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**GENERAL FISHERIES COMMISSION FOR  
THE MEDITERRANEAN**

**COMMISSION GÉNÉRALE DES PÊCHES  
POUR LA MÉDITERRANÉE**



**GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN**

**COMMITTEE ON AQUACULTURE (CAQ)**

**Seventh Session**

**Rome, Italy 8-10 March 2011**

**REPORT OF THE WGSC - SHoCMed MEETING ON  
ENVIRONMENTAL QUALITY STANDARDS FOR MARINE FISH  
FARMS**

**St. George's Bay, Malta, 23-25 November 2010**

(Draft)

## **OPENING OF THE MEETING**

1. The WGSC-SHoCMed meeting on environmental quality standards for marine fish farms was held from 23 to 25 November 2010 in St. George's Bay, Malta. It was organised by the Working Group on Siting and Carrying Capacity and was hosted by the Ministry for Resources and Rural Affairs of Malta. The meeting was attended by experts from Albania, Greece, Croatia, Spain, Turkey, Israel, Italy, Malta, Tunisia, France and Montenegro. The Agenda of the meeting as well as the list of participants is attached to this report respectively in Appendix I and Appendix II.

2. The meeting was opened by the Coordinator of the Working Group of Site Selection and Carrying Capacity, Mr. Ioannis Karakassis. He recalled the objectives of the WGSC and of the SHoCMed project, and in particular he made reference to the major related concepts and steps to achieve the objectives of the meeting, with a focus on the identification of Environmental Quality Standards. Furthermore he referred to the specific challenges for the establishment of environmental quality standards, to the answers given by different agencies in various parts of the world and the need for specific standards for aquaculture in the allowable zone of effect (AZE)<sup>1</sup>, other than those proposed for the implementation of the Water Framework directive of the European Union (EU). Finally he presented the specific

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1. The AZE is an area around the farm which is expected to become impacted by farming activities (Cromeey & Black 2005). The AZE is a concept used in some countries (in the immediate vicinity of the farms).

tasks that were expected to be discussed during the Malta workshop for the development of environmental quality standards.

3. Mr Fabio Massa, from the GFCM Secretariat, welcomed the participant and recalled the importance given by the Commission to the issues related to site selection and the integration of aquaculture into coastal areas and, in more in general terms, to the development of sustainable aquaculture within Mediterranean countries. He also informed the experts on the main issues talked by the Indicators for Sustainable Development of Aquaculture and Guidelines for their use in the Mediterranean (InDAM) project within the activities of the Working Group on Sustainability on Aquaculture (WGSA).

4. The participants were also informed on the outcomes of the WGSC-SHoCMed Workshop on Allocated Zones for Aquaculture (AZA) held in Seville, Spain, 18<sup>th</sup>-20<sup>th</sup> October 2010, by Mr. Pablo Avila, chairman of the workshop. A brief description of the schedule and agenda of the workshop as well as of the presentations given by the participants was made. The main outputs from the discussion on AZA and the reached conclusions were reported, highlighting the importance of the definition and of the implementation of AZA within the Mediterranean countries as a mean to achieve a sustainable development of aquaculture. Some definitions and attributes for AZA were given, as well as some recommendations guidelines on how AZA has to be defined and implemented according to an Ecosystem Approach for Aquaculture (EAA) and within the Integrated Coastal Zone Management (ICZM) framework.

## **REVIEW AND SYNTHESIS OF MEDITERRANEAN ENVIRONMENTAL QUALITY STANDARDS APPLIED TO AQUACULTURE MONITORING**

5. Two case studies on marine fish farm monitoring in Italy, one located in the South Adriatic Sea and the other in North Tyrrhenian Sea, were presented by Mr. Paolo Tomassetti, from the Italian National Institute for Environmental Protection and Research (ISPRA). The results obtained by analyzing chemical and biological indicators showed signs of environmental perturbation in the fish farm with low sea current speed and mainly muddy sea bottoms. On the contrary the fish farm with high sea current speed and sandy bottom did not show evident adverse impacts. These results enabled selection of chemical, biological and site specific indicators to be used in monitoring programmes for European sea bass and gilthead sea bream farms. The selected chemical indicators are: redox potential, sulphide, total carbon, total organic carbon, total nitrogen, total phosphorus, and total sulphur. The selected biological indicator is the macrobenthic fauna. The selected site specific indicators are: sea current speed and sediment grain size. These research activities can be useful to establish guidelines for site selection and monitoring programmes of marine fish farms in Italy.

6. Ms. Giulia Li Bianchi, from the GFCM Secretariat, presented a preliminary report on the Environmental Quality Standards for marine fish farms in the different GFCM member countries. She considered the monitoring of chemical, physical and biological parameters from a legislative point of view and described the monitoring protocols and the threshold values used in five countries: Croatia, Cyprus, Malta, Tunisia and Turkey. She also presented the environmental quality standards for Mediterranean countries, highlighting that several countries have no reference values for monitoring.

7. Ms. Danijela Joksimovic, research scientist from Montenegro, gave a presentation on “Monitoring water quality at fish and mussels farm on the Montenegrin coastline” based on the agreement between the Ministry for Agriculture, Forestry and Water Management (MAFWM) and the Institute of Marine Biology (IMB). The IMB is a national laboratory reference for the monitoring of water quality in fish and mussels farms (Law on Marine fishery and Mariculture, Article 88-2009). There are two fish farms in Kotor Bay and it is considered that fish farms have a negative interaction with the marine environment, so the recommendation is that in the future this type of farming should be located at suitable localities *i.e.* in the open part of the Montenegrin Sea in presence of currents. In the framework of the Montenegro Institutional Development and Agriculture Strengthening (MIDAS) Project, funded by the World Bank. A part of the Institute of Marine Biology will be reconstructed and a new Laboratory (EU DG SANCO approval) licensed and accredited as per regulations for monitoring water quality in mariculture, will be built.

8. Ms. Guzel Yucel Gier, from Dokuz Eylul University, Institute of Marine Science and Technology (IMST) in Turkey, presented a report on the recent advance on the “Road Map for Turkish Marine aquaculture site selection and zoning using an Ecosystem Approach to Management”. This was to be developed during a series of workshops and activities held in Ankara, Izmir and Mugla. Following organizational and scoping discussions between the international and local team members, stakeholders of the coastal zone, jointly selected by Ministry of Agriculture and Rural Affairs (MARA) and FAO, were invited to attend two workshops. They were asked to identify, define and discuss their problems, to classify them as urgent, medium or long term, identify the responsible institutions and to cooperate in the development of action plans, including aspects related to site selection for aquaculture and for their resolution in a participatory manner.

9. Mr. Houssam Hamza, from the Tunisian Ministry of Agriculture, Hydraulic Resources and Fisheries, made a presentation of the Tunisian experience on Allocated Zones for Aquaculture and the different steps to obtain final agreement for the activity of marine aquaculture. A description of the Tunisian standard and monitoring system was presented to show the specificity of this activity and its interaction with the other marine space users. Special attention was given also to the Tunisian strategies for aquaculture sustainable development by starting a survey on site selection, farm monitoring and sanitary issues.

10. Mr. Joseph A. Borg, from the Department of Biology, University of Malta Msida, made a presentation on general aspects of monitoring of aquaculture in Malta. Sea bass, sea bream and meagre are produced by one farm, and capture-based farming of bluefin tuna is carried out by five tuna farms. Environmental monitoring of aquaculture was initiated in the early 90's, when there were no national guidelines. However, in 1994, the Malta Environment and Planning Authority<sup>2</sup> (MEPA) issued guidelines for environmental monitoring of sea-based fish farms in the Maltese Islands. Environmental monitoring of tuna farms was started in Malta in 1999 with initiation of tuna penning activities, and has been undertaken regularly to date. The results of such environmental monitoring indicated that adverse impacts (significant changes in benthic diversity, organic carbon and organic nitrogen levels, and mean sediment grain size), when detected, were mainly localised in the immediate vicinity of the tuna pens. In 2005, the Maltese Fisheries Conservation and Control Division of the Ministry for Rural Affairs and the Environment (responsible also for aquaculture) applied to the MEPA to designate an “Offshore Aquaculture Zone” (OAZ), where tuna penning

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<sup>2</sup> Known then as the Planning Authority.

operations started in July 2006. To date, the results of monitoring of sediment quality and benthic diversity indicated that there was no significant adverse impact on the seabed within the OAZ that may be attributed to the tuna penning activities. Mr. Joseph A. Borg presented conclusions acquired from experience of monitoring aquaculture activities on Malta.

11. Some reflections were made by the participants and discussions were held on the difficulties in reaching an acceptable level of standards when monitoring activities are implemented in the areas surrounding marine fish farms. Some participants highlighted that the adoption of the Water Framework Directive by EU countries which requires that by 2015 all coastal areas including those where fish farms are currently established will comply with a set of standards at 5 levels reaching at least the level “Good”. It was remarked that this scheme is unlikely to be compatible with cages for finfish marine aquaculture as several studies have shown. Moreover it was said that a monitoring system should be more efficient and reference was made to the importance of a monitoring system in the immediate vicinity of the farms. This could be more realistic for addressing the issues of environmental protection. The adoption of the Allowable Zone of Effects (AZE) as applied in other regions could be more focused for monitoring the environment surrounding the farms. In this respect the term of AZE was adopted by the participants as the area that can be influenced by the farm and in which the monitoring activities should be done.

#### **METHOD AND SUGGESTED VALUES FOR EQS FOR FINFISH MARINE AQUACULTURE ACCORDING TO THE DIFFERENT ENVIRONMENTS**

12. Mr. Pablo Sanchez-Jerez, from the University of Alicante in Spain, presented some considerations about the “Delphi approach for selection of Variables and Environmental Quality Standards for monitoring Mediterranean fish farming: test of an online questionnaire” applied by the WGSC. He explained that the Delphi method is a systematic, interactive forecasting method which relies on a panel of experts and the reason for using this method is to implement multi-stakeholders approaches for participative policy-making, and in the present case, to develop monitoring programmes for fish farming aquaculture on coastal Mediterranean areas. Some examples of Delphi studies applied to aquaculture were shown. Considerations about experimental design, and temporal and spatial scales were also discussed. Finally, he presented the results from a Delphi pilot study to show the partners the potentiality of the online questionnaire development at the GFCM secretariat preparing a dedicated platform.

13. The discussion focused on the validity of the test made on the Delphi approach and participants agreed on the methodology applied in support of the discussion of the WGSC. It was also agreed that the platform developed by the GFCM secretariat should be further developed and implemented to improve the discussion for the determination of the environmental variables for monitoring the environment surrounding fish farms. In this respect the experts decided to organise a new Delphi round discussion<sup>3</sup> during the workshop considering a wide range of indicators for both the sediment and the pelagic environment surrounding the cages.

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<sup>3</sup> Within the activities of the 2<sup>nd</sup> year of SHoCMed and with reference to the EQS, the WGSC required the establishment of a Delphi-driven procedure to support a panel of experts in the Mediterranean areas in determining such standards. The Delphi that is being carried out is based on the preparation of a technical questionnaire that are being distributed among selected experts through a dedicated web platform and the results are successively analyzed by the WGSC.

14. As a result of the first Delphi round discussion a series of variables were ranked for monitoring the quality of the benthic habitats (*Beggiatoa*<sup>4</sup>, gas bubbles, farm litter), the chemical variables for monitoring the benthic habitats (COD, total organic matter, sulphide, total sulphur, total phosphorus, total carbon, total organic carbon). Regarding biological indicators, the following were selected by the experts: total macrofaunal biomass, number of species, index of diversity (Shannon-Wiener), AMBI (AZTI's Marine Biotic Index, dominance calculated using abundance data and Capitellid polychaetes as percentage of total faunal abundance). Furthermore redox potential was selected for the quality of benthic habitats, whereas dissolved oxygen, chlorophylla and turbidity were selected for monitoring water column quality.

15. On the basis of the results obtained the experts confirmed the necessity to plan a second Delphi round discussion with a number of experts from a wide range of Mediterranean countries and different production situations. The experts will be invited by the Secretariat to confirm the variables for which the indication of two thresholds, one for the cautionary values and one for the critical values, will be established. The results will be analysed and discussed accordingly.

16. Mr. Dror Angel, from the University of Haifa, recalled that the public availability of the reports on the analysis of the environment surrounding aquaculture facilities would improve the image of aquaculture and of its product. In many places there is the suspicion associated with aquaculture activity that fish farmers are not reporting the real situation to the authorities and this has a serious negative impact on the image of aquaculture. In order to improve public opinion regarding fish farming (*i.e.* the integrity of this industry), in particular and regarding aquaculture as a whole, it is important to consider how the results of farm monitoring could be made transparent (*i.e.* freely accessible) to the public, since the sector must ultimately adhere to and comply with regulatory standards.

17. Participants further commented on the necessity to increase communication between farmers and the society and concurred that data analysis of the environment surrounding the fish farms should be made public in order to improve the image of aquaculture.

## CONCLUSION AND RECOMMENDATION

18. A brainstorming discussion among the experts followed and can be summarised as below:

- The WGSC reviewed the situation in different countries regarding monitoring requirements and standards. The discussion confirmed the great variability in legislative frameworks across the Mediterranean as previously found within the other activities of the WGSC-SHoCMed (site selection procedures and licensing, etc) as well as the lack of specific Environmental Quality Standards (EQSs) for monitoring environment surrounding aquaculture facilities and corresponding to precise and stated Environmental Quality Objectives (EQOs).

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<sup>4</sup> *Beggiatoa* is a genus of colorless, filamentous proteobacteria. With cells up to 200 microns in diameter, species of *Beggiatoa* are among the largest prokaryotes and are found in polluted marine environments, and can be seen by the naked eye as a white filamentous mat on top of the water as a sign of environmental deterioration. Dudley, M. [http://filebox.vt.edu/users/chagedor/biol\\_4684/Microbes/Beggiatoa.htm](http://filebox.vt.edu/users/chagedor/biol_4684/Microbes/Beggiatoa.htm)

- During the discussion, participants stressed that research activities and results of monitoring have an essential role in the identification and determination of the EQSs. These will also help countries to determine such values in consideration of the environmental condition of the different allocated sites for fish farms. Regulation and monitoring should be adapted to the environmental conditions to the Mediterranean countries and threshold should also be based on the existent experience.
- Both the lack of EQSs and the variability of monitoring practices leave the aquaculture industry exposed to bear the responsibility that can generate conflict with other users and interests in the coastal zone. Therefore the WGSC emphasised the need to establish not only criteria for site selection but also EQSs agreed between the regulators and all the stakeholders in the coastal zone.
- Transparency in data reporting is an essential element in the collection of monitoring information on fish farms. Indeed, the image of aquaculture can be severely affected by the suspicion that fish farmers do not report real data to authorities, especially if the sector must comply with regulatory standards. It is therefore important to consider ways to make the results of farm monitoring freely accessible to the public, in order to improve public opinion on aquaculture and aquaculture products.
- For the monitoring of the environment surrounding the aquaculture facilities, the adoption of the AZE (allowable zone of effects or mixing zone) concept should be used in the immediate vicinity of the farms, to become a useful tool for addressing the issue of environmental protection in a realistic way.
- The WGSC agreed on the need for specific EQSs for aquaculture within this AZE in order to ensure that this zone will not be degraded to a point beyond which the services provided by the ecosystem will be severely or irreversibly compromised. The adoption of such standards will protect both the environment and the fish farms from adverse effects on the farms which may result in reduced growth, disease or mortality.
- The WGSC reviewed a wide spectrum of variables and metrics that could be used to produce EQSs and selected a number of the most relevant ones based on a series of criteria including reliability, cost effectiveness and proven scientific merit.
- The selected variables will be used by the WGSC for a Delphi exercise using a large number of experts from the Mediterranean countries, or using previous working experience in the Mediterranean, to obtain expert opinion on thresholds for (a) the precautionary condition and (b) the critical condition which, when exceeded, should trigger more intense monitoring and mitigation measures including the possibility for introducing production strategy measures (reduction, species change, etc.).
- From the Delphi shortlisted EQSs variables, the most appropriate indicators (or EQS) for use in monitoring will be selected by the WGSC, based on their consistency of response over time and space. This selection should also be based on the understanding of such indicators by stakeholders with relevance to the environmental assessment, to the feasibility of use (i.e. cost-effectiveness) and to their sensitivity in detecting environmental changes and to enable appropriate mitigation/management actions to be undertaken. The outcome of this exercise will have to be discussed with stakeholders to ensure maximal consensus and applicability in the Mediterranean context.

- Another set of qualitative and quantitative information was also taken into consideration by the experts and which should be also considered to be recommended to be part of the standard monitoring as indicators for the Mediterranean. These are: depth, sediment type, distance from shore, hydrodynamic regime, exposure and farmed species. Macroscopic descriptors of environmental conditions such as: outgassing, Beggiatoia, colour, including protected species and habitats.
- The establishment of EQSs will improve the Environmental Impact Assessment (EIA) process since it will allow predictions against predefined and known criteria, thus increasing consistency in the licensing and monitoring procedures. This will increase the relations between farmers and regulators.
- The WGSC also discussed other needs for monitoring that are to be addressed in the final proposal, including (a) differences between offshore and coastal aquaculture sites, (b) particular extra environmental variables that have to be monitored in specific types of farming (e.g. tuna), (c) different number of variables and/or frequency of monitoring depending on farm size and/or sensitivity of the receiving environment, (d) specific measures for monitoring AZAs and (e) availability of information regarding the effects of the environment and other activities on aquaculture.
- The monitoring of the activities of finfish marine aquaculture is essential to evaluate the effects and interaction of aquaculture on the environment and on aquaculture itself. Environmental monitoring should also be made on the human activities that can impact aquaculture, including any kind of environmental risks from the other human activities in the surrounding marine area.

## **WORKPLAN**

19. The GFCM Secretariat presented the workplan of the activities of the WGSC for 2010-2011 and focused on SHoCMed activities as agreed during the third CMWG carried out in FAO-HQ in February 2010 and reported to the 34<sup>th</sup> Commission of the GFCM. These include the activities related to the outputs: Output 1: The study to design the best strategy for a consensus on site selection and establishment of Mediterranean standards for carrying /holding capacity of aquaculture farms. Outputs 2: Review on relevant source of information and scientific evidence for thresholds related to the environmental changes; and Outputs 3: Production of criteria and related guidelines of aquaculture site selection.

20. The workplan activities as included in the project SHoCMed for the second year of activities is attached as Appendix III.

**Appendix I****Agenda**

1. Opening of the meeting
2. Review and synthesis of Mediterranean environmental quality standards applied for aquaculture monitoring
3. Method and suggested values for EQS for finfish marine aquaculture according to the different environments
4. Production of criteria and related guidelines (including standards) for aquaculture site selection in the GFCM region
5. Conclusion and Recommendations



## Appendix II

## List of participants

**Pablo AVILA**

Aquaculture and Fisheries Advisor  
 Junta de Andalucia  
 Empresa Publica Desarrollo Agrario y  
 Pesquero  
 Calle Severo Ochoa 38  
 Parque tecnologico de Andalucia  
 Campanillas 29590 Málaga, Spain  
 Tel: +34 951924081  
 Mob: +34 670944050  
 Fax: +34 951924083  
 E-mail: pavila@dap.es

**Joseph A. BORG**

Department of Biology, University of  
 Malta Msida, Malta  
 Tel: +356 23402088  
 Fax: +356 342488  
 E-mail: joseph.a.borg@um.edu.mt

**Maria COZZOLINO**

Institute for Economic Research on  
 Fisheries and Aquaculture (IREPA)  
 Via S. Leonardo - Traversa Migliaro  
 84131 Salerno, Italy  
 Phone: +39 089330919  
 Fax: +39 089330835  
 E-mail: cozzolino@irepa.org

**Dror ANGEL**

University of Haifa  
 Mt Carmel, 31905 Haifa, Israel  
 Tel: +972 4 828 8130  
 Tel: +972 4 824 0493  
 E-mail: adror@research.haifa.ac.il

**Nathalie ELLUL**

MEPA, Environmental Permitting &  
 Industry Unit  
 P.O. Box 200, Marsa, MRS 1000, Malta  
 Tel: +35622907231  
 E-mail: nathalie.ellul@mepa.org.mt

**Cristina GARCIA DIEZ**

Spanish Aquaculture Observatory  
 Foundation (FOESA)  
 C/Fortuny, 47 1º 17, Madrid,  
 Spain  
 Tel: +34 91 310 75 46  
 Fax: +34 91 702 34 74  
 E-mail: cgarcia@fundacionoesa.es

**Sébastien GOUPIL**

Bureau de la Pisciculture et de la Pêche  
 Continentale (BPPC), Direction des Pêches  
 Maritimes et de l'Aquaculture (DPMA)  
 Ministère de l'Alimentation, de  
 l'Agriculture et de la Pêche (MAAP)  
 3, place Fontenoy  
 75007 Paris, France  
 tél : +33 (0) 1.49.55.57.91  
 fax : +33 (0) 1.49.55.82.00  
 E-mail :  
 sebastien.goupil@agriculture.gouv.fr

**Houssam Auadh HAMZA**

Head of Department, General Direction of  
 Fishries and Aquaculture  
 Tunis, Tunisia  
 Tel: +216 71782635  
 Fax: +216 71799401

**Danijela JOKSIMOVIC**

Institute of Marine Biology  
 Dobrota bb  
 P.Box 69, Kotor, 85 330  
 Montenegro  
 Tel/Fax +382 32 334 570  
 Cell + 382 67 830 182  
 E mail: djoksimovic@ibmk.org

Ioannis **KARAKASSIS**  
University of Crete  
Biology Department  
Vasilika Vouton  
71409 Heraklion Crete, Greece  
Tel: +30 2810394061  
Fax: +302810384408  
E-mail: karakassis@biology.uoc.gr

Melvin **MAGRI**  
Malta Aquaculture Research Centre  
Fort San Lucjan, Marsalokk  
Malta  
Tel.: +356 22293300  
Fax: +356 21659380  
E-mail: melvin.magri@gov.mt

Carmen **MIFSUD**  
MEPS, Ecosystems Management Unit  
PoBox 200, Marsa, 100 Malta  
Tel: +356 22907103  
E-mail: carmen.mifsud@mepa.org.mt

Maja **POLIC**  
Ministry of Agriculture, Fisheries and Rural  
development, Department of Fisheries  
I. Mažuranića 30, 23000 Zadar, Croatia  
Tel: +385 23 309820  
Fax: +385 23 309830  
E-mail:  
mps-uprava-ribarstva2@zd.t-com.hr

Pablo **SÁNCHEZ JEREZ**  
Senior Lecturer  
University of Alicante  
Dept. of Marine Science and Applied  
Biology. Edf. Ciencias 5 Ap. C. 99 03080  
Alicante, Spain  
Tel:+ 34 965903400, ext 2977  
Fax:+ 34 965909897  
E-mail: psanchez@ua.es

Paolo **TOMASSETTI**  
Research scientist  
ISPRA Aquaculture Unit  
Via di Casalotti 300, Roma, Italy  
Tel: +39 06 61570553  
Fax: +39 06 61561906  
E-mail: paolo.tomassetti@isprambiente.it

Guzel **YUCEL GIER**  
Dokuz Eylul University  
Institute of Marine Science and  
Technology  
Baku Bvd 100  
35340 Inciralti, Izmir, Turkey  
Fax: +090 232 2785082  
E\_mail: yucel.gier@deu.edu.tr

Fabio **MASSA**  
Aquaculture Officer  
CAQ Technical Secretary  
International Institutions and Liaison  
Service  
Fisheries and Aquaculture Economics and  
Policy Division  
Fisheries and Aquaculture Department  
Tel.: +39 06 57053885  
Fax: +39 06 57056500  
E-mail: fabio.massa@fao.org

Giulia **LI BIANCHI**  
Fisheries and Aquaculture Department  
Tel.: +39 06 57055078  
Fax: +39 06 57056500  
E-mail: giulia.libianchi@fao.org

## Appendix III

**SHoCMed Workplan for the second year of activities****OUTPUT 1**

**Completion of the preliminary study to design the best strategy to achieve consensus on site selection on the establishment of Mediterranean standards for carrying/holding capacity of aquaculture farms**

**Activity 1.1 *Organization of a workshop on AZA legislation.*** The main aims of the workshop can be summarised as: *a) Review and make synthesis of Mediterranean experience on Allocated Zones for Aquaculture; b) Review technical and legal procedures applied within the different coastal areas and related to the AZA; c) Consider the different formats and experiences on GIS techniques for planning aquaculture activities in coastal areas.* A common template to be sent to selected participants for presentation of the case studies will be prepared as case studies.

**Activity 1.2 *Preparation of a review on the experience and knowledge on Allocated Zones for Aquaculture (AZA) activities*** and the integration of aquaculture into coastal zone management and guidelines (legal aspects, methodologies, procedures). A technical document on the AZA in the Mediterranean will be based on the discussion/synthesis held in the AZA workshop and on information on AZA that will be collected in other Mediterranean areas and not presented during Activity 1.1.

**Activity 1.3 *Finalization of a review on legal aspects related to site selection and carrying capacity*** collected during the SHoCMed first year of activities. Further attention will be given on gaps in reporting and communication of monitoring programmes and the legal procedures implemented for improving the governance and the participation of the different stakeholders. Information included in the report should be improved to cover some countries not yet included in the document. In addition, national experts already contacted during the first year of SHoCMed, will be again contacted for updating the information if necessary. The report will be translated into French and published as *GFCM Studies and Reviews* for a wider diffusion within the GFCM Members.

**OUTPUT 2**

**Production of criteria and related guidelines (including standards) for aquaculture site selection in the GFCM region**

**Activity 2.1 *Improvement of the SHoCMed database hosted in the SIPAM website,*** by including metadata or published information on the interaction between aquaculture and environment. Attempts will be made to enhance cooperation with national research institutions in order to improve/update data and their utilisation. This part should be carried out in close collaboration between the WGSa and SIPAM. The SHoCMed portal hosted by SIPAM will be improved by the GFCM Secretariat.

**Activity 2.2 *Preparation of a Glossary on Site Selection and Carrying Capacity for aquaculture activities.*** This glossary should include legal aspects, the different terms used by WGSC, related to the Site Selection Issues. The possibility to open one specific section related to site selection and carrying capacity issues in the FAO Glossary of Aquaculture will be also investigated. The online Glossary could be used as a repository system for new terms and definitions on site selection for aquaculture and put at disposals of the countries.

### OUTPUT 3

#### Issues regarding carrying capacity of aquaculture sites and carrying capacity standards and identification of Environmental Quality Standards (EQS)

##### **Activity 3.1. Strengthening of the network on Site Selection and Carrying Capacity for aquaculture activities in the Mediterranean region**

During the first year of activities, the work carried out by the WGSC within the SHoCMed project also permitted the establishment of a network of experts and stakeholders from different Mediterranean countries, to share and discuss on the main aspects of site selection and environmental impact and monitoring of aquaculture activities within CZM. This communication system on site selection and carrying capacity within the WGSC will be further strengthened in support to all SHoCMed activities.

##### **Activity 3.2 Environmental Quality Standards and EQS Delphi method**

Activity 3.2.1 The definition of the EQS and to the main environmental parameters identified by the WGSC will be discussed among the experts within the Mediterranean areas. This activity will also be carried out through the Delphi method for determining the EQS values from a panel of experts in the Mediterranean areas. To optimize the work of this activity a specific IT platform will be developed and implemented within the SHoCMed portal.

Activity 3.2.2 A First round discussion on Delphi results will be done by the WGSC by the Organization of a workshop (on Identification on Environmental Quality Standards (EQS) for Marine fish farms). The main objective of this workshop should be to discuss the results of the first round of Delphi and should be an expert's discussion on the interactive method applied and results. The workshop will be also an opportunity to present the results of the meeting on AZA.

Activity 3.2.3 A Second restricted round with selected experts on Delphi results will be done for fine tuning and follow up.

**Activity 3.3 Regional review on carrying capacity of aquaculture sites and carrying capacity standards** prepared on the basis of the main environmental parameters identified by the WGSC and the main physical parameters (current, depth, distance from the coastline, etc). This activity will be focused on the collection and synthesis of the existing physical parameters (current, depth, distance from the coastline, etc) and, where they exist, of EQS, within the Mediterranean countries.

**Activity 3.4 Collection of review papers (to be added with tables and maps), to be edited and published** The compendium including the relevant SHoCMed reports and reviews prepared during the first year of activities will be improved and finalised for a wide diffusion, including printing.

Linkages with other regional projects related to aquaculture sustainability and ICZM, will also be created to follow links between sustainability of aquaculture and sustainability of Mediterranean fisheries, in particular coastal fisheries.

The integration of the project in the GFCM framework will be beneficial as GFCM will provide regular fora for discussion of the progress and follow-up, as well as access to donor for ad-hoc actions that will be determined in the course of the programme.