



**GENERAL FISHERIES COMMISSION FOR
THE MEDITERRANEAN**

**COMMISSION GÉNÉRALE DES PÊCHES
POUR LA MÉDITERRANÉE**



GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

SCIENTIFIC ADVISORY COMMITTEE (SAC)

**Fourteenth Session
Sophia, Bulgaria 20-24 February 2012**

**REPORT OF THE 2nd TRANSVERSAL WORKING GROUP ON BY-CATCH
7-9 December 2011, Antalya (Turkey)**

OPENING AND ADOPTION OF THE AGENDA

1. The meeting of the 2nd Transversal Working Group on By-catch was held in Antalya (Turkey), from 7 to 9 December 2011 at the Ramada Hotel conference room. It was attended by 29 participants from 9 countries as well as representatives of the GFCM and ACCOBAMS Secretariats (see List of participants in Appendix A).
2. Ms Pilar Hernández on behalf of GFCM Secretariat welcomed the participants and thanked the Turkish Authorities for their kindness in hosting and arranging the meeting, she recalled the framework whereby the workshop is being carried out, the Terms of References as approved by the SAC and highlighted the two aspects to deal with during the meeting: on the one hand the monitoring (current schemes in force, availability and quality of data, geographical coverage, the need of indicators) and on the other hand the possible measures to mitigate the interactions with species of conservation concern, specially with cetaceans.
3. Mr Erdiñç Güneş, Head of the Department of Statistics and Information of the Ministry of Food, Agriculture and Livestock, spoke about the importance of addressing the problems of by-catch through a participatory approach with all the stakeholders. He also informed group about the recent development in new organizational structure of the fisheries administration in Turkey where five separate fisheries departments have been established Department for Fishing and Control, Department for Aquaculture, Department for Resource Management, Department for Statistics and Information Systems and Department for Coordination and Management Services.

4. Mrs M. Cristine Grillo-Compulsione also welcomed the participants, and thanked the Turkish authorities and recalled the objectives of ACCOBAMS and its collaboration with GFCM. She stressed that the possible outcomes of this important working group would be to outline some recommendations on specific actions to mitigate by catch of marine mammals for its consideration by potential donors already identified by the GFCM Secretariat as prone to finance some pilot study in the Mediterranean and Black sea.
5. Ms. Vassiliki Vassilopoulou and Mr Jacques Sacchi were introduced as Moderators and co-chairs of the Working Group each one conducting a part of the sessions. Ms Vassilopoulou chaired the first part dealing mostly with monitoring issues while Mr Sacchi chaired the sessions dealing with possible mitigation measures.
6. The agenda was presented and adopted with minor changes (see Agenda in Appendix B). Ms Pilar Hernandez from GFCM Secretariat assisted by Mr Konstantinos Tsagarakis and Ms Roberta Mifsud were appointed as rapporteurs.

REVIEW OF AVAILABLE DATA ON BY-CATCH IN GFCM AREA

7. Ms Vassilopoulou provided an introductory presentation on key issues related to by-catch and discards along with a review of existing knowledge on fisheries by-catches and discards in the GFCM area.

Review of existing knowledge on fisheries by-catches and discards in the GFCM area

(by the Moderator, Ms V. Vassilopoulou)

Several definitions of by-catch have been used, with the most common being “incidental capture of non-target organisms either retained or discarded”. By-catch and discards are affected by several factors related to natural condition, community, state, markets as well as their interactions. Several organizations have focused on the discards issue and several countries have approached the issue by banning discarding practice. In addition, EU is in the process of reforming its fisheries policy towards this direction. Implementation of such measures needs real time area closures, strong surveillance using electronic monitoring systems and the help of fishers to ensure effectiveness and compliance. Ms Vassilopoulou schematically presented the possible fates of discards and how they can affect the food-web. In the Mediterranean, target species are not clearly defined and thus it is not always clear what by-catch represents. As a result, most studies refer to outcomes and practices related to discarding, being a rather straightforward process. The current situation concerning trawl, purse seine, artisanal fisheries and other fisheries discards in the GFCM area, was briefly presented, including discarding rates per fishery, main species discarded and main reasons for discarding. Bottom trawls are characterized by high discarding rates in contrast to purse seiners, midwater trawls and artisanal fleets. However, the latter may still produce high discards quantities since they are the main fishing activity in the GFCM area and responsible for the bulk of catches. Several gaps of knowledge in the GFCM area, related to time span, spatial scale and coverage of the relevant studies were revealed. In addition, much of the information is placed on grey literature and should be better communicated. Several solutions to mitigate by-catch and discards have been proposed, such as technical and regulatory measures aiming either to the general reduction of fishing effort, or to the reduction of by-catch per fishing effort. For example, MPA establishments, spatio-temporal measures and modification of fishing gears could be proven as effective tools towards this direction. However, selective fishing may have impacts on community structure and biodiversity, a point that needs to be considered before decision making.

8. In the discussion following the introductory presentation it was mentioned that there are more studies concerning by-catch and discards, which were not included in the review. Dissemination of current knowledge and cooperation among partners were included in the highlights of this introductory presentation and partners were invited to provide any further information.
9. A question was raised concerning the framework of data collection in EU countries, whether it is effective in recording by-catch of species of conservation concern and how it can be improved in the future. Forthcoming presentations and discussion were expected to shed further light on this issue.
10. The meeting continued with presentations by participants concerning results from several case studies in the GFCM area. Their abstracts and the discussions following each presentation are provided below.

Target and by-catch species by deepwater trawl fishery in the Antalya Bay, eastern Mediterranean (by Deval M.C. and Güven O.)

Red shrimps, specifically the giant red shrimp (*Aristaeomorpha foliacea* Risso, 1827) and the blue and red shrimp (*Aristeus antennatus* Risso, 1816) and deep-water rose shrimp *Parapenaeus longirostris* Lucas, 1846 are the prime targets of deepwater bottom trawl fishing carried out in the Antalya Bay of the eastern Mediterranean. The commercial importance of these species, along with more than 10 marketable by-catch species, including crustaceans (pandalid shrimps *Plesionika martia* and *Plesionika edwardsii*), fishes (European hake *Merluccius merluccius*, the blackbelly rosefish *Helicolenus dactylopterus*, forkbeard *Phycis blennoides* and the monkfish *Lophius piscatorius*) and cephalopods (elegant cuttlefish *Sepia elegans*, pink cuttlefish *Sepia orbignyana*, and the fourhorn octopus *Pteroctopus tetracirrhus*) makes the deep-water resources of increasing interest. In our study we aimed to show the catch composition of shrimps trawl fisheries realized in the Antalya Bay. For this purpose was performed operation in four different depth contour lines (between 300 and 699 m) in the area. During the 12 month, totally 53 valid haul with a total time of 85 hour 10 minutes carried out. More than 90% of the total catch was by-catch which constituted of 76 Teleost, 15 Elasmobranch, 35 Crustacean, 14 Cephalopod, 10 Echinoderm and 4 Cnidaria species while teleostei was the most abundant group. Approximately 70% of the catch was discarded. *Chlorophthalmus agassizi* is one of the main by-catch species but it may turn to target species in the future. Protection of elasmobranches species should be considered since they are one of the more fragile groups.

11. Concerning *Chlorophthalmus agassizi* the authors mentioned that there are efforts for creating a new market for its commercialization either by processing it for human consumption or for aquaculture. The group concluded that this type of utilization would be a great improvement for mitigating discards.
12. The authors were asked which mitigation measures they consider as adequate for the protection of elasmobranches and whether reducing trawl duration would help minimize by-catches. A possible spatial closure of the fishery was discussed, taking into account the extent of trawling grounds. It was indicated that one of the ways to reduce by-catch in this type of fishery is to reduce vertical opening of the trawl net. However, the authors noted that fishermen are using traditional trawls and in case they needed to switch to other types of gears it might have an impact on their income, in terms of both the commercial catch and

fuel consumption. The fishers don't seem to care that they are throwing 70% of the catch back to the sea. Thus, an awareness campaign on ecosystems effects might help them understand that discarding leads to deterioration of ecosystem goods and services which would reduce their profits, a situation which could be reversed if appropriate measures are in place.

Discard characteristics of demersal trawl fishery from the Turkish coasts of the middle Aegean Sea (by *Soykan O., Tosunoğlu Z. and Kinacigil H.T.*)

This study aimed to determine the seasonal distribution of by-catch species in Turkish coasts of the middle Aegean Sea. Forty trawl hauls were performed between October 2007 and April 2009 by a commercial trawler. Seasonal samplings were carried out 88-450m depth by using 1200 meshes modified demersal trawl net. 110 species were determined and 9 of those were commercial, 72 were discards (non-commercial) and 29 species took place in both commercial and non-commercial compositions (occurrence of undersized individuals of commercial species). It was found that 72.6% of the total catch was commercial and 27.4% discard. Group based analysis of the discarded catch composition showed that bony fishes dominated the discard with 52% followed by cartilaginous fishes (27%), crustaceans and cephalopods (9%) and other groups (3%).

13. The authors noted that if fishers' incentives are understood it would be easier to effectively implement tools for discards reduction. Utilization of discarded species should be promoted but at the same time attention should be paid not to increase fishing effort.
14. Based on questions by the participants the authors clarified that the high discarding (in terms of numbers) of target species is mostly due to undersized individuals. Moreover, fishermen tired after a long day of labour discard increased quantities after a few haul operations. The allocation of fishing activities to deeper waters during summer, which was shown in the presentation, was attributed to spatial closures of the fishery.
15. Mr Sacchi highlighted that to increase trawl selectivity, modifications should be made concerning the technical characteristics of the trawls depending on their target species (e.g., fish or crustaceans). It is important to provide specificities of the trawling characteristics in order to have the fishing operation and métiers well identified so as to be able to look for measures adapted to any specific métier. For instance reducing the capacity of the métiers would be a way to progress. However, the first step is to gather a good knowledge on the real capacity of our fleets. In addition, changes of gears should be promoted depending on the different areas, for better adaptation to aggregations at different depths. This implies economical issues, which are not generally welcome at the professional level, so relevant campaigns aiming to increase the awareness of fishers should be also promoted.

Size analysis of the most important discarded commercial species captured by demersal trawls in the Turkish Coast of Middle Aegean Sea (Poster) (by *Akgül A., Soykan O., Tosunoğlu Z. and Kinacigi H.T.*)

Size analysis of the most important discarded commercial species captured by demersal trawls in the Turkish Coast of Middle Aegean Sea was presented. An important fraction of the length distribution of certain retained species was lower than the MLS, showing that MLS is not an effective measure.

16. Mr Sacchi pointed out that only with a good information at a regional scale specifying gears and métiers with high by-catch it would be possible to apply correct management measures.

Discards of the trawl fishery in Turkish Black Sea waters

(by Zengin, M., Gümiş, A., Süer, S., Dağtekin, M., Zengin, M., Dalgıç, G. and Akpınar İ. Ö.)

The sampling scheme was described which included monitoring of the commercial fisheries as well as an experimental survey. Discards rates of the commercial bottom trawls were species specific and differed in 2009 and 2010. Discards were linearly related with market price. A large fraction of the length distribution of the marketed catch for red mullet and whiting was well below the MLS for these species.

17. It was noted by the participants and also confirmed by the author that fishing effort has increased from 1998-2006, while a decreasing trend in whiting and red mullet catch was observed. These results suggest an existing overcapacity of the fleet, which was also acknowledged by the representative from the ministry, he informed that the number of boats has remained still since 2003, but regarding engine power, it seems that it has not been kept stable, and in fact it increased. Discussion underlined that apart from selectivity improvement a reduction of fishing effort is needed at the same time. Mr Sacchi suggested that in general the criteria used to regulate fishing effort should change, e.g. by disconnecting the engine power from the size of the gear and by setting limitations to the size of the doors.
18. Many fish were landed in sizes below their MLS but not below the size at first maturity. MLS is probably not an effective tool to manage discards and a reconsideration of the existing MLS was also proposed.
19. Mr Nikolaev noted that behaviour of fishers in the Black Sea, including Turkish fishers, adapts to fisheries resources, swapping between different activities. For example, total catch of anchovy decreased but catch of sprat increased. The possibility of setting quotas in pelagic fisheries in Black Sea was discussed but for the moment it is not considered as a feasible and effective measure. Finally it was noted that at least more effort should be placed in regulation of vulnerable commercial species, e.g. sturgeon.

Review of available data on by-catch in Spanish Mediterranean, Trawl Fleets GFCM area

(by Carbonell A., García E., García T., González M., Guijarro B., Pérez J.P. and Torres P.)

Since the introduction of the EU Data Collection Regulation and the subsequent Data Collection Framework (2009-present), monitoring the catches on board fishing vessels is undertaken routinely around the Spanish Mediterranean Coast. The Spanish Mediterranean coast is divided in five broad areas following the GFCM geographical subdivisions for the 37.1.1. Mediterranean Division (General Fishery Commission of Mediterranean) (GSA 1, GSA 2, GSA 5, GSA 6, GSA 7), within each of those areas; a number of métiers are used as the basis for Data Collection. The observers programme is based on a stratified random sampling on voluntary collaborative fleet basis. The sampling unit was the trip and all the hauls of a trip are usually sampled, afterwards haul-raised data are further raised to trip level. From 2003 to 2009 two main métiers were considered Demersal Species Fishery (DEF) and Deep Water Species (DWS), in some cases a third métier the Mixed Demersal Species and Deep Water Species fishery have also considered (MDD). From 2009 a new sampling scheme has been tuned on basis of the concurrent sampling. During a typical catch sampling trip data is collected on the gear type used, fishing ground, weather conditions; species catch composition and quantity of the landings and discards in the catch. The Spanish Institute of Oceanography (IEO) has developed a data storage system called "SIRENO". Data from existing sources under control obligations rules (landings, effort, log-books data, and census fleet) are obtained from the database of fisheries control of the Spanish Ministry of Fisheries. Sampled data

from observers on board are also stored. To manage all the data is used the "SIRENO" application, which stores information from many slices, observers on board commercial vessels and research surveys. The application SIRENO is developed under Oracle Application System. It is a modular application with different accessibility based in three levels: collection data, processing and reports generations in available format *.txt. It is a tool that, thanks to its configuration and development is always open to new modules and functionality that are developed to integrate, in a comprehensive manner, the areas in which the IEO is working. Using program routines discards are raised to effort or/ total landings. Moreover, data routine outputs allow using the Standard Data-Exchange Format specifications (COST, ICES, 2009). This is the European common format of data sets comprising all the variables needed to raise the data.

20. Ms Carbonell mentioned that the most appropriate way to estimate discards is by placing experienced observers onboard commercial vessels. She also clarified that data on gear characteristics need also to be collected.
21. The important issue of establishing collaborations with fishermen came up. Data collection is on a voluntary basis for fishers in Spain and some of them are reluctant to cooperate. The group noted that in some regions it is difficult to establish cooperation with fishers and that sometimes this leads to using always the same vessels which can create biases. Moreover, fishers' attitude may change when there are observers onboard. It was highlighted that fishers need to be engaged in the whole process providing at the same time security onboard. Concerning recommendations for gear changes in specific métiers Ms Carbonell paid special attention to the fact that the first step is to record and study discards and then try to modify the behaviour of fishers.
22. The Moroccan expert suggested that Morocco and Spain should work together likely under the support of COPEMED project to assess the discards in both Moroccan and Spanish areas following a standardized methodology and check whether the same species are considered as discards in both countries. The extension to other areas that share common stocks was also highlighted (e.g., Turkey/Greece, countries in the Black Sea).

Catch composition of the Greek trawl fisheries, with emphasis to quantification and analysis of by-catch species (by *Palialexis A.* and *Vassilopoulou V.*)

Catch composition of the Greek trawl fisheries were analyzed in GSA20 (Ionian Sea) and GSA 22 (Aegean Sea). Targeted species correspond to a high proportion of the landings in both areas, and present increased commercial value and market demand (*Merluccius merluccius*, *Mullus barbatus*). The highly diversified species composition and the predominance of small size species in the Greek trawl fisheries, does not allow a clear distinction between the target and by-catch categories. The latter group comprised of specimens of species with increased commercial value but having a small size (lower than MLS) and species with decreased value but with high proportion in catch (*Trachurus trachurus*). Moreover, in the by-catch category there was a varying proportion of species with no commercial value, which were discarded in all cases. The discards-catch ratio in Greek trawl fisheries is relatively high reaching more than 30% in both GSA areas.

23. Some comments pointed out the appropriateness of using predictive models. The authors noted that this is an example on how to analyze data of the DCF and that such approaches have been applied to several issues stressing that one of the major points for such an

approach is to select the appropriate variables. The need for standardization of data collection in the GFCM area was also highlighted.

Discards of the purse seine fishery for small pelagic fish in the Aegean and Ionian Seas

(by *Tsagarakis K., Vassilopoulou V., Kallianiotis A. and Machias A.*)

Data collected on board commercial purse seine vessels in the Greek waters (Aegean and Ionian Seas) from 2003 to 2008 were analyzed. The sampling was seasonally stratified taking place three times per year. In each area, five species constituted the majority of the marketable catch (>97%), resulting in low by-catch quantities. The discarded quantities were also low, on average 4.6% and 2.2% of the total catch, by weight, in the Aegean and Ionian Seas respectively. The discards on Marketable ratio didn't present any particular trend during the sampling period. At the species level, sardine and mackerel were seldom discarded and even small individuals were retained, while large amounts of anchovy were discarded only during its recruitment period (Autumn), when juvenile fish dominate the population. Discarding of bogue, picarel and round sardinella fluctuated a lot showing that these species constitute a supplementary source of income for the fishers. Generalized Additive Models were applied to describe the effect of fishing parameters on the discarded quantities, which were lower at intermediate marketable quantities and fishing depths. Discarding practices and implications for management of purse seine fisheries are discussed based on the results.

24. Some comments were raised on the underestimation of mortality at sea for individuals escaping from the net. This mortality is not assessed regularly, which may be an important fraction in fisheries with low discards rates. It was noted that an experimental scheme should be considered and applied in different regions to evaluate results. Selectivity experiments of different setups are also of interest. A discussion on the use of logbooks emerged and whether the information provided by fishers is reliable. Ms Hernandez informed that starting from January 2013 logbooks will be mandatory for vessels over 15 m LOA for GFCM members.

By-catches and discards in static net fisheries in Greece (by *Palialexis A. And Vassilopoulou, V.*)

Small scale fisheries in the Mediterranean are characterized as multi-species, operated by a big variety of fishing gears. They produce a relatively high proportion of the total catch and include the vast majority of fishing vessels (more than 97% in Greece) yielding the 55% of the total landings in 2008. Fishermen's incentives to increase their profit are the main drivers for the selection of target species, while a large proportion of the catch could be allocated to the by-catch category. Generally, discards in small scale fisheries correspond to an average of 10% of the total catch, but taking into account the large size of the fleet, their impact on the ecosystem should be considered at a local scale. However, due to the variety and the size of small scale fishing activities it is rather complicated to achieve high quality information and organize monitoring strategies, which are usually based on reports from observers on board commercial vessels.

25. The Group noted that the issue of considering monofilament and multifilament net panels has to be taken into consideration because they produce different figures of discards. Monofilament nets, even though forbidden in many areas, produce lower amounts of discards than multifilament nets.
26. The general discussion that closed the session focused on data needs for by-catch in the GFCM area. The importance of appropriate monitoring was highlighted. Given the fact that there are huge gaps of knowledge, improved data monitoring and time series (at least 5

years) are needed to enable us to develop indicators for by-catch. Standardization of monitoring and collaboration among partners are important steps towards this direction.

EVALUATE THE QUALITY OF CURRENTLY AVAILABLE BY-CATCH DATA (BY YEAR, GSA, FISHERY AND STOCK)

27. Ms Vassilopoulou opened this session of the meeting summarizing the issues raised so far. She noted that to move forward concerning the highlighted issues and to provide solid scientific advice, data of good quality are needed. The session continued with presentations related to regional data collection surveys.

Issues related to onboard sampling for assessing by-catch and discards in Greek waters

(by *Tsagarakis K., Vassilopoulou V. and Machias A.*)

The sampling scheme of the onboard data collection related to discards estimations in Greek waters is described. Sampling design includes spatial, seasonal and gear stratification. Data collection includes catch composition and length distribution of both retained and discarded fractions as well as positional, environmental and fishery variables. Problems and issues raised during the previous years are presented and discussed.

28. Sampling coverage and the number of vessels monitored in each sampling period was raised. Sampling coverage depends on the variability of fishing operations, and catch composition as well as on the available budget. Sampling coverage of less than 0.1% up to more than 10% have been applied in different areas worldwide. Simple statistical analysis applied to data gathered in pilot studies could help decide on such issues for future implementation.
29. The alternative of using electronic surveillance / cameras instead of observers on board vessels in the GFCM area was raised. The group was informed that cameras on board are being used, at least in pilot studies in the Northern European seas, however the group questioned their applicability in the Mediterranean and the Black sea suggesting that they might prove helpful for the release of endangered species. Moreover their application, combined with other measures such as eco-labelling might help fishers build a more eco-friendly image.

The collection of fisheries by-catch data in Malta (by *Mifsud R., Gravino F., Muscat E. and Knittweis L.*)

The current state of data on discards collected from the Maltese fishing fleet was described. The methods used, the fishing gears covered and some preliminary data were shown. Data are collected through onboard observations as well as from fishers' logbooks, following the EU's Data Collection Framework. Discards sampling through on-board observations are collected for trawlers and drifting long-lines. Case studies on by-catches were presented. A high incidence of turtle by-catch was recorded for surface long lines. Malta provides full by-catch data to GFCM Task 1 database concerning the associated species, while from 2012 the data reported will be substantially expanded. A change in the definition of associated species (current definition: by-catch of commercial species) in GFCM Task 1 database was proposed.

30. It was noted by the group that definitions should be clear and a recommendation to the GFCM was made, i.e. to change the definition of "Associated species" to "Commercial non-targeted species caught as by-catch".

31. The meeting concluded that it is important to record protected species which are returned to the sea alive. Awareness and training of fishers on how to release caught individuals of such species in order to reduce post-release mortality is essential.

Data collection scheme on by-catch through GFCM Task 1.4 (by *Hernandez P.*)

The data collection scheme on by-catch through GFCM Task 1.4 was introduced. The GFCM structure, the partner countries, its budget and its objectives were briefly presented. The four sub-committees and the GFCM secretariat structure were presented along with their responsibilities. Indicative GFCM decisions and recommendations (e.g. concerning the banning of specific gears and the by-catch of sea turtles, seabirds, elasmobranchs and marine mammals) were also provided and are presented in Appendix C. Availability on by-catch data is not satisfactory in the GFCM area. Starting from 2010, the member countries have to report data on by-catch to the GFCM Task 1 Protocol (Task 1.4). Data should be reported per country, area, season and operational unit (a clear definition of operational unit was provided). Examples of the reporting sheets and data needed were shown. GFCM representative also informed about the starting up of negotiations with potential donors for a future framework program to enhance the Ecosystem Based Fishery Management, to improve the reporting capacity of the member countries, and enhance artisanal fisheries, among others objectives with emphasis in the cooperation in the Black Sea and in the South Mediterranean regions.

32. Ms Hernandez answering questions posed by members of ACCOBAMS assured that the reporting system is now effective in collecting data for cetaceans' by-catch. The tools are available, but the compliance level by the countries is only partial. More cooperation regarding data reporting was asked by the group.
33. Some doubts and concerns were raised on the different data submissions which have to comply with EU, GFCM and other organizations. Maximum compatibility and formatting to avoid duplication of work was asked. There were also some comments on terminology with regards to the concept of métier vs operational units. It was mentioned that they should be perfectly compatible and not a source of extra work.
34. Ms Vassilopoulou noticed that the low reporting (13 out of 23 countries) possibly shows that there are no data available. She proposed to participants to briefly present available data in their countries and potential ideas on how a co-monitoring programme, could be organized.
35. The need to launch a general campaign in the GFCM area on by-catch, including evaluation of data, focusing on small scale fishery was raised by Mr Sacchi. In such a programme, stakeholders (especially fishers) should be also involved, particularly fishers' associations. Ms Hernandez mentioned that there are several issues that could be included in specific call for proposals under a framework programme but the whole process is under development.

CONSIDER BY-CATCH INDICATORS AND NECESSARY SUPPORTING DATA ON BY-CATCH RATES BY STOCK AND FISHERY FOR TRENDS INTERPRETATION

36. An introductory presentation on the definitions, the characteristics of indicators and the criteria for selecting meaningful and relevant indicators for fishery management presenting briefly the BADMINTON Project, was provided by the Moderator, Ms. Vassilopoulou.

Additional information on the use of indicators to quantify fishery discards and some recent examples applicable in the GFCM area is provided in appendix D

Overview of indicators in fisheries management (by the Moderator Ms V. Vassilopoulou)

Indicators are measurements that provide useful information about the condition of the natural, cultural or economic environment. The European Union Marine Strategy Framework Directive and descriptors of Good Environmental Status were briefly described along with a brief overview of indicators and reference levels currently applied in fisheries management. Indicators potentially used to evaluate the effects of fishing on the marine ecosystems are “state”, “pressure” or “response” indicators, some of which may be related to the discarding process (e.g., discarding rates for commercial species). Indicators are selected and applied based on a list of suitable criteria. Indicators applied to the MEDITS data were shown as an example. The BADMINTON project directly aims at developing indicators of by-catches and its general framework was briefly described. The need for acquiring adequate data series in order to analyze and estimate indicators was highlighted.

37. Three more presentations on the characteristics of the by-catch indicators were presented.

Indicators describing fishery by-catch/discards: An example from the Greek case study of the BADMINTON project (by *Palialexis A. and Vassilopoulou V.*)

The selection of a robust set of informative and easily interpretable indicators sheds light on the efficacy of management measures reflecting the state of the resources and potentially the ecosystem. Fisheries impact on the ecosystem, not only through the extraction of targeted species and non-targeted species but also through the portion discarded in the sea. Indicators based on a Driver-Pressure-State-Impact-Response could potentially provide a comprehensive tool for managers, stakeholders and decision-makers. In the Greek case study of the BADMINTON project pressure indicators were estimated using data collected in the DCF during 2003-2008. Additionally, state indicators were quantified from time-series derived by MEDITS data. The estimated indicators were evaluated by applying linear regression and extracting the corresponding trends.

Development of indicators to monitor and manage discard issues for European fisheries/fleets: Landing and By-catch fishery data for the coastal demersal fishery for the Balearic Islands trawl fleet (by *Carbonell A.*)

A data set spanning 9 years (2001- 2008) of demersal fishing in the Balearic Islands was used to estimate three different diversity indices (Species richness, Simpson’s and Shannon’s diversity indices) for landed and discarded fish species. Species caught in more than 10% of sampling trips were used in the analyses. Data were standardized to kg per hour per trip and then square root transformed. Diversity indices were averaged across each year by using bootstrapping. Sensitivity of the indicators such as expected effect of fishing, exclusiveness to fishing effects, and measurability based on the Rochet and Trenkel review (2003) was analyzed.

Trends in metrics of fish community for otter-trawl discards in the Ionian Sea

(by *Tsagarakis K., Karakassis I., Giannoulaki M., Somarakis S., Vassilopoulou V. and Machias A.*)

We examined trends in diversities, and trophic levels of the demersal fish community using data from a seasonally closed commercial trawl fishery in the eastern Mediterranean Sea (Ionian Sea), over a period of about 10 years. Trends were also examined for the artificial fractions derived from the discarding process (the marketed, the discarded, and the non-marketed clusters of the catch), as well as for the “Big” and “Small” fractions (defined by the size at which 50% of all specimens were discarded). The values of these metrics were compared among the pseudo-communities and seasonal effects were investigated. Declining trends for several metrics and fractions were observed over the examined period which were related to the deterioration of the community as well as the adaptive

discarding practices. The composition and/or trophic level of discards in relation to the marketed catch seemed to be indicative of the exploitation state of the demersal community: differences between the discarded and marketed fractions were high at the beginning of the fishing season (autumn), but the values of the indices converged at the end of the fishing season (spring). These changes could be attributed to alternative discarding strategies for certain species in response to increased cumulative fishing mortality towards the end of the period.

38. In the general discussion following the presentations of this session, the use of MSY as an effective indicator in fisheries was argued. The interest on MSY has grown again during the past few years, however its use requires stock assessments and in most cases suitable data are sporadic and fragmented. The author clarified that they have considered its application; however its sensitivity to ecosystem changes should be tested. Moreover, some participants noted that other indicators are multi-species and have different objectives than MSY which is mainly used for single species approach. The group agreed on placing special attention to the use of a suite of indicators rather than just a single one in order to get a thorough idea and reach a robust conclusion. Also, familiarization of decision makers with indicators was raised as a key point.
39. GFCM representative noted that the use of indicators is very important and GFCM is interested in the follow-up of these results. She reminded participants that GFCM also uses MSY as an indicator in other stock assessment Working Groups of the SAC. It was concluded that more effort should be placed on stock assessments for different species and different areas.

INTERACTIONS BETWEEN MARINE MAMMALS AND FISHERIES IN THE MEDITERRANEAN AND BLACK SEA

40. A general introductory presentation was done by the Moderator Mr J. Sacchi. The main type of interactions, gears, areas and the species more commonly caught were described. He also provided a review of technical mitigation measures by gear.

Background on marine mammals' by-catch issue in Mediterranean and Black sea

(by the Moderator Mr J. Sacchi)

Interaction between marine mammals and fisheries is one of the main sources of anthropogenic mortality that should be assessed. The cetacean species that are impacted mainly concern dolphins and especially species that inhabit coastal areas which are more affected by anthropogenic factors. The main impacting factors include ghost fishing, discards released at sea, aquaculture, and a variety of fishing operations (e.g., pelagic trawling, driftnetting, bottom static nets and pelagic longlines). Interactions may be direct (incidental catch and depredation) or indirect (e.g., competition for food or space, mortality after release, modification of the abundance). Assessment of the interactions includes a good understanding of the impact of fisheries per gear on marine mammals and vice versa. To explore mitigation measures for static nets we need to identify catch modes, gear characteristics (height, hanging ratio, mesh size etc.) and the characteristics of fishing operations. The potentially applied mitigation measures can be curative or preventive from technical or management point of view. Technological advances such as acoustic repulsive devices, passive reflectors for static nets or physical depredation mitigation devices (PDMD), alternate hook design for longlines (e.g. circle hooks), BRDs for trawls, which could help to release large animals like sharks, turtles and marine mammals should be tested. Moreover it should be recommended to avoid the use of stainless hooks

and metallic branchlines for longlines . Management measures including among others, MPAs, seasonal closures, ban of certain gears and reduction of fishing effort should be considered. Increased acceptability and communication through awareness campaigns, education and training of fishers, implication of fishers to decision making process, incentive measures, labelling, legislation, monitoring and control may effectively reduce by-catch. Marine mammals' by-catch is mainly a conservation issue which may become a socio-economic problem.

41. Some participants posed the question about what is our knowledge on possible relationships between by-catch and IUU fishing. Illegal fisheries are a main problem (e.g. driftnets) and that in some cases when a vessel carrying out IUU fishing is about to be caught, fishers abandon the nets at sea causing ghost fishing, which is even worse. Moreover there is a general problem to implement a prohibition, especially for small scale fisheries. For example, the problem of driftnet ban is that it was not in agreement with the fishers and thus some of them continue to use this gear.
42. It was noticed that in the Black sea there is a big problem of ghost fishing and poaching, especially concerning turbot fishery which is the most dangerous for cetaceans. Ukrainian expert proposed the initiation of a survey in the EEZ of Romania, Ukraine and Bulgaria during the periods when temporary closures are applied in order to estimate the effect of ghost- and illegal fishing and collect all the nets released.
43. Important problems with legal and illegal fisheries that catch dolphins were confirmed by more participants from Black Sea countries. It was concluded that banning of certain gears in certain hotspots areas should be discussed in the future.
44. In addition, anthropogenic waste (e.g. plastic) and bad use of damaged fishing gears by the fishermen who often release the ruined parts at sea, were reported to greatly affect cetaceans. Once again the issue of awareness of the fishermen about the avoidance of cetacean by-catch was stressed.
45. Finally, Mr Sacchi highlighted that gear characteristics is a major problem. Some nets are too large and soak time is too long, increasing the impact. One solution is to reinforce the implementation of devices like time recorders, which in the Atlantic have proven useful. Logbooks should also be implemented but in the Mediterranean their applicability is questionable.

Évaluation de l'interaction entre *Tursiops truncatus* et les filets de la senne tournante dans la région du Cap Bon (Nord Est de la Tunisie) (by Benmessaoud R.)

Ms Benmessaoud presented an evaluation of the interaction between *Tursiops truncatus* and purse seines in Tunisia and some estimates of the economic losses of fishermen. Purse seines catches largely consist of sardines which constitute an important diet of the bottlenose dolphins. An important fraction of the purse seine fleet was sampled. Holes caused by dolphins were recorded along fishing operations. The frequency of attacks and the cost of repairing were higher during the summer. Mending cost / production was almost 12%, while 70% of damaging was caused by dolphins. The main conflicts are that the fleet operates in areas with high dolphin abundance during summer and that fishermen and dolphins target the same species. Potential mitigation measures are (a) to increase the thickness of the net filament to make it stronger, (b) to favour ecotourism activity

to mitigate the cost of repairing the damage and (c) to prohibit fishing in shallow areas and during the spawning period of small pelagics.

46. The participants argued that temporal or spatial closures may not be effective because it is possible that dolphins follow fishing activity and also because they will probably not be very well accepted by fishermen since this fishery is been carried out in areas rich in sardines, which would be considered for such closures. Moreover, it was noted that the proposed closure is in summer when weather conditions are good and fishers prefer to fish. As an alternative, the use of acoustic devices should be considered. Ms Benmessaoud clarified that the use of pingers has been tested but they are difficult to setup in purse seiners since they are made for static nets.

Acoustic devices to reduce bycatch (by *Najih M.*)

The most important fleets interacting with cetaceans in Morocco are handline fisheries, purse seine fishery and driftnets which still operate and will be banned in 2012. Information on these interactions is relatively low. Interactions have been observed between bluefin tuna fishery and killer whales. Killer whale attacks on tunas are observed during summer in the straits of Gibraltar. Bottlenose dolphins attack the purse seine nets in a frequency of 16% causing economic losses in the Moroccan Mediterranean. The INRH established in 2002 a program to monitor the phenomenon of interaction that is manifested by attacks of the bottlenose dolphin (*Tursiops truncatus*) on the net at the encirclement of the fish. In 2004, losses to this fishery were valued at nearly 23.3 million MAD (Moroccan Currency) per year. (Leak fish through the tears, reducing fishing effort and damage fishing nets). In 2003, the INRH tested a traditional device "Dolphin Tube" and the results showed an efficiency around 50 % during the first two months, afterward we observed a very important diminution. In 2005, an electronic device was tested « Hight Impact Savers » and showed an efficiency around 90%. However, the experimentation duration was only 2 months. Further to these encouraging results, the INRH, with a support of ACCOBAMS, led a pilot study to the Mediterranean scale. The devices "Dolphin Spheres" showed an efficiency completed during the first two months with zero attack recorded. Afterward, this efficiency considerably decreased, probably due to habituation of the animals to this sound.

Development of national network for monitoring the Black Sea cetacean in Romania and identification of relevant measures for mitigation the adverse impact of fisheries

(by *Nicolaev S. and Radu G.*)

Mr Nicolaev presented a data collection programme, which was scheduled based on recommendations of the ACCOBAMS. The main tasks were to collect basic information using several methodologies, improve reporting, build an appropriate database and disseminate the results. Based on the collected information it was shown that banning of the sturgeon fishery in 2007 had a positive effect in by-catch reduction. Modification of the gillnets for turbot (200mm and thickness less than 0.5mm) is proposed as an effective measure for by-catch mitigation. Future objectives include the strengthening of the partnerships among organizations and developing validation methods for stranding data.

47. Participants from the Black Sea area noticed that similar by-catch rates (120-170 harbour porpoise per 100km of nets 40 or 38 cm mesh size) are observed in different countries in the Black Sea.

Estimates of Cetacean Bycatch in the Turbot Fishery on the Turkish Western Black Sea Coast in 2007 and 2008 (by *Tonay A.M.*)

There are three cetacean species living in the Black Sea; the harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*) and common dolphin (*Delphinus delphis*). Cetaceans in the Black Sea are faced with several threats such as accidental catches in fishing gear (bycatch), habitat degradation causing the reduction of prey resources, marine pollution and epizootics resulting in mass mortality events (Birkun, 2008). There are few cetacean bycatch studies in the Turkish Black Sea waters such as Öztürk et al., (1999), Tonay and Öz (1999), Tonay and Öztürk (2004), Gönener and Bilgin (2009). In this study, the turbot fishing boat was observed during two fishing seasons from April till the end of July in 2007 and mid-September in 2008. 24 harbour porpoise and one bottlenose dolphin bycaught in turbot trammel nets on the Western Black Sea coast were examined. According to the results, the CPUE was found to be 0.18 harbour porpoise and 0.01 bottlenose dolphin individuals per kilometer in 2007, and 0.19 harbour porpoise individuals in 2008. Total cetacean bycatch during turbot fishing season was estimated following Northridge and Fortuna (2008). It was estimated that the numbers of harbour porpoises died were; 361(±332) (CV: 0,92) in 2007; 608(±408) (CV: 0,67) in 2008 during the legal period (April and July) and 1829(±675) (CV: 0,37) in 2007; 2249(±790) (CV: 0,35) in 2008 during legal and illegal periods of turbot fishing season. In conclusion, the estimated number of bycaught harbour porpoises in turbot fishery on Turkish western Black Sea coast would be a combination of these two estimates. Turbot fishing carried out by using bottom nets, especially in May and June, when turbot fishery is banned, is a threat to the sustainability of harbour porpoise stocks. This is the first study about estimation of cetacean bycatch in the Turkish Black Sea.

48. The group proposed an increase in the trammel net mesh size as a mitigation tool of juveniles of turbot and harbour porpoises catches.

Cetacean bycatches in turbot fisheries on the central coast of the Bulgarian Black Sea

(by Mihaylov K.)

Some of the material reported to this working group is part of the project “*Establishment of a network on cetacean strandings monitoring and on bycatch assessment in Bulgaria*” financed by ACCOBAMS. Gillnet fishery is known to be associated with most cases of interactions with cetaceans raising in particular the majority of harbour porpoises bycatches in the Black Sea. An estimate of cetacean bycatch in different parts of the basin on the basis of onboard monitoring schemes is just getting underway in order to assess the scale of this threat. In 2010-2011 during the most intense turbot fishing season April-July direct recording of cetacean bycatches in bottom set gillnets was conducted in the central Bulgarian area. During the trips 982 nets hauled were examined with a total length of 88.4 km. All trips were positive for cetacean bycatches except for one carried out in April 2011. In total 21 cetaceans: nineteen harbour porpoises (90%) and two bottlenose dolphins (10%) were recorded bycaught. All porpoises and bottlenose dolphins were dead on hauling. The bycatch index of *P. phocoena* was estimated at 22 per 100 km net set and that of *T. truncatus* – 2 per 100 km net set or overall 24 cetaceans per 100 km net set. Taking into account that this onboard monitoring of cetacean bycatch is the first one organized in Bulgaria, it may represent an important baseline for further investigations. The extending of observer-based studies to cover a number of fishing units of the fishing fleet adequate for accurate bycatch assessments will promote the evaluation of human induced impacts on cetacean populations. The above would ultimately conduce ACCOBAMS Resolutions on bycatch issues and the ICES Regulations and Advice for protecting cetaceans against incidental catch to be met in a more effective way.

49. Mr Mihaylov was asked whether there are any EU regulations for this fishery and if they have been implemented. He responded that an increase in mesh size has been applied but there are no regulations concerning the length of the nets.

50. The issue of IUU fishing in Black sea was raised again as the main problem in the area and a possible switch from gillnets to longlines was proposed. A working group of experts from the area, including NGOs and ACCOBAMS was encouraged to initiate working on the problem.

Cetacean by-catch levels in the northern Black Sea: results of onboard monitoring programme
(by *Birkun A. Jr.* and *Krivokhizhin S.*)

Incidental catch in bottom-set gillnets for turbot (*Psetta maeotica*) and spiny dogfish (*Squalus acanthias*) continues to be the major source of human-induced mortality among Black Sea harbour porpoises (*Phocoena phocoena relict*) and bottlenose dolphins (*Tursiops truncatus ponticus*), the cetaceans recognized by IUCN and ACCOBAMS as the endangered subspecies. In order to estimate levels of the bycatch in the Ukrainian Black Sea, a monitoring programme was implemented in 2006-2009 on board of a fishing boat specialized in this kind of fishery and operated all year round. During the examination of 4,769 nets with an overall length of 354.1km, a total of 519 cetacean carcasses (514 harbour porpoises and five bottlenose dolphins) were found, whereas the catch of target fish species came to 5,080 turbot and 2,641 dogfishes. Aggregate bycatch indices of those fishing operations were evaluated as follows: 142 porpoises and two bottlenose dolphins per 100km of turbot nets; 151 porpoises and no dolphins per 100km of dogfish nets; 65 porpoises and one dolphin per 1000 turbot; and 70 porpoises per 1000 dogfishes. Peaks of harbour porpoise bycatches occurred in June (2.7 indiv./km, turbot nets) and August (7.6 indiv./km, dogfish nets). This dismal statistics were obtained from just one fishing boat legally operating in small coastal area. In the meanwhile, hundreds of vessels are permitted annually to catch turbot and dogfish in the Black Sea. In addition, IUU fishing became widespread in the region suggesting that a significant share of cetacean bycatches takes place due to marine poaching.

51. The authors stressed the fact that in some areas of the Black Sea, IUU is estimated as 6 times the legal fishing, so any data obtained can be biased. However according to the results shown during this meeting, little differences exist in by-catch rates among the Black Sea countries. The Working group suggested that an agreement on the use of the same indicators should be considered. Reference levels should be established for acceptable by-catch, however population estimates are not available. A workshop for scientist of all the Black Sea countries should deal with these issues, including standardization of cetacean by-catch data between the different states surrounding the Black Sea for the calculation of total by-catch.
52. The Group suggested that prohibition of dogfish nets in the Black Sea should be examined as (a) it has a high rate of cetacean by-catch and (b) most of the targeted catch is discarded since species die very fast after their entanglement.

Action Plan for the mitigation of the negative effects of monk seal - fisheries interactions in Greece
(by *Paximadis G.*)

The Action Plan for the mitigation of the negative effects of monk seal - fisheries interactions in Greece includes specific measures to mitigate the seal-fishery interaction, utilizing the results from the MOFI Life Nature project's field work, bibliographic references on available legislative, structural and technical measures, and experiences from case studies that attempted to mitigate similar wildlife-human interactions globally. The Action Plan, elaborated in extensive consultation with key stakeholders (fishermen) and national competent authorities, resulted in a set of interrelated specific, realistic and feasible proposals for measures, including the necessary structures and resources for its implementation. In particular, the proposed measures aim at the protection and

restoration of key fish stocks, thus addressing the root source of the conflict, at the decrease of fishery-related mortality of the monk seal and at the financial support of coastal fishermen for the damages suffered by the marine mammals. Although the project focused on the monk seal, the action plan includes also interactions with bottlenose dolphins.

53. Mr Paximadis proposed specific management measures, i.e. prohibition of all fishing activities during May, ban of the octopus fishing in May and June, an increase in the Minimum Landing Weight for octopus, financial aids for damages, implementation of protective and reinforced nets in aquacultures and improvements in the gear selectivity by an increase in gill net mesh size. He clarified that financial aid for damages should aim the enforcement of the proposed measures.
54. The majority of mitigation matters proposed for the monk seal can also be proposed for cetaceans as most of them aim to increase fish stocks. However, some amendments should be made as for the octopus mitigation measures since cetaceans mainly prey on small pelagics and mostly interact with purse seining.
55. The SAC recommendation to prohibit static gears in distances less than 5 nm around monk seal caves although not adopted finally by the Commission at its 35th meeting in May 2011, was discussed among the participants. The Recommendation finally adopted as presented in Appendix C requests the Member Countries to mark the identified spots where monk seals are present and send the geographical coordinates to the GFCM Secretariat before the end of January 2012 so as to properly analyze the places and consider if this recommendation can be discussed and further expanded. Mr Paximadis showed a map of the Greek areas that fishing prohibition would apply to almost the entire Aegean Sea what could justify objection by the Greek authorities to this recommendation.

CONSIDER WAYS TO START AND/OR EXPAND BY-CATCH MONITORING SCHEMES AND SPECIALLY IN THE CONTEXT OF BY-CATCH REDUCTION ISSUE IN GFCM AREA

56. Mr Sacchi presented a case study from French Mediterranean waters concerning the by-catch of species of conservation concern and related mitigation tools.

GTMF-bycatch group activities in French Mediterranean waters

(by *Claro F.* and *Poisson, F.* Presented by the Moderator Mr J. Sacchi)

The GROUPE TORTUES MARINES FRANCE (GTMF) created in 2007 by the French Ministry in charge of the Natural Environment aims to reflect and to make propositions on all issues concerning the management of sea turtles in all French waters, including overseas, with links to the conservation actions at the international level. It is open to all the actors of the marine turtles conservation in France and gathers to-date 150 members, who can exchange information through its weblist gtnf@mnhn.fr. The work of GTMF is organized into 5 working group concerning the following themes: databases, by-catch reduction, habitat restoration, public sensitization, legislation and training. The main actions carried out by the by-catch WG during these last years were to take stock of the situation of the sea turtles in the different French waters based on the analysis of a National questioner on various interaction of fisheries with sea turtles. Provisory maps on repartition of turtle strandings and catches were drawn with information on most impacting gears. Furthermore, posters

to disseminate to fishers were also drawn to advise them on best ways to avoid mortality on board or during retrieval.

57. Most of the discussion following this presentation focused on the hook shape and the used materials. Circular hooks might pose a danger to turtles as they are easier to ingest, while there is a higher possibility for J-hooks to remain in their mouth. Scientific studies show different conclusions about the use of circular hooks, however, it is best to explore the use of different hooks for specific fishing gears and areas as this depends a lot on the type of by-catch caught and the species targeted. Emphasis was placed on using oxidizing corrosive hooks, which would deteriorate in case of ingestion by turtles and other animals of conservation concern.
58. The group concluded that an appropriate structure to disseminate knowledge to those who interact with species of conservation concern should be considered and created. A document needs to be drafted concerning all situations of by-catch release (cetaceans and turtles).
59. In order to improve data collection and monitoring schemes on by-catch we need first to know what are the existing data as well as the past and ongoing sampling schemes for data collection. Participants were asked to briefly present related information in their countries. This information is provided below.

Information about Malta, Greece and Spain were already given through the presentations made by the experts (see abstracts above).

Bulgaria

Summary to be provided by the country representative to the meeting

France

Summary to be provided by the country representative to the meeting

Morocco

Summary to be provided by the country representative to the meeting

Romania

Summary to be provided by the country representative to the meeting

Turkey

Summary to be provided by the country representative to the meeting

Ukraine

Summary to be provided by the country representative to the meeting

Tunisia

Summary to be provided by the country representative to the meeting

60. A programme for marine mammals by-catch mitigation **“Strategy on marine mammals by-catch reduction in gillnets and longlines fisheries. Assessment of main causes of by-catch. A pilot study project”**. was introduced by the Moderator, Mr J. Sacchi. This programme should aim to (a) expand and improve data collection, especially on technical

characteristics and practices responsible of impacts on marine mammals, (b) increase the awareness of fishers and (c) include some case studies where mitigation measures should be urgently applied such as those of Black Sea turbot fishery, coastal static nets fisheries, drifting longlines, depredation in purse seine fisheries and other fisheries cases identified as harmful to marine mammals. This pilot study project could be considered within the GFCM Framework Program.

61. The working group acknowledged the initiative and fully supported the idea of this project. Many participants expressed their opinion in favour to participate if such a program is finally set in force.

CONCLUSIONS AND RECOMMENDATIONS

62. Based on the overview of the existing information and the results and projects presented by the participants the following conclusions were outlined:

- There are several gaps of knowledge regarding basic information on fisheries by-catches, including species of conservation concern and discards in the GFCM area. Regular onboard monitoring takes place in certain sub-regions while such information is completely absent from other areas. Moreover, certain gears, mainly concerning the small scale fishery are under-sampled or are not sampled at all due to budgetary limitations.
- Much of the existing information is placed on unpublished technical reports and other sources which are considered as grey literature.
- In order to propose measures and tools for the mitigation of by-catch and discards, the first step is to collect appropriate data based on well designed surveys on board commercial vessels.
- Based on the results presented by the participants it was notable that grand portions of the landed fish were below their minimum landing size (MLS), when it's in place. Thus, MLS may not be an effective tool for by-catch mitigation when it is not followed by strong surveillance.
- Consideration of the utilization of up to now regularly discarded organisms has been initiated, which can be one of the great improvements for the discards issue. Promising steps and efforts towards this direction were shown which are in line with the progressive adoption of the Ecosystem Approach
- Overcapacity has been seen as a general characteristic of most fleets. Improvement of gear selectivity is not enough and should be followed by a reduction in fishing effort and capacity in such cases.
- Illegal Unreported and Unregulated (IUU) fishing is considered a major threat for fishery resources and for species of conservation concern. It is responsible for important

unaccounted mortality and is a source of large by-catch generation. Prohibited gears like driftnets continue to operate in certain areas, all around the GFCM area.

- The working group recognized that the small scale fishery is very difficult to monitor, especially when taking into consideration that the GFCM area fleets are mainly composed of small boats.
- The meeting recognized the importance of developing and using indicators related to by-catch and discards as tools to monitor relevant activities. It was reminded that it is best to use a suite of, instead of using a unique indicator
- In general the following mitigation measures towards the reduction of by-catch marine mammals concern were proposed:
 - Regulation of fishing activities
 - Seasonal closure during spawning period of the animal's prey during which period the highest rate of entanglement of marine mammals juveniles is usually observed (Tunisia, Greece)
 - To ban the dogfish fishery using nets as it has a high rate of cetacean by-catch and most of the targeted catch is discarded due to the species dying very fast after being caught (Ukraine)
 - Increase gear selectivity
 - With regards to the turbot fishery in the Black sea
 - The use of 40 cm stretched mesh size and twine thickness less than 0.5 mm diameter was suggested (Romania)
 - Trials of targeting the turbot with trammel nets having a larger mesh size than the currently used gill nets was suggested
 - Adaptation of the gear so as to reduce cetacean fatalities and losses to the fishermen
 - Test if increasing the net filament thickness can prevent holes in the net made by the dolphins (Tunisia)
 - Awareness and education for the reduction of by-catch of species of conservation concern
 - Awareness on why it is important to mitigate by-catch of species of conservation concern
 - Importance of recording protected by-catch species in log books and other data sheets, even if they are released unharmed
 - Education campaigns on how to release live, caught, protected species in the safest way possible

63. GENERAL RECOMMENDATIONS

- Dissemination of current knowledge should be promoted. It is very important to distribute results and related information to all stakeholders: scientific publications for researchers as well as education material for fishers' and public awareness.
- Fishers should be well informed of the mid-term economic gains following the restoration of stocks that could be reached with the adoption of technical measures. Motivation contributes to the persuading of fishers and would lead to an increased implementation of mitigation measures.
- Explore new market options for presently discarded non-marketed species, ensuring that fishing effort is not going to be increased.
- Technical modifications of fishing gears: specific modifications may reduce by-catch quantities for certain operations without causing substantial economic losses. However the applicability of such modifications is not expected to be feasible in all gears, especially in the GFCM area where it is usual for one gear to exert more than one fishing practices. As a first step the use of such modifications should be established in well identified métiers with clearly defined target species.
- Change the definition in the GFCM e-glossary of "associated species" from "by-catch of commercial species" to "commercial non target species caught as by-catch"

To the researchers

- Cooperation among partners is greatly encouraged and is considered essential in order to standardize monitoring methods, compare results and explore by-catch mitigation, especially for shared stocks, which is a common feature in the GFCM area.
- A general comment during the working group was that even though good, useful data on the current state of cetacean by-catch around the Black Sea is available in individual countries (Bulgaria, Romania and Ukraine), there is a great need of standardizing the data so that a cetacean by-catch estimate could be obtained for the whole Black Sea.
- The meeting probed that the idea of fishermen changing fishing grounds in order to avoid cetaceans may not be effective, since, the occurrence of cetaceans very much depends on the occurrence of fishermen since the cetaceans may go in search of readily available food. The meeting suggests that this will be an interesting factor to investigate which will lead for better knowledge and advice to managers with regards to the subject.

To the National Administrations

- The meeting emphasized the establishment of good communication with the stakeholders, mainly with the fishermen, so as to create awareness about both the importance to reduce discards, as well as the by-catch of species of conservation concern.

- Member countries are encouraged to illustrate to both fishermen and on-board observers the importance of recording protected species that are released back to the sea, such that these catches will be well recorded in both log books and other data sheets.
- In order to better follow Recommendation GFCM/35/2011/4 stating that specimens of sea turtle and sea monks accidentally taken in fishing gears shall be safely released alive, education on the subject is encouraged. The 'FAO Guidelines to reduce sea turtle mortality in fishing operations' (FAO, 2009) can be helpful for this purpose.
- The meeting recognized the importance of collecting data about by-catch and discards all over the Mediterranean and the Black Sea. GFCM Secretariat urges member countries to comply with the Recommendation in force and fill in Task 1.4. They are encouraged to complete it in the best possible manner.
- The meeting emphasized the use of data collected through log books which are going to be mandatory in the GFCM area starting in 2013 for vessels longer than 15m LOA.

Proposal of management measures at regional level

- Prohibition of the use of inoxidable materials in hooks and metals in snoods in long lines so that caught protected animals (for example sharks) will be able to cut the line and release themselves unharmed.
- Member countries should make every possible effort in order to eliminate ghost fishing, especially when this occurs due to fishermen dumping unwanted, old gear at sea instead of disposing of it appropriately.
- While by EU regulations the mesh size for trawlers was increased, the mesh size of gill net was retained without any increase (with the exception of Romania and Bulgaria that already have adopted the 40 cm). GFCM should recommend an increase in gill net mesh size.
- To strengthen national fishery regulations by stating that, for legal purposes, when an illegal fishing implement is carried on board it shall be considered to have been used. This is a cost effective measure which also helps in reducing ghost fishing. Through this law, inspections for illegal gear could be carried while the boat is berthed (or even in the port), reducing travelling time for enforcement authorities. With the current legislation there is the possibility that fishermen, realizing that enforcement officers are approaching the vessel while operating, throw the illegal gears overboard to avoid being caught red handed. This will result in ghost fishing, which can be avoided through the amendment suggested.

ADOPTION OF THE REPORT

64. The Conclusions and Recommendations were adopted by the Working Group on the 9th of December 2011. The whole report was adopted after revisions and amendments by electronic correspondence within the following two weeks.

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Agenda

Wednesday 7 December 2011

Morning Session (9:00-13:00)

1. Opening session

- Opening, arrangement of the meetings
- Logistical aspects
- Nomination of the rapporteur(s)

2. Review of available data on by-catch in GFCM area

2.1. Presentations

- Review of existing knowledge on fisheries by-catches and discards in the GFCM area (by the Moderator , Dr. V. Vassilopoulou)
- Target and by-catch species by deepwater trawl fishery in the Antalya Bay, eastern Mediterranean (by *Deval M.C.* and *Güven O.*)
- Discard characteristics of demersal trawl fishery from the Turkish coasts of the middle Aegean Sea (by *Soykan O.*, *Tosunoğlu Z.* and *Kinacigil H.T.*)
- Size analysis of the most important discarded commercial species captured by demersal trawls in the Turkish Coast of Middle Aegean Sea (Poster) (by *Akgül A.*, *Soykan O.*, *Tosunoğlu Z.* and *Kinacigi H.T.*)
- Discards of the trawl fishery in Turkish Black Sea waters (by *Zengin M.*, *Gümüüş A.*, *Süer S.*, *Dağtekin M.*, *Zengin M.*, *Dalgıç G.* and *Akpınar İ.Ö.*)

Afternoon Session (14:30-17:30)

- Review of available data on by-catch in Spanish Mediterranean, Trawl Fleets GFCM area (by *Carbonell A.*)
- Catch composition of the Greek trawl fisheries, with emphasis to quantification and analysis of by-catch species (by *Palialexis A.* and *Vassilopoulou V.*)
- Discards of the purse seine fishery for small pelagic fish in the Aegean and Ionian Seas (by *Tsarakis K.*, *Vassilopoulou V.*, *Kallianiotis A.* and *Machias A.*)
- By-catches and discards in static net fisheries in Greece (by *Palialexis A.*, *Vassilopoulou, V.*)

2.2. General discussion

Thursday 8 December 2011
Morning Session (9:00-13:00)

3. Evaluate the quality of currently available by-catch data (by year, GSA, fishery and stock)

3.1. Presentations

- Issues related to onboard sampling for assessing by-catch and discards in Greek waters (by *Tsagarakis K., Vassilopoulou V. and Machias A.*)
- The collection of fisheries by-catch data in Malta (by *Mifsud R., Gravino F., Muscat E. and Knittweis L.*)
- Data collection scheme on by-catch through GFCM Task 1.4 (by *GFCM Secretariat*)

3.2. General discussion

4. Consider by-catch indicators and necessary supporting data on by-catch rates by stock and fishery for trends interpretation

4.1. Presentations

- Overview of the use of indicators in fisheries management and a brief presentation of the MariFish Badminton project. (by the Moderator, Dr. V. Vassilopoulou)
- Indicators describing fishery by-catch/discards: An example from the Greek case study of the BADMINTON project (by *Palialexis A. and Vassilopoulou V.*)
- Development of indicators to monitor and manage discard issues for European fisheries/fleets: Landing and By-catch fishery data for the coastal demersal fishery for the Balearic Islands trawl fleet (by *Carbonell A.*)
- Trends in metrics of fish community for otter-trawl discards in the Ionian Sea (by *Tsagarakis K., Karakassis I., Giannoulaki M., Somarakis S., Vassilopoulou V. and Machias A.*)

4.2. General discussion

Afternoon Session (14:30-17:30)

5. Interactions between marine mammals and fisheries in the Mediterranean and Black Sea

5.1. Presentations

- Background on marine mammals' by-catch issue in Mediterranean and Black Sea (by the Moderator, Dr. J. Sacchi)
- Évaluation de l'interaction entre *Tursiops truncatus* et les filets de la senne tournante dans la région du Cap Bon (Nord Est de la Tunisie) (by *Benmessaoud R.*)

- Acoustique dans la diminution des bycatch (by *Najih M.*)
- Development of national network for monitoring the Black Sea cetacean in Romania and identification of relevant measures for mitigation the adverse impact of fisheries (by *Nicolaev S.* and *Radu G.*)
- Estimates of Cetacean Bycatch in the Turbot Fishery on the Turkish Western Black Sea Coast in 2007 and 2008 (by *Tonay A.M.*)
- Cetacean bycatches in turbot fisheries on the central coast of the Bulgarian Black Sea (by *Mihaylov K.*)
- Cetacean by-catch levels in the northern Black Sea: results of onboard monitoring programme (*Birkun A.Jr.* and *Krivokhizhin S.*)
- Action Plan for the mitigation of the negative effects of monk seal - fisheries interactions in Greece (by *Paximadis G.*)

5.2. General discussion

Friday 9 December 2011
Morning Session (9:00-13:00)

6. Consider ways to start and/or expand by-catch monitoring schemes and specially in the context of by-catch reduction issue in GFCM area

6.1. Presentations

- GTMF- bycatch group activities in French Mediterranean waters (by *Claro F.* and *Poisson, F.* Presented by the Moderator, Dr. J. Sacchi)

6.2. General discussion

- 6.2.1. Suggestions to improve data collection and monitoring schemes on by-catch to be submitted to the SAC/GFCM
- 6.2.2. Review of the existing initiatives related to by-catch monitoring

7. Any other matters

8. Conclusions and Recommendations

9. Adoption of the Report

GFCM Recommendations concerning the reduction of by-catch

- REC. GFCM/2005/1 On the management of certain fisheries exploiting demersal and deepwater species.
ftp://ftp.fao.org/FI/DOCUMENT/gfcm/web/GFCM_Recommendations2005.pdf
- REC. GFCM/2005/3(A) Concerning ICCAT Recommendation [03-04] relating to Mediterranean swordfish.
ftp://ftp.fao.org/FI/DOCUMENT/gfcm/web/GFCM_Recommendations2005.pdf
- REC. GFCM/35/2011/3 On reducing incidental by-catch of seabirds in fisheries in the GFCM Competence Area.
http://151.1.154.86/GfcmWebSite/docs/RecRes/GFCM_2011_RecRes_en.pdf
- REC. GFCM/35/2011/7(E) Concerning ICCAT Recommendation [07-07] on reducing the incidental by-catch of seabirds in longline fisheries.
http://151.1.154.86/GfcmWebSite/docs/RecRes/GFCM_2011_RecRes_en.pdf
- REC. GFCM34/2010/4(C) On the conservation of thresher sharks (Family Alopiidae) caught in association with fisheries in the ICCAT convention area.
http://151.1.154.86/GfcmWebSite/docs/RecRes/GFCM_2010_RecRes_en.pdf
- REC. GFCM/35/2011/7(B) Concerning ICCAT Recommendation [10-06] on Atlantic Shortfin Mako (*Isurus oxyrinchus*) sharks caught in association with fisheries managed by ICCAT.
http://151.1.154.86/GfcmWebSite/docs/RecRes/GFCM_2011_RecRes_en.pdf
- REC. GFCM/35/2011/7(C) Concerning ICCAT Recommendation [10-08] on Hammerhead sharks (Family Sphyrnidae) caught in association with fisheries managed by ICCAT.
http://151.1.154.86/GfcmWebSite/docs/RecRes/GFCM_2011_RecRes_en.pdf
- REC. GFCM/35/2011/4 On the incidental by-catch of sea turtles in fisheries in the GFCM Competence Area.
http://151.1.154.86/GfcmWebSite/docs/RecRes/GFCM_2011_RecRes_en.pdf
- REC. GFCM/35/2011/5 On fisheries measures for the conservation of the Mediterranean monk seal (*Monachus monachus*) in the GFCM Competence Area.
http://151.1.154.86/GfcmWebSite/docs/RecRes/GFCM_2011_RecRes_en.pdf

Using indicators to quantify fishery discards: some recent examples

Discards mitigation is one of the core aspects of modern fisheries management. Several organizations and countries already have or are in the process of implementing management measures to reduce discarding. However, the existing complexity of factors affecting the variability of discards highlights the need for good understanding of discards incentives before decision making on management measures. Rochet & Trenkel (2005) provided an inclusive overview concerning these factors and related them to (i) resource availability (environmental conditions, species composition of communities or length structure of populations, year-class strength), (ii) fishing operation (fishing time, fishing methods), (iii) catch (amount of catch and landings, length composition of the catch), (iv) market incentives (market prices), (v) technical constraints (hold capacity) and (vi) regulations (minimum landing size, total allowable catch and quotas). Given this variety of factors that affect discarding, the development and use of indicators is essential for evaluating the implementation of policies aiming discards mitigation (Catchpole *et al.* 2011).

The use of indicators as tools to identify changes, quantify problems and monitor the implementation of policies and regulations is developed rapidly in fisheries and ecosystem fields (Jennings 2005). The selection of a robust set of informative and easily interpretable indicators is required by the policymakers, managers and stakeholders, in order to evaluate the performance of management measures or to validate the current status of ecosystem before the establishment of precautionary and mitigation actions. Rice & Rochet (2005) proposed a framework for the objective selection of a suite of indicators to be used in fisheries management. The eight steps that compile the indicator selection framework are: (1) identification of user groups and their needs, featuring the setting of operational objectives, (2) identification of a corresponding list of candidate indicators, (3) assigning weights to nine screening criteria for the candidate indicators: *concreteness, theoretical basis, public awareness, cost, measurement, historic data, sensitivity, responsiveness, and specificity*, (4) scoring indicators against the criteria, (5) summarizing the results, (6) deciding how many indicators are needed, (7) making the final selection of complementary suites of indicators and (8) presenting to all users of the information contained in the final selected indicators.

In the EU there is intensive data collection of by-catch and discards onboard commercial vessels, but there have been few attempts to describe the general patterns in these data, and still less to understand the factors that determine what and how much is discarded. The latter step is crucial for developing operational indicators and proposing mitigation tools for fisheries management. Based on these data, several efforts have initiated towards this direction. In the framework of the Marifish Badminton Project, a provisional list of pressure, state and response indicators was drawn to tackle specific issues related to catch and discarding practices in European fisheries and fleets. Candidate state indicators describing the ecosystem or fish community, that can be quantified using data derived through fishery independent surveys, pressure indicators describing the intensity and selectivity of fishing (input to the fishing activity) as well as the catch & discards (output of the fishing activity), depending on records made by observers on board commercial vessels, and response indicators reflecting management efficiency for limiting by-catch and discards appear in Table 1. ICES Working Group on

Ecosystem Indicators of Discarding analyzed available data on cod discards in the Baltic Sea (ICES WKEID 2010). The quality of data and sampling was evaluated and discards rates were statistically modeled and considered as indicators in a preliminary approach at national and regional levels. However, the working group concluded that a single indicator (discards rate) cannot describe discarding and effectively evaluate relevant policies. Catchpole *et al.* (2011) proposed a Discard Quantity Index to provide annual changes in total discard quantity. However, they noted that changes in total annual discards may not reflect changes in discarding practices but may be affected by fishing effort. Therefore, they also calculated a Discard Rate Index adjusted to fishing days and Discard Proportion Indices adjusted to total landings, based on effort raised data, to demonstrate how discarding behaviour during fishing operations changes with time (Catchpole *et al.* 2011). Based on these indices, which were most powerful when used in combination, a reduction of 61% between 2002 and 2008 in the weight of discards was revealed, which was attributed to reducing levels of fishing effort and diminishing catch weights instead of changes in discarding practices (Catchpole *et al.* 2011).

Approaches which use regularly collected fisheries data (landings, fishing effort) and observers onboard to estimate discards quantities and practices, like the one proposed by Catchpole *et al.* (2011), are particularly useful and relatively easy to implement in data poor regions like the GFCM area. Nevertheless, the existence of reliable, unbiased data and good time series is essential for the use of such indices and the development and evaluation of new metrics. Standardization of data collection schemes among different areas and countries is necessary for testing the applicability of these indicators in a large spatio-temporal scale.

Table 1. List of candidate indicators for describing by-catch and discards of different fleets and fisheries (source: BADMINTON mid-term report).

Type of indicator	Proposed indicators
Pressure indicators describing the intensity and selectivity of fishing (input to the fishing activity)	<ul style="list-style-type: none"> - selectivity-at-length curves by gear / fleet / fishery - number of vessels, fishing time, fishing time × power by gear / fleet / fishery
Pressure indicators describing catch & discards (output of the fishing activity)	<ul style="list-style-type: none"> - catch and discards amount: whole catch / per species - minimum, mean and maximum size of catch & discards (whole catch / per species) - sorting size for species that are both retained and discarded - diversity indices (richness, evenness) of total catch - trophic level of total catch
State indicators describing the ecosystem or fish community	<p>Stock level:</p> <ul style="list-style-type: none"> - total biomass or SSB - descriptors of age or length structure (e.g., 25%, the 75% percentile of the length distribution) <p>Community / ecosystem level:</p> <ul style="list-style-type: none"> - total biomass - diversity indices (richness, evenness) of the community - mean trophic level of the community - descriptors of size structure (e.g., proportion of large fish) - proportion of non-commercial species
Response indicators describing the regulations intended to improve selectivity / limit discarding	<ul style="list-style-type: none"> - stock-specific Minimum Landing Size - mesh size regulation - selective devices regulations - discarding regulations

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- ICES WKEID 2010. Report of the Working Group on Ecosystem Indicators of Discarding (WKEID). 28 September - 1 October 2010, ICES HQ, Copenhagen, Denmark, 66p.
- Jennings S. 2005. Indicators to support an ecosystem approach to fisheries. *Fish and Fisheries* 6: 212-232.
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