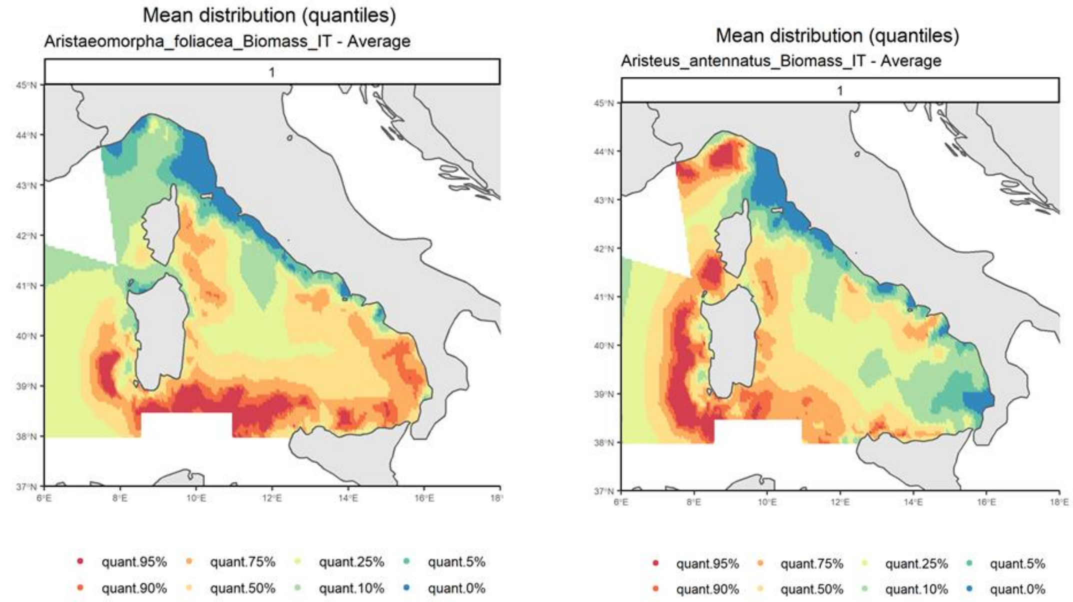


Figure 4.3.6. Mapping the 2015-2020 average Aristeus antennatus and Aristaeomorpha foliacea density, here classified by quantile, obtained by applying the statistical modeling approach described in Alglave et al. (2022) in EMU2 and based on Italian data only. Mapped on 0.05 x 0.05 grid cells.

To be conservative and limit the uncertainty, EWG 22-01 decided to restrict the VMS-logbook model (Figure 4.3.6) by areas of existing fishing effort coverage to avoid model extrapolation artefact. No additional covariates were indeed included in the model as VMS-logbook data do not provide reliable estimates for the species-habitat relationship and only allow to identify spatial and spatio-temporal correlation structures (Alglave et al. 2022, Annex I). Therefore, no hotspots could be identified in not trawled areas following this conservative approach.

EWG 22-01 decided to identify persistent areas by selecting grid cells defined with high commercial LPUEs and CV approximately above 0.5 and below 1, areas of low variance associated with extrapolation to low data density were excluded (Table 4.3.2). In EWG 22-01 this approach was used only to identify two potential area closures (one in GSA 11.1 and one in GSA 8), because for these areas no survey data (MEDITS) were available. In particular, being deep fishing areas, LPUE spatial distribution of the two deep shrimps (red shrimp and blue shrimp) were used. These two potential areas are still consider are relevant by EWG 23-01. While the use of LPUE data was restricted to species or areas for which MEDISEH data were not available, EWG 23-01 considers this approach valid in cases where the 'hotspot' approach based on MEDISH data fails to produce sufficient reductions in catches particularly as this year the negative correlation between persistence and fishing effort was quite apparent particularly in the Italian GSAs.

Table 4.3.2. Ad hoc CV range per species chosen to delineate areas of high fish concentration on the species-specific density maps provided by Alglave et al. (2022)

Species	CV range

Red shrimp	0.2-1.3
Blue shrimp	0.4-1.0

The EWG notes that using commercial LPUEs could be a biased approach because it could pool vessels with different fishing power, where the largest vessel expected to develop higher catch rates (STECF EWG 18-09). However, this piece of information was used predominantly as a post-hoc confirmation of the hotspots identified, only where AIS data and FDI landings matched. Still, the mismatch with the FDI was considered high (i.e., FDI record with no corresponding AIS, AIS records with no corresponding FDI declaration of landings), resulting in a few AIS-based fishing grounds.

4.3.3 *Define closure areas based on persistent hotspots and historical spatial effort allocation*

We describe hereafter the criteria for prioritising, developing and updating closure areas based on their conservation value on the basis of existing closures, proposed closures from EWG 22-01 and new proposals developed by EWG 23-01 based on updated MEDISEH layers. The EWG focused here on examining the consistency in the spatial distribution of hotspots based on previous and new MEDISEH layers, adding new areas in newly perceived (new data) hotspots and additional criteria that could be used to determine relevant areas when the sum of hotspot areas were thought to be insufficient in reducing the catches to sustainable levels. Sources of information used by EWG- 23-01

- Fishing effort spatial distribution layer from VMS data from EWG 22-01 ad-hoc contract n. 2191 and 2192
- new MEDISEH layers (EWG 23-01) updated by the ad-hoc contract n. 2301 and 2302, and previous MEDISEH layers for the species and stage for which no updates were available. After thresholding by persistence class, each of these 11 layers was converted to a binary raster with 1 for pixel identified as a hotspot for the corresponding species and life-stage, and 0 otherwise. These layers were summed up to derive a single layer that identifies multispecific hotspots, for which protection is considered relevant.
- Layers of species based on commercial LPUE analysis carried out from EWG 22-01 ad-hoc contract n. 2191 and 2192. These layers were used for species and areas not covered by MEDISEH layers.

Procedure applied:

Historical MEDISEH layers were compared with new MEDISEH layers (EWG 23-01 ad-hoc) to assess whether the new information predicted either changes in distribution of 'persistence' and evaluate if previously suggested closures were still valid.

The EWG acknowledges that a more robust model has been used for redefining the MEDISHEH layer (a Species Distribution Model (sdmTMB) approach including environmental covariates, see Section 4.3.1). Greater reliance on environmental covariates used in the model development underlying the new MEDISEH layers ensured a better interpolation of 'persistence' in data-poor areas and a smoother transition. It also ensures that proposed closure areas account for habitat characteristics (e.g. sediment, depth range). Generally, the pattern remained quite similar, but specific locations indicated that there were additional areas that could be protected for additional resource benefits. Bearing in mind that the only evidence we had was that the proposed closures from EWG 22-01 (section 3.4.2) were insufficient in reducing fishing mortality additional and enlarged areas were proposed rather than the removal of areas.

STECF-PLEN-22-03 indicated concerns that high levels of exploitation may mask aggregations of specific life stages, like spawners, for stocks heavily over-exploited. Such areas would only become apparent after a reduction in exploitation as the population redistributed in space necessitating regular reanalysis of what could be impaired by the current low level of abundance.

Last year (EWG 22-01), few model outputs were available to indicate whether the current reductions in catches were sufficient to reduce the catches of demersal species as aimed by the West Med MAP. For Italian waters, the output from last year's SMART model evaluation of the proposed areas (EWG 22-01) had suggested that the area closures proposals made by EWG 22-01 were insufficient to reduce total catches by ~20%.

Overlaying the new high persistence areas based on the revised MEDISEH layers the available VMS effort distribution suggests there is, at least locally, an inverse relationship between the effort and the persistence, suggesting:

- High persistence areas were only lightly exploited, or high fishing effort areas were unlikely to have high persistence;
- This inverse correlation / mutual exclusion of the two areas was somewhat surprising although ecologically sensible;
- Previous additional 'persistence hot spots' proved to be ineffective in reducing catches to meet the management target, possibly because persistence occurred in areas of low fishing effort so that resources were already effectively protected by fishing behavior;

While closing persistent areas is important for the conservation of remaining hotspots of abundance from possible effort redistribution, only closing areas with low fishing effort is unlikely to contribute mainly to a reduction in fishing mortality. Therefore, the EWG tested additional areas in grounds of higher fishing effort in proximity to proposed or existing closures and where one might reasonably expect persistence to be higher in the absence of fishing due to similarity of environmental conditions. This was done to increase the effectiveness of closure areas in reducing fishing mortality. In addition, the extension of closure areas based on high fishing effort should create a buffer zone of protection around high persistence areas if the fishery responds to management by redistribution of effort (Ohayon et al., 2021). This is especially valuable in the case of the West Med MAP where targets are provided in terms of catch reductions which are not linearly linked to reduction in the instantaneous rate of fishing mortality especially when the fishery response alters the selection pattern.

For transparency reasons, the EWG specify the rationales justifying each of the new proposed additional closure areas in Italian waters (i.e. protection of identified persistent areas or extension towards adjacent areas of high fishing areas). Because the discrepancy between historical effort allocation and detected persistence areas were more obvious in Italian than Spanish waters, designation of additional Spanish areas was based on both the historical effort and persistence area criteria. No additional closure areas were provided for the Gulf of Lion due to the extensive nature of existing closures (EWG 22-01 estimated that closure areas in GSA 7 already cover about 30% of overall trawlable area) suggesting that if further reductions in F are needed this would be better addressed with other management measures.

Figures 4.3.7 – 4.3.8 below show the proposed areas for closure together with the existing closure areas per GSA of the West Med.

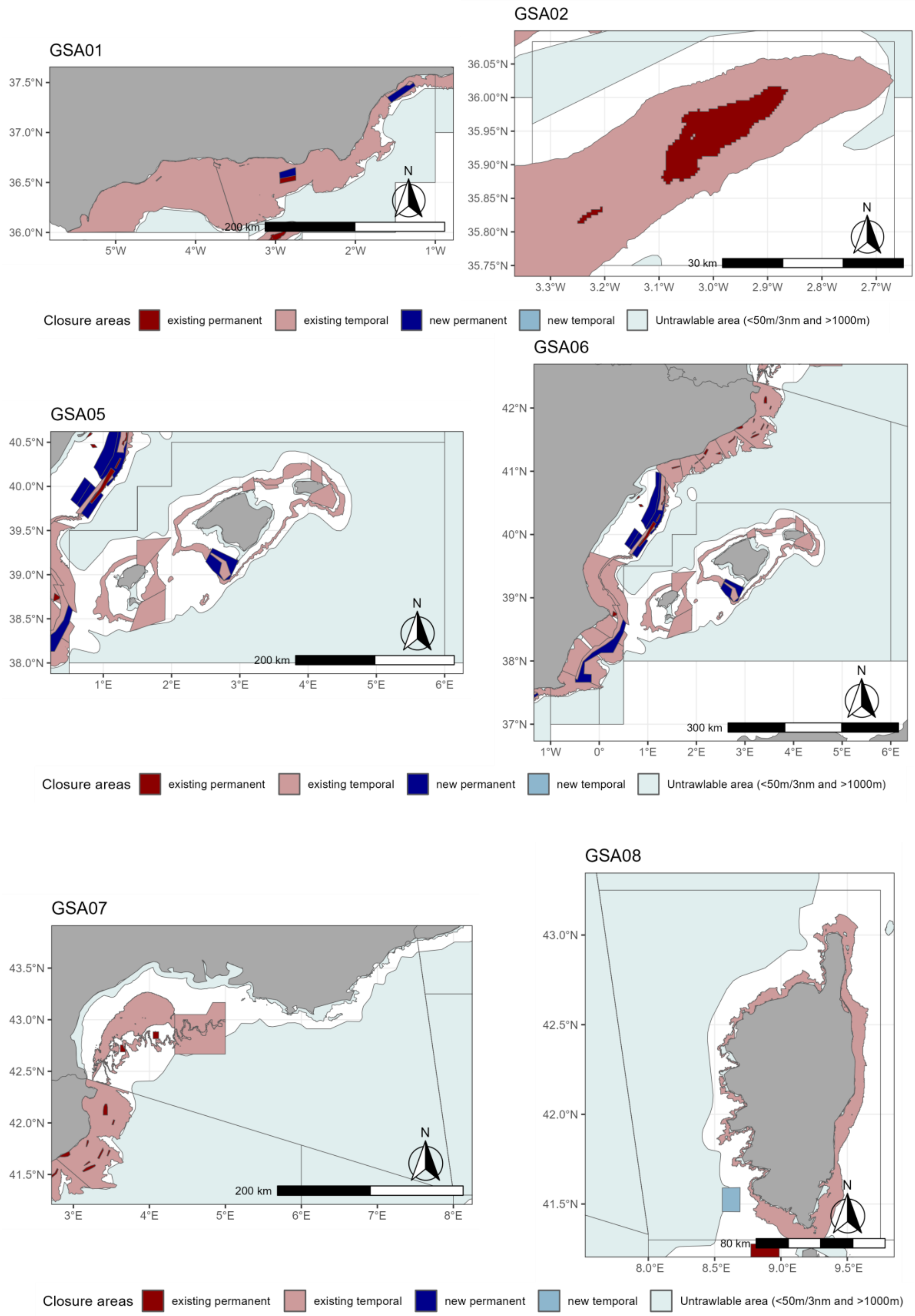


Figure 4.3.7 Existing and proposed areas by the EWG for closure in GSAs 1, 2, 5, 7 and 8 of the western Mediterranean.

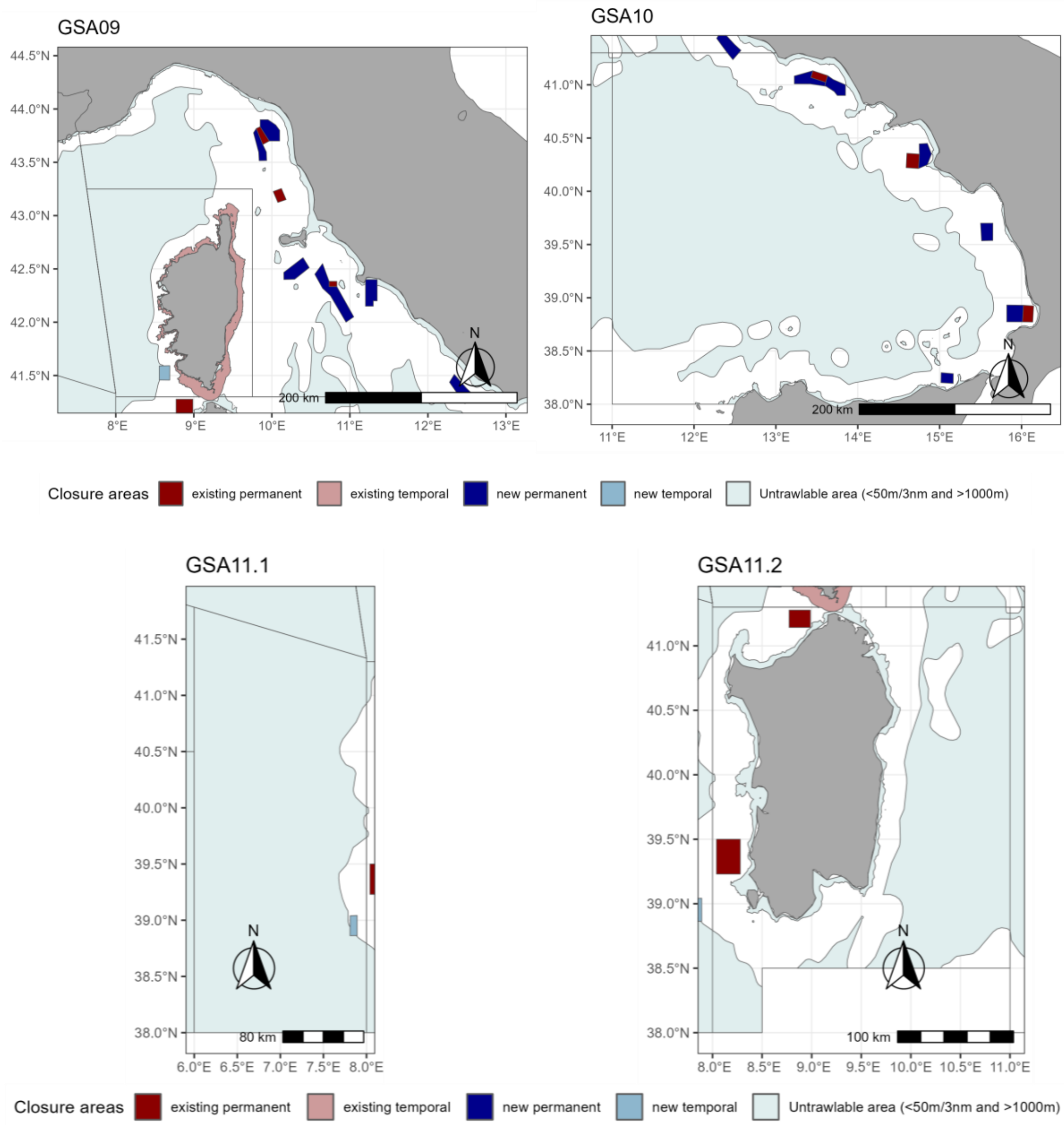


Figure 4.3.8. Existing and proposed areas by the EWG for closure in GSAs 9, 10, 11.1 and 11.2 of the western Mediterranean.

The EWG provides the percent ratio of the existing closed areas (baseline closures, including all closed areas already implemented, Figure 4.3.9) and proposed surface area for new closed areas (New closures, Figure 4.3.9) over the trawlable area (>50m depth or >3nm and <1000m depth) per GSA. It is worth noting that some closures extend beyond the area that has been historically exploited. So comparisons between historical and protected areas over time are potentially misleading and potentially greater than 100%. To maintain consistency with previous analysis and to provide information on the effective increase in protection of the new areas, in Figure 4.3.9 only the historically trawled areas (see Annex I) of the closures are considered. Finally, because not all areas are closed all year around (for example, the latest Spanish closures implemented in January 2023 are very large, encompassing a large part of trawled area, but only extend over 4 consecutive weeks) percentages on Figure 4.3.9 right panel are rescaled proportionally to the proportion of the year the closure exists.

Figure 4.3.9 shows that the percentage of the overall GSA area closed to fishing strongly differs among GSAs. In particular, GSAs 1, 2 and 6 are the most spatially impacted area with more than 60% of the trawled area already affected by the existing area closures, but this percentage drastically reduces when accounting for the seasonal element of these closures (Figure 4.3.9, right). GSA 5, 7 and 6 show an area closure of about 35 % of the total surface area, and again these impacted surface areas are almost halved when accounting for the seasonal element of the closure. When accounting for the seasonal element of the closure, GSA 7 remains the most spatially impacted area. The Italian GSAs are the least affected by closures both with the currents and with the additional proposed closures (always below the 10% of the GSA surface area).

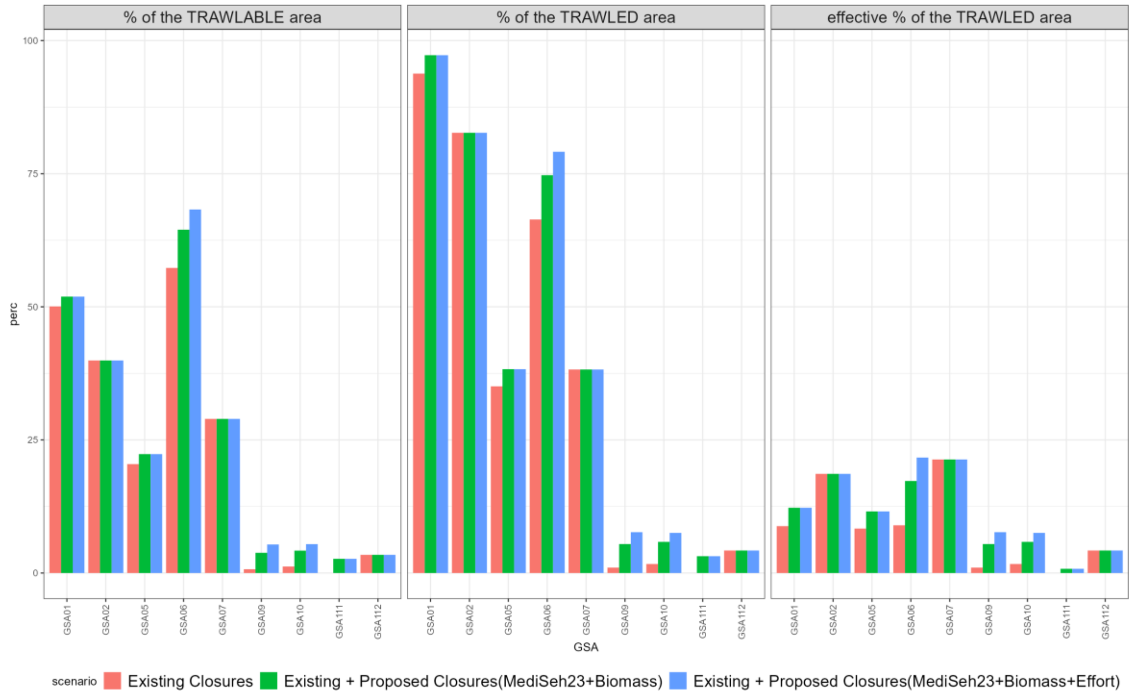


Figure 4.3.9 Left- Percentage of the trawlable area (>50m/3nm and <1000m) covered by the closure; middle- Percentage of the trawled area covered by existing (Base Closures) and suggested new closures; right- Percentage of trawled area covered by the closure per area per month. Scenarios correspond to an expansion of the surface areas around the closure by 50 and 100%, which are not applied to GSA 7 and GSA 11.2. Besides, no new closures are proposed for GSA7 and GSA 11.2)

The EWG provides the overlay between the closure areas (baseline and proposed closures) and the MEDISEH nursery/spawning grounds, weighting according to the proportion of the year the closures exist (Figure 4.3.10 – Figure 4.3.11). It visualizes the species/life stage combination that is prioritized by each scenario.

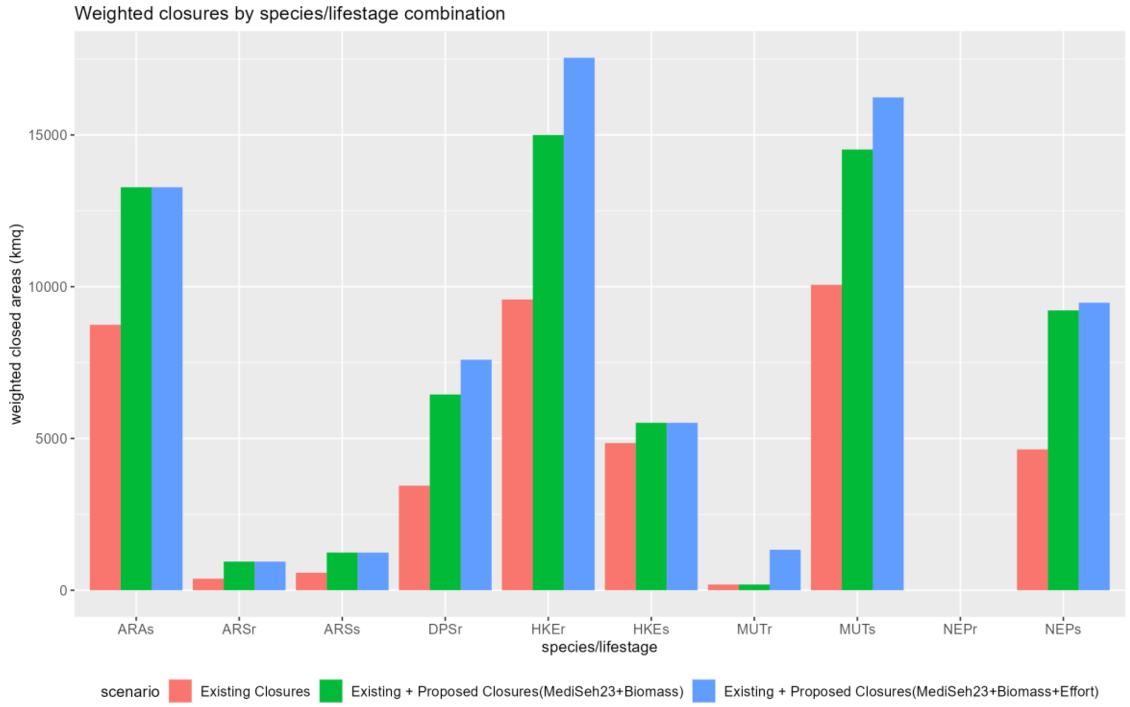


Figure 4.3.10. Weighted closure areas (kmq) by species/lifestage combination. Scenarios correspond to the existing closures, the existing closures plus the areas proposed basing on MediSeh 2023 and Biomass, the existing closures plus all the proposed ones. No modelled nursery grounds are available from MediSeh for NEP in WestMed.

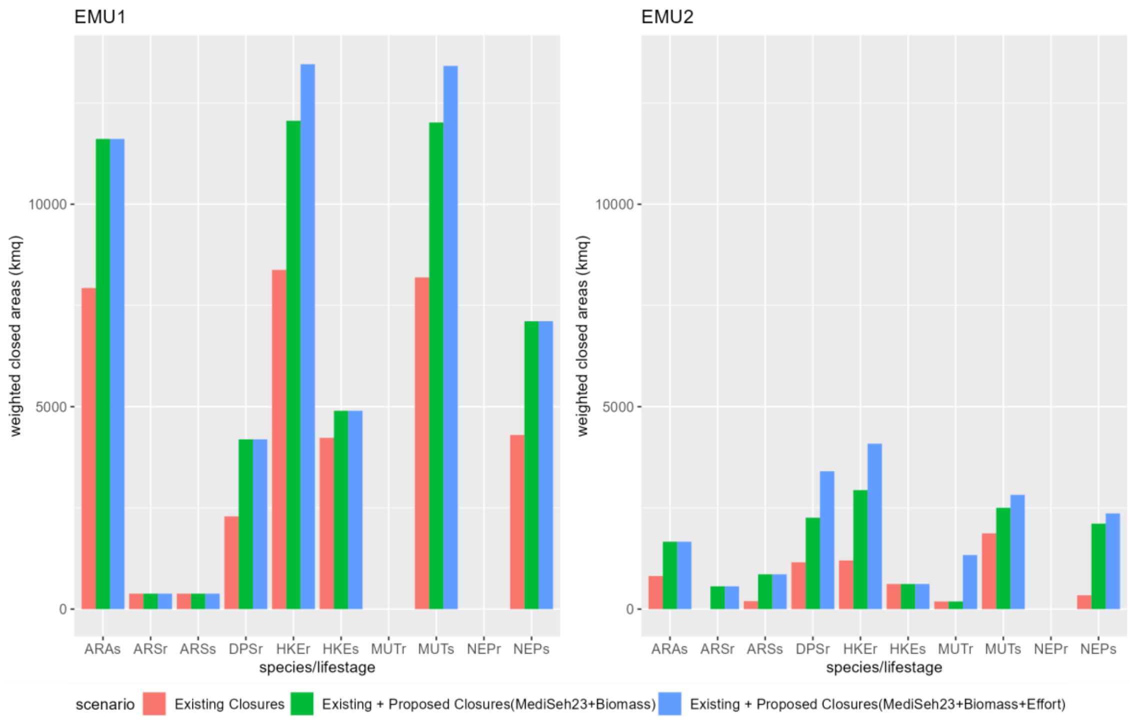


Figure 4.3.11. Weighted closure areas (kmq) by species/lifestage combination, for EMU1 and EMU2. Scenarios correspond to the existing closures, the existing closures plus the areas proposed basing on MEDISEH 2023 and Biomass, the existing closures plus all the proposed ones. No modelled nursery grounds are available from MEDISEH for NEP in WestMed.

Examination of the existing Spanish closure areas in the north of GSA 6 presented some difficulties for EWG 23-01 due to limitations on data at the appropriate spatial temporal resolution: layers based on the MEDITS survey are deemed most representative of the 2nd quarter and layers based on VMS data lack the necessary spatial resolution to assess the efficacy appropriately. On this scale, the precision of survey data is likely insufficient given natural variability of distribution and highly sensitive to the interpolation methodology. Generally, it is unlikely that small areas such those in GSA 6 may have a significant positive effect to reduce the effort on species targeted by Art. 11.3 (European hake, red mullet, deep-water rose shrimp, blue and red shrimps, giant red shrimp, Nephrops) given species mobility range and the possible spatial extent of the seasonal fish concentration that is larger than the extent of these areas (e.g., Sala-Coromina *et al.,* 2021). Any positive effect derived from the closure is likely to be offset by the spillover effect, especially considering that an increase in effort in adjacent areas is likely as seen in the Gulf of Lion (see section 4.4) and the difficulty for fishermen to accurately locate such small closures. That said, it should be noted that none of the closures implemented and proposed in GSAs 1, 5 and 6 were evaluated neither in EWG 22-01 nor during this EWG as the extension of ISIS-Fish to these areas is not complete yet.

The monthly Spanish closures of the new (2023) decree are considerably more spatially extensive than the existing permanent ones and cover most of the exploited area. The exception is the delta of the Ebro river where the shallow bathymetry results in a rather small closed area due to the specification according to depth bands to meet requirements in Article 8 for compensatory mechanisms. (February-March or October-November; COUNCIL REGULATION (EU) 2023/195). However, because the timing of closures defined in the new 2023 decree is not consistent with the available MEDITS scientific data (a spring survey in GSAs 1, 2 and 6) and not consistent with the quarterly resolution of the VMS based layers from EWG 22-01, the EWG is unable to properly assess the impact on catches of species covered by the plan. While these closed areas do cover the area of annual fishing effort, the closed period alternate spatially so that effort reallocation is likely to occur from closed towards adjacent open areas, at least partially limiting the total effort reduction. Moreover, the 3.5% increase in fishing days offered as compensation is based on the baseline data prior to the recent effort reductions (baseline 2015-17) and therefore the final impact in terms of effort and catch reduction cannot be effectively evaluated by EWG 23-01 without running simulations. This was not possible because the Spanish data from the ad-hoc datacall to inform such simulations was missing TRIP_ID values for nearly all VMS records to link them to the landings information, additionally a lack of a suitably conditioned bioeconomic model for the area does not allow to properly test the closures efficacy. In EMU2, the two news scenarios (i.e., a) baseline + new closures based on MEDISEH and b) baseline + new closures based on MEDISEH + new closures based on fishing effort) are tested using the bio-economic model SMART (see section 4.5).

4.4 Evaluation of closure areas in EMU 1 (GSA 7)

4.4.1 *VMS data to evaluate effort displacement*

In 2020, a spatio-temporal closure aimed at protecting hake juvenile has been implemented in the Gulf of Lion (GSA 7, FigureFigure 4.4.1.1).

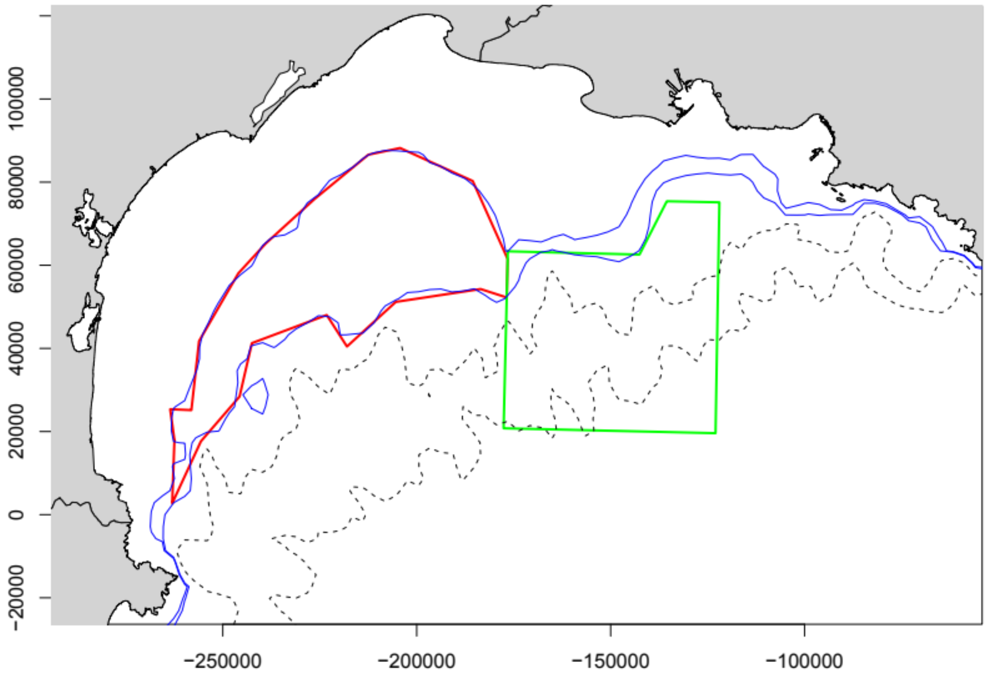


Figure 4.4.1.1 – Map of the continental shelf of the Gulf of Lion (GSA7), showing the location of the patio-temporal closure. Red polygon: bathymetric area, closed 8 month from September to April; green polygon: extended GFCM box, closed 6 month from November to April.

The closure is constituted of two areas, one (in red) mostly defined between the 90 and 100m isobath, and closed from September to April ; and another (in green) corresponding to the extended GFCM Fisheries Restricted Area, closed from November to April. Introducing such a large closure area must have some repercussions on the distribution of the fishing effort, but to which extent? Quantifying this effect is a necessary step towards the proper inclusion of the effect of the closure in management scenario evaluated through spatially-explicit models such as SMART or ISIS-FISH.

Today, this spatio-temporal closure has been established for two years, and we wish to estimate how it has affected the distribution of the fishing effort in the Gulf of Lion at the seasonal level. To do so, we will rely on the estimation of fishing time and landings per statistical square provided by the ALGOPESCA algorithm (IFREMER, 2021) for the time period 2015-2022. These estimates are obtained through the daily positions recorded through the Vessel Monitoring System (VMS). The resulting data consists of estimates of fishing time, at the temporal resolution of the fishing trip and at the spatial resolution of 00° 03' 00". Only vessels operating demersal trawling gears (OTM and OTT) are selected for this analysis.

We will focus on three seasons, termed "Winter" (January to April), "Spring-Summer" (May to August) and "Fall" (September to December), and three time periods, termed "Prior closure" (2015-2019), "Transition" (2020) and "Post closure" (2021-2022). The Prior closure period serves as a reference for comparison of the spread of the fishing effort.

The spatial distribution of the fishing effort can be observed in Figure 4.4.1.2.

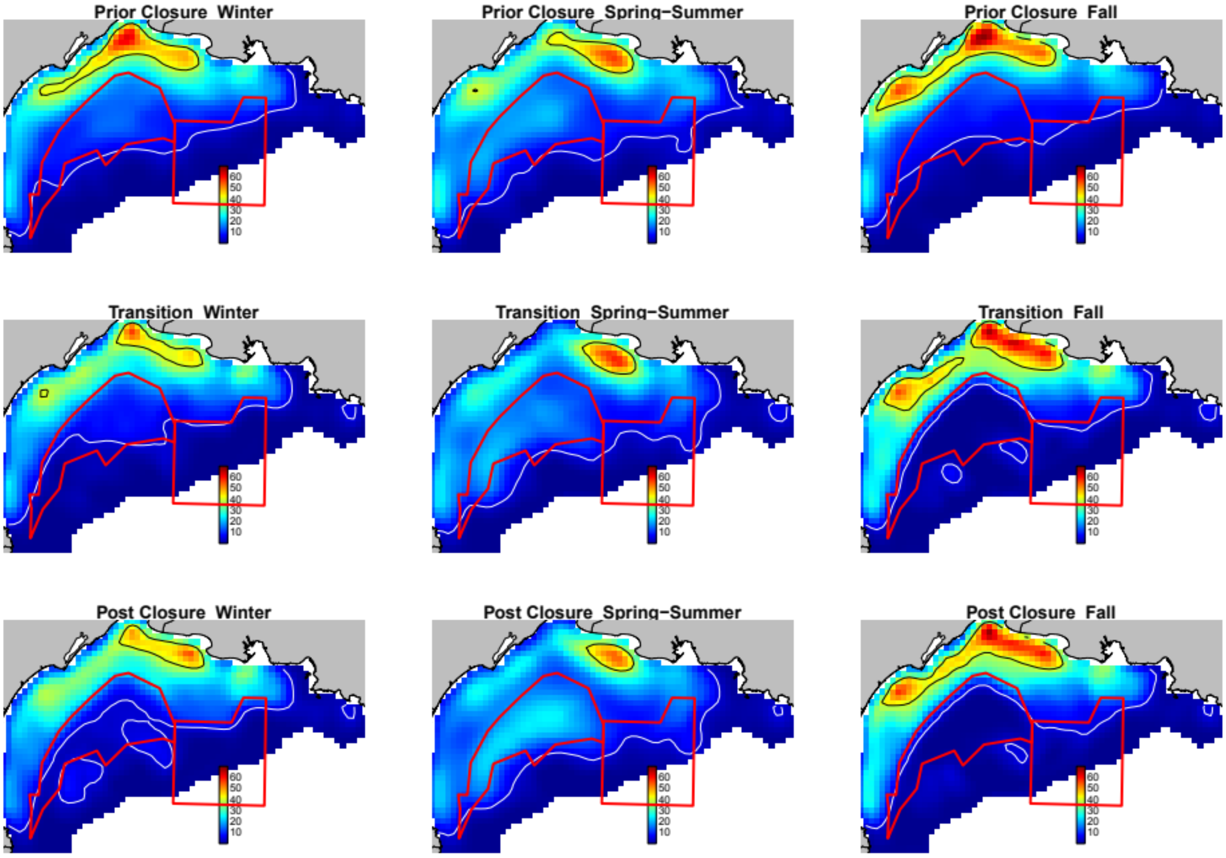


Figure 4.4.1.2. Average monthly fishing effort per season and period. From top to bottom the three time periods (2015-2019; 2020; 2021-2022); from left to right the three seasons (January to April, May to August, September to December).

Figure 4.4.1.2 clearly demonstrates that fishing effort is mostly distributed in a coastal band, with seasonal hotspots moving along a longitudinal gradient. With better weather conditions in the summer, some of that effort can be displaced southward, even though the hotspots remain coastal.

To better observe the effect of the spatial closure on the fishing effort, we built for each season an index of effort displacement D_i where i is an index of the spatial location (Figure 4.4.1.3). Basically,

$$D_i = \frac{Ha_i}{Hb_i + Ha_i}$$

where Ha_i is the average fishing time at location i after the closure (2021-2022), and Hb_i is the average fishing time at location i before the closure (2015-2019). We also reported the relationships between D_i and the distance to the closure border (with "negative" distances indicating a location within the closure). This index is easy to interpret: when below 0.5, it means effort reduction, while above 0.5 it represents effort increase.

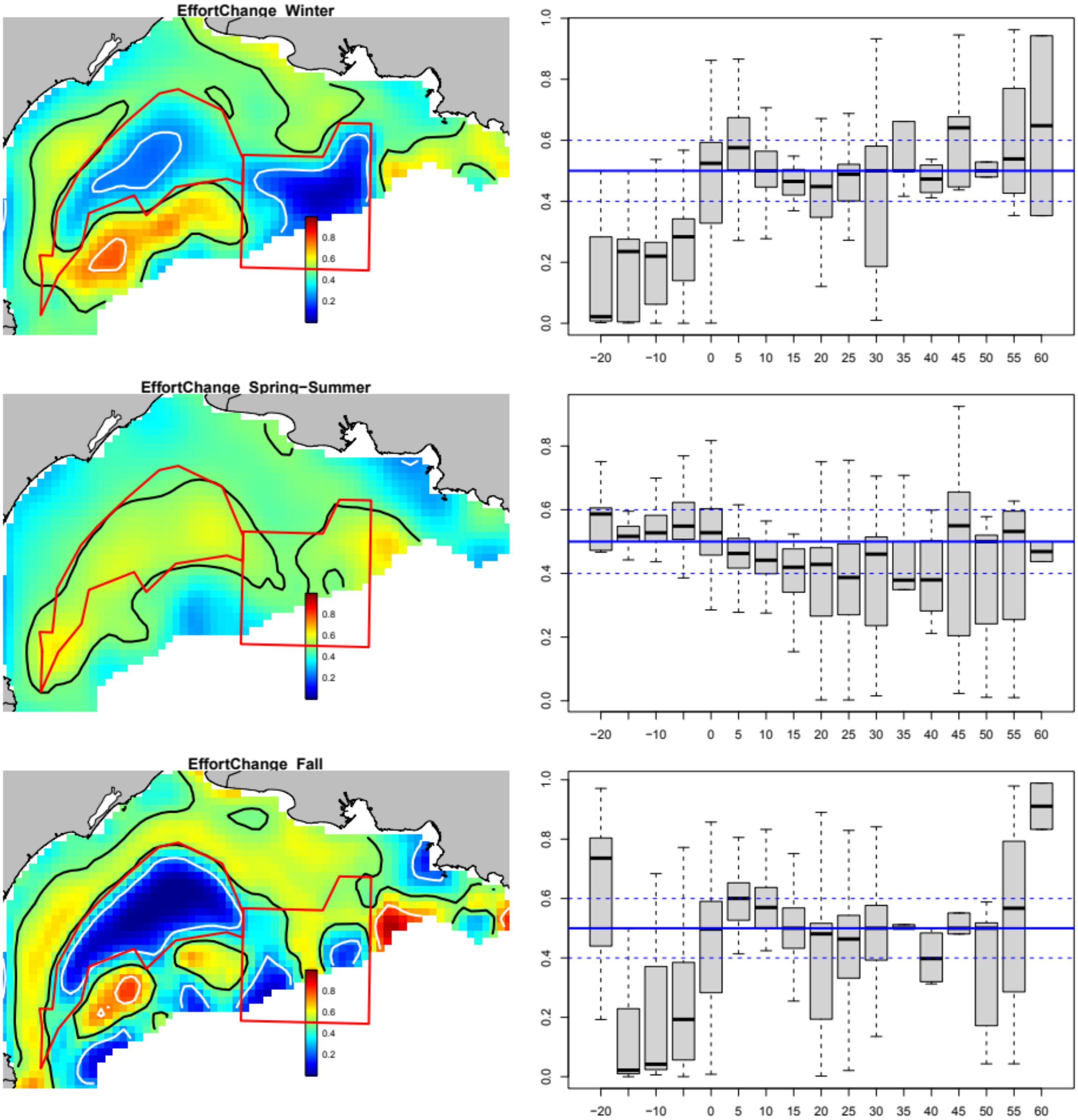


Figure 4.4.1.3. Left – Maps of D_i showing effort change by season. Black isolines mark 0.5, white isolines mark 0.25 and 0.75. Right - : boxplots showing how Di (y-axis) evolves with distance to the closure border (x axis, in km).

Effort displacement maps clearly illustrates how the establishment of the spatio-temporal closure warped the spatial distribution of the fishing effort, not only during the closure (winter and fall seasons) but also outside (spring-summer). The shape of the closure are clearly visible in all seasons, associated to a strong effort reduction in winter and fall, and to a slight effort augmentation in spring-summer.

In more detail, the bathymetric closure is associated to strong fishing effort reduction in fall, and to weaker reduction in winter. The reverse is observed for the GFCM closure, where some increased effort area are still observed in the fall. This might be due to fishing activity in September and October, when the GFCM area is still open while the bathymetric area is closed. Interestingly, small coastal effort reductions are observed all year long: during the closure, vessels increased their fishing effort along the closure border, with a typical 'fishing the line' pattern, especially in the fall. In Spring-Summer, fishing effort increased within the closure area, and decreased almost everywhere outside. It is clear from this analysis that the establishment of the spatio-temporal closure imposed a strong seasonal constraint to the fishing effort in the Gulf of Lions, and that the fishermen community responded quite well to the new rule.

To get a more detailed view of the fishermen response, we produced monthly time series of the porportion of time spent fishing within each area (the bathymetric closure, the extended GFCM box, and outside of each, Figure 4.4.1.4), by dividing the fishermen community in three groups according to their landing location.

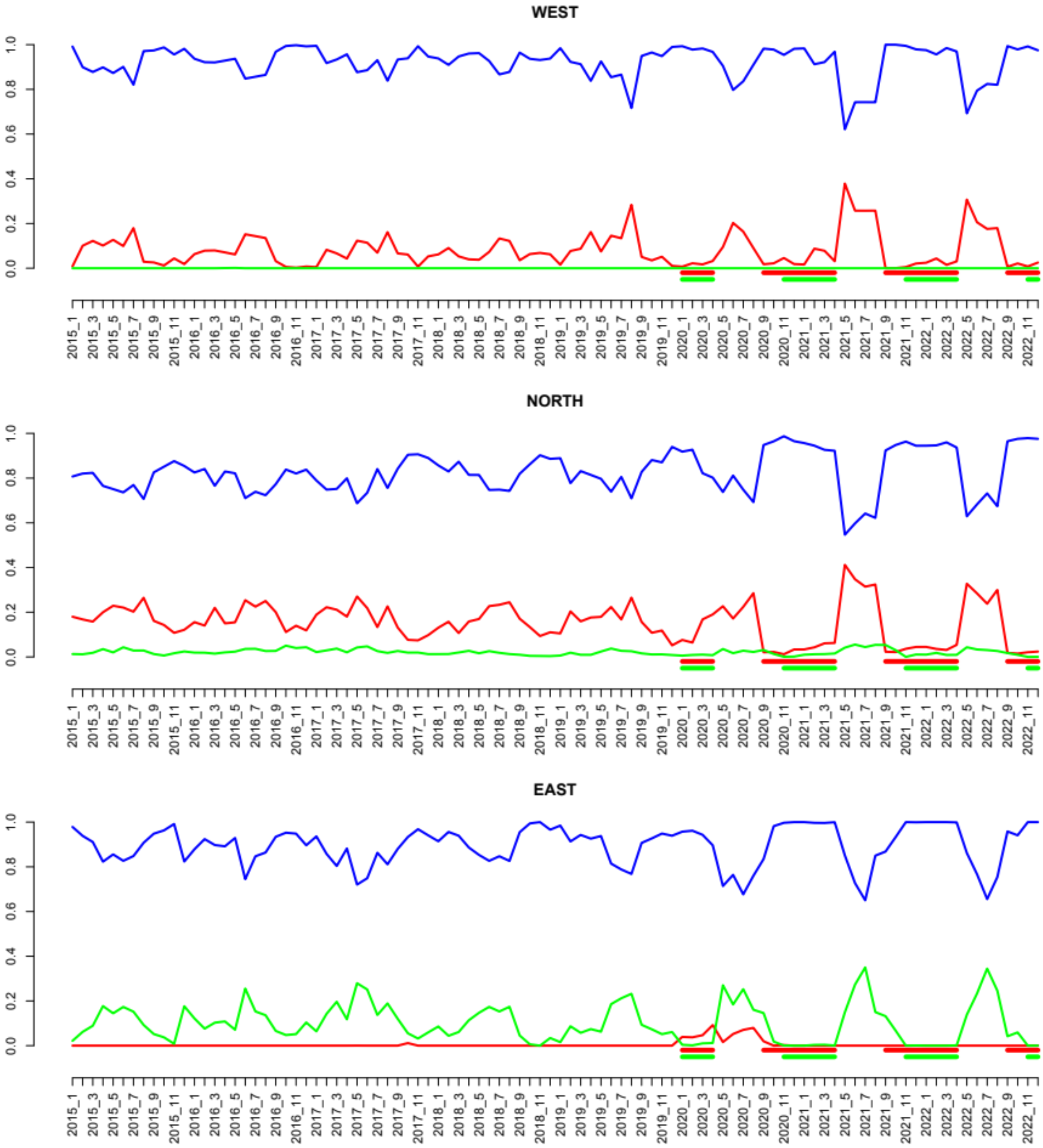


Figure 4.4.1.4. Porportion of time (y-axis) spent in each area (blue: outside the areas, red: within the bathymetric closure, green: within the GFCM box) through time (x-axis, noted year_month). Upper panel, WEST landing location (from Port-Vendre to Port-La-Nouvelle); Central panel, NORTH (from Agde to Grau-du-Roi);

lower panel EAST (from Port-de-Bouc to Marseille). Coloured thick lines indicates time-period of closure.

This analysis demonstrates that there are differences in area usage according to landing location: vessels that are landing in the western most areas do not fish within the GFCM box at-all, while the reverse is observed for vessel landings in the eastern most area. Vessels landing in the Northernmost area uses both the bathymetric and GFCM area, but with a preference for the bathymetric area. When areas are closed, the proportion of time spent fishing within the closed area drops sharply each time, suggesting strong compliance from the fishermen community.

To conclude on that exercise, one can note that fishing vessels in the Gulf of Lion (GSA7) have well responded to the establishment of the spatio-temporal closure, with high levels of compliance. Fishing effort has been warped accordingly, with three important patterns:

(i) a strong drop in fishing effort within the area when they are closed;

(ii) a slight increase in fishing effort around the area when they are closed and within the area when they are open;

(i) a slight reduction of coastal fishing effort at all times.

Provided that the area have been chosen according to juvenile hake catch, we can expect that, given the strong observed response of the fishermen community, the closure in GSA7 has the potential to positvely impact the hake recruitment in the long run. Still, two years of implementation remains a short time-scale to observe strong changes in a long-lived stock. More time, observations and analysis will be necessary in the future to further quantify the efficiency of these closures. That said, the documented effort re-distribution patterns observed in our anaysis can be used as a basis for implementing realistic effort-redistribution scenario in models such as ISIS-Fish that are attempting to predict the effect of the establishment of spatio-temporal closures.References

4.4.2 *ISIS-Fish*

4.4.2.1 Progress of the model

Two ISIS-Fish applications are now developed for the evaluation of the management measures in EMU1: the GSA7 model (Gulf of Lion) and the EMU1 model, extended to GSA 1, 5 and 6. The GSA7 model has been used in EWG 22-01 to simulate the impact of several closures and maximum catch limits (STECF 22-01). It has not been updated since then, because of the efforts concentrated on the developments of the EMU1 model.

The EMU1 model now comprises GSA 1, 5, 6, and 7. It is parameterised based on 2018-2020 data (FDI and log-books) for the French and Spanish fleets. The FDI segmentation is further refined to consider home harbour and strategy (main métiers) of the vessel and therefore account for fishing zones. Fishing zones have been identified for each fleet and metier with the characterisation of a core zone (where most of the effort concentrates and a secondary zone) using clustering with continuity constraints. Hake population distribution has been updated using the results of the ad-hoc contracts (EWG 22-01) and clustering with continuity constraints. Habitats and seasonal movements have been defined accordingly (STECF 22-11). The calibration of the EMU1 model is ongoing.

4.4.2.2 Update on the simulations of closures

The scenarios simulated during EWG 22-01 were omitting two closures in place in the Gulf of Lion since 2018. The simulations were therefore re-ran using the same version of the model (GSA7) and compared with 22-01 results. In addition, a scenario of a new permanent offshore closure was proposed and evaluated by the model (SCh). See table 4.4.2.1 for a summary of the settings.

Table 4.4.2.1: ISIS-Fish setting for the simulation of spatio-seasonal closures

Scenario	Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	… 2030
	ISIS-Year	0	1	2	3	4	5	6	7	8	9	10	15
		Calibration			Hindcast					Projection			
	Effort	2015	2016	2017	Mean 2015-2017					Mean 2015-2017			
	Effort red trawlers (rel.2015-17)						-10%	-7.5% (-17.5%)	(-17.5%)	(-17.5%)			
	Recruitment	2015	2016	2017	2018	2019	2020	Mean 2018-2020		Mean 2018-2020			
a baseline	Closures						For trawlers only (OTB & OTT) - 90-100 isobath: sept→avr - New FRA / box PACA: nov→avr						
					Additional closure EWG 23-01 All gears (except OTM) - 150-275m isobath: oct→nov - 3 offshore squares: permanent								
b	Closures permanent				Same as SCa					Permanent			
c	Closures all gear				Same as SCa					All gear			
h	Closures new polygon				Same as SCa					New polygon permanent all gear			

4.4.2.3 Comparison between the baseline of EWG 22-01 and EWG 23-01

The additional closures (SCa_23) cause an additional reduction in fishing mortality of about 2% of the fishing mortality compared to the closures taken into account in EWG 22-01 (SCa_22) (Figure 4.4.2.1).

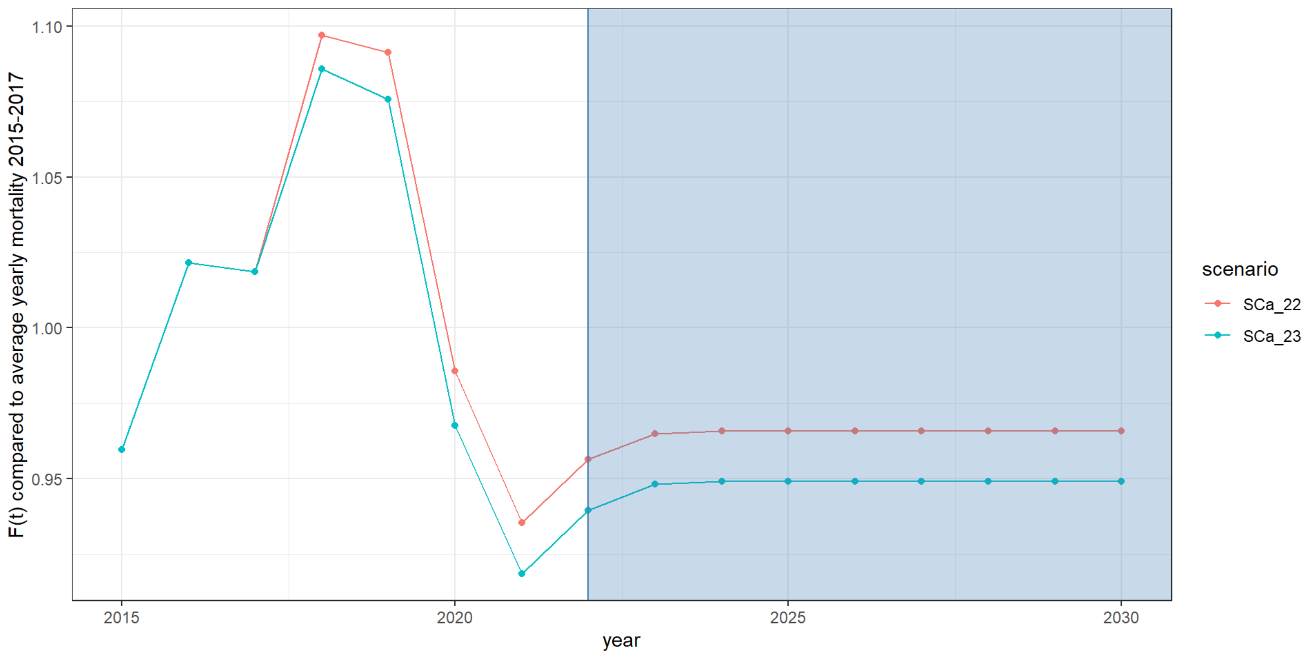


Figure 4.4.2.1: Fishing mortality (in percentage of the average 2015-2017) in scenario a) ran in EWG 22-01 (SCa_22) and in EWG 23-01 (SCa_23) with the additional closures from 2018 on.

The pressure is particularly released on older individuals on the Accores, which is expected given the offshore location of the closures (Figure 4.4.2.3).

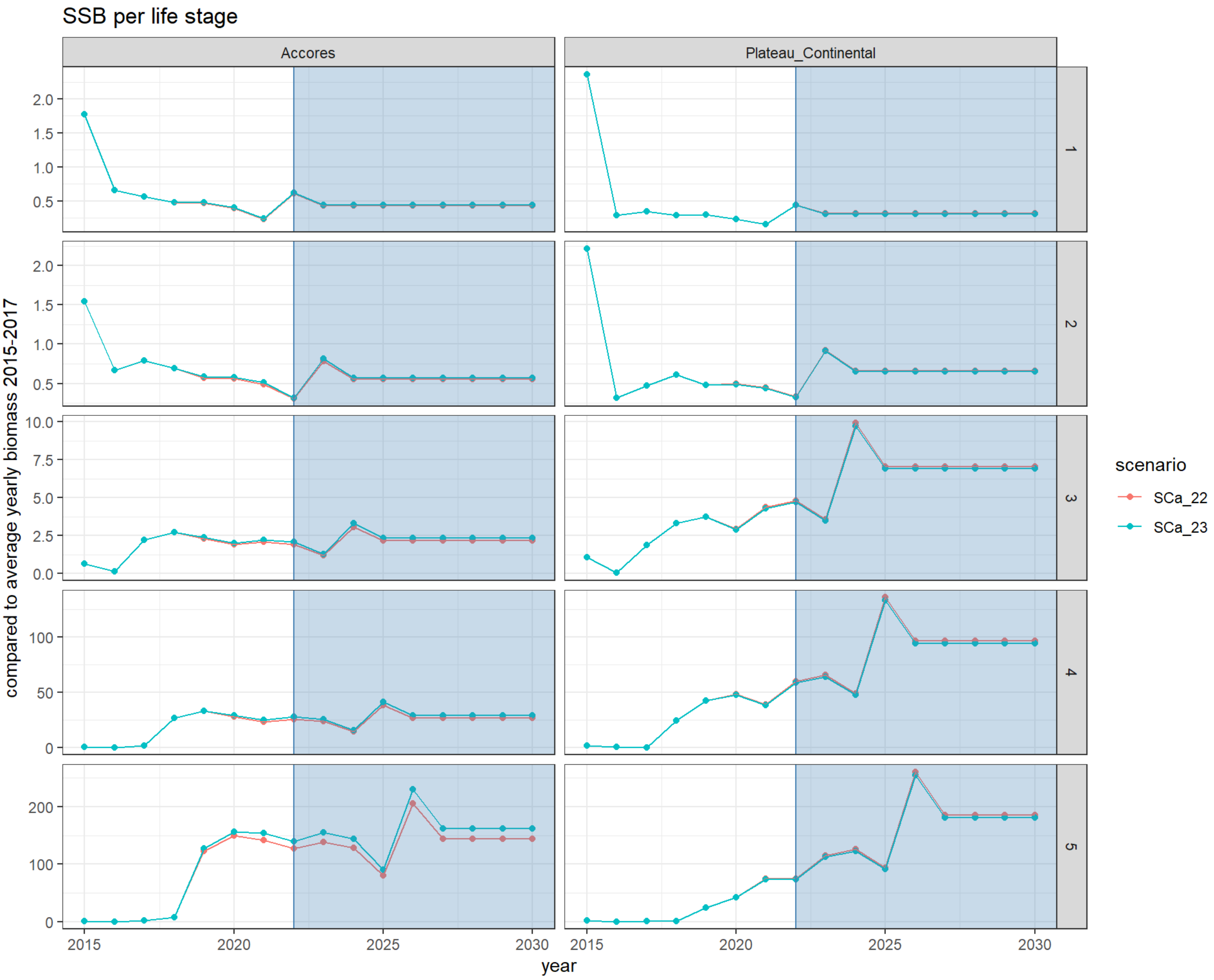


Figure 4.4.2.2: SSB per age age and zone as a % of the average 2015-2017 in scenario a) ran in EWG 22-01 (SCa_22) and in EWG 23-01 (SCa_23) with the additional closures from 2018 on.

The reduction in gross value and catches is very limited for French fleets, but an increase is noted for Spanish fleets particularly long-liners that is supposedly attributed to the release of competition with trawlers (Figure 4.4.2.3).

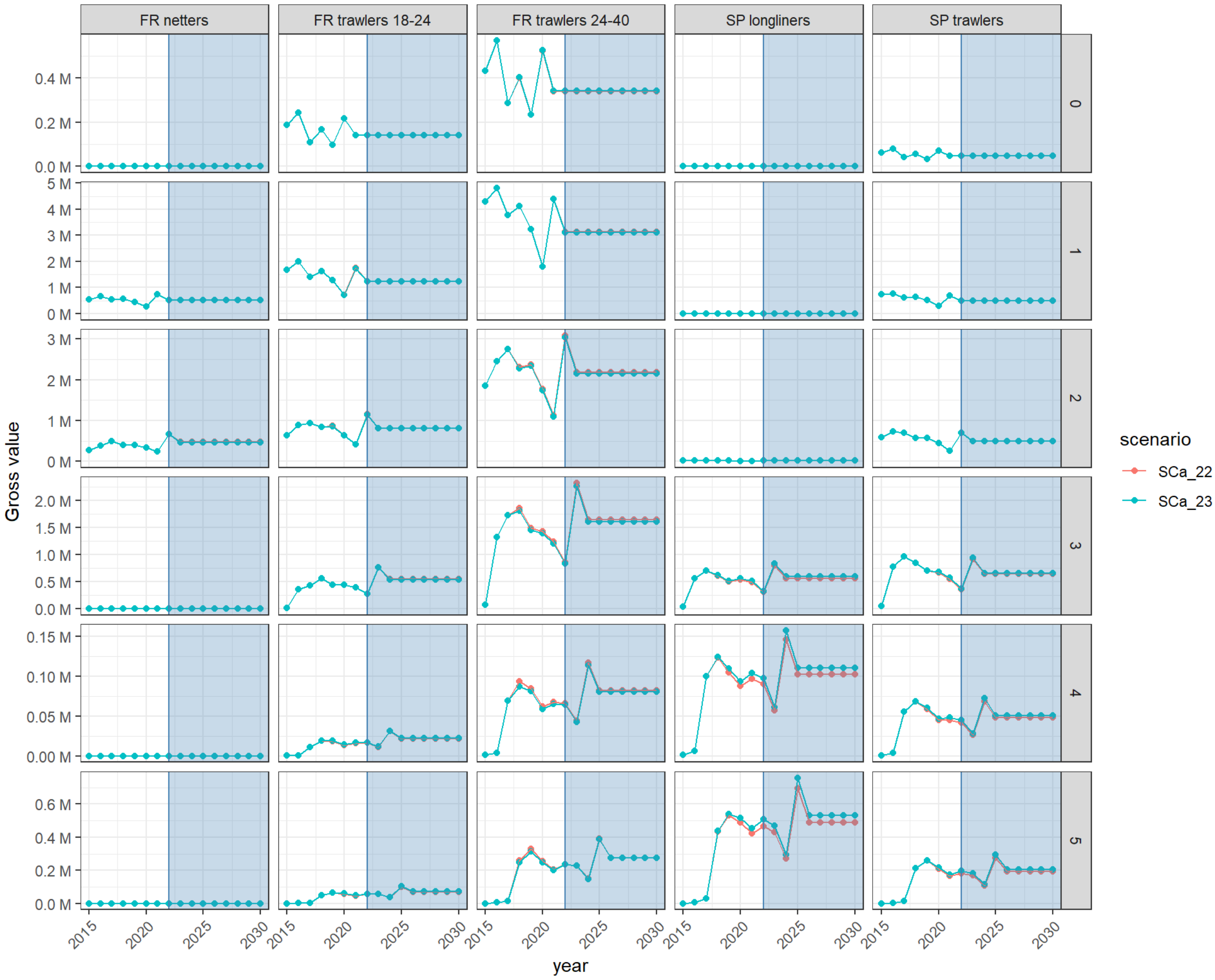


Figure 4.4.2.3: Gross value of hake landings per fleet and age classes in scenario a) ran in EWG 22-01 (SCa_22) and in EWG 23-01 (SCa_23) with the additional closures from 2018 on.

4.4.2.4 Updated scenarios

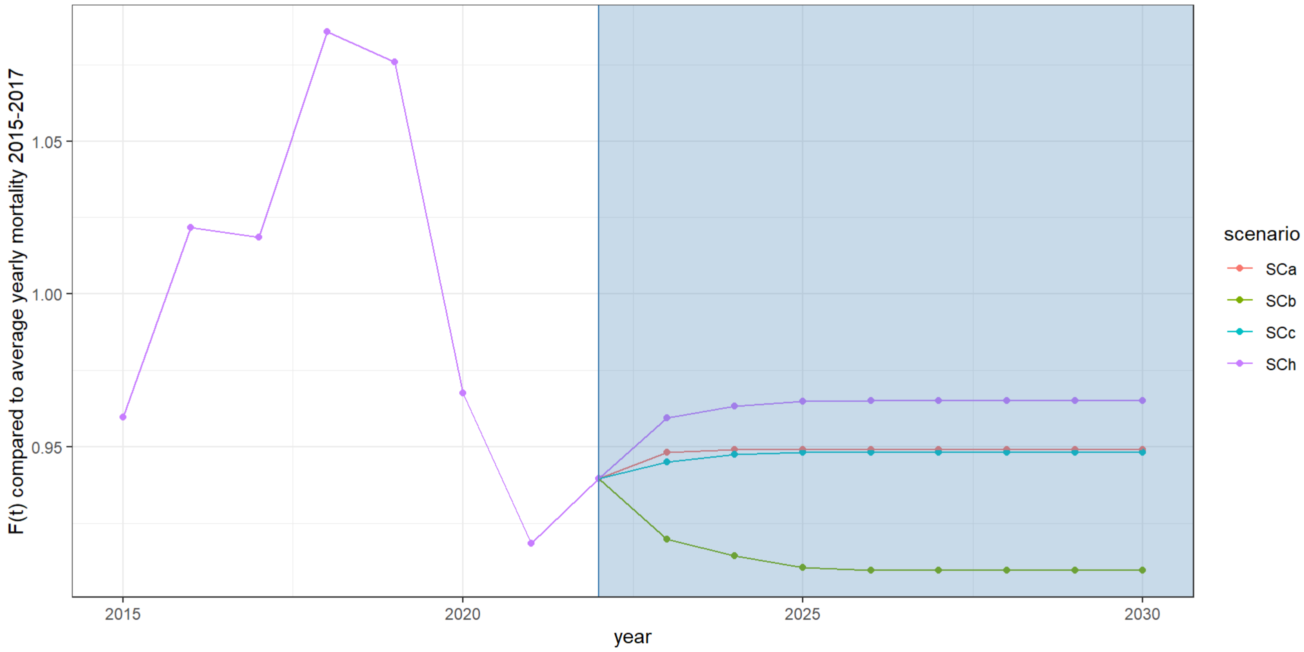


Figure 4.4.2.4: Change in fishing mortality compared to the reference period average (2015-2017) with the four scenarios tested.

With the closures, and effort reduction as applied since 2018, fishing mortality of hake is reduced by 4 to 9% depending on the scenario in 2025 (Figure 4.4.2.4). The permanent closures (SCb) provide the highest decrease in mortality while the latest scenario (SCh) combining current closures and a hypothetical additional permanent one offshore is less efficient than the current closures alone. This may happen in the model when the effort reallocation causes an increased fishing pressure locally.

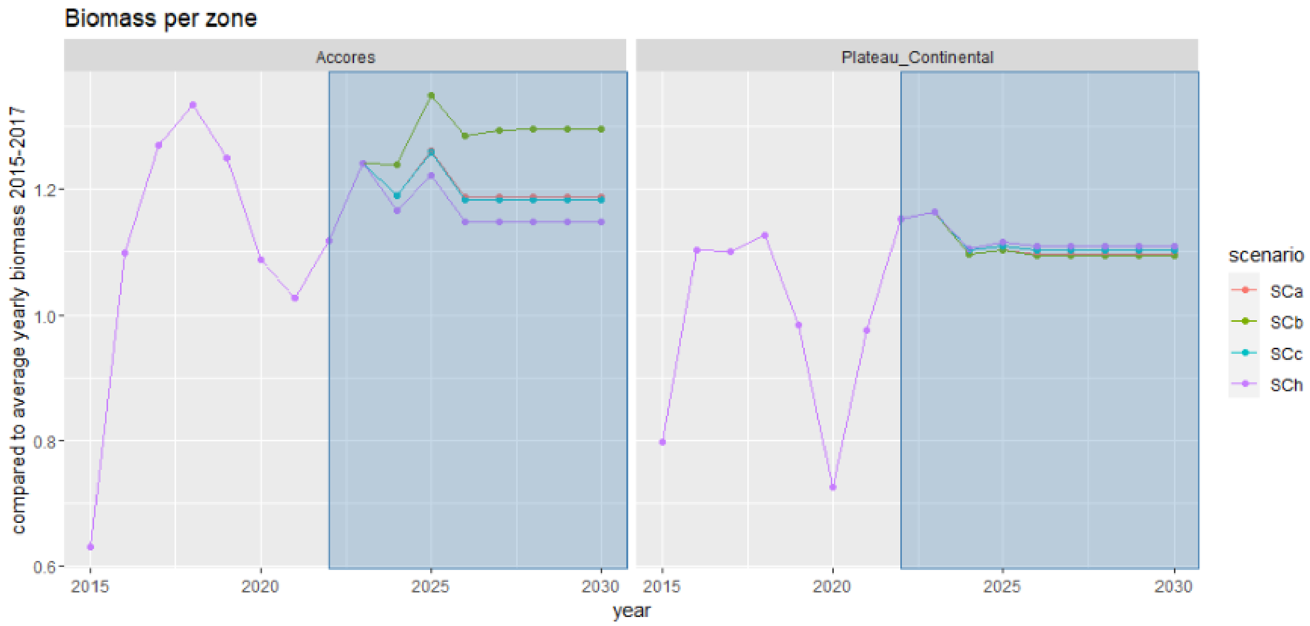


Figure 4.4.2.5: Change in biomass in the two hake habitats compared to the reference period average (2015-2017) with the four scenarios tested.

All the scenarios provide an increase in hake biomass compared to the reference period. Contrary to the Accores, there is little difference between the scenarios on the plateau. Scenarios “a” and “c” are really similar in both habitats with an increase of 26% offshore (Accores) and 10 to 11% on the plateau. The current closures becoming permanent (SCb) bring a significant improvement in the Accores (+35%). On the contrary, scenario “h” (the new permanent polygon), provide a lower improvement (+22%) (Figure 4.4.2.5).

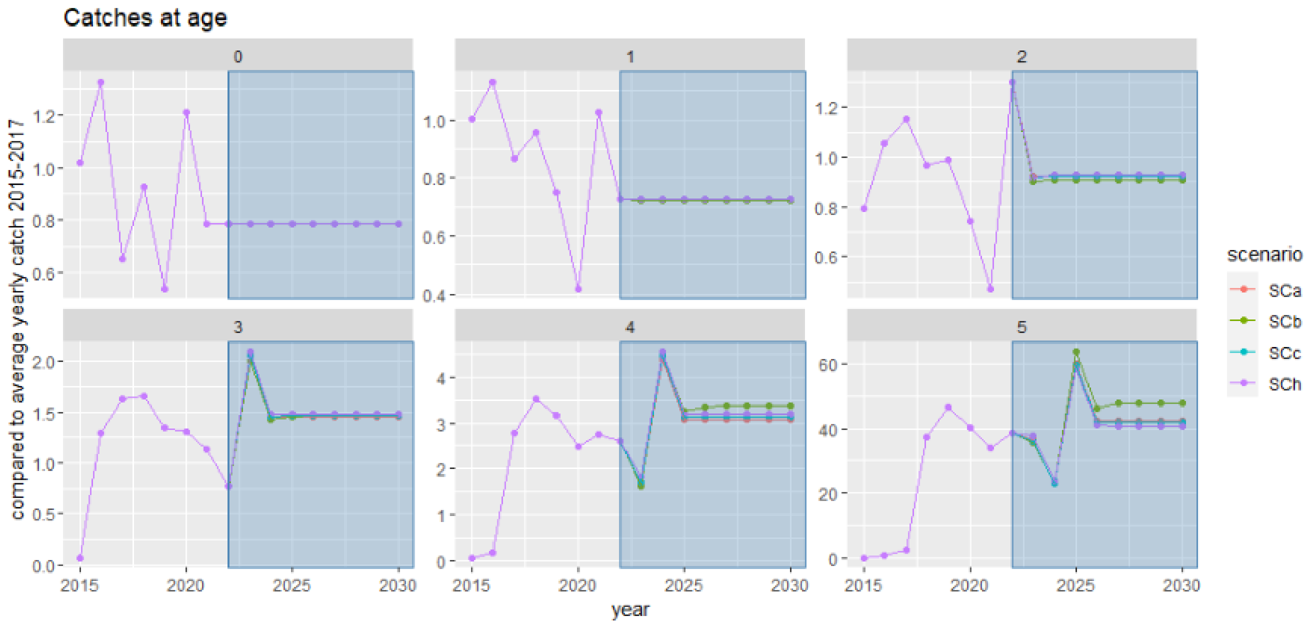


Figure 4.4.2.6: Catch at age under the different closures compared to the reference period.

All closures produce very similar results in terms of reduction of juveniles’ catches in 2025. Age 0, 1 and 2 catches are reduces by respectively 22, 27 and 8%. Conversely catches of adults are increased largely (Figure 4.4.2.6). This is an effect of the rapid biomass rebuilding predicted by the model once fishing pressure is released. This effect is more limited on younger ages because recruitment is forced to average values instead of benefiting from the increased SSB.

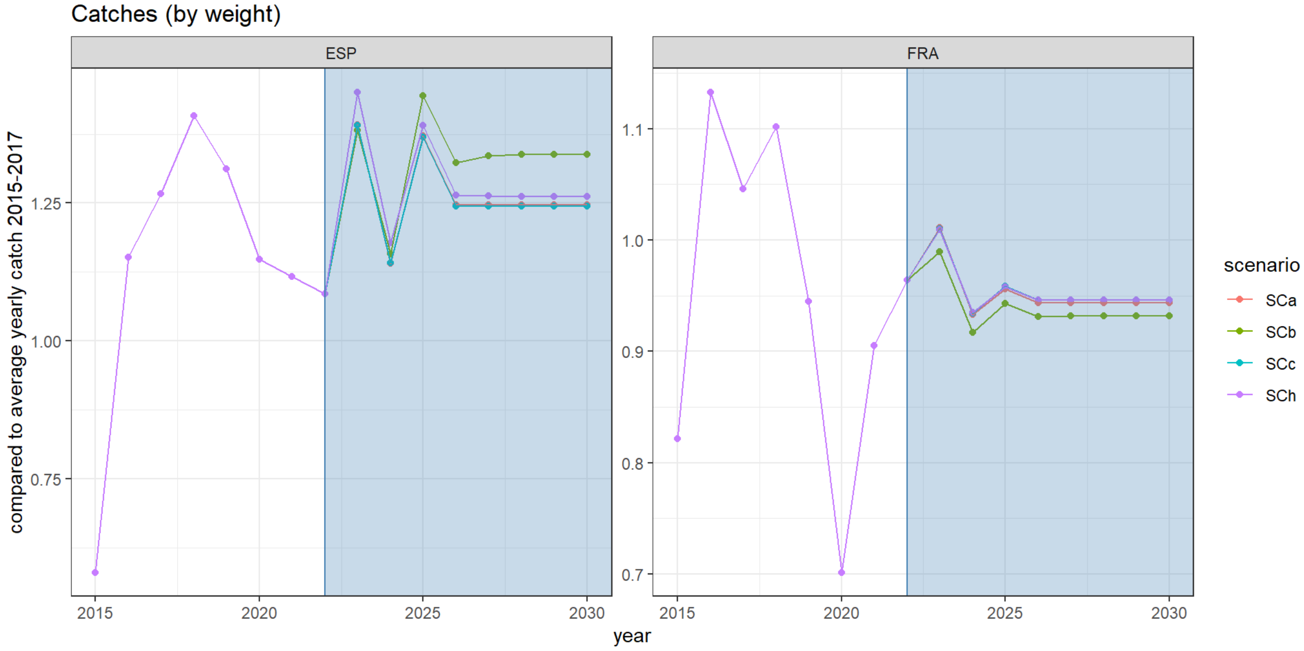
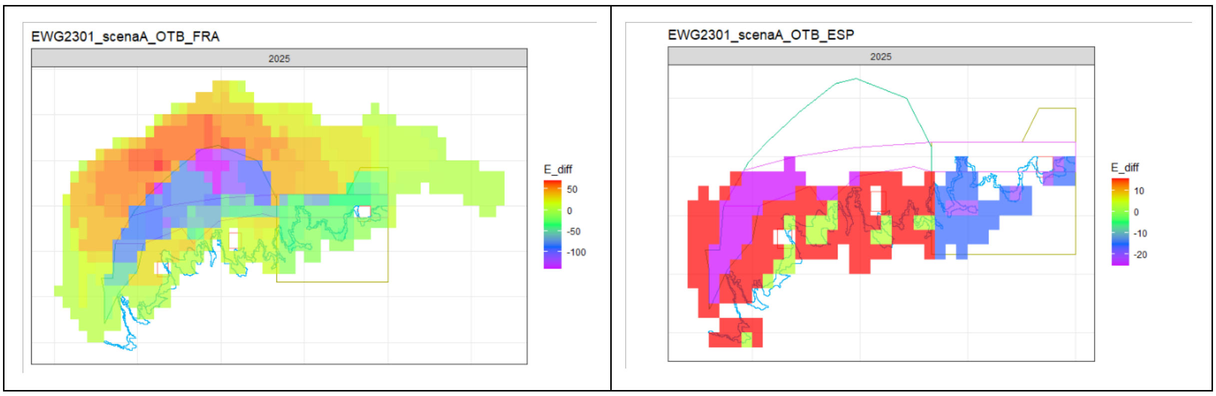


Figure 4.4.2.7: Catches per country under the different closures compared to the reference period.

The unbalanced effect of the closures in the Gulf of Lion is illustrated again here, with French catches dropping by 5% while Spanish catches increase due to the increased biomass of adults in the Accores (Figure 4.4.2.7). However, it must be recalled that this version of the model only simulate a small part of the Spanish fishery and results are not representative of the effect of the plan in Spain. The difference across scenarios is only significant for scenario "b".

4.4.2.5 Effort reallocation maps

Maps of fishing effort have been produced to i) compare the assumptions made in ISIS-Fish to the actual fisher's reactions to the closures and ii) ease the understanding of the effect of the closures. An example is provided Figure 4.4.2.8, which shows the exclusion of Spanish trawlers from the eastern part of GSA 7 in scenario b. It also evidenced the preferential report of effort of the French trawlers in the coastal zones, north of the 90-100m isobaths closure, which is roughly in agreement with first observations of their real behaviour (see section 4.4.1).



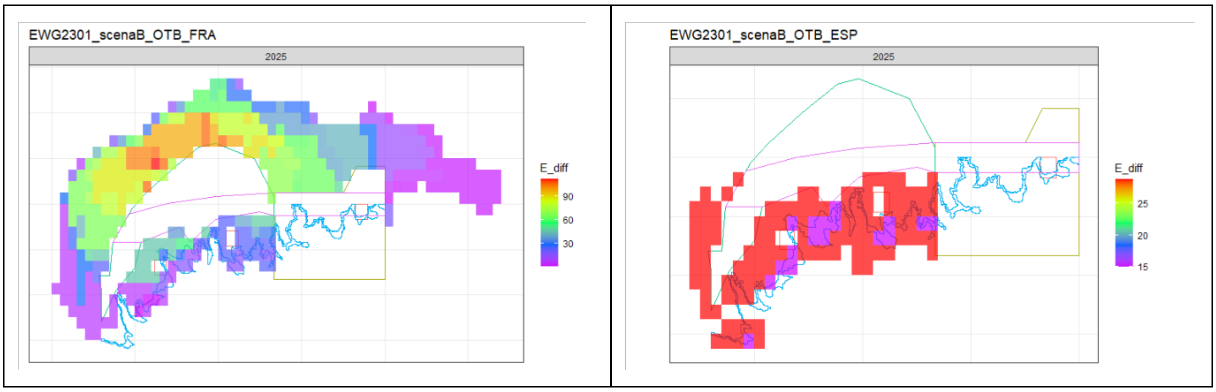


Figure 4.4.2.8: Effort reallocation as parameterised in ISIS-Fish in response to spatio-seasonal closures. Effort is cumulated over the year and expressed as the difference with the effort during the reference period (2015-2017). Warning: the scale is adapted to each map.

4.5 Evaluation of closure areas in EMU 2

4.5.1 *SMART in EMU 2*

During EWG 23-01, the input data sets were updated to incorporate the historical time-series from 1 January 2012, to 31 December 2021. The R package "smartR" (D'andrea et al., 2020) was employed to configure the SMART model and suit it to the requirements of the EMU2 case study. The SMART model, as well as the workflow of the smartR package, can be summarized in the following logical steps:

1. Use landings and catch data, combined with VMS data, to estimate the spatial/temporal productivity of each cell, in terms of aggregated LPUE by species;
2. Use survey data to estimate the Length-Frequency Distribution (LFD) and the Age- Frequency Distribution (AFD), by species, for each cell/time;
3. Use VMS data to assess the fishing effort by vessel/cell/time;
4. Combine LPUE, LFD/AFD, and VMS data to model the landings by vessel/species/length class/time;
5. Estimate the cost by vessel/time associated with a given effort pattern and the related revenues, which are a function of the landings by vessel/species/length class/time;
6. Combine costs and revenues by vessel, at the yearly scale, to obtain the incomes, which are the proxy of the vessel performance. Incomes could be aggregated at the fleet level to estimate the overall performance;
7. Use estimated landings by species/age, together with survey data, to run MICE model for the selected case of study in order to obtain a biological evaluation of the fisheries.

This workflow allows SMART to simulate the potential adaptation of fishers, in terms of fishing effort displacement in space and time, to different management measures including fisheries-restricted areas and temporal stops of the fishing activity. Given that a new fishing effort pattern corresponds to new catches and related revenues, cost and, ultimately, profits, SMART forecasts the biological and economical consequences of different management scenarios.

The key aspects resulting from the application of SMART are 1) the explicit reference to the spatial dimension and consequent geographical allocation of effort, landings, costs, and revenues; 2) individual-based optimization of the single vessels' patterns of fishing effort at a monthly time scale; 3) multiple species stock assessment with the MICE (Model of Intermediate Complexity of the Ecosystem) paradigm. A detailed description of an application of the method is available in Russo et al., 2019, and a detailed description of the smartR package is provided in D'Andrea et al., 2020.

In addition, the stock objects of the EWG 23-01 were integrated and processed using a modified version of the Elman network described in Russo et al., 2014. Actually, the Elman network was fed with the time series of catches in number of individuals by age class, SSB by year, and abundance at sea in number of individuals by age class and trained by species in order to fit the historical time series. Then, the trained Elman networks were used to predict the future trends of SSB and abundance at sea in number of individuals by age class using the new pattern of catch, as obtained after the estimation of fishing effort adaptation/displacement.

Application of the SMART model to the West Med MAP

The spatial productivity (monthly LPUE as grams of catch per meter of LOA and hour of fishing) was estimated using landings and VMS data, according to the procedure of Russo et al., 2018 and Russo et al., 2019. At the same time, the economic parameters needed to model the relationships between 1) fishing effort and its related costs (crew salaries, fixed costs, etc.); 2) spatial fishing footprint and its related costs (i.e. fuel consumption); 3) yield and production costs (i.e. commercialization); 4) yield and revenues (using the prices at the market of the different species by size class) were collected and integrated into the model. Values of prices at the market by species and length class, together with the price of fuel, were partially retrieved by Russo et al. (2014b) and integrated using the public databases provided by the "Istituto di servizi per il mercato agricolo alimentare" (ISMEA - http://www.ismea.it/flex/FixedPages/IT/WizardPescaMercati.php/L/IT) and by the Ministry of Economic Development (https://dgsaie.mise.gov.it/prezzi_carburanti_mensili.php).

4.5.1.1 Space and time scale

For this application of SMART to the case study of Western Mediterranean Effort Management Unit 2, the resolution of the square grid for the GSAs 9, 10, and 11 is the same as the EWG 19-14 with cells of 6 x 6 nm (Figure 4.5.1.1). The cells covering the area deeper than 800m depth were excluded to reduce the complexity and computational time required for the simulations.

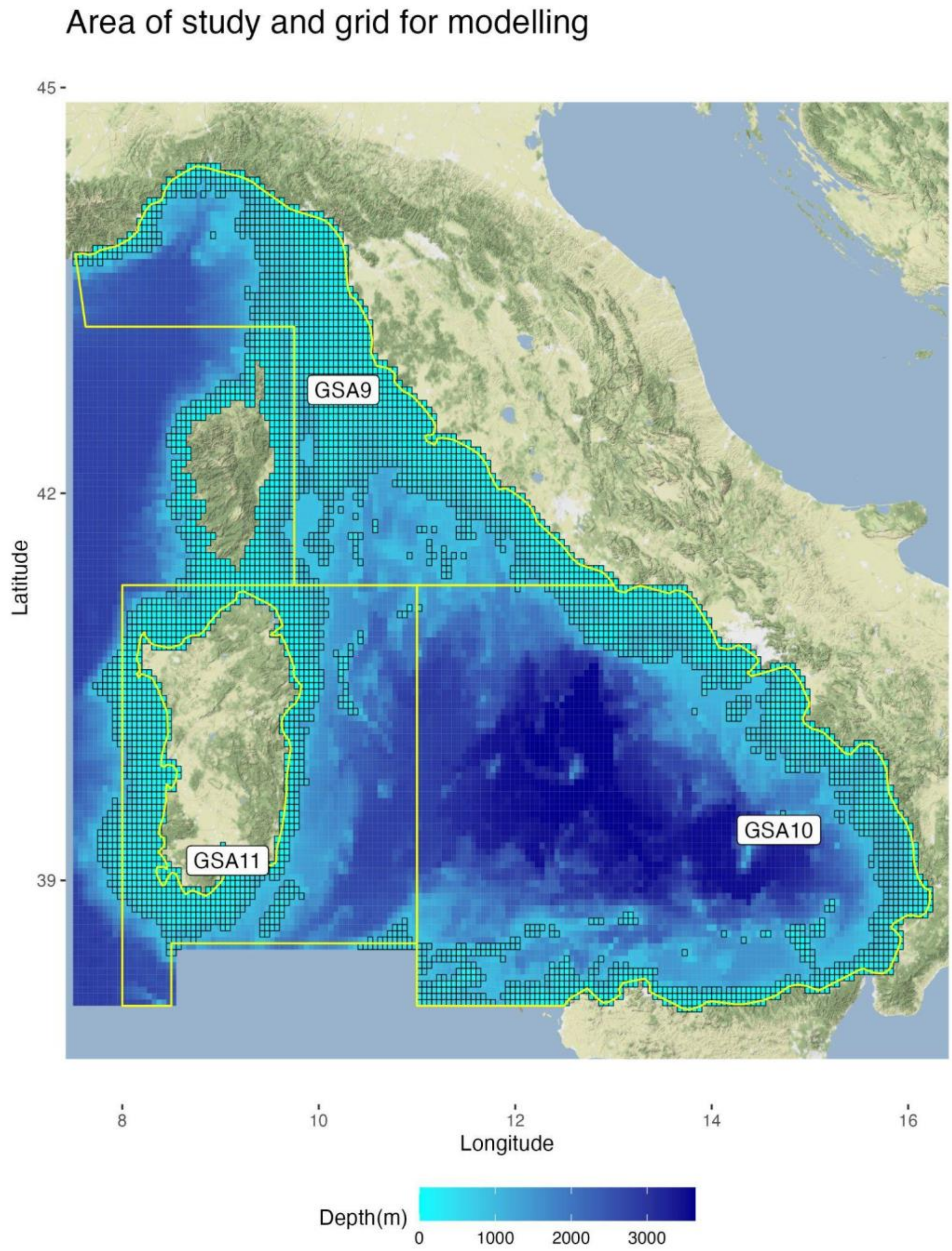


Figure 4.5.1.1 – Area of the Effort Management Unit 2 case study considered in the Western Mediterranean EWG 20 13. The square grid of 6 x 6 nm used for the definition of the SMART model for the Italian GSAs in the Tyrrhenian Sea (9 – 10 - 11).

4.5.1.2 Fleets

The fleet included in the analyses is composed of the Italian trawlers with LOA equal or larger than 15 m, that is the portion of the fleet equipped with VMS. The native VMS pings were pre-processed using the VMSbase platform (Russo et al., 2014) and coupled, at the level of single vessels and at a monthly scale, with logbook, landings, and economic data (fuel consumption, etc.). Figure 4.5.1.2 depicts the average hours of fishing by year, fleet segment and cell.

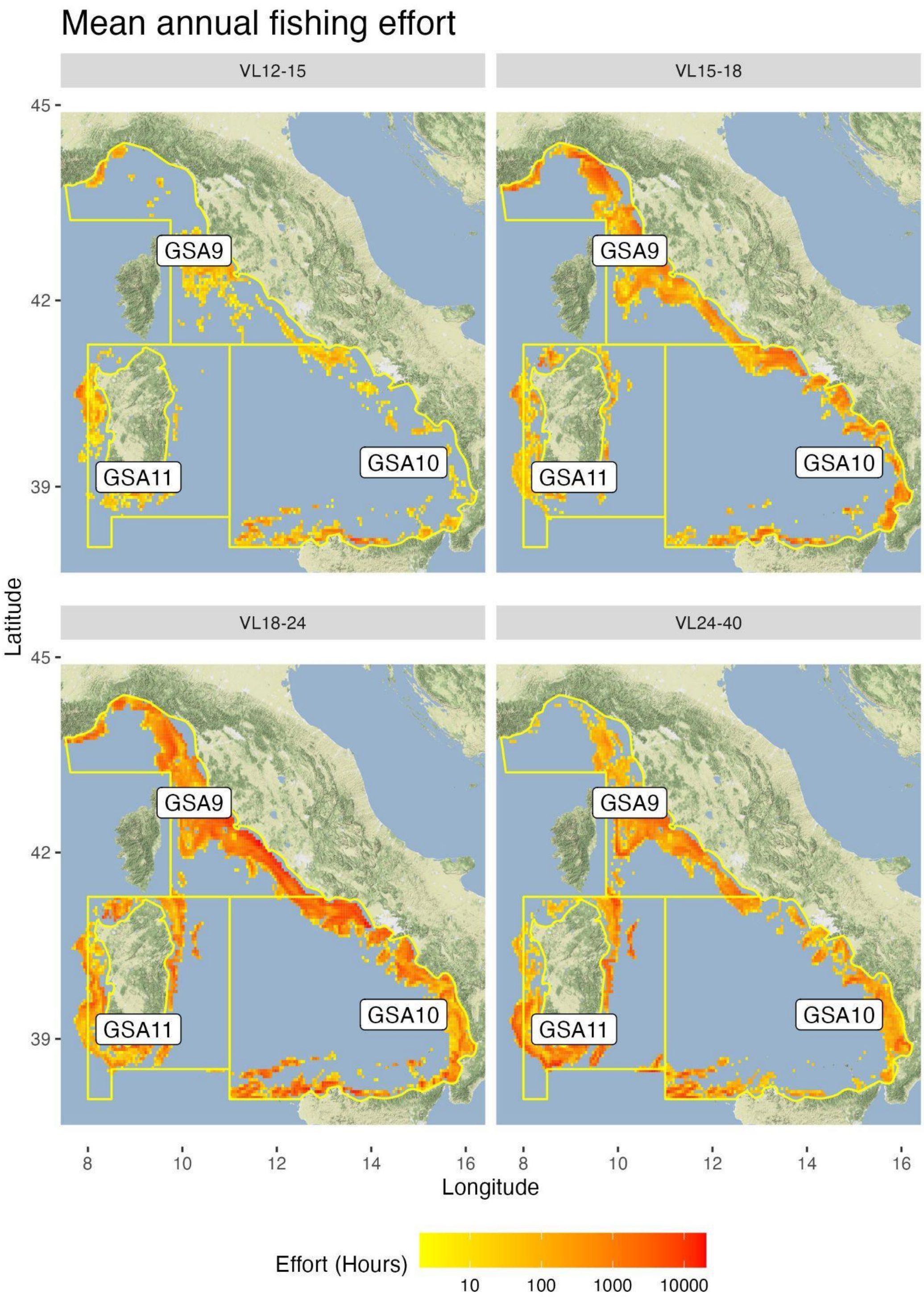


Figure 4.5.1.2 – Map of the average fishing hours (in logarithmic base 10 scale represented by a color scale from yellow – low to orange – high) for the 96 months' temporal series (years 2012- 2020).

4.5.1.3 Simulated Scenarios

The SMART model is devised to estimate the potential effect of whatever management actions (including reduction of fishing capacity, effort, spatial closures, TAC or selectivity changes). The SMART model was used to assess the potential effect of the series of scenarios listed in the following table.

Table 4.5.1.1 – Table of the features of each area closure scenarios.

Scenario	**Base Closures**	**Winter Ban by GSA (JAN in GSA10, FEB in GSA09)**	**MEDISEH-based Closures**	**Effort-based Closures**
1	**X**			
2	**X**	**X**		
3	**X**	**X**	**X**	
4	**X**	**X**	**X**	**X**

The simulations of this EWG, including the activation of the restriction of fishing activities, have been conducted using the FRA network currently established by the regulation in Italy. In particular, some specific FRAs are present: off the coasts of Argentario promontory, GSA 9 (50 km^2, from 160 to 220 m depth); in the Gulf of Gaeta, Lazio, GSA 10 (125 km^2 from 100 to 200 m depth); in GSA 11, there are three FRAs closed to trawling according to specific Regional legislations in the Gulf of Cagliari, the Gulf of Palmas and the Gulf of Oristano. The different sets of spatial closures used to define the scenarios is represented in Figure 4.5.1.4.

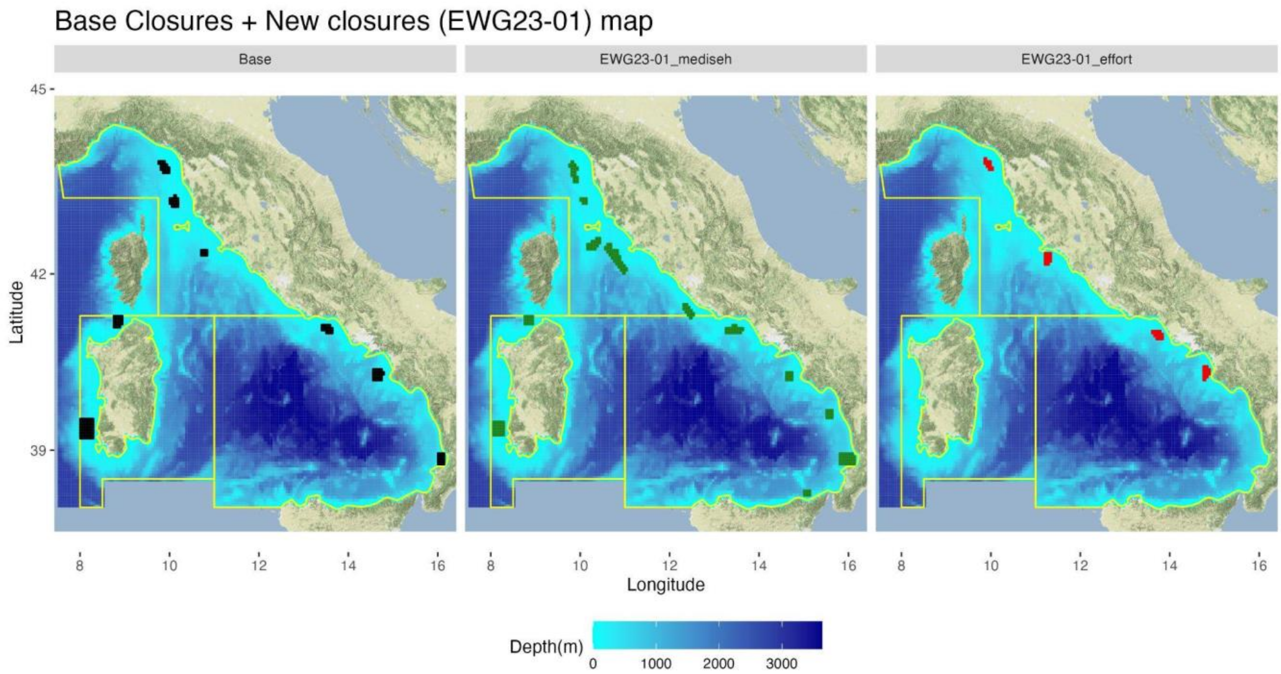


Figure 4.5.1.4 – Representation of the closure areas in the EMU2 already implemented by the Italian Ministry (left panel) and the set of closures (including the ones defined within the EWG23-01) considered in the simulated scenarios 3 and 4 (intermediate and right panel).

In practice, scenario 1 is simply the status quo defined by the set of areas already closed to fishing by the Italian government. Scenario 2 adds to Scenario 1 a break in fishing activities based on GSAs. Finally, scenarios 3 and 4 correspond to the further closure of several areas variously defined in EWG 23-01. It is worth noticing that the new areas identified in EWG 23-01 are mainly related to shallow waters (the "Effort" areas) and the range 100-400 m in depth (the "MEDISEH" areas).

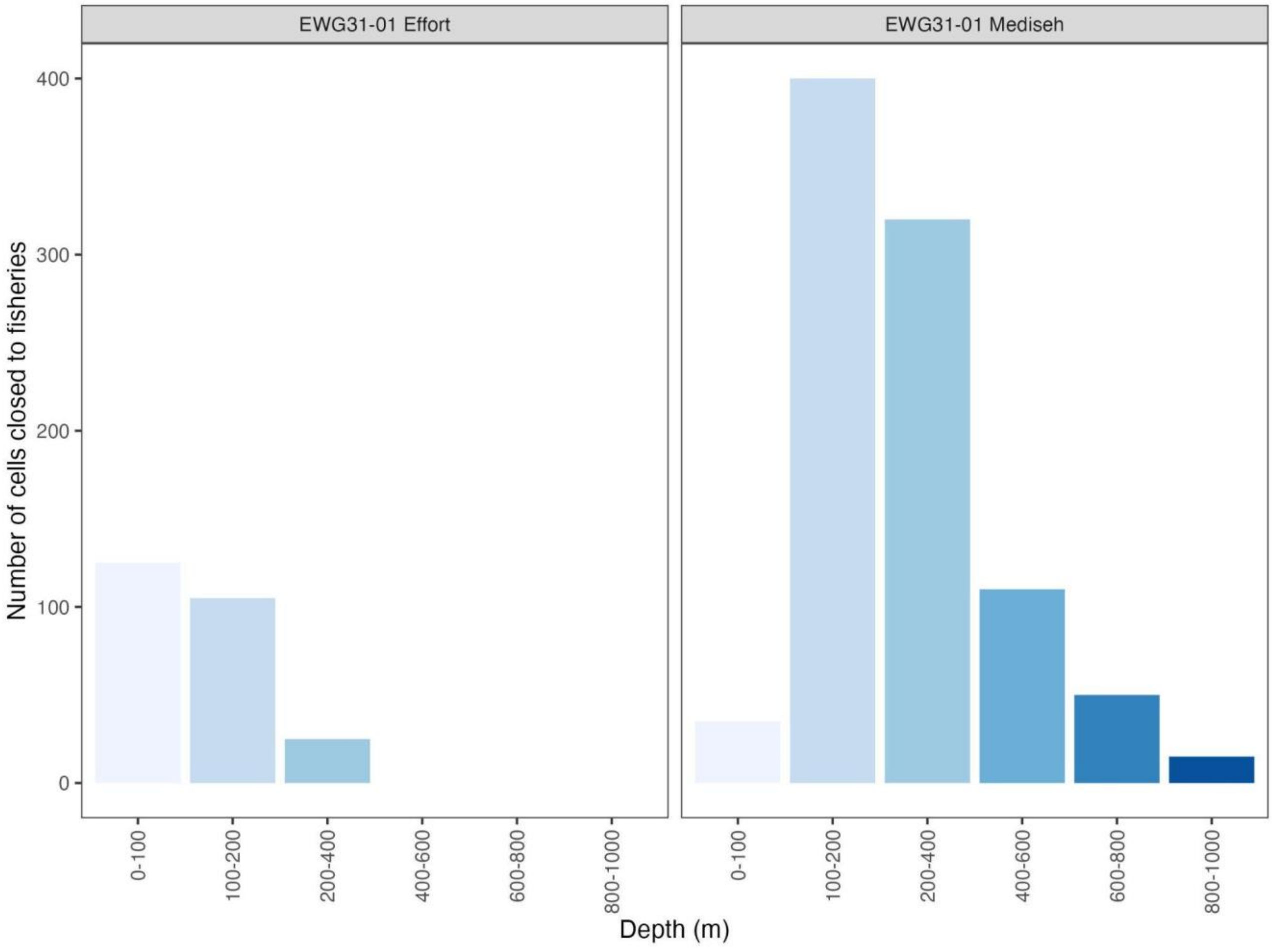


Figure 4.5.1.5 – Distribution of the mean depth of the the cells defined, during the EWG 23-01, as new potential Fisheries Restricted Areas according to the amount of fishing effort (left panel) and revision/update of the MEDISEH analyses

In the SMART modelling approach, the effort displacement resulting from the scenario simulation is obtained according to an individual based optimization of the observed pattern of effort of each fishing vessel following a strategy of profit maximization (Figure 4.5.1.5).

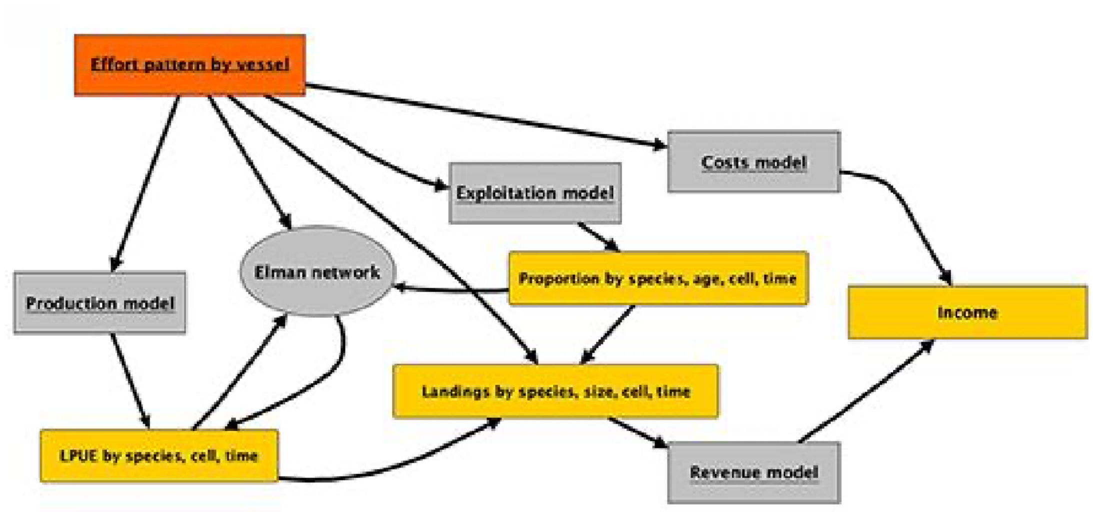


Figure 4.5.1.6 – Workflow of the Individual-Based Model used to optimize the effort pattern of each vessel

In essence, for each individual fishing unit, SMART tries to predict the new activity pattern (fishing effort per cell/time) based on the profit analysis (defined by the combination of revenues and costs) associated with each possible new effort pattern. Effort patterns are generated for each vessel using a Bayesian approach. This part of the SMART workflow was also recently shared via an interactive Shiny application (https://rlab.shinyapps.io/lander/).

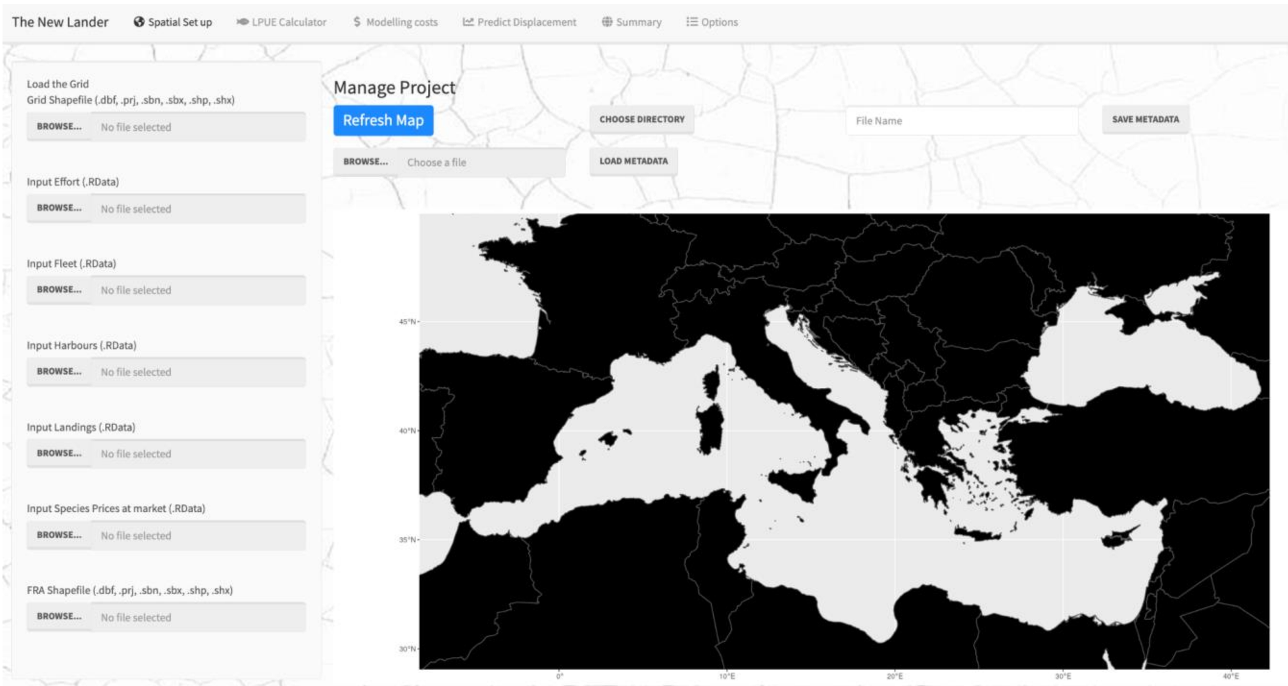


Figure 4.5.1.7 – Main interface of the Shiny version of SMART *(https://rlab.shinyapps.io/lander/)*

4.5.1.4 Stocks

Five species corresponding to six stocks of the MAP were considered for this implementation of SMART. Namely:

- the Giant red shrimp (*Aristeomorpha foliacea* - ARS) in GSA 9, 10 and 11;

- the Deep-water rose shrimp (*Parapenaeus longirostris* – DPS) in GSA 9, 10 and 11;
- the Hake (*Merluccius merluccius* – HKE) in GSA 9, 10 and 11;
- the Norway loabster (*Nephrops norvegicus* - NEP) in GSA 9;
- the Red mullet (*Mullus barbatus* - MUT) in GSA 9;
- and the Red mullet (*Mullus barbatus* - MUT) in GSA 10.

The stock object for the blue and red shrimp (*Aristeus antennatus* – ARA) in GSA 9, 10 and 11 was not available.

The relationships between these stocks and the fleet of trawlers are described in Figure 4.5.1.6.1.

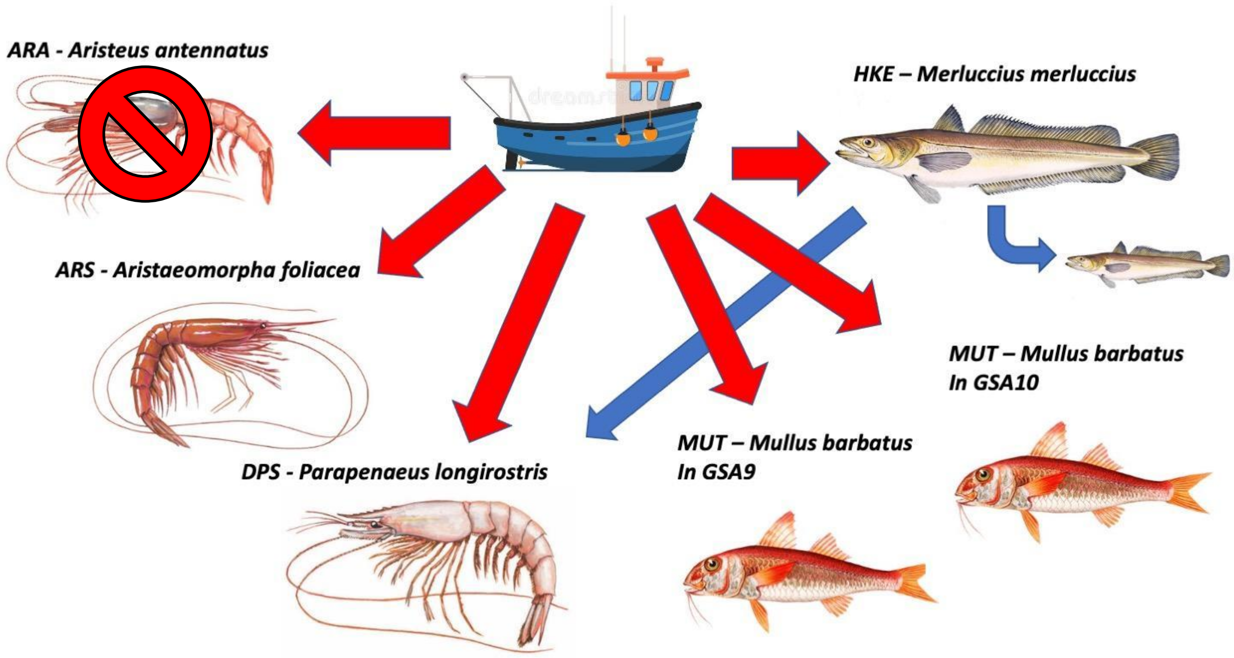


Figure 4.5.1.8 – Representation of the relationships between trawl fishing and the four stocks considered for the application of SMART in the EMU2, together with the main trophic relationships between stocks. Adult HKE is a predator of DPS and HKE juveniles. MUT and ARS were considered as stand-alone stocks with no trophic relationship with other investigated species.

4.5.1.5 Effects on the fishing effort

The predicted patterns of fishing effort by Fleet segment and Depth are represented in Figure 4.5.1.9. These patterns include the displacement determined by the FRA.

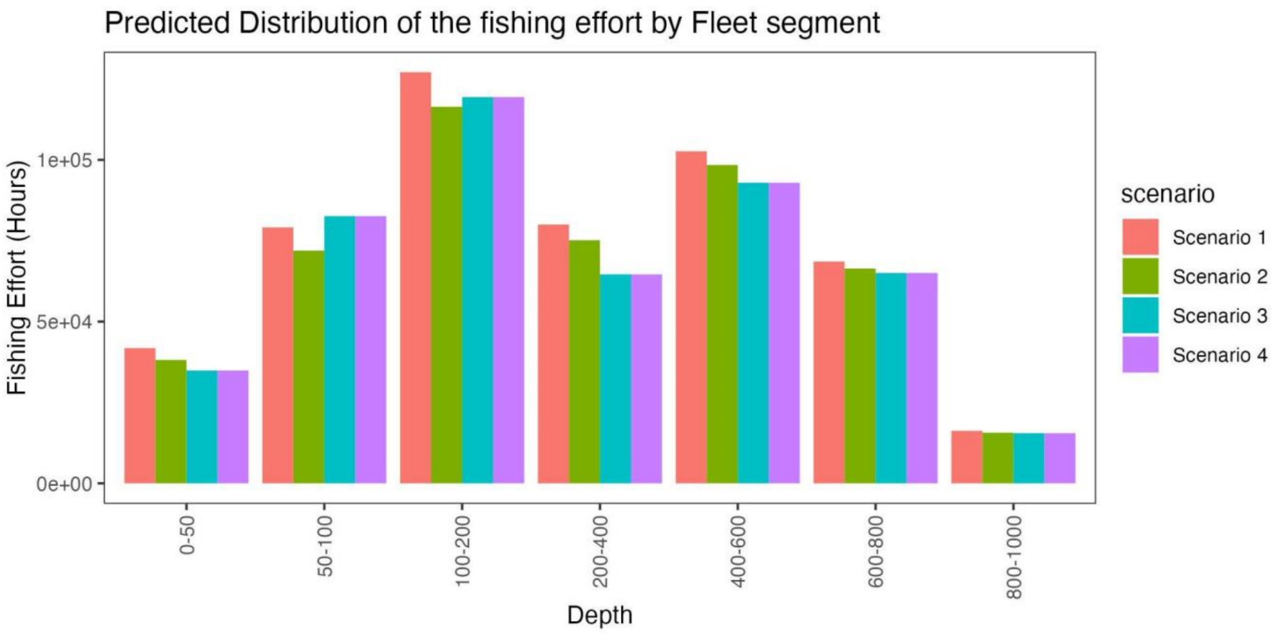


Figure 4.5.1.9 – Barplot of the fishing effort (hours trawling) by Depth in the different scenarios

The output of the simulations returned by SMART indicates that the Scenarios 2, 3 and 4, which are characterized by a temporal stop of fishing activity for a month in winter, correspond to a decrease of the effort in all the depth ranges. However, when the Scenarios 3 and 4 (with increasing spatial closures identified in EWG 23-01) are compared with the Scenario 2, it appears that most of the effort originally present in the new FRA is displaced in coastal areas, and especially in the depth intervals 50-100m and 100-200m.

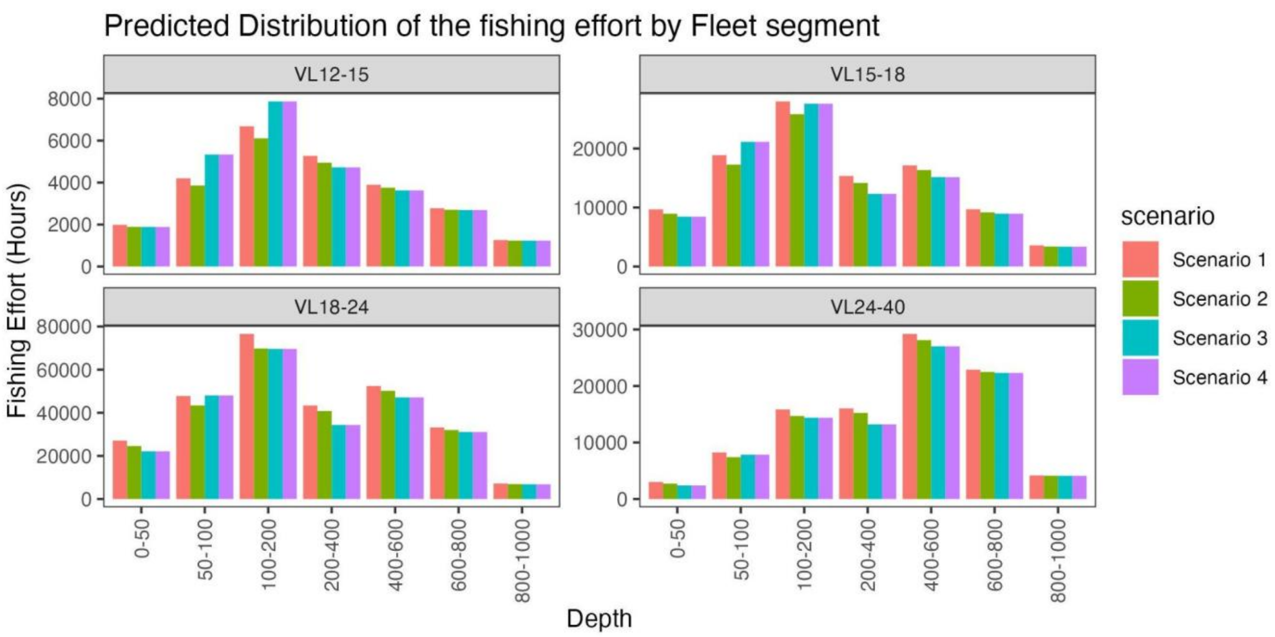


Figure 4.5.1.10 – Barplot of the fishing effort (hours trawling) by Depth and Fleet segment in the different scenarios

When the same pattern is inspected by Fleet Segment, it is evident that the displacement of the original effort (determined by the new FRAs) towards more coastal and shallow fishing grounds occurs mainly for the VL12-15 and VL15-18 fleet segments.

Overall, as shown in Figure 4.5.1.11, this displacement effect occurs in all the GSAs, but in GSA09 and GSA10 the new values of fishing effort are lower that the original ones (Scenario 1) since a fraction of the original effort is lost for the temporal stop in winter. In contrast, the patterns of the different scenarios in GSA11 are more homogeneous since no new FRAs were defined for this GSA.

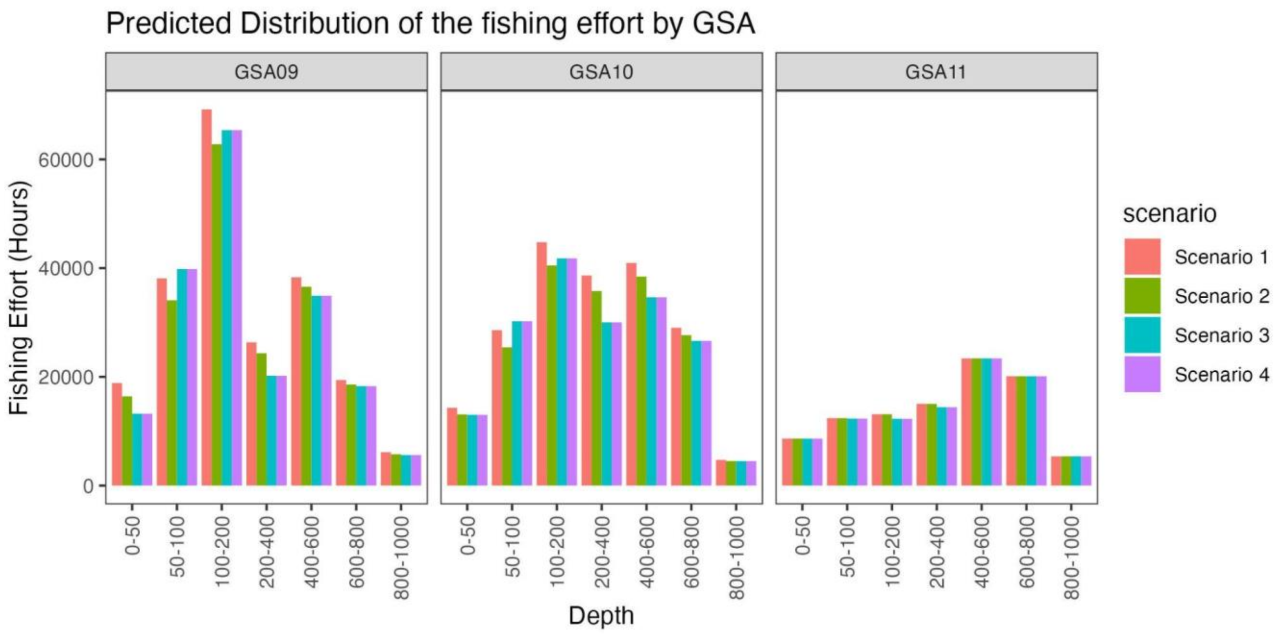


Figure 4.5.1.11 – Barplot of the fishing effort (hours trawling) by Depth and GSA in the different scenarios

4.5.1.6 Effects on the economic indicators

The predicted patterns of revenues, costs and profits by GSA are represented in Figure 4.5.1.12

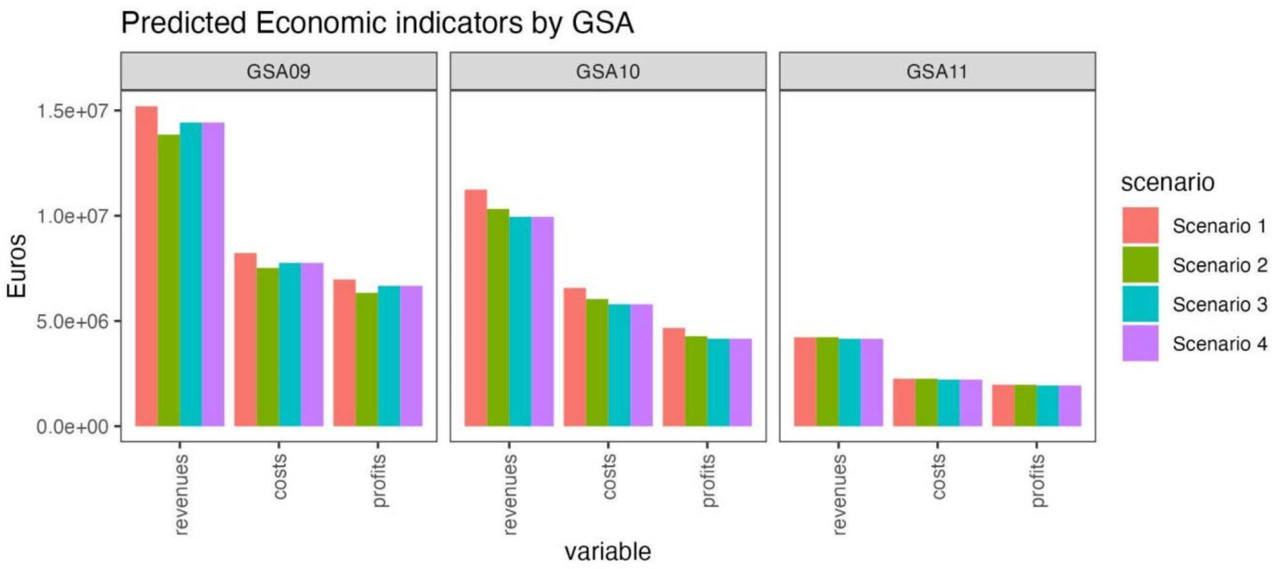


Figure 4.5.1.12 – Barplot of the main economic indicators by GSA in the different scenarios

According to SMART, all the scenarios are associated with a decrease of revenues and profits with respect to Scenario 1. However, this effect is reasonably determined by the temporal stop of the activity that cannot be "displaced in time" and allocated in other periods of the year.

4.5.1.7 Effects on the fishing mortality

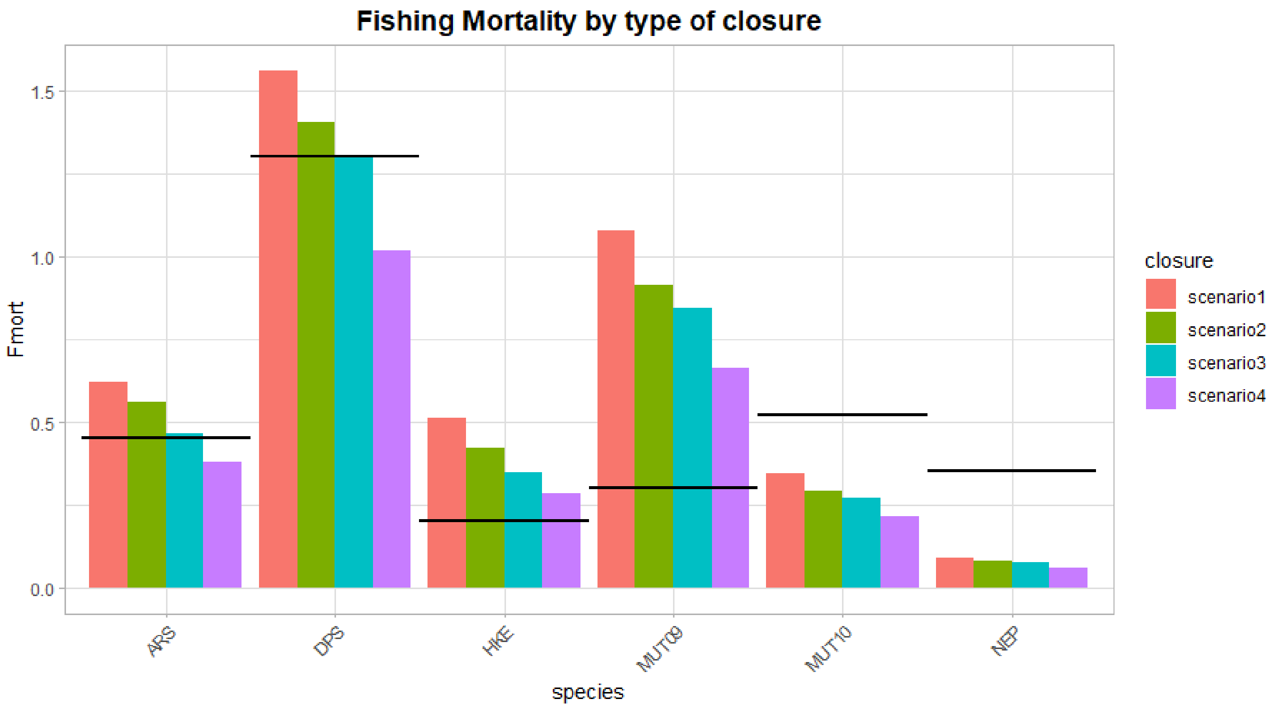


Figure 4.5.1.13 – Representation of the mean Fishing mortality by species and scenarios. Black lines correspond to FMSY for each stock.

The changes in fishing mortality in the simulated patterns, with respect to the base closure scenario, are shown in Figure 4.5.1.13. The color scale of bars indicates the different closure scenarios (as listed in table 4.1.5.1)

The analysis of the quantities of fishing mortality broken down by scenario shows that increasing closures are likely to determine a decrease of fishing mortality for all the species, but especially for HKE and less for MUT in GSA10 and NEP.

4.5.1.8 Effects on the stocks: Spawning Stock Biomass (SSB)

The effects of the new fishing effort pattern (as predicted by SMART after the estimation of the effort displacement) on the exploited stocks are summarized in Figures 4.5.1.14 – 4.5.1.19.

In the case of *Aristeomorpha foliacea* (ARS) in GSA 9, 10 and 11, the simulation for the third scenario shows a faster increase in SSB until 2025, while after 2025 all the scenarios tend to converge.

***Aristeomorpha foliacea* (ARS) in GSA 9, 10 and 11**

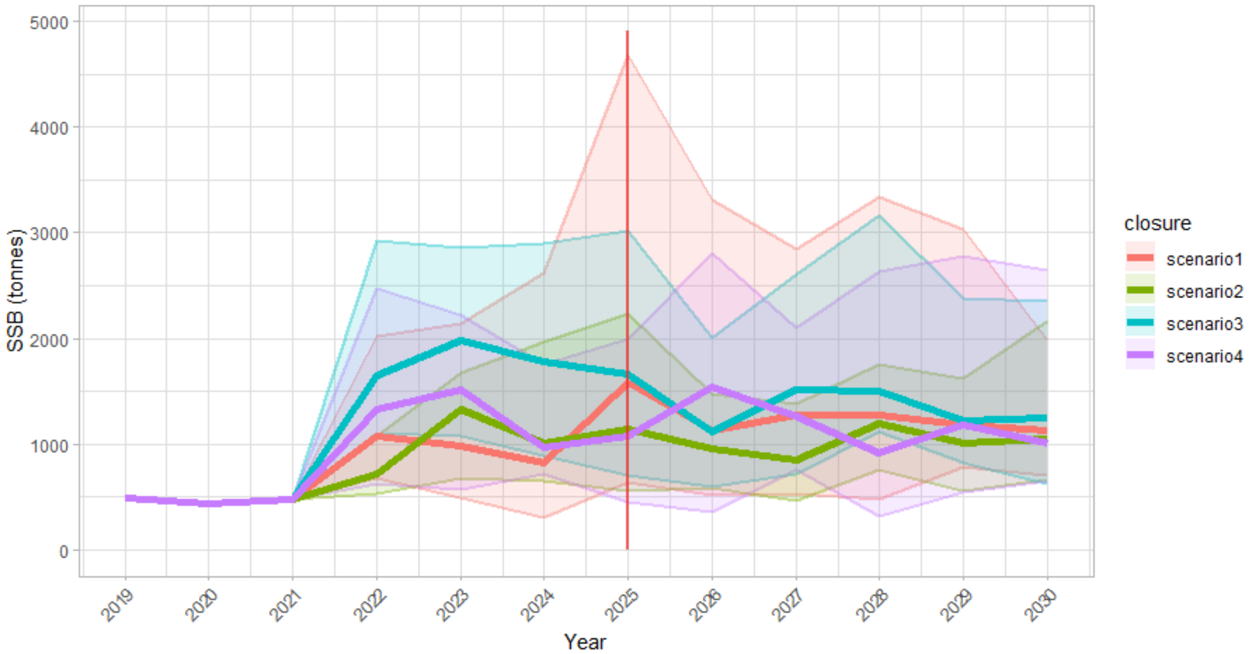


Figure 4.5.1.14 – Simulations of the effect of different area closure scenarios on stock abundance up to year 2030 for ARS in GSAs 9, 10 and 11.

In the case of *Parapenaeus longirostris (DPS) in GSA 9, 10 and 11*, the simulation resulting from the closures depicted in the fourth scenario shows a slightly positive effect compared to the other scenarios (except for the year 2025); by the year 2030, scenario 1 is the worst performing one.

***Parapenaeus longirostris (*DPS) in GSA 9, 10 and 11**

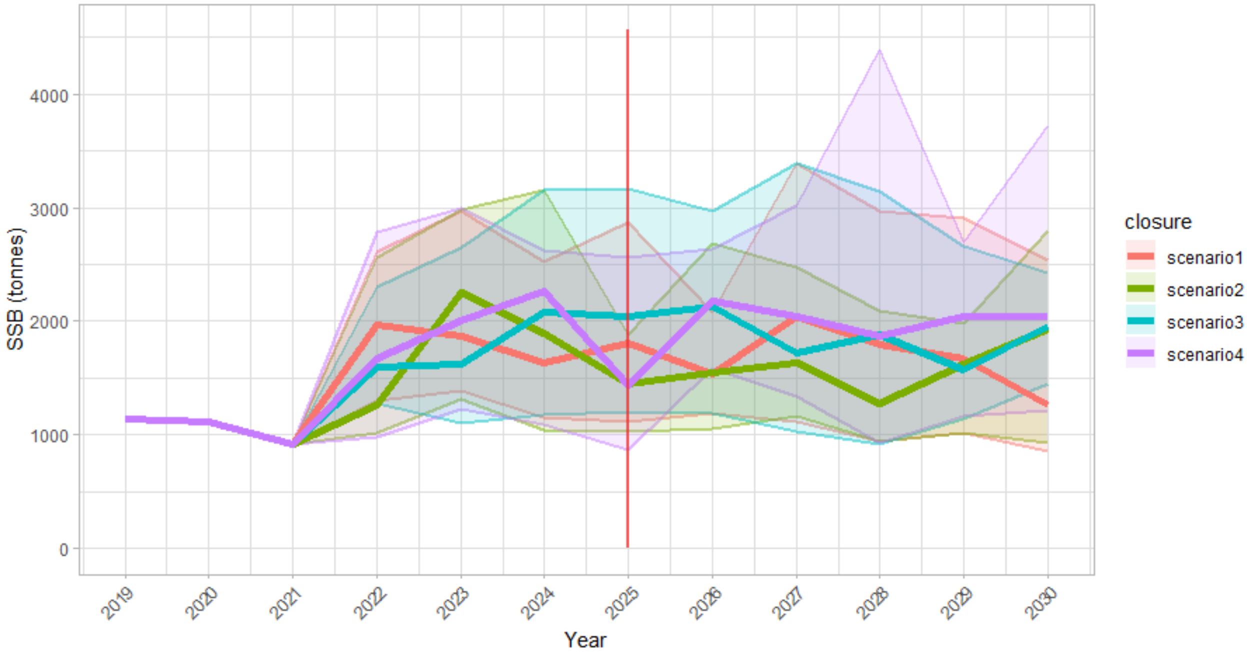


Figure 4.5.1.15 – Simulations of the effect of different area closure scenarios on stock abundance up to year 2030 for DPS in GSAs 9, 10 and 11.

In the case of *Merluccius merluccius (HKE) in GSA 9, 10 and 11*, the simulation for scenario 1 reflects the overall most positive trend in stock abundance, while the others tend to converge by year 2030. Scenario three performs best in years 2025-2027.

***Merluccius merluccius* (HKE) in GSA 9, 10 and 11**

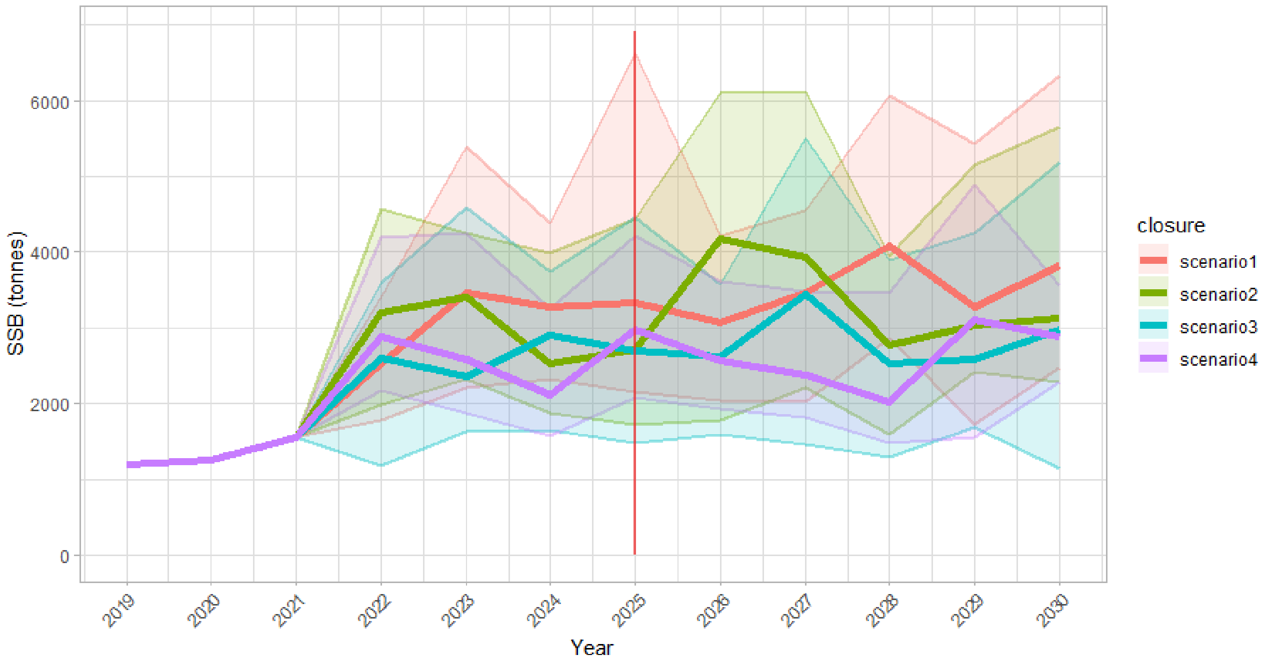


Figure 4.5.1.16 – Simulations of the effect of different area closure scenarios on stock abundance up to year 2030 for HKE in GSAs 9, 10 and 11.

In the case of *Mullus barbatus* (MUT) in GSA 9, the simulations for all the scenarios show no differences until year 2025, where scenario 4 has a minor effect on stock abundance. By year 2030 scenarios 2 and 3 results SSB is greater than in the other two scenarios.

***Mullus barbatus* (MUT) in GSA 9**

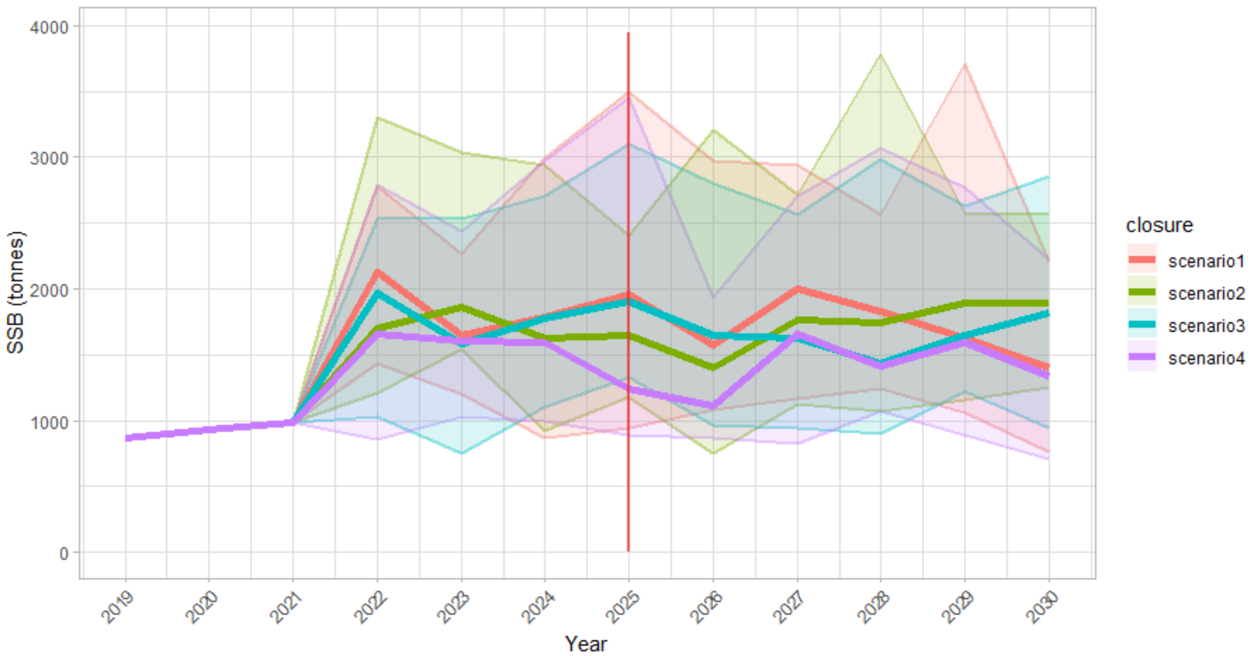


Figure 4.5.1.17 – Simulations of the effect of different area closure scenarios on stock abundance up to year 2030 for MUT in GSA 9.

In the case of *Mullus barbatus* (MUT) in GSA 10, scenarios 3 and 4 show an alternate swinging trend on the SSB, while by year 2023 the most positive effect on stock abundance is resulting by the closures from scenarios 1 and 3.

Mullus barbatus **(MUT) in GSA 10**

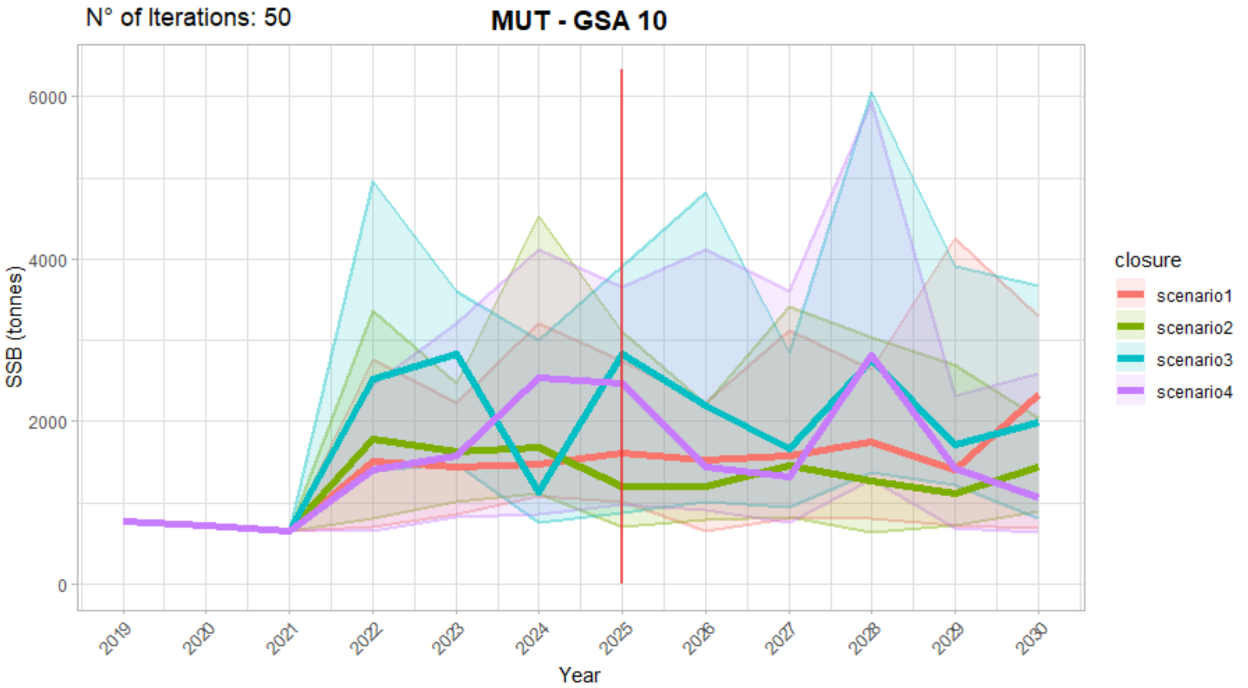


Figure 4.5.1.18 – Simulations of the effect of different area closure scenarios on stock abundance up to year 2030 for MUT in GSA 10.

In the case of *Nephrops norvegicus* (NEP), the simulation for scenario 3 is the better performing one up to 2026; by year 2023 the simulations for scenarios 2, 3 and 4 tend to converge, while scenario 1 has a minor effect on stock abundance.

Nephrops norvegicus **(NEP) in GSA 9**

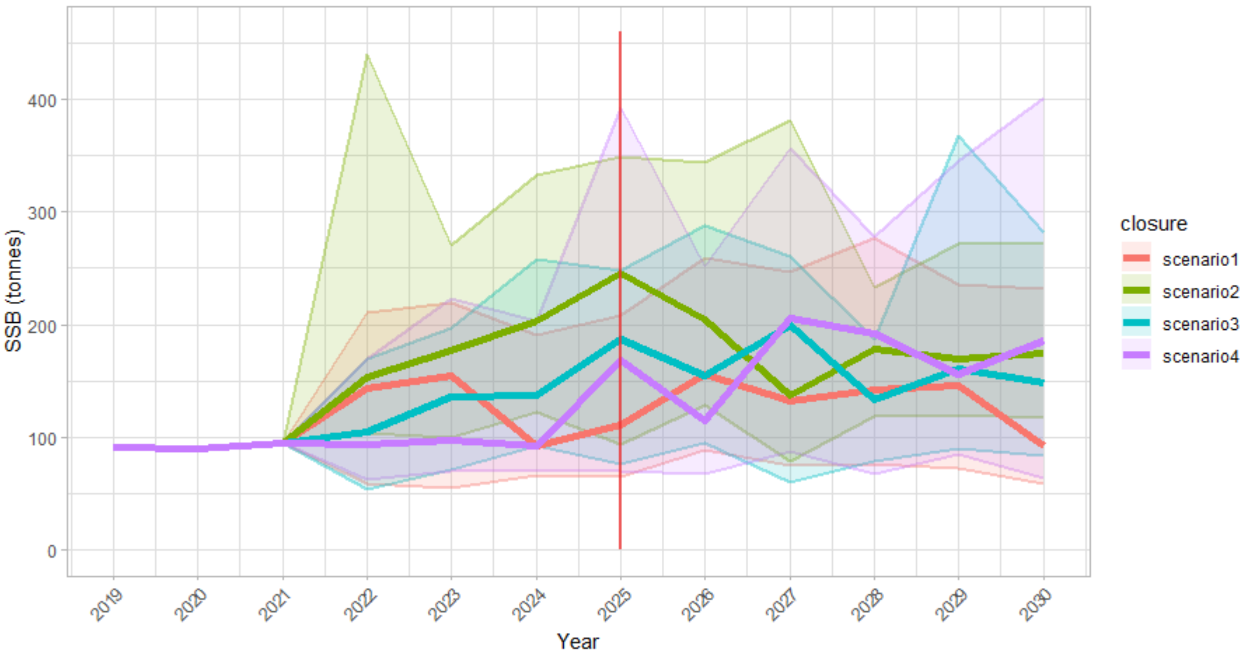


Figure 4.5.1.19 – Simulations of the effect of different area closure scenarios on stock abundance up to year 2030 for NEP in GSA 9.

4.5.1.9 References

5 REVIEW OF ARTICLE 8 OF COUNCIL REGULATION (EU) 2023/195

5.1 Review of criterions a) to f) to obtain the Compensation Mechanism

The EWG 23-01 has been asked to review Article 8 criterions which should give rights to Member State (MS) in requesting back a quota of fishing days which should be equal to 3.5% of the baseline value (average between 2015-2017) added to the current yearly fishing opportunities established in the Regulation (see tables 5.5.4-7).

5.1.1 *A) "vessel uses a trawl net with a 45 mm square-mesh codend in order to reduce by at least 25 % catches of the juveniles of hake"*

The EWG went through the IMPLEMED report in which some different gear/mesh size selectivity combinations have been tested., Unfortunately, none of the codend tested was equal to the 45mm square mesh size.

At the same time a Technical Report (ICATMAR, 21-05, 2021) on preliminary results on selectivity trial at sea on the effect of changing mesh size on the catch of Red mullet (*Mullus barbatus*), European hake (*Merluccius merluccius*), Deep-water rose shrimps (*Parapenaeus longirostris*), Norway lobster (*Nephrops norvegicus*) and Blue and red shrimp (*Aristeus antennatus*) in GSA6 has been made available by Spanish experts during the EWG. Three different mesh size have been tested (i.e. 40, 45 and 50mm square mesh). The preliminary results showed that comparing the selectivity of a 45mm square mesh size against the current legal one (40mm square mesh) the total catches of European hake reduction in number was about 25% (13% in weight) when all the depth strata are considered. The percentage increases (up to 43.8% in number and 27.65 in weight) or decreases (0% for both) according to a more restricted depth stratum. The reduction observed in fishing grounds were recruits settled is 17.5% in number (19.7% in weight) (Figure 5.1.1).

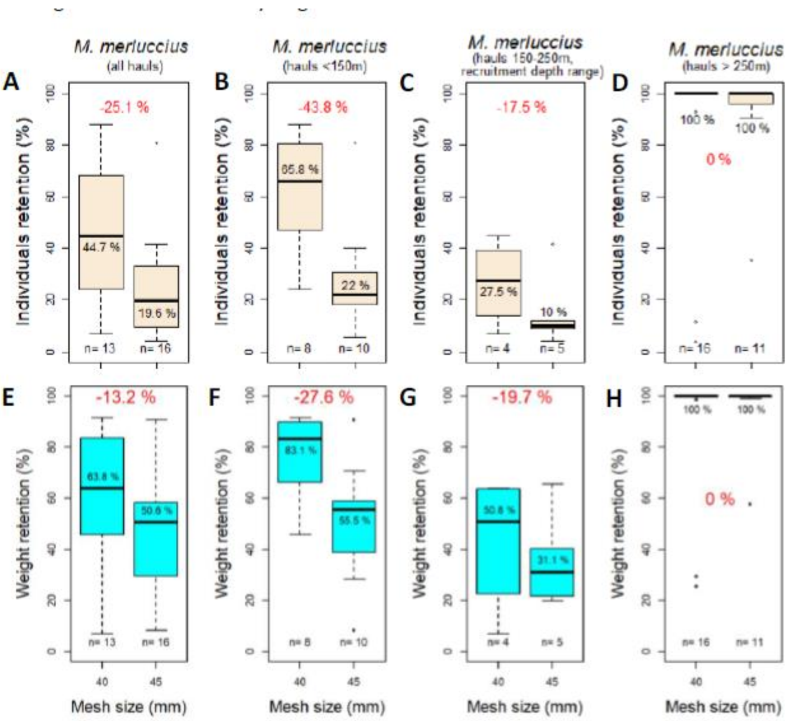


Figure 5. Boxplots showing catch retention percentages of *Merluccius merluccius* by individuals **(A-D)** and by weight **(E-H)** for commercial 40mm square mesh codend and experimental 45mm square mesh codends in coastal fisheries. Note that the recruitment bathymetric range for this species is between 150 and 250m depth (along the shelf-slope break). Juveniles are generally found all over the year within this bathymetric range. Horizontal bold line in boxplots represents the median value.

Figure 5.1.1 – Percentage of catch retention of European hake in number or weight using different mesh size extracted from ICATMAR, 21-05

Moreover, the highest percentage of reduction (about 44%) is obtained at shallower depth respect the range suggested for hake recovery in point f of Article 8 criterions for which the temporary closures must be set according to a depth range between 150-500m.

According to these results it isn't clear if using the 45mm mesh size can ensure a percentage of reduction in compliance with the criteria requested (25% of juvenile reduction).

5.1.2 *B) "the vessel uses a trawl net with a 50 mm square-mesh codend for deep-water fisheries in order to reduce by at least 25 % catches of blue and red shrimps with a carapace length (CL) of less than 25 mm in geographical subareas 1, 2, 5, 6, 7, 8, 9, 10 and 11 and to reduce by at least 25 % catches of giant red shrimps with a CL of less than 35 mm in the geographical subareas 8, 9, 10 and 11"*

The EU Regulation (2019/1241, annex IX) doesn't mention any Minimum Conservation Reference Size (MCRS) for the two red shrimps species. The EWG recognized that the two reference sizes requested should be derived from an ad-hoc study reviewed by STECF during the Summer Plenary of 2022 (STECF 22-02). The L50% based on maturity ranged between 25-30mm CL for the Blue and red shrimp and from 35-40 mm CL for the Giant red shrimp. So, the two reference sizes for which the point b is referring to are the two minimum values provided which are quite different for the two species. Indeed, in EMU1 the deep-water fisheries has, as main target, only the blue and red shrimp while in EMU2 both species having similar size can be caught on the same fishing grounds. Having different reference size could make difficult for a certain vessel to follow the requested threshold of 25% reduction for both species.

Also, for these two species the selectivity trials tested in IMPLEMED project cannot help because there isn't any mention on the effect introducing the 50mm square mesh sized codend on the red shrimps fisheries in any of the two EMUs. However, information on the change on the length at first capture (L50%) have been provided in a review of published papers. According to this review the L50% for the Blue and red shrimp increases from 21.1 to 26.2mm CL when comparing a square mesh size codend of 40mm versus a 50mm.

At the same time the report (ICATMAR, 21-05, 2021) provided by Spanish experts during the EWG provided some preliminary results of trials at sea of the effect in catch reduction of Blue and red shrimp when a 50mm square mesh size is used (Figure 5.1.2)

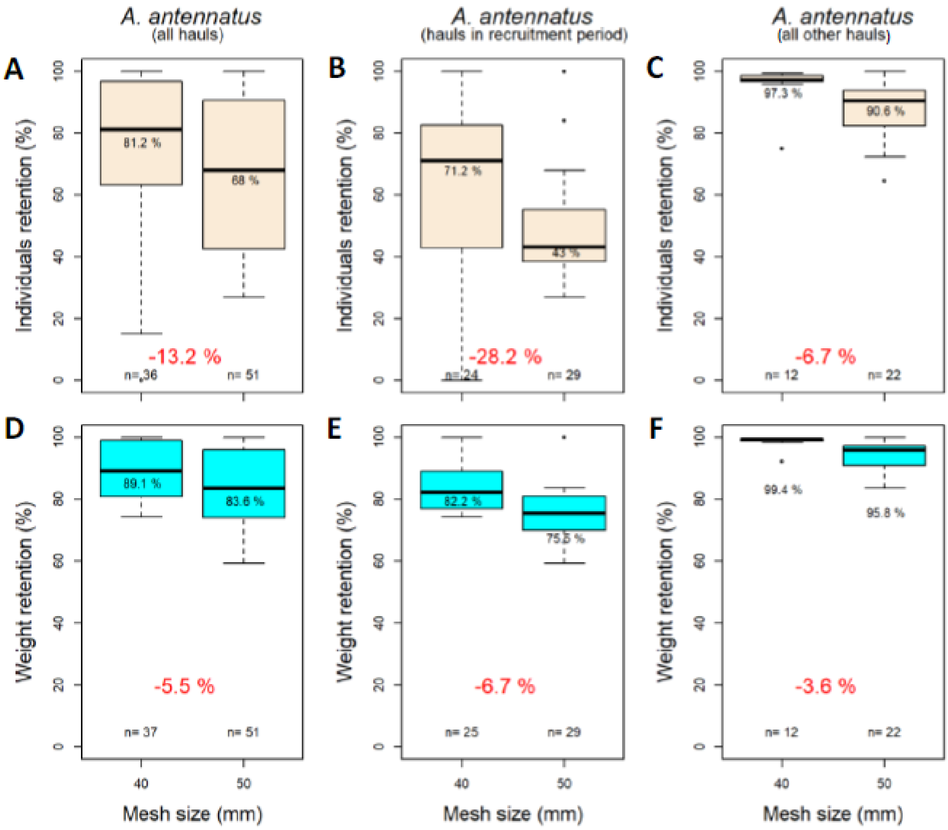


Figure 8. Boxplots showing the catch retention percentage of *Aristeus antennatus* by individuals **(A-C)** and by weight **(D-F)** for commercial 40mm square mesh codend and experimental 50mm square mesh codend in deep-sea fisheries. Horizontal bold line in boxplots represents the median value.

Figure 5.1.2 – Percentage of catch retention of Blue and red shrimp in number or weight using different mesh size extracted from ICATMAR, 21-05

The preliminary results showed that comparing the selectivity of a 50mm square mesh size against the current one (40mm) the total catches of Blue and red shrimp would be reduced in number of about 13% in number (5% in weight) when all the hauls carried out have been considered. The percentage increase when only hauls carried out during the recruitment period have been evaluated. In this latter case the reduction observed is about 28.2% in number (6.7% in weight) (Figure 5.1.2). Unfortunately, it wasn't clear which was the thresholds in size used in define recruits.

The EWG looking for others published references to be used in exploring the impact of the introduction of this mesh size on the red shrimps catches. Gorelli et al. (2017) provided ogive parameters estimated for the Blue and red shrimps in Spanish waters using the requested mesh size. The ogive parameters (a=-8.02 b=0.31) has given the EWG a possibility to test which would be the percentage of reduction on specimens below the 25mm CL in the length frequencies distributions. The test has been done using the catch length frequencies distributions of blue and red shrimp provided during the last official MEDBS data call.

The catch reduction has been computed on the number.

The results showed that in all the GSAs/MSs combinations for which length frequencies distributions were available the reduction in the catches of individuals below the reference size (CL 25mm) resulted much higher than the 25% requested (Figure 5.1.3).

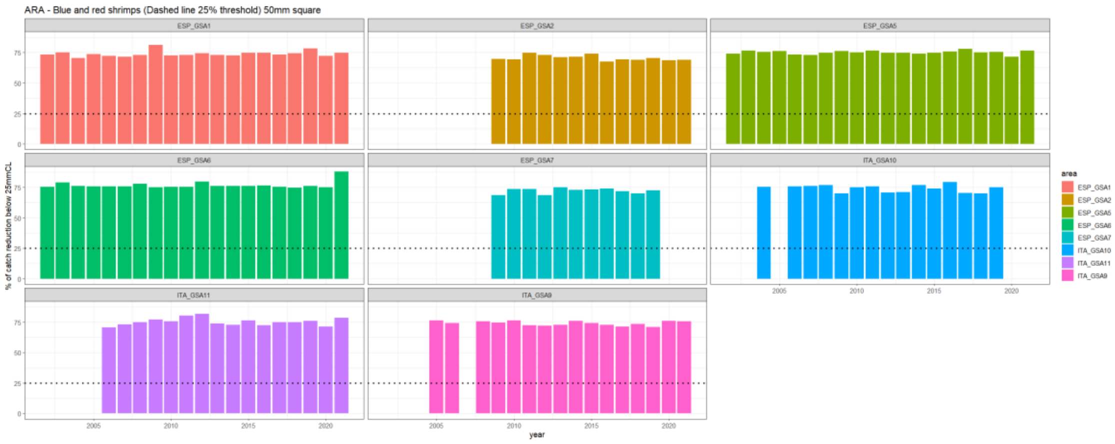


Figure 5.1.3 Percentage of catch reduction in number of specimens of blue and red shrimp below the 25mm CL reference size when a 50mm square mesh codened is used by the trawlers.

However, it is not possible evaluated if the planned catch reduction in number for this length fraction could improve the stock status of Blue and red shrimps in the areas. Indeed, the percentage of specimens caught below the 25mm size thresholds is in average below 20% in all the areas, although a bit higher in GSA5 and GSA6 (see Figure 5.1.4)

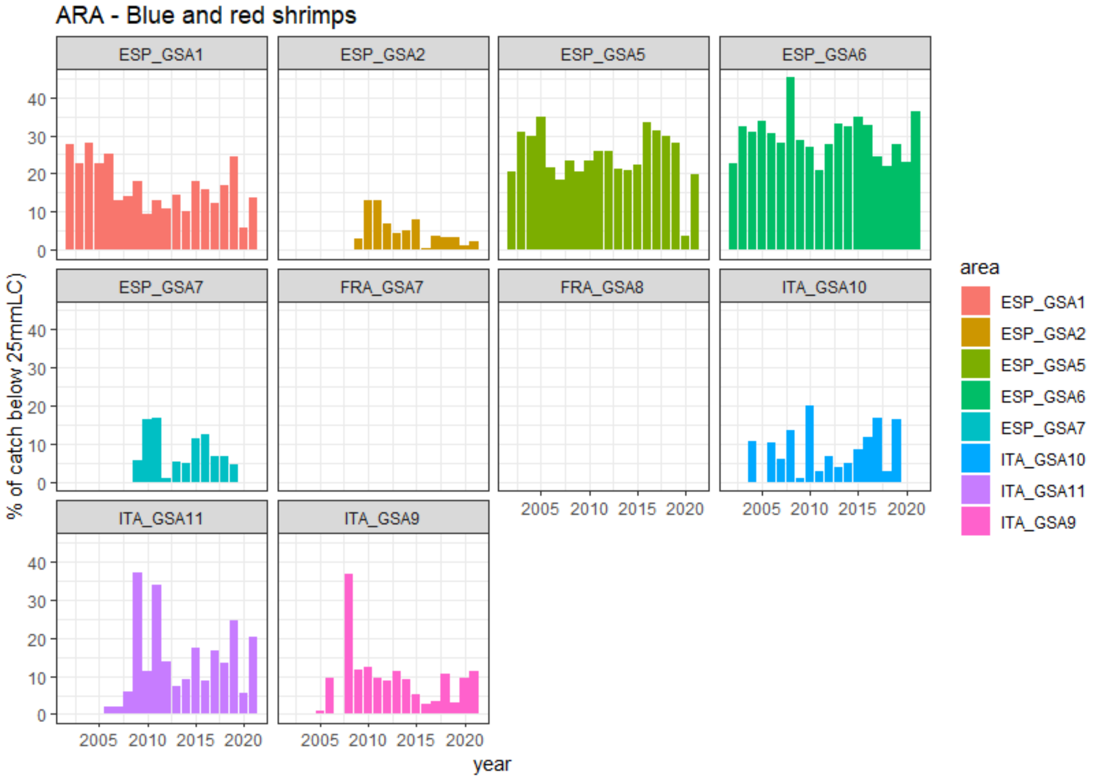


Figure 5.1.4 Percentage of catch in number of specimens of Blue and red shrimp below the 25mm CL reference size in the current length frequencies distributions provided through the official MEDBS data call for trawlers fleet.

Based on the above results the introduction of a 50mm square mesh size could be lead to a reduction on smaller individuals in compliance with the criterion b.

The EWG didn't find any selectivity studies on Giant red shrimp but a reference from the Strait of Sicily in which 3 different diamond mesh size have been tested (Ragonese et al., 2002). The EWG couldn't perform any further analysis to formulate any conclusion for this species.

5.1.3 *C) "the vessel uses a regulated highly selective gear, the technical specifications of which result in, according to the scientific study by STECF, a reduction of at least 25 % of catches of juveniles of all demersal species or at least 20 % of catches of spawners of all demersal species compared to 2020, such as a sorting grid with 20 mm spacing."*

A sorting grid with 20 mm bar spacing placed in the extension piece of a commercial bottom trawl net was tested during the Implemented project in GSA9 (IMPLEMED). The trials at sea were conducted in the depth range 80-230 m, therefore EWG 23-01 has no information on the possible 25% reduction of catches of juveniles or spawners of Western Mediterranean MAP demersal target species living at deeper depth (specifically no information on Blue and red shrimp, Giant red shrimp and Norway lobster).

As concluded in the STECF Plenary 22-03 for the three MAP species covered by the depth range (European hake, Red mullet and Deep-water rose shrimp), only for the European hake a reduction of the discards fraction (below hake MCRS=20cm TL) has been observed. There are no variations for Deep-water rose shrimp and Red mullet (Table 5.1.1)

However, it should be emphasized that a possible reduction in European hake discards is accompanied by a significant reduction in the commercial fraction of the main trawlers target species, as the case of Deep water rose shrimp and Short tail squid.

In Table 5.1.1 the comparison between total catches between the current gear used in the area and the one modified with a grid is showed.

Table 5.1.1 Catch fraction comparison between the current gear having mesh size 40mm square mesh and the tested one adding a grid with 20mm bar spacing (from Sbrana et al (2022) modified)

Mean (± SD) biomass (kg h^{-1}) and abundance (n h^{-1}) indices of the total catch and discarded fraction of the target species. The percentage of discarded fraction is also shown. CTRL: control net with 40 mm square mesh in the codend.

SPECIES	CTRL					GRID					% reduction in the discards fractions
	Total catch Kg h^{-1} (average ± SD)		Discarded fraction Kg h^{-1} (average ± SD)		% of discard = (discarded fraction / total catch)*100	Total catch Kg h^{-1} (average ± SD)		Discarded fraction Kg h^{-1} (average ± SD)		% of discard = (discarded fraction / total catch)*100	
M. merluccius	3.36	2.87	0.78	0.93	23.12	2.93	2.02	0.52	0.62	17.62	0.24
M. barbatus	1.23	1.04	0	0	0	0.91	0.85	0	0	0	
T. trachurus	3.46	8.81	0.08	0.12	2.4	2.01	3	0.03	0.04	1.42	0.41
P. longirostris	23.9	10	1	1.5	4.19	16.92	6.77	0.78	1.16	4.58	-0.09
I. coindetii	4.18	3.06	0.02	0.03	0.54	0.82	0.52	0.02	0.03	2.56	-3.74

Considering that the Mediterranean fishery is a mixed fishery to get, for all the demersal species (or also just for the six MAP species), the level of reduction requested could be challenging.

5.1.4 *D) "the Member State concerned has established temporary closure areas in order to reduce by at least 25 % catches of juveniles of all demersal species or by at least 20 % catches of spawners of all demersal species"*

EWG noticed that none of the closures scenarios tested in the previous Western Mediterranean Fishing Effort meetings explored the requested thresholds.

Moreover, even if, potentially, two models (ISIS and SMART) used it could be deal with the requested level of detail (i.e. to evaluate impact on juveniles and spawners for all the MAP species together) the parametrization will take much more time that the ones available in a week meetings also likely requesting data sets not requested by the Official Data Call.

Recalling the above point c) section Mediterranean fishery is a mixed fishery for which to get for all the demersal species (or just only for the six MAP species) the requested level of reduction could be challenging considering that different growth rate and spawning and recruitment period of these species.

Finally, EWG highlighted the need to specify better in the criterion whether closures have to be apply at the same period for all the species or planned case by case according to the biology and ecology of the species.

5.1.5 *E) "the Member State concerned has adopted a new minimum conservation reference size for hake of at least 26 cm, in order to progressively reach the length at first maturity"*

EWG agreed that the sentence, as it is, should be revised. Indeed, it is referring to an increase of the MCRS which should be leading only to an increase of the hake discard fraction (and potentially black market) without any others achievement in term of stock status and/or hake recovery. EWG suggested to add some reference to technical measures (e.g. increasing mesh size, better definition of different part of trawl gear etc) which should ensure an increase of the length at first capture at 26 cm TL which, hopefully, could guaranteed an improvement in hake stock status. Of course, this increase in length at first capture should be evaluated against the reduction in the catch of others important demersal commercial species (e.g. squids, Red mullet and crustaceans) and the relative socio-economic impacts (see STECF PLEN 22-03).

5.1.6 *F) "the Member State concerned has set a closure of at least four continuous weeks for fishing activities with trawlers in the areas and periods recognised as important, on the basis of the best available scientific advice, for the protection of spawners of hake stocks. Such areas shall also account for spatial patterns of spawners' distribution, including depths from 150 m to 500 m. The periods of the temporary fishing closure shall be from February to March and from October to November."*

EWG recalling some of the conclusions stated in STECF Plenary 22-03 on ToR6.7 "Follow-up of EWG 22-11: West Med management in terms of fishing effort and fishing closures:

"STECF 22-03 concludes that it remains challenging to demonstrate the existence of adult hake aggregations in the West Med, as concluded by STECF PLEN 21-03. The aggregations or "hot spots" that have been identified by previous scientific studies are primarily areas where juvenile hake aggregate ("nursery areas"). STECF concludes that there is no evidence in these studies for aggregations of spawners, given adult hake are found over a wide depth range, mainly on the upper slope, from 200 to 500 m depths.

STECF 22-03 concludes that with the current absence of appropriate datasets, additional scientific evidence investigating the spatial distribution of adult hake during the most likely spawning months could be obtained from a specifically dedicated survey targeted towards adult fish spatial distribution. Additionally, a more robust analysis of commercial data may also provide some insights into aggregations."

The available scientific knowledge confirms the European hake multispawning behavior in the Western Mediterranean areas, for which hake can spawn all along the year. However, some main peaks could be recognized in Winter in the Italians waters and in Autumn/Winter in Spanish/French ones (see Figure 5.1.5-9).

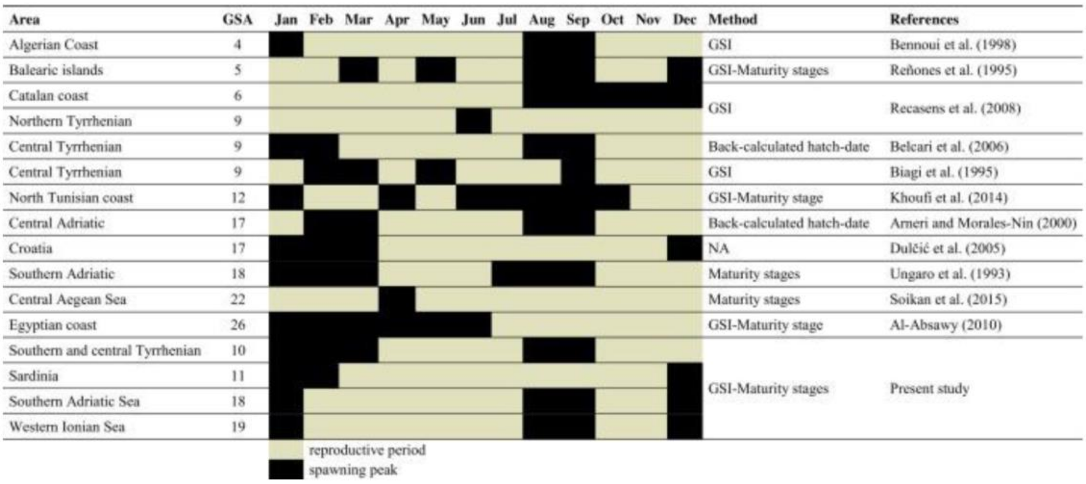


Figure 5.1.5 Extracted from Carbonara et al. 2019: Spawning period of Merluccius merluccius females in different Mediterranean areas

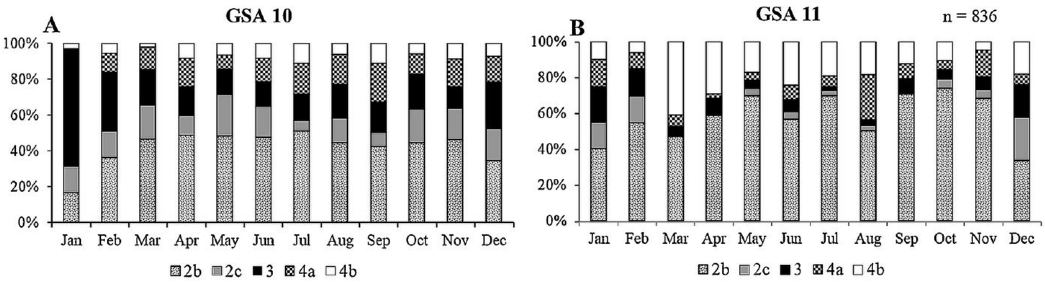


Figure 5.1.6 Extracted from Carbonara et al. 2019: Spawning period of Merluccius merluccius females in different GSA10 and GSA11

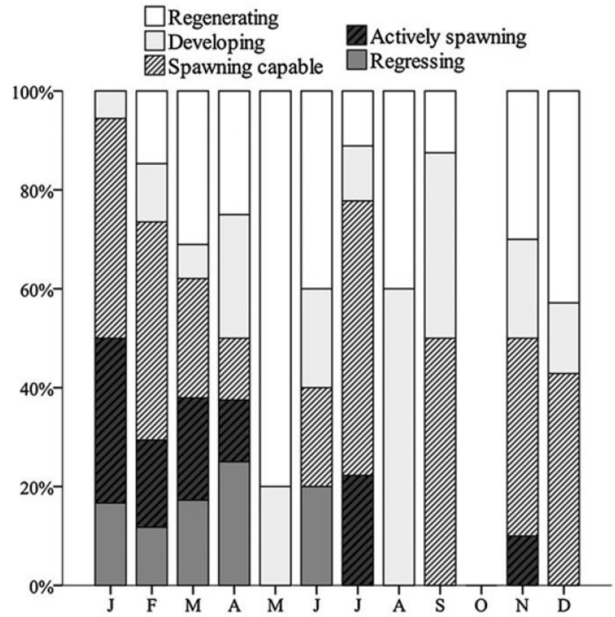


Figure 5.1.7 Extracted from Ferrer-Maza et al. 2014: Spawning period of Merluccius merluccius females in GSA7

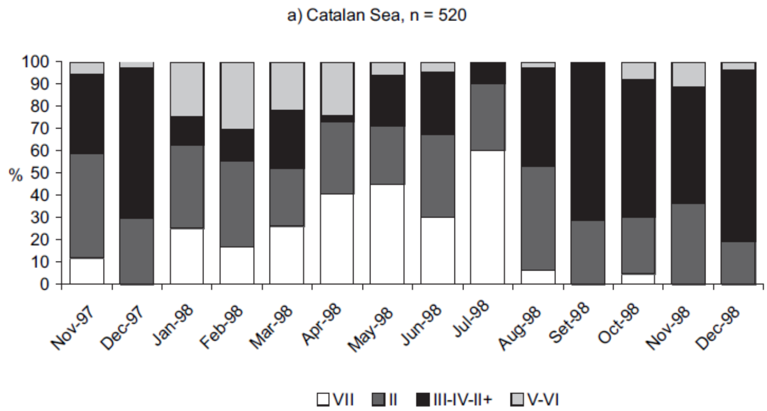


FIG. 7. – Catalan Sea. Monthly percentages of females in different maturity stages during sampling period.

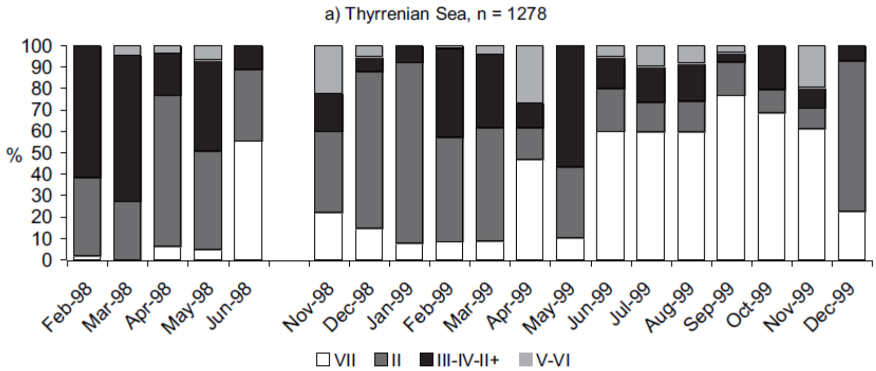


Figure 5.1.8 Extracted from Recasens et al. 2008: Spawning period of Merluccius merluccius females in GSA9 and GSA6

EWG collected information on the already in place national fishing ban to evaluate if they can be considered in compliance with the criterion request. Below the main characteristics of the fishing bans in the three countries are listed.

ITALY

In Italy a yearly trawling fishing ban (the whole fleet must be stopped) is already in place since the '90. For the Western Mediterranean GSAs the ban cover four continuous weeks in October for GSA9 and in September for GSA10 and in between for GSA11 (Table 5.1.2). Moreover, the trawlers must be stopped for additional days according to the GSA and vessel length (Table 5.1.3). See the National Decrete at https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/17888.

Table 5.1.2 – Italy 2022 trawling fishing ban by Maritime Districts, GSA and period.

MARITIME COMPARTIMENTS		PERIOD		GSA
Brindisi	Gaeta	05-Sep	04-Oct	10
Roma	Civitavecchia	13-Jun	12-Jul	9
Livorno	Imperia	03-Oct	01-Nov	9
All Sardinian waters		15-Sep	14-Oct	11

Table 5.1.3 – Italy 2022 trawling additional number of days of fishing ban by GSA and Vessel Length

GSA	LFT	NR. Of additional days year 2022
9	LFT≤12	24
	LFT>12	48
10	LFT≤12	31
	LFT>12	39
11	LFT≤24	34
	LFT>24	46

SPAIN

In the case of Spain, spatio-temporal closures have been adopted in 2023 following Article 8 paragraph 4.f instructions. That is, establishing closures in the periods February - March or October - November of at least four weeks that include 150 - 500 m depth range. Spanish measures were published in Orden APA/80/2023 de 30 de Enero.

Specifically, 17 different areas where divided, six from 1st February to 1st March, one from 25th February to 26th March, one from 4th March to 31th March, five from 1st October to 31th October, one from 7th October, two from 13th October to 12th November, and one from 1st November to 30th November. Five of these areas include 15-500m depth range while in the others trawling is forbidden in all depths.

FRANCE

In France two spatial-temporal closures (not a permanent ban) are already planned in GSA7:

*concern all bottom trawlers (gear codes OTB and OTT)

*concern two sub-areas:

- one called something like "Extended GCFM box": an extension of a existing GFCM restricted area, ± 2400km2 closed for 6 months from November to April, and including depths more than 150m

- and one called something like "Bathy 90-100m": a bathymetrical closure btw 90 and 100m, at the east of the previous, ± 2500km2 closed for 8 months from September to April

(https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000039668169)

5.1.7 *Conclusions*

The EWG went through the criterions listed in Article 8 concerning the possibility for MS to request compensation in term of increase of fishing days up to 3.5% of the baseline value.

The EWG concluded that considering the available knowledge and the analysis done during the meeting only the requests base on point b and point f could be considered fully in compliance with what the criterion stated, for point d) there weren't enough information to be fully evaluated if it is feasible or not while the others criterion seems to be not corroborate by available knowledge.

For point a) the results from a Spanish technical report in which a 45 square mesh size codend impact on the selectivity of the MAP species have been tested, showed that the requested threshold of at least 25% of reduction in hake juveniles seems not achievable.

For point b) only for Blue and red shrimps the introduction of a 50mm square mesh size seems to lead to the decrease of specimens below 25mm CL at least of 25%.

However, for vessels targeting Blue and red shrimps in EMU2 having as "by-catch" the Giant red shrimps the size threshold chosen for the latter one (35mm CL) couldn't let them to follow the expected catch reduction (25%). So, the EWG suggested that the criterion could be revised providing just one size threshold which should the Blue and red shrimps one (25mm CL).

According to the IMPLEMED results the same conclusion of point a) can be shared with point c) when a grid of 20mm space bar is used.

For point d) EWG cannot find any clear evidence or results which corroborate the fact that specific closures could lead to a reduction in juveniles and spawners at the level requested by the criterion. Indeed, none of the scenarios tested in the previous Western Mediterranean MAP EWG meetings evaluate the levels of reduction requested by the criterion.

Point e) referring to an increase of the MCRS for hake (26cm TL) which if not linked with some additional technical measures should just led to an increase of discards hake fraction and, likely, black market.

For point f), based on the above information, EWG agreed in considering the already proposed temporal closures for Spain and France are following the criterion while the Italian fishing ban already planned before the enter in force of the West Med MAP can't be consider in compliance with the criterion if the new closure period proposed have to be considered as a new proposal done in the Western Mediterranean MAP time window (from 2019). At the same time EWG recognized that the Italian fishing ban is planned by a regulation issued by the Authorities on yearly basis so could be still fall in the legal framework of the MAP.

EWG noticed that both definitions of "juveniles" and "spawners" are not clearly stated in the Regulations making a bit challenging the evaluation of the criterions. A similar consideration could be done for the term "catch reduction" which is never specified whether must be considered in number or weight.

Finally, EWG couldn't fully understand if the compliance with the criterions in term of results achieved would be evaluated at some point in the process.

5.2 Use of the criterions by Member States

EWG couldn't address the ToR request because no data/information have been made available at the time of the EWG.

5.3 Compare the existing temporary closures set to help the hake stocks recover and determine the optimal characteristics of temporary closures to protect hake, if possible looking in particular at spawners, in each GSA of the West Med in terms of duration of closures, bathymetry, etc.

EWG couldn't address the ToR requested because it wasn't clear on which basis the comparison should be done. Moreover, it wasn't clear what the term "optimal" is referring to.

5.4 Advice on additional criteria to speed up the recovery of hake stocks in the Western Mediterranean

EWG 23-01 recall the STECF 22-03 conclusion for which:

"STECF concludes that with the best knowledge available, mitigation of fishing pressure on spawners with closed areas may only benefit adult hake if a temporal (and not spatial) closure is implemented during the most likely spawning months. STECF concludes that, based on a few studies identified, the peak in hake spawning is most likely to occur between August to November, up to February, in the western areas and likely from January to March in Sardinian and Tyrrhenian waters."

According to the above conclusions and figures 5-9 provided in 5.1 EWG suggests that additional temporal closures and spatial closures could be tested.

For Italy an additional trawling fishing ban closure of 4 continuous weeks in February in GSA9 and January in GSA10 and 11 could be suggested with the aim to reduce trawlers fishing pressure during the main spawning peaks in the year. These days shall be deducted from the additional days planned in the Italian regulations (see table 3). However, these numbers are going to change on yearly basis.

For France the effect of a permanent closure of a core area inside of the already temporary closed areas could be verified not only in terms of hake biomass but also in the rebuilding of the benthic communities which could drive the recovery of the demersal stocks.

For Spain the fishing ban planned for 2023 seems already a good attempt in trying to help European hake recovery.

During the EWG the two proposed scenarios for Italy and France have been tested (see Sections 4.4.2 and 4.5).

5.5 Comparison of the fishing opportunities with the 3.5 % compensation days with the historical and observed fishing days

An additional ToR has been added during the meeting for which a comparison of the fishing opportunities already planned and observed in the previous years and the 2023 ones adding the 3.5 % compensation must be carried out.

Compared to STECF 22-11 report a new comparison of fishing days for 2023 regulation and the additional allocation of fishing days of 3.5% calculated from the baseline between 2015 and 2017 as a compensation mechanism was added for EMU1 and EMU2.

Details for EMU1:

Tables 5.5.4-5 compares the fishing days from the calculation of the 2023 regulation adding a 3.5% of the baseline with observed fishing effort available (2020 and 2021) for EMU1.

For French trawlers the comparison with FDI data available differs from the fleet segment, but the trend is negative for the total fishing effort. The additional allocation of fishing days added to the 2023 regulation is lower than the baseline in all fleet segments.

For Spanish trawlers, the comparison with FDI data available differs from the fleet segment, but the trend is negative for the total fishing effort. The additional allocation of fishing days added to the 2023 regulation is lower than the baseline in coastal fleet and higher in deeper fleet.

Details for EMU2:

Tables 5.5.6-7 compares the fishing days from the calculation of the 2023 regulation adding a 3.5% of the baseline with the corresponding observed fishing effort available (2020 and 2021) for EMU2.

For Italian trawlers the comparison with FDI data available differs from the fleet segment, but the trend is positive for the total fishing effort. The additional allocation of fishing days added to the 2023 regulation is lower than the baseline in all fleet segments.

For French trawlers, the comparison with FDI data available differs from the fleet segment, but the trend is positive for the total fishing effort. The additional allocation of fishing days added to the 2023 regulation is lower than the baseline in vessels smaller than 12 m, but higher in the rest of the fleet segments.

Table 5.5.4. Comparison of the fishing days from the calculation of the 2023/195 Regulation adding a 3.5% of the baseline of French trawlers in GSAs 1,2,5,6 and 7 with the corresponding observed fishing effort available (2020 and 2021) for EMU1.

Stock group	Fleet segment	FDI baseline: average of 2015-2017 fishing effort $E_{2015-2017}$	FDI Fishing effort in 2020	2020 Regulation	FDI Fishing effort in 2021	2021 Regulation	2022 regulation	2023 Regulation	2023 Regulation + 3.5% baseline	% of change between the 2020 FDI and 2023 regulation + 3.5% baseline	% of change between the 2021 FDI and 2023 regulation + 3.5% baseline	% of change between the baseline and 2023 regulation + 3.5% baseline
Red mullet in GSAs 1, 5, 6 and 7; Hake in GSAs 1-5-6-7; Deep-water rose shrimp in GSAs 1, 5 and 6; Norway lobster in GSAs 5 and 6	≥ 18 m and < 24 m	4666	4450	5144	4497	4715	4372	3972	4135	7.07%	8.04%	11.37%
	≥ 24 m	6115	5382	6258	5208	5737	5320	4833	5047	6.22%	3.10%	17.46%
TOTAL FISHING EFFORT OF FRENCH TRAWLS		**10781**	**9832**	**11402**	**9705**	**9912**	**9692**	**8805**	**9182**	**6.61%**	**5.39%**	14.83%

Table 5.5.5. Comparison of the fishing days from the calculation of the 2023/195 Regulation adding a 3.5% of the baseline of Spanish trawlers in GSAs 1,2,5,6 and 7 with the corresponding observed fishing effort available (2020 and 2021) for EMU1.

 **Stock group**	**Fleet segment**	**FDI baseline: average of 2015-2017 fishing effort** $E_{2015-2017}$	**FDI Fishing effort in 2020**	**2020 Regulation**	**FDI Fishing effort in 2021**	**2021 Regulation**	**2022 regulation**	**2023 Regulation**	**2023 Regulation + 3.5% baseline**	**% of change between the 2020 FDI and 2023 regulation + 3.5% baseline**	**% of change between the 2021 FDI and 2023 regulation + 3.5% baseline**	**% of change between the baseline and 2023 regulation + 3.5% baseline**
Red mullet in GSAs 1, 5, 6, 7; Hake in GSAs 1, 5, 6, 7; Deep-water rose shrimp in GSAs 1, 5, 6; Norway lobster in GSAs 5 and 6.	< 12 m	2708	1376	2260	1655	2072	1921	1745	1840	-33.70%	-11.20%	32.06%
	≥ 12 m and < 18 m	25123	21244	24284	17616	22260	20641	18752	19631	7.59%	-11.44%	21.86%
	≥ 18 m and < 24 m	51342	45587	45563	30059	41766	38728	35184	36981	18.88%	-23.03%	27.97%
	≥ 24 m	19334	16826	16047	9256	14710	13640	12392	13069	22.33%	-41.19%	32.40%
Total fishing effort of target assemblage		**98507**	**85033**	**88154**	**58586**	**80808**	**74930**	**68073**	**71521**	**15.89%**	**-22.08%**	**27.40%**
Blue and red shrimps in GSA 1,5,6,7	< 12 m	2	0	0	0	0	0	0				
	≥ 12 m and < 18 m	785	630	1139	857	1044	968	879	906	-43.88%	-5.83%	-15.47%
	≥ 18 m and < 24 m	7965	6169	10822	7705	10574	9805	8908	9187	-48.92%	-19.23%	-15.33%
	≥ 24 m	6911	5713	9066	6917	8488	7871	7151	7393	-29.40%	-6.89%	-6.97%
Total fishing effort of target assemblage		**15663**	**12512**	**21027**	**15478**	**20106**	**18644**	**16938**	**17486**	**-39.76%**	**-12.97%**	**-11.64%**
TOTAL FISHING EFFORT OF SPANISH TRAWLS		**212677**	**182578**	**197335**	**132651**	**181722**	**168504**	**85011**	**89007**	51.25%	32.90%	58.15%

Table 5.5.6. Comparison of the fishing days from the calculation of the 2023/195 Regulation adding a 3.5% of the baseline of Italian trawlers in GSAs 9, 10 and 11 with the corresponding observed fishing effort available (2020 and 2021) for EMU2.

Stock group	Fleet segment	FDI baseline: average of 2015-2017 fishing effort $E_{2015-2017}$	FDI Fishing effort in 2020	2020 Regulation	FDI Fishing effort in 2021	2021 Regulation	2022 regulation	2023 Regulation	2023 Regulation + 3.5% baseline	% of change between the 2020 FDI and 2023 regulation + 3.5% baseline	% of change between the 2021 FDI and 2023 regulation + 3.5% baseline	% of change between the baseline and 2023 regulation + 3.5% baseline
Red mullet in GSAs 9, 10 and 11; Hake in GSAs 9-10-11; Deep-water rose shrimp in	< 12 m	3374	4157	3081	7500	2824	2534	2294	2412	41.98%	67.84%	28.51%
	≥ 12 m and < 18 m	52679	30910	46350	33418	42487	38110	34505	36349	-17.60%	-8.77%	31.00%
	≥ 18 m and < 24 m	35031	23435	31170	26476	28572	25629	23205	24431	-4.25%	7.72%	30.26%
	≥ 24 m	4680	4267	4160	4670	3813	3421	3097	3261	23.58%	30.18%	30.32%
Total fishing effort of target assemblage		**95764**	**62769**	**84761**	**72064**	**77696**	**69694**	**63101**	**66453**	**-5.87%**	**7.79%**	**30.61%**
Giant red shrimp in GSAs 9, 10 and 11.	< 12 m	567	129	510	101	467	419	379	399	-209.18%	-294.90%	29.66%
	≥ 12 m and < 18 m	3345	3977	3760	1290	3447	3091	2799	2916	26.68%	-126.05%	12.82%
	≥ 18 m and < 24 m	2838	3648	3028	1099	2776	2489	2253	2352	35.52%	-114.04%	17.10%
	≥ 24 m	450	1459	405	233	371	333	302	318	78.22%	-36.37%	29.33%
Total fishing effort of target assemblage		**7199**	**9213**	**7703**	**2723**	**7061**	**6332**	**5733**	**5985**	**35.04%**	**-119.79%**	**16.87%**
TOTAL FISHING EFFORT OF ITALIAN TRAWLS		**102964**	**71982**	**92464**	**74787**	**84757**	**76026**	**68834**	**72438**	-0.63%	3.14%	**29.65%**

Table 5.5.7. Comparison of the fishing days from the calculation of the 2023/195 Regulation adding a 3.5% of the baseline of French trawlers in GSAs 9, 10 and 11 with the corresponding observed fishing effort available (2020 and 2021) for EMU2.

Stock group	Fleet segment	FDI baseline: average of 2015-2017 fishing effort $E_{2015-2017}$	FDI Fishing effort in 2020	2020 Regulation	FDI Fishing effort in 2021	2021 Regulation	2022 regulation	2023 Regulation	2023 Regulation + 3.5% baseline	% of change between the 2020 FDI and 2023 regulation + 3.5% baseline	% of change between the 2021 FDI and 2023 regulation + 3.5% baseline	% of change between the baseline and 2023 regulation + 3.5% baseline
Red mullet in GSAs 8, 9, 10 and 11; Hake in GSAs 8, 9, 10 and 11; Deep- water rose shrimp in GSAs 9, 10 and 11; Norway lobster in GSAs 9 and 10.	< 12 m	169	0	208	3	191	117	161	167		-5608.63%	1.02%
	≥ 12 m and < 18 m	516	319	833	383	764	709	644	662	-107.71%	-73.08%	-28.41%
	≥ 18 m and < 24 m	53	12	208	56	191	117	161	163	-1315.99%	-193.40%	-209.92%
	≥ 24 m	148	152	208	160	191	117	161	166	-9.18%	-3.97%	-12.48%
TOTAL FISHING EFFORT OF FRENCH TRAWLS		**884**	**482**	**1457**	**601**	**1337**	**1060**	1127	1158	-140.03%	-92.75%	-30.92%

6 References

Alglave et al. 2022. Combining scientific survey and commercial catch data to map fish distribution. ICES Journal of Marine Science, Volume 79, Issue 4, May 2022, Pages 1133–1149, https://doi.org/10.1093/icesjms/fsac032

Anderson, S. C., Ward, E. J., English, P. A., and Barnett, L. A. K. 2022, May 2. sdmTMB: an R package for fast, flexible, and user-friendly generalized linear mixed effects models with spatial and spatiotemporal random fields. bioRxiv. https://www.biorxiv.org/content/10.1101/2022.03.24.485545v2 (Accessed 21 February 2023).

Caddy J.F. (1998) - A short review of precautionary reference points and some proposals or their use in data-poor situations. FAO, Fisheries Technical Papers: 379 p.

Colloca F., M. T. Spedicato, E. Massutí, Garofalo G., G. Tserpes, P. Sartor, A. Mannini, , A. Ligas, G. Mastrantonio, B. Reale, C. Musumeci, I. Rossetti, M. Sartini, M. Sbrana, F. Grati, G. Scarcella, M. Iglesias, M. P. Tugores, F. Ordines, L. Gil de Sola, G. Lembo, I. Bitteto, M.T. Facchinii, A. Martiradonna, W. Zupa, R. Carlucci, M.C. Follesa, P. Carbonara, A. Mastradonio, Fiorentino F., Gristina M., Knittweis L., Mifsud R., Pace M.L., C. Piccinetti, C. Manfredi, G. Fabi, P. Polidori, L. Bolognini, R. De Marco, F. Domenichetti, R. Gramolini, V. Valavanis, E. Lefkaditou, K. Kapiris, A. Anastasopoulou and N. Nikolioudakis, (2013) Mapping of nursery and spawning grounds of demersal fish. Mediterranean Sensitive Habitats (MEDISEH) Final Report, DG MARE Specific Contract SI2.600741, Heraklion (Greece).

Colloca F, Garofalo G, Bitetto I, Facchini MT, Grati F, Martiradonna A, et al. (2015) The Seascape of Demersal Fish Nursery Areas in the North Mediterranean Sea, a First Step Towards the Implementation of Spatial Planning for Trawl Fisheries. PLoS ONE 10(3): e0119590. doi:10.1371/journal.pone.0119590

D'Andrea L, Parisi A, Fiorentino F, Garofalo G, Gristina M, Russo T, Cataudella S. (2020). smartR: a R package for spatial modelling of fisheries and simulation of effort management. Methods in Ecology and Evolution 00:1-10. 10.1111/2041-210X.13394

Ferrer-Maza, D., Lloret, J., Mun˜oz, M., Faliex, E., Vila, S., and Sasal, P. (2014). Parasitism, condition, and reproduction of the European hake (Merluccius merluccius) in the northwestern Mediterranean Sea. – ICES Journal of Marine Science, 71: 1088–1099

Fiorentino F, Garofalo G, De Santi A, Bono, Giusto GB, et al. Spatio-temporal distribution of recruits (0 group) of Merluccius merluccius and Phycis blennoides (Pisces, Gadiformes) in the Strait of Sicily (Central Mediterranean). Hydrobiologia. 2003; 503: 223–236.

Getis A, Ord JK. The analysis of spatial association by use of distance statistics. Geogr Anal. 1992; 24: 189–206.

Giannoulaki M., A. Belluscio, F. Colloca, S. Fraschetti, M. Scardi, C. Smith, P. Panayotidis, V. Valavanis M.T. Spedicato (2013). Mediterranean Sensitive Habitats, DG MARE Specific Contract SI2.600741, Final Report, 557 p.

Gorelli G., Company J.B., Bahamón N., Sardà F. (2017). Improving codend selectivity in the fishery of the deep-sea red shrimp Aristeus antennatus in the northwestern Mediterranean Sea. Scientia Marina 81(3), 381-386. doi: http://dx.doi.org/10.3989/scimar.04575.25A

ICATMAR, 21-05 (2021). Institut Català de Recerca per la Governança del Mar (ICATMAR). Scenarios for the implementation of management measures reported in Article 11.3 of the Western Mediterranean Multiannual Plan and Presidency Statement of December 2021 (ICATMAR, 21-05). Barcelona. DOI 10.2436/10.8080.05.13

IFREMER. Système d'Informations Halieutiques. (2021). Algorithme de traitement de données de géolocalisation ALGOPESCA. Note synthétique. https://archimer.ifremer.fr/doc/00682/79405/

IMPLEMED -Specific Contract No. EASME/EMFF/2019/1.3.2.6/01/ SI2.818717 - SC04 – IMPLEMED. Improving the selectivity of trawl gears in the Mediterranean Sea to advance the sustainable exploitation pattern of trawl fisheries.

MEDITS (2017) MEDITS-Handbook. Version n. 9, 2017, MEDITS Working Group: 106 pp.

Ohayon, S., Granot, I., & Belmaker, J. (2021). A meta-analysis reveals edge effects within marine protected areas. Nature Ecology & Evolution, 5(9), Article 9. https://doi.org/10.1038/s41559-021-01502-3

Ragonese S. Bianchini M.L., Di Stefano L. (2002). Trawl cod-end selectivity for depwater red shrimp (Aristeaomorpha foliacea, Risso 1827) in the Strait of Sicily (Mediterranean Sea). Fisheries Research 57, 13:144.

Recasens L., Chiericoni V., Belcari P. (2008). Spawning pattern and batch fecundity of the European hake (Merluccius merluccius (Linnaeus, 1758)) in the western Mediterranean. Scientia Marina 72(4), 721-732. doi: 10.3989/scimar.2008.72n4721

Regulation (EU) 2019/1022 of the European Parliament and of the council of 20 June 2019 establishing a multiannual plan for the fisheries exploiting demersal stocks in the Western Mediterranean Sea and amending Regulation (EU) No 508/2014.

Russo T, D'Andrea L, Franceschini S, Accadia P, Cucco A, Garofalo G, Gristina M, Parisi A, Quattrocchi G, Sabatella RF, Sinerchia M, Canu DM, Cataudella S and Fiorentino F (2019) Simulating the Effects of Alternative Management Measures of Trawl Fisheries in the Central Mediterranean Sea: Application of a Multi-Species Bio-economic Modeling Approach. Front. Mar. Sci. 6:542. doi: 10.3389/fmars.2019.00542. Sala-Coromina, J., García, J. A., Martín, P., Fernandez-Arcaya, U., & Recasens, L. (2021). European hake (Merluccius merluccius, Linnaeus 1758) spillover analysis using VMS and landings data in a no-take zone in the northern Catalan coast (NW Mediterranean). Fisheries Research, 237, 105870.

Russo T, Parisi A, Garofalo G, Gristina M, Cataudella S, et al. (2014) SMART: A Spatially Explicit Bio-Economic Model for Assessing and Managing Demersal Fisheries, with an Application to Italian Trawlers in the Strait of Sicily. PLoS ONE 9(1): e86222. doi:10.1371/journal.pone.0086222.

Russo T, Morello EB, Parisi A, Scarcella G, Angelini S, Labanchi L, Martinelli M, D'Andrea L, Santojanni A, Arneri E, Cataudella S (2018). A model combining landings and VMS data to estimate landings by fishing ground and harbor. Fisheries Research 199, 218-230.

Russo T, D'Andrea L, Franceschini S, Accadia P, Cucco A, Garofalo G, Gristina M, Parisi A, Quattrocchi G, Sabatella RF, Sinerchia M (2019). Simulating the effects of alternative management measures of trawl fisheries in the Central Mediterranean Sea: application of a multi-species bio-economic modelling approach. Frontiers in Marine Science, 6, p.542.

STECF (2008) Report of the SGMOS-08-01 Working group on the reduction of discarding practices. Luxembourg: Publications Office of the European Union

STECF (2010). Development of protocols for Multi-annual impact assessments. Luxembourg: Publications Office of the European Union

STECF (2012). Management plans Part 2 - Changes in cod plans. Luxembourg: Publications Office of the European Union

STECF (2019) Scientific, Technical and Economic Committee for Fisheries (STECF) – 62nd Plenary Meeting Report (PLEN-19-03). Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-14169-3, doi:10.2760/1597, JRC118961

STECF (2020) Scientific, Technical and Economic Committee for Fisheries (STECF) – 63 rd Plenary Report – Written Procedure (PLEN-20-01). Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-18117-0, doi:10.2760/465398, JRC120479

STECF (2021a) Scientific, Technical and Economic Committee for Fisheries (STECF) – West Med assessments: conversion factors, closures, effort data and recreational fisheries (STECF-21- 01). Publications Office of the European Union, Luxembourg, 2021, EUR 28359 EN, ISBN 978-92- 76-36193-0, doi:10.2760/36048, JRC124913.

STECF (2021b) Scientific, Technical and Economic Committee for Fisheries (STECF) – 67 th Plenary Report (PLEN-21-02). EUR 28359 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-40592-4 (online), doi:10.2760/559965 (online), JRC126123.

STECF (2022a). Scientific, Technical and Economic Committee for Fisheries (STECF) – 70th Plenary Report (PLEN-22-02). EUR 28359 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-55196-6, doi:10.2760/87451, JRC130331

STECF (2022b). Scientific, Technical and Economic Committee for Fisheries (STECF) – Assessment of balance indicators for key fleet segments and review of national reports on Member States efforts to achieve balance between fleet capacity and fishing opportunities (STECF-22-15). Publications Office of the European Union, Luxembourg, 2022.

STECF, (2022c). Scientific, Technical and Economic Committee for Fisheries (STECF): The 2022 Annual Economic Report on the EU Fishing Fleet (STECF 22-06) Annex, Prellezo, R., Sabatella, E., Virtanen, J. and Guillen, J. editors, Publications Office of the European Union, Luxembourg, 2022, doi:10.2760/358466, JRC130578.

STECF (2023). Scientific, Technical and Economic Committee for Fisheries (STECF) – 71 st Plenary report (STECF-PLEN-22-03). Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/016673, JRC132078

Sbrana M., De Carlo F., Ligas A., Massaro A., Musumeci C., Rossetti I., Sartini M., Vasapollo C., Viva C., Sartor P. and Pretti C. (2022). Testing experimental devices in the extension piece to increase the selectivity of bottom trawl in the NW Mediterranean. Front. Mar. Sci. 9:1017766. doi: 10.3389/fmars.2022.1017766

WP, 2019. Italian Work Plan for data collection in the fisheries and aquaculture sectors, 2020-2021, Version 1.0 – October 2019, Rome, 30 October 2019.

7 CONTACT DETAILS OF EWG-23-01 PARTICIPANTS

[1] - Information on EWG participant's affiliations is displayed for information only. In any case, Members of the STECF, invited experts, and JRC experts shall act independently. In the context of the STECF work, the committee members and other experts do not represent the institutions/bodies they are affiliated to in their daily jobs. STECF members and experts also declare at each meeting of the STECF and of its Expert Working Groups any specific interest which might be considered prejudicial to their independence in relation to specific items on the agenda. These declarations are displayed on the public meeting's website if experts explicitly authorized the JRC to do so in accordance with EU legislation on the protection of personnel data. For more information: http://stecf.jrc.ec.europa.eu/adm-declarations

STECF members		
Name	**Affiliation[1]**	**Email**
Pinto, Cecilia	University of Genova	cecilia.pinto@edu.unige.it
Döring, Ralf	Thuenen-Institute of Sea Fisheries	ralf.doering@thuenen.de
Mannini, Alessandro	CNR-IRBIM	alessandro.mannini@fastwebnet.it
Grati, Fabio	IRBIM-CNR	fabio.grati@cnr.it
Bastardie, Francois	DTU	fba@aqua.dtu.dk
Drouineau, Hilaire	Inrae	hilaire.drouineau@inrae.fr
Sabatella, Evelina Carmen	CNR National Research Council	e.sabatella@nisea.eu

Invited experts		
Name	**Affiliation[1]**	**Email**

Accadia, Paolo	Nisea Società Cooperativa	accadia@nisea.eu
Billet, Norbert	IFREMER	norbert.billet@ifremer.fr
Bitetto, Isabella	Fondazione COISPA	bitetto@coispa.it
Certain, Gregoire	IFREMER	gregoire.certain@ifremer.fr
Garriga Panisello, Mariona	ICATMAR - ICM (CSIC)	mariona.garripa@gmail.com
Gourguet, Sophie	IFREMER	sophie.gourguet@ifremer.fr
Lehuta, Sigrid	IFREMER	slehuta@ifremer.fr
Merzéréaud, Mathieu	Ifremer	mathieu.merzereaud@ifremer.fr
Phan, Tuan Anh	(consultant)	tuan.anh.phan@ifremer.fr
Russo, Tommaso	University of Rome Tor Vergata	Tommaso.Russo@Uniroma2.it
Stefani, Matteo	University of Roma "Tor Vergata"	matteo.stefani.42@gmail.com
Tassetti, Anna Nora	Italian National Research Council (CNR), Institute for Biological Resources and Marine Biotechnologies (IRBIM)	annanora.tassetti@cnr.it

Viva, Claudio	Freelance biologist	viva@cibm.it

JRC experts		
Name	**Affiliation**[1]	**Email**
Kupschus, Sven	JRC (focal)	Sven.KUPSCHUS@ec.europa.eu
Pierucci, Andrea	JRC	Andrea.PIERUCCI@ec.europa.eu

European Commission		
Name	**Affiliation**[1]	**Email**
Dragon, Anne-Cecile	DG-Mare (focal)	Anne-Cecile.DRAGON@ec.europa.eu
Kupschus, Sven	JRC (focal)	Sven.KUPSCHUS@ec.europa.eu
Pierucci, Andrea	JRC	Andrea.PIERUCCI@ec.europa.eu

Observers		
Name	**Affiliation**[1]	**Email**
Piron, Marzia	Mediterranean Advisory Council	segreteria@med-ac.eu
Sala-Coromina, Joan	Marine Science Institute (ICM-CSIC)	jsala@icm.csic.es

8 LIST OF ANNEXES

Electronic annexes are published on the meeting's web site on:
https://stecf.jrc.ec.europa.eu/web/stecf/ewg2301

List of electronic annexes documents:

EWG-23-01 – Annex 1 – Matrix of model assumptions
EWG-23-01 – Annex 2 – List of Indicators

9 LIST OF BACKGROUND DOCUMENTS

Background documents are published on the meeting's web site on:
https://stecf.jrc.ec.europa.eu/web/stecf/ewg2301

List of background documents:

EWG-23-01 – Doc1 - FishingOpportunities_2023_EU2023-195.pdf https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32023R0195

EWG-23-01 – Doc 2 - Declarations of invited and JRC experts (see also section 7 of this report – List of participants)

STECF

The Scientific, Technical and Economic Committee for Fisheries (STECF) has been established by the European Commission. The STECF is being consulted at regular intervals on matters pertaining to the conservation and management of living aquatic resources, including biological, economic, environmental, social and technical considerations.

The European Commission's science and knowledge service

Joint Research Centre

JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.

EU Science Hub
joint-research-centre.ec.europa.eu

@EU_ScienceHub

EU Science Hub - Joint Research Centre

EU Science, Research and Innovation

EU Science Hub

EU Science

Publications Office
of the European Union