



**GENERAL FISHERIES COMMISSION  
FOR THE MEDITERRANEAN  
COMMISSION GÉNÉRALE DES PÊCHES  
POUR LA MÉDITERRANÉE**



**Scientific Advisory Committee (SAC)**

**Subcommittee on Stock Assessment (SCSA)**

**Report of the Fifteenth Session**

**Bar, Montenegro, 3–4 February 2014**

**EXECUTIVE SUMMARY**

The fifteenth session of the SAC Subcommittee on Stock Assessment (SCSA) was held in Bar, Montenegro, on 3-4 February 2014, with the main aim to: i) revise the status of the stocks in the Mediterranean and Black Sea, as provided from the Sub-regional Group on Stock Assessment for the Black Sea (SGSABS) (Romania, 14-16 January 2014) and from the two Working Groups on Stock Assessment for small pelagic and demersal species (WGSASP, WGSAD) (Montenegro, 28 January - 1 February 2014), ii) revise the management advice to be proposed to the SAC for those stocks for which the assessment is considered reliable, and iii) revise methodological issues related to stock assessment and management advice. SCSA revised a total of 46 stocks – 30 demersal and 16 small pelagic stocks - providing advice for 39 of them. Overall 7 stocks were found to be sustainably exploited, while all other stocks were found to be under some kind of threat – overexploitation, being overexploited or ecologically unbalanced. In addition to this, SCSA proposed a new *framework for describing stock status and providing management advice in relation to reference points* to be discussed at the next session of the Scientific Advisory Committee.

## **OPENING AND ARRANGEMENTS OF THE MEETING**

1. The opening session of the SAC subcommittees, held back-to-back with the SCMEET Working Group on Marine Protected Areas (WG MPAs) and the SCESS Working Group on a common methodology to carry out socio-economic analysis in Bar, Montenegro, from 3 to 5 February 2014, was opened by Mr Abdellah Srour, GFCM Executive Secretary, who welcomed participants by recalling the latest achievements and activities of the GFCM that would be object of the subcommittees work.

2. He stressed the renewed interest in small-scale fisheries in the Mediterranean, which account for 80% of the fisheries in the region and mentioned the results obtained during the First Regional Symposium on Sustainable Small-Scale Fisheries (organized in November 2013, Malta) and referred to the FAO Technical Consultations on Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries held on 3–7 February 2014. He also introduced the main issues pertaining to the process of amendment of the GFCM legal and institutional framework - foreseen to empower the GFCM and to make its decision-making process more effective to sustain tangible results in all spheres.

3. Subsequently, H.E. Petar Ivanovic, Minister of Agriculture and Rural Development of Montenegro, greeted participants and underlined the efforts undertaken by his country to contribute to sustainable fishing in the Mediterranean, particularly in the Adriatic Sea in light of recent GFCM and European Union decisions and agreements, giving special priority to the development and recovery of the small fishing fleet. He also stressed the alarming state of fishery resources in the Mediterranean as a consequence of failure to implement previous decisions.

4. In this regard, he added that fisheries development was not just a matter of legislation and procedures, but also of finding mechanisms that should allow to fish in a balanced way with the actual market demand. He finally officially opened the subcommittee sessions expressing true hope that such meetings could help find answers to questions related to mechanisms and recommendations for the sustainable use of resources.

5. The fifteenth session of the subcommittee on stock assessment (SCSA) was attended by experts from 12 GFCM member countries, the FAO Regional Projects, representatives from the European Union and the GFCM Secretariat. The list of participants is available in Appendix B to this report.

6. The SCSA Coordinator and chair of the meeting, Mr Francesco Colloca, greeted participants and summarized the results that had been obtained by the activities held in Bar, Montenegro, from 28 January to 1<sup>st</sup> February 2014, namely the working groups on stock assessment on demersal (WGSAD) and small-pelagic (WGSASP) species and in particular the workshop on reference points. The outcomes of the sub-regional group on stock assessment in the Black Sea (SGSABS) were also presented. In light of such results, he underlined the important role of the subcommittee in reviewing and validating the work carried out as well as evaluating the main priorities and gaps to be brought to the attention of the SAC.

7. The agenda was adopted with few amendments and is reproduced in Appendix A.

## **DEFINITION OF REFERENCE POINTS FOR FISHERIES MANAGEMENT**

8. The SCSA reviewed the outcomes of the Workshop on Reference points as well as the proposals on reference points made at the Working Groups on Small Pelagics and Demersal species, and agreed on the importance to prepare guidelines for providing advice on stock status and fishery management in the framework of the GFCM expert groups on stock assessment, including the WGSASP, WGSAD and SGSABS. Therefore, the SC discussed a proposal for a *Framework for*

*describing stock status and providing management advice in relation to reference points* provided as Appendix D of the report, and submitted to the SAC as working document for discussion.

## **UPDATE ON THE STATUS OF MEDITERRANEAN AND BLACK SEA STOCKS**

9. The SCSA reviewed the assessment on stock status and the management advice provided by: i) the Sub-regional group on stock assessment in the Black Sea (SGSABS), ii) the Working Group on stock assessment of demersal species (WGSAD), and iii) the Working Group on stock assessment for small pelagics (WGSASP). The stock specific conclusions of the SCSA are included in Appendix C and an overall conclusion on the status of stocks in the Mediterranean and Black Sea is included in the *Conclusions and recommendations* section of this report.

## **TRANSVERSAL SESSION ON THE REVIEW OF THE DRAFT PROPOSAL FOR THE GFCM DATA COLLECTION REFERENCE FRAMEWORK (DCRF)**

10. Mr Miguel Bernal, from the GFCM Secretariat, introduced the transversal session of the SAC Subcommittees on the GFCM Data Collection Reference Framework (DCRF), underlining the importance of the DCRF to achieve a more efficient data collection programme at the subregional level and a better integration of data collection within the mandate of the GFCM. He highlighted that the DCRF contained GFCM data requirements included in the previous GFCM recommendations, but taking into consideration suggestions provided by the GFCM Members to simplify and clarify data requirements. He briefly recalled the preparatory steps of the document proposal, starting from the activities launched within the data collection work package (WP02) of the GFCM Framework Programme (FWP). In particular, he referred to the two assessments carried out in 2013, one internal (at Secretariat level), and the other external (at countries level through the questionnaire filled by the national focal points) and mentioned the three subregional workshops on data collection (March and April 2013) which served as technical basis for the elaboration of the proposal.

11. Mr Paolo Carpentieri, data collection regional coordinator, delivered the presentation on the GFCM-DCRF proposal<sup>1</sup>. After an overview of the historical background, including the GFCM performance review, the Task Force, the Framework Programme as well as the data collection activities, he summarized the main issues in terms of gaps, difficulties and proposals which arose from the subregional workshops on data collection. The presentation went on with a summary of DCRF tasks including the type of requested data and their purposes (as reproduced on table n.2 of the proposal):

- T.I Catch (landing data, catch data per species)
- T.II Bycatch of vulnerable species
- T.III Fleet
- T.IV Effort
- T.V Socioeconomics
- T.VI Biological information (stock assessment, length data, other biological data, dolphin fish, red coral)

12. Attention was drawn to the ten annexes of the DCRF document forming integral part of the proposal. Particular focus was placed on the priority species subdivided into three proposed groups

---

<sup>1</sup> *Proposal for the GFCM Data Collection Reference Framework (DCRF) – Draft version before editing (24 January 2014)*

according to different criteria (frequency of assessments, fishery importance, and conservation status) following a subregional approach.

13. The presentation concluded mentioning the potential strength of the DCRF proposal: its potential to encompass all the requested data in a single “volume” with a common structure for all the Tasks; its modular approach with scattered deadlines; the simplification of data with a better definition of data fields; the establishment of official data calls; the improvement of the submission tools and of the communications with the countries (summary report, national focal points). The floor was opened for discussion.

14. Participants expressed general appreciation of the DCRF proposal underlining the importance of the work carried out to strengthen the data collection framework in the GFCM area. The main issues emerged during the discussion are listed below.

#### **Language and distribution of the document**

15. Clarifications were asked concerning the timing, language and the distribution list of the GFCM DCRF proposal. The Secretariat informed that the document was circulated ten days before the meeting among the national focal points of the Framework Programme (for activities on data collection and management plans), the of SAC subcommittees coordinators and the FAO regional projects. The draft proposal was initially sent in English, the working language of the SAC subcommittees, but translation into French and comments received at the subcommittee meetings would be provided for the sixteenth session of the Scientific Advisory Committee.

#### **Subregions and priority species**

16. Some concern was expressed in relation to the subregions and the list of priority species proposed in Annex A of the DCRF proposal. Regarding the subregions, the importance of evaluating the separation of the Adriatic subregion from the central area was stressed. As for the proposed list of species, more information on criteria to classify the species into three different groups was requested. It was clarified that the proposed groups of species were based on the outputs of the three subregional workshops on data collection held in 2013. The grouping criteria took into consideration the frequency of assessments presented to the GFCM working groups (group 1), the percentage of contribution to total landing at sub-regional level (group 2) and the inclusion of the species under any recovery action plan for conservation plus non-indigenous species of greatest potential impact (group 3).

17. Furthermore, it was underlined that although all countries in a specific subregion should collect information for the identified species, some exemptions rules (such as presence/absence, landing by weight per species in the country percentage contributions at the subregional level) should be considered. Moreover the identified species at the subregional level should be redefined also taking into consideration the commercial value of the species. It was recalled that the lists were not static and that they could change over time according to the identified criteria.

#### **Fleet segmentation (effort, landing and biological variables)**

18. General consensus was expressed on the “revised” fleet segmentation, composed of already existing segments (with a more detailed breakdown by length classes) with the addition of the beam trawler (Annex B of the proposal). Concerning the method of assigning a fleet segment to a vessel, it was agreed to use the dominance criteria. This would be based on the percentage of time at sea using the same fishing gear over the year.

19. It was proposed to collect effort and landing data for each identified fleet segment whereas the biological variables should be collected for the most important ones. In this respect, the introduction of

a subregional threshold was considered advisable (in terms of activities or number of vessels within the segment).

### **Survey data biological information**

20. Participants suggested to include survey data, when available, in order to provide the requested biological information in the DCRF proposal.

### **Data transmission (frequency, deadlines and submission tools)**

21. Comments were made about the proposed data submission calendar (Annex A of the proposal) with particular respect to dolphin fish fisheries (*Coryphaena hippurus*) and red coral. It was noted that the proposed deadline for the transmission of dolphin fish data was June of each calendar year thus giving more time to the countries to prepare datasets, which posed a problem of discrepancy with current EU data call (January). Concerning red coral, although the harvesting season ends at the closure of the year, the proposed move to June aimed at allowing countries to better prepare their data for final transmission to GFCM.

22. The subcommittees were also informed that relevant data transmission protocols and submission tools would have been defined by the Secretariat upon adoption of the DCRF.

### **Stock assessment**

23. Clarifications were asked concerning the issue of stock assessment forms regarding the nature of the data (official or scientific), the national entities in charge for their transmission and the new proposed deadline for submission (September). It was explained that data used for stock assessment should be included in the stock assessment forms and presented to the GFCM working groups on stock assessment by the experts attending the meeting, providing a clear indication of the origin (official landings, scientific surveys, etc.) and coverage of the data. Concerning the deadline for transmission, the idea was to consider it a little bit before scheduling the working groups, so that stock assessment-related data for reference year n-1 could be available for the meetings.

### **Data quality**

24. Within the framework of the DCRF proposal, the subcommittees raised the issue of data quality control on datasets transmitted to GFCM. In this respect, attention was drawn to the different levels of quality control: the national level, under the responsibility of each country before data transmission, and the regional level, under the responsibility of the GFCM Secretariat once data are received. Experts were informed that some preliminary standards for quality control would be investigated upon adoption of the DCRF.

### **Data confidentiality and accessibility**

25. Several questions were raised about the confidentiality and accessibility of the collected data. In this respect, the Resolution GFCM/35/2011/2, currently in force, defining the rules on data confidentiality, security and access for all data, reports and messages (electronic and of other nature) transmitted and received pursuant to GFCM recommendations, was recalled. In light of the revision of GFCM data collection, these important issues should be tackled upon adoption of the proposed DCRF.

### **National focal points**

26. Participants reiterated the importance of the national focal points appointed for activities on data collection and management plans under the Framework Programme in 2013 and stressed the need to maintaining these functions for the coming years.

## CONCLUSIONS AND RECOMMENDATIONS FROM THE SUBCOMMITTEE ON STOCK ASSESSMENT

27. The SCSA revised a total of 30 demersal and 16 small pelagic stocks from the Mediterranean and Black Sea. The SCSA advice and recommendations for each stock revised are included in Appendix C;

28. On the basis of the mandate of the GFCM to the SAC, SCSA revised the current status of the small pelagic stocks in GSA 17 in relation to the management plan object of Recommendation GFCM/37/2013/1. Based on mid-year total stock biomass estimates for 2013 adopted by the SCSA and the reference points for this stock, the small pelagic fishery in GSA17 would be classified in option 16d – ii of the Recommendation above mentioned, which indicates that “GFCM shall decide on the modalities to ensure that the fishing effort exerted the previous year by the small pelagic fishing fleets, either in terms of capacity and/or fishing activity, shall be adapted by a ratio of [0.935]” where 0.935 is the result of applying the formula included in the management plan, using Total Biomass as indicator.

29. The SCSA informed that following the mandate of the Commission, the reference points for sardine in GSA 17 were revised. For anchovy, the SCSA concluded that – due to uncertainties in the historical perspective of two different models – no biomass reference points could be defined for this stock. In addition to this, WGSASP pointed out that there is a conceptual discrepancy between the reference points defined in Recommendation GFCM/37/2013/1 and the reference points proposed by the fourteenth session of the SCSA and adopted at SAC 14: the latter were proposed based on a time series of mid-year total biomass while the recommendation uses the same values but as reference points for mid-year spawning stock biomass. SCSA recommended that this matter be further discussed at the SAC in light of the revision of reference points;

30. The SCSA recommended to incorporate in the following year agenda of the stock assessment expert groups (i.e. WGSAs) a specific session to discuss the advice on the status of stocks included in Recommendation GFCM/37/2013/1;

31. The SCSA also recommended that management measures included within management plans in place in the Mediterranean and Black Sea should be compared with the management advice provided by the SAC;

32. The SCSA proposed that a framework for providing guidance in formulating advice and recommendations in relation to stock status and reference points, coherent with the GFCM guidelines on management plans, be discussed and adopted by the SAC. A first draft of this framework, taking into account the work done during the workshop on reference points and incorporating the comments of both the WGSAs and SCSA, is reproduced in Appendix D. The frequency of the definition and revision of reference points should also be established;

33. The SCSA recommended that the stock assessment expert groups further standardize the advice table, taking into consideration the following:

- the assessment model(s) on which the stock status and the advice are based should be clearly identified;
- the column “Management advice” should be in agreement with the framework proposed in Appendix D;
- additional information on the current values of the indicators used for advice (e.g. Fishing mortality and Biomass) in relation to their reference points (if existing) should be incorporated;

- Stocks for which the assessment is inconclusive and no advice is provided should be clearly identified.

34. The SCSA recommended to base advice, when possible, on reference points for both fishing mortality and biomass, and to attempt a maximum number of types of reference points (i.e. target, threshold and limit);

35. The SCSA recommended that, for shared stocks, management measures should take into account the impact of the different fleets operating in the shared stock (e.g. reduction of fishing mortality to be done taking into consideration the different effects of the fleets on the stock);

36. The SCSA endorsed the technical recommendations from the WGSAs and the SGSABS, with the following comments:

- in relation to the WGSAD recommendation to have a Workshop to standardize methodologies for the estimation of biological parameters for assessment models, the SCSA recommended to include a dedicated session on the estimation of growth parameters in the agenda of the following WGSAD;
- In relation to the classification of stock assessment as “qualitative” or “quantitative”, as proposed by WGSAD, the SCSA recommended to undertake further analysis in order to produce a classification applicable to all possible cases.

37. The SCSA recommended further improving stock assessment methodology used during the stock assessment expert groups, in agreement with standard procedures of other RFMOs. The SCSA provided some guidance on the adequate models to be used for different kinds of stocks, as reproduced in Appendix E. The SCSA proposed to prepare a glossary of the models used in the stock assessment expert groups, to be regularly updated;

## SCSA WORKPLAN

38. The SCSA discussed the expected activities as follows:

Meeting	Place/Date
Workshop on Black Sea scientific surveys at sea: harmonization of survey methodologies and analysis of data	TBD 2014*
Age reading workshops for Black Sea fisheries	TBD 2014
Workshop on stock assessment for data poor stocks	TBD 2014/2015
WGSAD	Rome, TBC (october – november)
WGSASP	Rome, TBC (october – november)
SCSA	Rome, TBC (october – november)

\*Already included in the FWP program for 2014.

**ANY OTHER MATTER**

39. No other matters were raised.

**DATE AND VENUE OF NEXT SESSION**

40. The SCSA recommended to hold its next meeting immediately after the assessment expert groups (end of October - end of November) and proposed to have it in Rome for logistical, economical and practical reasons.

**ADOPTION OF THE CONCLUSIONS AND CLOSURE OF THE MEETING**

41. The meeting formally adopted the conclusions, recommendations and appendices for the SCSA on Tuesday 4th of February 2014. The full report was adopted by e-mail on XX 2014.



## Agenda

- 1. Introduction of participants and adoption of the SCSA agenda**
- 2. Update on reference points definition and proposals from the Sub-Regional Group on Stock Assessment for the Black Sea (SGSABS) and the Working Groups on Stock Assessment (WGSASP and WGSAD)**
- 3. Review of new stock assessments and related scientific advice (as provided by the SGSABS, WGSAD, WGSASP)**
  - Black Sea stocks
  - Demersal species
  - Small pelagic species
  - Other relevant work
- 4. Transversal session on the review of the draft proposal for the GFCM Data Collection Reference Framework (DCRF)**
- 5. Provision on advice from the WG to the SAC:**
  - Stock Assessment forms
  - Summary sheets
  - Advice on data poor / uncertain stock status situations
- 6. Follow-up on:**
  - 6.1. Outcomes of the FWP Subregional Technical workshop on fisheries multiannual management plans for the Western, Central and Eastern Mediterranean
  - 6.2. EIFAAC/ICES/GFCM Working group on European Eel
  - 6.3. Planning for stock assessment needs: training, online material, capacity building
- 7. General conclusions and scientific advice**
- 8. 2014 SCSA workplan**
- 9. Any other matter**
- 10. Date and venue of next session**
- 11. Adoption of the conclusions and closure of the meeting**

## List of participants

**Sadok BEN MERIEM**

National Institute of Marine Sciences and  
Technologies  
Port de peche 2060 La Goulette  
Tunisia  
Tel.: +216 71 735 848  
E-mail: [sadokbm@yahoo.fr](mailto:sadokbm@yahoo.fr)

**Vanja ČIKEŠ KEČ**

Institute of oceanography and fisheries  
Set.I.Mestrovica 63  
Croatia  
E-mail: [cikes@izor.hr](mailto:cikes@izor.hr)

**Beatriz GUIJARRO**

Spanish Institute of Oceanography  
Moll de Ponent s/n  
Tel.: +34 971133720  
E-mail: [beatriz@ba.ieo.es](mailto:beatriz@ba.ieo.es)

**Igor ISAJLOVIĆ**

Institute of Oceanography and Fisheries  
Set. I. Mestovica 63  
Tel.: +385 21408021  
E-mail: [igor@izor.hr](mailto:igor@izor.hr)

**Aleksandar JOKSIMOVIC**

Institute of Marine Biology  
Dobrota b.b, PO box 69,  
Kotor, Montenegro  
E-mail: [acojo@ac.me](mailto:acojo@ac.me)

**Marios JOSEPHIDES**

Department of Fisheries  
and Marine Research (DFMR)  
101 Vithleem str,  
1416 Nicosia, Cyprus  
E-mail: [mjosephides@dfmr.moa.gov.cy](mailto:mjosephides@dfmr.moa.gov.cy)

**Jerina KOLITARI**

Head of Aquaculture and Fishery Laboratory  
Department of Aquaculture and Fishery  
Faculty of Agriculture and Environment  
Agricultural University of Tirana  
Albania  
E-mail: [jkolitari@ubt.edu.al](mailto:jkolitari@ubt.edu.al)

**Hatem MAHMOUD**

Associate Professor  
Arab academy for science and technology  
49 Rassafa st. Moharram Bik  
Alexandria, Egypt  
E-mail: [hatemhanafy@hotmail.com](mailto:hatemhanafy@hotmail.com)

**Roberta MIFSUD**

Department of Fisheries and Aquaculture  
MSDEC  
Ghammieri, Ngiered Road, Marsa,  
MRS 3303, Malta  
Tel.: +356 2292 125  
E-mail: [roberta.mifsud@gov.mt](mailto:roberta.mifsud@gov.mt)

**Srdjan MUGOSA**

Ministry of Agriculture and Rural  
Development  
Rimski trg 46,  
81 000 Podgorica, Montenegro  
E-mail: [srdjan.mugosa@mpr.gov.me](mailto:srdjan.mugosa@mpr.gov.me)

**Kenneth PATTERSON**

Deputy Head of Unit A2  
Directorate General for Maritime Affairs and  
Fisheries (DG MARE)  
European Commission  
rue Joseph II 99 - 1049 Brussels, Belgium  
Tel.: +32 22998227  
E-mail: [kenneth.patterson@ec.europa.eu](mailto:kenneth.patterson@ec.europa.eu)

**José Luis PEREZ GIL**

Spanish Institute of Oceanography  
Puerto Pesquero 29640 Fuengirola  
Spain  
Tel.: +34 952197 124  
E-mail: [joseluis.perez@ma.ieo.es](mailto:joseluis.perez@ma.ieo.es)

**Ana PESIC**

Institute of Marine Biology  
Dobrota bb, 85 330 Kotor  
Montenegro  
E-mail: [pesica@ac.me](mailto:pesica@ac.me)

**Tristan ROUYER**

IFREMER  
1, Avenue Jean Monnet  
BP171, 34203 Sète Cedex, France  
E-mail: [tristan.rouyer@ifremer.fr](mailto:tristan.rouyer@ifremer.fr)

**Claire SARAUX**  
 IFREMER  
 BP171 Av. Jean Monnet 34203  
 Sete, Cedex  
 France  
 E-mail: [claire.sarau@ifremer.fr](mailto:claire.sarau@ifremer.fr)

**Giuseppe SCARCELLA**  
 CNR - ISMAR  
 L.go Fiera della Pesca 2  
 60125 Ancona, Italy  
 Phone: 393387043071  
 Email: [g.scarcella@ismar.cnr.it](mailto:g.scarcella@ismar.cnr.it)

**Francisco Javier VAZQUEZ ALVAREZ**  
 Deputy Head of Unit D2  
 Directorate General for Maritime Affairs and  
 Fisheries (DG MARE)  
 European Commission  
 rue Joseph II 99 - 1049 Brussels, Belgium  
 Tel.: +32 295 83 64  
 E-mail: [francisco-javier.vazquez-alvarez@ec.europa.eu](mailto:francisco-javier.vazquez-alvarez@ec.europa.eu)

#### **FAO Regional Projects**

**Enrico ARNERI**  
 FAO AdriaMed/MedSudMed  
 Project Coordinator  
 Fisheries and Aquaculture Resources Use and  
 Conservation Division (FIRF)  
 Fisheries and Aquaculture Department  
 Viale delle Terme di Caracalla  
 00153 Rome, Italy  
 Ph.: + 39 06 57056092  
 E-mail: [enrico.arneri@fao.org](mailto:enrico.arneri@fao.org)

**Juan Antonio CAMIÑAS**  
 FAO CopeMed II  
 Project Coordinator  
 Fisheries and Aquaculture Resources Use  
 and Conservation Division (FIRF)  
 Subdelegación del Gobierno en Malaga  
 Paseo de Sancha 64  
 29071 Malaga, Spain  
 Ph: +34 695797666  
 E-mail: [juanantonio.caminas@fao.org](mailto:juanantonio.caminas@fao.org)

**Luca CERIOLA**  
 FAO MedSudMed  
 Fisheries and Aquaculture Resources Use and  
 Conservation Division (FIRF)  
 Fisheries and Aquaculture Department  
 Viale delle Terme di Caracalla  
 00153 Rome, Italy  
 Ph.: +39 346229179  
 E-mail: [luca.ceriola@fao.org](mailto:luca.ceriola@fao.org)

#### **SAC Bureau**

**Henri FARRUGIO**  
 SAC Chairperson  
 7 impasse de la Trémie,  
 34140 Bouzigues, France  
 Tel.: +33 687165530  
 E-mail: [henri.farrugio@ifremer.fr](mailto:henri.farrugio@ifremer.fr)

**Othman JARBOUI**  
 SAC vice-chairperson  
 Directeur du laboratoire Ressources  
 Marines Vivantes  
 Institut National des Sciences et Technologies  
 de la Mer (INSTM)  
 Centre de Sfax - BP 1035  
 3018 Sfax, Tunisia  
 E-mail: [othman.jarbou@instm.rnrt.tn](mailto:othman.jarbou@instm.rnrt.tn)

**SCSA Coordinator**  
**Francesco COLLOCA**  
 Istituto per l'Ambiente Marino Costiero  
 Consiglio Nazionale delle Ricerche (CNR)  
 Via Luigi Vaccara 61  
 91026 Mazara del Vallo (TP), Italy  
 Tel: +39 0923948966  
 E-mail: [francesco.colloca@iamc.cnr.it](mailto:francesco.colloca@iamc.cnr.it)

#### **GFCM Secretariat**

**Miguel BERNAL**  
 Fishery Resources Officer  
 Food and Agriculture Organisation of the  
 United Nations (FAO)  
 Via Vittoria Colonna 1  
 00193 Rome, Italy  
 Tel: +39 0657056437  
 E-mail: [miguel.bernal@fao.org](mailto:miguel.bernal@fao.org)

**Margherita SESSA**  
 Food and Agriculture Organisation of the  
 United Nations (FAO)  
 Via Vittoria Colonna 1  
 00193 Rome, Italy  
 E-mail: [margherita.sessa@fao.org](mailto:margherita.sessa@fao.org)

**Assessments for small pelagic species, with recommendations by the WGSASP and SCSA**

GSA	Species	Methodology used	Stock status	Management advice	WGSASP comments	SCSA comments
GSA 01	Anchovy, <i>Engraulis encrasicolus</i>	Indirect method: BioDyn (Surplus production Model)	<u>Uncertain</u> , with high fluctuations and population concentrated on first age classes.	The population may have a high pressure on juveniles, and this decrease the probability to reconstruct the adult population .	The assessment was not accepted as there were contradictory signals between the survey, catches, trial test with the ASPIC surplus production model, and independent estimates of exploitation rate. There was uncertainty in the assessment and methodological problems in incorporating acoustic time series in the production model, so the model only relies on CPUE, which is very similar to the landings. The fishery mainly depends on recruitment: the possibility to have an index of recruitment to manage the stock should be considered. The WGSASP suggested to evaluate the trend in effort data and that CPUE be evaluated independently to its performance in the production model. The WGSASP recommended the use of available time series both for CPUE and acoustic abundance indices. In the case of fitting problems, alternative production model should be tested.	The SCSA agreed that stock status is uncertain and therefore did not comment its advice. SCSA recommended that the WG advice be considered as WG comments.
GSA 01	Sardine, <i>Sardina pilchardus</i>	Indirect method: BioDyn (Surplus production Model)	<u>Sustainably exploited</u> Trend in landings is stable. Exploitation rate is lower than the Patterson's reference point (E=0.36). $B_{cur}/B_{MSY}=1.31$ $F_{current}$ (0.33) is below $F_{0.1}$ (0.5).	Not to increase fishing mortality	Uncertainty in the assessment and methodological problems in incorporating acoustic time series in the production model, so the model only relies on CPUE, which is very similar to the landings. The WGSASP suggested to evaluate the trend in effort data and that CPUE is evaluated independently to its performance in the production model. The WGSASP recommended the use of available time series both for CPUE and acoustic abundance indices. In the case of fitting problems, alternative production model should be tested. The area should be covered yearly with an independent survey.	The SCSA <u>endorsed stock status and advice</u> and stressed the limitation of the use of only CPUE indexes on production model. The SCSA agreed with the comments of the WG.
GSA 03	Sardine, <i>Sardina pilchardus</i>	Direct method: CPUE analysis. Indirect method: LCA	<u>Uncertain (preliminary assessment)</u> Decreasing trend in landings from 2000. Effort is slightly increasing. Exploitation rate is higher than the Patterson's reference point (E=0.56).	No advice is provided	The WGSASP encouraged that this assessment is presented for validation next year, and suggested to consider the use of acoustic data as a tuning index. Fishing mortality is high for small sizes and in 2012 a low percentage of large individuals was found in the landings. A reduction in fishing mortality should be considered to allow for the recovery of adults population.	The SCSA agreed with the comments from the WG

GSA	Species	Methodology used	Stock status	Management advice	WGSASP comments	SCSA comments
GSA 06	Anchovy, <i>Engraulis encrasicolus</i>	Indirect method: BioDyn (Surplus production Model)	<u>Sustainably exploited</u> Increasing trend in landings and biomass from acoustic $F_{\text{current}}$ (0.18) is lower than $F_{\text{MSY}}$ reference point (0.25). Exploitation rate is lower than the Patterson's reference point ( $E=0.24$ ). Current biomass is above $B_{\text{MSY}}$ .	Not to increase fishing mortality	Uncertainty in the assessment and methodological problems in incorporating acoustic time series in the production model, so the model only relies on CPUE which in this case is very similar to the landings. The WGSASP suggested that CPUE is evaluated independently to its performance in the production model. The WGSASP recommended the use of available time series both for CPUE and acoustic abundance indices. In the case of fitting problems, alternative production model should be tested. Empirical RP not reliable since an historical maximum or minimum is not obvious in the time series available.	The SCSA endorsed <u>stock status and advice</u> and stressed the limitation of the use of only CPUE indexes on production model. The SCSA agreed with the comments of the WG.
GSA 06	Sardine, <i>Sardina pilchardus</i>	Indirect method: BioDyn (Surplus production Model)	<u>Overexploited and in Overexploitation.</u> Both landings and CPUE decreasing. Exploitation rate is higher than the Patterson's reference point ( $E = 0.46$ ). $F_{\text{current}}$ (0.42) is higher than the $F_{0.1}$ reference point (0.25). $B_{\text{current}}$ is below $B_{\text{MSY}}$ ( $B_{\text{curr}}/B_{\text{MSY}}=0.37$ ).	Reduce fishing mortality. Apply a multiannual management plan.	Uncertainty in the assessment and methodological problems in incorporating acoustic time series in the production model, so the model only relies on CPUE, which in this case is very similar to the landings. The WGSASP suggested that CPUE is evaluated independently to its performance in the production model. The WGSASP recommended the use of available time series both for CPUE and acoustic abundance indices. In the case of fitting problems, alternative production model should be tested. The declining trend is clear and in accordance with the acoustic. The exercise on reconstructed time series of biomass based on harvest rate seems to be coherent with acoustic estimates and point out for low biomass.	The SCSA endorsed <u>stock status and advice</u> and stressed the limitation of the use of only CPUE indexes on production model. The SCSA agreed with the comments of the WG. The SCSA recommended that the current Management Plan in place is confronted to these scientific advices.
GSA 07	Anchovy, <i>Engraulis encrasicolus</i>	Direct method by acoustics and harvest rate from catches/acoustic	<u>Depleted</u> Low exploitation rate and very low biomass, low commercial-sized anchovy abundance. Declining trend in landings and biomass. Current biomass is below $B_{\text{lim}}$ (22,889).	Implement a recovery plan (including monitoring on biological parameters and limits on effort)	Biomass is more or less stable in this stock since 2005, with a slight increasing trend noted in 2012, but in 2013 the stock estimate decreased. Average size and condition of anchovy remains low. Unusual high acoustic energy close to the surface in all the area in 2013: extra uncertainty on the estimates due to difficulties in catch the signal and lower success in trawling.	The SCSA agreed with the comment from the WG but in line with the discussion on reference point at SC level, suggested to consider the <u>stock status as "low biomass" and the management advice to be "reduce fishing mortality"</u> . The SCSA recommended that the current Management Plan in place is confronted to this scientific advice.

GSA	Species	Methodology used	Stock status	Management advice	WGSASP comments	SCSA comments
GSA 07	Sardine, <i>Sardina pilchardus</i>	Direct method by acoustics and harvest rate from catches/acoustic	<u>Unbalanced</u> Landings continue decreasing, the biomass is stable, high recruitments, but the fish are small, young and in poor conditions.	Fishing mortality should not be allowed to increase, monitoring of changes in the fishing effort/gears required.	This year the juvenile-adult partition was not done (disappearance of the two modes and changes in growth). There is a change in the fishery: in 2012 purse seiners contribute to 95% of the catch of sardine (previously around 20%). Measures of effort should be improved (e.g. number of "fishing sets" for purse seiners).	The SCSA <u>endorsed stock status and advice</u> and considered this assessment as qualitative.  The SCSA recommended that the current Management Plan in place is confronted to this scientific advice.
GSA 16	Sardine, <i>Sardina pilchardus</i>	Harvest Rate and Surplus production model (BioDyn)	<u>Overexploited and in overexploitation</u> $F_{\text{Current}} (0.18)$ is below the sustainable fishing mortality at current biomass levels ( $F_{\text{cur}}/F_{\text{SYCur}}=0.74$ ) but above $F_{\text{MSY}}$ ( $F_{\text{MSY}}=0.16$ ; $F_{\text{cur}}/F_{\text{MSY}}=1.11$ ). $B (16415) < B_{\text{MSY}}$ (32830) $B_{\text{current}}$ is above $B_{\text{lim}}$ but below $B_{\text{pa}}$ .	Fishing mortality should be reduced by means of a multi-annual management plan.	The role of the environmental index in the population and in the model fitting procedure is unclear. Further analysis in the model fitting behaviour should be investigated (e.g. testing other environmental factors, sensitivity analysis on seed values...). The WGSASP suggested to look at the monthly catches and the LFD of the catches.	The SCSA <u>endorsed stock status and advice</u> and pointed out that $F_{\text{current}}$ is 11% higher than $F_{\text{MSY}}$ .  Given the low level of biomass it should be recommended to reduce fishing mortality immediately.
GSA 16	Anchovy, <i>Engraulis encrasicolus</i>	Harvest Rate and Surplus production model (BioDyn)	<u>In overexploitation</u> Exploitation rate is higher than the Patterson's reference point ( $E=0.42$ ) Model trial provides a high exploitation rate.	Fishing mortality should be reduced by means of a multi-annual management plan.	The assessment is uncertain. The catches and the biomass estimates provide opposite trends and the performances of the model are low. The WGSASP suggested to look at the monthly catches and the LFD of the catches. The overall picture shows a decreasing trend in biomass, a harvest rate that is fluctuating up to really high values (in 2011 was about 80%) and an increase in $F$ . Empirical RP not reliable since an historical maximum or minimum is not obvious in the time series available.	The SCSA <u>endorsed stock status and advice</u> and accepted that the assessment is considered to be qualitative.

GSA	Species	Methodology used	Stock status	Management advice	WGSASP comments	SCSA comments
GSA 17	Sardine, <i>Sardina pilchardus</i>	SAM tuned by acoustic  Tests with ICA and ASAP tuned by acoustic	<u>Increased risk of overexploitation.</u> Exploitation rate is higher than the Patterson's reference point (E=0.42). $B_{current}$ is above both limit and precautionary reference point. Positive trend. Harvest rate is equal to 26%.	Do not increase fishing mortality and revise stock advice next year.	The WGSASP chose the SAM model as the final assessment due to better performance. All models tested provide similar estimates in the recent years, nevertheless there are discrepancies in the historical perspective. Catch data and acoustic data show some inconsistencies in the abundance by age trend (cohorts signal). Partial coverage of the eastern acoustic survey in the last two years: analysis of spatial variability should be desirable. Some differences in the ALK between the eastern and western data were identified. The WGSASP recommended a revision of the input-basic data (e.g. age structure) including testing the use of recent biological data (length structure and ALKs) from the Eastern area in the older part of the eastern landings time series, instead of data from the Western area.	In line with the discussion on reference point at SC level, SCSA suggested to consider the stock status as " <u>increased risk of being overexploited and in overexploitation</u> " and the <u>management advice to be "reduce fishing mortality"</u> .  In relation to the GFCM management plan approved for small pelagic fish in the Adriatic Sea the current status of the stock would be classified in option 16d – ii of the plan, and therefore the advice will be to adapt F by a ratio of 0.935
GSA 17	Anchovy, <i>Engraulis encrasicolus</i>	Both ICA and SAM with acoustic tuning are considered for the advice.	<u>Overexploited and in overexploitation</u> Exploitation rate is higher than the Patterson's reference point (E=0.48-0.57). Biomass level is at a low level (between 12-19 percentile of the biomass estimates)	Fishing mortality should be reduced and the existing management plan should be applied.	Both models were retained to provide a comprehensive advice. The recent perspective is consistent, but models provide a different historical perspective; ICA 2012, ICA 2013 and SAM all give a different perspective in both maximum and minimum biomass and some variability in F for the more recent years. Terminal F shows a large drop (probably unreliable) with a large CI. Due to unclear historical perspective, previously adopted reference points were considered not reliable. Advice was therefore provided on a precautionary basis (exploitation rate and biomass percentiles). The WGSASP recommended that the discrepancies of the different models should be further investigated. Partial coverage of the Eastern acoustic survey in the last two years: analysis of spatial variability should be desirable. Some differences in the ALK between the Eastern and Western data were identified. The WG recommends a revision of the input-basic data (e.g. age structure) including testing the use of recent biological data (length structure and ALKs) from the eastern area in the older part of the Eastern landings time series, instead of data from the Western area.	The SCSA <u>endorsed stock status and advice</u> . In relation to the GFCM management plan approved for small pelagic fish in the Adriatic Sea the current status of the stock would be classified in option 16d – ii of the plan, and therefore the advice will be to adapt F by a ratio of 0.935

GSA	Species	Methodology used	Stock status	Management advice	WGSASP comments	SCSA comments
<b>GSA 18</b>	Anchovy, <i>Engraulis encrasicolus</i>	DEPM	<u>Uncertain (preliminary assessment)</u> Since this is just a preliminary estimation it is not possible to diagnose the status of the anchovy stock in GSA 18 based on the DEPM investigation.	No advice is provided This stock is not considered to be formally assessed	Data of only eastern GSA18 were considered. Low fishing pressure in Eastern GSA 18, especially in Montenegro. Higher fishing pressure in the Western GSA18, although part of the fleet also operates in GSA17. The WGSASP recommended to continue improving and standardizing the DEPM methods and comparing both acoustic and DEPM independent estimates, while improving the quality of the landings data in order to obtain an estimate of exploitation rate.	The SCSA agreed with the WG comments. The SCSA recommended data on Western side of GSA18 to be presented at the WG, in order to allow a formal assessment of the stock in GSA18.



**Assessments for demersal species, with recommendations by the WGSAD and SCSA**

GSA	Species	Data type	Years data	Methodology used	Stock status	Fcurr/F0.1	Management advice	WGSAD comments	SCSA comments
GSA 01	European hake, <i>Merluccius merluccius</i>	Catch, effort Lfreq catch & trawl surveys	2003-2012	XSA tuned with CPUE from commercial fleet and MEDITS data.	High overfishing Relative intermediate biomass	7.4	A reduction of the current fishing mortality is recommended by reducing the fishing effort and improving the selection pattern of the fishery.	No specific comments on this stock.	The SCSA endorsed the assessment and proposed to reduce fishing mortality. The SCSA pointed out that Fcurrent is about 7 times higher than the Fmsy.
GSA 03	European hake, <i>Merluccius merluccius</i>	Catch, CPUE, trawl surveys, Lfreq (commercial and surveys)	2003-2012	a) VIT (LCA,VPA,Y/R) b) ExcelSheet1 (Y/R) c) ExcelSheet2 (LCA, Y/R) M=0,2 d) ExcelSheet2 (LCA, Y/R) M=0,5 e) ExcelSheet2 (LCA, Y/R, M vector) f) Biodyn (Production Model)	Uncertain	a) 4.5-5 (2007, 2008) b) 8.3-9.1 (2007, 2008) c) 8,33 (2007, 2008) d)6,7 (2007, 2008) e) 2,9 (2007, 2008) f) 1.0 (2003-2012)	No management advice could be derived from the results. The assessment was not endorsed.	The original VPA showed some problems: it merged information from the fleet and from the surveys, M was used as a scalar not as a vector and the production model used a short data series, without clear contrasts reflecting substantial changes in fishing effort, as recommended last year. The assessment was re-run using VIT for the 2 years in which commercial data was available (2007-2008), but the results were not used for providing management advice as they were considered too old. A trial comparing trends from commercial CPUEs and survey data was carried out, trying to produce qualitative assessment, but there was not a clear correspondence between both series of data. It was recommended to use SURBA in the following years.	The SCSA agreed with the WG comments. However, considering the overfishing status of the fishery in 2007-2008, it was advised that <u>any increase of fishing effort/catches of hake in this area should be avoided until a new assessment of the stock is available.</u>
GSA 05	European hake, <i>Merluccius merluccius</i>	Catch, effort, Lfreq catch & trawl surveys	2000-2012	XSA and Y/R analysis	In high overfishing status with relative high biomass	8.4	To reduce fishing mortality.	No specific comments on this stock.	The SCSA endorsed the assessment and proposed to reduce fishing mortality. The SCSA pointed out that Fcurrent is about 8 times higher than the Fmsy.
GSA 07	European hake <i>Merluccius merluccius</i>	Catch, effort, Lfreq catch (French and Spanish trawlers, French gillnetters and Spanish longliners), trawl surveys	1998-2012	XSA and Y/R analysis	In High overfishing status; relative low biomass	12.2	- Improve the fishing pattern of the trawlers so that the minimum length of catches is consistent with the minimum legal landing size - reduce the effort of trawlers, longliners and gillnetters. - Freezing of the effort in the Fishery Restricted Area	The WGSAD was informed that some management measures have been taken since 2011 (reduction from 2010 to 2012 by 20% of the number of trawlers). This measure was enforced in 2013. Also, temporary closure for the trawlers (1 month per year) is enforced since 2011.	The SCSA endorsed the assessment and proposed to reduce fishing mortality. The SCSA pointed out that Fcurrent is about 12 times higher than the Fmsy.

GSA	Species	Data type	Years data	Methodology used	Stock status	Fcurr/F0.1	Management advice	WGSAD comments	SCSA comments
<b>GSA 12, 13, 14, 15, 16</b>	European hake, <i>Merluccius merluccius</i>	Catch & Lfreq catch	2010-2012	LCA, Y/R analysis	The stock is in high overfishing and low biomass level	5.8	F should be reduced and the fishing pattern improved by increasing the selectivity of gears	LCA run by year, and combining the last three years, showed similar results. The WGSAD agreed to consider the results of the last year (2012) as reference for advice. WGSAD agreed on assessment results and management advice provided.	The SCSA <u>endorsed the assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that Fcurrent is about 8 times higher than the Fmsy.
<b>GSA 18</b>	European hake, <i>Merluccius merluccius</i>	Catch, effort, Lfreq catch, trawl surveys	survey data: 1996-2012; catch data: 2007-2012	XSA; ALADYM	High overfishing	5.6	Stock is in overfishing status and intermediate biomass (estimates on the MEDITS time series). The stock is characterized by fluctuations of recruitment and abundance, which contribute to sustain the catches. The stock is in overfishing as current fishing mortality exceeds the $F_{0.1}$ levels (1 vs. 0.18) and thus a considerable reduction of the fishing mortality is necessary to allow the achievement of $F_{0.1}$ . Objectives of a more sustainable harvest strategy could be achieved with a multiannual plan that foresees a reduction of fishing mortality through fishing limitations. As observed in 2012, the production of hake in GSA 18 is split in 17% caught by Italian longlines, 74% by Italian trawlers, about 1% by Montenegrin trawlers and about 8% by Albania trawlers.	No specific comments on this stock.	The <u>endorsed the assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that Fcurrent is about 5 times higher than the Fmsy.

GSA	Species	Data type	Years data	Methodology used	Stock status	Fcurr/F0.1	Management advice	WGSAD comments	SCSA comments
<b>GSA 17</b>	Common sole, <i>Solea solea</i>	Trawls surveys, catch, Lfreq catch & Lfreq catch	1970-2012 (SCAA); 2006-2012 (XSA)	XSA, SCAA with SS3	High overfishing with relative low biomass level.	3.0	A reduction of fishing mortality towards the proposed reference point is advised. Considering the overexploited situation and the low values of SSB and biomass of the sole stock in GSA 17 a reduction of fishing pressure and an improvement in exploitation pattern is advisable, especially of Italian rapido trawlers and gillnetters, which mainly exploit juveniles. The best option to reduce effort and improve the exploitation pattern for sole in GSA 17, would be to introduce a closure for rapido trawling within 17 km of the Italian coast during the summer-fall period (June- December). Moreover, it was noted that in the last years some Italian artisanal fleets fish with gill net in the main spawning area during periods when trawling is prohibited. Additional measures to restrict exploitation of sole in the spawning area are desirable, to afford further protection of the Adriatic sole stock.	The WGSAD appreciated the comparison between the two models provided, as requested by last year's WG.	The SCSA endorsed the <u>assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that Fcurrent is about 3 times higher than the Fmsy.
<b>GSA 05</b>	Red mullet, <i>Mullus barbatus</i>	Catch, trawl surveys & Lfreq catch.	2000-2012	XSA and Y/R	High overfishing status with relative low biomass level.	6.6	To reduce fishing mortality.	No specific comments on this stock.	The SCSA endorsed the <u>assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that Fcurrent is about 6 times higher than the Fmsy

GSA	Species	Data type	Years data	Methodology used	Stock status	Fcurr/F0.1	Management advice	WGSAD comments	SCSA comments
GSA 06	Red mullet, <i>Mullus barbatus</i>	Total annual landings, annual catch in number by size class, abundance index from commercial fleet and MEDITS surveys	1995-2012	XSA, Y/R	High overfishing and relative intermediate biomass level.	1.8	A reduction in fishing mortality towards the $F_{0.1}$ level is advised. A progressive reduction in fishing effort is recommended.	The use of 40mm square or 50mm diamond mesh has improved the exploitation pattern. Age groups 0-1 were predominant in catches until 2010. From 2011 onwards age groups 1-2 are predominant.	The SCSA <u>endorsed the assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that $F_{current}$ is about 2 times higher than the $F_{msy}$ .
GSA 07	Red mullet, <i>Mullus barbatus</i>	Commercial and survey catch at age	2004-2012	XSA, Y/R	High Overfishing with relative high biomass level.	4.0	-Improve the fishing pattern of trawlers, so that the minimum length of catches is consistent with the minimum legal landing size -Reduce the effort of trawlers -Freezing the effort in the fishery Restricted Area	No specific comments on this stock.	The SCSA <u>endorsed the assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that $F_{current}$ is about 4 times higher than the $F_{msy}$ .
GSA 10	Red mullet, <i>Mullus barbatus</i>	Trawl surveys, catch & Lfreq catch.	survey data: 1994-2012; catch data: 2006-2012	XSA	Sustainable exploited with relative intermediate biomass level.	0.8	It is recommended to not increase the relevant fleets' effort and/or catches to maintain fishing mortality in line with the agreed reference point and to avoid future loss in stock productivity and landings.	No specific comments on this stock.	The SCSA <u>endorsed the assessment and advice</u> .

GSA	Species	Data type	Years data	Methodology used	Stock status	Fcurr/F0.1	Management advice	WGSAD comments	SCSA comments
GSA 17	Red mullet, <i>Mullus barbatus</i>	Trawls surveys, catch, Age freq catch	2006-2012	XSA, Y/R	High overfishing status with relatively intermediate high biomass level.	5.3	A reduction fishing mortality towards the proposed reference point is advised. Considering the overfishing situation of the red mullet stock in GSA 17 a reduction of fishing pressure and an improvement in exploitation pattern, especially of Italian trawlers exploiting a larger amount of Age 0+ group than Croatian and Slovenian trawlers, is advisable. However, from the analysis of the relative biomass observed in 2012 from MEDITS and from the SSB and total biomass estimated for the same year from XSA is possible to conclude that the abundance of the stock is high and there is not risk of stock depletion.	No specific comments on this stock.	The SCSA <u>endorsed the assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that Fcurrent is about 5 times higher than the Fmsy.
GSA 19	Red mullet, <i>Mullus barbatus</i>	Catch, Lfreq catch, trawl surveys	2006-2012 (commercial) 1994-2012 (survey)	LCA, Y/R	High overfishing status with relative intermediate biomass level.	3.1	Considering the results of the analyses, the objectives of a more sustainable harvest strategy could be achieved with a multiannual plan based on a reduction of the fishing mortality through fishing activity limitations and possibly fishing capacity decreasing, mostly focused on trawling.	No specific comments on this stock.	The SCSA <u>endorsed the assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that Fcurrent is about 3 times higher than the Fmsy.
GSA 05	Striped red mullet, <i>Mullus surmuletus</i>	Catch, trawl surveys & Lfreq catch.	2000-2012	XSA, Y/R and short term forecasts	High overfishing status with relative low biomass level.	3.0	To reduce fishing mortality.	The decrease in biomass and recruitment in the last two years is not connected with the dynamics of effort that is constant. This apparent contradiction is difficult to understand and could be related to changes in the fishing exploitation pattern related to market demands (it is a multispecific fishery), changes in selectivity or in the ecosystem.	The SCSA <u>endorsed the assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that Fcurrent is about 3 times higher than the Fmsy.

GSA	Species	Data type	Years data	Methodology used	Stock status	Fcurr/F0.1	Management advice	WGSAD comments	SCSA comments
<b>GSA 15-16</b>	Striped red mullet, <i>Mullus surmuletus</i>	Trawl surveys, catch & Lfreq catch	2002-2012	XSA, Y/R	High overfishing status with relative intermediate biomass level.	4.1	To reduce the current F toward the proposed FMSY, in order to avoid future loss in stock productivity and landings. This should be achieved by means of a multi-annual management plans, considering also reduction in the relevant fleets' effort and / or catches.	The reliability of MEDITS survey indices as tuning data was discussed. It is important to highlight that the XSA assessment would also benefit by the inclusion of time series of CPUE from gillnets and trammel nets to better reconstruct the dynamics of oldest age classes. It was suggested to repeat this assessment next year with the inclusion of Tunisian catch data if available.	The SCSA endorsed the <u>assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that Fcurrent is about 4 times higher than the Fmsy.
<b>GSA 26</b>	Striped red mullet, <i>Mullus surmuletus</i>	Catch & Lfreq catch	2011-2012	LCA, Y/R	High overfishing status	2.1	The objectives of a more sustainable harvest strategy could be achieved by reduction of fishing mortality through fishing activity limitations. Improve the selection pattern of the trawl fishery and enforcement of the application of the closed season will help in protecting the SSB. The lack of enforcement of the existing regulations, specifically the closed season during the last three years, can have a strong effect in this stock.	No specific comments on this stock.	The SCSA endorsed the <u>assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that Fcurrent is about 2 times higher than the Fmsy.
<b>GSA 26</b>	Brush tooth lizard fish, <i>Saurida undosquamis</i>	Catch & Lfreq catch	2011-2012	LCA, Y/R	In high overfishing status.	2.2	- Reduce the fishing mortality to F <sub>0.1</sub> by limitation of trawl fishing activities. - Improvement of the selection pattern of the trawl fishery	No specific comments on this stock.	The SCSA endorsed the <u>assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that Fcurrent is about 2 times higher than the Fmsy.
<b>GSA 25</b>	Picarel, <i>Spicara smaris</i>	Catch, Age freq catch, CPUE as tuning index	2005-2012	XSA, Y/R	Sustainable exploitation with intermediate biomass	0.6	Do not increase the fishing mortality.	No specific comments on this stock.	The SCSA endorsed the <u>assessment and advice</u> .

GSA	Species	Data type	Years data	Methodology used	Stock status	Fcurr/F0.1	Management advice	WGSAD comments	SCSA comments
<b>GSA 05</b>	Red shrimp, <i>Aristeus antennatus</i>	Catch, trawl surveys & Lfreq catch and commercial CPUE	1992-2012	LCA, XSA, VPA, Y/R	The stock is subject to high overfishing with relative low biomass level.	4.3	To reduce fishing mortality.	No specific comments on this stock.	The SCSA <u>endorsed the assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that Fcurrent is about 4 times higher than the Fmsy.
<b>GSA 03</b>	Deep-water pink shrimp, <i>Parapenaeus longirostris</i>	Catch CPUE Surveys Abundance indexes	2003-2012	Biodyn (Production Model)	The stock status is uncertain although with a relatively high level of biomass.	NA	Not to take any management decision based on this assessment.	The production model was not considered appropriate due to the shortness of the data series. Nevertheless, biomass indexes from the commercial fleet and the surveys showed similar and homogeneous trends. For all these reasons, the assessment was considered qualitative and could not be endorsed.	The SCSA agreed with the WG comments.
<b>GSA 05</b>	Deep-water pink shrimp, <i>Parapenaeus longirostris</i>	Catch, trawl surveys & Lfreq catch.	2002-2012	XSA, Y/R and short term forecasts	Low overfishing status with relative intermediate biomass level.	1.2	To reduce fishing mortality.	No specific comments on this stock.	The SCSA <u>endorsed the assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that Fcurrent is about 20% higher than the Fmsy.
<b>GSA 06</b>	Deep-water pink shrimp, <i>Parapenaeus longirostris</i>	Catch, trawl surveys & Lfreq catch	2001-2012	XSA, Y/R	High overfishing. Relative intermediate biomass.	5.5	A reduction of the current fishing mortality is recommended by reducing the fishing effort.	Fluctuations found in this stock are in agreement with those observed in other areas, probably related to environmental variability. The WGSAD endorsed the assessment and recommendations.	The SCSA <u>endorsed the assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that Fcurrent is about 5 times higher than the Fmsy.
<b>GSA 12-16</b>	Deep-water pink shrimp, <i>Parapenaeus longirostris</i>	Catch, trawl surveys & Lfreq catch	2007-2012	LCA, Y/R	High overfishing.	1.8	To reduce fishing mortality. The protection of juveniles is also recommended. This objective can be achieved by improving the exploitation pattern of trawlers, and the protection of nursery areas.	No specific comments on this stock.	The SCSA <u>endorsed the assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that Fcurrent is about 2 times higher than the Fmsy.

GSA	Species	Data type	Years data	Methodology used	Stock status	Fcurr/F0.1	Management advice	WGSAD comments	SCSA comments
GSA 18	Deep-water pink shrimp, <i>Parapenaeus longirostris</i>	Trawl surveys, catch & Lfreq catch	survey data: 1996-2007; catch data: 2007-2012	XSA, ALADYM	High overfishing.	1.8	It is necessary to consider a considerable reduction of the fishing mortality to allow the achievement of $F_{0.1}$ . The reference point $F_{0.1}$ can be gradually achieved by multiannual management plans that foresee a reduction of fishing mortality through fishing limitations. As observed in 2012, the contribution of each country to the total production of <i>P. longirostris</i> in the GSA18 is the following: Italy 60 %, Albania 38% and Montenegro 2%.	No specific comments on this stock.	The SCSA <u>endorsed the assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that $F_{current}$ is about 2 times higher than the $F_{msy}$ .
GSA 19	Deep-water pink shrimp, <i>Parapenaeus longirostris</i>	Trawl surveys, catch & Lfreq catch	survey data: 1994-2007; catch data: 2006-2012	XSA, ALADYM	High overfishing with relative high biomass level.	2.4	It is necessary to consider a considerable reduction of the fishing mortality in order to achieve the estimated $F_{0.1}$ levels. Objectives of a more sustainable harvest strategy could be achieved with a multiannual plan that foresees a reduction of fishing mortality through fishing limitations and improving selectivity pattern	No specific comments on this stock.	The SCSA <u>endorsed the assessment and proposed to reduce fishing mortality</u> . The SCSA pointed out that $F_{current}$ is about 2 times higher than the $F_{msy}$ .
GSA 15-16	Norway lobster, <i>Nephrops norvegicus</i>	Trawl surveys, catch & Lfreq catch	survey data: 2002-2012; catch data: 2002-2012	An SCA approach (Millar et al., 2012) using the a4a assessment model was performed on 2002-2012 catch data, tuned with Medits data	The estimated $F_{cur}$ was below $F_{MSY}$ in 2012 indicating that in this year the stock was exploited sustainably	0.7	Not to increase relevant fleets' effort or catches to maintain fishing mortality below the proposed $F_{MSY}$ level, in order to avoid future loss in stock productivity and landings.	The WGSAD identified uncertainty on the way the model reconstructed recruitment with outliers values in 2011 and 2012. Assessment and recommendations were endorsed.	The SCSA <u>endorsed the assessment and advice</u> .



**Assessments for Black Sea species, with recommendations by the SGSABS and SCSA**

GSA	Species	Data type	Years data	Methodology used	Stock status	Fcurr/Flim	Advice	SGSABS Comments	SCSA Comments
GSA 29	Turbot	a) catch-at-age data age-classes 2 to 10+	a) 1950-2012	a) SAM	<u>Black Sea stock:</u> Depleted and in overfishing	a) 2.1	A recovery plan is needed. Fishing mortality has to be reduced to allow the biomass to recover.	Two different assessments that cover different part of the Black Sea turbot populations were presented. Models differed in the estimation on IUU catches and in several technicalities. Model results are different, however both models agree that current fishing mortality is not sustainable. Some doubts on the estimate of F in the LCA remain. Further analysis of model differences should be investigated	The SCSA <u>endorsed the advice</u> . The SCSA recommended that an agreement on stock limits for the purpose of stock assessment is done.
		b) Ukrainian catch-at-length	b)	b) LCA	<u>Northwest population</u> (Ukrainian waters): in overfishing, with a slight decreasing trend in SSB	b) 3.8			
GSA 29	Sprat	Catch-at-age	1992-2012	ICA	Moderate exploitation rate. Average biomass Sustainably exploited	--	F could be maintained at current levels. Due to fluctuations this should be revised related to next year recruitment	Further information on biological parameters and environmental relationships from analysis of catches is desirable.	The SCSA recommended the advice to be rephrased as <u>do not increase the fishing mortality</u> . The SCSA agreed on the importance of a recruitment estimate to provide advice.
GSA 29	Anchovy <i>E. encrasicolus ponticus</i>			a) XSA with CPUE tuning  b) time series analysis exercise	Unknown  Exercise with time series of catches suggest that the current F may not be precautionary	--	Although the assessment is inconclusive, an exercise of estimating a virgin biomass and applying some precautionary concepts suggest that current F could be higher than a precautionary F.	Assessment model is not expected to be reliable until a time series of surveys is accumulated. Some uncertainties in the surveys due to coverage are expected. An alternative precautionary approach should be investigated. An exercise of estimation of a potential virgin biomass provides indication that current fishing pressure could be higher than a precautionary F.	The SCSA agreed with the SGSABS comments and recommended that continuation on surveys and improvement on survey coverage is ensured.
GSA 29-30	Anchovy <i>E. encrasicolus maeoticus</i>		1992-2012	Lampara surveys	Moderately exploited High biomass	0.25	F could be maintained at current levels.	Stock is managed using biomass reference points established based on time series. There are some uncertainties in the estimation of F (as assessment is only based on direct surveys and catches do not have complete coverage and do not include IUU), however biomass levels are high.	The SCSA recommended the advice to be rephrased as <u>do not increase the fishing mortality</u> .

GSA	Species	Data type	Years data	Methodology used	Stock status	Fcurr/ Flim	Advice	SGSABS Comments	SCSA Comments
GSA 29	Picked dogfish	--	--	--	depleted	--	Recovery plan needed. Some existing recommendations from GFCM apply, but further measures required to recover population	Only information on Ukrainian fisheries is presented. No formal assessment, however very low abundance and presence in catches confirm previous assessments that the stock is depleted	The <u>SCSA endorsed the advice</u> , but suggested that more detailed information on the available data is provided.
GSA 29	Atlantic Bonito	--	--	--	--	--	No advice	The catches of Bonito in the Black Sea are assumed to be from a small resident population and a larger migratory population from the Mediterranean sea. Further research on Bonito dynamics in the Black Sea required	The SCSA recommended that ecological role of Bonito in the Black Sea is further investigated.
GSA 29	Rapa whelk	--	--	--	--	--	No advice	Abundance and distribution of Rapa whelk in the Black Sea is unknown. Surveys are required.	The SCSA recommended that the abundance and distribution of Rapa whelk in the Black Sea is estimated and that SCME evaluates its effect in the Black Sea ecosystems

- Flim =
  - Turbot model a): Flim10 (SAM - STECF)
  - Turbot model b): F0.1 (LCA)
  - Azov Anchovy : Fpa based on Biomass reference point (not considered fully reliable)

## **Framework for describing stock status and providing management advice in relation to reference points**

### **INTRODUCTION**

1. One of the main purposes of the Scientific Advisory Committee (SAC) of the GFCM is to assess the status of exploited populations of fish and other marine living resources in the Mediterranean and the Black Sea and provide management advice to ensure the sustainable exploitation of these resources. The SAC assessment of stock status and related management advice emanates from dedicated expert groups (e.g. the working groups on stock assessment for small pelagics and demersal species or the recent Subregional group for the assessment of Black Sea stocks), which are revised by the Subcommittee on Stock Assessment (SCSA) and provided to the SAC for endorsement and final advice to the GFCM Commission.
2. Within the expert groups on stock assessment, advice has been provided following terms of reference and recommendations from the SAC, and also in accordance with FAO and international standards and guidelines. In 2012, following several recommendations made on the management of different fisheries in the Mediterranean and Black Sea (e.g. Recommendations GFCM/27/2002/1, GFCM/30/2006/1 and Resolution GFCM 33/2009/1 on the management of certain fisheries exploiting demersal and small pelagic), and on the basis of SAC advice on the need to develop multiannual management plans based on agreed reference points, the GFCM formulated at its thirty-sixth session “Guidelines on a general management framework and presentation of scientific information for multiannual management plans for sustainable fisheries in the GFCM area”<sup>2</sup>. These guidelines include clear indications on suitable objectives and procedures to implement a management plan, and provide a clear definition of the requirements to provide scientific advice useful for management. The framework is based on the definition of reference points related to key indicators of the status of stocks, such as stock biomass and fishing mortality.
3. In order to further standardize and simplify the definitions of stock status as well as management advice provided by the expert groups, the thirty-seventh session of the Commission agreed to organize a workshop on the definition and use of reference points to provide advice on stock status and management measures. The main conclusions of this workshop were revised by the both working groups on stock assessment and the SCSA and then endorsed by the SAC at its sixteenth session. This document contains a framework on how to describe status of stocks and provide management advice for those stocks for which reference points are adopted by the SAC.

### **GENERAL CONSIDERATIONS**

4. This document provides definitions for stock status and management advice on stocks for which reference points related to indicators of biomass and/or exploitation are available. The GFCM Guidelines on management plans define three categories of reference points to be used to provide advice:
  - target reference point, i.e. a management objective that points to a state of a fishing and/or biological resource which is considered to be desirable. Target reference points should be set sufficiently far away from a limit reference so that the probability that the limits will be exceeded is low. The trajectory toward the target(s) may be represented either on a linear plot

---

<sup>2</sup> These guidelines are referred to as Resolution OTH-GFCM/36/2012/1 in the Compendium of GFCM decisions.

with a single target reference point or on a two-dimension plot using two target reference points or on a multidimensional plot when more than two target reference points are used.

- threshold reference point, i.e. a precautionary reference point expressed either as fishing mortality rate or a level of biomass or another agreed indicator. They are between the limit and target reference points and used to reduce the probability that the limit reference point will be exceeded. They serve as a red flag and may trigger particular management actions designed to reduce fishing pressure and mortality. After this point pre-negotiated management measures to reverse the situation should be initiated.
- limit reference point, i.e. a conservation reference point expressed either as a fishing mortality rate or level of biomass or another agreed indicator that indicates to a state of a fishery and/or a resource which is considered to be undesirable and which management actions should avoid with high probability. After this point pre-negotiated management measures to reverse the situation should be initiated.

5. In addition to these definitions, the following considerations are proposed in this document:

### **In relation to reference points and stock status:**

- Suitable indicators for biomass can be either **Total Biomass** or **Spawning Stock Biomass**, while suitable indicators for exploitation can be either **Fishing mortality** or **Exploitation rate** (ratio between fishing mortality and total mortality). In all cases, reference points should be defined in relation to the indicator used. For simplification, in this document the acronym “**B**” refers to any biomass indicator, while the acronym “**F**” refers to any indicator of exploitation.
- Following the recommendations from the SAC, the advice should be based, if possible, on both indicators of biomass and exploitation, and for each indicator ideally target, threshold and limit (e.g.  $F_{tgt}$ ,  $F_{thr}$ ,  $F_{lim}$ ) reference points should be defined. When only one indicator is available, there should be a clear advice to explore the possibility of having indicators for both biomass and exploitation.
- In general terms, a suggested target reference point for biomass and exploitation is that value of the indicator at which maximum sustainable yield (MSY) is obtained from the fishery, in accordance with the 1995 UN Fish Stocks Agreement (UNFSA), while limit and threshold reference points should be established based on precautionary principles.
- When only one reference point is available for a given indicator, the reference point is referred to as unique reference point ( $B_{unique}$  or  $F_{unique}$ ), and it should refer to MSY.
- When the exploitation rate is used as an indicator, and in absence of a stock-specific reference point,  $F_{unique}$  for small pelagics can be defined as  $E=0.4$  following the proposal of Patterson (1999).
- When fishing mortality is used as an indicator,  $F_{0.1}$  (defined as the fishing mortality rate at which the slope of the yield-per-recruit curve is only one-tenth the slope of the curve at its origin) can be used as a proxy for  $F_{MSY}$ . If possible  $F_{0.1}$  should be complemented with an additional estimate of  $F_{lim}$  (e.g. from an independent  $B_{lim}$  estimate) and  $F_{thr}$  should be defined in relation to  $F_{lim}$ . In that case  $F_{MSY}$  will be considered as a target. Alternatively, if only  $F_{0.1}$  is available, it will be considered as  $F_{unique}$ .
- For small pelagic fish, a threshold and limit reference point for biomass, based on reproductive capacity should be established to maximize probability of obtaining good recruitments. In the absence of precise stock recruitment relationships that allow estimating it,  $B_{lim}$  is proposed to be defined as the lowest biomass from which a recovery has been confirmed ( $B_{loss}$ ), estimated from an analysis of time series of biomass estimates. Time series should be sufficiently long and only if the analysis provides consistent perspective in the historical and the recent part of the time series this reference points is to be considered. Whenever similar minima that meet the required criteria (recovery) exist in the time series the

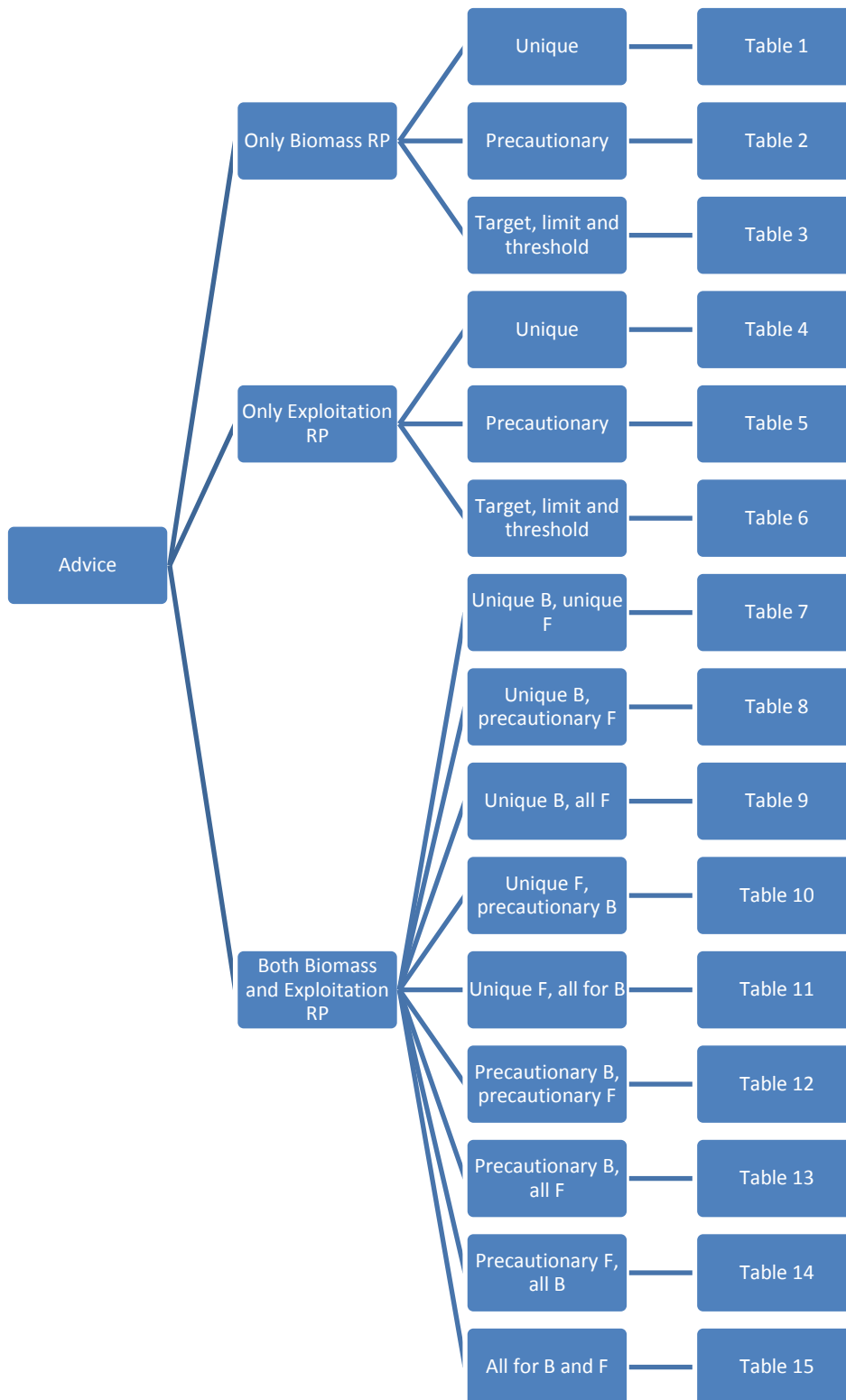
upper value should be chosen as a precautionary approach.  $B_{thr}$  is defined as a point at which the probability to be below  $B_{lim}$  is lower than 5%. In absence of precise estimates of the distribution of the biomass estimate, a lognormal distribution of  $B_{lim}$  should be assumed, with a coefficient of variation of 40%. This approximately results in  $B_{thr} = 2 * B_{lim}$

### **In relation to management advice:**

- Management advice is provided based on both the assessment of the status of the stock and the reference points used for this assessment. If the assessment is based on the full range of indicators (i.e. F and B) and reference points (i.e. target, threshold and limit), then a more precise advice can be provided. If on the other hand the assessment is based on a reduced number of indicators or reference points, then a more precautionary advice is provided due to limited information which could result in increasing risk for the sustainability of the fishery.
- When a reduction of fishing mortality is advised, it should be implemented by means of a multiannual management plan, done in accordance with the GFCM guidelines for management plans. The amount of reduction in fishing mortality resulting from the implementation of the plan should be proportional to the distance between the target fishing mortality and the current fishing mortality. Management advice emanating from the expert groups should therefore include the ratio between current estimate of the indicator of F and either its target or the unique reference point for F (i.e.  $F_{curr} / F_{target}$  or  $F_{curr} / F_{unique}$ )
- When the status of stock is outside biological limits (as indicated by one or both indicators used), a recovery plan should be established. Minimum objectives for recovery plan should ensure that human pressure (direct and indirect) on the population is reduced to minimum and a close monitoring of population condition is established.

### **STOCK STATUS AND MANAGEMENT ADVICE IN RELATION TO REFERENCE POINTS**

6. Stock status and proposed management advice for different combinations of indicators (only F, only B or both) and reference points (a unique reference point, precautionary – limit and threshold – reference points, or a full set of target, threshold or limit reference points) available for a given stock are provided in Tables 1 – 15. The diagram included in Figure 1 identifies the appropriate table for the different combinations of indicators and reference points available.



**Figure 1: Diagram for the different stock assessment and management advice situations based on the indicators used and the reference points adopted. For each stock, the diagram indicates the adequate table to provide an assessment of stock status and its associated management advice.**

**Table 1: Advice for stocks that only have a single reference point for biomass**

Current assessment	Status of stock	Advice
$B > B_{\text{unique}}$	No signals of overexploitation	Do not increase fishing mortality
$B < B_{\text{unique}}$	Overexploited	Reduce fishing mortality

**Table 2: Advice for stocks that have precautionary reference points only for biomass (threshold and limit)**

Current assessment	Status of stock	Advice
$B > B_{\text{thr}}$	No signals of overexploitation	Do not increase fishing mortality
$B_{\text{thr}} > B > B_{\text{lim}}$	Low biomass	Reduce fishing mortality
$B < B_{\text{lim}}$	Depleted / Collapsed	Implement a recovery plan

**Table 3: Advice for stocks that have all reference points (target, threshold and limit) for biomass only**

Current assessment	Status of stock	Advice
$B > B_{\text{trg}}$	Sustainably exploited	Do not increase fishing mortality
$B_{\text{trg}} > B > B_{\text{thr}}$	Biomass below target	Reduce fishing mortality
$B_{\text{thr}} > B > B_{\text{lim}}$	Low biomass	Reduce fishing mortality
$B < B_{\text{lim}}$	Depleted / Collapsed	Implement a recovery plan

**Table 4: Advice for stocks that only have a single reference points for exploitation**

Current assessment	Status of stock	Advice
$F < F_{\text{unique}}$	Sustainable exploitation	Do not increase fishing mortality
$F > F_{\text{unique}}$	In overexploitation	Reduce fishing mortality

**Table 5: Advice for stocks that only have precautionary reference points for exploitation (threshold and limit)**

Current assessment	Status of stock	Advice
$F < F_{thr}$	Sustainable exploitation	Do not increase fishing mortality
$F_{thr} < F < F_{lim}$	In overexploitation	Reduce fishing mortality
$F > F_{lim}$	In severe overexploitation	Immediate action to ensure a reduction in fishing mortality *

**Table 6: Advice for stocks that have all reference points (target, threshold and limit) for exploitation only**

Current assessment	Status of stock	Advice
$F < F_{trg}$	Sustainable exploitation	Do not increase fishing mortality
$F_{trg} < F < F_{thr}$	In low overexploitation	Reduce fishing mortality
$F_{thr} < F < F_{lim}$	In overexploitation	Reduce fishing mortality
$F > F_{lim}$	In severe overexploitation	Immediate action to ensure a reduction in fishing mortality *

\*Monitoring that the level of fishing mortality actually decreases should be ensured.



**Table 7: Advice for stocks with a unique reference point for both biomass and exploitation**

Current assessment	Status of stock	Advice
$B > B_{\text{unique}}$	Sustainably exploited	Evaluate potential fishing opportunities*
$F < F_{\text{unique}}$		
$B > B_{\text{unique}}$	Biomass above reference point and in overexploitation	Reduce fishing mortality
$F > F_{\text{unique}}$		
$B < B_{\text{unique}}$	Overexploited with a low fishing mortality or ecologically unbalanced but with a low fishing mortality**	Reduce fishing mortality and/or implement a recovery plan
$F < F_{\text{unique}}$		
$B < B_{\text{unique}}$	Overexploited and in overexploitation	Immediate action to ensure a reduction in fishing mortality ***
$F > F_{\text{unique}}$		

- \*Fishing opportunities should be evaluated taking into account ecosystem and socio-economic considerations and future risks for the target stock.
- \*\* Ecologically unbalanced refers to situations in which the low biomass is not believed to be caused by continuous human pressure, but else to changes in the ecosystem that prevents higher biomass.
- \*\*\*Monitoring that the level of fishing mortality actually decreases should be ensured.

**Table 8: Advice for stocks with precautionary (limit and threshold) reference points for exploitation and unique reference points for biomass**

Current assessment	Status of stock	Advice
$B > B_{\text{unique}}$	Sustainably exploited	Evaluate potential fishing opportunities*
$F < F_{\text{thr}}$		
$B > B_{\text{unique}}$	Biomass above reference point and in overexploitation	Reduce fishing mortality
$F_{\text{lim}} > F > F_{\text{thr}}$		
$B > B_{\text{unique}}$	Biomass above reference point and in severe overexploitation	Reduce fishing mortality immediately
$F > F_{\text{lim}}$		
$B < B_{\text{unique}}$	Overexploited with a low fishing mortality or ecologically unbalanced with a low fishing mortality**	Reduce fishing mortality and/or implement a recovery plan
$F < F_{\text{thr}}$		
$B < B_{\text{unique}}$	Overexploited and in overexploitation	Reduce fishing mortality and/or implement a recovery plan
$F_{\text{lim}} > F > F_{\text{thr}}$		
$B < B_{\text{unique}}$	Overexploited and in severe overexploitation	Immediate action to ensure a reduction in fishing mortality ***
$F > F_{\text{lim}}$		

- \*Fishing opportunities should be evaluated taking into account ecosystem and socio-economic considerations and future risks for the target stock.
- \*\* Ecologically unbalanced refers to situations in which the low biomass is not believed to be caused by continuous human pressure, but else to changes in the ecosystem that prevents higher biomass.
- \*\*\*Monitoring that the level of fishing mortality actually decreases should be ensured.

**Table 9: Advice for stocks with limit, threshold and target reference points for exploitation and unique reference points for biomass**

Current assessment	Status of stock	Advice
$B > B_{\text{unique}}$	Sustainably exploited	Evaluate potential fishing opportunities*
$F < F_{\text{tr}}$		
$B > B_{\text{unique}}$	Biomass above reference point and in low overexploitation	Reduce fishing mortality
$F_{\text{thr}} > F > F_{\text{tr}}$		
$B > B_{\text{unique}}$	Biomass above reference point and in high overexploitation	Reduce fishing mortality
$F_{\text{lim}} > F > F_{\text{thr}}$		
$B > B_{\text{unique}}$	Biomass above reference point and in severe overexploitation	Reduce fishing mortality immediately
$F > F_{\text{lim}}$		
$B < B_{\text{unique}}$	Overexploited with a low fishing mortality or ecologically unbalanced with a low fishing mortality**	Reduce fishing mortality and/or implement a recovery plan
$F < F_{\text{tr}}$		
$B < B_{\text{unique}}$	Overexploited and in low overexploitation	Reduce fishing mortality and/or implement a recovery plan
$F_{\text{thr}} > F > F_{\text{tr}}$		
$B < B_{\text{unique}}$	Overexploited and in overexploitation	Reduce fishing mortality and/or implement a recovery plan
$F_{\text{lim}} > F > F_{\text{thr}}$		
$B < B_{\text{unique}}$	Overexploited and in severe overexploitation	Immediate action to ensure a reduction in fishing mortality ***
$F > F_{\text{lim}}$ or		

- \*Fishing opportunities should be evaluated taking into account ecosystem and socio-economic considerations and future risks for the target stock.
- \*\* Ecologically unbalanced refers to situations in which the low biomass is not believed to be caused by continuous human pressure, but else to changes in the ecosystem that prevents higher biomass.
- \*\*\*Monitoring that the level of fishing mortality actually decreases should be ensured.

**Table 10: Advice for stocks with precautionary reference points for biomass ( $B_{thr}$  and  $B_{lim}$ ) and unique reference points for exploitation**

Current assessment	Status of stock	Advice
$B > B_{thr}$	Sustainably exploited	Evaluate potential fishing opportunities*
$F < F_{unique}$		
$B > B_{thr}$	Biomass above reference point and in overexploitation	Reduce fishing mortality
$F > F_{unique}$		
$B_{lim} < B < B_{thr}$	Overexploited with a low fishing mortality or ecologically unbalanced with a low fishing mortality**	Reduce fishing mortality or implement a recovery plan
$F < F_{unique}$		
$B < B_{lim}$	Depleted with a low fishing mortality or ecologically unbalanced with a low fishing mortality**	Immediate reduction of fishing mortality and implement a recovery plan
$F < F_{unique}$		
$B_{lim} < B < B_{thr}$	Overexploited and in overexploitation	Reduce fishing mortality immediately
$F > F_{unique}$		
$B < B_{lim}$	Depleted and in overexploitation	Implement recovery plan
$F > F_{unique}$		

- \*Fishing opportunities should be evaluated taking into account ecosystem and socio-economic considerations and future risks for the target stock.
- \*\* Ecologically unbalanced refers to situations in which the low biomass is not believed to be caused by continuous human pressure, but else to changes in the ecosystem that prevents higher biomass.
- \*\*\*Monitoring that the level of fishing mortality actually decreases should be ensured.

**Table 11: Advice for stocks with limit, threshold and target reference points for biomass and unique reference points for exploitation**

Current assessment	Status of stock	Advice
$B > B_{tr}$	Sustainably exploited	Evaluate potential fishing opportunities*
$F < F_{unique}$		
$B > B_{tr}$	Biomass above reference point and in overexploitation	Reduce fishing mortality
$F > F_{unique}$		
$B_{thr} < B < B_{tr}$	Increased risk of being overexploited	Do not increase fishing mortality and close monitoring of the stock status
$F < F_{unique}$		
$B_{thr} < B < B_{tr}$	Increased risk of being overexploited and in overexploitation	Reduce fishing mortality
$F > F_{unique}$		
$B_{lim} < B < B_{thr}$	Overexploited with a low fishing mortality or ecologically unbalanced with a low fishing mortality**	Reduce fishing mortality or Implement a recovery plan
$F < F_{unique}$		
$B < B_{lim}$	Depleted with a low fishing mortality or ecologically unbalanced with a low fishing mortality**	Immediate reduction of fishing mortality and implement a recovery plan
$F < F_{unique}$		
$B_{lim} < B < B_{thr}$	Overexploited and in overexploitation	Reduce fishing mortality immediately
$F > F_{unique}$		
$B < B_{lim}$	Depleted and in overexploitation	Implement recovery plan
$F > F_{unique}$		

**Table 12: Advice for stocks with precautionary (limit and threshold) reference points for biomass and exploitation**

Current assessment	Status of stock	Advice
$B > B_{thr}$	Sustainably exploited	Evaluate potential fishing opportunities*
$F < F_{thr}$		
$B > B_{thr}$	Biomass above reference point and in overexploitation	Reduce fishing mortality
$F_{lim} > F > F_{thr}$		
$B > B_{thr}$	Biomass above reference point and in severe overexploitation	Reduce fishing mortality immediately
$F > F_{lim}$		
$B_{lim} < B < B_{thr}$	Overexploited or ecologically unbalanced	Reduce fishing mortality or Implement a recovery plan
$F < F_{thr}$		
$B_{lim} < B < B_{thr}$	Overexploited and in overexploitation	Reduce fishing mortality
$F_{lim} > F > F_{thr}$		
$B_{lim} < B < B_{thr}$	Overexploited and in severe Overexploitation	Reduce fishing mortality immediately
$F > F_{lim}$		
$B < B_{lim}$	Depleted with a low fishing mortality or ecologically unbalanced with a low fishing mortality**	Immediate reduction of fishing mortality and implement a recovery plan
$F < F_{thr}$		
$B < B_{lim}$	Depleted and in overexploitation	Close the fishery and implement a recovery plan
$F_{lim} > F > F_{thr}$		
$B < B_{lim}$	Depleted with immediate risk of collapse	Close the fishery and implement a recovery plan
$F > F_{lim}$		

**Table 13: Advice for stocks with precautionary (limit and threshold) reference points for biomass and limit, threshold and target reference points for exploitation**

Current assessment	Status of stock	Advice
$B > B_{thr}$ $F < F_{tr}$	Sustainably exploited	Evaluate potential fishing opportunities*
$B > B_{thr}$ $F_{thr} > F > F_{tr}$	Increased risk of overexploitation	Do not increase fishing mortality and close monitoring of the stock status
$B > B_{thr}$ $F_{lim} > F > F_{thr}$	Biomass above reference point and in overexploitation	Reduce fishing mortality
$B > B_{thr}$ $F > F_{lim}$	Biomass above reference point and in severe overexploitation	Reduce fishing mortality immediately
$B_{lim} < B < B_{thr}$ $F < F_{tr}$	Overexploited or ecologically unbalanced	Reduce fishing mortality or Implement a recovery plan
$B_{lim} < B < B_{thr}$ $F_{thr} > F > F_{tr}$	Overexploited and in risk of being in overexploitation	Reduce fishing mortality
$B_{lim} < B < B_{thr}$ $F_{lim} > F > F_{thr}$	Overexploited and in overexploitation	Reduce fishing mortality
$B_{lim} < B < B_{thr}$ $F > F_{lim}$	Overexploited and in severe overexploitation	Reduce fishing mortality immediately
$B < B_{lim}$ $F < F_{tr}$	Depleted with a low fishing mortality or ecologically unbalanced with a low fishing mortality**	Immediate reduction of fishing mortality and implement a recovery plan
$B < B_{lim}$ $F_{thr} > F > F_{tr}$	Depleted with unsustainable exploitation or ecologically unbalanced with unsustainable exploitation **	Immediate reduction of fishing mortality and implement a recovery plan
$B < B_{lim}$ $F_{lim} > F > F_{thr}$	Depleted and in overexploitation	Close the fishery and implement a recovery plan
$B < B_{lim}$ $F > F_{lim}$	Depleted with immediate risk of collapse	Close the fishery and implement a recovery plan

**Table 14: Advice for stocks with precautionary (limit and threshold) reference points for exploitation and limit, threshold and target reference points for biomass**

Current assessment	Status of stock	Advice
$B > B_{tr}$	Sustainably exploited	Evaluate potential fishing opportunities*
$F < F_{thr}$		
$B > B_{tr}$	Biomass above reference point and in overexploitation	Reduce fishing mortality
$F_{lim} > F > F_{thr}$		
$B > B_{tr}$	Biomass above reference point and in severe overexploitation	Reduce fishing mortality immediately
$F > F_{lim}$		
$B_{thr} < B < B_{tr}$	Increased risk of being overexploited	Do not increase fishing mortality and close monitoring of the stock status
$F < F_{thr}$		
$B_{lim} < B < B_{thr}$	Overexploited or Ecologically unbalanced	Reduce fishing mortality or Implement a recovery plan
$F < F_{thr}$		
$B_{lim} < B < B_{thr}$	Overexploited and in overexploitation	Reduce fishing mortality
$F_{lim} > F > F_{thr}$		
$B_{lim} < B < B_{thr}$	Overexploited and in severe Overexploitation	Reduce fishing mortality immediately
$F > F_{lim}$		
$B < B_{lim}$	Depleted with a low fishing mortality or ecologically unbalanced with a low fishing mortality**	Immediate reduction of fishing mortality and implement a recovery plan
$F < F_{thr}$		
$B < B_{lim}$	Depleted and in overexploitation	Close the fishery and implement a recovery plan
$F_{lim} > F > F_{thr}$		
$B < B_{lim}$	Depleted with immediate risk of collapse	Close the fishery and implement a recovery plan
$F > F_{lim}$		



**Table 15: Advice for stocks with limit, threshold and target accepted reference points for both biomass and exploitation**

Current assessment	Status of stock	Advice
$B > B_{tr}$	Sustainably exploited	Evaluate potential fishing opportunities*
$F < F_{tr}$		
$B > B_{tr}$	Increased risk of overexploitation	Do not increase fishing mortality and close monitoring of the stock status
$F_{thr} > F > F_{tr}$		
$B > B_{tr}$	Biomass above reference point and in Overexploitation	Reduce fishing mortality
$F_{lim} > F > F_{thr}$		
$B > B_{tr}$	Biomass above reference point and in severe overexploitation	Reduce fishing mortality immediately
$F > F_{lim}$		
$B_{thr} < B < B_{tr}$	Increased risk of being overexploited	Do not increase fishing mortality and close monitoring of the stock status
$F < F_{tr}$		
$B_{lim} < B < B_{thr}$	Overexploited or ecologically unbalanced	Reduce fishing mortality or Implement a recovery plan
$F < F_{tr}$		
$B_{thr} < B < B_{tr}$	Increased risk of being both overexploited and in overexploitation	Reduce fishing mortality
$F_{thr} > F > F_{tr}$		
$B_{lim} < B < B_{thr}$	Overexploited and in risk of being in overexploitation	Reduce fishing mortality
$F_{thr} > F > F_{tr}$		
$B_{lim} < B < B_{thr}$	Overexploited and in overexploitation	Reduce fishing mortality
$F_{lim} > F > F_{thr}$		
$B_{lim} < B < B_{thr}$	Overexploited and in severe overexploitation	Reduce fishing mortality immediately
$F > F_{lim}$		
$B < B_{lim}$	Depleted with a low fishing mortality or ecologically unbalanced with a low fishing mortality**	Immediate reduction of fishing mortality and implement a recovery plan
$F < F_{tr}$		
$B < B_{lim}$	Depleted with unsustainable exploitation or ecologically unbalanced with unsustainable exploitation **	Immediate reduction of fishing mortality and implement a recovery plan
$F_{thr} > F > F_{tr}$		
$B < B_{lim}$	Depleted and in overexploitation	Close the fishery and implement a recovery plan
$F_{lim} > F > F_{thr}$		
$B < B_{lim}$	Depleted with immediate risk of collapse	Close the fishery and implement a recovery plan
$F > F_{lim}$		

## Appendix E

## Stock categories

Category	Catch (discards)	CPUE Fleet	Size (Age)-composition	Survey data	Comments	Type of assessment	Examples of methods
<b>1. Data rich and long time series</b>	X	(X)	X	X	Time series as long as the lifespan	Age/length-based analytical assessment (quantitative assessment)	Separable VPA, XSA, SCA
<b>2. Data moderate (short time series)</b>	X	(X)	(X)	X	Short time series (shorter than lifespan)	Age/length-based analytical assessment in steady state (quantitative assessment)	Pseudocohort analysis (vit), catch curve
<b>3. Data limited (moderate long time series)</b>	X	X			The available time series is long enough to gather contrasts reflecting substantial changes in fishing effort	Production models (quantitative assessment), time series analysis	Global models/ASPIC, catch-MSY method, time series analysis
<b>4. Data poor and short time series</b>	X	X				Only trends (qualitative assessment)	Percentile approach
<b>5. Only survey data</b>				X		Indicators-based assessment (qualitative assessment)	SURBA, time series analysis, size-age indicators (e.g. mean length)