GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

COMMISSION GÉNÉRALE DES PÊCHES POUR LA MÉDITERRANÉE

GFCM Working Group on the Black Sea (WGBS)

Report of the meeting of the subregional group on stock assessment in the Black Sea (SGSABS)

Bucharest, Romania, 14-16 January 2014

EXECUTIVE SUMMARY

The Subregional Group on Stock Assessment in the Black Sea (SGSABS) met for the first time in Bucharest, Romania (14-16 January 2014) with the main objectives to: i) revise the status of the main fish stocks in the Black Sea, with focus on turbot and small pelagic stocks, and ii) review the existing data and stock assessment methods for main stocks in the area. SGSABS reviewed a total of eight Black Sea fish stocks/populations, providing conclusions and recommendations on stock identification/migration and on required data to improve stock advice, and providing advice on the status of stocks for those stocks for which a sound scientific assessment is available. SGSABS concluded that the population of turbot (*Psetta maxima*) is depleted at Black Sea scale, and subject to overfishing in Ukrainian waters, although local populations in that area do not yet show signs of depletion. Picked dogfish (*Squalus acanthia*) is also considered depleted at Black Sea scale, and a recovery plan is advised for both turbot and picked dogfish stocks. Stocks of sprat (*Sprattus sprattus*) and Azov Sea anchovy (*Engraulis encrasicolus maeticus*) are considered to be currently exploited at sustainable levels. For the stock of anchovy (*Engraulis encrasicolus ponticus*) in the Black Sea, the assessment was considered uncertain, although an exercise on precautionary biomass reference points performed during the meeting suggested that current fishing mortality could be higher than a precautionary fishing mortality for this population. The Group also discussed research priorities towards the improvement of current assessments and towards the improvement of stock identification and the knowledge on migration routes for a number of stocks of relevance for the area, and provided a series of recommendations on the issue. A list of existing surveys in GFCM riparian countries was collected. The Group also concluded that future meetings should be carried out yearly in order to provide advice on the status of Black Sea stocks for the attention of the GFCM Working Group on the Black Sea and the Subcommittee of Stock Assessment and the Scientific Advisory Committee and provided a suggestion for the Terms of Reference for the next meeting.

OPENING, ARRANGEMENT OF THE MEETING AND ADOPTION OF AGENDA

1. The meeting of the sub-regional group on stock assessment in the Black Sea (SGSABS) was held in Bucharest, Romania, from 14 to 16 January 2014. The meeting was attended by 15 experts from the Black Sea riparian countries of Bulgaria, Georgia, Romania, Turkey and Ukraine, as well as by representatives of the European Union (EU) and the GFCM Secretariat. The list of Participants is provided in Appendix B of this report.

2. Mr Violin Raykov, vice-coordinator of the Working Group on the Black Sea (WGBS) and chair of the meeting, expressed his greetings and outlined the background leading to the creation of the SGSABS.

3. The representative of the hosting country welcomed participants on behalf of Mr George Cristinel Gherghisan, President of the Romanian National Agency on Fisheries and Aquaculture (NAFA), wishing the meeting success and fruitful conclusions. Mr Simion Nicolaev, Coordinator of the WGBS, recalled the positive endeavors of the WGBS – of which the SGSABS was a main output – by referring to the Black Sea states participation and fruitful contributions to the workshop on IUU fishing in the Black Sea (Turkey, February 2013), the Workshop on Data Collection in the Black Sea (Bulgaria, April 2013), the First Regional Symposium on sustainable small-scale fisheries in the Mediterranean and the Black Sea (Malta, November 2013). He underlined the considerable opportunity provided by this group, where all Black Sea riparian countries have a common forum to collaborate and identify shared priorities; the success of the activities undertaken insofar was a token of the potential of such cooperation. He finally pointed to the several advantages of close collaboration with the Advisory Group on Fisheries (AG FOMLR) of the Black Sea Commission (BSC).

4. The EU representative echoed the words expressed and insisted on the importance of the continuity of this initiative, stating the future of the group would be particularly related to the quality of the deliverables.

5. Mr Miguel Bernal, GFCM Fishery Resources Officer, highlighted the importance of assessing the status of main commercial stocks in the Black Sea, and providing advice on the management of main fisheries in the area, and introduced the preliminary objectives of the meeting, as follows:

- Revise the status of the main fish stocks in the Black Sea, with focus on turbot and small pelagic stocks
- Review existing data and stock assessment methods for main stocks in the area
- Review existing information on stock identification
- Discuss protocols for data poor stocks
- Discuss proposals on the future of the sub-regional group: objectives and operational procedures, including i) sharing of stock assessment data and analysis within the group and ii) providing advice to GFCM and other relevant fora

OVERVIEW ON THE STATUS OF STOCKS AND PRIORITY ISSUES FOR STOCK ASSESSMENT IN THE BLACK SEA

6. The GFCM Secretariat presented GFCM activities in the Black Sea together with the main outcomes and recommendations emanating from the latest meeting of the WGBS concerning i) the status of Black Sea stocks and methodological issues encountered, ii) the endorsement of actions to strengthen data collection, fight Illegal, Unreported and Unregulated (IUU) fishing and support multiannual management plans and iii) research and analysis of Black Sea fisheries. The overview was completed with the conclusions of the EU Scientific, Technical and Economic Committee for Fisheries (STECF) related to the status of nine Black Sea stocks.

7. The WGBS Coordinator presented the ongoing activities and projects in the area, with particular focus to the priorities identified by the BSC AG FOMLR (http://www.blacksea-commission.org/_ag-tor-fomlr.asp) during its sixteenth meeting in November 2013. In this regard, the workplan for the implementation of the existing Memorandum of Understanding between the GFCM and the BSC was submitted to the consideration of the group.

8. The EU representative stressed the importance of correctly identifying stock boundaries and in particular to understand whether these were also dependent on data availability. He considered this matter to be directly related to the structure of surveys – which must be designed in a harmonized way and trying to look for synergies and optimization of the available resources.

9. In this regard, the GFCM Secretariat reminded that a workshop on surveys was already planned within the WGBS workplan and suggested that SGSABS discuss on the main requirements for survey based indexes to support stock assessment in the Black Sea.

ASSESSMENTS ON THE STATUS OF BLACK SEA STOCKS IN 2013

10. Information on stock assessment for eight Black Sea fish stocks/populations was reviewed by the group, including i) five stock assessment attempts: Turbot (*Psetta maxima*) at Black Sea scale and only within western Ukrainian waters, two stocks of two Anchovy subspecies (*Engraulis encrasicolus ponticus* – Black Sea anchovy, and *Engraulis encrasicolus maeoticus* – Azov Sea anchovy) and Sprat (*Sprattus sprattus*), as well as ii) information on catches of Spiked Dogfish (Squalus acantia), Bonito (*Sarda Sarda*) and Rapa Whelk fisheries (*Rapana venosa*). Abstracts of the presentations by experts are reproduced in Appendix H. Full Stock Assessment Forms for the stocks assessed in the group are available online on the GFCM website (www.gfcm.org).

11. As a complement of information on the assessments presented, Maia Chkhobadze (Georgia) informed that in the 2011-2012 period, landings of turbot in Georgia were small (around 500kg/year) and Murat Dagtekin (Turkey) also provided information on turbot landings in the Black Sea coast of Turkey (up to 3000 t in the 90's while only between 150-750 t since 2002). In addition, Mr. Dagtekin informed the group about a scientific work documenting cases of Viral Hemorrhagic Septicemia (VHS) affecting turbot individuals, and commented that the relation between mortality induced by this disease and reduction of catches observed in Turkey since 2002 should be further investigated.

12. Additionally, Maia Chkhobadze presented an overview of her country's functioning vis-à-vis the management and regulation of natural resources, introducing the national bodies responsible for monitoring fisheries activities in the Black Sea (namely the Ministry of Environment and Natural Resources Protection and its Black Sea Service) as well as other authorities of which the activities are connected to the fisheries sector (namely the Ministry of Agriculture, the Ministry of Economy and Sustainable Development, Maritime Transport Agency, etc. together with local stakeholders such as the municipalities).. She then introduced the established process of licensing and the ensuing obligations for license holders, in particular in terms of stock assessment, for the latter have to provide a scientific report on the status of the stocks – on the basis of which the competent services of the Ministry determine the amount of actual fishing per year (the main catch being of anchovy). The captures – mainly by trawlers and set nets – are partly exported and/or sold in the internal market and partly processed in the four operating plants of the country. As a conclusion, she highlighted the need to sustain the decision making process via sound coordinated assessment methodologies and institutional capacity building. She pointed to the need of exploring alternatives (in the sphere of aquaculture, for example) and especially that of working in partnership with the other Black Sea states.

13. In the ensuing discussions, the group discussed the contents of the presentations and of the information provided by experts and put forth comments on the assessments presented.

14. For the case of turbot, thoughtful discussions addressed the existence of two different assessments – one that covers the population at Black Sea scale (*Black Sea model*), and another that only covers the western waters off Ukraine (*Ukrainian model*) – as well as the different assumptions and outcomes of the two assessments. In addition to having a different coverage, the two assessments mainly differ in the assessment model used (state-space assessment model – SAM in the Black Sea model versus Length Cohort Analysis – LCA in the Ukrainian model) and in the estimation of total catches from the available landings. In both cases the incorporation of IUU catches into the estimation of total catches was considered necessary; however, the estimates of IUU catches differed between the two assessments. The rates of potential unreported catch during the period 2002-2010 in the Black Sea model were estimated as a proportion between Turkish catches in 1993-2001 and 2009-2010, which then was added to the officially reported catch. The IUU catches in 2012 were estimated as average from proportions in 2002-2009, while in the Ukrainian model IUU catches in the Western area were estimated to be a flat rate of 800 t, based on expert knowledge. The absolute difference of IUU catches estimates using both assumptions on the Western Ukrainian waters, as well as the effect of these differences in the assessment outputs, were investigated (see extended information on the *hands on data session* section of the report), and further analysis on the extent of IUU turbot catches in the different fleets of the Black Sea was recommended.

15. The group agreed that signals from both the Black Sea model and the Ukrainian model indicated that the current fishing mortality imposed on turbot populations was not sustainable and that the stock (both at Black Sea scale and in Western Ukrainian waters) was in overfishing, with fishing mortality being three times higher than the reference point for mortality in both models. However, the Ukrainian population biomass showed a different trend than the overall Black Sea biomass in the last 15 years. The Black Sea population showed a strong negative trend of biomass, and the group agreed that it should be described as depleted. However, the Ukrainian population showed a stable biomass with a slight negative trend in the same period, and therefore in relation to the reference point for Biomass used the stock was not considered to be overexploited. In addition to this, the Ukrainian expert pointed out that the stable trend in biomass was not fully in agreement with the estimated fishing mortality for this population and therefore expressed some doubts on the absolute value of fishing mortality for this population.

16. The group considered that fishing mortality has to be reduced at Black Sea scale to allow the biomass of turbot to recover, and proposed that a recovery plan ensuring close monitoring as well as specific actions for this objective to be achieved should be implemented. Mr Ali Cemal Gucu (Turkey) mentioned that national measures on the different riparian states, including Turkey, had been recently implemented for the turbot fishery, and recalled that the *Recommendation GFCM/37/2013/2 on the establishment of a set of minimum standards for bottom-set gillnet fisheries for turbot and conservation of cetaceans in the Black Sea* had recently been adopted to improve selectivity of the fishery and decrease fishing mortality in younger individuals. In this respect, he mentioned that it was still early to know if these measures may allow the population to start inverting the decreasing trend observed.

17. In addition to the advice provided, the group also pointed out some shortcomings of the assessments that should be further investigated/improved for the following years, and namely recommended to:

a) continue improving the definition of stock boundaries, and evaluate the possibility to use flexible models that accommodate spatial differences in population biology and in exploitation patterns;

b) improve the quality of the estimates of landings, including incorporating information from Russian Federation;

c) improve the quality of the total catch estimate, by improving the estimates of discards and IUU catches;

d) further investigate the contrasting signals between some of the surveys in the area, and evaluate the possibility to improve coordination/harmonization between surveys carried out by different riparian states. This should take into consideration both current characteristics of the different surveys, but also potential spatial differences in population.

18. For the case of anchovy, the assessments of two different subspecies were presented to the group: *Engraulis encrasicolus ponticus* – Black Sea anchovy, and *Engraulis encrasicolus maeoticus* – Azov Sea anchovy. Although the two subspecies showed a different distribution in spring/summer, both showed a wintering migration and concentration off the coast of Georgia in winter time, when the two subspecies are difficult to separate in the catches. For the Black Sea anchovy, main catches (up to 90% since 1997) were taken by Turkish fleet, while both Ukraine and Russia had significant catches of Azov Sea anchovy.

19. The Black Sea anchovy stock assessment was attempted using XSA and ASPIC assessment models, using CPUE for tuning. Both methods provided different results and also unsatisfactory model diagnosis. The group agreed that the assessments were not reliable, mainly due to the lack of time series of fishery independent biomass index, and for the case of XSA due to the concentration of the population in the first ages, with individual being mature at age 1 or even during the first year of life (age 0). A consolidation of a time series of fishery independent biomass estimates (e.g. from acoustic surveys) was therefore considered a priority to be able to assess the status of the stock, either by direct methods or using biomass models. Furthermore, the group agreed that pending the consolidation of this series, further options to provide precautionary advice on the status of the stock would be desirable (see for example the exercise carried out in the *hands on data session* section of the report).

20. Contrarily to the Black Sea anchovy, for the Azov Sea anchovy a time series of biomass estimates using lampara surveys (since 1998) is available. Previous acoustic biomass estimates were in accordance to the absolute biomass estimates obtained with the lampara survey, although unfortunately the acoustic time series was interrupted in 2003. For this stock, a direct assessment of the biomass was considered appropriate, and a number of empirical reference points were defined by Ukraine and Russian Federation agencies. The group agreed to consider the stock as sustainably exploited.

21. For the case of sprat, a stock assessment of the stock at Black Sea level, using catches from 1992, a CPUE index and the same assessment model as the previous year (Integrated Catch at Age - ICA) was attempted. Results of the assessment provided a coherent picture of biomass and fishing mortality trends compared to the assessment carried out the previous year, with large fluctuations in both biomass and fishing mortality. In addition to this, the Ukrainian expert informed that in an exercise on the population in Ukrainian waters they had obtained a picture coherent with that presented at Black Sea scale. The group agreed that the stock was exploited at sustainable levels, in agreement with the advice provided the previous year. Nevertheless, the group recommended that a larger number of reference points should be attempted and that environmental issues could be taken into account for the definition of those reference points.

22. For the case of picked dogfish, bonito and Rapa whelk, not enough information was available to perform a full stock assessment, but information on biology, distribution and catches was made at disposal of the group.

23. Only numerical information on catches of picked dogfish in Ukrainian fisheries was presented, underlining a very low presence in the catches – also confirmed at a qualitative scale by experts from the other riparian countries present in the meeting. The group agreed that the very low presence in catches pointed to a depletion of the stock in the Black Sea, in agreement with previous assessments.

24. Catches of bonito by Turkish purse seiners were also presented to the group; catches in the Black Sea included individuals of ages 0+, although the lack of evidence of spawning in the Black Sea indicated that at least an important part of these catches are migrants from Mediterranean Sea

spawning areas. Catches range from 2500 t to 63000 t, with large inter-annual fluctuations and no apparent cohort trends. The fast growth rates of the species in the area were mentioned and the important local economic impact of the resource on the fleet was highlighted – as it becomes, when present in the area, the preferred target of purse seiners. Experts confirmed that some catches of bonito were also done off the coast of Bulgaria, but rarely off the coast of Romania. The group agreed that no assessment could be produced for this species, and that further research on the links between Mediterranean and Black Sea populations, as well as potential links between abundance in the Black Sea and environmental reasons should be investigated.

25. Concerning the information on Rapa whelk catches and fisheries off the Turkish coast presented, the group recommended that updates of early assessment of Rapa whelk abundance and distribution in the Black Sea should be carried out, by means of direct surveys. The possibility to use sampling methods from animal ecology (e.g. point or line sampling methods – Borchers and Buckland 2002; Buckland et al. 2005) as a more efficient assessment alternative should be investigated. Also, the group put forth a number of issues that should be further investigated in order to manage this fishery, as follows:

a) the effect of Rapa whelk in the Black Sea ecosystem (e.g. directly as a predator of other benthic resources such as mussels, or indirectly as affecting ecosystem productivity);

b) the effect of Rapa whelk fisheries in the ecosystems, e.g. the by-catch of turbot juvenile individuals and the effect of bean trawling for Rapa whelk in the bottom ecosystems;

c) potential fishing regulations to minimize point b) above, such as fishing gear and spatiotemporal restrictions.

HANDS ON DATA SESSION ON THE ANALYSIS OF THE STATUS OF SELECTED STOCKS

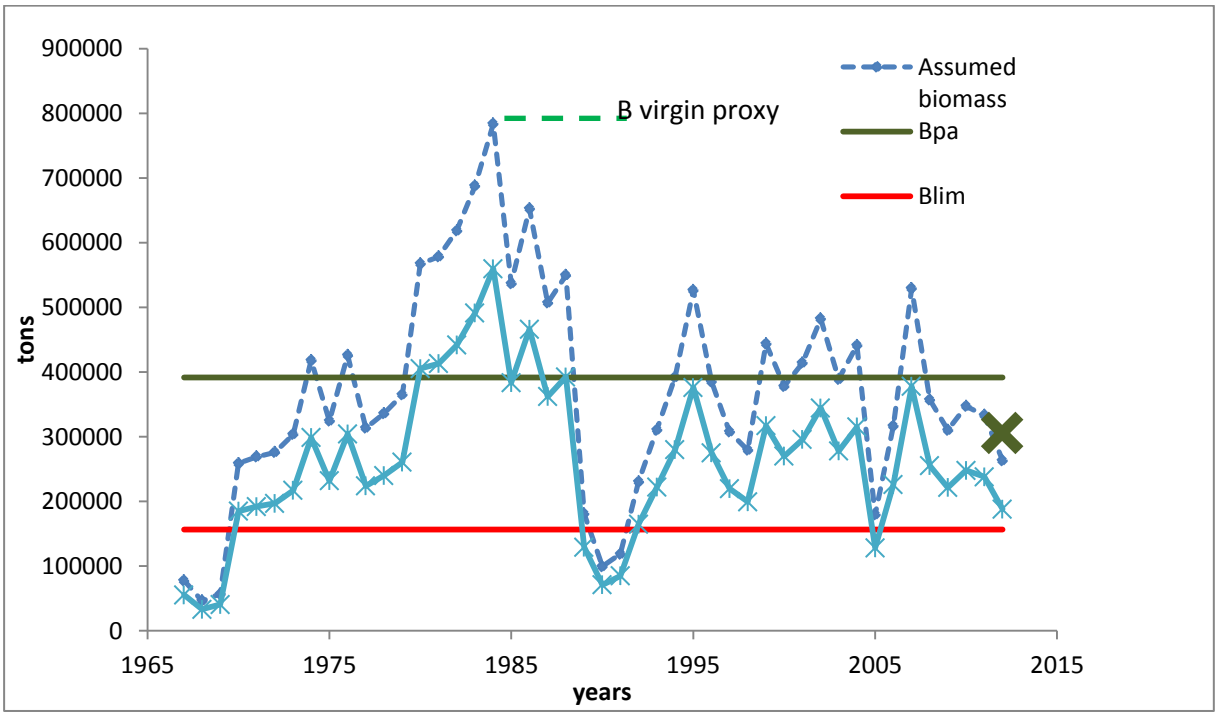
26. Based on the discussions on the status of Black Sea stocks, the group agreed to dedicate the programmed session on data analysis to work on a series of questions and issues as listed in Appendix D, namely i) the analysis of the influence of IUU estimates on the assessments of turbot, ii) an exercise to provide some preliminary advice on the status of the Black Sea anchovy, and iii) a collection of information on existing surveys that could be integrated, combined or harmonized in order to provide information on the status of Black Sea stocks, as well as identify gaps in survey needs.

27. In relation to turbot, the results of the analysis could be summarized as follows:

a) The two estimators of IUU provided very different estimates. IUU catches in Western Ukraine were estimated to be approximately 100 t using the estimation method for the Black Sea assessment, while they were assumed to be 800 t in the Ukrainian assessment. The group recommended that further investigation of potential IUU rates both at national and at Black Sea scale be performed.

b) Fishing mortalities obtained in the Ukraine assessment, using any of the two possible IUU estimates, were very different than the ones obtained in the Black Sea assessment. Although some changes in the exploitation in the Ukrainian waters in relation to the exploitation in other Black Sea areas exist, these may not be enough to justify such differences and further investigation of these differences should be carried out.

28. In relation to anchovy, a hypothetical biomass trend was reconstructed from total landings from the Black Sea assuming a constant harvest rate of 60% (Biomass / landings = 0.6). The maximum value of this series was used as an estimator of a potential maximum biomass (e.g. as an estimator of B_{virgin}); limit and precautionary biomass reference points were estimated following FAO (1995) and Serchuk et al. (1997): $B_{lim} = 0.2\ B_{virgin}$ and $B_{pa} = 0.5\ B_{virgin}$ (see figure below)



29. On the basis of the outcomes of this exercise, the existing acoustic based biomass estimate in 2012, close to the biomass proxy reconstructed, would be below the precautionary biomass reference point.

30. Participants agreed that the estimated reference points could only be considered as an exercise, considering the assumed constant harvest rate was not supported by previous studies. However, the estimated maximum biomass could be considered as a minimum indicator of the biomass existing in the middle 80's (as landings were not expected to be overestimated and a higher harvest rate is unlikely for anchovy stocks), and therefore B_{pa} could be considered as a minimum precautionary biomass. Under such scenario, the current anchovy stock biomass could be considered to be below precautionary threshold. Participants agreed that further information on potential harvest rates would be collected for the following meeting, where a precautionary advice should be sought as an alternative to more formal assessment based on validated numerical assessments, given existing uncertainties in previous analytical assessments for this stock.

31. In addition to the exercises on turbot and anchovy, participants from Romania, Bulgaria and Turkey collated a list of surveys related to stock assessment, specifying the coverage, objectives and survey method used. The complete list should form a basic document and be used as background information for the GFCM *Workshop on Black Sea scientific surveys at sea: harmonization of survey methodologies and analysis of data*, to be carried out in June 2014.

STOCK BOUNDARIES AND MIGRATION PATTERNS FOR MAIN BLACK SEA STOCKS

32. Following previous recommendations on the importance of enhanced stock identification and further understanding of population migration for main fish stocks in the Black Sea, a dedicated section on these issues was held during the SGSABS, including two different presentations and a follow up discussion.

33. Ms Petya Ivanova (Bulgaria) presented a comprehensive overview on recent and past genetic studies carried out for the populations of turbot, anchovy, horse mackerel, red mullet and Black Sea shads. In addition, Mr. Gucu presented results of ongoing projects to understand anchovy distribution and migration in the Black Sea, based on information from fisheries and dedicated surveys, but also on integrated ocean and biological models. The abstracts of both presentations are also included in Appendix H.

34. Main conclusions from the presentations and ensuing discussions are exhaustively reported in the *stock identification and migrations issues for Black Sea species* table in Appendix E.

ADVICE ON DATA LIMITED STOCKS

35. The group addressed a number of stocks which are relevant at Black Sea scale (in terms of catches, economic value or conservation issues) but for which existing information or methods used had impeded obtaining a reliable assessment. For these stocks, the group identified the main issues preventing an assessment of their status and proposed a series of recommendations to overcome these issues. The list of issues and recommendations is reproduced in Appendix F.

DISSEMINATION OF STOCK ASSESSMENT DATA AND ADVICE ON STOCK STATUS BETWEEN BLACK SEA RIPARIAN COUNTRIES

36. The GFCM secretariat presented the improvements to the Stock Assessment Form implemented for the WG, namely:

- A word document, with the detailed assessment and the main results;
- An excel file, including all the input data used for the assessment;
- An online library of metadata, available for each stock assessment form uploaded on the sharepoint website of the stock assessment working groups: whenever a file will be upload on the sharepoint, the user will be requested to provide the main information concerning the stock, such as the data available, some details on the assessments carried out and information on reference points and stock status.

37. The group agreed that information on stock assessment from all Black Sea stocks to be analyzed during the meeting should be collected by SAFs previous to the meeting, for the purpose of analysis and discussion during the meeting.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

38. On the basis of the discussions held and with the objective to foster sound work on stock assessment in the Black Sea, the SGSABS reached the following conclusions:

- The positive outcomes of the SGSABS were recognized and the group was regarded as an appropriate place for reviewing the status of stocks in the Black Sea, sharing and reviewing data for stock assessment and discuss priorities and gaps in terms of stock assessment needs. The importance of its continuity was stressed. The group should meet once a year in the period between October and December and submit its conclusions and workplan to the attention of the GFCM SAC subcommittees, the WGBS annual meeting and consequently the annual session of SAC;

- The terms of reference of the SGSABS, as discussed and agreed upon, are available under Appendix G of this report;

- The SGSABS agreed on sharing all required information to perform stock assessment for main stocks in the Black Sea prior to its meeting, and following the online procedures provided by the GFCM Secretariat (stock assessment forms, stock assessment metadata library and stock assessment input data template);

- Stock assessment and stock assessment advice was provided for five stocks in the Black Sea: Turbot, Sprat, Anchovy (*E. encrasicolus ponticus* and *E. encrasicolus maeoticus*) and Picked Dogfish. Information on stock status for two other stocks (Atlantic Bonito and Rapa whelk) was also analyzed but no stock status or advice was provided due to lack of sufficient information. The status of the stocks reviewed is available in Appendix C;

- The group recognized the importance to continue research on stock identification for a number of stocks in the Black Sea, and recommended to conduct a project on stock identification. Furthermore, the group provided a series of stock specific recommendations to improve the stock identification and the understanding of migration routes, which are reproduced in Appendix E;

- The comments of the group on data limited stocks are available in Appendix F;

- The relevance of establishing sound surveys was often recalled in order to support the assessments and related advice. SGSABS supported the organization of a *Workshop on Black Sea scientific surveys at sea: harmonization of survey methodologies and analysis of data* already programmed within the intersessional activities of the GFCM. As a preliminary step towards the identification of survey needs and priorities, a table containing information on all surveys by Bulgaria, Romania and Turkey was produced (Appendix I);

- The group also advised the preparation and holding of workshops on age reading for turbot, anchovy, red mullet, picked dogfish, horse mackerel and sprat. Prioritization of these activities for the 2014-2015 workplan could be done at the WGBS.

ANY OTHER MATTER

39. No other matters were raised.

DATE AND VENUE OF NEXT SESSION

40. The group strongly advised the holding of a second meeting of the SGSABS between October and December 2014. The exact dates and venue would be determined by the WGBS.

ADOPTION OF THE REPORT

41. The meeting formally adopted the conclusions, recommendations and appendices for the SGSABS on Thursday 16 January 2014. The full report was adopted by e-mail on 28 February 2014.

References

Borchers, David L., and Stephen T. Buckland. 2002. *Estimating Animal Abundance: Closed Populations*. Vol. 13. Springer.

Buckland, Stephen T., David R. Anderson, Kenneth P. Burnham, and Jeffrey L. Laake. 2005. *Distance Sampling*. Wiley Online Library.

Appendix A

Agenda

1. **Opening, arrangements of the meeting and adoption of the agenda**
2. **Overview on the status of stocks and priority issues for stock assessment in the Black Sea**
3. **Status of stocks and collaboration between GFCM and AGFOLMR (BSC)**
4. **Presentation and discussion of assessments on the status of stocks**
   - Stock assessment of Turbot in the Black Sea
   - Stock assessment of Turbot in the Ukrainian sector of the Black Sea
   - Information on turbot on the Turkish coast of the Black Sea
   - Stock assessment of Anchovy in the Sea of Azov and the Ukrainian sector of the Black Sea
   - Stock assessment of Anchovy
   - Stock assessment of Sprat
   - Information on stock assessment of Bonito
   - Assessment of the status of stock in Georgian waters
5. **Hands on data session on the analysis of the status of selected stocks:**
   - Discussion on priorities for data analysis
   - Data sharing
   - Stock Assessment forms
6. **Review of pending issues and existing information on stock boundaries and migration patterns for main Black Sea stocks**
   - Overview of issues on stock identification
   - Genetic identification of stocks; hybridization, migrations, species
   - Stock identification of Anchovy
7. **Presentation and discussion on advice on data limited stocks**
8. **Dissemination of stock assessment data and advice on stock status between Black Sea riparian countries**
9. **Formulation of conclusions, recommendations and management advice to be transmitted for the consideration by the SCSA, WGBS and SAC**
10. **Closing Session**

Appendix B

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Appendix C

Assessments for Black Sea species, with recommendations by the GFCM Sub-regional Group on the Black Sea

GSA	Species	Data type	Time series	Methodology used	Stock status	Fcurr/F lim	Advice	SGSABS Comments
29	**Turbot**	a) catch-at-age data age-classes 2 to 10+ b) Ukrainian catch-at-length	a) 1950-2012 b) 1997-2013	a) SAM b) LCA	<u>Black Sea stock:</u> Depleted and in overfishing <u>Northwest population</u> (Ukrainian waters): in overfishing, with a slight decreasing trend in SSB	a) 2.1 b) 3.8	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
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.
29	**Anchovy** ***(E. encrasicolus ponticus)***			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.

GSA	Species	Data type	Time series	Methodology used	Stock status	Fcurr/F lim	Advice	SGSABS Comments
29-30	**Anchovy** ***(E. encrasicolus maeoticus)***		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.
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
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
29	**Rapa whelk**	--	--	--	--	--	No advice	Abundance and distribution of Rapa whelk in the Black Sea is unknown. Surveys are required.

- 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)

Appendix D

Proposed exercise on stock assessment input data for Black Sea stocks

Stock	Question	Data required and proposed analysis
Turbot	Comparative extent of IUU fishing and discarding used in the SAM model and in the Ukrainian model	- Estimates of biomass from SAM model could be allocated to Western area (different approaches e.g. approximately using percentage of catches) then estimate IUU for the area using formula assumed - Compare total estimated catches (declared + IUU) in the W and total using both IUU estimates - List assumptions and results in the report
Turbot	Differences in SSB and Fishing mortality in SAM model and Ukrainian model	- Estimate the equivalent Fbar (SAM) obtained in the LCA (use similar lengths) and plot differences in F - Update SSB and F comparative plots for W stock (Ukrainian model) versus SAM total SSB estimates

Anchovy	Explore the possibility to estimate Blim and Bpa from analysis of the time series	- Blim can be estimated in different ways:
		- Trend in historical catches as a proxy for Bvirgin (some correction e.g. catch = 0.6 B) then:
		  - Blim = 0.2 * Bmax (survey index)
		  - Bpa = 0.5 * Bmax (survey index)
		- Plot the catch series and carry out the estimation exercise

All stocks	List available surveys with some details to evaluate potential uses and facilitate future harmonization	

Appendix E

Stock identification and migrations issues for Black Sea species, with recommendations by the GFCM Sub-regional Group on the Black Sea

Species	Comments on stock identification and migrations	SGSABS conclusions/recommendations in relation to stock identification/migrations
Sprat	Widespread in the black sea. Some differences in biological parameters (growth, morphometrics), however also differences in the fleet (e.g. minimum depths, gears). Key species for the ecosystem (forage fish in the diet of many top predators)	Inconclusive information on stock differentiation. Further information on biological parameters and environmental relationships from analysis of catches is desirable.
Turbot	Movement is assumed limited. There may be different populations with reduced migration flux among them. Information scarce and old. Status of the individual populations unclear. Genetics indications of some individuals of other species (possible *Scopthalmus rhombus*) in the catches. Homogenic genetic results in western samples, although some indicators of different populations along Bulgarian and Rumanian Black Sea coast. Turbot samples from the Black and Azov Seas area showed that they are different at population level.	Proposal for a Black Sea project on turbot population differentiation in the Black Sea, including separation between western and eastern areas and within western areas. Proposal should be further discussed at the WGBS and in collaboration with Black Sea Commission. Potential differences in exploitation patterns between different areas (specially west and east BS) and/or assessment model assumptions should be further evaluated
Anchovy	Different subspecies described in the Black Sea and Azov sea, however geographical overlapping. Migration of both species (wintering/spawning) Genetic evidence on two subspecies (Azov and Black Sea anchovies). New wintering migration road of Azov anchovy have been described and populations of both subspecies spatially overlap at wintering. Indications of hybridization and genetic differences shortening with time. Spawning of Azov anchovy in the western part of the Black Sea is assumed. Modeling exercise suggests some potential changes in migration routes (in agreement with genetics results) and also potential changes in the preferred spawning areas.	Investigation on environmental control on migration routes and spawning behaviour should be implemented. Variability in distribution and need for survey data for anchovy assessment calls for wide survey coverage.
Red mullet	Movement is assumed limited. There may be different populations with reduced migration flux among them. Information scarce, situation of the individual populations unclear. Genetic evidence on the presence of both *Mullus barbatus* and a hybrid species between *M. barbatus* and *M. surmulletus* (in some areas with high prevalence).	Further research on the presence of *M. surmulletus* and the distribution of both *M. surmulletus* and *M. barbatus*, as well as the hybrid species recently described should be performed.

Species	Comments on stock identification and migrations	SGSABS conclusions/recommendations in relation to stock identification/migrations
Horse mackerel	Widespread in the black sea, some information on migration routes available. Migration fluxes to and from Mediterranean sea is unknown in quantitative terms. Genetic evidence on the existence of a Black Sea subspecies (*Trachurus mediterraneus ponticus*). Also evidence for hybrid between *T mediterraneus* and *T. mediterraneus ponticus*, presenting large size. Some evidence on two subpopulations along Bulgarian coast, one of them wintering in the Black Sea and another one in the Marmara Sea.	Further research on migration routes and genetic differentiation on horse mackerel populations should be conducted. Acoustic surveys should be used to facilitate analysis of distribution and abundance.
Atlantic Bonito	No spawning activity of importance observed in the Black Sea. Hypothesis on a small resident population and a larger population that migrates from Mediterranean areas. Migration into the Black Sea happens at early age (0+), and abundance and mean length of individuals observed changes with time.	Review of information on spawning in the Mediterranean sea. Analysis of relation of catches with Mediterranean recruitment and environmental signals.
Rapa whelk	No information on stock distribution or identification provided at Black Sea level. Previous estimates of Rapa whelk in Romanian coast were of about 16000 tn (2008).	Review of the previous knowledge on Rapa whelk in the different BS countries, including socio - economic information. A specific survey on Rapa whelk distribution and abundance in the Black Sea desirable. Survey design should be thoughtfully investigated to maximize cost/efficiency. Also, further information on the impact of Rapa whelk fishing in the ecosystem (turbot and biocenosis) should be conducted.
Whiting	Widespread in the Black Sea.	No further information on stock identification presented to the group.
Piked dogfish	Movement assumed to be broad, however very limited information on migration patterns. Some information from tagging in former USSR indicates wider movement (information unpublished). Stock identification poor.	No further information on stock identification presented to the group.

Appendix F

Main issues identified for Black Sea data limited stocks, with recommendations by the GFCM Sub-regional Group on the Black Sea

Species	Main problems preventing assessment	SGSBSA conclusions and recommendations
Anchovy (BS anchovy, *Engraulis encrasicolus ponticus*)	Short lived (cohort analysis not viable) High discards Lack of survey time series Problems with survey coverage Problems of misidentification of subspecies (*E. encrasicolus ponticus*, *E. encrasicolus maeoticus*)	Research on methodology to separate sub species in the catches/surveys (morphological, easy genetic tracers, using results based on otholit morphometry – needed for ageing - etc.) Improve catch statistics in all BS riparian states. Separation of sub species should be done based on scientific research. Time series of surveys required. DEPM based biomass estimates for 2013 in the Turkish coast recommended. Coverage of full stock required, coordination/harmonization of surveys between BS countries desirable. Some calibration between acoustic/DEPM/lampara surveys desirable. Precautionary approach should be adopted while analytical assessment is not available. Precautionary reference points for biomass should be established to prevent effects on the fishery (both stock and socioeconomic depletion). An analysis of the time series of catches used as an exercise to evaluate potential biomass reference points suggest that a reduction of fishing pressure may be required.
Anchovy (Azov sea anchovy, *Engraulis encrasicolus maeoticus)*	Not reliable catch statistics Problems of misidentification of subspecies (*E. encrasicolus ponticus*, *E. encrasicolus maeoticus*) (differences are becoming more difficult)	Research on methodology to separate sub species in the catches/surveys (morphological, easy genetic tracers, using results based on otholit morphometry – needed for ageing - etc.) Improve catch statistics in all BS riparian states. Separation of sub species should be done based on scientific research.
Piked dogfish	Unknown discards and IUU catches Lack of biological information Uncertainty in age readings Lack of recent tuning data	Countries should report landings and discards of this species to the attention of this group. Main priority is to prepare a recovery plan

Species	Main problems preventing assessment	SGSBSA conclusions and recommendations
Whiting	Only targeted by the Turkish and Georgian trawlers (also allowed in Ukrainian). High discards, although estimates uncertain. Lack of direct surveys	Improve estimation of discards Attempt estimates of abundance of whiting in acoustic scientific surveys
Red mullet	Increasing interest in Bulgaria and Romania. Only age composition from Ukrainian Lack of definition of stock boundaries of different populations/species	Improvement of age readings and preparation of age-length keys in the different countries
Horse mackerel	Lack of reliable tuning data (main exploitation occurs in Turkish waters and there is no CPUE series in that area)	Attempt estimates of abundance of horse mackerel in acoustic scientific surveys
Atlantic Bonito	Migratory species (not fully on the BS) Lack of data	Attempt an index of abundance of bonito in the Black Sea in relation to environmental conditions and reproductive strength in the Mediterranean
Rapa whelk	Age reading problems Lack of biological data (growth) Lack of recent surveys and surveys covering all Black Sea. Lack of tested assessment model	A specific survey on Rapa whelk distribution and abundance in the Black Sea desirable. Survey design should be thoughtfully investigated to maximize cost/efficiency. Assessment models adequate for the species/ecosystem should be investigated (e.g. presence absence, line surveys, area swept, etc.)

Appendix G

Proposed Terms of Reference for the SGSABS

- Revise the status of the main commercial stocks in the Black Sea, with focus on turbot and small pelagic stocks
- Review existing data and stock assessment methods for main stocks in the area, with a special focus on the estimation of IUU and discards required to perform stock assessment
- Review updated information on stock identification
- Provide advice to GFCM and other relevant organizations on stock status and research priorities to improve the knowledge on status of stocks.

Appendix H

List of Abstracts

Stock assessment of Turbot (*Psetta maxima/Scophthalmus maximus*) in the Black Sea, 1950 – 2012 *(M. Panayotova)*

Turbot is a demersal species and occurs in local shoals all over the shelf area of all Black Sea countries at depths up to 100m -140m.

The species is represented by several local populations, which migrate and mix in the adjacent zones. They are independent units of the stock, and have to be covered in order to ensure an accurate assessment of the stock at regional level. The present assessment was done by STECF EWG 13-12 Black Sea Stock Assessment group and is based on the analysis of the best available information, obtained from combined data of all Black Sea countries and assuming the stock as representing a single unit in the entire Black Sea.

The Black Sea turbot historically has been fished by all coastal states, using both stationary and mobile fishing gears (gillnets and bottom trawls). The species is often caught as a by-catch of otter trawls, long lines and purse seiners' fishery. Total annual landings in the Black Sea present a decreasing trend since 2006 and are believed to be underestimates due to the occurrence of illegal, unregulated and unreported (IUU) catches. However, discards are considered to be negligible.

The data set for the period 1950-2012 was compiled using the historical data sources and new data for 2012. Available data of total landings, catch at ages, weights and maturity at age are considered appropriate for assessing the stock using the state-space assessment model (SAM) in FLR environment. Five tuning series - 4 surveys and 1 commercial CPUE series were compiled and used in the assessment. The model was applied to catch-at-age data for age-classes 2 to 10+ from the period 1950 to 2012. During this period annual catches of turbot have dropped from an average of about 4000 t during the 1950s and 1960s to an average of about 2000 t during the 1990s and 2000s. Except for a slight increase in catch in 2012, the annual catches have declined steadily since 2006. Survey indices and the SAM analyses indicate that the stock size is currently at a historic low (around 1100 t) and it is around one third of the estimated B_{lim} (2914 t). The F value estimated for 2012 (0.85) is more than three times higher than F_{MSY} (0.26). Recruitment has decreased since 2003 and the recruitment values estimated for the most recent set of cohorts are among the lowest observed in the time series.

The STECF EWG 13-12 proposes that Fmsy for this stock is 0.26 per year and should be set as a limit reference point consistent with achieving high long term yields. The EWG 13-12 classifies the stock of turbot in the Black Sea as being exploited unsustainably and at risk of collapse and on precautionary grounds there should be no directed fishing for Black Sea turbot and that by-catch should be minimized.

The main gaps in the fishery dependent data sets are related to the quality of the official landings and effort data, the unknown rates of discards and IUU catch. Lack of annual research surveys at sea, covering the whole distribution area of the turbot population in the Black Sea, greatly limits the input of fishery independent data. Results from genetic studies, historical information on stock spatial distribution, tagging, behavioral ecology, spatial distribution of the catches, etc. would be necessary to define the population structure of the turbot stock in the Black Sea.

Stock assessment of Turbot in the Ukrainian sector of the Black Sea *(V. Shlyakhov)*
Abstract missing

Stock assessment of Anchovy (*Engraulis encrasicolus, Engraulis encrasicolus ponticus)* in the Sea of Azov and the Ukrainian sector of the Black Sea *(V. Shlyakhov)*
Abstract missing

Stock assessment of Black Sea Anchovy (*Engraulis encrasicolus*) *(A. Gucu)*

Assuming that anchovy is represented by two different stocks in the Black Sea, the western stock (Black Sea anchovy) was assessed. The national Black Sea anchovy landings of the Black Sea countries except Russian Federation (fishing only Azov anchovy) partitioned into ages using age length keys and length-frequency data provided by the countries. Assessments are very sensitive to ALKs used to estimate Catch at age data and there are noticeable differences in the ALKs used by the countries. Whether or not these differences are linked to the biology of the fish needs to be justified in the future. As the surveillance and control on the landing ports has improved (particularly in Turkey), the undersized fish unintentionally caught during the purse seining operations were discarded at sea before returning to the port and so that percentage of fish (mainly recruits) discarded at sea has been increased significantly. Although there are some attempts to approximate the level of discard and incorporate the discarded fish in the assessment (mainly in Romania and Turkey) the actual discard rate should be estimated and elaborated in a more implicit manner in the future assessments.

Currently number of acoustic survey data is limited to past two years and their results could not be used in the assessments. Such data seems crucially important for the reliability of the assessment. XSA was therefore tuned by a single commercial CPUE of the major Turkish purse seiner. SVPA and ASPIC were also tested however as very high residual and poor retrospective analysis indicated none of the assessments were able to produced results with appreciable certainty, therefore assessment was not accepted. XSA and SVPA did not work with the anchovy data set available; ASPIC results were in conflict with age structured models. It is possible that XSA and SVPA do not perform well with such a short living species - number of limited year classes cannot resolve exploitation pattern (selectivity at age, partial recruitment). However it is clear from the data that the spawning stock biomass, which dropped significantly in 2005 seems to be still low and due to uncertainties in the assessment (XSA and SVPA) it is not clear if the situation is getting any better. Despite the assessment uncertainties, a noticeable increase in the recruitment is evident in the last years. The increase is particularly striking in the 2012-13 anchovy fishing season. Drop in the SSB and particularly at the oldest age class as oppose to increase in recruitment may point out an external factor influencing the stock. The assessment results for short and medium term scenarios were not sufficient to produce catch projections, however the upward trend in the exploitation level seems to be stopped in 2004. The optimistic estimates (XSA with high shrinkage, SVPA and ASPIC) indicated a slight decrease in the fisheries mortality, particularly in the last two years. This is the consequence of the effort regulation measures recently enforced by Turkey, namely i) restriction the anchovy fishery to night hours only (16:00 to 08:00) since 2007; ii) setting a depth limit (0-24m) for purse seining; and iii) by the buy-back program launched in 2012.

The historical effort data is an important gap. Rescuing and harmonization of such data would be very helpful to improve the assessment quality in the future.

Stock assessment of Sprat *(V. Raykov)*

Sprat is a key species for the Black Sea ecosystem. Its key role is determined by the importance from both commercial and ecological point of view. The sprat fishery takes place in the Black Sea (GFCM Fishing Sub-area 37.4 (Division 37.4.2) and Geographical Sub-area (GSA) 29). The sprat landings highly varied as for 2000-2012 the average catch accounted to 63827.62 tons. In 2012 the catch dropped significantly from 120708 t to 35025 t. In the recent years the SSB ranges at medium to high levels (between 200 000 and 500 000 t). In 2012, SSB has dropped to 228 000 t. Under a constant recruitment scenario and status quo F = 0.404, in 2013 SSB is expected to increase to 268 750 and after to slightly increase up to 289 667 t by 2015. Recruitment has increased up to 2008 and since then started a decreasing trend. Over the last few years the fishing mortality has peaked in 2010-2011 at a level of 0.7 - 1.12. In 2012 the fishing mortality decreased at F=0.404 .Status quo fishing implies catches in the range of 39 907- 45 504 t over 2013 - 2015 which are below the recommended catch of 64 544 t, at Fmsy.

Information on stock assessment of Bonito *(Sarda Sarda)* *(O. Ak)*

Bonito plays a major role as top predator in the Black Sea ecosystem and has high commercial importance, especially for the Turkish fishery. Fishing activity for bonito takes place in the Black Sea generally between August and February, and landings reach their highest levels during September and October. The vast majority of the bonito catches (85%) are caught by Turkish purse seine vessels. Bonito are also caught to a lesser extent (15%) by smaller Turkish vessels fishing with surface gill nets.

Data on landings of Atlantic bonito in the Black Sea are available only for Turkey. The other Black Sea nations have no reported landings of this species. During 1982 to 2012 the average report landing of bonito were large, 12322 ton and quite variable, ranging from 2603 t in 1984 to 63952 ton in 2005, Turkey. Samples of bonito were collected from the Eastern Black Sea (Samsun- Hopa). Length and weight data for bonito landed in Turkey were collected during the period 2000-2012, except for the years 2002-2004. In the available length frequency data almost all the fish were relatively small (< 50 cm) and there were very few large mature individuals, which suggests that the adult portion of this population may not reside in the Black Sea or is unavailable to fishing operations in the Black Sea.

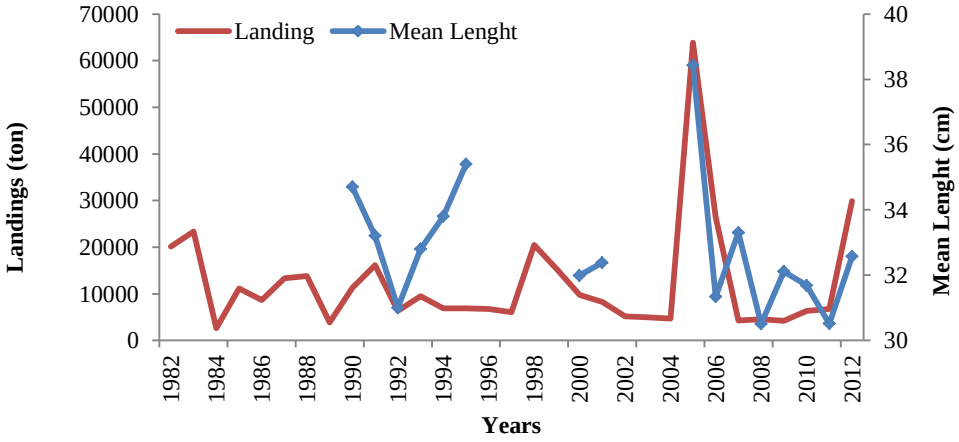

Figure 1. Distribution of landing and average length of Atlantic bonito by years, in the South Black Sea.

No discard data for bonito are available. The number of purse seine has varied annually in Turkey since 1998. There are no estimates of fishing effort for bonito except 2012. There are no scientific survey and ichyhyoplankton survey in Black Sea.

A total of 6433 individuals were collected between 2000 and October 2012 using market, purse seine and gill nets off the Turkey coast of Black Sea. The species is fast growing; age comprises 0-3 age groups. Minimum and maximum of the von Bertalanffy growth parameters were computed as $L\infty$ = 65.90 and 99.70 cm, k = 0.34 and 1.19 year^{-1}, $t0$ = –0.17- -0.38 years for all fish between 2000 and 2012 fisheries season. The von Bertlanffy Growth Parameters VBGF by Turkey is given in Table 1. The length–weight relationship was estimated for all years (Table 1). While the *b*-values and t-test results indicated positive allometric growth for all samples, the *b*-values showed no significant difference for years (P > 0.05).

Age	2000	2001	2005	2006	2007	2008	2009	2010	2011	2012
k	0.76	0.39	0.57	0.71	0.68	0.70	0.34	0.72	1.19	0.92
Loo	72.89	95.26	77.00	73.64	82.55	73.87	99.70	73.62	65.90	72.60
to	-0.23	-0.34	-0.29	-0.25	-0.23	-0.25	-0.38	-0.25	-0.17	-0.20
a	0.0044	0.0034	0.0027	0.0034	0.0037	0.0063	0.0021	0.0038	0.0038	0.0037
b	3.3282	3.3607	3.3871	3.3109	3.2831	3.2040	3.4464	3.2705	3.2873	3.2806
M	0.718	0.43	0.586	0.685	0.645	0.678	0.388	0.691	0.99	0.814

Table 1. VBGF parameters calculated in the Turkey coast of Black Sea

Atlantic Bonito has lengths comprised between 13 and 72cm. The highest frequency pertaining to the individuals of 30-40cm lengths (Figure 2). It has weights comprised between 15.8 and 5800g. The most of population has formed 0^{+} age groups. Rate of 1-3 age groups is decreased according to 0+ ages.

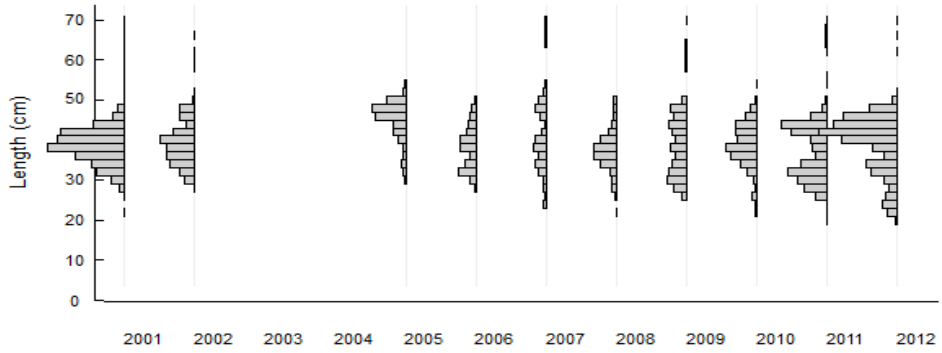

Figure 2. Growth curve of Atlantic bonito from Turkey Black Sea waters between 2001-2012 years

Sarda sarda fisheries in Turkey is regulationed by the Commercial Fishery Advice of General Directorate of Fishery:

(1) Regulations about Fishing area: For purse seines, it is not allowed in the waters shallower under the 24 m (from the coastal).

(2) Regulations about fishing gear: The depth of purse seine net can not be more than 164 m.

(3) Regulations about time periods: Fishing period of purse seine is between 1 September and 15 April.

Information on Rapa Whelk fisheries *(Rapana venosa)* in the Black Sea *(M. Dagtekin)*

Rapana venosa are large predatory marine gastropods that, to date, are the progenitors of known successful invasions into estuarine habitats around the world. Although native to Asian waters around Japan and Korea, Rapa whelks were discovered in Novorosisk Bay in the Black Sea in the mid-1940s and have spread throughout the Aegean, Adriatic and Mediterranean Seas and entered the Chesapeake Bay, Virginia, and Uruguay and Argentina (Zolotarev, 1996; Mann et. al., 2004).

Rapana venosa is well established in the benthic ecosystem of all Black Sea coastal states and has exerted significant predatory pressure on the indigenous malacofauna (Black Sea TDA, 2008; Sampson et. al., 2013).

In Turkey, the Ministry of Food, Agriculture and Livestock implemented three forms of limitation to the fishery for rapa whelk: i) the first type of regulation restricts the fishing method to scuba diving in the western part of Turkish waters and to dredging (with minimum mesh size of 40 mm) in the eastern part; ii)the second form of regulation is a fishing season, with scuba diving allowed throughout the year but dredges banned between 1 May and 30 August; and iii) fishing at night is also banned.

Whelk fisheries are carried out in the region Trabzon between İgneada. Fisheries much more Samsun shelf area . Rapa whelk is decrease length distribution via in the Eastern Black Sea (Figure 1).

Figure 1. Whelk fisheries area in the Black Sea Coasts (in Turkey).

Rapana venosa is one of the data poor species in the Black Sea. Three countries (Bulgaria, Turkey, and Ukraine) provided landings data for 2012 (Figure 2), but most other standard types of data were not available (Sampson et. all., 2013).

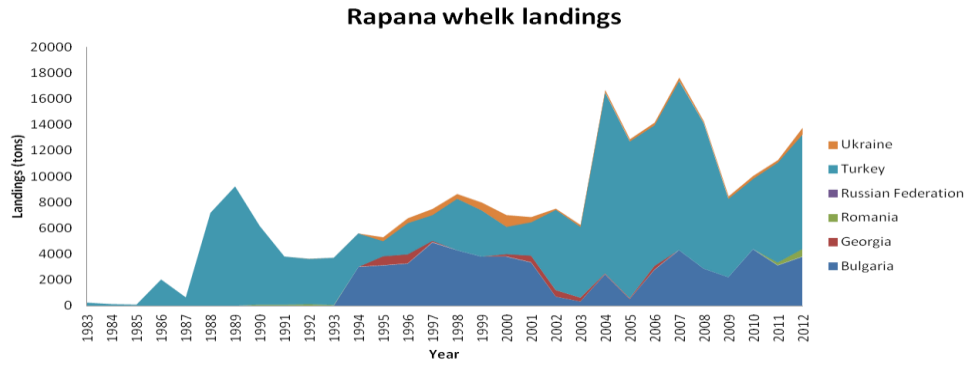

Figure 1. Rapa whelk landings in all Black Sea Countries.

Harvesting whelks using pots is applied commonly Canada, Northern Europe and Japan. Pots are often considered a more beneficial type than dredges because there is less impact on the bottom habitat and by-catch can be minimal, depending on the design of the pot. But, fishermen don't prefer tools (Sağlam et. al, 2007).

Growth Parameter K=0.3015 t0=-2,6798; L∞= 131,3 mm; Mt: M2= 0.12. M3= 0.54; M4= 1.28. M5= 1.40 (from 2010 EWG report). Length frequencies of Rapa whelk are also given in M in Turkey reported as 0.57 (Sağlam et. al. 2007)

To reduce the damage on ecosystems caused by by-catch, the pot fishery for Rapa whelk is considered as an alternative gear for dredging in the south eastern Black Sea. The objective of some researchers was to determine whether fishing for whelks using pots is an effective method to catch them, and whether this pot type would capture enough whelks to support fishery (Sağlam et al., 2007).

Due to lack of qualitative and quantitative long term data both from national and other countries' territorial waters, had limited serious efforts towards the estimation stock provide any short or medium term projections for size or catch of Rapa whelk.

Because of its high importance as a predator on benthic fauna, monitoring of the Rapa whelk stock(s) is very important. Also, implementation of management measures for the Rapa whelk population needs to be coordinated on a regional basis (Sampson et. al. 2013).

Application of genetical markers for evaluation and monitoring of the Black Sea fishes diversity *(P. Ivanova)*

The molecular markers are important tools for solving certain fishery problems such as accurate determination of fish stocks, its sustainable exploitation, protection of the biodiversity, fish distribution and migrations. Accurate determination of fish population structure based on application of molecular markers can be employed for fisheries management and conservation schemes and to maintain or improve marine resources and their utilization. Stock management and conservation programs can be effective if based on genetically differentiated stocks.

The most valuable fish species for the Black Sea is turbot - molecular data (mtDNA and allozymes) were used to specify turbot species and populations along the western Black Sea coast. One population from Romania coast and two from the Bulgarian coast (northern and eastern) were proved. On the basis of isoelectric focusing of hemoglobin two different species-specific spectra of the turbot along Bulgarian Black Sea coast were found. Haemoglobin spectra, typical for two turbot species correspond with their morphological differences. The data obtained could be used for species identification of the turbot in the Black Sea.

Anchovy - On the base of long term monitoring of allelic frequencies of the polymorphic esterase loci (*EST-1** and *EST-2**), wintering migration of Azov anchovy along the western Black Sea coasts was proved. Typical Azov anchovy winter together with the Black Sea anchovy and form mixed populations along the Ukrainian, Georgian, and Turkish Black Sea coasts. Azov anchovy was also registered along Bulgarian coast during the second part of May and July. The results allow supposing the north-western Black Sea as complementary spawning areas of Azov anchovy. Though introgressive hybridization between Azov and Black Sea anchovy is generally accepted, they could still consider as two different subspecies.

Horse mackerel - Genetic divergence between two horse mackerel subspecies (*Trachurus mediterraneus mediterraneus* and *Trachurus mediterraneus ponticus*) analysing 32 allozyme loci was proved. The genes flow from the Mediterranean horse mackerel to the Black Sea once can be proved by the existence of the large form of horse mackerel. Two main sub-populations ("Black Sea" - wintering in this sea only and "Sea of Marmara"- wintering in that sea and regions around the Bosporus) along Bulgarian Black Sea coast were ascertained. The last subpopulation migrated first along our coast.

Red mullus - Diagnostic loci between *M. barbatus* from Bulgarian Black Sea coast and *M. surmuletus* (Thessaloniki, Mediterranean) were found. The genetic distance calculated between *M. barbatus* and *M. surmuletus* (D=0.526) and time of divergence (t_{Nei} = 3 215 000 years) give an evidence for existence of these two well divergated species in one Genus. Existence of hybrids between *M. barbatus* and *M. surmuletus* in Bolshoj Utrish prove the existence of the *M. surmuletus* along the Russian coast.

Black Sea shads (*Alosa immaculata* and *A. caspia*) - All Black Sea shads were marked in the IUCN as vulnerable species. The absence of correspondence between morphological and genetical features showed complexity in genus *Alosa* taxonomy in the Black Sea. Genetical markers were applied for species identification of Genus Alosa as well as to clarify population-genetical structure of *A. immaculata* along Bulgarian Black Sea coast.

Genetic identification of sturgeon species and their hybrids, as well as populations, cavier and fillet were presented. The genetic markers established could be used for fast and precise species

identification. The existence of natural sturgeons' hybrids along Bulgarian Black Sea and Danube River was ascertained. The increasing presence of natural hybrids is another evidence for decreasing sturgeon stocks. Not only their reproduction is endangered, but also the genotypes of sturgeon are changed.

Stock identification of Anchovy *(A. Gucu)*

In 2011 Turkey launched a new anchovy monitoring program having two main targets. The first is to monitor the anchovy within the Turkish EEZ by acoustic and ichthyoplankton surveys. The second target is to closely monitor the fleet operations and landings. Until now, various cruises and landing site surveys have been carried out. The results indicate that the anchovy stocks in the Black Sea, *Engraulis encrasicolus ponticus* in particular has undergone remarkable changes in the last decades. An unusual distribution of 0 year class anchovies on the southern half of the Black Sea just before the onset of overwintering migration was found during the acoustical surveys. As was observed in the ichthyoplankton surveys, the number of anchovy aggregated and spawned in the southern part of the Black Sea seems to increase significantly in the last decades. These findings, along with the sharp decline in the anchovy landings of the countries located on the migration route of the species, point to a possible change in the migration pattern of anchovy. Moreover, abnormal distribution during spawning and before the overwintering migration may recall stock collapses associated with disruption of the biological mechanisms that sustain life-cycle closure of intrapopulation contingents experienced elsewhere (Petitgas, et al., 2010*).

Appendix I

Ongoing or recent surveys related to fisheries assessment for Black Sea stocks

Country	Species	Dates	Region covered	Main sampler	Alternative sampler	Objectives	Time series	Type of data available
Bulgaria	Sprat	May -June	Bulgarian marine area up to 100m isobath	PTS[1], R/v"Prof. Valkanov and F/V RK3	-	Biomass	2007-2009	CPUE,CPUA,biological data/age/length/sex ratio/weight/,SST, zooplankton
Bulgaria	Sprat	June	Bulgarian marine area up to 100m isobath	PTS, R/V Steaua de Marel, NIMRD	-	Biomass	2010	CPUE,CPUA,biological data/age/length/sex ratio/weight/,SST,zooplankton
Bulgaria	Sprat	November - December	Part of Bulgarian EEZ (2010); Bulgarian EEZ (2011)	EK60, OTM	-	Abundance and biomass indices	2010 - 2011	NASC m2.nm-2, biomass, biological data,hydrochemical parameters
Bulgaria	Turbot *Psetta maxima*	April-May October-November	Bulgarian marine area up to 100m isobaths	Demersal trawl	-	Abundance and biomass indices	2006-2009	CPUE,CPUA,biological data/age/length/sex ratio/weight/
Bulgaria	Turbot *Psetta maxima*	April-May October-November	Bulgarian marine area up to 100m isobath	Demersal trawl (22/27 - 34) (R/V"Steaua de Mare I",NIMRD) (2010-2012)	-	Abundance and biomass indices	2010-2012	CPUE,CPUA,biological data/age/length/sex ratio/weight/

[1] **(PTS = pelagic trawl survey)**

Country	Species	Dates	Region covered	Main sampler	Alternative sampler	Objectives	Time series	Type of data available
Romania	Turbot *Psetta maxima*	Spring (May-June)	Romanian marine area up to the 75 m isobath	Demersal trawl (57/63-62) R/V Steaua de Mare	-	Stock assessment	2003-2009 annually	C.P.U.E. Biomass Biological data Growth and length-weight parameters Maturity, Sex ratio
Romania	Turbot *Psetta maxima*	Autumn (October-November)	Romanian marine area up to the 75 m isobath	Demersal trawl (57/63-62) R/V Steaua de Mare	-	Stock assessment	2003-2009 annually	C.P.U.E. Biomass Biological data Growth and length-weight parameters Maturity, Sex ratio
Romania	Sprat *Sprattus sprattus*	Spring (June-July)	Romanian marine area up to the 60 m isobath	Pelagic trawl (50/35-74) R/V Steaua de Mare	-	Stock assessment	2000-2009	C.P.U.E. Biomass Biological data Growth and length-weight parameters Maturity, Sex ratio
Romania	Sprat *Sprattus sprattus*	Autumn (October-November)	Romanian marine area up to the 60 m isobath	Pelagic trawl (50/35-74) R/V Steaua de Mare	-	Stock assessment	2000-2009	C.P.U.E. Biomass Biological data Growth and length-weight parameters Maturity, Sex ratio
Romania & Bulgaria	Turbot *Psetta maxima*	Spring (May-June)	Romanian marine area up to the 75 m isobath	Demersal trawl (22/27-34) R/V Steaua de Mare	-	Stock assessment	2010-2012 annually	C.P.U.E. Biomass Biological data Growth and length-weight parameters Maturity, Sex ratio

Country	Species	Dates	Region covered	Main sampler	Alternative sampler	Objectives	Time series	Type of data available
Romania & Bulgaria	Turbot *Psetta maxima*	Autumn (October-November)	Romanian marine area up to the 75 m isobath	Demersal trawl (22/27-34) R/V Steaua de Mare	-	Stock assessment	2010-2012 annually	C.P.U.E. Biomass Biological data Growth and length-weight parameters Maturity, Sex ratio
Romania & Bulgaria	Sprat *Sprattus sprattus*	Spring (June-July)	Romanian marine area up to the 60 m isobath	Pelagic trawl (36/26-59) R/V Steaua de Mare	-	Stock assessment	2010	C.P.U.E. Biomass Biological data Growth and length-weight parameters Maturity, Sex ratio
Romania & Bulgaria	Sprat *Sprattus sprattus*	Autumn (December)	Romanian marine area up to the 100 m isobath	EK60 hydro acoustic R/V Akademic	-	Hydroacoustic survey Stock assessment	2010	C.P.U.E. Biomass Biological data Growth and length-weight parameters Maturity, Sex ratio
Romania & Bulgaria	Sprat *Sprattus sprattus*	Autumn (November-December)	Romanian marine area up to the 100 m isobath	EK60 hydro acoustic R/V Akademic	-	Hydroacoustic survey Stock assessment	2011	C.P.U.E. Biomass Biological data Growth and length-weight parameters Maturity, Sex ratio
Romania	Sprat *Sprattus sprattus*	Autumn (December)	Romanian marine area up to the 60 m isobath	Pelagic trawl (36/26-59) R/V Steaua de Mare	-	Stock assessment	2012	C.P.U.E. Biomass Biological data Growth and length-weight parameters

Country	Species	Dates	Region covered	Main sampler	Alternative sampler	Objectives	Time series	Type of data available
Romania	Whiting *Merlangius merlangus*	Spring (May-June)	Romanian marine area up to the 75 m isobath	Demersal trawl (22/27-34) R/V Steaua de Mare	-	Stock assessment	2007-2012 annually	C.P.U.E. Biomass Biological data Growth and length-weight parameters Maturity Sex ratio
Romania	Whiting *Merlangius merlangus*	Autumn (October-November)	Romanian marine area up to the 75 m isobath	Demersal trawl (22/27-34) R/V Steaua de Mare	-	Stock assessment	2007-2012 annually	C.P.U.E. Biomass Biological data Growth and length-weight parameters Maturity, Sex ratio
Romania	Dogfish *Squalus acanthias*	Spring (May-June)	Romanian marine area up to the 75 m isobath	Demersal trawl (22/27-34) R/V Steaua de Mare	-	Stock assessment	2010-2012 annually	C.P.U.E. Biomass Biological data Growth and length-weight parameters Maturity, Sex ratio
Romania	Dogfish *Squalus acanthias*	Autumn (October-November)	Romanian marine area up to the 75 m isobath	Demersal trawl (22/27-34) R/V Steaua de Mare	-	Stock assessment	2010-2012 annually	C.P.U.E. Biomass Biological data Growth and length-weight parameters Maturity, Sex ratio

Country	Species	Dates	Region covered	Main sampler	Alternative sampler	Objectives	Time series	Type of data available
Turkey	Anchovy	Nov 2011- Nov 2013	All All All All Eastern Eastern All East	Hydro Acoustic	Pelagic trawl	Over wintering ground determination	Nov-Dec 2011 Jan-Feb 2012 Nov 2012 Dec 2012 Jan 2013 Feb 2013 July 2013 Nov-Dec 2013	Bio mass Length -frequency Age distribution Sex ratio
Turkey	Anchovy	June 1992- July 2013	All All All All All East East	Hensen egg net	Hydro acoustic Pelagic trawl	Spawning area	June 1991 July 1992 August 1993 June-July-1996 July 2013 Jan-Dec 2011 Jan-Dec 2013	Abundance and distributions
Turkey	Demersal comercial species	1991-1996	Eastern Eastern Eastern Eastern Eastern	Bottom trawl	Bottom trawl		1991-1992 1992-1993 1993-	Bio mass Length -frequency Age distribution Sex ratio

Country	Species	Dates	Region covered	Main sampler	Alternative sampler	Objectives	Time series	Type of data available
							1994 1994-1995 1995-1996	
Turkey	Demersal comercial species	2009-2012	Middle Middle Middle	Bottom trawl	-	CPUE	2009-2010 2010-2011 2011-2012	Bio mass Length -frequency Age distribution Sex ratio
Turkey	Demersal comercial species	2009-2013	Western Western Western	Commercial trawl	-	CPUE Discard	2009-2010 2010-2011 2011-2012	Bio mass Length -frequency Age distribution Sex ratio
Turkey	Demersal comercial species	2010-2013	Western Western Western	Demersal	Bottom trawl	CPUA	2009-2010 2010-2011 2011-2012	Bio mass Length -frequency Age distribution Sex ratio