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Reports of the Scientific, Technical and Economic Committee for Fisheries (STECF) - Methodology for the stock assessments in the Mediterranean Sea (STECF-16-14)

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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 deals with methodology for the stock assessments in the Mediterranean Sea.

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SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES (STECF)

Methodology for the stock assessments in the Mediterranean Sea (STECF-16-14)

THIS REPORT WAS REVIEWED DURING THE PLENARY MEETING HELD IN BRUSSELS, 04-08 JULY 2016

Request to the 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.

Terms of reference of the EWG: The EWG was asked to work on the following tasks: (i) ranking of the importance of Mediterranean stocks; (ii) produce guidelines on type of assessment/indicator based on available data and priority; (iii) reconstruct a time series of historical catch and effort data for the stocks of anchovy and sardine in the Aegean Sea (GSA 22 and 23); (iv) provide a qualitative evaluation of the advantages and disadvantages, of applying different management regimes in the small pelagic fisheries in the Adriatic Sea; and (v) provide the lower and upper bounds of F_{MSY} for the demersal stocks of the Western Mediterranean Sea.

Specifically the EWG was asked to:

ToR 1-1 Identify the stocks (species/area) driving demersal and small pelagic fisheries and rank them in order of priority. For this purpose, it should be consulted the list and criteria suggested in STECF 15-06, as well as the approach used in EWG 15-19 (i.e. landing Weight/Value) and/or any alternative methods such as Productivity and Susceptibility Analysis (PSA);

ToR 1.2 Discuss and identify the most appropriate assessment method (from fully analytical to less-data rich assessment) that can be undertaken for each stock or group of stocks, the scientific advice that can be provided by such assessment methods and the ideal assessment frequency. Particular attention should be given to those stocks where an assessment: (i) has never been done or; (ii) was made long time ago (i.e. more than 4 years) or; (iii) has serious data limitations;

ToR 1.3 To the extent possible, reconstruct time series of historical catch and effort data for the stocks of anchovy and sardine in the Aegean Sea (GSA 22 and 23).

ToR 2.1 Provide a qualitative evaluation of the advantages and disadvantages, from biological, social and economic viewpoints, of applying different management regimes in the small pelagic fisheries in the Adriatic Sea. The management regimes should include at least the following: (1) capacity limitations; (2) effort regime; (3) spatio-temporal closures; (4) technical measures relating to gear and; (5) catch-limitations. These measures should be considered individually as well as in combination.

ToR 2.2 Further develop the past STECF advice (STECF-15-14), indicating that small pelagic fisheries in the Mediterranean Sea could qualify for a TAC control system, based either on the classic MSY framework (F_{MSY} and B_{lim} and $B_{trigger}$ with HCRs) or on an escapement strategy. The advantages and disadvantages of both options should be provided.

ToR 3.1 Provide the lower and upper bounds of F_{MSY} for the stocks listed in table 6.2.2-110 of the EWG 16-05 report.

STECF observations

STECF notes that EWG 16-05 took place 20 to 24 June and the EWG had thus only one week to produce its report to the STECF. Given this tight timeline, the EWG was not in a position to provide a fully edited final report. Although this complicated the review process, STECF acknowledges that the EWG fully addressed the ToRs. STECF also notes that the main conclusions drafted in the version available for STECF are not going to be changed after the present review and are considered as final.

In relation to each of the Terms of Reference (ToRs), STECF notes the following:

ToR 1.1. - The analysis conducted by EWG 16-05 provides a ranking by species and GSA with the selection of 20 most important demersal stocks and the 10 small pelagics species for each GSA (or combination of GSAs). The ranking is based on two independent criteria: (i) a PSA (Productivity Susceptibility Analysis) as an expression of vulnerability by species equal in all GSAs and (ii) value of landings by GSA, as an expression of economic importance. The results of this ranking was examined by EWG 16-05 experts and considered in most cases to give an appropriate selection of species, but a number of other species considered important by the experts were not ranked high by the methodology, either because these species were not included in the PSA analysis or because they were not selected by the ranking process. These species were thus added *a posteriori* by the experts, because they were considered important for management purposes. The choice of equal weight between the two criteria is essentially arbitrary and made in the absence of alternative guidance to EWG 16-05. STECF notes that vulnerability of each species in the PSA is assumed to be the same for the entire Mediterranean Sea, while regional differences in growth rates, natural mortality and fishing operations clearly exists across the basin.

Such a combined approach aims to account for species that have a specific conservation requirement (e.g. elasmobranchs) in addition to the species that are commercially important. STECF notices that several of the elasmobranchs species included in the PSA are rarely caught in the Mediterranean.

While STECF acknowledges that some other methods might have highlighted a few other species as “sensitive”, it is unlikely that significantly different results would have been obtained in terms of the most important species. Additionally, the results of the PSA method were combined with expert knowledge, and STECF considers therefore that the results presented by the EWG are robust.

While STECF acknowledges that other methods (e.g. SAFE) may have selected fewer sensitive species compared to PSA, it is unlikely that significantly different results would have been obtained in terms of the most important species. PSA is though an established method used in other regions worldwide, and was selected by the EWG on the basis that initial work on Mediterranean stocks was already available from Osio et al. (2015). While STECF acknowledges that some other methods might have highlighted a few other species as “sensitive”, it is unlikely that significantly different results would have been obtained in terms of the most important species. Additionally, the results of the PSA method were combined with expert knowledge, and STECF considers therefore that the results presented by the EWG are robust. Indeed most of the priority fish stocks ranked by EWG 16-05 are those already considered a key species for the management of Mediterranean fisheries, confirming that the majority of the important species are already assessed, consistent with the outcomes of EWG 13-05 and EWG 14-08. A number of additional stocks have though appeared that have never been assessed.

ToR 1.2 - The EWG 16-05 combined the ranking with data availability and identified at least one appropriate stock assessment method to be used to determine stock status of a given species in each GSA. All results are available in tables in section 3.5 of the EWG report. Overall, the report identified 84 units (species by GSA) that can be assessed with analytical models (level 1) of which 28 would be new units not previously assessed. There are 77 units that could be evaluated by biomass/survey trends (levels 2 and 3). In addition to these there are 307 species by GSA that have been identified as potentially suitable for status indicators (level 4 and 5) of which 51 have potential for indicator developing over time (level 4). Of these 4 and 5 level units, 11 and 46 respectively have been identified in the report as higher priority to be examined for simple indices. There may be some scope for reduction of the number of units by combing GSAs.

This categorization of units might be considered as a good starting point for selection of stocks to be assessed and methods to be used. However, STECF notes that many of the species identified as level 4 and 5 are species rarely caught and for which even simple indicator based on survey would be difficult to develop.

The EWG 16-05 also examined the basis for frequency of assessment and has provided guidance on how this should be done, but the EWG 16-05 did not have sufficient resources to finalize a protocol for frequency of assessments. STECF suggests that the definition of stock assessment frequencies by species and GSA (or combination of GSAs) will be carried out during the following EWGs of Mediterranean stocks.

ToR 1.3 - The EWG 16-05 conducted a data revision/reconstruction of historical catch and effort data for the stocks of anchovy and sardine in the Aegean Sea (GSA 22 and 23), but it was only possible to cover the European fleets operating in GSA 22 and not the Turkish ones. EWG 16-05 considered that reported catches in GSA 23 are negligible. The revision cannot be completed for all years due to a lack of data for some years (2009-2012). Catch data are available from 1970-2014. Fleet capacity data in terms of number of vessels is thought to be acceptable from 1947, earlier data does not seem to be acceptable. Capacity data in terms of engine power is available from 1990. Considerable problems were encountered in replacing missing data for days at sea, thus a recent effort data series has not been obtained. The EWG 16-05 report contains a summary of data sources and a discussion of future possibilities and an excel file for data series is available from the JRC. In the absence of Turkish data, STECF notes that it is unclear to which extent this reconstructed time series can be of use for stock assessment.

ToR 2.1 – The EWG 16-05 addressed the ToR using a qualitative evaluation of the biological, social and economic aspects of different management approaches (see table in paragraph 6.2 of the EWG 16-05 report), which were identified and tabulated. STECF notes that only biologists participated at the meeting so the analysis should be revised with the contribution of social scientists and economists.

ToR 2.2 - The EWG 16-05 assessed the consequences of using either F_{MSY} or an escapement strategy if the management would be performed with TAC. The EWG considered that the consistency of the cohort estimation from the acoustic survey for anchovy and sardine has not yet been demonstrably resolved and issues remain. Until this is resolved, it is unlikely that advice for a biomass escapement strategy can be provided either through STECF or GFCM. Under these circumstances, STECF suggested that exploitation advice should be based on an F_{MSY} and MSY $B_{trigger}$ approach for the immediate future instead of a $B_{escapement}$ strategy.

The EWG 16-05 also suggested that there is potential for further improvement in the advice flow by following the data analysis/advice and management procedures used for Bay of Biscay anchovy which has a similar flow of data (an acoustic survey in September). For Bay of Biscay anchovy the advice and TAC setting procedure is based on assessment and forecast carried out in November following the survey in September (STECF, 2014). This is then used through a management procedure to give catch advice for the following calendar year January to December. While this approach uses the survey data from September it uses catch projections from July to December in the survey year. STECF agrees that the advice flow for the Adriatic small pelagic fish stocks should be improved. However, STECF notes that while comparable, there are some differences between the Bay of Biscay and the Adriatic that must be considered. In the Bay of Biscay the assessment of anchovy is based on three surveys (rather than only the MEDIAS survey in the Adriatic) which facilitate in-year assessment: A Daily Egg Production Method (DEPM); an independent acoustic survey carried out in May, during the peak of the spawning period; and an autumn acoustic survey (JUVENA) carried out in September/October to provide an index of recruitment for the next year. The timing of the JUVENA survey in the Bay of Biscay has been adjusted to match the spawning period of anchovy (April-mid July) and the growth pattern of young fish (the juveniles have to become big enough to be detected by the echo-sounders in autumn). In the Adriatic Sea, the spawning period of anchovy is long (April-November) with a peak in June/July, so the ability of MEDIAS to accurately reflect anchovy recruitment needs to be analysed further, also considering that the current timing of the MEDIAS survey differs between the eastern part of GSA17 where the survey is carried out in September, and the western part of GSA17 and the entire GSA18 where the survey is carried out in June/July. Notwithstanding, the MEDIAS survey in the Adriatic Sea could potentially be used to derive recruitment indices for the sardine stock. .

ToR 3.1 – This ToR was added during the first day of the meeting, and following a discussion it was decided that there were insufficient resources to carry out a full analysis for the requested stocks. Preliminary values for F_{lower} and F_{upper} have been supplied by EWG 16-05, based on a regression analysis and existing MSY target values. The F_{MSY} values are those from the stock assessment (REF EWGPLEN-15-03). The F_{lower} values can be used as initial values. The F_{upper} values are preliminary and have not yet been checked for precautionary considerations, and until this has been done, the values are not recommended for management use but are only provided as indicative values.

STECF conclusions

Regarding ToRs 1.1-1.2: Recent analyses conducted by STECF and GFCM has clearly demonstrated that more than 95% of the Mediterranean assessed stocks are exploited at level larger or much larger than F_{MSY} (STECF 2015; 2016; Colloca et al., 2013; Vasilakopoulos et al., 2014). There may be a general perception among stakeholders that more science is needed in the Mediterranean Sea before effective management actions can be implemented. STECF considers rather that the implementation of management measures aiming to reduce catches and decrease the level of fishing mortality exerted on the different stocks to be a high priority in the Mediterranean Sea, and these can be launched even when the biological knowledge and the status of stocks is uncertain. The lack of knowledge on the status of rare species does not affect the general perception of the Mediterranean fisheries and should not be used as an excuse to delay action. STECF notes also that some policies are already in place for monitoring and protecting vulnerable elasmobranchs in the Mediterranean Sea (e.g. 2009 EU Action Plan on sharks and GFCM Recommendation GFCM/36/2012/3 on conservation of sharks and rays).

STECF supports EWG considerations that trade-offs need to be made between the complexity of stock assessment methods and the number of stocks on which these can be applied. Complex assessment models allow a better knowledge at finer spatial and temporal scales and can also be used to quantify the technical interactions at fleet level and the biological interactions at ecosystem level. Complex models allow also better estimates of uncertainty when catch data are uncertain. The development of these methods and their application to Mediterranean fisheries should therefore be encouraged to the extent possible. Nevertheless, due to data limitations it is often not possible to perform analytical assessments for all stocks. This situation is similar to other regions, and a number of less robust "data-poor" assessment methods can be used for such stocks for deriving useful indicators of trends and thereby monitoring the impact of management actions across a wide range of species.

STECF acknowledges that both approaches (complex models and data-poor methods) are complementary and fulfill different needs, and the ongoing development of integrated assessment models in the Mediterranean Sea should be continued. STECF reiterates meanwhile that the limited number of stocks assessed with complex analytical assessments should not be used as reason to delay the implementation of immediate management actions.

STECF stresses the need of methodological working groups to conduct benchmark assessments of those key stocks which are driving the management plans in the different regions of the Mediterranean Sea.

STECF reiterates the strong need for a better coordination and full harmonization among the scientific bodies of FAO-GFCM and EU, in order to develop common approaches and make the best use of the human resources.

Regarding ToR 1.3, STECF acknowledges the reconstruction of time series of historical landing and effort data for Eastern Mediterranean stocks of sardine and anchovy, Nevertheless, STECF notes that in the absence of Turkish catch data, it is unclear to which extent this reconstructed time series can be of use for stock assessment.

Regarding ToR 2.2, the EWG examined possible management approaches and their impacts in terms of achieving the MSY targets of the CFP for small pelagic (sardine and anchovy) fisheries in the Adriatic (GSA17 and GSA18). STECF considers that the choice proposed by the EWG (F_{MSY}-based approaches instead of partial escapement strategies) is advisable given the long time lag between the conduction of the survey and the completion of the advice (over a year). STECF recommends that efforts should be done to reduce this time lag.

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REPORT TO THE STECF

EXPERT WORKING GROUP ON Methodology for the stock assessments in the Mediterranean Sea (EWG-16-05)

Ispra, Italy, 20-24 June 2016

EXECUTIVE summary

The EWG 16-05 meeting was held in JRC, ISPRA from 20-24 June. The work is summarised by ToR

ToR 1.1 Ranking of the importance of Mediterranean stocks

The EWG provides a ranking by species by GSA and the selected top 20 demersal stocks and around 10 pelagic stocks for each GSA. The ranking is based on two independent criteria, the Value of landings by GSA as an expression of economic importance, and PSA results as an expression of the vulnerability by species. A combined factor based on equal ranking of these two criteria was used to select the top 20 demersal and rank the 10 pelagic stocks. The results of this ranking was examined by experts and considered in most cases that they give an appropriate selection of stocks. Where the method did not include all stocks either because they had not been included in the PSA analysis or because the ranking was not considered to capture the importance a few additional stocks are noted. While the choice of equal Weight between the two types of ranking (landing Value and PSA) is somewhat arbitrary in the absence of alternative guidance equal Weight is the logical choice. The choice of ranking is in the end a management choice which can only be informed by science.

The coherence of this top ranked stock list with MS management plans is noted, only a few local stocks appear to be missed by the approach. The number of stocks is chosen to be 20 as this results in around 400 stocks for consideration out of a potential 6300 species GSA combinations. Managers could change (reduce) the number easily or the final decision can be made based on other management needs not considered here. It was noted in the EWG that some GSAs are already combined and there were some proposals for combining more, the EWG would like to continue this process. Overall the EWG was satisfied that this provided a basis for stock selection.

ToR 1.2 Type of assessment / indicator evaluation based on available data and priority.

The EWG has identified around 400 stocks by GSA based on priority (ToR 1.1) This information has been combined with and data availability by evaluation of the quantity but not the quality of data in the JRC DCF database. Based on availability of information, the priority of the stock as a driver for fisheries the potential type of assessment / indicator for management has been identified. This list is considered as a good starting point for selection of stocks requiring a full assessment and those for which a simple indicator of MSY status is considered appropriate. It should be noted that only when the evaluation identified is actually carried out will the quality of the data be fully evaluated an a final decision on assessment/indicator taken. While this list is a good starting point in the future a stock could be moved from one assessment status to another should the need occur. Overall this results in a potential 84 units (Species by GSA) with the potential to be assessed (level 1) of which 28 would be new units not previously assessed. There are 77 units that could be evaluated by biomass/survey trends (level 2 and 3) which could be assessed with simpler models. In addition to these there are 307 species by GSA that have been identified as potential suitable for status indicators (level 4 and 5) of which 51 have potential for indicator developing over time (level 4). Of these level 4 and 5 level units 11 and 46 respectively have been identified as higher priority to be examined for simple indices. From these units the data would need to be evaluated to look at a subset that should be monitored. It should be noted that there may be some scope for reduction by combing GSAs to give a single stock unit so these numbers may overestimate the number of units to be monitored.

There is some potential for combing some species (such as hake and mackerels) across GSA, this is noted where it is considered relevant.

The EWG also examined the basis for frequency of assessments and has provided guidance on how this should be considered, but the EWG did not have sufficient time/personnel resources to finalise a regime for frequency of assessment, this could be done relatively quickly once the list of assessments and indicators is finalised and the overall workload identified.

ToR 1.3 Time series of historical catch and effort data for the stocks of European anchovy and sardine in the Aegean Sea (GSA 22 and 23).

Data revision/reconstruction has been carried out as far as possible but cannot be completed for all years due to a lack of data for some years (2009-2012). Catch data are available from 1970-2014. Fleet capacity in terms of number of vessels is thought to be acceptable from 1947, earlier data does not seem to be acceptable. Capacity data in terms of engine power is available from 1990. Considerable problems were encountered in replacing missing data for days at sea, thus a recent effort data series has not been obtained. The WG report contains a summary of data sources and a discussion of future possibilities and an excel file for data series is available from the JRC.

ToR 2.1 Provide a qualitative evaluation of the advantages and disadvantages, of applying different management regimes in the small pelagic fisheries in the Adriatic Sea.

The EWG has provided a table commenting on the advantages and disadvantages of different options: capacity limitations; effort regime; spatio-temporal closures; technical measures relating to gear and; catch-limitations. In addition the EWG noted the type of information needed to implement such measures for the major regimes. This has been noted within economic considerations as the different approaches have cost (economic) differences.

The measures were also considered briefly in combination. It was noted that bringing capacity closer to catch/effort levels may be benificial in the longer term though full management by capacity alone is not recomended.

Tor 2.2 Comparison, of the classic MSY framework (FMSY and Blim and Btrigger with HCRs) and on an escapement strategy.

A brief description of the general needs and suitability of MSY/Bescapement is provided. The EWG concentrated its efforts documenting the specific issue of the regime suggested for Adriatic small pelagics as this appears to provide the best option of consideration of the issues, and it appeared that these stocks were a primary consideration. Similar considerations would be required stock by stock before implementing an escapement strategy.

For the Adriatic there remain some issues with age data for timeseries of catch and survey that can perturbed an assessment. The use of B escapement would imply changes to flow of information to recommendations for management. It is recommended for this stock that MSY recommendations are followed until the survey is improved and catch recommendations are sufficiently timely to be informative.

3.0 FMSY

This ToR was request on the first day of the meeting, and following a discussion it was decided that there were insufficient resources to carry out a full analysis for the requested stocks. Preliminary values for Flower and Fupper have been supplied based on a regression analysis and existing MSY target values. The Fmsy values are those already presented by STECF, the Flower values provide a reasonable approximation and can be used as initial values. The Fupper values are preliminary and have not yet been checked for precautionary considerations, and until this has been done the values are not recommended for use in management but are provided as indicative values.

1 INTRODUCTION: THE STRUCTURE OF THE MEETING AND REPORT

The meeting was held at JRC in Ispra. An initial plenary session commenced at 0900 on the first day. The ToRs were discussed and examined in detail.

The meeting was well attended by participants from most areas of the Mediteranean, however, there was no participation with knowledge of GSA areas 7 and 8 and rather limited input for the social and economic issues in ToR 2.1

Presentations were given on the ranking methods including PSA (ToR 1.1) and it was decided to examine together information on both Value of fisheries, and vulnerability of stocks, a subgroup identified additional species to be evaluated through PSA.

For ToR 1.2 Information on the current assessment methods used for the Mediterranean stocks had been assesmbled by JRC prior to the meeting. A presentation on the ICES approaches used for stocks with limited data and without full assessments was made and the possibilities discussed. A second subgroup carried out an evaluation data held in three DCF databases in the JRC in order to establish the available data by species by area.

For ToR 1.3 the task was allocated to the one participant with local knowledge.

ToR 2 was addressed by a third subgroup which considered both parts. The biological social and economic aspects of different management approaches were identified and tabulated (ToR 2.1). The MSY and B escapement strategies were considered in the context of information flow and quality. A comparison was made the management approach used for Bay of Biscay European anchovy, a stock with somewhat similar management issues to both European anchovy and to some extent sardine in the Adriatic.

The EWG received an additional preliminary ToR on the first day of the meeting (ToR 3.1) regarding MSY ranges for a number of Mediterranean stocks. A discussion of how the EWG might deal with this ToR was held in Plenary and it was considered that given the short notice and lack of opportunity to prepare for this ToR it would not be possible to carryout a full evaluation of MSY values and ranges. However, a regression method based on the ranges established for some ICES stocks was identified and it was considered that preliminary ranges could be estimated based on the previously evaluated values of FMSY. This analysis provides provisional values that are consistent with current FMSY values. However, the precautionary considerations have not been evaluated through the use of an MSE and the Fupper will need further evaluation before they can be considered precautionary. The Fmsy values previously advises by STECF and Flower derived from these can be considered acceptable. While there is no particular reason to be concerned with the Fupper values particularly if FMSY has been derived from F0.1 analysis have not been evaluated they should not be used to set exploitation rates without the necessary check. The results of the regression analysis are provided in the report.

The meeting operated in subgroups over Tuesday and Wednesday with plenary session daily to check on progress deal with any issues arising.

The report is organised by ToR, Sections 2,3,4 for ToR 1.1,1.2 and 1.3, Sections 5 and 6 for the two parts of ToR 2 and Section 7 for ToR 3

The draft reults for ToRs 1.3, 2.1, 2.2 and 3.1 were made available to all participants on Thursday and any resulting issues were resolved. Results for ToRs 1.1 were discussed on Thursday and once these had been fed into ToR 1.2 these were discussed in draft on Friday. General agreement was reach for ToR 1.1 and for 1.2 demersals however some issues were remained consercing the choice of indicators for some pelagiuc stocks. This was not completed due to time issues in the meeting.

1.1 TERMS OF REFERENCES:

The EWG 16-05 is requested to:

PART 1 – Methodology for stock assessments

1.1. Identify the stocks (species/area) driving demersal and small pelagic fisheries and rank them in order of priority. For this purpose, it should be consulted the list and criteria suggested in STECF 15-06, as well as the approach used in EWG 15-19 (i.e. landing Weight/Value) and/or any alternative methods such as Productivity and Susceptibility Analysis (PSA);

1.2. Discuss and identify the most appropriate assessment method (from fully analytical to less-data rich assessment) that can be undertaken for each stock or group of stocks, the scientific advice that can be provided by such assessment methods and the ideal assessment frequency. Particular attention should be given to those stocks where an assessment: (i) has never been done or; (ii) was made long time ago (i.e. more than 4 years) or; (iii) has serious data limitations;

1.3. To the extent possible, reconstruct time series of historical catch and effort data for the stocks of European anchovy and sardine in the Aegean Sea (GSA 22 and 23).

PART 2 – Small Pelagic Fisheries in the Adriatic Sea

2.1. Provide a qualitative evaluation of the **advantages and disadvantages, from biological, social and economic viewpoints, of applying different management regimes in the small pelagic fisheries in the Adriatic Sea**.

The management regimes should include at least the following: (1) capacity limitations; (2) effort regime; (3) spatio-temporal closures; (4) technical measures relating to gear and; (5) catch-limitations. These measures should be considered individually as well as in combination.

2.2. Further develop the past STECF advice (STECF-15-14), indicating that small pelagic fisheries in the Mediterranean Sea could qualify for a TAC control system, based either on the classic MSY framework (FMSY and Blim and Btrigger with HCRs) or on an escapement strategy. The advantages and disadvantages of both options should be provided.

PART 3 – Multiannual plan for demersal fisheries in the Western Mediterranean Sea

3.1. Provide the lower and upper bounds of Fmsy for the following stocks:

GSA	Scientific name	Ref year	Fcurr	Fmsy	F/FMSY	REPORT	Year of Advice
1	*Lophius budegassa*	2013	0,25	0,16	1,56	STECF 15-06 (Assessment of Mediterranean Sea stocks - Part II)	2014
1	*Mullus barbatus*	2013	1,31	0,27	4,85	STECF 15-06 (Assessment of Mediterranean Sea stocks - Part II)	2014
1	*Parapenaeus longirostris*	2012	0,43	0,26	1,65	STECF 13-22 (2013 Assessment of Mediterranean Sea stocks part I)	2013
5	*Lophius budegassa*	2013	0,84	0,08	10,50	STECF 15-06 (Assessment of Mediterranean Sea stocks - Part II)	2014
5	*Mullus barbatus*	2012	0,93	0,14	6,64	STECF 14-08 (2013 Assessment of Mediterranean Sea stocks part II)	2013
5	*Nephrops norvegicus*	2013	0,29	0,17	1,71	STECF 15-06 (Assessment of Mediterranean Sea stocks - Part II)	2014
5	*Parapenaeus longirostris*	2012	0,77	0,62	1,24	STECF 13-22 (2013 Assessment of Mediterranean Sea stocks part I)	2013
6	*Lophius budegassa*	2013	0,91	0,14	6,50	STECF 15-06 (Assessment of Mediterranean Sea stocks - Part II)	2014
6	*Micromesistius poutassou*	2013	1,52	0,16	9,50	STECF 14-17 (Assessment of Mediterranean Sea stocks - Part I)	2014
6	*Mullus barbatus*	2013	1,47	0,45	3,27	STECF 14-17 (Assessment of Mediterranean Sea stocks - Part I)	2014
6	*Nephrops norvegicus*	2013	0,59	0,15	3,93	STECF 14-17 (Assessment of Mediterranean Sea stocks - Part I)	2014
6	*Parapenaeus longirostris*	2012	1,40	0,27	5,18	STECF 13-22 (2013 Assessment of Mediterranean Sea stocks part I)	2013
7	*Lophius budegassa*	2011	0,97	0,29	3,34	STECF 12-19 (Assessment of Mediterranean Sea stocks part I)	2012
7	*Mullus barbatus*	2013	0,45	0,14	3,21	STECF 14-17 (Assessment of Mediterranean Sea stocks - Part I)	2014
9	*Mullus barbatus*	2013	0,70	0,60	1,17	STECF 14-17 (Assessment of Mediterranean Sea stocks - Part I)	2014
9	*Nephrops norvegicus*	2013	0,43	0,21	2,05	STECF 14-17 (Assessment of Mediterranean Sea stocks - Part I)	2014
9	*Parapenaeus longirostris*	2013	0,69	0,71	0,97	STECF 15-06 (Assessment of Mediterranean Sea stocks - Part II)	2014
11	*Mullus barbatus*	2012	1,07	0,11	9,73	STECF 14-08 (2013 Assessment of Mediterranean Sea stocks part II)	2013

2 RANKING OF STOCKS

Tor 1.1: Identify the stocks (species/area) driving demersal and small pelagic fisheries and rank them in order of priority. For this purpose, it should be consulted the list and criteria suggested in STECF 15-06, as well as the approach used in EWG 15-19 (*i.e.* landing Weight/Value) and/or any alternative methods such as Productivity and Susceptibility Analysis (PSA);

2.1 General Approach

Different criteria have been used in the past years by the STECF EWGs to define lists of priority species/areas for stock assessment. STECF EWG 14-19, in proposing a sampling frame for Mediterreanan EU stocks, used a combination of a ranking by landings Weight/ Value and priority species lists of GFCM. The derived list covered approximately 80 % of the landings.

STECF EWG 15-19, in the context of the Landing Obligation implementation, estimated the cumulative percentage in terms of Value of landings accounts for 75 % by area and metier.

Both these approaches focused on the Value of landings to identify important species and this is of course an important aspect that needs to be considered in respect of where to focus resources for stock assessment and management. However, by focusing on landings Value, two underlying assumptions are made:

- By using recent Value of landings it is assumed that what is present is what is important. There is no consideration on stocks that could have been important in the past and had collapsed.
- By using only Value of landings it is implicitly decided that stocks with low Value or low landings can be neglected.

In a recent paper, Osio *et al.* (2015 proposed a novel method for ranking stocks for scientific advice and data collection. The authors proposed a combined index composed of two established methods: the Value of landings and the relative vulnerability of the species (Productivity and Susceptibility Analysis : PSA). This approach was applied to Mediterranean demersal species caught in a trawl fishery and aimed at balancing the relative importance of landings Value with a combination of life history traits and susceptibility of the species.

This novel approach was presented and discussed in EWG 16-05 and the group agreed that it was worth pursuing a similar approach with some refinements and expansions.

The first step taken in this EWG was to expand the demersal trawl Productivity and Susceptibility Analysis (PSA) to also crustacean and cephalopods in the trawl PSA and create a new PSA for the pelagic purse seine fishery.

The ranking of the species was built using Vulnerability scores derived from a general PSA applied across EU MED GSAs (Figure 2.1.1) while the Value of landings was GSA specific.

The ranking index was derived in a different way than in the Osio *et al.* (2015) to give equal Weight to the two index components. Equal Weight was selected as the most appropriate method as there was no scientific bases for preferring one criteria over another. Such a choice could be made by managers. However, sensitivity to small changes in weighting are unlikely to change the general composion of the highest ranked stocks (See section below).

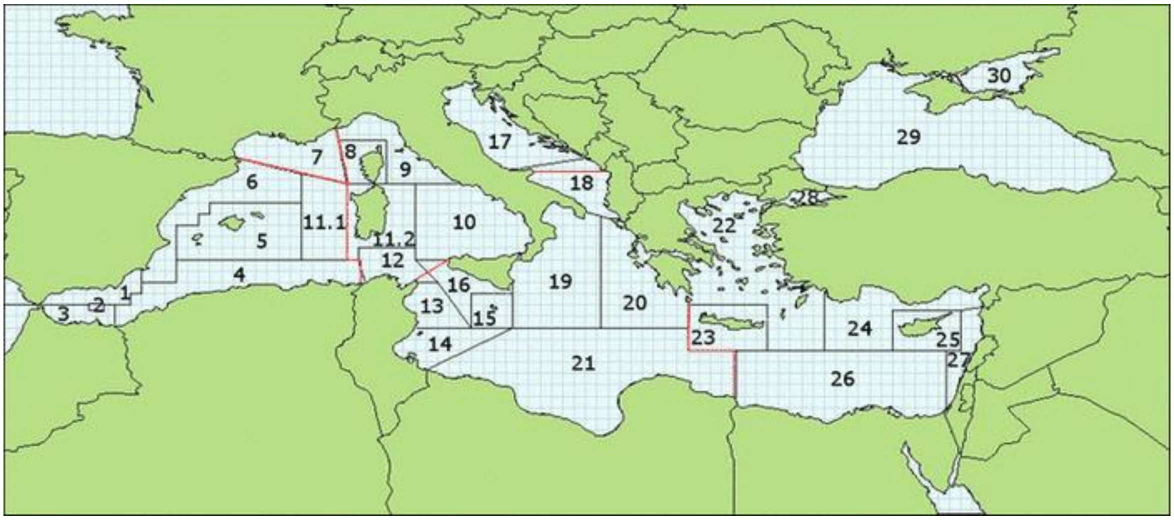


Figure 2.1 GFCM areas

1	Northern Alboran Sea	9	Ligurian Sea and North Tyrrhenian Sea	16	Southern Sicily	24	Northern Levant Sea
2	Alboran Island	10	Southern and Central Tyrrhenian Sea	17	Northern Adriatic	25	Cyprus
3	Southern Alboran Sea	11.1	Western Sardinia	18	Southern Adriatic Sea	26	Southern Levant Sea
4	Algeria	11.2	Eastern Sardinia	19	Western Ionian Sea	27	Eastern Levant Sea
5	Balearic Island	12	Northern Tunisia	20	Eastern Ionian Sea	28	Marmara Sea
6	Northern Spain	13	Gulf of Hammamet	21	Southern Ionian Sea	29	Black Sea
7	Gulf of Lion	14	Gulf of Gabes	22	Aegean Sea	30	Azov Sea
8	Corsica	15	Malta	23	Crete		

2.1.1 Description of Productivity and Susceptibility Analysis (PSA)

The EWG 16-05 performed two PSA analyses, at the Mediterranean scale. The article by Osio *et al.* (2015), where the vulnerability of Mediterranean demersal fish species was assessed in relation to the bottom trawl fishery, was taken as reference. Crustaceans and cephalopod species were added to those used by Osio *et al.* (2015). A PSA to assess the vulnerability of small pelagic fishes in relation to purse seine fishery was performed as well. The species selection was done based on experts' knowledge. The species that were included in the PSAs were the following:

i) small pelagics: *Engraulis encrasicolus, Sardina pilchardus, Sprattus sprattus, Sardinella aurita, Scomber scombrus, Scomber colias, Trachurus trachurus, Trachurus mediterraneus, Belone belone, Boops boops;*

ii) crustaceans: *Nephrops norvegicus, Parapenaeus longirostris, Aristaeomorpha foliacea, Aristeus antennatus, Squilla mantis, Penaeus kerathurus, Maja squinado, Scyllarides latus, Palinurus elephas, Homarus gammarus, Palinurus mauritanicus;*

iii) cephalopods: *Eledone cirrhosa, Eledone moschata, Loligo vulgaris, Loligo forbesi, Illex coindetti, Sepia officinalis, Octopus vulgaris, Todaropsis eblanae, Todarodes sagitatus, Alloteuthis media.*

All the input files and results for the 2 PSA are available in Appendix 2 of this report.

2.1.2 PSA method

The vulnerability of a stock is directly related to overfishing and is defined as a function of its productivity and susceptibility. The values for the two factors, productivity and susceptibility, are determined by providing a score ranging from 1 to 3 for a standardized set of attributes. The information necessary to rank the productivity and susceptibility attributes was collected from the published literature, available stock assessments in STECF EWG and GFCM stock assessment working groups, EU Annual Economic Report and online databases (for example: Fishbase, SeaLifeBase, IUCN). Where data was not available the group decided based on expert opinion and respecting a precautionary approach.

Once assigned, the scores are averaged for each factor and graphically displayed on an x–y scatter plot. We used averaged scores since this method is used more often than the multiplicative approach and avoids the tendency to underestimate vulnerability. The overall vulnerability score of a stock is calculated as:

$$Vulnerability = \sqrt{(susceptibility - 1)^2 + (3 - productivity - 1)^2}$$

which is the distance from the origin of the PSA plot to the data point. Stocks that received a low productivity score and a high susceptibility score are considered to be the most vulnerable to overfishing, while stocks with a high productivity score and low susceptibility score are considered to be the least vulnerable (Patrick et al., 2009).

The productivity and susceptibility from the PSA in Osio et al 2015, were plotted in relation to the IUCN criteria for Red List classification and there was a very good correspondence (Figure 2.1.2.1) indication the utility of this approach for identifying vulnerable species that require closer attention in the area.

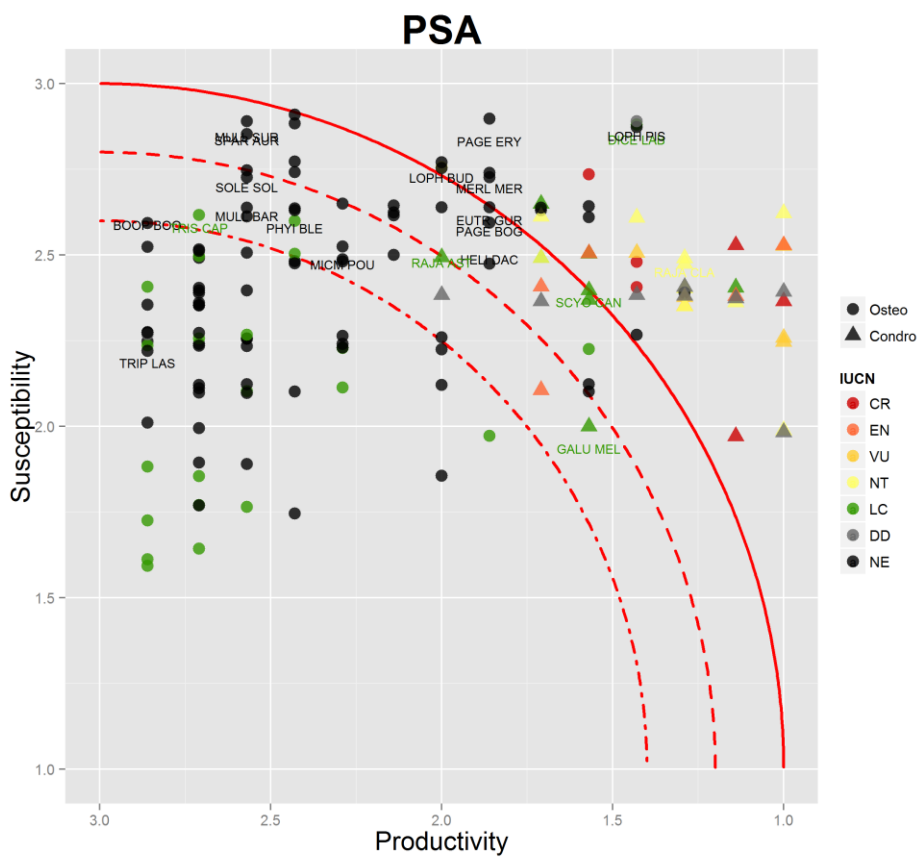


Figure 2.1.2.1 Productivity and Susceptibility analysis for Mediterranean Demersal stocks subject to trawling, according to the expert knowledge scoring of PSA attributes following Cope *et al.* (2011). All species in relation to IUCN red list classification (colours) where the symbols represent groups of species circles = Osteichthyes (Bony fish), triangles= Chondrichthyes (Cartilagineous fish), from Osio *et al.* 2015.

2.1.2.1 PSA for Demersal Species

The productivity and susceptibility attributes used in the demersal PSA are presented in Table 2.1.2.1.

Table 2.1.2.1. Definition of productivity and susceptibility attributes used in the demersal community interacting with the bottom trawl fishery PSA analysis.

Productivity attributes	High (3)	Moderate (2)	Low (1)
Maximum age	<10 years	10-30 years	>30 years
Maximum size	<60 cm	60-150 cm	>150 cm
Von Bertalanffy growth coefficient (k)	>0.25	0.15-0.25	<0.15

Estimated M	>0.40	0.20-0.40	<0.20
Measured fecundity	>10e4	10e2 – 10e4	<10e2
Age at maturity	< 2 years	2-4 years	>4 years
Mean trophic level	<2.5	2.5-3.5	>3.5
Susceptibility attributes	**Low (1)**	**Moderate (2)**	**High (3)**
Areal overlap	Stock is distributed mainly in the Southern part of the Mediterranean Sea.	Stock is distributed in the whole Mediterranean Sea.	Stock is distributed mainly in the Northern part of the Mediterranean Sea.
Vertical overlap	<25% of stock occurs in the depths fished.	Between 25% and 50% of the stock occurs in the depths fished.	>50% of stock occurs in the depths fished.
Morphology affecting capture	Lmat<mesh size; Lmax over 5 m	Lmat 1-2 times mesh size; Lmax 4-5 m	Lmat >2 times mesh size
Desirability/Value of the fishery	No market for the species.	Species mean price per Kg < mean price per Kg of all fishes.	Species mean price per Kg > mean price per Kg of all fishes.
Management strategy	Targeted stocks have catch limits and proactive accountability measures; non-target stocks are closely monitored.	Targeted stocks have catch limits and reactive accountability measures.	Targeted stocks do not have catch limits or accountability measures; non-target stocks are not closely monitored.
Fishing rate relative to M	<0.5	0.5-1.0	>1
Survival after capture and release	Probability of survival >67%.	Probability of survival between 33% and 67%.	Probability of survival <33%.

The results of the PSA of 172 demersal species in relation to the bottom trawl fishery are presented in Figures 2.1.2.2 and 2.1.2.3

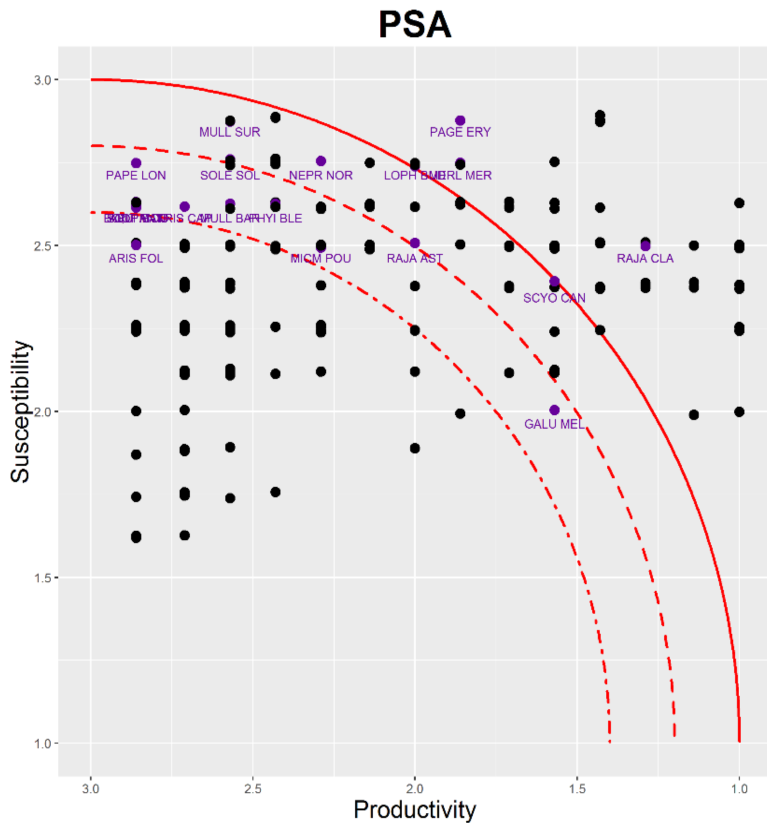


Figure 2.1.2.2 Productivity and Susceptibility analyses on the demersal species in relation to the Mediterranean bottom trawl fishery. In purple the code names of species that have been assessed at least in one Mediterranean GSA.

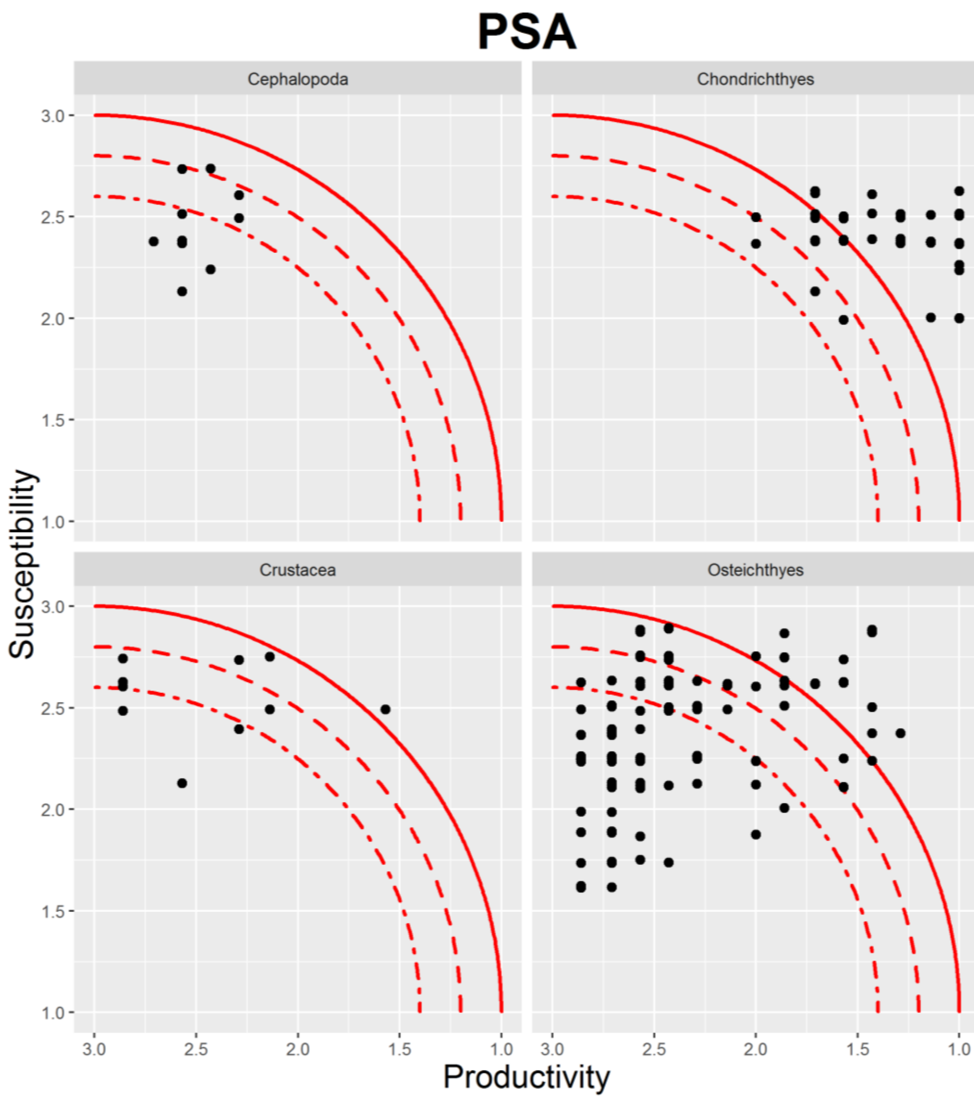


Figure 2.1.2.3 Productivity and Susceptibility analyses on the demersal species in relation to the Mediterranean bottom trawl fishery. A separate panel was made to separate the results for Crustacea (shrimps and lobsters), Cephalopoda (octopuses, squids, cuttle fish), Chondrichtyes (sharks and rays) and Osteichtyes (bony fishes).

The results presented here (Figure 2.1.2.3) show a distinct pattern of productivity and susceptibility by group. Cephalopods (octopuses, squids, cuttle fish), scored in the high susceptibility and high productivity, which places most of them in a moderate risk of overexploitation. Chondrichtyes (sharks and rays) mostly fall in the area of low productivity and high susceptibility, which corresponds to the area of higher risk. Crustaceans (shrimps and lobsters) scored on a wide range of productivity and relatively narrow susceptibility, this placing themselves in an intermediate area of risk. (bony fishes) have a wide range of vulnerability with several being in the area of high risk of overfishing.

2.1.2.2 PSA for Small Pelagic Species

In table 2.1.2.2 the productivity and susceptibility attributes used in the small pelagics PSA are presented.

Table 2.1.2.2 Definition of productivity and susceptibility attributes used in the small pelagic fish purse seine fishery PSA analysis.

Productivity attributes	High (3)	Moderate (2)	Low (1)
Maximum age	<4 years	4-8 years	>8 years
Maximum size	<25 cm	25-50 cm	>50 cm
Von Bertalanffy growth coefficient (k)	>0.25	0.15-0.25	<0.15
Estimated M	>0.5	0.5-0.3	<0.3
Age at maturity	< 1 years	1-2 years	>2 years
Mean trophic level	<2.5	2.5-3.5	>3.5
Susceptibility attributes	**Low (1)**	**Moderate (2)**	**High (3)**
Areal overlap	Stock is distributed mainly in the Southern part of the Mediterranean Sea.	Stock is distributed throughout the Mediterranean Sea.	Stock is distributed mainly in the Northern part of the Mediterranean Sea.
Desirability/ Value of the fishery	No market for the species.	Species mean price per Kg < mean price per Kg of all fishes.	Species mean price per Kg > mean price per Kg of all fishes.
Management strategy	Targeted stocks are regularly assessed. Minimum landing size is defined.	Targeted stocks are not regularly assessed. Minimum landing size is defined.	Targeted stocks are not regularly assessed. No minimum landing size is defined.
Fishing rate relative to M	<0.5	0.5-1.0	>1
Survival after capture	No survival expected.	Moderate probability of	High probability of survival.

and release		survival.	
Seasonal migration	Seasonal migrations decrease overlap with the fishery.	Seasonal migrations do not substantially affect the overlap with the fishery.	Seasonal migrations increase overlap with the fishery.
Schooling behaviour	Behavioural responses decrease the catchability of the gear.	Behavioural responses do not substantially affect the catchability of the gear.	Behavioural responses increase the catchability of the gear.

The results of the PSA of ten small pelagic species in relation to the purse seine fishery are presented in Figure 2.1.2.4.

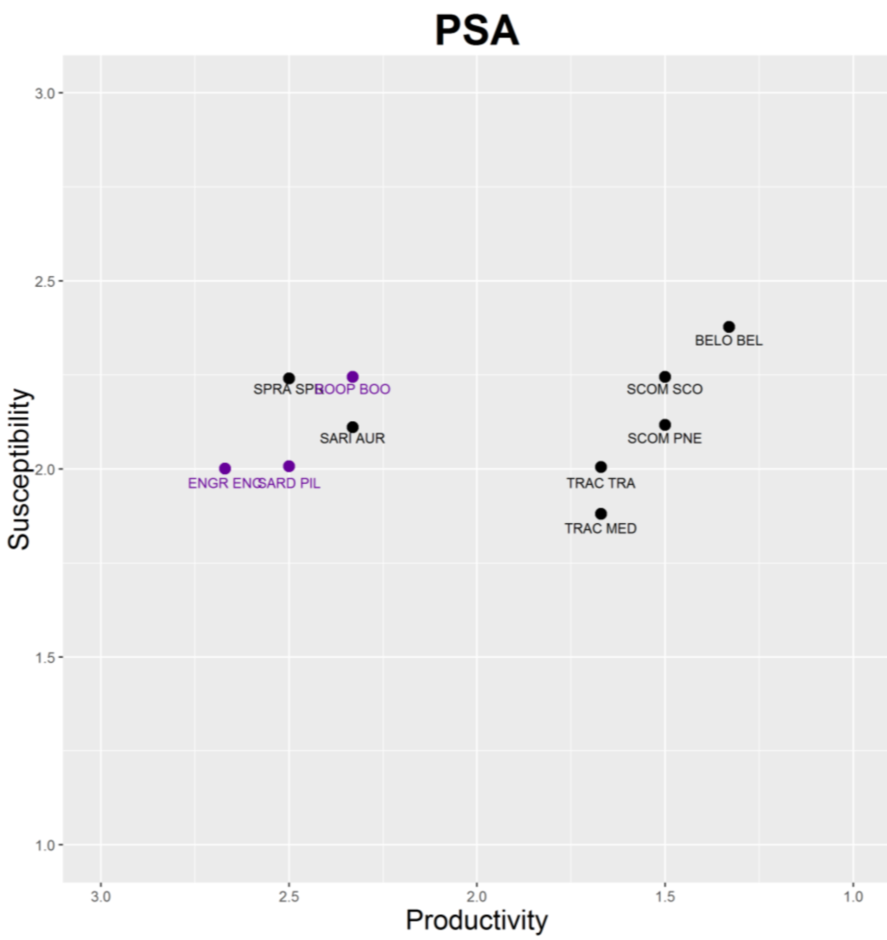


Figure 2.1.2.4 Productivity and Susceptibility analyses on the small pelagic fishes in relation to the Mediterranean purse seine fishery. In purple the species that have been assessed at least in one Mediterranean GSA.

The results show limited differences in terms of susceptibility scores between the species (range between 1.88 and 2.38) while the main differences can be seen in the productivity scores (range between 1.33 and 2.67). The latter in practice separate the species. *Belone belone* (garfish) appears as the most vulnerable species.

2.1.3 Ranking of Value of landings

Landings Value by species and GSA was taken from the DCF Transversal Data collected under the Data Call. This choice was due to a more complete coverage of species landings than in the MED DCF Biological Data landings/catches. Additionally data on Value of landings is available only in the transversal .

The dataset was subset for FAO area 37. Data coming from Bulgaria, Romania and Portugal were removed. Final areal coverage is for GSA 1, 5, 6, 7, 8, 9, 10, 11, 15, 16, 17, 18, 19, 20, 22, 23 and 25, by year and gear (except for Spain). The variables retained were Value of Landings and Live Weight of Landings. To get a recent representation of landings Value, only years ranging from 2012 to 2015 were retained. The Value of landings and live Weight by species and GSA were summed over vessel length and gear by year and then averaged across years.

2.1.4 Relative weighting of Value of landings and vulnerabiltity

The table with the mean Value of landings and live Weight by species and GSA was combined with the table containing the vulnerability scores derived from the Demersal and Pelagic PSA. The vulnerability scores are the same across GSAs.

The process retained only the species that were present in both tables. Thus the demersal PSA + transversal landing Value contains the species available in both tables by GSA (170 species) and pelagic PSA + transversal landings contains the selected 10 species. This implies that if a species is important for example in only a trap fishery, not having its vulnerability score, means that it can’t be in the final rankings. This would be the case of Transparent goby (*Aphia minuta*) for example which has a particular coastal fishery not covered by the demersal trawl PSA. Such situations are included in the evaluations by GSA is section 3.

There is no agreed method for combining Value and vulnerability scores to derive a combined ranking. A multiplicative combination (ranking variable = Value x vulnerability) used by Osio *et al.* (2015) results in a proportional equal rank curve over Value and vulnerability. Also the relative importance of the two criteria cannot be changed but is based on the combination of very different ranges of the PSA score and landing Value. Overall the multiplicative ranking variable forms a nonlinear ranking surface over Value and vulnerability. Use of an additive combination (ranking variable = scaled landings Value + scaled vulnerability) results in linear equal ranking lines over Value and vulnerability. An additive linear ranking was thus considered easier to interpret providing a linear ranking increase over both vulnerability and Value. This method can also be used to emphasise one criteria over the other should managers have a specific option in mind.

To create a ranking index giving equal Weight to the mean Value of landings and vulnerability, both these variables were standardized by dividing each by its Standard Deviation across species within GSA. The standardized indexes were then summed by GSA and ordered in decreasing order to explore the 20 top ranking species.

$$rank = \frac{mean\left(value\ landings_{year}\right)_{species,gsa}}{SD\ \left(mean\left(value\ landings_{year}\right)_{species,gsa}\right)} + \frac{vulnerability_{species,gsa}\left[value\ landings_{species}\ \neq Null\right]}{SD\ (vulnerability_{species,gsa}\left[value\ landings_{species}\ \neq Null\right])}$$

2.1.5 Cross checking Species with Management Plans and expert validation

The Commission representative provided the EWG with a list of species by GSA that are contained in MS management plans (Table 2.1.3)

Table 2.1.3 Species under Proposed National Management Plans (Provided by the European Commission).

MS	FISHING GEAR	GSA	Target species
Croatia	Trawler	GSA 17	Hake (*Merluccius merluccius*), Red mullet (*Mullus barbatus*), Octopus (O*ctopus* spp.), Norway lobster (*Nephrops norvegicus*)
Croatia	Purse seiner	GSA 17	European anchovy (*Engraulis encrasicolus*), Sardina (*Sardina pilchardus*)
Cyprus	Trawler	GSA 25	Red mullet (*Mullus barbatus*), Surmullet (*Mullus surmuletus*), Bogue (*Boops boops*), Common pandora (*Pagellus erythrinus*), Picarel (*Spicara smaris*)
Greece	Trawler	GSAs 20-22-23	Hake (*Merluccius merluccius*), Red mullet (*Mullus barbatus*), Surmullet (*Mullus surmuletus*), Deep water rose shrimp (*Parapenaeus longirostris*), Picarel (*Spicara smaris*)
France	Trawler	GSA 07	Hake (*Merluccius merluccius*)
France	Mechanised dredges	GSA 07	Murex droit épine (*Bolinus brandaris*), moule d'Europe (*Mytilus galloprovincialis*)
France	Gangui	GSA 07	*Scorpaena porcus, Serranus scriba, Serrranus cabrilla, Symphodus tinca, Symphodus rostratus*

France	Beach seines	GSA 07	Salema (*Sarpa salpa*), Greater amberjack (*Seriola dumerili*), Sand smelt (Atherina spp.), Sardine (Sardina pilchardus)
Greece	Purse seiners	GSAs 20, 22	European anchovy (Engraulis encrasicolus), Sardina (Sardina pilchardus)
France	Purse seiners	GSA 07	European anchovy (Engraulis encrasicolus), Sardina (Sardina pilchardus)
Italy	Pelagic - Trawlers and purse seiners	GSA 09	European anchovy (Engraulis encrasicolus), Sardina (Sardina pilchardus)
Italy	Pelagic - Trawlers and purse seiners	GSA 10	
Italy	Pelagic - Trawlers and purse seiners	GSA 16	
Italy	Pelagic - Trawlers and purse seiners	GSAs 17-18	
Italy	Demersal trawler	GSA 09	Hake (*Merluccius merluccius*), Red mullet (*Mullus barbatus*), Deep-water rose shrimp (*Parapenaeus longirostris*)
Italy	Demersal trawler	GSA 10	
Italy	Demersal trawler	GSA 11	
Italy	Demersal trawler	GSA 17	Hake (*Merluccius merluccius*), Red mullet (*Mullus barbatus*), Norway lobster (*Nephrops norvegicus*)
Italy	Demersal trawler	GSA 18	
Italy	Demersal trawler	GSA 19	Hake (*Merluccius merluccius*), Red mullet (*Mullus barbatus*), Deep-water rose shrimp (*Parapenaeus longirostris*)
Italy	Demersal trawler < 18 m	GSA 16	
Italy	Demersal trawler > 18 m	GSA 16	
Italy	Boat seine	GSA 09	Transparent goby (*Aphia minuta*)
Italy	Dredges	GSA 17	Venus clam (*Chamellea gallina*)
Malta	Trawler	GSA 15	Giant red shrimp (*Aristeomorpha foliacea*), Red Mullet (*Mullus* spp.), Deep-water rose shrimp (*Parapenaeus longirostris*)
Malta	Surrounding nets (Lampuki FAD + Lampara)	GSA 15	Dolphinfish (*Coryphaena hippurus*), Mackerel (*Scomber japonicus*), Round Sardinella (*Sardinella aurita*)
Slovenia	Trawler	GSA 17	Whiting (*Merlangius merlangus*), Musky octopus (*Eledone moschata*), Cuttlefish (*Sepia officinalis*), European squid (*Loligo vulgaris*), Picarel (*Spicara flexuosa*)
Slovenia	Purse seiner	GSA 17	European anchovy (*Engraulis encrasicolus*), Sardine (*Sardina pilchardus*), Grey mullet (*Mugilidae*)

Spain	Trawler	GSAs 1-5-6-7	*Merluccius merluccius, Mullus barbatus, Mullus surmuletus, Aristeus antennatus, Parapenaeus longirostris, Nephrops norvegicus*
Spain	Purse seiner	GSAs 1-5-6	European anchovy (*Engraulis encrasicolus*), Sardina (*Sardina pilchardus*)
Spain	Boat seine (Murcia)	GSA 01	Transparent goby (*Aphia minuta*)
Spain	Boat seine (Baleares)	GSA 05	Transparent goby (*Aphia minuta*), Ferrer's goby (*Pseudaphya ferreri*), and Picarel (*Spicara smaris*)
Spain	Boat seine (Catalonia)	GSA 06	Sand eel (*Gymnammodytes cicerelus* and *G. semisquamatus*), Goby (*Aphia minuta*, *Crystalogobius linearis*)
Spain	Mechanised dredges (Andalusia)	GSA 01	Venus clam (*Chamellea gallina*), Wedge shell (*Donax trunculus*), Hard clam (*Callista chione*), Tuberculate cockle (*Acanthocardia tuberculata*)
Spain	Mechanised dredges (Valencia)	GSA 06	Venus clam (*Chamellea gallina*), Wedge shell (*Donax trunculus*)
Spain	Mechanised dredges (Catalonia)	GSA 06	Venus clam (*Chamellea gallina*), Wedge shell (*Donax trunculus*), Hard clam (*Callista chione)*

2.2 Rankings By GFCM area

2.2.1 Ranking GFCM area 1, 5, 6 ,7

Generally, the 20 top ranking species included many of the main fishing target species in each area, while a few important fishing targets were not in this group, because of their high productivity or relatively low susceptibility. In addition elasmobranch species (sharks and rays) appeared in the high positions, although landings are practically nil. This is because of the very high vulnerability of these species. Indeed, there is a general lack of knowledge on the status of these species. The ranking results are given below by GSA.

2.2.1.1 Results for Demersal Species GSAs 1,5,6 and 7

The target species of the MS Spanish trawler management plan are *Merluccius merluccius*, *Mullus barbatus*, *Mullus surmuletus*, *Aristeus antennatus*, *Parapenaeus longirostris*, *Nephrops norvegicus, all included in the priotity tables for the GSAs where the landings are highest.*

GSA1

Table 2.2.1.1-1 showes the ranking for demersal species in GSA 1

Target species of management plans which are not in the main trawl fisheries, not included in the PSA, are the following:

Mechanised dredges (Andalusia)- Venus clam (*Chamellea gallina*), Wedge shell (D*onax trunculus*), Hard clam (*Callista chione*), Tuberculate cockle (*Acanthocardia tuberculata*)

Boat seine (Murcia)- Transparent goby (*Aphia minuta*)

Table 2.2.1.1-1 First 20 priority demersal species in GSA 1 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vulne	Vuln index	Value index	rank
Blue and red shrimp	*Aristeus antennatus*	1.63	5044233	185843.1	769214.1	0.337	4.833	6.558	11.391
Common octopus	*Octopus vulgaris*	1.37	5185070	1204068	769214.1	0.337	4.062	6.741	10.803
Blackspot(=red) seabream	*Pagellus bogaraveo*	1.99	2169235	172574.3	769214.1	0.337	5.900	2.820	8.721
European hake	*Merluccius merluccius*	2.09	1833095	295081.9	769214.1	0.337	6.197	2.383	8.580
Angler(=Monk)	*Lophius piscatorius*	2.45	449205.3	80251.74	769214.1	0.337	7.264	0.584	7.848
Kitefin shark	*Dalatias licha*	2.58	463.625	164.8	769214.1	0.337	7.650	0.001	7.650
Gulper shark	*Centrophorus granulosus*	2.5	7466.777	5108.433	769214.1	0.337	7.413	0.010	7.422
Deep-water rose shrimp	*Parapenaeus longirostris*	1.76	1648620	113839.7	769214.1	0.337	5.218	2.143	7.362
European seabass	*Dicentrarchus labrax*	2.45	37299.43	2640.46	769214.1	0.337	7.264	0.048	7.313
Wreckfish	*Polyprion americanus*	2.45	11796.31	749.0633	769214.1	0.337	7.264	0.015	7.280
Picked dogfish	*Squalus acanthias*	2.36	21.31	5.35	769214.1	0.337	6.998	0.000	6.998
Marbled electric ray	*Torpedo marmorata*	2.31	288.4967	270.4733	769214.1	0.337	6.849	0.000	6.850
Sharpnose sevengill shark	*Heptranchias perlo*	2.31	184.8333	90.35	769214.1	0.337	6.849	0.000	6.850
Common pandora	*Pagellus erythrinus*	2.2	242096.9	71937.84	769214.1	0.337	6.523	0.315	6.838
Longnosed skate	*Raja oxyrinchus*	2.28	144.5567	72.97667	769214.1	0.337	6.760	0.000	6.760
Thornback ray	*Raja clavata*	2.28	27.9	17.575	769214.1	0.337	6.760	0.000	6.760
Bluntnose sixgill shark	*Hexanchus griseus*	2.24	45.29	75.63	769214.1	0.337	6.642	0.000	6.642
European conger	*Conger conger*	2.2	20704.69	13274.85	769214.1	0.337	6.523	0.027	6.550
Smooth-hound	*Mustelus mustelus*	2.2	4690.41	1374.69	769214.1	0.337	6.523	0.006	6.529
Red scorpionfish	*Scorpaena scrofa*	2.16	94598.92	5951.677	769214.1	0.337	6.405	0.123	6.527

GSA5

Table 2.2.1.1-2 shows the top 20 ranked demersal species for GSA5

Target species of management plans other than trawl, not included in the PSA, are the following:

Boat seine (Baleares)- Transparent goby (*Aphia minuta*), Ferrer's goby (*Pseudaphya ferreri*), and Picarel (*Spicara smaris*)

Table 2.2.1.1-2 **First 20 priority demersal species in GSA 5 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).**

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vulne	Vuln index	Value index	rank
Blue and red shrimp	*Aristeus antennatus*	1.63	4062075	152572.2	482585.6	0.332	4.908	8.417	13.326
Red scorpionfish	*Scorpaena scrofa*	2.16	960875.2	60386.09	482585.6	0.332	6.504	1.991	8.495
Angler(=Monk)	*Lophius piscatorius*	2.45	196125.3	35022.4	482585.6	0.332	7.378	0.406	7.784
Gulper shark	*Centrophorus granulosus*	2.5	330.4333	236.1667	482585.6	0.332	7.528	0.001	7.529
Common spiny lobster	*Palinurus elephas*	1.73	1060019	28681.94	482585.6	0.332	5.209	2.197	7.406
European seabass	*Dicentrarchus labrax*	2.45	1662.417	117.5	482585.6	0.332	7.378	0.003	7.381
Wreckfish	*Polyprion americanus*	2.45	1004.113	62.5	482585.6	0.332	7.378	0.002	7.380
European hake	*Merluccius merluccius*	2.09	487753.7	78009.23	482585.6	0.332	6.293	1.011	7.304
John dory	*Zeus faber*	1.96	617329.1	38000.5	482585.6	0.332	5.902	1.279	7.181
Sharpnose sevengill shark	*Heptranchias perlo*	2.31	114.205	64.3	482585.6	0.332	6.956	0.000	6.956
Thornback ray	*Raja clavata*	2.28	13602.59	7109.473	482585.6	0.332	6.866	0.028	6.894
Longnosed skate	*Raja oxyrinchus*	2.28	2446.433	1077.22	482585.6	0.332	6.866	0.005	6.871
Surmullet	*Mullus surmuletus*	1.92	444161.1	49793.61	482585.6	0.332	5.782	0.920	6.702
Common pandora	*Pagellus erythrinus*	2.2	29969.61	8881.797	482585.6	0.332	6.625	0.062	6.687
European squid	*Loligo vulgaris*	1.78	628080.6	50104.5	482585.6	0.332	5.360	1.301	6.661
European conger	*Conger conger*	2.2	13485	8682.013	482585.6	0.332	6.625	0.028	6.653

Smooth-hound	*Mustelus mustelus*	2.2	12489.92	3646.407	482585.6	0.332	6.625	0.026	6.651
Longnose spurdog	*Squalus blainville*	2.2	2906.157	838.1167	482585.6	0.332	6.625	0.006	6.631
Common stingray	*Dasyatis pastinaca*	2.2	1574.173	1413.64	482585.6	0.332	6.625	0.003	6.628
Nursehound	*Scyliorhinus stellaris*	2.2	539.9467	143.0667	482585.6	0.332	6.625	0.001	6.626

GSA6

Table 2.2.1.1-3 gives the ranking for top 20 demersal species.

Table 2.2.1.1-3 **First 20 priority demersal species in GSA 6 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).**

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vulne	Vuln index	Value index	rank
European hake	*Merluccius merluccius*	2.09	13451734	2156227	2153591	0.339	6.164	6.246	12.410
Blue and red shrimp	*Aristeus antennatus*	1.63	14558470	545673.8	2153591	0.339	4.808	6.760	11.568
Norway lobster	*Nephrops norvegicus*	1.89	6881951	372990.8	2153591	0.339	5.574	3.196	8.770
Angler(=Monk)	*Lophius piscatorius*	2.45	2811471	501931.4	2153591	0.339	7.226	1.305	8.532
Gilthead seabream	*Sparus aurata*	1.92	5120015	672619.1	2153591	0.339	5.663	2.377	8.040
Kitefin shark	*Dalatias licha*	2.58	91.83	74	2153591	0.339	7.610	0.000	7.610
European seabass	*Dicentrarchus labrax*	2.45	533825.8	37878.19	2153591	0.339	7.226	0.248	7.474
White skate	*Raja alba*	2.5	524.4133	123.6667	2153591	0.339	7.374	0.000	7.374
Gulper shark	*Centrophorus granulosus*	2.5	41.86667	30.71	2153591	0.339	7.374	0.000	7.374
Common pandora	*Pagellus erythrinus*	2.2	1840989	547516.4	2153591	0.339	6.489	0.855	7.344
Wreckfish	*Polyprion americanus*	2.45	14365.48	909.2033	2153591	0.339	7.226	0.007	7.233
Angelshark	*Squatina squatina*	2.43	65.63	31.5	2153591	0.339	7.167	0.000	7.167
Picked dogfish	*Squalus acanthias*	2.36	843.46	209.3833	2153591	0.339	6.961	0.000	6.961
Roughtail stingray	*Dasyatis centroura*	2.31	512.32	271	2153591	0.339	6.813	0.000	6.813
Marbled electric ray	*Torpedo marmorata*	2.31	102.71	114.6333	2153591	0.339	6.813	0.000	6.813

Sharpnose sevengill shark	*Heptranchias perlo*	2.31	13.14	5	2153591	0.339	6.813	0.000	6.813
Red mullet	*Mullus barbatus*	1.68	3972013	713159	2153591	0.339	4.955	1.844	6.799
Common octopus	*Octopus vulgaris*	1.37	5811883	1305549	2153591	0.339	4.041	2.699	6.739
Thornback ray	*Raja clavata*	2.28	2538.437	1375.473	2153591	0.339	6.725	0.001	6.726
Longnosed skate	*Raja oxyrinchus*	2.28	19.62	10.5	2153591	0.339	6.725	0.000	6.725

Demersal species GSA7- Spain

No additional information was available on the species ranking for the Spanish fleets operating in GSA7.

Target species of management plans other than trawl, not included in the PSA, are the following shell fish fisheries:

Mechanised dredges (Valencia)- Venus clam (Chamellea gallina), Wedge shell (*Donax trunculus*).

Mechanised dredges (Catalonia)- Venus clam (*Chamellea gallina*), Wedge shell (*Donax trunculus*), Hard clam (*Callista chione*)

Boat seine (Catalonia)- Sand eel (*Gymnammodytes cicerelus* and *G. semisquamatus*), Goby (*Aphia minuta*, *Crystalogobius linearis*).

Demersal species GSA 7 France

The target species of the French trawler management is *Merluccius merluccius*.

Target species of management plans other than trawl, not included in the PSA, are the following:

Mechanised dredges- Murex droit épine (*Bolinus brandaris*), moule d'Europe (*Mytilus galloprovincialis*)

Gangui- *Scorpaena porcus, Serranus scriba, Serrranus cabrilla, Symphodus tinca, Symphodus rostratus*.

Table 2.2.1.1-4 **First 20 priority demersal species in GSA 7 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).**

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vulne	Vuln index	Value index	rank
European hake	*Merluccius merluccius*	2.09	6411953	1375828	944643.2	0.321	6.514	6.788	13.302
European eel	*Anguilla anguilla*	2.26	2793685	317770.3	944643.2	0.321	7.044	2.957	10.001
European seabass	*Dicentrarchus labrax*	2.45	1749611	110866	944643.2	0.321	7.636	1.852	9.488
Gilthead seabream	*Sparus aurata*	1.92	2984038	365401.6	944643.2	0.321	5.984	3.159	9.143
Kitefin shark	*Dalatias licha*	2.58	1419.547	230.29	944643.2	0.321	8.041	0.002	8.043
Common sole	*Solea solea*	1.8	2137000	119915	944643.2	0.321	5.610	2.262	7.873
Common octopus	*Octopus vulgaris*	1.37	3349150	721774.1	944643.2	0.321	4.270	3.545	7.816
White skate	*Raja alba*	2.5	5497.52	1860.9	944643.2	0.321	7.792	0.006	7.798
Angler(=Monk)	*Lophius piscatorius*	2.45	17331.23	3350.25	944643.2	0.321	7.636	0.018	7.655
Wreckfish	*Polyprion americanus*	2.45	2405.19	140.46	944643.2	0.321	7.636	0.003	7.639
Surmullet	*Mullus surmuletus*	1.92	1549048	275230.6	944643.2	0.321	5.984	1.640	7.624
Angelshark	*Squatina squatina*	2.43	630.55	146.64	944643.2	0.321	7.574	0.001	7.575
Thresher	*Alopias vulpinus*	2.36	5070.667	1298.227	944643.2	0.321	7.356	0.005	7.361
Picked dogfish	*Squalus acanthias*	2.36	4040.3	1863.233	944643.2	0.321	7.356	0.004	7.360
Common pandora	*Pagellus erythrinus*	2.2	437279.9	134922.2	944643.2	0.321	6.857	0.463	7.320
Thornback ray	*Raja clavata*	2.28	65923.56	14421.74	944643.2	0.321	7.106	0.070	7.176
Longnosed skate	*Raja oxyrinchus*	2.28	17253.06	8781.4	944643.2	0.321	7.106	0.018	7.125
Shagreen ray	*Raja fullonica*	2.26	25.1	12	944643.2	0.321	7.044	0.000	7.044
European conger	*Conger conger*	2.2	169203	112273.3	944643.2	0.321	6.857	0.179	7.036
Bluntnose sixgill shark	*Hexanchus griseus*	2.24	50.25667	187.8333	944643.2	0.321	6.982	0.000	6.982

POSSIBILITY OF MERGING GSAs FOR STOCK ASSESSEMENT BASED ON STOCKMED PROJECT RESULTS

According to Stockmed project results, a single hake stock is present is GSAs 1, 5, 6 and 7. It is worth noting that a joint assessment of hake was performed by STECF 15-18. This joint assessment delivered reasonable results in the past and could continue to be explored to exasmine if it provides a more robust assessment for the area.

2.2.1.2 Small Pelagics

*S*mall pelagic species GSAs 1-5-6

The target species of the Spanish purse seine management plan are European anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*).

GSA 1

Table 2.2.1.2-1 shows the ranking for 10 small pelagic species in GSA1

Table 2.2.1.2-1 Priority rank of small pelagic species in GSA 1, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vulne	Vuln index	Value index	rank
Sardine	*Sardina pilchardus*	1.12	12277253	6710688	4030443	0.366	3.059	3.046	6.105
Garfish	*Belone belone*	2.16	88783.07	101077.7	4030443	0.366	5.900	0.022	5.922
Atlantic mackerel	*Scomber scombrus*	1.95	1109919	785309.1	4030443	0.366	5.326	0.275	5.601
Chub mackerel	*Scomber japonicus*	1.88	603745.8	1310216	4030443	0.366	5.135	0.150	5.285
Atlantic horse Mackerel	*Trachurus trachurus*	1.67	1504619	1689270	4030443	0.366	4.561	0.373	4.935
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	1313849	1593893	4030443	0.366	4.343	0.326	4.669
European anchovy	*Engraulis encrasicolus*	1.05	7236686	3688471	4030443	0.366	2.868	1.796	4.663
Bogue	*Boops boops*	1.42	54131.11	138461.7	4030443	0.366	3.879	0.013	3.892
Round sardinella	*Sardinella aurita*	1.31	1012839	2249045	4030443	0.366	3.578	0.251	3.829
European sprat	*Sprattus sprattus*	1.35	2044.45	1352	4030443	0.366	3.687	0.001	3.688

GSA 5

In this area the purse seining activity is low, thus, low priority should be given to purse seine targets in this area, however, the vulnerability scores are probably similar for the other fisheries and the majority of the contrast in the PSA is due to productivity which will be very similar in all areas and fisheries.

Table 2.2.1.2-2 Priority rank of small pelagic species in GSA 5, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vulne	Vuln index	Value index	rank
European anchovy	*Engraulis encrasicolus*	1.05	617935.6	318774.1	207404.9	0.381	2.755	2.979	5.734
Garfish	*Belone belone*	2.16	40.19	41.00667	207404.9	0.381	5.668	0.000	5.668
Atlantic mackerel	*Scomber scombrus*	1.95	11529.16	7712.333	207404.9	0.381	5.117	0.056	5.172
Chub mackerel	*Scomber japonicus*	1.88	6.125	12	207404.9	0.381	4.933	0.000	4.933
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	57648.85	69584.57	207404.9	0.381	4.172	0.278	4.450
Atlantic horse mackerel	*Trachurus trachurus*	1.67	9685.85	10206.33	207404.9	0.381	4.382	0.047	4.429
Sardine	*Sardina pilchardus*	1.12	256204	142464	207404.9	0.381	2.939	1.235	4.174
Bogue	*Boops boops*	1.42	1053.18	2646.883	207404.9	0.381	3.726	0.005	3.731
Round sardinella	*Sardinella aurita*	1.31	31239.24	67619.1	207404.9	0.381	3.437	0.151	3.588

GSA 6

Table 2.2.1.2-3 Priority rank of small pelagic species in GSA 6, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial value.Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vulne	Vuln index	Value Index	rank
Garfish	*Belone belone*	2.16	3763.42	2968.407	8530257	0.366	5.900	0.000	5.900
European anchovy	*Engraulis encrasicolus*	1.05	25289332	12523047	8530257	0.366	2.868	2.965	5.833
Atlantic mackerel	*Scomber scombrus*	1.95	850110.6	578411.8	8530257	0.366	5.326	0.100	5.426
Chub mackerel	*Scomber japonicus*	1.88	99603.58	201224.8	8530257	0.366	5.135	0.012	5.147
Sardine	*Sardina pilchardus*	1.12	13613946	7449109	8530257	0.366	3.059	1.596	4.655
Atlantic horse mackerel	*Trachurus trachurus*	1.67	508745.6	541543.2	8530257	0.366	4.561	0.060	4.621
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	237928.2	296808	8530257	0.366	4.343	0.028	4.371
Bogue	*Boops boops*	1.42	45304.8	114297.3	8530257	0.366	3.879	0.005	3.884
European sprat	*Sprattus sprattus*	1.35	115.92	397.5	8530257	0.366	3.687	0.000	3.687
Round sardinella	*Sardinella aurita*	1.31	783837.6	1733018	8530257	0.366	3.578	0.092	3.670

Small Pelagics France GSA7

The target species of the French purse seine management plan European anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*).

Table 2.2.1.2-4 Priority rank of small pelagic species in GSA 7, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vulne	Vuln index	Value index	rank
Atlantic mackerel	*Scomber scombrus*	1.95	1084904	732238.1	1092088	0.381	5.117	0.993	6.110
European anchovy	*Engraulis encrasicolus*	1.05	3219466	2359197	1092088	0.381	2.755	2.948	5.703
Garfish	*Belone belone*	2.16	4021.973	2584.423	1092088	0.381	5.668	0.004	5.671
Chub mackerel	*Scomber japonicus*	1.88	51471.3	72730.75	1092088	0.381	4.933	0.047	4.980
Atlantic horse mackerel	*Trachurus trachurus*	1.67	380635.4	366483	1092088	0.381	4.382	0.349	4.730
Sardine	*Sardina pilchardus*	1.12	1539411	1078526	1092088	0.381	2.939	1.410	4.348
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	3708.873	5720.003	1092088	0.381	4.172	0.003	4.175
Bogue	*Boops boops*	1.42	91839.4	179550.4	1092088	0.381	3.726	0.084	3.810
Round sardinella	*Sardinella aurita*	1.31	7257.117	15680.98	1092088	0.381	3.437	0.007	3.444

Target species of management plans other than trawl, some of which are not included in the PSA: Beach seines- Salema (*Sarpa salpa*), Greater amberjack (*Seriola dumerili*), Sand smelt (*Atherina* spp.), Sardine (*Sardina pilchardus*).

POSSIBILITY OF MERGING GSAs FOR STOCK ASSESSEMENT BASED ON STOCKMED PROJECT RESULTS

According to Stockmed project results, a single European anchovy stock is present is GSAs 1, 5, 6 7 and 9. Nevertheless, at present it seems difficult to conduct a joint assessment considering the situation of European anchovy in GSA 7, may be changing due to environmental influences, see comments above. European anchovy in GSA1,5 and 6 could be considered.

One Mediterranean horse mackerel (*Trachurus mediterraneus*) single stock is considered to be present in GSAs 1, 5, 6 and 7. The same situation was reported for Atlantic horse mackerel

(*Trachurus trachurus*), one single stock present in GSAs 1, 5, 6 and 7. Thus developing a single species indicators should be considered as assessments have never been made for any of these GSAs, and, in addition, the limited available information on these species may make a joint assessment difficult at present (see Section 3).

2.2.2 Ranking GFCM area 8

2.2.2.1 Demersal species GSA 8

First 20 priority

Table 2.2.2.1.1-1 Priority rank of demersal species in GSA 8, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial value.Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vulne	Vulne index	Value index	rank
Common stingray	*Dasyatis pastinaca*	2.2	13.02	30	49640.11	0.326	6.745	0.000	6.745
Common sole	*Solea solea*	1.8	82524.53	5025.99	49640.11	0.326	5.518	1.662	7.181
Turbot	*Psetta maxima*	2.02	727.1	31.97333	49640.11	0.326	6.193	0.015	6.207
Silver scabbardfish	*Lepidopus caudatus*	1.78	406.88	108.32	49640.11	0.326	5.457	0.008	5.465
Bluntnose sixgill shark	*Hexanchus griseus*	2.24	84	280	49640.11	0.326	6.867	0.002	6.869
Blackspot(=red) seabream	*Pagellus bogaraveo*	1.99	7644.497	3927.91	49640.11	0.326	6.101	0.154	6.255
Common cuttlefish	*Sepia officinalis*	1.8	41155.3	5337.047	49640.11	0.326	5.518	0.829	6.347
Brill	*Scophthalmus rhombus*	1.68	298.4733	22.44333	49640.11	0.326	5.150	0.006	5.156
Thornback ray	*Raja clavata*	2.28	11565.01	2613.983	49640.11	0.326	6.990	0.233	7.223
Argentine	*Argentina sphyraena*	1.61	3064.887	1459.333	49640.11	0.326	4.936	0.062	4.998
Thresher	*Alopias vulpinus*	2.36	600.755	172	49640.11	0.326	7.235	0.012	7.247
European conger	*Conger conger*	2.2	4874.827	2262.99	49640.11	0.326	6.745	0.098	6.843
Common pandora	*Pagellus erythrinus*	2.2	8198.013	1600.453	49640.11	0.326	6.745	0.165	6.910
Deep-water rose shrimp	*Parapenaeus longirostris*	1.76	12870.9	2043.167	49640.11	0.326	5.396	0.259	5.655
European lobster	*Homarus gammarus*	2.07	49633.43	1805.343	49640.11	0.326	6.346	1.000	7.346
European hake	*Merluccius merluccius*	2.09	17009.52	3367.003	49640.11	0.326	6.407	0.343	6.750
John dory	*Zeus faber*	1.96	103501	5330.41	49640.11	0.326	6.009	2.085	8.094
Poor cod	*Trisopterus minutus*	1.65	16.995	11.55	49640.11	0.326	5.058	0.000	5.059
Pink spiny lobster	*Palinurus mauritanicus*	1.95	31120.33	753.0933	49640.11	0.326	5.978	0.627	6.605

2.2.2.2 *Small Pelagic specie GSA8*

Table 2.2.2.2-1 Priority rank of small pelagic species in GSA 8, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial value.Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vulne	Vulne index	Value index	rank
European sprat	*Sprattus sprattus*	1.35	8.82	15	5920.21	0.315	4.288	0.001	4.289
Atlantic horse mackerel	*Trachurus trachurus*	1.67	13104.14	9214.69	5920.21	0.315	5.304	2.213	7.518
Bogue	*Boops boops*	1.42	3988.25	6043.083	5920.21	0.315	4.510	0.674	5.184
Chub mackerel	*Scomber japonicus*	1.88	643.45	1354.13	5920.21	0.315	5.971	0.109	6.080
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	794.465	3182.2	5920.21	0.315	5.050	0.134	5.185
Sardine	*Sardina pilchardus*	1.12	4626.203	2896.603	5920.21	0.315	3.557	0.781	4.339
Atlantic mackerel	*Scomber scombrus*	1.95	15740.57	4448.927	5920.21	0.315	6.194	2.659	8.853
European anchovy	*Engraulis encrasicolus*	1.05	1143.703	1032	5920.21	0.315	3.335	0.193	3.528
Round sardinella	*Sardinella aurita*	1.31	60.52	220	5920.21	0.315	4.161	0.010	4.171

2.2.3 *Ranking GFCM area 9, 10, 11, 15, 16*

2.2.3.1 *Demersal Speciues Area 9, 10,11, 15 and 16*

Combining the 20 top ranking species in the five GSAs, a list of 41 species among bony fish, crustacean, cephalopods, and elasmobranchs is obtained. Surmullet, Conger eel, European seabass, European hake, Anglerfish, Red scorpionfish, Thornback ray, and common 45aponic are the species that appear among the 20 top ranking species in all the five GSAs.

Some elasmobranchs (e.g., *Alopias vulpinus*, *Hexanchus griseus*, *Heptranchias perlo*, *Squatina squatina*, etc.) that are high in the ranking because of their high vulnerability represent just accidental by-catch in some fisheries. Therefore, data on those species are very scarce and scattered, probably not allowing performing any assessment but there may potential for indicators of status. In contrast, some species that are very important in the landings, such as horned octopus, *Eledone cirrhosa*, and red mullet, *Mullus barbatus*, are included among the 20 top ranking species in several GSAs. Though for example, red mullet is only 35th in the rank in GSA 16, despite a landings of 420 tons (DCF, 2014). This is probably due to the low vulnerability level estimated for those species in the analyses.

The overall rankings for top 20 species are given by GSA in tables 2.2.3.1-1 to5.

Species included in management plans

The management plans in force in the area covering GSAs 9-16 are based on the assessment of only some demersal species: European hake, red mullet and deep-water pink shrimp in GSAs 9, 10, 11, and 16, and Giant red shrimp, red mullet, and deep-water pink shrimp in GSA 15. However, the measures put into force by those management plans are targeting all the demersal species. Although GSA 15 management plan is based on red mullet and deep-water pink shrimp (together with giant red shrimp), those two species are not ranking among the top 20 species so do not contribute in a major way to vulnerability or Value.

In addition there are some specific local fisheries: in GSA9, a management plan for transparent goby, *Aphia minuta*, is in force. The fishery targeting this species is performed by small vessels in Liguria and Tuscany. The landings of this species are low, although the economic Value of this fishery is important especially at local level.

As concerns small pelagics, the management plans in force in the area covering GSAs 9-16 are based on the assessment of European anchovy and sardine in GSAs 9, 10, and 16, and round sardinella dolphinfish, and chub mackerel, in GSA 15, the two later species are not included in the analysis

Table 2.2.3.1-1 First 20 priority demersal species in GSA 9 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vuln	Vuln index	Value index	rank
European seabass	*Dicentrarchus labrax*	2.45	886480.7	41760.05	1953604	0.273	8.963	0.454	9.417
Angler(=Monk)	*Lophius piscatorius*	2.45	815266.7	91128.86	1953604	0.273	8.963	0.417	9.380
Norway lobster	*Nephrops norvegicus*	1.89	4262983	153157.5	1953604	0.273	6.914	2.182	9.096
Common cuttlefish	*Sepia officinalis*	1.8	4896779	477558.1	1953604	0.273	6.585	2.507	9.092
Deep-water rose shrimp	*Parapenaeus longirostris*	1.76	5114725	586125.1	1953604	0.273	6.439	2.618	9.057
Surmullet	*Mullus surmuletus*	1.92	3528976	254387.5	1953604	0.273	7.024	1.806	8.831
Red mullet	*Mullus barbatus*	1.68	5219316	817202.9	1953604	0.273	6.146	2.672	8.818
Common pandora	*Pagellus erythrinus*	2.2	1412649	201577.3	1953604	0.273	8.048	0.723	8.772
Red scorpionfish	*Scorpaena scrofa*	2.16	1211314	57061.53	1953604	0.273	7.902	0.620	8.522
Thornback ray	*Raja clavata*	2.28	205574.1	45580.7	1953604	0.273	8.341	0.105	8.446
Gilthead seabream	*Sparus aurata*	1.92	2544563	131993	1953604	0.273	7.024	1.302	8.327
Blue and red shrimp	*Aristeus antennatus*	1.63	4615105	148872.9	1953604	0.273	5.963	2.362	8.326
European squid	*Loligo vulgaris*	1.78	3375691	208420.7	1953604	0.273	6.512	1.728	8.240
Bluntnose sixgill shark	*Hexanchus griseus*	2.24	3080.51	1151.37	1953604	0.273	8.195	0.002	8.196

European conger	*Conger conger*	2.2	113865.7	39582.27	1953604	0.273	8.048	0.058	8.107
Horned octopus	*Eledone cirrhosa*	1.56	4636245	651613.7	1953604	0.273	5.707	2.373	8.080
Nursehound	*Scyliorhinus stellaris*	2.2	2427.25	543.32	1953604	0.273	8.048	0.001	8.050
Smooth-hound	*Mustelus mustelus*	2.2	771.6067	88.14	1953604	0.273	8.048	0.000	8.049
Sand steenbras	*Lithognathus mormyrus*	1.96	1173483	147626.6	1953604	0.273	7.170	0.601	7.771

Table 2.2.3.1-2 First 20 priority demersal species in GSA 10 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vuln	Vuln index	Value index	rank
European hake	*Merluccius merluccius*	2.09	10385670	1143516	1827670	0.262	7.975	5.682	13.658
Angler(=Monk)	*Lophius piscatorius*	2.45	495239.5	67601.37	1827670	0.262	9.349	0.271	9.620
European seabass	*Dicentrarchus labrax*	2.45	250053.5	14798.18	1827670	0.262	9.349	0.137	9.486
Common pandora	*Pagellus erythrinus*	2.2	1502009	193853.9	1827670	0.262	8.395	0.822	9.217
Giant red shrimp	*Aristaeomorpha foliacea*	1.51	6112755	337755.2	1827670	0.262	5.762	3.345	9.107
Deep-water rose shrimp	*Parapenaeus longirostris*	1.76	4180960	520387.1	1827670	0.262	6.716	2.288	9.004
Common cuttlefish	*Sepia officinalis*	1.8	3555957	321390.4	1827670	0.262	6.869	1.946	8.814
Thornback ray	*Raja clavata*	2.28	41736.33	8679.147	1827670	0.262	8.700	0.023	8.723
Red scorpionfish	*Scorpaena scrofa*	2.16	621063.7	67983.75	1827670	0.262	8.242	0.340	8.582
Sand steenbras	*Lithognathus mormyrus*	1.96	1876308	223315	1827670	0.262	7.479	1.027	8.506
European conger	*Conger conger*	2.2	147317.7	47628.81	1827670	0.262	8.395	0.081	8.476
Surmullet	*Mullus surmuletus*	1.92	1861553	198559.2	1827670	0.262	7.326	1.019	8.345
Silver scabbardfish	*Lepidopus caudatus*	1.78	2830048	599742.4	1827670	0.262	6.792	1.548	8.341
Common sole	*Solea solea*	1.8	2134369	128299.1	1827670	0.262	6.869	1.168	8.036
Blackbellied angler	*Lophius budegassa*	2.02	438300	69735.49	1827670	0.262	7.708	0.240	7.948
European lobster	*Homarus gammarus*	2.07	24786.42	826.15	1827670	0.262	7.899	0.014	7.912
Slender rockfish	*Scorpaena elongata*	2.07	15863.01	1553.38	1827670	0.262	7.899	0.009	7.908
Red mullet	*Mullus barbatus*	1.68	2574005	398091.1	1827670	0.262	6.411	1.408	7.819
Grey gurnard	*Eutrigla gurnardus*	1.99	353302.9	33657.27	1827670	0.262	7.594	0.193	7.787
Turbot	*Psetta maxima*	2.02	115241.7	6629.33	1827670	0.262	7.708	0.063	7.771

Table 2.2.3.1-3 First 20 priority demersal species in GSA 11 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vulne	Vuln index	Value index	rank
Common octopus	*Octopus vulgaris*	1.37	6136714	1024555	1112922	0.292	4.689	5.514	10.203
Surmullet	*Mullus surmuletus*	1.92	3164374	252562.4	1112922	0.292	6.572	2.843	9.415
European hake	*Merluccius merluccius*	2.09	2078505	264726.7	1112922	0.292	7.154	1.868	9.021
Angler(=Monk)	*Lophius piscatorius*	2.45	649028.5	106152.2	1112922	0.292	8.386	0.583	8.969
European seabass	*Dicentrarchus labrax*	2.45	93122.9	7605.057	1112922	0.292	8.386	0.084	8.469
Red scorpionfish	*Scorpaena scrofa*	2.16	1017232	91238.49	1112922	0.292	7.393	0.914	8.307
Common cuttlefish	*Sepia officinalis*	1.8	2236618	277030.3	1112922	0.292	6.161	2.010	8.171
European squid	*Loligo vulgaris*	1.78	2272229	178565.4	1112922	0.292	6.093	2.042	8.134
Thresher	*Alopias vulpinus*	2.36	16083.55	3965.16	1112922	0.292	8.078	0.014	8.092
Common spiny lobster	*Palinurus elephas*	1.73	2320747	44630.17	1112922	0.292	5.921	2.085	8.007
Common pandora	*Pagellus erythrinus*	2.2	456201.3	45801.8	1112922	0.292	7.530	0.410	7.940
Thornback ray	*Raja clavata*	2.28	140904.3	66836.41	1112922	0.292	7.804	0.127	7.931
Sharpnose sevengill shark	*Heptranchias perlo*	2.31	3521.69	1504.03	1112922	0.292	7.907	0.003	7.910
European conger	*Conger conger*	2.2	328958.3	89726.36	1112922	0.292	7.530	0.296	7.826
European eel	*Anguilla anguilla*	2.26	4806.79	499.515	1112922	0.292	7.735	0.004	7.740
Bluntnose sixgill shark	*Hexanchus griseus*	2.24	2362.18	1062.37	1112922	0.292	7.667	0.002	7.669
John dory	*Zeus faber*	1.96	957632.6	71593.34	1112922	0.292	6.709	0.860	7.569
Black scorpionfish	*Scorpaena porcus*	1.91	904410.7	134328.1	1112922	0.292	6.538	0.813	7.350
European lobster	*Homarus gammarus*	2.07	288329.9	7891.473	1112922	0.292	7.085	0.259	7.344
Norway lobster	*Nephrops norvegicus*	1.89	839581.5	36019.94	1112922	0.292	6.469	0.754	7.223

Table 2.2.3.1-4 **First 20 priority demersal species in GSA 15 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).**

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vuln	Vuln index	Value index	rank
Giant red shrimp	*Aristaeomorpha foliacea*	1.51	716278.8	35591.81	108184.6	0.323	4.679	6.621	11.300
Red scorpionfish	*Scorpaena scrofa*	2.16	332787.3	25750.09	108184.6	0.323	6.693	3.076	9.769
Surmullet	*Mullus surmuletus*	1.92	379407.4	46106.8	108184.6	0.323	5.949	3.507	9.456
Silver scabbardfish	*Lepidopus caudatus*	1.78	290411.9	61132.39	108184.6	0.323	5.515	2.684	8.200
European hake	*Merluccius merluccius*	2.09	166985.9	24500.07	108184.6	0.323	6.476	1.544	8.019
Wreckfish	*Polyprion americanus*	2.45	30437.74	4172.905	108184.6	0.323	7.591	0.281	7.872
White skate	*Raja alba*	2.5	3053.968	1359.07	108184.6	0.323	7.746	0.028	7.774
Gulper shark	*Centrophorus granulosus*	2.5	457.82	341.25	108184.6	0.323	7.746	0.004	7.750
Angler(=Monk)	*Lophius piscatorius*	2.45	16645.65	3449.688	108184.6	0.323	7.591	0.154	7.745
Common pandora	*Pagellus erythrinus*	2.2	96626.64	13201.29	108184.6	0.323	6.817	0.893	7.710
European seabass	*Dicentrarchus labrax*	2.45	651.485	96.775	108184.6	0.323	7.591	0.006	7.597
Angelshark	*Squatina squatina*	2.43	250.45	31.32	108184.6	0.323	7.529	0.002	7.531
Picked dogfish	*Squalus acanthias*	2.36	19626.72	7189.917	108184.6	0.323	7.312	0.181	7.494
Thornback ray	*Raja clavata*	2.28	34338.58	22964.58	108184.6	0.323	7.064	0.317	7.382
Longnose spurdog	*Squalus blainville*	2.2	59028.97	22165.33	108184.6	0.323	6.817	0.546	7.362
Sharpnose sevengill shark	*Heptranchias perlo*	2.31	1917.033	923.63	108184.6	0.323	7.157	0.018	7.175
Bluntnose sixgill shark	*Hexanchus griseus*	2.24	16674.71	7019.653	108184.6	0.323	6.940	0.154	7.095
Longnosed skate	*Raja oxyrinchus*	2.28	2748.38	951.9825	108184.6	0.323	7.064	0.025	7.090
European conger	*Conger conger*	2.2	15007.28	5787.745	108184.6	0.323	6.817	0.139	6.955
Smooth-hound	*Mustelus mustelus*	2.2	7272.455	2222.835	108184.6	0.323	6.817	0.067	6.884

Table 2.2.3.1-5 **First 20 priority demersal species in GSA 16 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).**

English name	Scientific name	Vulne	Mean Value	Mean Mass	Sd Value	Sd Vuln	Vuln index	Value index	rank
Deep-water rose shrimp	*Parapenaeus longirostris*	1.76	34307111	5784937	6249283	0.269	6.553	5.490	12.043
Giant red shrimp	*Aristaeomorpha foliacea*	1.51	29319641	1623573	6249283	0.269	5.622	4.692	10.314
Angler(=Monk)	*Lophius piscatorius*	2.45	1156725	217355.8	6249283	0.269	9.123	0.185	9.308
European hake	*Merluccius merluccius*	2.09	9038740	1487681	6249283	0.269	7.782	1.446	9.228
European seabass	*Dicentrarchus labrax*	2.45	39891.76	2472.107	6249283	0.269	9.123	0.006	9.129
Thresher	*Alopias vulpinus*	2.36	2195.32	709.86	6249283	0.269	8.787	0.000	8.788
Thornback ray	*Raja clavata*	2.28	371582.8	166739.8	6249283	0.269	8.490	0.059	8.549
Common pandora	*Pagellus erythrinus*	2.2	794566.3	185165.9	6249283	0.269	8.192	0.127	8.319
Red scorpionfish	*Scorpaena scrofa*	2.16	1053042	107038.7	6249283	0.269	8.043	0.169	8.211
European conger	*Conger conger*	2.2	41964.89	21183.68	6249283	0.269	8.192	0.007	8.198
Smooth-hound	*Mustelus mustelus*	2.2	15972.71	5264.447	6249283	0.269	8.192	0.003	8.194
Norway lobster	*Nephrops norvegicus*	1.89	5976992	340197.1	6249283	0.269	7.037	0.956	7.994
Surmullet	*Mullus surmuletus*	1.92	5238987	569964.4	6249283	0.269	7.149	0.838	7.987
Slender rockfish	*Scorpaena elongata*	2.07	348403.6	34829.72	6249283	0.269	7.708	0.056	7.763
European lobster	*Homarus gammarus*	2.07	46070.51	1392.337	6249283	0.269	7.708	0.007	7.715
Turbot	*Psetta maxima*	2.02	14774.06	1719.75	6249283	0.269	7.521	0.002	7.524
Blackbellied angler	*Lophius budegassa*	2.02	4809.145	1110.185	6249283	0.269	7.521	0.001	7.522
Blackspot(=red) seabream	*Pagellus bogaraveo*	1.99	66791.25	6763.34	6249283	0.269	7.410	0.011	7.420
Grey gurnard	*Eutrigla gurnardus*	1.99	59505.22	17859.44	6249283	0.269	7.410	0.010	7.419
John dory	*Zeus faber*	1.96	610605.3	57808.8	6249283	0.269	7.298	0.098	7.396

2.2.3.2 Small Pelagic species in GSA 9,10,11, 15 and 16

As regards small pelagics, garfish and round sardinella rank among the most important species in all the GSAs (9-16). However, these two species are not included in the biological sampling under the EU DCF. Therefore, no data are available for these two species for assessment purposes though evaluation by indicator may be possible, with the only exception of GSA 15, where round sardinella is included in the small pelagic fisheries management plan.

Sardine is one of the most important species in terms of landings in the whole Mediterranean. However, this species is in the last positions in the ranking in almost all the GSAs considered in this exercise (GSAs 9, 10, 11, 15, and 16).

Table 2.2.3.2-1 Priority rank of small pelagic species in GSA 9, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
European anchovy	*Engraulis encrasicolus*	1.05	9118728	4594292	2965399	0.381	2.755	3.075	5.830
Garfish	*Belone belone*	2.16	15701.71	1626.367	2965399	0.381	5.668	0.005	5.673
Atlantic mackerel	*Scomber scombrus*	1.95	159439.9	58789	2965399	0.381	5.117	0.054	5.170
Chub mackerel	*Scomber japonicus*	1.88	230354.7	145252.2	2965399	0.381	4.933	0.078	5.011
Atlantic horse mackerel	*Trachurus trachurus*	1.67	382884.7	212979.7	2965399	0.381	4.382	0.129	4.511
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	165238.2	86910.21	2965399	0.381	4.172	0.056	4.228
Bogue	*Boops boops*	1.42	126940.5	74728.39	2965399	0.381	3.726	0.043	3.769
Round sardinella	*Sardinella aurita*	1.31	26937.29	60777.84	2965399	0.381	3.437	0.009	3.446
Sardine	*Sardina pilchardus*	1.12	1276919	1623734	2965399	0.381	2.939	0.431	3.369

Table 2.2.3.2-2 Priority rank of small pelagic species in GSA 10, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
European anchovy	*Engraulis encrasicolus*	1.05	9177851	4533092	2917234	0.381	2.755	3.146	5.901
Garfish	*Belone belone*	2.16	26366.88	4283.04	2917234	0.381	5.668	0.009	5.677
Atlantic mackerel	*Scomber scombrus*	1.95	574612.6	201912.3	2917234	0.381	5.117	0.197	5.314
Chub mackerel	*Scomber japonicus*	1.88	65566.94	44165.31	2917234	0.381	4.933	0.022	4.955
Atlantic horse mackerel	*Trachurus trachurus*	1.67	1436239	704951.1	2917234	0.381	4.382	0.492	4.874
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	155409.8	80044.89	2917234	0.381	4.172	0.053	4.225
Bogue	*Boops boops*	1.42	799046.8	351158.5	2917234	0.381	3.726	0.274	4.000
Round sardinella	*Sardinella aurita*	1.31	258079.6	319267.8	2917234	0.381	3.437	0.088	3.526
Sardine	*Sardina pilchardus*	1.12	1050979	695931.3	2917234	0.381	2.939	0.360	3.299

Table 2.2.3.2-3 **Priority rank of small pelagic species in GSA 11, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).**

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
Bogue	*Boops boops*	1.42	295353.1	141275.3	106967.6	0.408	3.481	2.761	6.243
Garfish	*Belone belone*	2.16	919.06	178.29	106967.6	0.408	5.296	0.009	5.304
Atlantic mackerel	*Scomber scombrus*	1.95	12282.93	3097.11	106967.6	0.408	4.781	0.115	4.896
Atlantic horse mackerel	*Trachurus trachurus*	1.67	58078.94	29402.66	106967.6	0.408	4.094	0.543	4.637
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	19916.46	13247.57	106967.6	0.408	3.898	0.186	4.084
Sardine	*Sardina pilchardus*	1.12	103.73	31.12	106967.6	0.408	2.746	0.001	2.747
European anchovy	*Engraulis encrasicolus*	1.05	11370.12	2965.57	106967.6	0.408	2.574	0.106	2.681

Table 2.2.3.2-4 Priority rank of small pelagic species in GSA 15, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
Chub mackerel	*Scomber japonicus*	1.88	478608.9	481837.5	192658.9	0.366	5.135	2.484	7.619
Round sardinella	*Sardinella aurita*	1.31	486613.8	206183.2	192658.9	0.366	3.578	2.526	6.104
Garfish	*Belone belone*	2.16	377.81	137.4	192658.9	0.366	5.900	0.002	5.902
Atlantic mackerel	*Scomber scombrus*	1.95	28107.93	53641.5	192658.9	0.366	5.326	0.146	5.472
Atlantic horse mackerel	*Trachurus trachurus*	1.67	67080.89	19306.25	192658.9	0.366	4.561	0.348	4.910
Bogue	*Boops boops*	1.42	122656	43127.17	192658.9	0.366	3.879	0.637	4.515
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	19379.49	11073.59	192658.9	0.366	4.343	0.101	4.443
European sprat	*Sprattus sprattus*	1.35	25931.07	46848	192658.9	0.366	3.687	0.135	3.822
Sardine	*Sardina pilchardus*	1.12	9061.25	18122.5	192658.9	0.366	3.059	0.047	3.106
European anchovy	*Engraulis encrasicolus*	1.05	193.75	311	192658.9	0.366	2.868	0.001	2.869

Table 2.2.3.2-5 Priority rank of small pelagic species in GSA 16, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
Garfish	*Belone belone*	2.16	121998.6	15301.46	1710139	0.388	5.563	0.071	5.634
European anchovy	*Engraulis encrasicolus*	1.05	4911321	1965784	1710139	0.388	2.704	2.872	5.576
Atlantic mackerel	*Scomber scombrus*	1.95	235917.1	103417.6	1710139	0.388	5.022	0.138	5.160
Atlantic horse mackerel	*Trachurus trachurus*	1.67	642141.3	343997.7	1710139	0.388	4.301	0.375	4.676
Sardine	*Sardina pilchardus*	1.12	2361785	1566496	1710139	0.388	2.884	1.381	4.265
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	8916.81	8356.135	1710139	0.388	4.095	0.005	4.100
Bogue	*Boops boops*	1.42	711254.5	252461.1	1710139	0.388	3.657	0.416	4.073
Round sardinella	*Sardinella aurita*	1.31	48007.87	51074.13	1710139	0.388	3.374	0.028	3.402

2.2.4 Ranking GFCM area 17 & 18

2.2.4.1 Demersal species GSA 17 and 18

Tables 2.2.4.1-1 and 2.2.4.1-2 give the top 20 ranked demersal species for areas 17 and 18.

Table 2.2.4.1.**1**-1 **First 20 priority demersal species in GSA 17 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).**

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
European hake	*Merluccius merluccius*	2.09	13790167	2393722	3846890	0.297	7.031	3.585	10.616
Common sole	*Solea solea*	1.8	16215498	1439959	3846890	0.297	6.055	4.215	10.271
Common cuttlefish	*Sepia officinalis*	1.8	15318363	2373934	3846890	0.297	6.055	3.982	10.037
Norway lobster	*Nephrops norvegicus*	1.89	12516742	785684.2	3846890	0.297	6.358	3.254	9.612
Spottail mantis squillid	*Squilla mantis*	1.63	14363470	2096921	3846890	0.297	5.484	3.734	9.217
Angler(=Monk)	*Lophius piscatorius*	2.45	1390249	135254.8	3846890	0.297	8.242	0.361	8.604
European seabass	*Dicentrarchus labrax*	2.45	1158674	61772.84	3846890	0.297	8.242	0.301	8.543
Wreckfish	*Polyprion americanus*	2.45	2502.4	368	3846890	0.297	8.242	0.001	8.243
Picked dogfish	*Squalus acanthias*	2.36	86815.29	17571.47	3846890	0.297	7.939	0.023	7.962
Thresher	*Alopias vulpinus*	2.36	7255.993	1246.988	3846890	0.297	7.939	0.002	7.941
Thornback ray	*Raja clavata*	2.28	169133.9	48030.07	3846890	0.297	7.670	0.044	7.714
European eel	*Anguilla anguilla*	2.26	156174.6	11467.33	3846890	0.297	7.603	0.041	7.644
Red mullet	*Mullus barbatus*	1.68	7411319	2662307	3846890	0.297	5.652	1.927	7.578
Common pandora	*Pagellus erythrinus*	2.2	520534.5	119471.6	3846890	0.297	7.401	0.135	7.536
European conger	*Conger conger*	2.2	156876.8	79317.76	3846890	0.297	7.401	0.041	7.442
Red scorpionfish	*Scorpaena scrofa*	2.16	638753.9	41354.58	3846890	0.297	7.267	0.166	7.433
Smooth-hound	*Mustelus mustelus*	2.2	93878.82	20928.37	3846890	0.297	7.401	0.024	7.425
European squid	*Loligo vulgaris*	1.78	4131997	372792.1	3846890	0.297	5.988	1.074	7.062
Gilthead seabream	*Sparus aurata*	1.92	2252069	298999.3	3846890	0.297	6.459	0.585	7.045
Brown meagre	*Sciaena umbra*	2.09	7500.853	553.5625	3846890	0.297	7.031	0.002	7.033

Table 2.2.4.1.**1**-2 **First 20 priority demersal species in GSA 18 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).**

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
European hake	*Merluccius merluccius*	2.09	16728826	2506787	3246020	0.284	7.362	5.154	12.515
Angler(=Monk)	*Lophius piscatorius*	2.45	3734333	429988.1	3246020	0.284	8.630	1.150	9.780
Norway lobster	*Nephrops norvegicus*	1.89	10128491	579290.6	3246020	0.284	6.657	3.120	9.778
European seabass	*Dicentrarchus labrax*	2.45	358910.5	32012.36	3246020	0.284	8.630	0.111	8.740
Wreckfish	*Polyprion americanus*	2.45	9914.18	833.45	3246020	0.284	8.630	0.003	8.633
Common cuttlefish	*Sepia officinalis*	1.8	7327893	830815.6	3246020	0.284	6.340	2.258	8.598
Red mullet	*Mullus barbatus*	1.68	6953666	1539433	3246020	0.284	5.918	2.142	8.060
Thornback ray	*Raja clavata*	2.28	28103.86	5710.99	3246020	0.284	8.031	0.009	8.040
Common pandora	*Pagellus erythrinus*	2.2	768012.5	66724.89	3246020	0.284	7.749	0.237	7.986
European conger	*Conger conger*	2.2	226296.9	196846.3	3246020	0.284	7.749	0.070	7.819
Red scorpionfish	*Scorpaena scrofa*	2.16	294043.6	23169.08	3246020	0.284	7.608	0.091	7.699
Deep-water rose shrimp	*Parapenaeus longirostris*	1.76	4384354	631431.5	3246020	0.284	6.199	1.351	7.550
Surmullet	*Mullus surmuletus*	1.92	2206502	166427.4	3246020	0.284	6.763	0.680	7.443
Spottail mantis squillid	*Squilla mantis*	1.63	5416752	1277170	3246020	0.284	5.742	1.669	7.410
Grey gurnard	*Eutrigla gurnardus*	1.99	1049605	214663.5	3246020	0.284	7.010	0.323	7.333
European squid	*Loligo vulgaris*	1.78	3349781	342197.7	3246020	0.284	6.270	1.032	7.302
European lobster	*Homarus gammarus*	2.07	3661.27	84.19	3246020	0.284	7.291	0.001	7.293
Blackbellied angler	*Lophius budegassa*	2.02	78876.6	14139.6	3246020	0.284	7.115	0.024	7.140
Turbot	*Psetta maxima*	2.02	38583.65	2517.19	3246020	0.284	7.115	0.012	7.127
Blackspot(=red) seabream	*Pagellus bogaraveo*	1.99	49232.17	3901.483	3246020	0.284	7.010	0.015	7.025

2.2.4.2 Small pelagic species GSA 17 and 18

Tables 2.2.4.2.1 and 2.2.4.2.2 give the ranked small species for areas 17 and 18.

Table 2.2.4.2-1 Priority rank of small pelagic species in GSA 17, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
Garfish	*Belone belone*	2.16	13214.36	3927.298	11608318	0.366	5.900	0.001	5.901
Sardine	*Sardina pilchardus*	1.12	28328893	64530917	11608318	0.366	3.059	2.440	5.499
Atlantic mackerel	*Scomber scombrus*	1.95	797108	196966.8	11608318	0.366	5.326	0.069	5.395
European anchovy	*Engraulis encrasicolus*	1.05	27194153	23605124	11608318	0.366	2.868	2.343	5.211
Chub mackerel	*Scomber japonicus*	1.88	418293.9	684602.6	11608318	0.366	5.135	0.036	5.171
Atlantic horse mackerel	*Trachurus trachurus*	1.67	373701.9	272338.5	11608318	0.366	4.561	0.032	4.594
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	44746.47	33032.2	11608318	0.366	4.343	0.004	4.347
Bogue	*Boops boops*	1.42	101146.2	117230.7	11608318	0.366	3.879	0.009	3.887
European sprat	*Sprattus sprattus*	1.35	138491.4	146194.5	11608318	0.366	3.687	0.012	3.699
Round sardinella	*Sardinella aurita*	1.31	58119.81	59933.87	11608318	0.366	3.578	0.005	3.583

Table 2.2.4.2-2 Priority rank of small pelagic species in GSA 18, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
Atlantic mackerel	*Scomber scombrus*	1.95	777153.1	275386	3185718	0.332	5.867	0.244	6.111
European anchovy	*Engraulis encrasicolus*	1.05	9385301	4853079	3185718	0.332	3.159	2.946	6.105
Chub mackerel	*Scomber japonicus*	1.88	460089.1	437227.4	3185718	0.332	5.656	0.144	5.801
Atlantic horse mackerel	*Trachurus trachurus*	1.67	565862.5	587605.3	3185718	0.332	5.025	0.178	5.202
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	13529.44	22064.32	3185718	0.332	4.784	0.004	4.788
Bogue	*Boops boops*	1.42	284380.3	277815.4	3185718	0.332	4.272	0.089	4.362
Round sardinella	*Sardinella aurita*	1.31	22555.68	24762.8	3185718	0.332	3.941	0.007	3.948
Sardine	*Sardina pilchardus*	1.12	774110	1324900	3185718	0.332	3.370	0.243	3.613

2.2.5 Ranking GFCM area 19

2.2.5.1 Demersal Species GSA 19

Table 2.2.5.1**.1-**1 **First 20 priority demersal species in GSA 19 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).**

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
European hake	*Merluccius merluccius*	2.09	6275040	725053.7	1667111	0.278	7.505	3.764	11.269
Blue and red shrimp	*Aristeus antennatus*	1.63	7205717	268481.8	1667111	0.278	5.853	4.322	10.175
Angler(=Monk)	*Lophius piscatorius*	2.45	946299	116107.2	1667111	0.278	8.797	0.568	9.365
Giant red shrimp	*Aristaeomorpha foliacea*	1.51	6034644	310451	1667111	0.278	5.422	3.620	9.042
European seabass	*Dicentrarchus labrax*	2.45	27482.78	2016.973	1667111	0.278	8.797	0.016	8.814
Deep-water rose shrimp	*Parapenaeus longirostris*	1.76	3654418	416212.8	1667111	0.278	6.320	2.192	8.512
Common cuttlefish	*Sepia officinalis*	1.8	3413274	339202.8	1667111	0.278	6.463	2.047	8.511
Thresher	*Alopias vulpinus*	2.36	23554.82	6529.8	1667111	0.278	8.474	0.014	8.488
Surmullet	*Mullus surmuletus*	1.92	2654286	220080.3	1667111	0.278	6.894	1.592	8.486
Common pandora	*Pagellus erythrinus*	2.2	843922.4	108264	1667111	0.278	7.900	0.506	8.406
Sharpnose sevengill shark	*Heptranchias perlo*	2.31	22403.1	11096.48	1667111	0.278	8.295	0.013	8.308
Red scorpionfish	*Scorpaena scrofa*	2.16	791046.2	63442.25	1667111	0.278	7.756	0.475	8.231
Thornback ray	*Raja clavata*	2.28	13025.33	3090.603	1667111	0.278	8.187	0.008	8.195
European conger	*Conger conger*	2.2	257097	89786.05	1667111	0.278	7.900	0.154	8.054
Norway lobster	*Nephrops norvegicus*	1.89	1265365	67866.44	1667111	0.278	6.787	0.759	7.546
Sand steenbras	*Lithognathus mormyrus*	1.96	843958.7	82399.23	1667111	0.278	7.038	0.506	7.544
Black scorpionfish	*Scorpaena porcus*	1.91	1132683	78720.98	1667111	0.278	6.858	0.679	7.538
Silver scabbardfish	*Lepidopus caudatus*	1.78	1777343	504001.3	1667111	0.278	6.392	1.066	7.458
European lobster	*Homarus gammarus*	2.07	14891.44	547.87	1667111	0.278	7.433	0.009	7.442
Blackbellied angler	*Lophius budegassa*	2.02	159010	28810.34	1667111	0.278	7.253	0.095	7.349

2.2.5.2 *Small pelagic species GSA 19*

Table 2.2.5.2.1-1 Priority rank of small pelagic species in GSA 19, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
European anchovy	*Engraulis encrasicolus*	1.05	2987189	544646.3	933190.2	0.381	2.755	3.201	5.956
Atlantic mackerel	*Scomber scombrus*	1.95	702916.2	216818.9	933190.2	0.381	5.117	0.753	5.870
Garfish	*Belone belone*	2.16	55187.73	9831.577	933190.2	0.381	5.668	0.059	5.727
Atlantic horse mackerel	*Trachurus trachurus*	1.67	832490.8	371888.1	933190.2	0.381	4.382	0.892	5.274
Chub mackerel	*Scomber japonicus*	1.88	84859	55698.75	933190.2	0.381	4.933	0.091	5.024
Bogue	*Boops boops*	1.42	1186396	485469.9	933190.2	0.381	3.726	1.271	4.997
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	214909.6	98371.17	933190.2	0.381	4.172	0.230	4.402
Sardine	*Sardina pilchardus*	1.12	685743.6	295439.7	933190.2	0.381	2.939	0.735	3.674
Round sardinella	*Sardinella aurita*	1.31	10637.37	3774.85	933190.2	0.381	3.437	0.011	3.449

2.2.6 *Ranking GFCM area 20, 22 & 23*

2.2.6.1 *Demersalsspecies for GSA 20, 22&23*

A list of the top 20 species was identified by PSA in GSAs 22, 23, 20 in terms of vulnerability and Value of landings.

Thirteen species were commonly identified in all 3 GSAs including: hake, red mullet, surmullet, cuttlefish, wreckfish, seabass, thornback ray, common pandora, angler monkfish, common stingray, European conger, Blackbellied angler and red scorpion fish. In all cases, hake was always in the top 3 species and red mullet was within the top 5 species.

Concerning the elasmobranchs, a group that is not often evaluated in the Mediterranean, analysis showed that *Squatina squatina, Raja clavata, Dasyatis pastinaca and Hexanchus griseus* were found important in terms of vulnerability and landings. Concerning the cephalopods *Sepia officinalis* was the only cephalopod selected within the top 20 species list. In addition it was suggested in all 3 GSAs. Concerning Crustacea species, *Nephrops norvegicus and Papapenaeus longiro*stris were important in terms of vulnerability and landings in GSA 22 whereas Penaeus kerathurus was included in GSA 20.

Table 2.2.6.1**.1-**1 **First 20 priority demersal species in GSA 20 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).**

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
European hake	*Merluccius merluccius*	2.09	5804440	584531	1158446	0.301	6.937	5.011	11.948
White seabream	*Diplodus sargus*	1.84	3584755	250855	1158446	0.301	6.108	3.094	9.202
Gilthead seabream	*Sparus aurata*	1.92	3068521	229634	1158446	0.301	6.373	2.649	9.022
Caramote prawn	*Penaeus kerathurus*	1.63	4007497	239184	1158446	0.301	5.410	3.459	8.870
Red mullet	*Mullus barbatus*	1.68	3296117	303886	1158446	0.301	5.576	2.845	8.422
European seabass	*Dicentrarchus labrax*	2.45	263431	19164	1158446	0.301	8.132	0.227	8.360
Angler(=Monk)	*Lophius piscatorius*	2.45	141327	34470	1158446	0.301	8.132	0.122	8.254
Wreckfish	*Polyprion americanus*	2.45	64272	4285	1158446	0.301	8.132	0.055	8.188
Angelshark	*Squatina squatina*	2.43	7358	2383	1158446	0.301	8.066	0.006	8.072
Common pandora	*Pagellus erythrinus*	2.2	715169	76873	1158446	0.301	7.302	0.617	7.920
Thornback ray	*Raja clavata*	2.28	6154	1231	1158446	0.301	7.568	0.005	7.573
European eel	*Anguilla anguilla*	2.26	558	112	1158446	0.301	7.502	0.000	7.502
Bluntnose sixgill shark	*Hexanchus griseus*	2.24	12773	2555	1158446	0.301	7.435	0.011	7.446
European conger	*Conger conger*	2.2	34985	9875	1158446	0.301	7.302	0.030	7.333
Common stingray	*Dasyatis pastinaca*	2.2	5317	1330	1158446	0.301	7.302	0.005	7.307
Surmullet	*Mullus surmuletus*	1.92	955211	64902	1158446	0.301	6.373	0.825	7.198
Red scorpionfish	*Scorpaena scrofa*	2.16	6478	881	1158446	0.301	7.170	0.006	7.175
White grouper	*Epinephelus aeneus*	2.02	540773	26238	1158446	0.301	6.705	0.467	7.172
Common cuttlefish	*Sepia officinalis*	1.8	1385128	219254	1158446	0.301	5.975	1.196	7.170
Brown meagre	*Sciaena umbra*	2.09	66425	8427	1158446	0.301	6.937	0.057	6.995

Table 2.2.6.1**.1**-2 **First 20 priority demersal species in GSA 22 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).**

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
European hake	*Merluccius merluccius*	2.09	19563206	2041324	3561535	0.303	6.898	5.493	12.391
Surmullet	*Mullus surmuletus*	1.92	15393732	1144969	3561535	0.303	6.337	4.322	10.659
Common pandora	*Pagellus erythrinus*	2.2	4247016	331333	3561535	0.303	7.261	1.192	8.453
Deep-water rose shrimp	*Parapenaeus longirostris*	1.76	8912781	2298042	3561535	0.303	5.809	2.503	8.311
Angler(=Monk)	*Lophius piscatorius*	2.45	513556.5	122162.3	3561535	0.303	8.086	0.144	8.230
European seabass	*Dicentrarchus labrax*	2.45	485568	52636	3561535	0.303	8.086	0.136	8.222
Wreckfish	*Polyprion americanus*	2.45	8868	625	3561535	0.303	8.086	0.002	8.088
Angelshark	*Squatina squatina*	2.43	10762	3196	3561535	0.303	8.020	0.003	8.023
Red mullet	*Mullus barbatus*	1.68	8770836	781774.5	3561535	0.303	5.544	2.463	8.007
Gilthead seabream	*Sparus aurata*	1.92	5714369	419033	3561535	0.303	6.337	1.604	7.941
Norway lobster	*Nephrops norvegicus*	1.89	5949446	368912	3561535	0.303	6.238	1.670	7.908
Red scorpionfish	*Scorpaena scrofa*	2.16	1470642	116696	3561535	0.303	7.129	0.413	7.542
Common sole	*Solea solea*	1.8	5692317	419225	3561535	0.303	5.941	1.598	7.539
Thornback ray	*Raja clavata*	2.28	2328	466	3561535	0.303	7.525	0.001	7.525
Longnosed skate	*Raja oxyrinchus*	2.28	1152	288	3561535	0.303	7.525	0.000	7.525
Common stingray	*Dasyatis pastinaca*	2.2	757567	194358	3561535	0.303	7.261	0.213	7.473
Bluntnose sixgill shark	*Hexanchus griseus*	2.24	18268	3654	3561535	0.303	7.393	0.005	7.398
European conger	*Conger conger*	2.2	55358	14924	3561535	0.303	7.261	0.016	7.276
White seabream	*Diplodus sargus*	1.84	3592102	227861	3561535	0.303	6.073	1.009	7.081
Brown meagre	*Sciaena umbra*	2.09	598129	49966	3561535	0.303	6.898	0.168	7.066

Table 2.2.6.1**.1**-3 **First 20 priority demersal species in GSA 23 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).**

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
Red mullet	*Mullus barbatus*	1.68	1623535	133077	286414	0.304	5.524	5.668	11.193
Surmullet	*Mullus surmuletus*	1.92	851179	58300	286414	0.304	6.314	2.972	9.286
European hake	*Merluccius merluccius*	2.09	579323	56796	286414	0.304	6.873	2.023	8.895
Common pandora	*Pagellus erythrinus*	2.2	286528	25813	286414	0.304	7.234	1.000	8.235
European seabass	*Dicentrarchus labrax*	2.45	1164	106	286414	0.304	8.057	0.004	8.061
Wreckfish	*Polyprion americanus*	2.45	857	52	286414	0.304	8.057	0.003	8.060
Angler(=Monk)	*Lophius piscatorius*	2.45	327	80	286414	0.304	8.057	0.001	8.058
Thornback ray	*Raja clavata*	2.28	305	61	286414	0.304	7.498	0.001	7.499
White seabream	*Diplodus sargus*	1.84	351588	22980	286414	0.304	6.051	1.228	7.278
Red scorpionfish	*Scorpaena scrofa*	2.16	47742	4420	286414	0.304	7.103	0.167	7.270
Common stingray	*Dasyatis pastinaca*	2.2	6343	1546	286414	0.304	7.234	0.022	7.257
European conger	*Conger conger*	2.2	1851	712	286414	0.304	7.234	0.006	7.241
Bogue	*Boops boops*	1.63	476057	140017	286414	0.304	5.360	1.662	7.022
White grouper	*Epinephelus aeneus*	2.02	92043	4183	286414	0.304	6.643	0.321	6.964
Brown meagre	*Sciaena umbra*	2.09	2305	253	286414	0.304	6.873	0.008	6.881
Blackbellied angler	*Lophius budegassa*	2.02	23828	3665	286414	0.304	6.643	0.083	6.726
Common cuttlefish	*Sepia officinalis*	1.8	185660	35703	286414	0.304	5.919	0.648	6.567
Blackspot(=red) seabream	*Pagellus bogaraveo*	1.99	392	47	286414	0.304	6.544	0.001	6.545
Sand steenbras	*Lithognathus mormyrus*	1.96	28000	2617	286414	0.304	6.445	0.098	6.543
John dory	*Zeus faber*	1.96	27831	3198	286414	0.304	6.445	0.097	6.542

2.2.6.2 Small pelagic species GSA 20, 22 & 23

A list of 10 small pelagic fish species were included in the PSA and ranked in terms of vulnerability and Value of the amount of landings in GSAs 22, 23, 20.

Chub mackerel was persistently found in the top 3 species list in all 3 GSAs. European anchovy and sardine were found in the top 3 species list in GSA 20, Atlantic mackerel and European anchovy in GSA 22 whereas bogue and Atlantic horse mackerel were found in the top 3 species list in GSA 23.

Sardine which is one of the most abundant species and has been assessed was ranked fourth in GSA 22 and six in GSA 23. In this GSA another clupeid *Sardinella aurita* was ranked fourth.

Table 2.2.6.2.2-1 Priority rank of small pelagic species in GSA 20, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
Chub mackerel	*Scomber japonicus*	1.88	541470	164716	425615.9	0.332	5.656	1.272	6.929
European anchovy	*Engraulis encrasicolus*	1.05	1167057	403105	425615.9	0.332	3.159	2.742	5.901
Sardine	*Sardina pilchardus*	1.12	1076565	526072	425615.9	0.332	3.370	2.529	5.899
Atlantic mackerel	*Scomber scombrus*	1.95	898	129	425615.9	0.332	5.867	0.002	5.869
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	375370	54148	425615.9	0.332	4.784	0.882	5.666
Bogue	*Boops boops*	1.42	540173	199003	425615.9	0.332	4.272	1.269	5.542
Atlantic horse mackerel	*Trachurus trachurus*	1.67	36870	7707	425615.9	0.332	5.025	0.087	5.111
Round sardinella	*Sardinella aurita*	1.31	397525	296018	425615.9	0.332	3.941	0.934	4.875

Table 2.2.6.2.2-2 Priority rank of small pelagic species in GSA 22, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
Chub mackerel	*Scomber japonicus*	1.88	3862112	1016424	8654497	0.315	5.971	0.446	6.418
Atlantic mackerel	*Scomber scombrus*	1.95	152429	19470	8654497	0.315	6.194	0.018	6.211
European anchovy	*Engraulis encrasicolus*	1.05	23647519	7001343	8654497	0.315	3.335	2.732	6.068
Sardine	*Sardina pilchardus*	1.12	17512179	5549704	8654497	0.315	3.557	2.023	5.581
Atlantic horse mackerel	*Trachurus trachurus*	1.67	869008	203015	8654497	0.315	5.304	0.100	5.405
Mediterranean horse mackerel	*Trachurus mediterraneus*	1.59	146892.6	24251	8654497	0.315	5.050	0.017	5.067
Bogue	*Boops boops*	1.42	3855416	1154855	8654497	0.315	4.510	0.445	4.956
Round sardinella	*Sardinella aurita*	1.31	2037923	1073991	8654497	0.315	4.161	0.235	4.396
European sprat	*Sprattus sprattus*	1.35	207	41	8654497	0.315	4.288	0.000	4.288

Table 2.2.6.2.2-3 Priority rank of small pelagic species in GSA 23, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
Bogue	*Boops boops*	1.42	476057	140017	191603.7	0.320	4.436	2.485	6.921
Chub mackerel	*Scomber japonicus*	1.88	3560	981	191603.7	0.320	5.873	0.019	5.892
Atlantic horse mackerel	*Trachurus trachurus*	1.67	6950	1546	191603.7	0.320	5.217	0.036	5.254
Round sardinella	*Sardinella aurita*	1.31	12474	5669	191603.7	0.320	4.093	0.065	4.158
Sardine	*Sardina pilchardus*	1.12	6572	2054	191603.7	0.320	3.499	0.034	3.533
European anchovy	*Engraulis encrasicolus*	1.05	4383	1252	191603.7	0.320	3.280	0.023	3.303

-Species included in management plans for GSAs 20 22 and 23

Existing management plans for demersal species in GSAs 20, 22 and 23 include hake, red mullet, surmullet as well as deep water rose shrimp and picarel. Deep water rose shrimp was included in the first 20 ranked species only in GSA 22.

Concerning SPF existing management plans for GSAs 20 and 22 include only European anchovy and sardine. Both of them were included in the top 5 species list.

2.2.7 Ranking GFCM area 25

2.2.7.1 Demersal species GSA 25

The demersal species included in the PSA were ranked in terms of vulnerability and Value of landings in GSA 25.

The top 5 species in the rankings are *Mullus surmuletus*, *Boops boops*, *Dicentrarchus labrax*, *Polyprion americanus* and *Lopius piscatorius*.

Concerning the elasmobranchs, a group that is poorly evaluated in the Mediterranean and not assessed in GSA 25, no species are found important in terms of vulnerability and landings in the first 20 and only one species (*Mustelus punctulatus*) have landings in GSA 25. Concerning the cephalopods *Sepia officinalis* and *Loligo vulgaris* are the only cephalopods selected within the top 20 species list. Concerning the crustaceans only *Nephrops norvegicus* is within the top 20 species.

Table 2.2.7.1**.1-**1 **First 20 priority demersal species in GSA 25 ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).**

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
Surmullet	*Mullus surmuletus*	1.92	523673.3	26186.97	155020.4	0.309	6.216	3.378	9.594
Bogue	*Boops boops*	1.63	654184.7	88113.33	155020.4	0.309	5.277	4.220	9.497
European seabass	*Dicentrarchus labrax*	2.45	18945.06	2018.5	155020.4	0.309	7.932	0.122	8.054
Wreckfish	*Polyprion americanus*	2.45	3199.267	299.5333	155020.4	0.309	7.932	0.021	7.952
Angler(=Monk)	*Lophius piscatorius*	2.45	250	100	155020.4	0.309	7.932	0.002	7.933
Common pandora	*Pagellus erythrinus*	2.2	120066.5	9288.003	155020.4	0.309	7.122	0.775	7.897
Red mullet	*Mullus barbatus*	1.68	364019.2	20297.7	155020.4	0.309	5.439	2.348	7.787
European eel	*Anguilla anguilla*	2.26	973	389	155020.4	0.309	7.317	0.006	7.323
European conger	*Conger conger*	2.2	370.1667	148.0667	155020.4	0.309	7.122	0.002	7.125
European hake	*Merluccius merluccius*	2.09	43868.97	4229.5	155020.4	0.309	6.766	0.283	7.049
White seabream	*Diplodus sargus*	1.84	161499.3	9953.725	155020.4	0.309	5.957	1.042	6.999
Gilthead seabream	*Sparus aurata*	1.92	99313.82	24750.63	155020.4	0.309	6.216	0.641	6.856
Common cuttlefish	*Sepia officinalis*	1.8	126274.1	13345.4	155020.4	0.309	5.827	0.815	6.642
White grouper	*Epinephelus aeneus*	2.02	2311	154.0667	155020.4	0.309	6.540	0.015	6.554
Sand steenbras	*Lithognathus mormyrus*	1.96	20790.55	1408.3	155020.4	0.309	6.345	0.134	6.479
Blackspot(=red) seabream	*Pagellus bogaraveo*	1.99	1470.333	588.1333	155020.4	0.309	6.442	0.009	6.452
John dory	*Zeus faber*	1.96	2493.073	378.3333	155020.4	0.309	6.345	0.016	6.361
European squid	*Loligo vulgaris*	1.78	71025.03	6143	155020.4	0.309	5.763	0.458	6.221
Norway lobster	*Nephrops norvegicus*	1.89	2317.5	103	155020.4	0.309	6.119	0.015	6.134
Blackbelly rosefish	*Helicolenus dactylopterus*	1.89	1060	424	155020.4	0.309	6.119	0.007	6.126

2.2.7.2 Small pelagic species GSA 25

The 10 small pelagic species in GSA 25 included in the PSA were ranked in terms of vulnerability and Value of landings. Only six species have landings: *Boops boops*, *Scomber scombrus*, *Scomber japonicus*, *Sardinella aurita*, *Sardina pilchardus* and *Engraulis encrasicolus*. According to the ranking *Boops boops* is the most important small pelagic species in this area.

Species included in management plan for GSA 25

The existing management plan for trawlers in GSA 25 includes *Mullus barbatus*, *Mullus surmuletus*, *Boops boops*, *Pagellus erythrinus* and *Spicara smaris*. All of these species are within the first 20 ranked species between the demersal, *Boops boops* is also ranked first between the small pelagics while *Spicara smaris* is not included in the analyses.

Table 2.2.7.2-1 Priority rank of small pelagic species in GSA 25, ranked according to the combination of their vulnerability index (Vulne) and their mean commercial Value (Mean Value) standardized by the Standard Deveiation (SD).

English name	Scientific name	vulne	Mean value	Mean Mass	Sd value	Sd vuln	Vuln index	Value index	rank
Bogue	*Boops boops*	1.42	654184.7	88113.33	262679.4	0.381	3.731	2.490	6.222
Atlantic mackerel	*Scomber scombrus*	1.95	1232.85	492.6	262679.4	0.381	5.124	0.005	5.129
Chub mackerel	*Scomber japonicus*	1.88	43504.19	15580.7	262679.4	0.381	4.940	0.166	5.106
Round sardinella	*Sardinella aurita*	1.31	268.75	107.5	262679.4	0.381	3.442	0.001	3.443
Sardine	*Sardina pilchardus*	1.12	4037.23	1379.5	262679.4	0.381	2.943	0.015	2.958
European anchovy	*Engraulis encrasicolus*	1.05	10845.42	3974.067	262679.4	0.381	2.759	0.041	2.800

2.2.8 Conclusion on TOR 1.1

The EWG analysis described above provides a ranking by species by GSA and the selected top 20 demersal stocks. The ranking is based on two independent criteria PSA as an expression of vulnerability by species and secondly the Value of landings by GSA. A combined factor based on equal ranking of these two criteria was used to select the top 20. The EWG regards this analysis as indicative of the importance of stocks to GSAs. The results of this ranking was examined by experts and considered in most cases give an appropriate selection of stocks though a few stocks previously considered important are missing. Where the method did not include all stocks either because they had not been included in the PSA analysis or because the ranking was not considered to capture the importance of additional stocks is noted. While the choice of equal weight between the two types of ranking is essentially arbitrary in the absence of alternative guidance it is the logical choice. The choice of ranking is in the end a management choice which can be informed by science but is a decision for managers to take. The small pelagic stocks were also treated this way, the analysis was more sensitive to PSA Value in most cases and management plans often include just European anchovy and sardine. For the small pelagics consideration should be given to the top two or three small pelagic species in addition to sardine and European anchovy.

The coherence of this top ranked stock list with MS management plans is noted, only a few local stocks appear to be missed by the approach. The number of stocks is chosen to be twenty as this results in around 400 stocks for consideration. Managers could change reduce the number easily or the final decision could be made based on other management needs not considered here. Overall the EWG was satisfied that this provided a good starting basis for stock selection.

3 ASSESSMENT METHODS BY STOCKS

ToR 1.2: Discuss and identify the most appropriate assessment method (from fully analytical to less-data rich assessment) that can be undertaken for each stock or group of stocks, the scientific advice that can be provided by such assessment methods and the ideal assessment frequency. Particular attention should be given to those stocks where an assessment: (i) has never been done or; (ii) was made long time ago (i.e. more than 4 years) or; (iii) has serious data limitations;

Since 2000, an EU framework for the collection and management of fisheries data has been in place. This framework was reformed in 2008 resulting in the Data Collection Framework (DCF). Under this framework, Member States (hereafter MSs) collect a wide range of fisheries data needed for scientific advice. Data are collected on a National Program basis in which each MS indicates data that have to be collected, resources allocated for the collection, and how data are collected.

The main information collected concern a) transversal variables: capacity (no. of vessels, kW, GT, average age of vessels), effort (fishing days) and landings (weight and price) and b) the collection of biological data relating to the fishing activity (métier) and fishing stocks. For métier-related variables, the sampling is performed on a quarterly basis to obtain catch-at-length distributions of species and discards rates. In order to identify the métier to be sampled, a ranking system is used in each GSA based on i) amount of commercial landings (tonnes), ii) total value of landings (EUR), and iii) total effort (fishing days). Sampling strategies involve samplings both on board and at landing sites. The number of fishing days to be sampled is defined in proportion to the effort (fishing days) and landings.

For all species, the acquisition of the variables related to the stock concerns: age, individual weight, sex and gonadal maturity.

The species subject to sampling (see Commission Decision 93/2010 - Annex VI) are classified according to a ranking procedure:

Group 1: Species that drive the international management process including species under EU management or recovery plans or EU recovery plans or EU long term multi annual plans or EU action plans for conservation and management;

Group 2: Other internationally regulated species and major non-internationally regulated by-catch species;

Group 3: All the other species (Fish and Crustaceans). The G3 list is agreed at a Regional level and endorsed by STECF.

Finally, independent fisheries data are collected through two surveys at sea. MEDITS (Mediterranean International Bottom Trawl Survey) is an experimental trawling survey in which the main information gathered concern biomass and density indices of all species caught and the length distributions by sex and stage of maturation of all the target species. MEDIAS (Pan-Mediterranean pelagic survey) is an acoustic survey that aims to gather information on the biomass and spatial distribution of small pelagic fish.

3.1 General Approach

According to ToR 1.2 and on the basis of the data available by stock and GSA, the group has tried to identify the most appropriate evaluation methods that can be used for each stock or group of stocks and the scientific advice that can be derived from such evaluation methods, as well as the ideal evaluation frequency. Given the individual nature of each stock and the specific data requirements for the different stock assessment methods, it is not possible to provide a recommended method for each stock. This will have to be finalized once an evaluation is undertaken. However, potential types of evaluation have been identified based on the availability of data.

The choice of evaluation model will be driven by several factors including the availability of appropriate data, the resources and expertise available and the type of advice required. In general, more sophisticated assessment models can provide more detailed advice and allow forecasts for fisheries management to be performed. However, these assessments also require additional data inputs and can be complex, time-consuming, and costly. The growing complexity has a number of negative features (Hilborn, 2003). Increasing complexity and importance of internal assumptions make it often hard to understand what drives an assessment. More importantly, as the models become more complex, with fewer people able to run and understand them, there will be less understanding of the models within working groups and stakeholder organisations. Advanced mathematical methods are more reliant on assumptions, less intelligible, harder to verify, less open to criticism, and therefore less trustworthy by the primary customers, i.e. fishers, fishery managers, and others with direct economic, social or conservation interests in the stock (Cotter et al., 2004).

Only specific situations require this kind of investment in complex models. Most of the stocks can be managed using less assumption- and data-rich evaluation models. Therefore, it is important to identify the data sources and assumptions that are pertinent for each stock to be assessed and to select the most appropriate method which best uses all the available information (ICES, 2015). In addition, the level of assessment that is best for each stock's situation has to be objectively decided in order to achieve the best compromise possible between using all available information, reliability of results, and resources required to carry out the assessment (e.g. technical skills, effort, time, etc.). The STECF EWG Med has been capable, over the past years, of attempting 30 stock assessments per year over two EWGs, with the bulk of assessments being XSAs. Expanding substantially the number of assessments required, while holding the same number of EWG meetings, would require simpler methods. Similarly going to more advanced stock assessments methods would require a reduction in the number of yearly assessments.

3.2 Assessment methods

The following list of assessment methods and models is mainly based on the Report on the Classification of Stock Assessment Methods developed by SISAM (ICES, 2012) and on SAC workshop on stock assessment of selected species of elasmobranchs in the GFCM area (2011). In addition some simpler evaluation methods documented by ICES in WKLIFEV (ICES 2015) are noted. For each category, population dynamics assumptions, minimum data requirements, management advice that can be given and notes on some of the limitations are provided.

3.2.1 Catch only

These models do not assume any population dynamics and they are simple methods for estimating sustainable catch levels when the only data available are little more than a time series of catches. An example is the Depletion Corrected Average Catch (DCAC; MacCall, 2007). These models provide advice on whether the recent average catch is sustainable or not but without information on stock status and/or trend.

Several new catch only models have appeared in recent years. For example, Rosenberg et al. (2013) tested 4 of these models and their performance in retrieving B/BMSY. Martell and Froese (2013) have produced an approach based on surplus production (Catch MSY) but consider that it requires more than 10 years of catch data.

In many cases long timeseries of data is not available under the DCF, (though this may be available from FAO databases) thus methods requiring less catch but some length data may be more applicable (see below)

3.2.2 Time series models

As in the catch only model the assumptions on the population dynamics are minimal. Typical data are catch or abundance index time series. An example is the Index Method (AIM) which fits a relationship between time series of relative stock abundance indices obtained from the surveys and historical landings data. The AIM calculates two derived quantities Replacement Ratio and Relative Fishing mortality. Management advice could be qualitative (i.e. trend in time) and if the stock is approaching a possible trigger for management action (e.g. the lowest point in the abundance index time series).

3.2.3 Length-based model estimator of Z: SEINE

The Beverton-Holt mortality estimator has been frequently used, especially in data-limited situations, because it only requires information on the von Bertalanffy growth parameters (k and L_∞), on the smallest size at which animals are fully vulnerable to the fishery L’ and to the sampling gear and the mean length of the animals larger than L’. The Beverton–Holt mortality estimator assumes equilibrium conditions. Hilborn and Walters (1992) described the transitional behavior of a similar estimator for a population that experiences a change in total mortality to a higher level. If the mortality estimator is applied continually to mean length data over time, the resulting estimates will show a gradual increase over time and will reach the true (new) value only when the new equilibrium condition will be reached.

Gedamke and Hoening (2006) investigated conditions affecting the reliability of the Beverton–Holt results and then developed a new procedure that allows a series of mortality rates to be estimated from mean length data representing non equilibrium conditions in multiple years.

The SEINE model is based on this work and it estimates the levels of total mortality based on observed length frequency data and the von Bertalanffy growth parameters. The user may estimate either single or multiple changes in mortality levels. SEINE allows a series of mortality rates to be estimated from mean length data representing non-equilibrium conditions in multiple years

3.2.4 Survey based model (SURBA)

The basis of SURBA is a simple survey-based separable model of mortality. The separable model used in SURBA assumes that total mortality $Z_{a,y}$ for ages a and y can expressed as:

$Z_{a,y}=s_a \text{ x } f_y$

where s_a and f_y are respectively the age and year effects of mortality. Parameters are estimated by minimising the weighted sum-of-squares of observed and estimated abundance indices. Abundance estimates (and therefore biomass measures) are currently generated by SURBA on a relative scale only, and are usually plotted as mean-standardised values for ease of comparison. Therefore SURBA can be used to provide advice on relative trends in abundance and total mortality, but not absolute levels. The model is most sensitive to assumptions about catchability. In particular, estimates of Z can be very different under different assumptions about catchability; SSB estimates are more robust (Cotter et al, 2007).

3.2.5 Biomass dynamics models

Surplus production models are among the simplest stock assessment models commonly employed by fisheries scientists to model population dynamics and track biomass. These models are designed to characterize the dynamics of a stock in terms of changes in total biomass without regard to age or size structure and they cannot incorporate any biological information regarding individual body growth, maturity or natural mortality rate. A disadvantage of surplus production models is they cannot provide possible explanations for changes in abundance, because the changes in standing stock biomass, recruitment, and mortality are all examined collectively. The models assume aggregate biomass dynamics controlled by a low number of parameters: typically just K (carrying capacity), r (intrinsic growth rate), initial population biomass and a catchability coefficient related to fishing mortality. The minimal data request are catch/effort data and one or several abundance indices (from surveys). One example could be ASPIC (Prager, 1994) which fits non-equilibrium versions of Schaefer, Fox and the generalised version of Pella and Tomlinson model (1969).

Biomass dynamic model with sufficient contrast in the time series, preferably by having observations above and below BMSY, as well as periods where the abundance index increases over time can provide estimates of MSY, current biomass relative to BMSY, current F relative to FMSY and are able to estimate the current catch that would correspond to FMSY (ICES, 2012).

More recent implementations of production models are the state-space surplus production model with Schaefer production function developed by J. Thorson (https://github.com/James-Thorson/state_space_production_model). SPICT (https://github.com/mawp/spict), also implemented in Template Model Builder (TMP), is an R-package for fitting surplus production models in continuous-time to fisheries catch data and biomass indices (either scientific or commercial). Main advantages of spict are:

1. All estimated reference points (MSY, Fmsy, Bmsy) are reported with uncertainties.
2. The model can be used for short-term forecasting and management strategy evaluation.

3. The model is fully stochastic in that observation error is included in catch and index observations, and process error is included in fishing and stock dynamics.
4. The model is formulated in continuous-time and can therefore incorporate arbitrarily sampled data.

3.2.6 Delay-difference models

An example is Collie-Sissenwine Analysis (Catch Survey Analysis) model (Collin-Sissenwine, 1983). This model is a stage-based model that estimates the abundance of two classes, defined as recruits and post-recruits and often some somatic growth relationship and natural mortality are included in the population dynamics. The model requires indices of abundance for these two stages and provides estimates of both abundance and mortality rates. Main limitations are generally similar to biomass dynamics models, although they have more biological realism than the biomass dynamics models by partitioning recruitment and adult somatic growth.

3.2.7 VPA-based approaches

Virtual population analysis (VPA) is a method usually applied to catch-at-age data (treated as known and without error in every time step) to provide estimates of historical population size and fishing mortality. It is performed separately for each ‘cohort’ or ‘year class’ within the exploited component of the population, starting from the latest year and oldest true age for each cohort. It works backward in time from this terminal age to the youngest age for which it is possible to estimate the numbers of fish that should have been alive, if catch-at-age and natural mortality rate are known. A common problem with VPAs is several cohorts will not have reached its maximum age in the last year of the model. Therefore, we lack information on mortality of younger fish in the final years of an assessment. Thus, we know the least about cohorts contributing to future abundance, which is often the most desirable information from a fisheries management perspective. Scientists use research surveys, catch and effort data, or tagging data to estimate fishing mortality for the most recent years, which can be used to estimate abundance in the ‘incomplete’ cohorts. Some of these models used abundance index for calibration (typically termed “tuning” in a VPA context). Finally, as a rule of thumb the time series of catch at age data should be cover at least the entire life history of a cohort. The VPA model most utilized during the EWG-meeting is the Extended Survival Analysis (XSA). Other common models are: ADAPT, sepVPA, LCA, etc. VPA models estimate time series of Biomass and Fishing mortality and if a spawners recruitment function is fitted to model outputs, complete advice on status determination and forecasts of limit and target catch levels can be provided as well as estimates of reference points.

3.2.8 Statistical catch-at-age (SCAA) models

Statistical catch-at-age analysis utilizes catch-at-age data to derive estimates of historical population size and fishing mortality. However, unlike VPA, model parameters estimated using catch-at-age analysis are done so by working forward in time and analyses do not require the assumption that removals from the fishery are known without error. Data typically used are: catch, abundance index, statistical sample of age composition of catch and abundance index.

ASAP, SAM, A4A, ICA and many custom ADMB coded applications are examples of these models. Generally complete advice on status determinations and forecasts of limit and target catch levels are attainable as well as estimates of reference points. SCAA models can also provide estimates of uncertainty in the estimated model parameters.

3.2.9 Integrated analysis (IA) models

Integrated assessment models are complex models that internally estimate a range of biological and fisheries parameters as well as stock abundance and mortality. In an SCAA these biological parameters are also estimated but the estimation is performed prior to the assessment making it more explicit and transparent. An example of an IA model is SS3 which is also capable of including spatial and size-based dynamics, as well as age-based dynamics and can operate on a range of time steps, such as seasonal. This means that IA models can capture some stock dynamics that SCAA models are unable to. However, they are typically labour intensive to set up, are ‘data hungry’, estimate a large number of parameters (particularly when spatial and size-based dynamics are considered) and can take a long time to fit, Additionally, given their complexity, the results can be hard to interpret by those unfamiliar with the model. Generally complete advice on status determinations and forecasts of limit and target catch levels are attainable as well as estimates of reference points. However, performing forecasts with results from a IA model such as SS3 is not straightforward.

Table 3.2.1 – Summary of the main assessment methods and of the data required.

Catch	Effort	Abundance indexes from scientific surveys (biomass and density indexes)	Catch number at age or length	Age/length structured tuning indexes	Natural mortality	Biological parameters (proportion of mature, LW parameters, ect)	Example models	Comments
Yes							Catch MSY, DCAC, SRA	Enough long time series, and enough contrast are needed In some cases series must include pristine situation
Yes		Yes					AIM (time series models)	Enough long time series, enough contrast is needed
Yes	Yes	Yes					Biomass dynamic model e.g. ASPIC, SPICT, state-space Schaefer	Production models can be fitted with catch and index of biomass that can not necessarily be CPUE
Yes			Yes		Yes		SepVPA	Useful for trends and not for absolute values
				Yes	Yes	Yes	Fishery independent assessment models (e.g. SURBA)	Strong assumptions on selectivity at age
Yes		Yes	Yes	Yes	Yes	Yes	VPA models (XSA, ADAPT, ecc)	Time series of biomass and fishing mortality and if a spawners recruitment function is fitted to model outputs, complete advice on status determination and forecasts of limit and target catch levels can be provided
Yes		Yes	Yes	Yes	Yes	Yes	SCAA models (A4A,ICA ecc)	Generally complete advice on status determinations and forecasts of limit and target catch levels are attainable if spawner-recruitment dynamics are embedded. Otherwise, advice is limited to estimates of biomass and fishing mortality time series
Yes		Yes	Yes	Yes	Yes	Yes	IA models (SS3)	Generally complete advice on status determinations and forecasts of limit and target catch levels are attainable if spawner-recruitment dynamics are embedded. Otherwise, advice is limited to estimates of biomass and fishing mortality time series. Can also provide advice on size and spatial stock structure.

The EWG noted above assessment models are based on single-species approach and suited to single species evaluation and advice. Therefore, these models do not consider ecological interactions between different species additional to the inclusion of natural mortality included in the model and observed changes in growth (i.e. explicit predator-prey relations, food competitions etc.). In the future, multispecies models or ecosystem models may be a good choice if there are requests for multi-species ecosystem based management (EBM), however, these are not need to give advice on the status of single species.

3.2.10 Some empirical indicators and some length-based indicators

Listed below are some possible indicators based both on fishery independent (scientific surveys) and fishery dependent (commercial catches/landings) information usefully in data poor or shortage conditions:

- trends in mean age/length/weight of the stock
- trends in catch or catch per unit of effort;
- estimation of and changes of area distribution (stock or specific life-stages)
- proportion by weight of large fish in the stock
- trends in the average maximum length.

In the following table some length-based indicators (ICES, 2015) are compared to appropriate reference points related to conservation, optimal yield and length distribution relative to expectations under MSY assumptions. Such an approach can be used if length frequency data is available, which is often the case for these stocks

Table 3.2.2 present the selected indicators, reference points, indicator ratios and their expected values. These are grouped in terms of i) conservation/sustainability; ii) optimal yield; and iii) MSY considerations (ICES, 2015).

Indicator	Calculation	Reference point	Indicator ratio	Expected Value	Property
Lmax5%	Mean length of largest 5%	Linf	Lmax%%/Linf	> 0.8	Conservation (large individuals)
L95%	95th percentile		L95%/Linf		
Pmega	Proportion of individuals above Lopt+10%	0.3-0.4	Pmega	> 0.3	
L25%	25th percentile of length distribution	Lmat	L25%/Lmat	> 1	Conservation (immatures)
Lc	Length at first catch (length at 50% of mode)	Lmat	Lc/Lmat	> 1	
Lmean	Mean length of individuals larger Lc	Lopt = 2/3 Linf	Lmean/Lopt	~ 1	Optimal yield

Lmaxy	Length class with maximum biomass in catch	Lopt = 2/3 Linf	Lmaxy/Lopt	~ 1	
Lmean	Mean length of individuals larger Lc	LF=M=(0.75Lc+0.25Linf)	Lmean/LF=M	≥ 1	MSY

3.3 Establish appropriate frequency of assessments

One of the most important aspects to take into account in order to achieve the best efficiency in managing stock assessment activities is to establish the ideal interval between assessment updates to meet management needs. The frequency of the assessment of a stock relies upon a range of factors including the biology of the stock and the stock status. When a stock's abundance fluctuates a lot, they need to be assessed more frequently to track changes. This allows us to make sure we are providing responsive fisheries management. If stocks are assessed too frequently, it is an inefficient use of resources (e.g. other stocks could be assessed with the same resources) and burdens managers with unnecessary adjustments. In contrast, if stocks are assessed too infrequently, management may be based on information that is out of date. In general, target assessment frequencies are typically in the range 1-3 years, but they may vary up to a maximum of 10 years for long-living species stocks. Fishery importance also is recognized as a factor in the frequency of updates.

The period between assessments defines how closely the assessment will be able to track fluctuations in stock abundance and to forecast corresponding changes in management options (Methot, 2015). Stocks with short life spans and/or high fluctuations in productivity are most in need of frequent updating. Stocks that are expected to have high natural fluctuations not only need frequent updating, they also need suitable data to use in this updating. For short-lived species, this means an indicator of changes in stock abundance must be very quickly turned into management advice on catch limits for the upcoming fishery season. For medium lifespan species, this generally means that size and/or age data needed for estimation of incoming recruitment will need to be collected and processed quickly to enable a quick turnaround from data collection to management action.

A pragmatic starting point could be using the mean age of fish in the catch as the most appropriate interval between assessment updates. Alternatively, a formula based on total mortality (Z) or natural mortality (M) could be used (Methot, 2015): for example, if a stock recruits at age 1, the mean age in the catch can be closely approximated by 0.5+(1/Z), or by 0.5+(1/(2*M)). It may be necessary to multiply this mean age by a scaling factor to achieve a good overall frequency of assessment, and to average mean age data over several years to remove the effect of variable recruitment. The definition of a threshold may be needed so that long-living species stocks are not assigned an unreasonably long assessment frequency.

Fishery importance and ecosystem importance must also be taken into account while defining the most appropriate frequency of assessment because of the improved fishing opportunity obtained by quickly tracking increase in stock biomass; at the same time, fishery and ecosystem risks are prevented by monitoring possible stock decrease.

Finally, stock status must also be considered when establishing a target frequency of assessment, as stocks that are known to be overfished need to be monitored more closely to enable management adjustments. Because stocks that are overfished will also tend to be stocks that have high fishery importance, it seems preferable to use fishery importance in setting the ideal assessment frequency and then use stock status in the prioritization process.

Although stocks that have rebuilding plans or are overfished needmore frequent updates because these conditions are indicators of changing stock abundance or fishing mortality rates, the prioritization system should avoid excessive diversion of assessment efforts from healthy stocks supporting major fisheries, as doing so will weaken reliable tracking of their available yield.

Once the list of priority species and choice of evaluation/assessment has been endorsed it will be easier to reconcile resources and propose timing along these lines.

3.4 Stock assessments carried out in Mediterranean so far

Since 2008, 46 species were assessed in the Mediterranean and Black Sea under STECF EWGs and FAO-GFCM WGs, for a total of 181 stocks assessed.

If we look at the methodologies applied throughout the years of activity of assessment working groups under STECF, nine different assessment methods were used so far, from production models to statistical catch-at-age models. In the 58% of stocks assessed, Extended Survivor Analysis (XSA) has been used, while Length-Cohort Analysis (LCA) performed by VIT (Llenoart and Salat, 1997) was applied in the 27% of the assessments carried out under the framework of STECF EWGs in the Mediterranean and Black Sea. Statistical catch-at-age models, such as a4a and Integrated Assessments such as SS3, are still used for very few stocks.

3.4.1 Assessing data availability of Mediterranean stocks for assessment

It was necessary to evaluate the kind and amount of data available for Mediterranean stocks. Only officially collected DCF data was considered although other data may be available orfor some stocks. Historical landings have been collected in most EU Mediterranean Member States since the 1950’s and while not available in a structured database, are available to different degrees and would be very important to extend DCF time series backwards in time.

Data from several sources was considered:

Table 3.4.1 Data sources available under the EU Data Collection Framework

Source	Type
DCF economic transversal data	Total Weight of landings
DCF biological data	Total Weight of landings
DCF biological data	Landings at length
DCF biological data	Catches at age
MEDITS	Survey indices at length
MEDIAS	Survey indices at length /and age for target species

Total Weight of discards and discards at length from the DCF was also available but was not considered. Additionally, effort data was available from the DCF biological data which could be used to generate a CPUE series. However, given the limited time available, this was not considered further at the meeting.

Each of the sources in Table 3.4.1 had data by species and area for a range of years. The years, area and species availability differed within and between the sources. There were a total of 2399 species across 22 areas and 6329 stock and area combinations.

Five levels of data availability were identified (Table 3.4.2). These can be used to help determine the type of stock assessment methods that are potentially available for each stock in each area.

Table 3.4.2 Classification of level of information (1-5) and stock assessment methods to determine stock status.

Level	Criteria	Potential assessment type
Level 5	At least 1 year of data from at least one of the sources.	Data poor method
Level 4	Landings Weight only – at least 8 years.	See Table 3.2.1 above
Level 3	Landings or catches at length only – at least 8 years.	See Table 3.2.1 & 3.2.2 above
Level 2	Landings Weight plus a scientific survey – at least 8 intersecting years.	Biomass dynamic
Level 1	Landings or catches at length or age plus a scientific survey – at least 8 intersecting years.	Tuned VPA, SCAA, IA

3.4.2 Stock assessments models for Mediterranean stocks

Determining the appropriateness of a stock assessment model depends on a large range of factors including the quality and information content of the available data and the age structure and life history of the stock. As such it is not possible to automatically assign an assessment method to each stock. This must be done by looking at each stock in detail and performing trial runs. However, it is possible to use Table 3.4.2 to give some guidance as to what methods may be possible, given the length and type of the available data.

It is very important to note that the Value of 8 years in Table 3.4.2 was chosen as a very general descriptor of data availability. Like selecting the most appropriate assessment method, the actual number of years necessary for an assessment depends on many factors including the quality and information content of the data and the age structure and life history of the stock. For example, a short time series with a lot of contrast in the data is more useful than a longer time series which has no contrast. Nevertheless it is considered that 8 years may form a good minimum. Those stocks with data sets less than 8 years may be evaluated only through current status methods such as the length criteria described above and such stocks are classified only as level 5 may still have enough data to perform a simple, data-poor type analysis such as pseudo cohort analysis that may be able to provide some semi-quantitiative or qualitative advice.

Levels were assigned to each stock and area combination to give an indication of the data available and the potential assessment method. The number of stocks in each area that had the different levels can be seen in Table 3.4.3.

Table 3.4.3. Number of species in each GSA which had the different data criteria. As mentioned above, the data availability criteria are for guidance only. For example, the table does not state with any certainty that in GSA 25 there are 5 species for which we can perform SCAA.

Table 3.4.2 Classification of level of information for stock assessment for the number of species in each GSA.

GSA	Level 5	Level 4	Level 3	Level 2	Level 1
1	1273	58	10	31	9
2	63	6	0	0	0
3	1	0	0	0	0
4	1	0	0	0	0
5	568	59	7	31	7
6	1717	57	10	32	10
7	434	59	9	34	7
9	148	36	16	28	14

10	146	30	10	22	6
11	146	11	9	11	9
12	58	0	0	0	0
13	10	0	0	0	0
14	42	0	0	0	0
15	214	60	1	0	0
16	141	10	7	6	5
17	233	101	8	26	7
18	132	30	9	25	8
19	135	30	12	21	8
20	213	0	0	0	0
22	287	0	0	0	0
23	103	0	0	0	0
25	264	5	5	5	5

If the data classification was performed including also historical landings from National databases, as it should be done, level 1 classification would have better coverage and for a much longer period than 8 years.

This information was combined with the outputs of the PSA and the outputs of current STECF stock assessments (if any) to give a summary table for the highest ranked demersal and small pelagic stocks in each GSA (TABLES). Some species appear multiple times in a GSA table as they are assessed in single and combined GSAs.

3.5 Assessment/Evaluation methods (by GFCM area)

As discussed above the choice of stock evaluation method has been based on first the stock priority, secondly data availability and finally expert evaluation to identify additional stocks or MS MPs that require additional species.

Throught this section each table contains two final columns one indicating the level of evaluation (1 to 5) that should be attempted. Only once a method has been tested on the actual data available will it be possible to determine if the method will be of use.

For stocks with Level 5 data there is often some length data (see above) if possible these stock will be evaluated with length analysis. In the longer term it may be that more data particularly on vulnerable species may need to be collected.

3.5.1 Assessment/Evaluation Methods GFCM area 1, 5, 6 & 7

3.5.1.1 Demersal species in GFCM areas 1,5,6 &7

The GSA 1 table (3.5.1.1-1) includes information collected for species of commercial interest in each area. For this reason it may not be possible with the available information to evaluate above Level 5 any of the very vulnerable elasmobranch species that appear in the top 20 species ranking. Some length data may be available for these secies, this should be checked. Also, for several of the species among the top 20 in GSAs 1, 5 and 6 it will be possible only to analyze landings trend, the only available information (e.g. red scorpionfish, gilthead seabream, common pandora). The evaluation of status of gilthead seabream, European seabass and surmullet in GSA 7 would be possible, since information on lengths is also available.

The most recent assessments, working group that conducted the assessment and stock status of target species of the Spanish trawler management plan are: for hake GFCM WGASP (2015), overexploited; for blue and red shrimp EWG 15-11, overexploited; and for deep-water rose shrimp EWG 13-22, overexploited.

Species not included in the top 20, which are target species of the trawler management plan are: Norway lobster, evaluated in 2011 by STECF 13-05, overexploited; red mullet, assessed in 2013; and surmullet never evaluated. However, these species are more prevalent in catches for other GSAs covered by the management plans.

Blackspot (=red) seabream has been assessed in the frame of CopeMed II.

Priority species not previously evaluated among the 20 top ranking could be common octopus, anglerfish and common pandora, species that have never been assessed but are ranked high mostly because their have high Value.

Table 3.5.1.1-1 Data availability for the first 20 priority demersal species in the GSA 1, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
Blue and red shrimp	11.391	4.833	6.558	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_11	3.90	Level 1	priority
Common octopus	10.803	4.062	6.741	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	Priority
Blackspot(=red) seabream	8.721	5.900	2.820	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
European hake	8.580	6.197	2.383	TRUE	TRUE	TRUE	TRUE	TRUE	2012	XSA	STECF 13 -22	7.14	Level 1	Priority
European hake*	8.580	6.197	2.383	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_11	2.88	Level 1	Priority
Angler(=Monk)	7.848	7.264	0.584	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	Priority
Kitefin shark	7.650	7.650	0.001	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Gulper shark	7.422	7.413	0.010	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Deep-water rose shrimp	7.362	5.218	2.143	TRUE	TRUE	TRUE	TRUE	TRUE	2012	XSA	STECF 13 -22	1.65	Level 1	priority
European seabass	7.313	7.264	0.048	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 2	priority
Wreckfish	7.280	7.264	0.015	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Picked dogfish	6.998	6.998	0.000	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
Marbled electric ray	6.850	6.849	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality
Sharpnose seven gill shark	6.850	6.849	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality
Common Pandora	6.838	6.523	0.315	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 4	priority
Longnosed skate	6.760	6.760	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality
Thornback ray	6.760	6.760	0.000	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	Check data quality
Bluntnose sixgill shark	6.642	6.642	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality

European conger	6.550	6.523	0.027	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality
Smooth-hound	6.529	6.523	0.006	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality
Norway lobster									2011	VIT	STECF13-05	1.65		Species included in MS Management Plans
Red mullet									2013	XSA	EWG14_19	4.8		Species included in MS Management Plans
Surmullet														Species included in MS Management Plans
Venus clam (*Chamellea gallina*)														Species included in MS Management Plans
Wedge shell (*Donax trunculus*)														Species included in MS Management Plans

*Assessment on merged GSAs 01_05_06_07

Table 3.5.1.1-2 Data availability for the first 20 priority demersal species in the GSA 5, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Meth	Meeting	F/Fmsy	Proposed evaluation	Comments
Blue and red shrimp	13.326	4.908	8.417	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	Priority
Red scorpionfish	8.495	6.504	1.991	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 3	Check data quality
Angler(=Monk)	7.784	7.378	0.406	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	Check data quality
Gulper shark	7.529	7.528	0.001	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality
Common spiny lobster	7.406	5.209	2.197	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality
European seabass	7.381	7.378	0.003	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	Check data quality

Wreckfish	7.380	7.378	0.002	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality
European hake*	7.304	6.293	1.011	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_11	2.88	Level 1	Priority
European hake	7.304	6.293	1.011	TRUE	TRUE	TRUE	TRUE	TRUE	2010	XSA	STECF 12-03	NA	Level 1	Priority
John dory	7.181	5.902	1.279	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	Check data quality
Sharpnose seven gill shark	6.956	6.956	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality
Thornback ray	6.894	6.866	0.028	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	Check data quality
Longnosed skate	6.871	6.866	0.005	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality
Surmullet	6.702	5.782	0.920	TRUE	TRUE	TRUE	TRUE	TRUE	2012	XSA	STECF 13-19	2.64	Level 1	Priority. Species included in MS Management Plans
Common Pandora	6.687	6.625	0.062	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
European squid	6.661	5.360	1.301	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 4	Check data quality
European conger	6.653	6.625	0.028	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality
Smooth-hound	6.651	6.625	0.026	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality
Longnose spurdog	6.631	6.625	0.006	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality
Common stingray	6.628	6.625	0.003	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Check data quality
Norway lobster									2013	XSA	EWG14_19	1.64		Species included in MS Management Plans
Red mullet									2012	XSA	STECF 13-19	7.64		Species included in MS Management Plans
Venus clam (*Chamellea gallina*)														Species included in MS Management Plans
Wedge shell (*Donax trunculus*)														Species included in MS Management Plans

*Assessment on merged GSAs 01_05_06_07

Table 3.5.1.1-3 Data availability for the first 20 priority demersal species in the GSA 6, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Meth	Meeting	F/Fmsy	Proposed evaluation	Comments
European hake	12.410	6.164	6.246	TRUE	TRUE	TRUE	TRUE	TRUE	2013	XSA	EWG14_09	9.77	Level 1	
European hake*	12.410	6.164	6.246	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_11	2.88	Level 1	
Blue and red shrimp	11.568	4.808	6.760	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_11	1.23	Level 1	
Norway lobster	8.770	5.574	3.196	TRUE	TRUE	FALSE	TRUE	FALSE	2011	VIT	STECF 13-05	5.00	Level 2	Species included in Management Plans
Angler(=Monk)	8.532	7.226	1.305	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
Gilthead seabream	8.040	5.663	2.377	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
Kitefin shark	7.610	7.610	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
European seabass	7.474	7.226	0.248	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
White skate	7.374	7.374	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
Gulper shark	7.374	7.374	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
Common Pandora	7.344	6.489	0.855	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
Wreckfish	7.233	7.226	0.007	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
Angelshark	7.167	7.167	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Picked dogfish	6.961	6.961	0.000	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
Roughtail stingray	6.813	6.813	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Marbled electric ray	6.813	6.813	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	

Sharpnose seven gill sha	6.813	6.813	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Red mullet	6.799	4.955	1.844	TRUE	TRUE	TRUE	TRUE	TRUE	2013	XSA	EWG14_09	2.77	Level 1	Species included in Management Plans
Common octopus	6.739	4.041	2.699	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	
Thornback ray	6.726	6.725	0.001	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Surmullet														Species included in Management Plans

*Assessment on merged GSAs 01_05_06_07

Table 3.5.1.1-4 Data availability for the first 20 priority demersal species in the GSA 7, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
European hake*	13.302	6.514	6.788	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_11	2.88	Level 1	
European hake	13.302	6.514	6.788	TRUE	TRUE	TRUE	TRUE	TRUE	2013	a4a	EWG14_09	7.88	Level 1	
European eel	10.001	7.044	2.957	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
European seabass	9.488	7.636	1.852	TRUE	TRUE	TRUE	FALSE	FALSE	NA	NA	NA	NA	Level 3	
Gilthead seabream	9.143	5.984	3.159	TRUE	TRUE	TRUE	FALSE	FALSE	NA	NA	NA	NA	Level 3	
Kitefin shark	8.043	8.041	0.002	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Common sole	7.873	5.610	2.262	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
Common octopus	7.816	4.270	3.545	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
White skate	7.798	7.792	0.006	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	

Angler(=Monk)	7.655	7.636	0.018	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1
Wreckfish	7.639	7.636	0.003	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis
Surmullet	7.624	5.984	1.640	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1
Angelshark	7.575	7.574	0.001	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis
Thresher	7.361	7.356	0.005	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis
Picked dogfish	7.360	7.356	0.004	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis
Common pandora	7.320	6.857	0.463	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2
Thornback ray	7.176	7.106	0.070	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2
Longnosed skate	7.125	7.106	0.018	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis
Shagreen ray	7.044	7.044	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis
European conger	7.036	6.857	0.179	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis

*Assessment on merged GSAs 01_05_06_07

3.5.1.2 Small pelagic species in GFCM areas 1,5,6 and 7

Atlantic mackerel, Chub mackerel

According to the table, insufficient information is available on Atlantic mackerel and Chub mackerel in GSAs 1,5,6, and 7. Nevertheless, some information in GSAs 1, 5 and 6 is likely to exist, at least landings data. From the acoustic surveys the relative abundance and biomass trend could be known.

European sprat in GSA 7

If considered interesting to evaluate the biomass trend of the small pelagics species in the Gulf of Lions, from the acoustic surveys this could be known. This issue has been investigated by Saraux *et al*. (2014).

GSA 1

According to the last assessment of sardine (GFCM WGASP, 2015), this stock is overexploited. The assessment of European anchovy (GFCM WGASP, 2015), was not accepted and thus, this stock should a priority for assessment.

GSA6

According to the last assessments of sardine and European anchovy (GFCM 2015) these stocks are over exploited.

The possibility of evaluating purse seine targeted species that have never assessed could be considered, in particular Atlantic mackerel, Chub mackerel, Atlantic horse mackerel and Mediterranean horse mackerel.

GSA 7

An environmental change appears to be taking place in the Gulf of Lions. Sardine and European anchovy biomasses have declined over the past 5 years causing an important fishery crisis while sprat abundance has increased (Saraux et al 2014).

According to the last assessments (GFCM WGASP, 2015) the status of sardine and European anchovy stocks is unknown.

The possibility of assessing European sprat, although of no commercial interest in the area, could be considered, since its increasing abundance coincides with the decrease in abundance of European anchovy and sardine.

Table 3.5.1.2-1 Data availability for the priority small pelagic species in the GSA 1, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
European pilchard	6.105	3.059	3.046	TRUE	TRUE	TRUE	TRUE	TRUE	2012	sepVPA	STECF 13-19	NA	Level 1	
Garfish	5.922	5.900	0.022	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Atlantic mackerel	5.601	5.326	0.275	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Chub mackerel	5.285	5.135	0.150	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Atlantic horse mackerel	4.935	4.561	0.373	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	Priority
Mediterranean horse mackerel	4.669	4.343	0.326	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 4	
European anchovy	4.663	2.868	1.796	TRUE	TRUE	TRUE	TRUE	TRUE	2009	XSA	SG-MED 10-02	2.33	Level 1	
Bogue	3.892	3.879	0.013	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Not Proposed	Lower Ranking insufficient data
Round sardinella	3.829	3.578	0.251	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Not Proposed	Lower Ranking insufficient data
European sprat	3.688	3.687	0.001	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Not Proposed	Lower Ranking insufficient data

Table 3.5.1.2-2 Data availability for the priority small pelagic species in the GSA 5, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
European anchovy	5.734	2.755	2.979	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	priority
Garfish	5.668	5.668	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Atlantic mackerel	5.172	5.117	0.056	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	priority
Chub mackerel	4.933	4.933	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	priority
Mediterranean horse mackerel	4.450	4.172	0.278	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
Atlantic horse mackerel	4.429	4.382	0.047	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
European pilchard	4.174	2.939	1.235	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	priority
Bogue	3.731	3.726	0.005	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Not Proposed	
Round sardinella	3.588	3.437	0.151	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Not Proposed	

Table 3.5.1.2-3 Data availability for the priority small pelagic species in the GSA 6, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
Garfish	5.900	5.900	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
European anchovy	5.833	2.868	2.965	TRUE	TRUE	TRUE	TRUE	TRUE	2009	XSA	SG-MED 10-02	NA	Level 1	Priority
Atlantic mackerel	5.426	5.326	0.100	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Chub mackerel	5.147	5.135	0.012	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Sardine	4.655	3.059	1.596	TRUE	TRUE	TRUE	TRUE	TRUE	2013	XSA	EWG14_19	1.66	Level 1	Priority
Atlantic horse mackerel	4.621	4.561	0.060	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	Priority
Mediterranean horse mackerel	4.371	4.343	0.028	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
Bogue	3.884	3.879	0.005	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Not Proposed	
European sprat	3.687	3.687	0.000	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Not Proposed	
Round sardinella	3.670	3.578	0.092	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Not Proposed	

Table 3.5.1.2-4Data availability for the priority small pelagic species in the GSA 7, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
Atlantic mackerel	6.110	5.117	0.993	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
European anchovy	5.703	2.755	2.948	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	Priority
Garfish	5.671	5.668	0.004	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Chub mackerel	4.980	4.933	0.047	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Atlantic horse mackerel	4.730	4.382	0.349	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	Priority
Sardine	4.348	2.939	1.410	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	Priority
Mediterranean horse mackerel	4.175	4.172	0.003	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	Priority
Bogue	3.810	3.726	0.084	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
Round sardinella	3.444	3.437	0.007	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
European sprat													Level 4	Priority

3.5.2 Assessment Methods GFCM area 8

The final table with the rankings was not output from the R script and could not be included. There was no local expertise at the meeting.

3.5.3 Assessment Methods GFCM area 9, 10, 11, 15, 16

3.5.3.1 Demersal species GSA 9,10,11,15 and 16

In GSA9, stock assessment has been performed on seven demersal species out of the 20 top ranking species, while only four and two species out of the 20 top ranking were assessed in GSA10 and GSA11, respectively. In GSAs 15-16, six species out of the 20 top ranking species were assessed: six in GSA16, and four in GSA15. In contrast, several species that are not included among the 20 top ranking species have been assessed, such as red mullet and deep-water pink shrimp in GSA 11.

According to the availability of data on demersal species in GSA9, full analytical assessments could be performed for 10 species: European hake, Norway lobster, common cuttlefish, deep-water rose shrimp, surmullet, red mullet, common Pandora, blue and red shrimp, European squid and horned octopus. For European seabass, anglerfish, Thornback ray and gilthead seabream only a time series of landings are available, thus status indicators could be applied.

For the other six species included in the top 20 list (Bluntnose sixgill shark, Red scorpionfish, European conger, Nursehound, Smooth-hound and Sand Steenbras), insufficient information is available for a Level 4 assessment but some length information over less years may be avaiable.

Twelve out of the first 20 ranking species in GSA 10 have at least Level 4 data. Therefore, the use of some indicator model could be explored. The species that could be considered for assessment are the following: European hake, monkfish, common Pandora, giant red shrimp, deep-water rose shrimp, cuttlefish, thornback ray, surmullet, common sole, anglerfish, and red mullet. Norway lobster is not included in the top 20 species list. However, this species represents an important target for demersal fisheries in GSA 10, and data are available for full analytical assessment of this species.

Considering the 20 top ranking species in the GSA 11, the table seems to be consistent with the expectations in data availability for assessment purposes. However, there are other four species (Blue and red shrimp, giant red shrimp, red mullet and deep-water rose shrimp) not ranking in the top 20 because they were not in the PSA analysis that should be worth of note for being assessed because they have to be considered as drivers in shelf and mid-waters fishing grounds, and in deep water fisheries blue and red shrimp, giant red shrimp).

In GSA16, it should be possible to run full assessment for the following demersal species: Deep water rose shrimp, Giant red shrimp, European hake, Norway lobster, Surmullet. Red mullet is not included in the top 20 species. However, due to the importance of this species for the demersal fisheries, it is recommended to carry out a full assessment on this stock.

In GSA 15, data appear scarce and scattered. For demersal stocks, the group strongly support performing joined assessments between GSA 15 and 16.

Priority for future assessment

Surmullet, common pandora, and anglerfish are ranking among the top 20 species in all the five GSAs. Surmullet has only been assessed in GSA 9, common pandora in GSA 9 and 15-16, and anglerfish in GSAs 9-16. Therefore, these three species could represent priority stocks to be assessed in the near future. Blue and red shrimp stock in GSA 9 has been assessed in 2011 (Ref. Year 2010). A new assessment of this stock in GSA 9 could be important as it represents the target species of deep-water OTB fisheries.

According to Stockmed Project results (Fiorentino et al., 2015), a single stock of European hake is present in GSAs 9, 10, 11, 15 and 16. A joined stock assessment of hake has been previously performed combining GSAs 9, 10, and 11. The results of that assessment showed good fit and more stable pattern that the assessments performed on single GSAs. Therefore, the exploration of the feasibility of carrying out combined assessment on other species, such as deep-water rose shrimp, Norway lobster, red mullet, European anchovy, etc., is suggested.

Table 3.5.3.1.1-1 Data availability for the first 20 priority demersal species in the GSA 9, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
European hake*	12.766	7.646	5.120	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_11	5.26	Level 1	
European hake	12.766	7.646	5.120	TRUE	TRUE	TRUE	TRUE	TRUE	2013	XSA	EWG14_09	5.17	Level 1	
European seabass	9.417	8.963	0.454	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
Angler(=Monk)	9.380	8.963	0.417	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 4	
Norway lobster	9.096	6.914	2.182	TRUE	TRUE	TRUE	TRUE	TRUE	2013	XSA	EWG14_09	2.03	Level 1	
Common cuttlefish	9.092	6.585	2.507	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	
Deep-water rose shrimp	9.057	6.439	2.618	TRUE	TRUE	TRUE	TRUE	TRUE	2013	XSA	EWG14_19	0.97	Level 1	
Surmullet	8.831	7.024	1.806	TRUE	TRUE	TRUE	TRUE	TRUE	2010	VIT	STECF 11-14	1.94	Level 1	
Red mullet	8.818	6.146	2.672	TRUE	TRUE	TRUE	TRUE	TRUE	2013	XSA	EWG14_09	1.17	Level 1	
Common pandora	8.772	8.048	0.723	TRUE	TRUE	TRUE	TRUE	TRUE	2010	VIT	STECF 11-14	NA	Level 1	
Red scorpionfish	8.522	7.902	0.620	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Thornback ray	8.446	8.341	0.105	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
Gilthead seabream	8.327	7.024	1.302	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
Blue and red shrimp	8.326	5.963	2.362	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	
European squid	8.240	6.512	1.728	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	
Bluntnose sixgill shark	8.196	8.195	0.002	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
European conger	8.107	8.048	0.058	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Horned octopus	8.080	5.707	2.373	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	

Nursehound	8.050	8.048	0.001	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Smooth-hound	8.049	8.048	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	

*Assessment on merged GSAs 9_10_11

Table 3.5.3.1.1-2 Data availability for the first 20 priority demersal species in the GSA 10, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
European hake	13.658	7.975	5.682	TRUE	TRUE	TRUE	TRUE	TRUE	2012	XSA	STECF 13 -22	6.87	Level 1	Priority
European hake*	13.658	7.975	5.682	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_11	5.26	Level 1	Priority
Angler(=Monk)	9.620	9.349	0.271	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	Priority
European seabass	9.486	9.349	0.137	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Common pandora	9.217	8.395	0.822	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	Priority
Giant red shrimp	9.107	5.762	3.345	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_11	1.40	Level 1	Priority
Deep-water rose shrimp	9.004	6.716	2.288	TRUE	TRUE	TRUE	TRUE	TRUE	2012	XSA	STECF 13 -22	1.33	Level 1	Priority
Common cuttlefish	8.814	6.869	1.946	TRUE	TRUE	TRUE	FALSE	FALSE	NA	NA	NA	NA	Level 3	
Thornback ray	8.723	8.700	0.023	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
Red scorpionfish	8.582	8.242	0.340	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Sand steenbras	8.506	7.479	1.027	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
European conger	8.476	8.395	0.081	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Surmullet	8.345	7.326	1.019	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	Priority
Silver scabbardfish	8.341	6.792	1.548	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	

Common sole	8.036	6.869	1.168	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
Blackbellied angler	7.948	7.708	0.240	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	Priority
European lobster	7.912	7.899	0.014	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Slender rockfish	7.908	7.899	0.009	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Red mullet	7.819	6.411	1.408	TRUE	TRUE	TRUE	TRUE	TRUE	2010	VIT	STECF 12-03	2.46	Level 1	Priority
Grey gurnard	7.787	7.594	0.193	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
Norway lobster														Priority

*Assessment on merged GSAs 9_10_11

Table 3.5.3.1.1-3 Data availability for the first 20 priority demersal species in the GSA 11, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
Common octopus	10.203	4.689	5.514	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Surmullet	9.415	6.572	2.843	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	
European hake*	9.021	7.154	1.868	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_11	5.26	Level 1	
Angler(=Monk)	8.969	8.386	0.583	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
European seabass	8.469	8.386	0.084	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Red scorpionfish	8.307	7.393	0.914	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Common cuttlefish	8.171	6.161	2.010	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	
European squid	8.134	6.093	2.042	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	
Thresher	8.092	8.078	0.014	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Common spiny lobster	8.007	5.921	2.085	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Common pandora	7.940	7.530	0.410	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Thornback ray	7.931	7.804	0.127	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Sharpnose sevengill shark	7.910	7.907	0.003	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
European conger	7.826	7.530	0.296	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
European eel	7.740	7.735	0.004	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Bluntnose sixgill shark	7.669	7.667	0.002	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
John dory	7.569	6.709	0.860	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Black scorpionfish	7.350	6.538	0.813	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	

European lobster	7.344	7.085	0.259	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Norway lobster	7.223	6.469	0.754	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	
Blue and red shrimp														Priority
Giant red shrimp									2014	XSA	EWG15_11	0.22		Priority
Red mullet									2012	XSA	STECF13_19	9.53		Priority
Deep-water rose shrimp									2011	VIT	STECF12_19	1.41		priority

*Assessment on merged GSAs 9_10_11

Table 3.5.3.1.1-4 Data availability for the first 20 priority demersal species in the GSA 15, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
Giant red shrimp*	11.300	4.679	6.621	TRUE	TRUE	FALSE	FALSE	FALSE	2011	XSA	STECF 13-05	5.57	Level 1	Priority
Red scorpionfish	9.769	6.693	3.076	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
Surmullet**	9.456	5.949	3.507	TRUE	TRUE	FALSE	FALSE	FALSE	2012	XSA	STECF 13-19	4.11	Level 4	
Silver scabbardfish	8.200	5.515	2.684	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
European hake**	8.019	6.476	1.544	TRUE	TRUE	FALSE	FALSE	FALSE	2009	VIT	SGMED10-03	7.47	Level 4	Priority, should be Level 1
Wreckfish	7.872	7.591	0.281	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
White skate	7.774	7.746	0.028	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Gulper shark	7.750	7.746	0.004	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
Angler(=Monk)	7.745	7.591	0.154	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
Common Pandora**	7.710	6.817	0.893	TRUE	TRUE	FALSE	FALSE	FALSE	2011	XSA	STECF 12-19	2.4	Level 1?	This should be Level 1 if XSA

European seabass	7.597	7.591	0.006	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis
Angelshark	7.531	7.529	0.002	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis
Picked dogfish	7.494	7.312	0.181	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis
Thornback ray	7.382	7.064	0.317	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4
Longnose spurdog	7.362	6.817	0.546	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis
Sharpnose sevengill shark	7.175	7.157	0.018	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis
Bluntnose sixgill shark	7.095	6.940	0.154	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis
Longnosed skate	7.090	7.064	0.025	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4
European conger	6.955	6.817	0.139	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4
Smooth-hound	6.884	6.817	0.067	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis

*Assessment on merged GSAs 12_13_14_15_16

**Assessment on merged GSAs 15_16

Table 3.5.3.1.1-5 Data availability for the first 20 priority demersal species in the GSA 16, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
Deep-water rose shrimp*	12.043	6.553	5.490	TRUE	TRUE	TRUE	TRUE	TRUE	2009	VIT	SGMED10-03	1.53	Level 1	priority
Giant red shrimp*	10.314	5.622	4.692	TRUE	TRUE	TRUE	TRUE	TRUE	2011	XSA	STECF 13-05	5.57	Level 1	Priority
Angler(=Monk)	9.308	9.123	0.185	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Priority
European hake**	9.228	7.782	1.446	TRUE	TRUE	TRUE	TRUE	TRUE	2009	VIT	SGMED10-03	7.47	Level 1	Priority
European seabass	9.129	9.123	0.006	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Thresher	8.788	8.787	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Thornback ray	8.549	8.490	0.059	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Common Pandora**	8.319	8.192	0.127	TRUE	FALSE	FALSE	FALSE	FALSE	2011	XSA	STECF12-19	2.4	Length analysis	Priority
Red scorpionfish	8.211	8.043	0.169	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
European conger	8.198	8.192	0.007	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Smooth-hound	8.194	8.192	0.003	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Norway lobster**	7.994	7.037	0.956	TRUE	TRUE	TRUE	TRUE	TRUE	2012	a4a	STECF13 -22	0.75	Level 1	Priority
Surmullet**	7.987	7.149	0.838	TRUE	TRUE	FALSE	TRUE	FALSE	2012	XSA	STECF13-19	4.11	Level 4	Priority
Slender rockfish	7.763	7.708	0.056	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
European lobster	7.715	7.708	0.007	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Turbot	7.524	7.521	0.002	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Blackbellied angler**	7.522	7.521	0.001	TRUE	FALSE	FALSE	FALSE	FALSE	2011	VIT	STECF12-19	NA	Length analysis	Should be at least Level 2
Blackspot(=red) seabream	7.420	7.410	0.011	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	

Grey gurnard	7.419	7.410	0.010	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
John dory	7.396	7.298	0.098	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Red mullet**									2011	XSA	STECF12_19	2.89		Priority

*Assessment on merged GSAs 12_13_14_15_16

**Assessment on merged GSAs 15_16

3.5.3.2 Small pelagic species in GSA 9,10,11,15 and 16

As regards small pelagics, only European anchovy and sardine stocks were assessed by previous STECF EWGs: European anchovy stocks were assessed in GSA9 and GSA16, while sardine was assessed in GSA9 only. The rest of the small pelagic species have never been assessed before.

For small pelagics, full information is available for horse mackerel. For European anchovy and sardine time series of landing and demographic structure are available. For Mediterranean horse mackerel and bogue, time series of landing and survey are available. For Garfish, Atlantic mackerel and Chub mackerel no assessments could be performed as no data is available. It is worth noting that survey data for small pelagics in GSA 9 are from MEDITS survey, but acoustic data should become available from 2015.

As concerns small pelagics in GSA 10, six species out of the nine included in the ranking analysis have at least Level 4 data available: European anchovy, sardine, bogue, chub mackerel, Atlantic horse mackerel, and Mediterranean horse mackerel. For these species, the feasibility of carrying out at least an indicator model could be explored, although the species driving the fisheries are European anchovy and sardine.

GSA11: Data on small pelagics are scarce and scattered, not allowing any type of assessment. Given the ranking of several small pelagic species and the lack of data, some data collection effort should be considered.

GSA 16: As concerns small pelagic species, it should be possible to provide evaluations on the state of exploitation of European anchovy and Sardine only, not status indicators are possible given the lack of any data. Given the ranking of several small pelagic species and the lack of data, some data collection effort should be considered.

GSA 15: The only species with at least level 3 data is bogue. However, we strongly suggest the exploration of the feasibility of performing some indicator model on those species included in the small pelagics management plan in GSA 15 (round sardinella and chub mackerel).

Table 3.5.3.2.2-1 Data availability for the priority small pelagic species in the GSA 9, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
European anchovy	5.830	2.755	3.075	TRUE	TRUE	TRUE	FALSE	FALSE	2010	VIT	STECF11-14	NA	Level 3	Priority
Garfish	5.673	5.668	0.005	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Atlantic mackerel	5.170	5.117	0.054	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Chub mackerel	5.011	4.933	0.078	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Atlantic horse mackerel	4.511	4.382	0.129	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	Priority
Mediterranean horse mackerel	4.228	4.172	0.056	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
Bogue	3.769	3.726	0.043	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
Round sardinella	3.446	3.437	0.009	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
European pilchard	3.369	2.939	0.431	TRUE	TRUE	TRUE	FALSE	FALSE	2012	sepVPA	STECF13-19	NA	Level 3	

Table 3.5.3.2.2-2 Data availability for the priority small pelagic species in the GSA 10, method used in accepted assessments, reference year, source of information and F/Fmsy.

English Name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
European anchovy	5.901	2.755	3.146	TRUE	TRUE	TRUE	FALSE	FALSE	NA	NA	NA	NA	Level 3	Priority
Garfish	5.677	5.668	0.009	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Atlantic mackerel	5.314	5.117	0.197	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Priority

Chub mackerel	4.955	4.933	0.022	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	priority
Atlantic horse mackerel	4.874	4.382	0.492	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
Mediterranean horse mackerel	4.225	4.172	0.053	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
Bogue	4.000	3.726	0.274	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	Level 2	
Round sardinella	3.526	3.437	0.088	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
European pilchard	3.299	2.939	0.360	TRUE	TRUE	TRUE	FALSE	FALSE	NA	NA	NA	NA	Level 3	priority

Table 3.5.3.2.2-3 Data availability for the priority small pelagic species in the GSA 11, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
Bogue	6.243	3.481	2.761	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Garfish	5.304	5.296	0.009	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Atlantic mackerel	4.896	4.781	0.115	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Atlantic horse mackerel	4.637	4.094	0.543	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Mediterranean horse mackerel	4.084	3.898	0.186	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Sardine	2.747	2.746	0.001	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	priority
European anchovy	2.681	2.574	0.106	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Priority

Table 3.5.3.2.1-4 Data availability for the priority small pelagic species in the GSA 15, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
Chub mackerel	7.619	5.135	2.484	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	priority
Round sardinella	6.104	3.578	2.526	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	priority
Garfish	5.902	5.900	0.002	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Atlantic mackerel	5.472	5.326	0.146	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Atlantic horse mackerel	4.910	4.561	0.348	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Bogue	4.515	3.879	0.637	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Level 4	
Mediterranean horse mackerel	4.443	4.343	0.101	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
European sprat	3.822	3.687	0.135	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Sardine	3.106	3.059	0.047	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Priority with GSA 16
European anchovy	2.869	2.868	0.001	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Priority with GSA 16

Table 3.5.3.2.1-5 Data availability for the priority small pelagic species in the GSA 16, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed evaluation	Comments
Garfish	5.634	5.563	0.071	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	

European anchovy	5.576	2.704	2.872	TRUE	TRUE	TRUE	FALSE	FALSE	2011	XSA	STECF13-05	9	Level 3	Priority with GSA 15, should be Level 2 or 4
Atlantic mackerel	5.160	5.022	0.138	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Atlantic horse mackerel	4.676	4.301	0.375	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Sardine	4.265	2.884	1.381	TRUE	TRUE	TRUE	FALSE	FALSE	NA	NA	NA	NA	Level 3	Priority with GSA 15, should be Level 2 or 4
Mediterranean horse mackerel	4.100	4.095	0.005	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Bogue	4.073	3.657	0.416	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	
Round sardinella	3.402	3.374	0.028	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length analysis	Priority with GSA 15

3.5.4 Assessment Methods GFCM area 17 & 18

3.5.4.1 Demersal Species GSA 17 and 18

Species prioritization

We merged the first 20 demersal species from GSA 17 and GSA 18 respectively and obtained a list of 27 species, important for the Adriatic Sea. There are 13 priority species common to both GSAs (European conger, European seabass, European squid, anglerfish, European hake, red mullet, Norway lobster, common pandora, wreckfish, thornback ray, red scorpionfish, common cuttlefish, spottail mantis), 7 species only occur in the ranking of GSA 17 (thresher, European eel, smooth-hound, brown meagre, common sole, gilthead seabream, picked dogfish), and 7 in the ranking of GSA 18 (grey gurnard, European lobster, blackbellied angler, surmullet, blackspot seabream, deep-water rose shrimp, turbot).

Among these, 7 species (thresher, European eel, European conger, grey gurnard, wreckfish, turbot and brown meagre) have low landings, since they are not target species and they only appear in the landing as by-catch. Because the Adriatic fishery is mostly mixed, any reductive measures enforced for the priority species will expectedly also positively influence the status of by-catch species and hence these 7 should be candidates for evaluation of status in GSAs 17 & 18. Though simple indicators of status for vulnerable bycatch species may be sufficient.

On the other hand, 4 species (horned octopus, musky octopus, common octopus, caramote prawn) that do not appear among the top 20 species for any of the analysed GSAs, probably due to low estimated vulnerability, but they are important target species of the Adriatic fisheries. We recommend considering these 4 species as priority species in GSAs 17 & 18 in addition to the ones identified by the ranking performed in this EWG.

It should be noted that this analysis does not include information on certain fisheries of the South Eastern Adriatic Sea, specifically those of Montenegro and Albania, however the landings from these countries are marginal compared to Italy and Croatia, so the results of the rankings would not be affected by lack of data from these countries.

National management plans

There are 4 management plans in force in GSAs 17 and 18 targeting demersal species:

- Croatian management plan (CMP) for bottom trawlers includes: european hake, red mullet, *Eledone spp* and Norway lobster.
- Italian management plan for bottom trawlers includes european hake, red mullet and Norway lobster.
- ; and Italian management plan for dredges includes only the venus clam.
- Slovenian management plan for bottom trawlers includes: whiting, musky octopus, common cuttlefish, European squid and picarel).

Of the 9 taxonomic groups (horned octopus and musky octopus are considered as a single taxonomic group in CMP) appearing in the management plans, 5 species (European hake, red mullet, Norway lobster, common cuttlefish and European squid) also appear among the priority species for GASs 17 &18, while 4 taxonomic groups (*Eledone spp*, venus clam, whiting and picarel) were not ranked among the top 20 species in our analysis. Venus clam and picarel were not analysed in the PSA and so do not appear on the list at all. Whiting is a highly important species for Slovenian bottom trawl fishery, but scored lower due to its lower overall landing Value and medium PSA score. We believe *Eledone spp*. should be included in the priority species list, since they are target species of several fisheries in the Adriatic and only appear low on the priority list due to their relatively low vulnerability.

Stock assessment prioritization

Of the 24 demersal priority species identified in the Adriatic (GSA 17 & 18), only 6 have previously been assessed at least once: common sole, Norway lobster, red mullet, European hake, spottail mantis and deep-water rose shrimp. All but one of the assessed stocks have data available to perform level 1 assessment. *S*pottail mantis has data with the potential to perform level 2 assessment. These stocks are important in every aspect, so the regular assessments should be continued.

On the contrary, the giant red shrimp has been assessed more than once in the past, but scored 58th in GSA 17 and 42^{nd} in GSA 18. Both its vulnerability and landing Value are low, so there is no need to include it in the priority species list.

Of the as of yet unassessed species on the priority list we suggest stock assessment to be performed on 11 species: common cuttlefish, horned octopus, musky octopus, blackbellied angler, anglerfish, European squid, common octopus, common pandora, thornback ray, European seabass and caramote prawn. Common pandora, blackbellied angler, anglerfish and thornback ray should be assessed as soon as possible since decreasing catches and low biomass index in the MEDITS survey have been recorded for these species and the assessment has never been performed on them before. The majority of these species has level 2 data availability and so stock assessment can be performed for all of them.

The two exceptions are the European seabass and Caramote prawn that have data availability level 4. Caramote prawn is a highly valued species in the Adriatic, but its vulnerability score is low compared to other analysed species, so it ranked lower in the priority species list. There is only landing data available for this species, so we recommend at least indication of stock status to be obtained. Since European seabass is not targeted by bottom trawl fisheries, but is an important target species in artisanal fisheries we recommend an indication of stock status to be obtained for this species as well. On the basis of these indications future actions can be determined.

Additionally, we believe identification inaccuracies in the landing data are present for species from genera: *Lophius* and *Eledone*. Since the two species in each of the respective genera are very similar, fishermen either report them at genera level or assign them to species randomly. To reduce biases, assessment for these genera should be performed on genera level.

Furthermore, identification biases are also expected in the landing data for picked dogfish, red scorpionfish,smooth-hound and species from the Family Triglidae, but these species are not currently on the assessment priority list, except the smooth-hound in GSA 17.

Table **3.5.4.1.1-1 Data availability for the first 20 priority demersal species in the GSA 17, method used in accepted assessments, reference year, source of information and F/Fmsy.**

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	Fratio	Proposed Evaluation	Comments
European hake	10.616	7.031	3.585	TRUE	TRUE	TRUE	TRUE	TRUE	2011	XSA	STECF 13-05	9.55	LEVEL 1	Priority. Included in management plan
European hake*	10.616	7.031	3.585	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_16	5.57	LEVEL 1	Priority. Included in management plan
Common sole	10.271	6.055	4.215	TRUE	TRUE	TRUE	TRUE	TRUE	2014	SS3	EWG15_16	2.44	LEVEL 1	Priority
Common cuttlefish	10.037	6.055	3.982	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	LEVEL 1	Priority. Included in management plan
Norway lobster	9.612	6.358	3.254	TRUE	TRUE	TRUE	TRUE	TRUE	2008	NA	SG-MED10-02	NA	LEVEL 1	Priority. Included in management plan
Spottail mantis squillid*	9.217	5.484	3.734	TRUE	TRUE	TRUE	TRUE	FALSE	2014	XSA	EWG15_16	1.24	LEVEL 2	Priority
Spottail mantis squillid	9.217	5.484	3.734	TRUE	TRUE	TRUE	TRUE	FALSE	2011	VIT	STECF 12-19	3.33	LEVEL 2	Priority
Angler(=Monk)	8.604	8.242	0.361	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority. Genera level assessment
European seabass	8.543	8.242	0.301	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 4	
Wreckfish	8.243	8.242	0.001	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Picked dogfish	7.962	7.939	0.023	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 4	
Thresher	7.941	7.939	0.002	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 4	
Thornback ray	7.714	7.670	0.044	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority
European eel	7.644	7.603	0.041	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 4	
Red mullet*	7.578	5.652	1.927	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_16	1.32	LEVEL 1	Priority. Included in management plan
Red mullet	7.578	5.652	1.927	TRUE	TRUE	TRUE	TRUE	TRUE	2012	SS3	STECF 13-19	2.61	LEVEL 1	Priority. Included in management plan
Common pandora	7.536	7.401	0.135	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority
European conger	7.442	7.401	0.041	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 4	

Red scorpionfish	7.433	7.267	0.166	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis
Smooth-hound	7.425	7.401	0.024	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 4

*Assessment on merged GSAs 17_18

Table 3.5.4.1.1-2 Data availability for the first 20 priority demersal species in the GSA 18, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed Evaluation	Comments
European hake*	12.515	7.362	5.154	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_16	5.57	LEVEL 1	Priority. Included in management plan
European hake	12.515	7.362	5.154	TRUE	TRUE	TRUE	TRUE	TRUE	2012	XSA	STECF 13 -22	5.76	LEVEL 1	Priority. Included in management plan
Angler(=Monk)	9.780	8.630	1.150	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority. Genera level assessment
Norway lobster	9.778	6.657	3.120	TRUE	TRUE	TRUE	TRUE	TRUE	2013	XSA	EWG14_19	6.08	LEVEL 1	Priority. Included in management plan
European seabass	8.740	8.630	0.111	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Wreckfish	8.633	8.630	0.003	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Common cuttlefish	8.598	6.340	2.258	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	LEVEL 1	Priority. Included in management plan
Red mullet	8.060	5.918	2.142	TRUE	TRUE	TRUE	TRUE	TRUE	2013	XSA	EWG14_19	1.07	LEVEL 1	Priority. Included in management plan
Red mullet*	8.060	5.918	2.142	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_16	1.32	LEVEL 1	Priority. Included in management plan
Thornback ray	8.040	8.031	0.009	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority
Common pandora	7.986	7.749	0.237	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority

European conger	7.819	7.749	0.070	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Less concern
Red scorpionfish	7.699	7.608	0.091	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Deep-water rose shrimp	7.550	6.199	1.351	TRUE	TRUE	TRUE	TRUE	TRUE	2011	NA	STECF 13-08	NA	LEVEL 1	
Deep-water rose shrimp**	7.550	6.199	1.351	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_16	2.21	LEVEL 1	
Surmullet	7.443	6.763	0.680	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	LEVEL 1	
Spottail mantis squillid	7.410	5.742	1.669	TRUE	TRUE	TRUE	FALSE	FALSE	2011	VIT	STECF 12-19	3.85	LEVEL 3	
Spottail mantis squillid*	7.410	5.742	1.669	TRUE	TRUE	TRUE	FALSE	FALSE	2014	XSA	EWG15_16	1.24	LEVEL 3	
Grey gurnard	7.333	7.010	0.323	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	
European squid	7.302	6.270	1.032	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	

*Assessment on merged GSAs 17_18

**Assessment on merged GSAs 17_18_19

3.5.4.2 *Small pelagic species GSA 17 and 18*

Species prioritization

Since PSA was only performed for 10 small pelagic species considered most important in purse seine fishery by the experts, the same species were generally present on the priority list for both GSAs (17 & 18), but their order differed slightly. The top priority species in GSA 17 mostly due to its high vulnerability is garfish, which is not landed in GSA 18 at all. Sardine is the 2nd most important species in GSA 17, but ranks last in the GSA 18 because of its medium landing Value in that GSA and a low vulnerability score. It is worth mentioning that PSA attributes were selected based on the available data for the purse seine fishery and for all selected species, so some important attributes of small pelagic fish species (e.g. highly fluctuating productivity) might be overlooked.

Besides sardine and *E*uropean anchovy, which are already included in management plans and their stock assessments are performed regularly, European sprat and species from genera *Scomber* and *Trachurus* are the most vulnerable and important by-catch species in the purse seine fisheries in the Adriatic and would thus benefit from determination of their status.

It should be noted that this analysis does not include information on certain fisheries of the South Eastern Adriatic Sea, specifically those of non EU countries, Montenegro and Albania, however the landings from these countries are marginal so the results of the rankings would not be affected by lack of data from these countries.

National management plans

There are 3 management plans in force in GSAs 17 and 18 managing small pelagic fisheries and they target 2 small pelagic species (Sardine and European anchovy) and the species from Family Mugilidae:

- Croatian management plan for purse seiners includes sardine and European anchovy.
- Italian management plan for pelagic trawlers includes: sardine and European anchovy.
- Slovenian management plan for purse seiners includes: sardine, European anchovy and Mugilidae.

Both of the species targeted by all 3 management plans are regularly assessed and appear in the priority species list for the Adriatic (GSAs 17 & 18). The species from the Family Mugilidae appear in the Slovenian management plan as a consequence of specificity of Slovenian coastal sea and the purse seine fishery in that area and while hugely important locally, do not score either high landing Value nor vulnerability score and as such, they do not appear on the priority species list of either GSA.

Stock assessment prioritization

The 2 most important small pelagic species in the Adriatic (sardine and European anchovy) have been regularly assessed and appear high on the priority species list. In addition to these 2 species, we propose preliminary catch based assessments be performed for species of the genera Scomber and Trachurus. There are multiple species in both these genera that are not easily identified and so fishermen either report them at genera level or assign them to species randomly. Consequently, the statistics for separate assessment are not reflecting the actual catches of the species from these genera and assessments should be performed on genera level to reduce biases. As the last species to be considered for indication of stock status as soon as possible is European sprat, an important by-catch species in the Northern Adriatic pelagic trawl and purse seine fishery. However, this species is caught in very small amounts mixed with European anchovy and/or sardine. Therefore, sprats are offten discarded or landed in mixed catches and usually misreported as European anchovy or sardine. Consequently, the statistics for separate sprat assessment are not available, and the only source of information could be acoustic surveys (MEDIAS).

Table 3.5.4.2.2-1 Data availability for the priority small pelagic species in the GSA 17, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed Evaluation	Comments
Garfish	5.901	5.900	0.001	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 4	
Sardine*	5.499	3.059	2.440	TRUE	TRUE	TRUE	TRUE	TRUE	2013	SAM	EWG14_09	2.32	LEVEL 1	Included in management plans
Atlantic mackerel	5.395	5.326	0.069	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 4	Priority. Genera level assessment
European anchovy*	5.211	2.868	2.343	TRUE	TRUE	TRUE	TRUE	TRUE	2013	SAM	EWG14_09	2.09	LEVEL 1	Included in management plans
Chub mackerel	5.171	5.135	0.036	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 4	Priority. Genera level assessment
Atlantic horse mackerel	4.594	4.561	0.032	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority. Genera level assessment
Mediterranean horse mackerel	4.347	4.343	0.004	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority. Genera level assessment
Bogue	3.887	3.879	0.009	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	
European sprat	3.699	3.687	0.012	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 4	Priority
Round sardinella	3.583	3.578	0.005	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 4	

*****Assessment on merged GSAs 17_18

Table 3.5.4.2.2-2 Data availability for the priority small pelagic species in the GSA 18, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed Evaluation	Comments
Atlantic mackerel	6.111	5.867	0.244	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority. Genera level assessment
European anchovy*	6.105	3.159	2.946	TRUE	TRUE	TRUE	TRUE	TRUE	2013	SAM	EWG14_09	2.09	LEVEL 1	Included in management plans
Chub mackerel	5.801	5.656	0.144	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 4	Priority. Genera level assessment
Atlantic horse mackerel	5.202	5.025	0.178	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority. Genera level assessment
Mediterranean horse mackerel	4.788	4.784	0.004	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority. Genera level assessment
Bogue	4.362	4.272	0.089	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	
Round sardinella	3.948	3.941	0.007	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Sardine*	3.613	3.370	0.243	TRUE	TRUE	TRUE	TRUE	TRUE	2013	SAM	EWG14_09	2.32	LEVEL 1	Included in management plans

*****Assessment on merged GSAs **17_18**

It has been noticed that valuable additional data on sardine fry fishery in the Adriatic Sea are available from EU Project SARDONE (http://ec.europa.eu/research/fp6/ssp/sardone_en.htm). Use of these data may increase the quality of sardine assessment, given the fact that previously this “derogation based” sardine fry fishery exploited the same stock of sardine in the Adriatic Sea.

3.5.5 Assessment Methods GFCM area 19

3.5.5.1 Demersal species GSA 19

Species prioritization

We ranked the demersal species in terms of vulnerability and Value of landings in GSA 19. There are 11 bony fish species, 3 elasmobranchs, 5 crustaceans and 1 cephalopod species in the top 20 species list (Table **2.2.5.1**.1-**1**). Since there was no expert from the area present at the EWG we consider the priority species list to be a good indication of their relative importance.

In addition, since bottom trawl fishery in GSA 19 is targeting especially crustaceans and despite their relatively low vulnerability, the common spiny lobster and the spottail mantis have high landing values and should be included in the priority species list. Another species to be considered for inclusion in the priority species list is the common octopus, for the same reasons.

Among the 10 analysed small pelagic species, European anchovy is the most important species, followed by garfish due to its high vulnerability, but this species seems to be marginal in terms of landing Value in this GSA.

National management plans

The Italian management plan for demersal trawlers in force in GSA 19 includes two fish species and 1 crustacean, namely European hake, red mullet and deep-water rose shrimp, ranking 1st, 19th and 7th in the priority species list respectively.

There is no management plan for small pelagic fish species in force in GSA 19.

Stock assessment prioritization

Assessments for 3 demersal species have been performed in GSA 19 thus far: European hake, giant red shrimp and deep-water rose shrimp. These species scored 1st, 4th and 7th on the priority species list. Additionally, we propose stock assessment to be of priority for the following demersal species: blue and red shrimp, *Lophius spp*, giant red shrimp, common cuttlefish, surmullet, Norway lobster, common spiny lobster, common octopus and spottail mantis.

Level 1 data is available for blue and red shrimp, surmullet and Norway lobster, Level 2 data is available for Lophius spp, giant red shrimp, common cuttlefish and common octopus and Level 3 data is available for spottail mantis. No data is available for the common spiny lobster and the European seabass. Since artisanal fishery in GSA 19 is of minor importance and the fact that the European seabass is mainly targeted by this fishing sector, its status identification might not be a priority.

We believe identification inaccuracies in the landing data are present for the 2 species from genus *Lophius*, since they are very similar and fishermen either report them at genera level or assign them to species randomly. To reduce biases, assessment for these genera should be performed on genera level.

3.5.5.2 Small pelagic species GSA 19

Only 1 small pelagic species has thus far been assessed in GSA 19, namely the European anchovy and the assessment is 4 years old. In addition to updating assessment of this species, the following species should be considered a priority: *Scomber spp*, bogue, *Trachurus spp* and sardine.

There are 3 small pelagic species with a Level 2 data availability – bogue and both species of genus *Trachurus*; 2 species with Level 3 data availability – European anchovy and sardine- and 1 species with Level 4 data available – chub mackerel. There are also 3 small pelagic species with no data available – garfish, Atlantic mackerel and round sardinella.

Round sardinella was included in the PSA but is of minor importance in the GSA 19 both in terms of vulnerability and landing Value and is thus not a priority species for stock assessment.

Table 3.5.5.2.1-1 Data availability for the first 20 priority demersal species in the GSA 19, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed Evaluation	Comments
European hake	11.269	7.505	3.764	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_16	4.86	LEVEL 1	Priority
Blue and red shrimp	10.175	5.853	4.322	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	LEVEL 1	Priority
Angler(=Monk)	9.365	8.797	0.568	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority. Genera level assessment
Giant red shrimp*	9.042	5.422	3.620	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_16	1.10	LEVEL 1	Priority
European seabass	8.814	8.797	0.016	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Not proposed	
Deep-water rose shrimp	8.512	6.320	2.192	TRUE	TRUE	TRUE	TRUE	TRUE	2012	XSA	STECF 13 -22	2.38	LEVEL 1	Priority
Deep-water rose shrimp**	8.512	6.320	2.192	TRUE	TRUE	TRUE	TRUE	TRUE	2014	XSA	EWG15_16	2.21	LEVEL 1	Priority
Common cuttlefish	8.511	6.463	2.047	TRUE	TRUE	TRUE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority
Thresher	8.488	8.474	0.014	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Surmullet	8.486	6.894	1.592	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	LEVEL 1	Priority
Common pandora	8.406	7.900	0.506	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	
Sharpnose seven gill shark	8.308	8.295	0.013	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Red scorpionfish	8.231	7.756	0.475	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Thornback ray	8.195	8.187	0.008	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 4	
European conger	8.054	7.900	0.154	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	

Norway lobster	7.546	6.787	0.759	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	LEVEL 1	Priority
Sand steenbras	7.544	7.038	0.506	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Black scorpionfish	7.538	6.858	0.679	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Silver scabbardfish	7.458	6.392	1.066	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
European lobster	7.442	7.433	0.009	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Common octopus														
Mantis shrimp														
Pink spiny lobster														

*Assessment on merged GSAs 18_19

**Assessment on merged GSAs 17_18_19

Table 3.5.5.2.2-1 Data availability for the priority small pelagic species in the GSA 19, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed Evaluation	Comments
European anchovy	5.956	2.755	3.201	TRUE	TRUE	TRUE	FALSE	FALSE	2012	sepVPA	STECF 13-19	NA	LEVEL 3	Priority
Atlantic mackerel	5.870	5.117	0.753	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA		Priority. Genera level assessment.
Garfish	5.727	5.668	0.059	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Not proposed	No data available

Atlantic horse mackerel	5.274	4.382	0.892	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority. Genera level assessment
Chub mackerel	5.024	4.933	0.091	TRUE	TRUE	FALSE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 4	Priority. Genera level assessment
Bogue	4.997	3.726	1.271	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority
Mediterranean horse mackerel	4.402	4.172	0.230	TRUE	TRUE	FALSE	TRUE	FALSE	NA	NA	NA	NA	LEVEL 2	Priority. Genera level assessment
Sardine	3.674	2.939	0.735	TRUE	TRUE	TRUE	FALSE	FALSE	NA	NA	NA	NA	LEVEL 3	Priority
Round sardinella	3.449	3.437	0.011	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Not proposed	Lower ranking

3.5.6 Assessment Methods GFCM area 20

3.5.6.1 Demersal species GSA 20

Table 3.5.6.1.1-1 Data availability for the first 20 priority demersal species in the GSA 20, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/F msy	Proposed Evaluation	Comments
European hake	11.948	6.937	5.011	TRUE	FALSE	FALSE	FALSE	FALSE	2008	VIT	STECF 12-21	NA	Length Analysis	Priority
White seabream	9.202	6.108	3.094	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Gilthead seabream	9.022	6.373	2.649	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Caramote prawn	8.870	5.410	3.459	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority

Red mullet	8.422	5.576	2.845	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
European seabass	8.360	8.132	0.227	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Angler(=Monk)	8.254	8.132	0.122	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Wreckfish	8.188	8.132	0.055	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Angelshark	8.072	8.066	0.006	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Common pandora	7.920	7.302	0.617	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Thornback ray	7.573	7.568	0.005	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
European eel	7.502	7.502	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Bluntnose sixgill shark	7.446	7.435	0.011	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
European conger	7.333	7.302	0.030	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Common stingray	7.307	7.302	0.005	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Surmullet	7.198	6.373	0.825	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Red scorpionfish	7.175	7.170	0.006	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Stock status in MSY context	Priority
White grouper	7.172	6.705	0.467	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Common cuttlefish	7.170	5.975	1.196	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Stock status in MSY context	Priority
Brown meagre	6.995	6.937	0.057	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	

3.5.6.2 Small pelagic secies GSA 20

Table 3.5.6.2.2-1 Data availability for the priority small pelagic species in the GSA 20, method used in accepted assessments, reference year, source of information and F/Fmsy.

English name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed Evaluation	Comments
Chub mackerel	6.929	5.656	1.272	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Stock status in MSY context	Priority
European anchovy	5.901	3.159	2.742	TRUE	FALSE	FALSE	FALSE	FALSE	2008	XSA	SG-MED 10-02	NA	Length Analysis	Priority
Sardine	5.899	3.370	2.529	TRUE	FALSE	FALSE	FALSE	FALSE	2008	XSA	SG-MED 10-02	NA	Length Analysis	Priority
Atlantic mackerel	5.869	5.867	0.002	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Stock status in MSY context	Candidate for assessment
Mediterranean horse mackerel	5.666	4.784	0.882	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Bogue	5.542	4.272	1.269	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Atlantic horse mackerel	5.111	5.025	0.087	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Round sardinella	4.875	3.941	0.934	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	

3.5.7 Assessment Methods GFCM area 22 & 23 Combined

Species included in assessments

From the demersal species list, hake, red mullet, surmullet and deep-water rose shrimp were regularly assessed in GSAs 20, 22 up to 2010. Latest assessment was carried out in 2012 and it is more than 4 years old. Deep-water rose shrimp was not found important in terms of vulnerability and landings in GSAs 20 and 23.

Picarel, blotched picarel and bogue in GSA 22-23 were assessed once in 2012 and this assessment is also more than four years old. Bogue was in the top 20 demersal species only in GSA 23 whereas picarel and blotched picarel do not appear as they were not included in our analysis.

From the small pelagic species list only European anchovy and sardine were regularly assessed in GSAs 20 and 22 up to 2012. Latest assessment was carried out in 2012 and it is more than 4 years old. Bogue was found in the top of the small pelagic species list only in GSA 23. As mentioned above, picarel, blotched picarel and bogue in GSA 22-23 were assessed once in 2012 but this assessment is more than four years old.

3.5.7.1 Demersal speciessGSA 20,22 and 23

Targeted by the fishery and identified as important in terms of vulnerability and landings in all three GSAs should be priority for assessment: hake, red mullet, surmullet, cuttlefish, common Pandora, anglerfish, Blackbellied angler and red scorpionfish. From these species hake, red mullet, surmullet, common Pandora, should be priority for <u>analytical stock assessment</u> as they drive the fishery in all three GSAs. In addition, <u>analytical stock assessment should be performed</u> for anglerfish, Blackbellied angler provided that there is adequate information. Otherwise an indication for stock status in MSY context should be given for these species. An indication for stock status in MSY context should be given for the cuttlefish and red scorpionfish. An indication for stock status in MSY context is advisable also for the elasmobranchs species indicated by the analysis (Common stingray, thornback ray, angelshark and bluntnose sixgill shark) should be explored as no elasmobranchs assessment has been done before.

In addition, Caramote prawns should be a priority in GSA 20 and deep-water rose shrimp in GSA 22. Analytical stock assessment should be done for these species.

The lack of DCF data for the period 2009-2012 sets additional difficulties for analytical stock assessment in GSAs 20, 22 and 23. This would largely depend on the length of the time series available prior to 2009. In case that available data are not adequate for analytical stock assessment at least an indication for stock status in MSY context should be provided for all the above species.

DEMERSAL

Table 3.5.7.1.1-1 Data availability for the first 20 priority demersal species in the GSA 22, method used in accepted assessments, reference year, source of information and F/Fmsy.

English Name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed Evaluation	Comments
European hake	12.391	6.898	5.493	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Surmullet	10.659	6.337	4.322	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Common Pandora	8.453	7.261	1.192	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Deep-water rose shrimp	8.311	5.809	2.503	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Angler(=Monk)	8.230	8.086	0.144	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
European seabass	8.222	8.086	0.136	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Wreckfish	8.088	8.086	0.002	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Angelshark	8.023	8.020	0.003	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Red mullet	8.007	5.544	2.463	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Gilthead seabream	7.941	6.337	1.604	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Norway lobster	7.908	6.238	1.670	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Red scorpionfish	7.542	7.129	0.413	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Stock status in MSY context	Priority
Common sole	7.539	5.941	1.598	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Thornback ray	7.525	7.525	0.001	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	

Longnosed skate	7.525	7.525	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis
Common stingray	7.473	7.261	0.213	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis
Bluntnose sixgill shark	7.398	7.393	0.005	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis
European conger	7.276	7.261	0.016	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis
White seabream	7.081	6.073	1.009	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis
Brown meagre	7.066	6.898	0.168	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis

Table 3.5.7.1.1-2 Data availability for the first 20 priority demersal species in the GSA 23, method used in accepted assessments, reference year, source of information and F/Fmsy.

English Name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed Evaluation	Comments
Red mullet	11.193	5.524	5.668	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Surmullet	9.286	6.314	2.972	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
European hake	8.895	6.873	2.023	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Common pandora	8.235	7.234	1.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
European seabass	8.061	8.057	0.004	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Wreckfish	8.060	8.057	0.003	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Angler(=Monk)	8.058	8.057	0.001	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority

Thornback ray	7.499	7.498	0.001	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
White seabream	7.278	6.051	1.228	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Red scorpionfish	7.270	7.103	0.167	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Stock status in MSY context	Priority
Common stingray	7.257	7.234	0.022	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
European conger	7.241	7.234	0.006	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Bogue	7.022	5.360	1.662	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
White grouper	6.964	6.643	0.321	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Brown meagre	6.881	6.873	0.008	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Blackbellied angler	6.726	6.643	0.083	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Common cuttlefish	6.567	5.919	0.648	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Stock status in MSY context	Priority
Blackspot(=red) seabream	6.545	6.544	0.001	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Sand Steenbras	6.543	6.445	0.098	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
John dory	6.542	6.445	0.097	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	

3.5.7.2 Small pelagic species GSA 20,22 and 23

priority for assessment should include European anchovy, sardine in GSAs 22 and 20. Analysis showed that chub mackerel should be assessed in all 3 GSAs. Analytical stock assessment is recommended for these three species. For chub mackerel at least an indication for stock status in MSY context should be given.

The priority for GSA 23 should be bogue and Atlantic horse mackerel instead of European anchovy and sardine. An analytical stock assessment should be given for bogue. An indication for stock status in MSY context should be given for both species in case that available data are not adequate.

Atlantic mackerel can be a candidate for assessment in GSAs 20 and 22 and round sardinella for GSA 23. Given the unknown origin of Atlantic mackerel in the GSA 20 & 22 separate stock assessments are precautionary advised for this species. An indication for stock status in MSY context should be given for these species in case that available data are not adequate.

The lack of DCF data for the period 2009-2012 sets additional difficulties for analytical stock assessment in GSAs 20, 22 and 23. This would largely depend on the length of the time series available prior to 2009. In case that available data are not adequate for analytical stock assessment other kind of methodologies like tuning the recruitment with suitable environmental indices should be explored or at least an indication for stock status in MSY context should be provided for all the above species.

Table 3.5.7.2.2-1 Data availability for the priority small pelagic species in the GSA 22, method used in accepted assessments, reference year, source of information and F/Fmsy.

English Name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed Evaluation	Comments
Chub mackerel	6.418	5.971	0.446	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Atlantic mackerel	6.211	6.194	0.018	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Stock status in MSY context	Candidate for assessment
European anchovy	6.068	3.335	2.732	TRUE	FALSE	FALSE	FALSE	FALSE	2008	XSA	STECF 12-03	NA	Length Analysis	Priority
Sardine	5.581	3.557	2.023	TRUE	FALSE	FALSE	FALSE	FALSE	2008	XSA	STECF 12-03	NA	Length Analysis	Priority
Atlantic horse mackerel	5.405	5.304	0.100	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Mediterranean horse mackerel	5.067	5.050	0.017	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Bogue	4.956	4.510	0.445	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Round sardinella	4.396	4.161	0.235	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
European sprat	4.288	4.288	0.000	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	

Table 3.5.7.2.2-2 Data availability for the priority small pelagic species in the GSA 23, method used in accepted assessments, reference year, source of information and F/Fmsy.

English Name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed Evaluation	Comments
Bogue	6.921	4.436	2.485	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Stock status in MSY context	Priority
Chub mackerel	5.892	5.873	0.019	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Priority
Atlantic horse mackerel	5.254	5.217	0.036	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Stock status in MSY context	Priority
Round sardinella	4.158	4.093	0.065	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Stock status in MSY context	Candidate for assessment
Sardine	3.533	3.499	0.034	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
European anchovy	3.303	3.280	0.023	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Bogue	6.921	4.436	2.485	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Chub mackerel	5.892	5.873	0.019	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Atlantic horse mackerel	5.254	5.217	0.036	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	

3.5.8 Assessment Methods GFCM area 25

3.5.8.1 Demersal species GSA 25

From these species lists red mullet and picarel have been assessed but the last accepted ones are more than 5 years old. Mullus barbatus is within the top 10 species in GSA 25 between the demersal whereas Spicara smaris is not included in our analyses.

Priority for assessment

Surmullet, being the most important species in GSA 25 according to the demersal ranking, and bogue, being the second most important in the demersal ranking and the most important in the small pelagics ranking, should have priority in analytical assessment.

Common pandora could be also taken in consideration for an analytical assessment (6th in the ranking).

The two stocks that have been assessed in the past, red mullet (7th in the ranking) and picarel (not included), would deserve priority for analytical assessment as well.

Norway lobster has been identified in position 19 in the table below. It is considered that this species is not found in the fisheries in GSA 25 and that it bprobably results from area misreporting so it should not be considered for further evaluation (see table 3.5.8-1)

Table 3.5.8.1.1-1 Data availability for the first 20 priority demersal species in the GSA 25, method used in accepted assessments, reference year, source of information and F/Fmsy.

English Name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed Evaluation	Comments
Surmullet	9.594	6.216	3.378	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	Priority
Bogue	9.497	5.277	4.220	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	Priority
European seabass	8.054	7.932	0.122	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
Wreckfish	7.952	7.932	0.021	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
Angler(=Monk)	7.933	7.932	0.002	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
Common Pandora	7.897	7.122	0.775	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	Level 1	Priority
Red mullet	7.787	5.439	2.348	TRUE	TRUE	TRUE	TRUE	TRUE	2008	VIT	SG-MED 10-02	3.82	Level 1	Priority
European eel	7.323	7.317	0.006	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
European conger	7.125	7.122	0.002	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
European hake	7.049	6.766	0.283	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
White seabream	6.999	5.957	1.042	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
Gilthead seabream	6.856	6.216	0.641	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
Common cuttlefish	6.642	5.827	0.815	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
White grouper	6.554	6.540	0.015	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
Sand Steenbras	6.479	6.345	0.134	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	

Blackspot(=red) seabream	6.452	6.442	0.009	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	
John dory	6.361	6.345	0.016	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
European squid	6.221	5.763	0.458	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
Norway lobster	6.134	6.119	0.015	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA		Not proposed
Blackbelly rosefish	6.126	6.119	0.007	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
Picarel											STECF11_14 GFCM 2013		Level 2	Priority; Species included in MS Management Plans

3.5.8.2 Small pelagic species GSA 25

Table 3.5.8.2.2-1 Data availability for the priority small pelagic species in the GSA 25, method used in accepted assessments, reference year, source of information and F/Fmsy.

English Name	rank	Vuln index	Value index	Level 5	Level 4	Level 3	Level 2	Level 1	year	Method	Meeting	F/Fmsy	Proposed Evaluation	Comments
Bogue	6.222	3.731	2.490	TRUE	TRUE	TRUE	TRUE	TRUE	NA	NA	NA	NA	LEVEL 1	Priority
Atlantic mackerel	5.129	5.124	0.005	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
Chub mackerel	5.106	4.940	0.166	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
Round sardinella	3.443	3.442	0.001	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
Sardine	2.958	2.943	0.015	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality
European anchovy	2.800	2.759	0.041	TRUE	FALSE	FALSE	FALSE	FALSE	NA	NA	NA	NA	Length Analysis	Check data quality

3.6 *Data availability for stocks with proposed management plans*

The Commission provided a list of proposed national management plan by species (Table 2.1.3), these were organised as species by GSA and compared with the list of prioratised species from Section 3.5. Of the 117 species by GSA covered by these plans 66 are already included in the priority tables, of the remainder (61) Table 3.6.1 shows the data availability. Some of these plans are for local fisheries such as transparent goby, others for shellfish such as hard or Venus clams that were not included in the analysis. A few are for red mullet which does not have a high vulnerability score and unlike hake is not of sufficient value to appear in the top twenty in all GSAs. The table below can be used to indicate the potential data and the level of evaluation that may be possible. Some of these species were specifically added to the top 20 tables and highlighted for priority.

Table 3.6.1 Species included in MS management plan prposals but not ranked in top 20 demersal species or in selected 10 small pelagic species. Data availability for species by GSA, TRUE indicated analysis at this level could be investigated, FALSE indicates some data is available but insufficient for the analysis, N/A indicates that no data is available in the JRC DCF database.

Common Name	Scientific Name	GSA	Level 5	Level 4	Level 3	Level 2	Level 1
Tuberculate cockle	*Acanthocardia tuberculata*	01	TRUE	FALSE	FALSE	FALSE	FALSE
Transparent goby	*Aphia minuta*	01	TRUE	FALSE	FALSE	FALSE	FALSE
Smooth callista	*Callista chione*	01	TRUE	FALSE	FALSE	FALSE	FALSE
Venus clam	*Chamellea gallina*	01	#N/A	#N/A	#N/A	#N/A	#N/A
Truncate donax	*Donax trunculus*	01	TRUE	FALSE	FALSE	FALSE	FALSE
Red mullet	*Mullus barbatus*	01	TRUE	TRUE	TRUE	TRUE	TRUE
Surmullet	*Mullus surmuletus*	01	TRUE	TRUE	TRUE	TRUE	TRUE
Norway lobster	*Nephrops norvegicus*	01	TRUE	TRUE	FALSE	TRUE	FALSE
Transparent goby	*Aphia minuta*	05	TRUE	FALSE	FALSE	FALSE	FALSE
Red mullet	*Mullus barbatus*	05	TRUE	TRUE	TRUE	TRUE	TRUE
Norway lobster	*Nephrops norvegicus*	05	TRUE	TRUE	FALSE	TRUE	FALSE
Deep-water rose shrimp	*Parapenaeus longirostris*	05	TRUE	TRUE	TRUE	TRUE	TRUE
Pseudaphya ferreri	*Pseudaphya ferreri*	05	TRUE	FALSE	FALSE	FALSE	FALSE
Picarel	*Spicara smaris*	05	TRUE	TRUE	FALSE	TRUE	FALSE
Smooth callista	*Callista chione*	06	TRUE	FALSE	FALSE	FALSE	FALSE
Venus clam	*Chamellea gallina*	06	#N/A	#N/A	#N/A	#N/A	#N/A
Truncate donax	*Donax trunculus*	06	TRUE	FALSE	FALSE	FALSE	FALSE
Smooth sandeel	*G. semisquamatus*	06	#N/A	#N/A	#N/A	#N/A	#N/A
Mediterranean sand eel	*Gymnammodytes cicerelus*	06	#N/A	#N/A	#N/A	#N/A	#N/A
Surmullet	*Mullus surmuletus*	06	TRUE	TRUE	TRUE	TRUE	TRUE
Deep-water rose shrimp	*Parapenaeus longirostris*	06	TRUE	TRUE	TRUE	TRUE	TRUE
Transparent goby	*Aphia minuta*	07	#N/A	#N/A	#N/A	#N/A	#N/A
Sand smelts nei	*Atherina spp.*	07	#N/A	#N/A	#N/A	#N/A	#N/A
Purple dye murex	*Bolinus brandaris*	07	TRUE	FALSE	FALSE	FALSE	FALSE
Cristal goby	*Crystallogobius linearis*	07	#N/A	#N/A	#N/A	#N/A	#N/A
Mediterranean mussel	*Mytilus galloprovincialis*	07	TRUE	FALSE	FALSE	FALSE	FALSE
Salema	*Sarpa salpa*	07	TRUE	FALSE	FALSE	FALSE	FALSE
Black scorpionfish	*Scorpaena porcus*	07	TRUE	FALSE	FALSE	FALSE	FALSE
Greater amberjack	*Seriola dumerili*	07	TRUE	FALSE	FALSE	FALSE	FALSE
Comber	*Serranus cabrilla*	07	TRUE	FALSE	FALSE	FALSE	FALSE
Painted comber	*Serranus scriba*	07	#N/A	#N/A	#N/A	#N/A	#N/A
Symphodus wrasses nei	*Symphodus rostratus*	07	#N/A	#N/A	#N/A	#N/A	#N/A
Symphodus wrasses nei	*Symphodus tinca*	07	#N/A	#N/A	#N/A	#N/A	#N/A
Transparent goby	*Aphia minuta*	09	TRUE	FALSE	FALSE	FALSE	FALSE

Red mullet	*Mullus barbatus*	11	TRUE	TRUE	TRUE	TRUE	TRUE
Deep-water rose shrimp	*Parapenaeus longirostris*	11	TRUE	TRUE	TRUE	TRUE	TRUE
Common dolphinfish	*Coryphaena hippurus*	15	TRUE	TRUE	FALSE	FALSE	FALSE
Deep-water rose shrimp	*Parapenaeus longirostris*	15	TRUE	TRUE	TRUE	TRUE	TRUE
Venus clam	*Chamellea gallina*	17	#N/A	#N/A	#N/A	#N/A	#N/A
Musky octopus	*Eledone moschata*	17	TRUE	TRUE	FALSE	TRUE	FALSE
Whiting	*Merlangius merlangus*	17	TRUE	TRUE	FALSE	FALSE	FALSE
Mullets nei	*Mugilidae*	17	TRUE	TRUE	FALSE	FALSE	FALSE
Octopus spp	*Octopus spp.*	17	#N/A	#N/A	#N/A	#N/A	#N/A
Picarels nei	*Spicara flexuosa*	17	#N/A	#N/A	#N/A	#N/A	#N/A
Red mullet	*Mullus barbatus*	19	TRUE	TRUE	TRUE	TRUE	TRUE
Deep-water rose shrimp	*Parapenaeus longirostris*	20	#N/A	#N/A	#N/A	#N/A	#N/A
Picarel	*Spicara smaris*	20	#N/A	#N/A	#N/A	#N/A	#N/A
Picarel	*Spicara smaris*	22	TRUE	FALSE	FALSE	FALSE	FALSE
Deep-water rose shrimp	*Parapenaeus longirostris*	23	#N/A	#N/A	#N/A	#N/A	#N/A
Picarel	*Spicara smaris*	23	#N/A	#N/A	#N/A	#N/A	#N/A
Deep-water rose shrimp	*Parapenaeus longirostris*	25	TRUE	TRUE	TRUE	TRUE	TRUE

3.7 Conclusions to ToR 1.2

The EWG has identified around 20 demersal stocks by GSA based on priority (Section 2) This information has been combined with and data availability by evaluation the quantity but not the quality of data in the JRC DCF database. Based on availability of information, the priority of the stock as a driver for fisheries the potential type of assessment / indicator for management has been identified. This list is considered as a good starting point for selection of stocks requiring a full assessment and those for which a simple indicator of MSY status is considered appropriate. While this list is a good starting point a stock could be moved from one assessment status to another should the need occur. . . Overall this results in a potential 84 units (Species by GSA) with the potential to be assessed (level 1) of which 28 would be new units not previously assessed. There are 77 units that could be evaluated by biomass/survey trends (level 2 and 3) which could be assessed with simpler models. In addition to these there are 307 species by GSA that have been identified as potential suitable for status indicators (level 4 and 5) of which 51 have potential for indicator developing over time (level 4). Of these level 4 and 5 level units 11 and 46 respectively have been identified as higher priority to be examined for simple indices. From these units the data would need to be evaluated to look at a subset that should be monitored. It should be noted that there may be some scope for reduction by combing GSAs to give a single stock unit so these numbers may overestimate the number of units to be monitored.

There is some potential for combing some species (such as hake ad mackerels) across GSA, this is noted where it is considered relevant.

The EWG also examined the basis for frequency of assessment and has provided guidance on how this should be done , but the EWG did not have sufficient time/personnel resources to finalise a regime for frequency of assessment, this could be done relatively quickly once the list of assessments and indicators is finalised.

4 TIMESERIES CATCH AND EFFORT OF EUROPEAN ANCHOVY AND SARDINE (GSA 22-23)

ToR 1.3: To the extent possible, reconstruct time series of historical catch and effort data for the stocks of European anchovy and sardine in the Aegean Sea (GSA 22 and 23).

Background information

European anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*) are two of the most important target species for the purse seine fishery in the Greek Seas as pelagic trawls are banned and benthic trawls are allowed to catch small pelagics in percentages less than 5% of their total catch. The main distribution area of the two stocks in Aegean Sea (GSA 22) is located in the continental shelf of the northern Aegean Sea. Their spatial distribution is strongly related to semi closed gulfs, shallow waters (less than 100 m depth) with high productivity, often related to areas of rivers outows (e.g. Tsagarakis et al., 2008; Giannoulaki et al., 2011; Giannoulaki et al., 2013). The distribution of the two stocks over the Cretan Sea (GSA 23) is very variable and abundance is considered negligible. Available stock assessment of European anchovy and sardine stocks has been carried out so far only in GSA 22 and the information has derived from the Greek part of the Aegean Sea. Since the European data collection frameworks were implemented, early 2000's, sampling was carried out in GSA 22 for the period 2003-2006, 2008 and 2013-2014. The information available includes European anchovy and sardine monthly landings, and length frequency information based on sampling on-board commercial vessels. Discards are estimated to be negligible, <1% of the total catch of the purse seine fishery (Tsagarakis et al 2012). Gaps in the fisheries information result into a series of limiting data issues for stock assessment purposes. Given the short time frame available to the EWG1605 and the load of work to retrieve available information the reconstruction of historical catch and effort data for the two stocks to the extent possible was limited to GSA 22.

4.1 Revised timeseries (currently available)

Within the framework of the EWG1605 a reconstruction of historical catch and effort data for European anchovy and sardine stocks in GSA 22 to the extent possible was carried out.

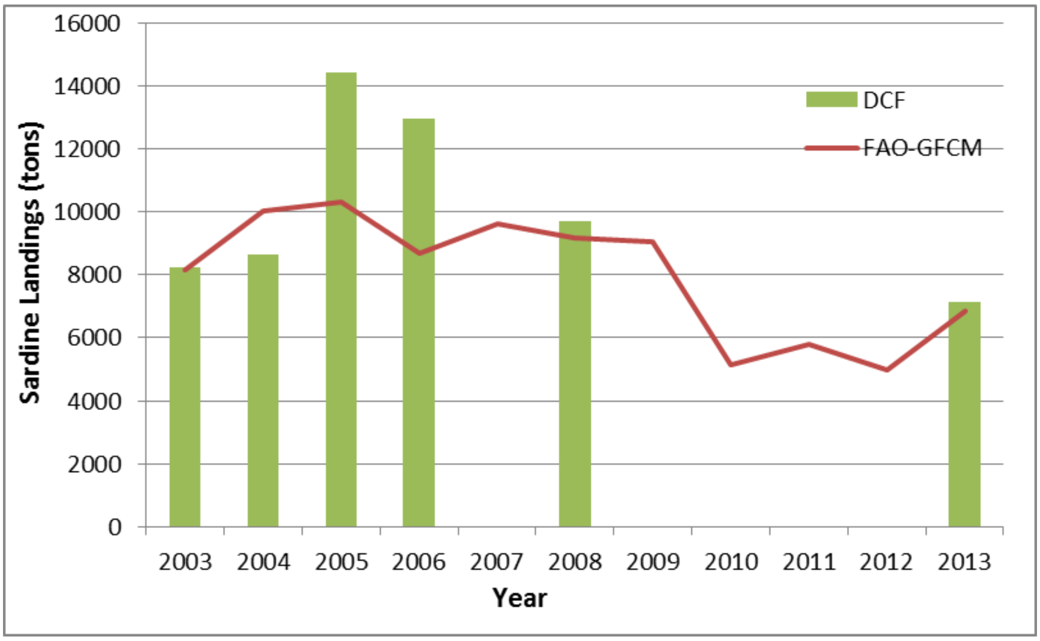
Catches

Data available

Historical catches are available from FAO GFCM Fisheries Statistics Dataset for Aegean Sea concerning Greece (Fig 1). These historical catches however do not include any age or length structure information. Since the European data collection frameworks were implemented, early 2000's, landings sampling was carried out in the Greek part of GSA 22 for the period 2003-2006, 2008 and 2013-2015.

Fig 4.1. Historical catches since 1970 are available from FAO GFCM Fisheries Statistics Dataset for the Greek part of Aegean Sea.

Deviations were observed between the historical landings and the ones reported based on the DCF/DCR for the period 2000-2008 and 2014 (Fig 2) and the need for adjustment was identified.



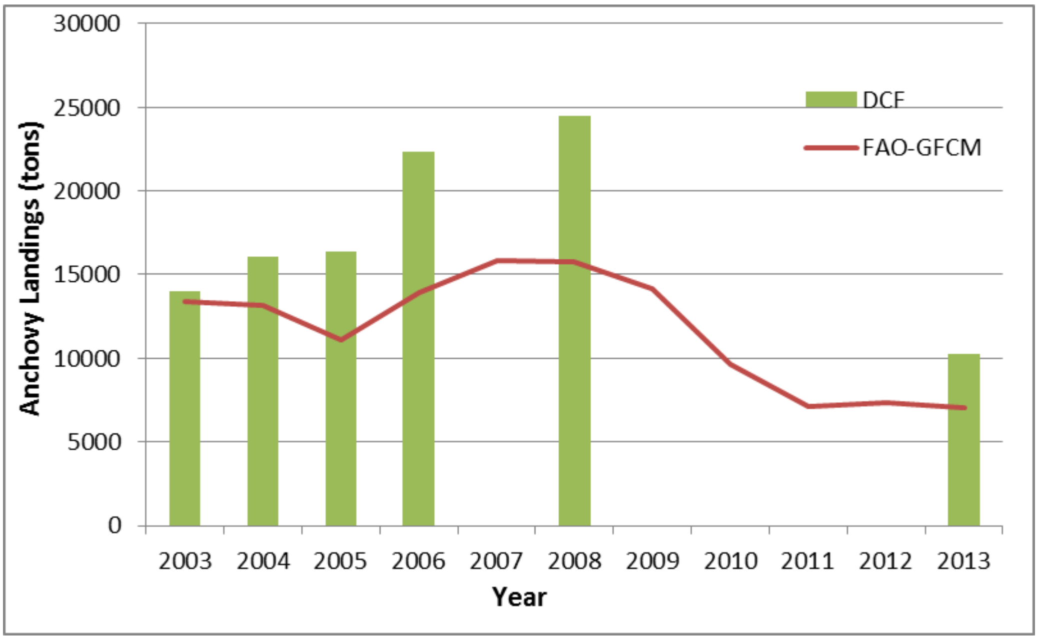


Fig 4.2 Sardine and European anchovy landings comparison between FAO-GFCM and DCF/DCR for the period 2003-2014.

As no age or length structure information is available at the FAO GFCM Fisheries Statistics Dataset or any other known catch or landings dataset, reconstruction was limited to total catches per species.

Effort

Historical Data available

Revision of effort information involving European anchovy and sardine stocks in GSA 22 was limited to the purse seine fishery as this fishery in the Greek Seas is responsible for the bulk of the catches as pelagic trawls are banned and benthic trawls are allowed to catch small pelagics in percentages less than 5% of their total catch. Available stock assessments in STECF EWG and GFCM stock assessment working groups are based on landings that derive from the purse seine fleet.

Historical effort information of the purse seine fleet in GSA 22 mainly involves information on capacity variables like number of vessels, engine power and vessel capacity.

Within the framework of EWG 15-06 the reconstruction of the purse seine fleet (PS) in terms of number of vessels in GSA 22 was based on the time series of PS as published by Moutopoulos and Stergiou (2012) and it was provided to the STECF EWG 12-10. This was initially aggregated for all three GSAs and it was adjusted to reflect the situation in GSA 22.

Within the framework of EWG 15-06 the reconstruction of the purse seine fleet concerning engine power and vessel capacity the available information by National Statistical Service of Greece since 1991 (HELSTAT 2012) was used.

As no historical data were collected in Greece concerning the fishing days at sea by the National Statistical Service of Greece, this seriously limited our potential to reconstruct the effort timeseries within the framework of STECF EWG 15-06.

To the extent possible given the strict time frame the EWG 15-06 identified the estimates of days at sea* engine power and days at sea * fishing capacity for the period 1998 to 2001 as presented in Machias et al., 2008; Kapantagakis et al 2001. This information was added to the DCF/DCR information for the recent period.

Experts' opinion within the STECF EWG 15-06 identified the presence of additional problems in this particular fishery. In Greece there is a number of mixed vessels operating part of the year as both bottom trawlers and part of the year as purse seiners. For these vessels monitoring the actual fishing days as purse seiners is essential and a modeling approach cannot really overcome this impediment. In addition national legislation has enforced different type of spatial or temporal bans per area (eg. Saronikos Gulf: PS operate during the full moon period but not during the weekend in areas like, Thracian Sea: PS operate during the weekend but not 5 days around the full moon period in each month in areas).

4.2 Revised timetimetime-series, further possibilities and approach needed

Revised timetimetime-series of Catches

As no age or length structure information is available at the FAO GFCM Fisheries Statistics Dataset or any other known catch or landings dataset, reconstruction was limited to total catches per species. Deviations were observed between the historical landings and the ones reported based on the DCF/DCR for the period 2000-2008 and 2014 thus the need for adjustment was identified. Catches adjustment for the two species in GSA 22 was based on the work carried out in Jardim et al 2015. A small percentage to take into account discards (~2%) was also added.

The revised time series for the two species is shown in Fig 3.

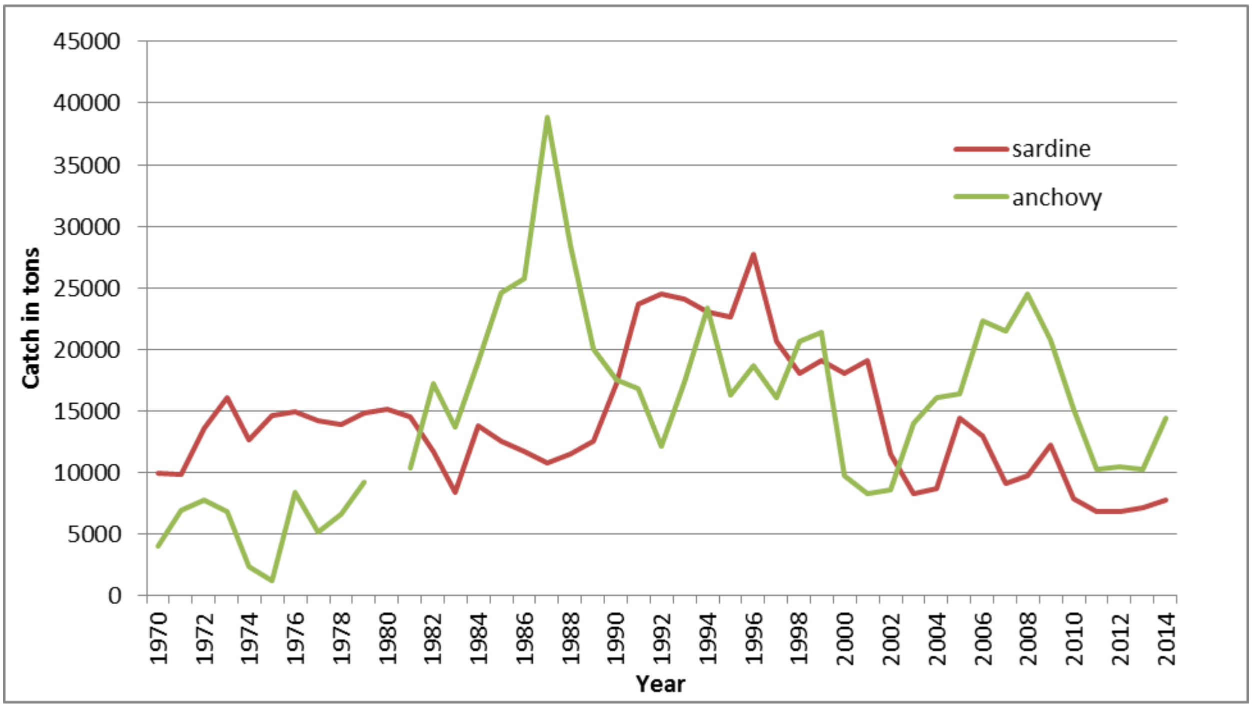


Fig. 4.3 Adjusted historical catches going back to 1970 based on the FAO GFCM Fisheries Statistics Dataset for the Greek part of GSA 22.

Revised time series of Effort

Total number of vessels

Within the framework of STECF EWG 15-06 the reconstruction of the purse seine fleet in terms of number of vessels in GSA 22 was based on the time series as published by Moutopoulos and Stergiou (2012). This was considered the longest available that has taken into account information from various sources in Greek waters. The data used in this publication were provided for stock assessment purposes to the STECF EWG 12-10. The time series of the number of PS involves all three GSAs and dates back to 1928. It was adjusted to reflect the situation in GSA 22.

Specifically, a linear model was fitted between the number of vessels as recorded by the HELSTAT+DCF for GSA 22 in the period 1991-2007 vs those given by Moutopoulos & Stergiou (2012) for GSA 22+23 regarding the same period.

Adjustment was made based on a linear model between the number of PS vessels recorded by the HELSTAT+DCF for GSA 22 vs those given by Moutopoulos & Stergiou (2012) in GSAs 22+23 for the period 1991-2007. The resulted significant equation ($PS_{\_Moutopoulos\ \&\ Stergiou} = 0.8202*PS_{HELSTAT} + 34.915$, $R^2 = 0.9473$) was applied to estimate the number of PS vessels (Fig. 4)

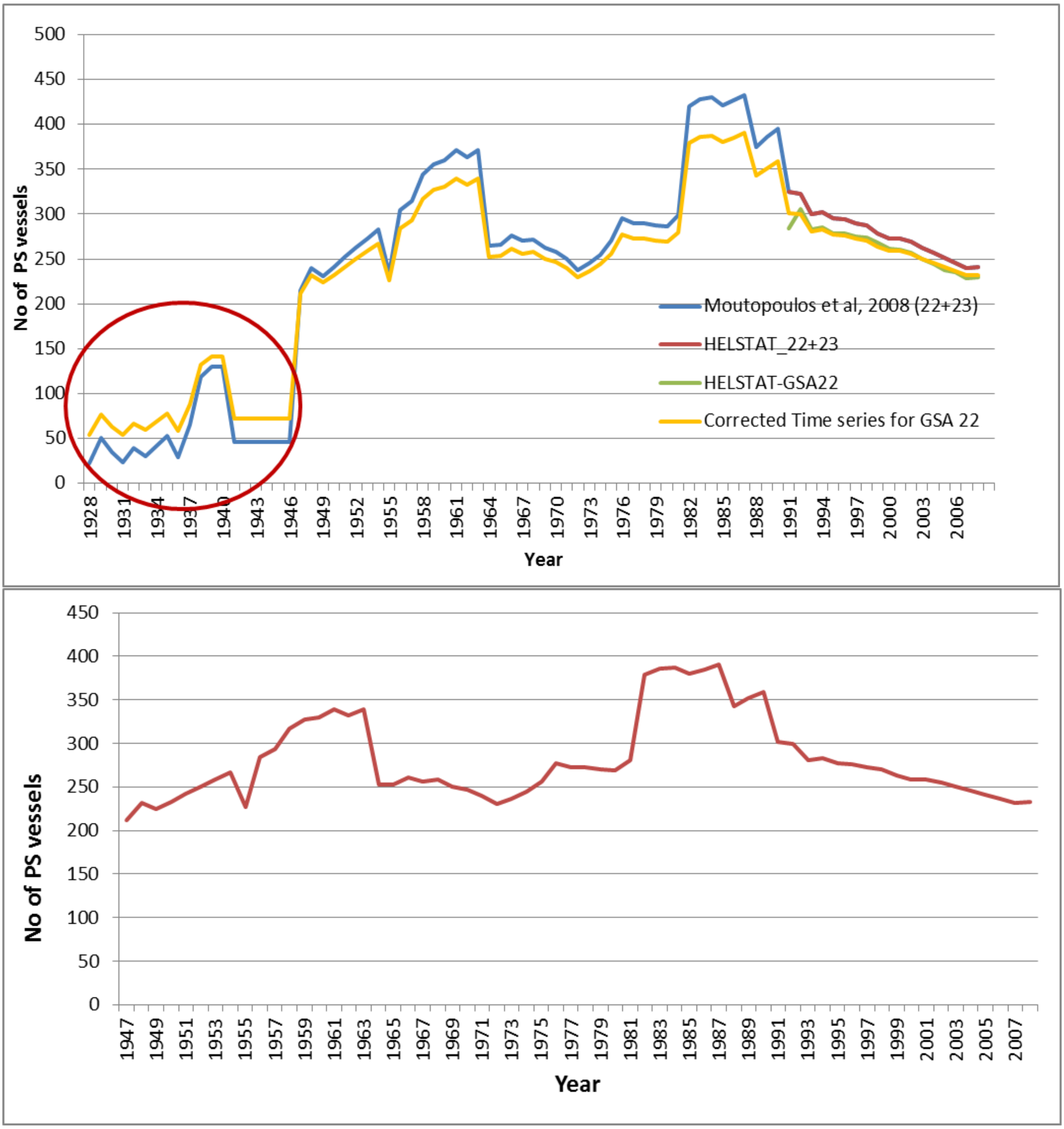


Fig. 4.4 Top: The available time series of the number of PS based on different sources. Bottom: The reconstructed time series of the number of PS vessels in GSA 22 based on the adjustment of the estimates given by Moutopoulos and Stergiou (2012).

As a significant reduction in the PS fleet was observed prior to 1946, being outside the range of values for the fitted model, it was considered unreliable to extend the reconstruction before 1946.

Total engine power and vessel capacity

Within the framework of STECF EWG 15-06 the reconstruction of the purse seine fleet concerning engine power and vessel capacity information available by the National Statistical Service of Greece (HELSTAT 2012) since 1991 was used. The updated time series is shown in Figs 5 and 6.

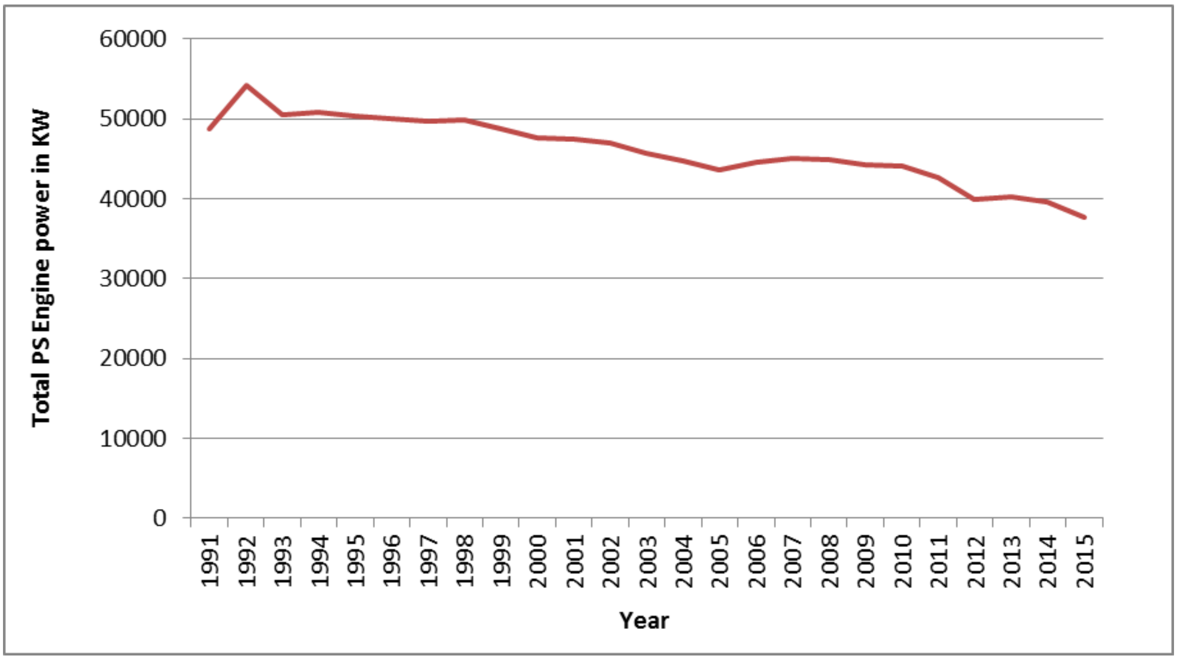


Fig 4.5. Updated time series of total PS engine power in GSA 22 based on HELSTAT

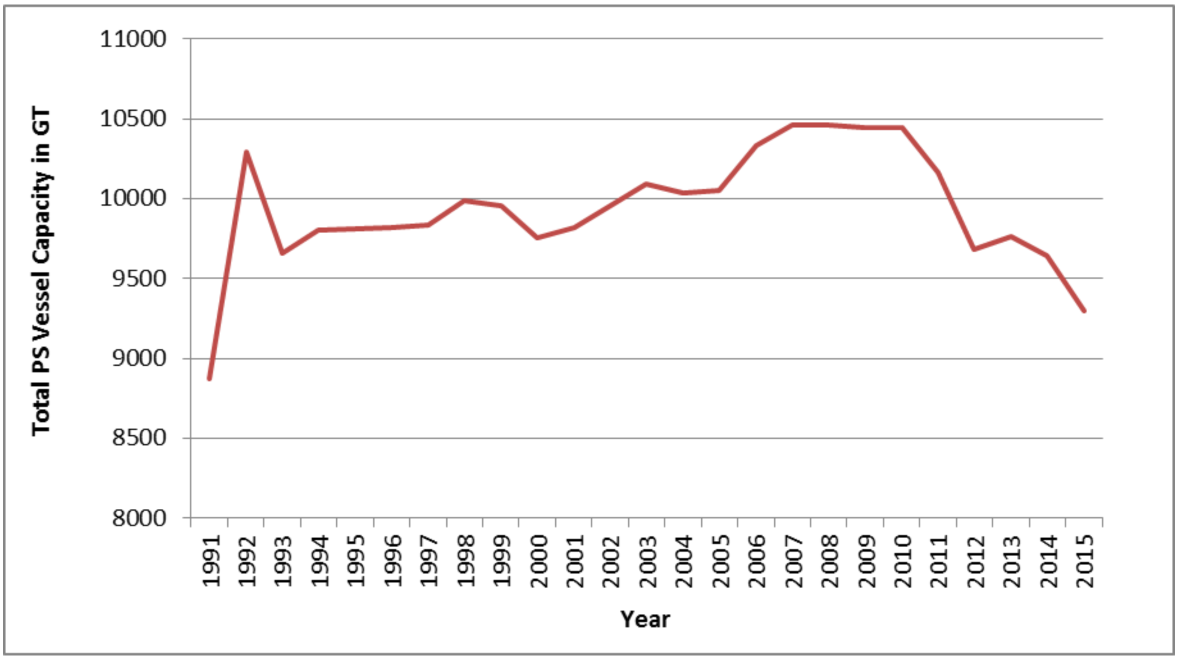


Fig 4.6. Updated time series of total PS capacity in GSA 22 based on HELSTAT

Total Days at Sea

Effort as days at sea, note the problems in the recent years

To the extent possible and given the strict time frame the STECF EWG 15-06 identified the estimates of days at sea* engine power and days at sea * fishing capacity for the period 2008 to 2000 as presented in Machias et al., 2008; Kapadagakis et al 2001. This information was added to the DCF/DCR information for the period 2003 onward.

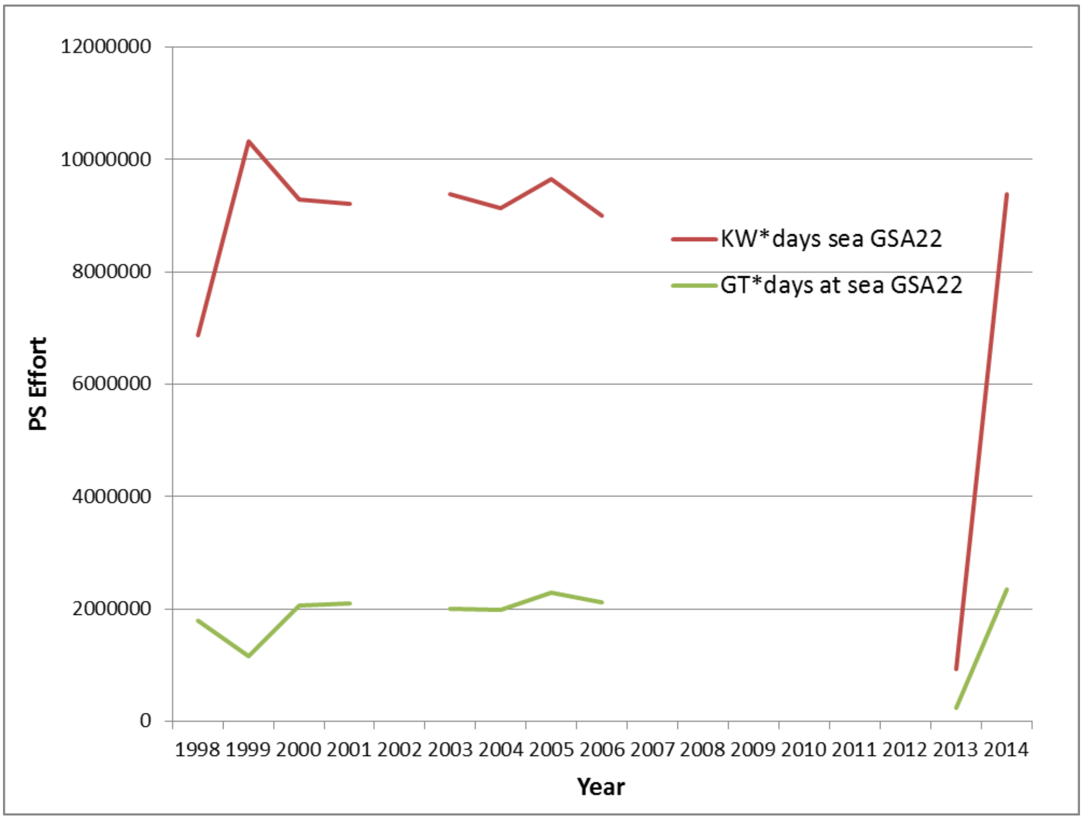


Fig 4.7. Updated time series of the PS fleet in GSA 22. DCF/DCR information is included for the years after 2003. Information for the period 1998-2001 is given in Machias et al 2008; Kapadagakis et al 2001.

A series of problems were identified concerning the reconstruction of the effort days at sea time series and summarized below:

- No historical data on days at sea are available by the National Statistical Service of Greece (NSSH).
- Moreover, the lack of the DCF/DCR in Greece in 2007, 2009-2012 creates an additional problem to any reconstruction attempt making modeling unreliable.
- Experts' opinion within the STECF EWG 15-06 identified the presence of additional problems in this particular fishery. In Greece there is a number of mixed vessels operating part of the year as both bottom trawlers and part of the year as purse seiners. For these vessels monitoring the actual fishing days as purse seiners is essential and a modeling approach cannot really overcome this impediment. In addition national legislation has enforced different type of spatial or temporal bans per area (eg operating during the full moon period but not during the weekend like Saronikos Gulf, operating during the weekend but not 5 days around the full moon period in each

month). These are issues that cannot be easily covered by some sort of modeling. At least not in the framework

Economic and effort data are currently collected within the DCF/DCR aggregated and not per GSA basis. However assessment of European anchovy and sardine stocks are applied in GSA basis so info collected would be more helpful if presented in the same way.

Further possibilities

A summary Table of the time series of the reconstruction achieved and the various sources of information is given below.

Variable	**Onset of time series**	**Source**
Total number of vessels	1946	Moutopoulos & Stergiou 2012; HELSTAT, DCR/DCF
Total GT	1991	HELSTAT/DCR/DCF
Total KW	1991	HELSTAT/DCR/DCF
Days at sea*GT	2003	DCR/DCF
Days at sea*KW	2003	DCR/DCF
Days at sea*GT	1998-2001	Machias et al 2008; Kapadagakis et al 2001
Days at sea*KW	1998-2001	Machias et al 2008; Kapadagakis et al 2001
European anchovy catch	1970	FAO-GFCM/DCR-DCF
Sardine catch	1970	FAO-GFCM/DCR-DCF

Additional work that goes beyond the timeframe available for the EWG 1506 should be given to retrieve information on the PS effort related variables in GSA 22 and especially Days at Sea from past projects carried out in the area as well as in the databases of the respective Greek authorities involved. A list of these authorities is given below.

For Greece, fishery statistics are collected by four independent organisations: the National Statistical Service of Greece (NSSH) now called Hellenic Statistical Authority (HELSTAT); (b) the Agricultural Bank of Greece; (c) the National Company for the Development of Fisheries (ETANAL); and (d) the Ministry of Agriculture and Food. The collected information from these organizations is overlapping, contradictory, and sometimes leads to confusion (STERGIOU *et al.*, 1997). HELSTAT has recorded fisheries statistics for Greek waters since January 1964.

Although HELSTAT statistical data suffer from various biases and the degree of bias is hard to estimate (Moutopoulos and Koutsikopoulos 2012), they are the best figures available. The Agricultural Bank of Greece collects data on active fishing vessels and provides assessments of their landings from 1974 onwards. The Ministry of Rural Development and Food is the official administrator of the Greek fishing industry and the body responsible for management of fisheries resources. ETANAL is a non-profit organization under state control, whose role is the management of the major Greek fishing ports; ETANAL has been granted by law exclusive jurisdiction over auctions (eleven in several parts of country) and supervision of related transactions.

Two important drawbacks of all the above-mentioned data sources exist : (a) fishing effort is not recorded on a monthly basis; (b) no data are available concerning fishing effort expressed as fishing days at sea, which has been proposed by the European Union (EU) (see European Commission Regulation 1639/2001).

Additional information is likely to be retrieved from:

- Hellenic Centre for Marine Research
- Fisheries Research Institute of Kavala
- Greek Universities that were involved in various fisheries related projects such as:
    - the Department of Biology in the Aristotle University,
    - the Department of Biology in the University of Patras,
    - the Department of Icthyology and Aquatic Environment of the University of Thessalia,
    - the Fisheries Technological Educational Institute of Western Greece-Department of Fisheries and Aquaculture.

Any future modeling approach requires cautiousness as various factors can drive the variability of the fishing days at sea and available information is fragmented. Moreover, when it comes to the use of fleet characteristics information for stock assessment purposes the impact of technological improvement to the catchability of the fleet should not be ignored.

5 QUALITATIVE EVALUATION OF THE ADVANTAGES AND DISADVANTAGES, OF APPLYING DIFFERENT MANAGEMENT REGIMES IN THE SMALL PELAGIC FISHERIES IN THE ADRIATIC SEA.

ToR 2.1: Provide a qualitative evaluation of the **advantages and disadvantages, from biological, social and economic viewpoints, of applying different management regimes in the small pelagic fisheries in the Adriatic Sea**.

The management regimes should include at least the following: (1) capacity limitations; (2) effort regime; (3) spatio-temporal closures; (4) technical measures relating to gear and; (5) catch-limitations. These measures should be considered individually as well as in combination

5.1 General Approach

Currently management of small pelagics is not done by TACs. Currently fishery access is based on access through a licence regime. Most of the fisheries are currently regulated through some capacity measures, minimum landing sizes and spatio-temporal closures (EU 2006). Fishing vessels targeting adult part of small pelagic fish stocks use two principal fishing gears - pelagic trawl and purse seine, while fisheries targeting juveniles use other gears (i.e. beach seine). Fishery that targeted sardine fry (“biancheto”) is currently closed using an appropriate gear restriction EC 1994 (EC Regulation 1626/94.

Pelagic trawls are currently used on the western Adriatic coast (Italy) only, while purse seines are dominantly used on the eastern Adriatic coast (Croatia). Many of these vessels used in the small pelagic fisheries in the Adriatic may change their fishing activities/gears, and participate in other fisheries.

If it is necessary to reduce fishing mortality for biological reasons then whatever management measure is chosen that should result in reduction in catch. This reduction may result in short term economic and social impacts in all cases. In the table below this overall economic impact has not been addressed as it is considered as a common aspect to all the measures.

In some cases particularly for gear or spatio/temporal measures or capacity metrics the result of restriction may not be equitable across all fleets or countries, i.e. an area closure influences only those who fish in that area, gear regulations affect only those who deploy that gear and capacity measures may have different impacts on towed or purse seine gear operators.

Consideration of measures taken one at a time.

The table below is intended to show the advantages and disadvantages in the different measures.

Any measure, from those discussed below, that is chosen is likely to be most effective if it can be applied equitably across all fleets and countries (including non-EU countries) with transparency and ensuring effective control and enforcement measures.

5.2 Comparison

Management regime: (1) Capacity limitations

GSA 17+18 (Adriatic Sea)	Advantages	Disadvantages
Biological viewpoint	May have positive biological results if capacity is related to fishing mortality.	Its effectiveness is not necessarily linear and will be dependent on the current utilisation level. It is the least predictable method of achieving required reductions in fishing mortality Older less effective vessels tend to be removed preferentially; so biological reduction of fishing mortality due to effective capacity may be less than expected. If capacity reductions have been very substantial, then in the occasions of high abundance of the resources (i.e. after few years of successful recruitment), there may be insufficient capacity to take advantage of this.
Social viewpoint	A smaller number of vessels/operators may be easier to involve in management more effectively.	Reduces number of vessels and may therefore reduce employment quickly with little biological effect. May affect other fishery related sectors such as maintenance and ship building Concentration of economic benefits of fisheries to a smaller number of operators (i.e. to very small part of society). Under capacity control alone particularly at low levels of abundance it may be difficult to set correct effort levels.
Economic viewpoint	Simple to implement relatively cheap to control, may reduce overall control and enforcement costs. A smaller more efficient fleet may be economically more successful.	May require initial decommissioning costs to enable a capacity regime. Though this has been done elsewhere through allowing consolidation of fishing rights to fund vessel removal. Smaller number of operators may result in less competition and higher fish product prices on the market. Decommissioning can be reinvested in new equipment, reducing

		the effectiveness of this management measure
	A more economically successful fleet will cope better with reduced and or fluctuating catch/revenue .	Use of capacity limitations as a control measure requires a forecast of F relative to Fmsy which implies provision of a simpler type of assessment than required for management through catch limitation. Its expected that the relationship between capacity and fishing mortality is weaker than the relation under effort control measure. As a consequence the use capacity control may be less effective for the same cost of data and information base.

Management regime: (2) Effort regime

GSA 17+18 (Adriatic Sea)	Advantages	Disadvantages
Biological viewpoint	Direct fishing effort is better related to fishing mortality than capacity.	It is difficult to determine the relationship between effort and fishing mortality, so it is difficult to get the predicted outcome.
		Requires a baseline of effort that is in practice difficult to define.
	Can be adapted more easily to resource abundance. It is easier to increase or decrease effort than capacity.	Changes in on board technology resulting from effort restriction can cause adaptations that reduce the effectiveness of reductions in effort thus requiring further reductions. Eg more effective equipment (or greater fishing times if time at sea is limited.)
	Acts relatively equitably across areas maintaining more even biological impacts.	If implementation is not controlled effectively it may result in less effective reduction fishing mortality.
		Under effort control alone at low levels of abundance it may be difficult to set the correct effort levels.
Social viewpoint	In comparison to capacity measures this regime may maintain number of operating vessels and thus employment may remain relatively unchanged.	Reduced effort may make jobs 'poorer' with less wages per job due to less activity
		May result in more dangerous fishing practices due to fishing activity under greater time stresses
Economic viewpoint	Effort control may work better than catch control under conditions of variable resource abundance if this is not accurately detected (ie. More consistent fishing mortality under changing supply of catch)	Requires a more complex administration for effort control than for capacity control.
		Leads to unutilised capacity which may result in poorer economic performance as
	Once the effort regime is well established, it should require less change from year to year.	The fixed costs remain the same with less fishing activity.
	Effort control and enforcement is expected to be easier than catch control and its enforcement.	
	Use of effort limitations as a control measure requires a	

	forecast of Fishing mortality relative to Fmsy which implies provision of a simpler and cost effective type of assessment than required for management through catch limitations.	

Management regime: (3) Spatio-temporal closures

GSA 17+18 (Adriatic Sea)	Advantages	Disadvantages
Biological viewpoint	Can easily target sensitive period like spawning times and juvenile phase and be specifically directed to protect sensitive areas for short periods only (Eg. nursery areas) May improve selectivity exploitation pattern eg. by avoiding small sizes in a nursery area, or avoiding large spawners if this is considered necessary. If substantial areas are closed for long period this can have positive biological effects reducing overall mortality.	If fishing effort is just diverted overall mortality may be unchanged. Can concentrate the spread fishing mortality into smaller parts of the stock which may preferentially effects that are not beneficial European anchovy and Sardine are mobile, and migrate and this can reduce the effectiveness of closures unless they are large and for long periods
Social viewpoint	If applied for short periods only, may have limited impact on jobs. May be possible to apply partial closures without impacts on market supply (eg. closure of juvenile areas)	May result in disadvantages disproportionally if some part of the fleet is located close to closed areas.
Economic viewpoint	Simple to apply particularly if closure zones are large and for long periods.	May make the fishery more costly for some situations particularly if better fishing zones are closed. Ie. Closure of spawning grounds might close high catch rate fishing opportunities. May increase travel time to fishing grounds and thus costs. May require some careful control implementation even for vessels with VMS ie. tamper proof equipment particularly if zones are small and of short duration or far shore. Disruption of product availability may result in problems for shore based industry. Use of spatial/temporal alone are unlikely to deliver sufficient control of fishing to manage small pelagic stocks, so spatial/temporal measures would need to be used in combination with other measures. It is often difficult to predict the outcome of spatial/temporal measures on overall mortality

Management regime: (4) Gear technical measures

GSA 17+18 (Adriatic Sea)	Advantages	Disadvantages
Biological viewpoint	There is potential for changing species selectivity particularly in trawl gears by inclusion of such things as grids or escape panel. These are most effective for escape of other species (ie. Protected species).	The effectiveness of mesh size as a way of changing gear selectivity for the target species is not generally thought to be useful in small pelagic fisheries.
Social viewpoint		Modification of trawl gear appears possible, but less effective for purse seines, so may impact on different fisheries in different ways.
Economic viewpoint		Effective control and enforcement can be expensive as it can require at sea inspection. Can have the potential to result in high cost if it involves major gear modification. Use of gear technology alone is unlikely to deliver sufficient control of fishing to manage small pelagic stocks, so gear measure would need to be used with along with other measures. It is often difficult to predict the outcome of gear technical measures on overall mortality

Management regime: (5) Catch-limitations

GSA 17+18 (Adriatic Sea)	Advantages	Disadvantages
Biological viewpoint	It is the measure most directly related to fishing mortality and if based on good information and enforced effectively it is the most effective single measure for small pelagics.	Single species TACs may have negative effects on multi-species fisheries. (i.e. result in discards or misreporting). This impacts on both fishing mortality and data quality used in assessments. This would be exacerbated under a landing obligation.
Social viewpoint	Easiest measure to spread equitably across the fleets.	
Economic viewpoint		Relative to effort and capacity measures it is expensive to control and enforce catch limitations effectively. Use of catch limitations as a control measure required a catch forecast.

Use of Multiple Measures

Use of these measures should be considered in combination as well as individually. Generally relying upon just one measure alone is likely to leave a potential for conflict. To maintain a capacity that is well out of line with effort or catch opportunity is likely to lead to long term conflict and difficulties in management as well as less profit from the fishery. Thus reducing capacity to more closely match the level of effort needed would probably be beneficial. Matching capacity so that fisheries can remain profitable with a TAC control will generally result in better long term management. The use of capacity regulation alone is not considered suitable for dealing with detailed year on year control requirements, but it may be very useful for obtaining the generally appropriate fleet size to match fishing opportunities.

The use of spatial/temporal closures and/or gear related technical measures alone are unlikely to be sufficient to control fishing mortality. These measures are best suited to obtain improved species selectivity and increase resource resilience to exploitation, but will need to be implemented along with other measures.

The proper control and enforcement in practice of any chosen management regime will be a critical part of its success.

6 FURTHER DEVELOP STECF ADVICE FOR SMALL PELAGIC FISHERIES IN THE MEDITERRANEAN SEA: TAC CONTROL SYSTEM, BASED EITHER ON THE MSY FRAMEWORK OR ON AN ESCAPEMENT STRATEGY.

ToR 2.2 Further develop the past STECF advice (STECF-15-14), indicating that small pelagic fisheries in the Mediterranean Sea could qualify for a TAC control system, based either on the classic MSY framework (FMSY and Blim and Btrigger with HCRs) or on an escapement strategy. The advantages and disadvantages of both options should be provided.

6.1 Previous STECF advice (STECF 15-14)

Summary of comments from STECF Report 15-14

With regard to the Management Strategy Evaluation STECF drew the following conclusions.

For sardine:

1. Moving to MSY will result in considerable decrease in catches.

2. The catches are variable (high CVs) throughout reflecting the variable, autocorrelated nature of recruitment in the stock.

3. The probability of being below Blim is relatively high throughout.

4. Similar to European anchovy, the escapement strategy does not appear to offer more benefit over the HCR in terms of the probability of SSB < Blim. This reflects the choice of Bescapement = Blim, as the HCR adjusts up to Bpa but the escapement strategy implemented sets fishing mortality at the target when SSB > Blim.

For European anchovy: 1. Moving to MSY will result in considerable decrease in catches in the short-term though they increase and stabilise over the longer-term.

2. The catches are variable (high CVs) throughout reflecting the variable, autocorrelated nature of recruitment in the stock.

3. The probability of being below Blim is initially very high but decreases over the time of management.

4. The escapement strategy does not appear to offer more benefit over the HCR in terms of the probability of SSB < Blim. This reflects the choice of Bescapement = Blim, as the HCR adjusts up to Bpa but the escapement strategy implemented sets fishing mortality at the target when SSB > Blim.

6.2 General basis of MSY and Escapement Strategies

6.2.1 Basis of MSY advice

Based on a steady state exploitation - target F with a reduction if SSB<Biomass trigger, suited for stocks with low M and F where the combination of growth and natural mortality are similar such that fish not taken one year are generally available the following year.

Catch from F = FMSY B>Btrigger

F= FMSY (B/Btrigger) B<=Btrigger

6.2.2 Basis of Escapement Strategy Advice

Based directly on a risk to spawning biomass for short lived species. Suitable in situations where M is high and generally fish left in the stock after the fishery will die before the fishery the following year. This works best when the fishery is on post spawning adults. The strategy is based on a <5% risk of SSB falling below a biomass limit reference point. The strategy requires a projected probability if SSB<Blim. This can but does not necessarily require a Fcap.

Catch = Catch (<5% risk of SSB <= Blim)

And optional (F<Fcap)

The current proposal has Fcap set to Fmsy. This management procedure normally requires simulations to evaluate risk, and the risks may be acceptable at Fcap set higher than Fmsy, though the procedure may imply closure if the stock is close to Blim.

Comparison of MSY and Escapement Strategies

The ToR refers to pelagics in the Mediterranean however, the heading for ToR 2 relates to the Adriatic, it is under that context that this ToR has been addressed, though the general approach would be the same for other sardine and European anchovy stocks.

As indicated above the use of the Bescapement strategy relies on information on the state of the stock and the magnitude of the yearclasses that are expected to contribute to the fishery. The acoustic survey for sardine and European anchovy in the Adriatic was considered by STECF at its plenary in July 2015 (STECF 2015a). It was noted that the age data from acoustic survey for both species required in-depth revision with the goal of improving cohort tracking. STECF (2015a) noted that for European anchovy, the input catch-at-age data displayed moderate internal consistency (cohort tracking) that drives the assessment; in contrast, the MEDIAS acoustic survey displayed no internal consistency and is considerably downweighted in the current assessment. Understanding why there is a lack of consistency in this survey should be a high priority.

The low internal consistency of the sardine catch-at-age data and largely absent internal consistency of the MEDIAS surveys contribute to the lack of acceptable alternative fits for sardine. During EWG 16-05 it has been explained that after meeting of AdriaMed Study Group on intercalibration of sardine otolith reading and revision of criteria in the Adriatic Sea (Split, Croatia, 8-10 April 2015), otolith age readings for MEDIAS in Croatia, for years 2013 and 2014, were repeated. Detailed comparisons between previous and “new” age readings for years 2013-15 and related explanations will be available in next EWG assessment meeting (i.e. EWG 16-13). For Slovenia ages from year 2014-2015 have been read according to the revised age reading procedure and there are no plans for revision of earlier survey. Also for Italy, the 2014 ALKs from western acoustic surveys were used to convert numbers at length from acoustic surveys (Italy west GSA 17 and west GSA 18 into numbers at age. (Final Report

Working Group on Stock Assessment of Small Pelagic Species (WGSASP) 23 - 28 novembre 2015) Data included in the Data Call of 10 march 2016 follows indication derived from the revision and utilization of the new ALK. It is supposed that all of these changes could have positive affect on cohort tracking.

STECF (2015a) considered that variability in estimated recruitment reflects a natural variability and that a two-year advice cycle may not prevent the stock falling below a limit threshold with resultant impacts on yield.

STECF (2015a) considered that management strategies such as a biomass escapement strategy with a capped F may assist in mitigating for the natural recruitment variability. The escapement approach works by forecasting SSB or total biomass forward to the end of the fishery as implemented, for example, in North Sea sprat (ICES 2015a). A management strategy evaluation based on fixed proportion (e.g., F MSY) or fixed escapement should then be tested using an MSE. Such an approach however, will require a reliable a consistent index of abundance (survey index), which is not yet available. Currently the escapement advice would have to rely on the estimates of age zero fish based on the catch-at-age data, which under the current advise timeline will not affect advice until the yearclass is three years old (Figures 6.1 and 6.2).

The consistency of the cohort estimation has not yet been demonstrably resolved and issues remain. Until this and the advice timeline are resolved it is unlikely that advice for a biomass escapement strategy can be provided either through STECF or GFCM (see below). Under these circumstances it is suggested that exploitation advice should be based on an FMSY and MSY Btrigger approach for the immediate future.

The performance of biomass escapement or MSY HCRs relies on assessments and advisory timelines that expediently track population dynamics of the stocks. While recent re-ageing efforts have the potential to improve cohort tracking, it is imperative that the new ageing protocols are applied consistently to the historical data (both catch and survey). Where the growth pattern has varied over time, the new ageing protocol should be applied to the historical otolith archive to generate time-specific age-length keys. Where the growth pattern is considered static over time, the updated age-length key could be applied to the historical catch-at-length data. Either way, two years of catch-at-age matrix derived from an altered ageing-protocol cannot be appended to the end of the historical catch-at-age matrix. Doing so will adversely affect estimates of recruitment and mortality in the most recent years, which are of critical importance to responsive management.

STECF has previously identified the need to consider the advice cycle for these two species in the Adriatic and a ToR was given to EWG-15-14 regarding shortening the advice cycle but this was not addressed (see STECF 2015b). The length of the advice cycle is of critical importance for relatively short lived species and is of direct relevance to the performance of either management strategy. Here the current EWG considered this issue and confirmed that the current advice cycle through GFCM will not be able to provide timely catch/exploitation rate advice for European anchovy or sardine as based on recent 5 year averages only about 6% by Weight of the yearclasses of European anchovy and 9% by Weight of the sardine are estimated in the catch year for which GFCM would currently provide advice. STECF would however be able to provide advice at least one year earlier without any major revision of the current data analysis approach, this would greatly improve the situation as under these circumstances on average 44% and 33% of the sardine and European anchovy catch respectively would come from estimated year classes. However, this approach still depends on the production of a relatively reliable index of yearclass strength from the survey. The timeline of data and advice for STECF and GFCM is given in Figure 6.1 and 6.2 for Adriatic sardine and European anchovy

There is potential for further improvement in the advice flow by following the data analysis/advice and management procedures used for Bay of Biscay European anchovy which has a more or less equivalent flow of data (an acoustic survey in September). For Bay of Biscay European anchovy the advice and TAC setting procedure is based on assessment and forecast carried out in November following the survey in September (STECF 2014). This is then used through a management procedure to give catch advice for the following calendar year January to December. While this approach uses the survey data from September it uses catch projections from July to December in the survey year. Such an approach given a survey index would provide a directly comparable model of how advice and catch rates could be set for European anchovy and sardine in the Adriatic if this was considered desirable.

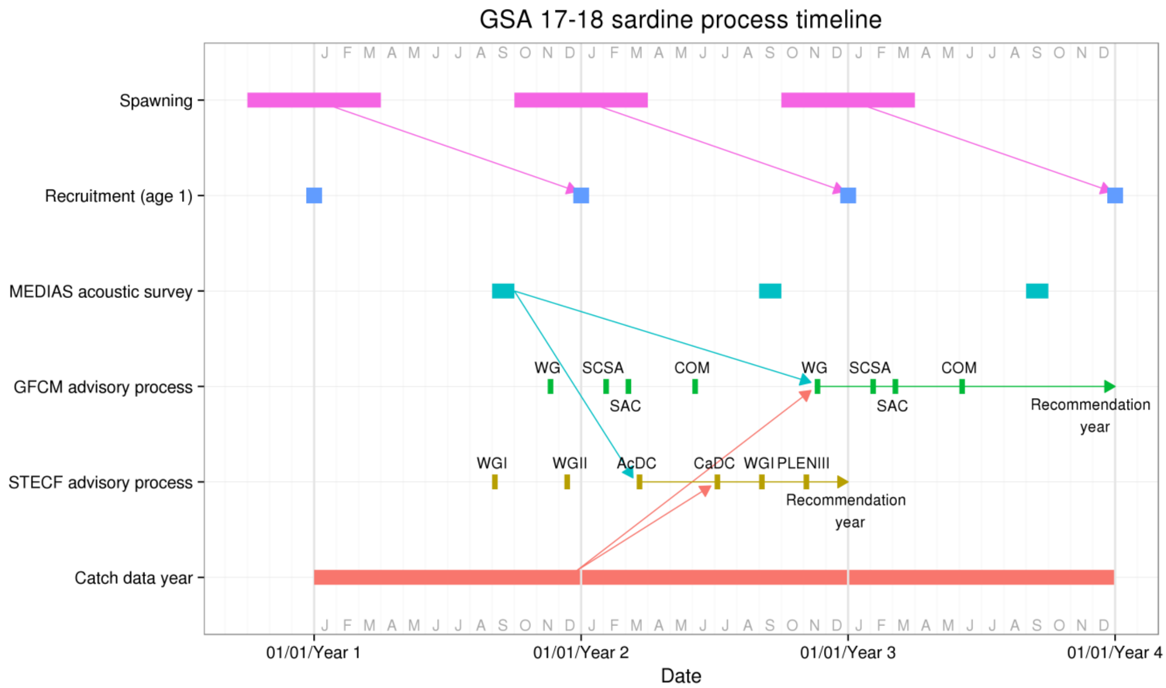


Figure 6.1. Adriatic Sardine recommendations timeline: illustrating the biological (spawning and recruitment), survey and advisory processes. GFCM advisory process steps comprise the: Working Group on Stock Assessment of Small Pelagics Species (WG); Subcommittee on on Stock Assessments (SCSA; recently SRCs or SRC-AS for the Adriatic); Scientific Advisory Committee (SAC); Mediterranean Commission (COM). STECF advisory process steps comprise the: March acoustic data call (AcDC), which is currently slightly ahead of DCF data submission requirements; June catch data call (CaDC); Mediterranean assessments part 1 (WGI); winter plenary (PLENIII). Arrows on the advisory processes follow the flow and timing of data into the advisory process through to the year in which the recommendation / advice pertains to.

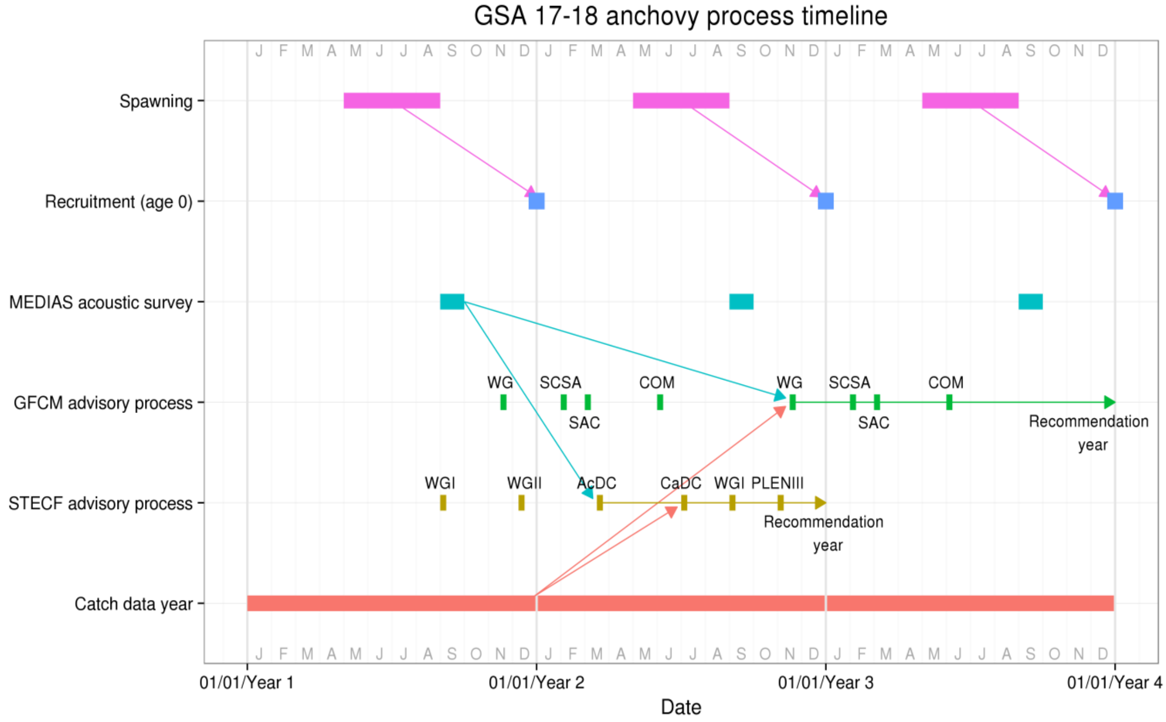


Figure 6.2. Adriatic European anchovy recommendations timeline: illustrating the biological (spawning and recruitment), survey and advisory processes. Note that the recent GFCM change to calendar year catch data for this species (GFCM, 2015) is reflected. GFCM advisory process steps comprise the: Working Group on Stock Assessment of Small Pelagics Species (WG); Subcommittee on Stock Assessments (SCSA; recently SRCs or SRC-AS for the Adriatic); Scientific Advisory Committee (SAC); Mediterranean Commission (COM). STECF advisory process steps comprise the: March acoustic data call (AcDC), which is currently slightly ahead of DCF data submission requirements; June catch data call (CaDC); Mediterranean assessments part 1 (WGI); winter plenary (PLENIII). Arrows on the advisory processes follow the flow and timing of data into the advisory process through to the year in which the recommendation / advice pertains to.

7 MSY INTERVALS

ToR Provide the lower and upper bounds of F_{MSY} for a list of species (see ToR in section 1)

7.1.1 Approach used by the EWG

EWG 16-05 was asked by DG MARE on the first day of the EWG to provide F_{MSY} range (F_{low} and F_{upp}) for 18 fish and shellfish stocks from the north-western Mediterranean. The EWG considered the request and decided that it would not be possible to carry out a full evaluation during the meeting but agreed to provide indicative values based on a regression equation. This limitation was accepted by the Commission (by Email). The group gathered the F_{MSY} values from the most updated assessments carried out and accepted under the framework of STECF EWGs on Mediterranean stocks assessment. Those values were used in the formulas provided by STECF EWG 15-06 (STECF, 2015) to derive F_{MSY} range (F_{low} and F_{upp}).

The empirical relationships used to estimate F_{MSY} range are the following:

$F_{low} = 0.00296635 + 0.66021447 \times F_{0.1}$

$F_{upp} = 0.007801555 + 1.349401721 \times F_{0.1}$

where $F_{0.1}$ is a proxy of F_{MSY}.

7.1.2 Values of Fmsy Fupper and Flower

The table below is showing the information regarding the stocks requested by DG MARE and the estimated values of F_{MSY} range (F_{low} and F_{upp}).

The values of Flow and FMSY are regarded as reseasonable estimates that can be expected to be precautionary and thus may be used directly. The values for Fupp are indicative only, they have not been evaluated as precautionary and should not be used as such without further evaluation.

Table 7.1 FMSY range (Flow and Fupp) for 18 fish and shellfish stocks from the north-western Mediterranean. The values for Fupp are indicative only they have not been evaluated as precautionary and should not be used as such without further evaluation..

GSA	3A_code	Scientific name	Ref year	Fcurr	F msy	Fupp	Flow	Fcurr/ FMSY	Report	Year of advice
1	ANK	*Lophius budegassa*	2013	0.25	0.16	0.22	0.11	1.56	STECF15_06	2014
1	MUT	*Mullus barbatus*	2013	1.31	0.27	0.37	0.18	4.85	STECF15_06	2014
1	DPS	*Parapenaeus longirostris*	2012	0.43	0.26	0.36	0.17	1.65	STECF13_22	2013
5	ANK	*Lophius budegassa*	2013	0.84	0.08	0.12	0.06	10.50	STECF15_06	2014
5	MUT	*Mullus barbatus*	2012	0.93	0.14	0.20	0.10	6.64	STECF14_08	2013
5	NEP	*Nephrops norvegicus*	2013	0.29	0.17	0.24	0.12	1.71	STECF15_06	2014
5	DPS	*Parapenaeus longirostris*	2012	0.77	0.62	0.84	0.41	1.24	STECF13_22	2013
6	ANK	*Lophius budegassa*	2013	0.91	0.14	0.20	0.10	6.50	STECF15_06	2014
6	WHB	*Micromesistius poutassou*	2013	1.52	0.16	0.22	0.11	9.50	STECF14_17	2014
6	MUT	*Mullus barbatus*	2013	1.47	0.45	0.62	0.30	3.27	STECF14_17	2014
6	NEP	*Nephrops norvegicus*	2013	0.59	0.15	0.21	0.10	3.93	STECF14_17	2014
6	DPS	*Parapenaeus longirostris*	2012	1.40	0.27	0.37	0.18	5.19	STECF13_22	2013
7	ANK	*Lophius budegassa*	2011	0.97	0.29	0.40	0.19	3.34	STECF12_19	2012
7	MUT	*Mullus barbatus*	2013	0.45	0.14	0.20	0.10	3.21	STECF14_17	2014
9	MUT	*Mullus barbatus*	2013	0.70	0.60	0.82	0.40	1.17	STECF14_17	2014
9	NEP	*Nephrops norvegicus*	2013	0.43	0.21	0.29	0.14	2.05	STECF14_17	2014
9	DPS	*Parapenaeus longirostris*	2013	0.69	0.71	0.97	0.47	0.97	STECF15_06	2014
11	MUT	*Mullus barbatus*	2012	1.07	0.11	0.16	0.08	9.73	STECF14_08	2013

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8 CONTACT DETAILS OF EWG-16-05 LIST OF PARTICIPANTS

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9 LIST OF ANNEXES

Electronic annexes are published on the meeting's web site on:
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List of electronic annexes documents:

EWG-16-14 – Annex 1 – PSA input data and results
EWG-16-14 – Annex 2 – Species rankings and level of information

10 LIST OF BACKGROUND DOCUMENTS

Background documents are published on the meeting's web site on:
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List of background documents:

EWG-16-05 – Doc 1 - Declarations of invited and JRC experts (see also section 8 of this report – List of participants)

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