



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



Committee on Aquaculture (CAQ)
Working Group on Site Selection and Carrying Capacity (WGSC)
Reports of: Training Workshop on site selection, allocated zones for aquaculture (AZA) and site management for coastal marine aquaculture (M'diq, Morocco, 4-7 February 2013); and
Ad hoc meeting on 'Environmental monitoring scheme for Mediterranean and Black Sea marine aquaculture activities' (M'diq, Morocco, 7-8 February 2013) - (WGSC-SHoCMed)

INTRODUCTION

1. This report comprises two distinct parts which refer to: Part I - the 'Training Workshop on site selection, allocated zones for aquaculture (AZA) and site management for coastal marine aquaculture', held from 4-7 February 2013; and Part II – the ad hoc meeting on 'Environmental monitoring scheme for Mediterranean and Black Sea marine aquaculture activities' held from 7-8 February 2013. The two initiatives were organized back-to-back at the Kabila Hotel in M'diq, Morocco.

PART I: TRAINING WORKSHOP ON SITE SELECTION, ALLOCATED ZONES FOR AQUACULTURE (AZA) AND SITE MANAGEMENT FOR COASTAL MARINE AQUACULTURE

EXTENSIVE SUMMARY

2. The Training Workshop (T/W) on site selection, allocated zones for aquaculture and site management for coastal marine aquaculture was attended by experts from Algeria, Libya, Morocco and Tunisia, as well as by lecture-experts from Spain, Greece, Italy, Tunisia and Turkey. The list of participants is provided in Appendix C to this report. The T/W was organized within the framework of the Working Group on Site Selection and Carrying Capacity (WGSC) SHoCMed project and was designed to support the development of sustainable marine and brackish water aquaculture in the GFCM Area. The T/W is a follow up of the work plan agreed

at the WGSC meeting held in Málaga, Spain (November 2011) and endorsed by the 36th GFCM Session (Marrakech, Morocco, May 2012). The T/W was organized with the cooperation of the Institut National de Recherche Halieutique (INRH) in Morocco, the FAO Department of Fisheries and Aquaculture (FIRA - Aquaculture Service) in Rome, the FAO Sub-regional Office of West Africa (FAO-SNEA) in Tunis, and the collaboration of the Networking of Institutes of Fisheries Research of Maghreb.

3. Allocated zones for aquaculture have been identified as a necessity for activities related to the sustainable development of aquaculture in the Mediterranean and Black Sea. At its 36th Session, the Commission adopted the Resolution GFCM/36/2012/1 on guidelines on allocated zones for aquaculture (AZA). Within the remit of the GFCM work, the T/W has been designed to support the establishment of AZA in the GFCM Area following the adoption of the specific Resolution.

4. The T/W has been both *informative* and *participative* on its process. A well-balanced content between theoretical presentations and practical sessions based on real cases and experiences gained by international experts, were delivered. The T/W mainstream and conduct line were taken from the content of the draft document “Establishment of Allocated Zone for Aquaculture (AZA). Guide for establishing coastal zones dedicate to aquaculture in Mediterranean countries”.¹ A degree of flexibility to adapt to participants’ requests on specific issues (e.g. the Carrying Capacity concept) was also embraced.

5. The activities and results of the T/W, as reflected in the full report, can be briefly summarized in three main parts. The first part provided basic elements and concepts on integrated coastal zone management (ICZM) and ecosystem approach to aquaculture (EAA); the use of the Geographic Information System (GIS); and available case studies on AZA. Practical exercises on stakeholders, parameters and criteria identification as well as a site selection exercise were performed by participants.

6. The second part introduced to the concept of management plan and its components; environmental monitoring programme for AZA; environmental impact assessment (EIA) and interaction of aquaculture and other coastal activities. Special attention was given to the concept of Carrying Capacity as requested by participants. Description of the allowable zone of effects (AZE), and management and planning activities within AZA were also presented. Finally during the third part participants discussed and elaborated a synthesis report on the challenges posed by adopting AZA including main constraints for its implementation and opportunities for aquaculture development.

7. The T/W aimed also to establishing a dialogue among participants in order to receive feedback about the possibility of implementing AZA in their respective countries, and to gather end-users (producers) opinions, suggestions as well as indications about limiting factors for the AZA concept and process.

8. Practical sessions have been held splitting participants into groups in order to facilitate dialogue on the different proposed issues. Presentations from groups and global discussion on

¹ To be published within the GFCM Studies and Reviews series.

the questions raised were encouraged and performed in order to achieve consensus on results. Simple didactic tools, such as image through internet or paper work were used to help participation of all the trainees. Interventions and questions from participants arose throughout the training, with the consequent enrichment of the dialogue and exchange of information among participants. Special effort was made on translating different presentations in English and French as main languages, but also Arabic was used in certain situations.

9. A final practical session with a questionnaire (Appendix E) on main issues related to AZA and AZE was submitted to participants who decided to split into groups clustered by country. Conclusions and recommendations were extracted from the plenary discussion on the questionnaire results.

OPENING, ARRANGEMENT OF THE MEETING AND ADOPTION OF AGENDA

10. Mr Karim Hilmi, Head of Oceanography Division of the INRH welcomed participants in the name of the institution and the hosting country. Mr Hilmi highlighted the high interest on this type of actions, especially from the hosting country, due to the general concern about aquaculture development in northern African countries.

11. Mr Fabio Massa, FAO Aquaculture Officer of the GFCM Secretariat thanked Morocco for its hospitality and participants for their interest on the work performed by the GFCM-CAQ working groups. He underlined the importance of pursuing the sustainable development of aquaculture, especially by the provision of knowledge and tools for the implementation of AZA within the Mediterranean and Black Sea.

12. Mr Hassan Nhhala, Director of the Centre Aquacole of INRH, welcomed and thanked all participants for their interest on this T/W and briefly introduced each of them.

13. Mr Pablo Avila, Coordinator of the CAQ Working Group on Sustainability of Aquaculture (WGSA), introduced himself as facilitator and rapporteur of the T/W and presented the agenda on behalf of organizers. The agenda was adopted and is provided in Appendix A to this report.

INTRODUCTION TO THE AZA CONTEXT

Recent progress and knowledge in the GFCM Area regarding the application of allocated zones for aquaculture (by Massa, F.)

14. Abstract: The structure of the GFCM and the Committee on Aquaculture, their objectives and main lines of work were presented. Special attention was given to the WGSC and its role on addressing the problem of marine space concerning the occupation of the public domain as a constraint for the development of aquaculture in the Mediterranean and Black Sea. In this regard, the most important issue was the Resolution GFCM/36/2012/1 on guidelines on allocated zones for aquaculture (AZA) adopted by the GFCM in 2012. The main aspects of this

resolution were presented as conclusions of all the previous work implemented by a wide range of WGSC experts and as a starting point for the implementation of AZA in all Mediterranean and Black Sea countries.

Guide for the establishment of AZA in Mediterranean countries *(by Macias, J.C.)*

15. Abstract: The draft guide for the establishment of AZA in Mediterranean countries was presented along with other complementary actions within the SHoCMed project. The main objective of the guide is to provide the GFCM Members with a comprehensive and common tool to be applied on the process for the establishment of Allocate Zones for Aquaculture in order to achieve the sustainable development of aquaculture. The content of the guide was presented, in particular focusing on the most important aspects in each chapter and section, including: the main end-users, objectives, principles, approach, establishment, management, and methodological process.

BASIC CONCEPTS FOR AZA

Introduction *(by Macias, J.C.)*

16. Abstract: The most important concepts and the general context of the AZA including: sector planning of aquaculture development, the importance of site selection studies prior to the establishment of AZA, definition and spatial context of AZA, and principles and criteria for the establishment of AZA were outlined. In this sense, special attention was given to the importance of sector planning as a basic tool for the development of localization strategies and zoning for aquaculture. Stakeholders' identification within the sector, their competences and their different interests at stake were analyzed within the development of aquaculture. The importance of studies for site selection in establishing AZA and possibilities for aquaculture development were pointed out. Different terminologies associated to the declaration of areas of interest were presented, as well as main characteristics. In addition a brief analysis of the problem of marine space within the European aquaculture, as acknowledged by the EC within the latest strategic documents published in 2001 and 2009, was mentioned. A basic introduction to principles and concepts to consider for the establishment of AZA including integrated coastal zone management (ICZM), ecosystem approach to aquaculture (EAA), geographic information system (GIS), environmental monitoring programme (EMP), environmental impact assessment (EIA), and carrying capacity (CC) were provided. These elements were then further addressed in depth within other sessions during the T/W.

Integrated Coastal Zone Management and Site Selection for AZA *(by Avila, P.)*

17. Abstract: The main concepts related to the ICZM Protocol approved by countries as the 7th protocol of the Barcelona Convention for the better management and protection of coastal areas in the Mediterranean were presented. Objectives and main principles of the protocol were presented as well as specific aspects related to aquaculture. Instruments for the implementation of the protocol such as information gathering on GIS systems, strategies and plans for aquaculture were proposed and some direct relations to site selection and AZA process were explained.

Ecosystem Approach to Aquaculture (by Soto, D.)

18. Abstract: An introduction to Ecosystem Approach to Aquaculture (EAA) was delivered. Aquaculture zoning and site selection were defined within the concept of EAA i.e. from a conventional to a new vision considering the participatory approach, scale and adaptive approach, towards site selection and site management. Aspects related to economic, environment, social and governance dimensions were explained in the context of EAA. Finally a set of minimum requirements to support the implementation of the EAA such as the creation of adequate legal frameworks, the creation of new institutional arrangements, integration of aquaculture with other sectors and the zoning process were proposed. The process and steps for site selection and the importance of carrying capacity assessment were introduced. The four dimensions of carrying capacity or different types, physical, productive, ecological and social carrying capacity were explained as well as their importance in the process. The ecological footprint was defined and its relation to aquaculture. Phases of the site selection process such as: determination of criteria, estimation of carrying capacity, the holistic decision support, monitoring and evaluation of adaptive management measures, as well as models were presented.

1st PRACTICAL SESSION

19. Abstract: An exercise considering the process of site selection was proposed by Ms Doris Soto. Participants were split in three groups to choose a specific coastal space for aquaculture, in which stakeholders or users of the space had to be identified and listed. As a second step, parameters considered the most relevant for site selection had to be identified, listed and prioritized considering environmental, socio-economics and governance issues. All of them had to be agreed upon the members of the groups in order to achieve a consensus. Results were presented and discussed among the three groups (Appendix D to this report). This exercise was very welcomed by participants and helped in understanding the process of site selection, the principles of participation by involving all stakeholders and also the importance of selecting the most appropriate criteria and parameters applied to all dimensions of sustainability.

ESTABLISHMENT OF ALLOCATED ZONES FOR AQUACULTURE (AZA)

Legal framework to support the establishment and implementation of AZA (by Avila, P.)

20. Abstract: Some of the results and global overview on administrative issues, licensing and regulations for aquaculture within the Mediterranean Sea basin were presented, based on the work carried out by CETMAR and led by Ms Rosa Chapela-Perez under the framework of SHoCMed project. The main constraints concerning legal aspects for the development of aquaculture were explained such as: timing of procedures, coordination among administrations, legal support, rights and responsibilities of the different agents involved, planning and support to decision making among others. The necessity of a homogeneous legal framework to be developed for AZA in order to facilitate the sustainable development of the aquaculture activity was underlined.

Methodological aspects (by Macias, J.C.)

21. Abstract: The methodological aspects concerning the AZA process were presented along with the steps related to the AZA process on a sequential manner: from the identification of needs of development, analysis of the aquaculture sector and the legal framework to the identification of the study area and agents involved. The basic data needed from an administrative and environmental point of view as well as the socio-economic data required was emphasized. The selection of criteria and the representation process on GIS systems were also presented. The consultative process within the participatory approach was highlighted in order to achieve consensus among parties. Finally, an overview of the management plan related to AZA and the integration of AZA in the legal framework were provided.

Spatial tools for aquaculture site selection and planning (by Aguilar-Manjarrez, J.)

22. Abstract: This session combined lectures, plenary discussions, as well working group hands-on activities, and a presentation of software for siting marine fish cages. This session provided concepts, methodological content and illustrative case study applications on the use of spatial tools (i.e. GIS, satellite remote sensing and dynamic models) for aquaculture zoning, micro-zoning, site selection and carrying capacity from around the world. It also focused on the key criteria (i.e. social, economic, environmental and governance) needed for aquaculture zoning and site selection and the participatory process through the EAA. The session did not focus on the tools *per se*, but rather on the spatial issues and the processes and steps required for aquaculture zoning and siting.

2nd PRACTICAL SESSION**Case study on marine cage siting in Oban, Scotland (UK)**

23. Based on a real situation, this case study offered the opportunity to participants to select a site for a given type of farm, based on a minimum set of criteria concerning environmental, economic, social and governance issues. The location of the study was in a small bay on the West coast of Scotland. This exercise used only four variables within a GIS to make a decision about where to locate small cages for marine aquaculture. The farming system was specifically based on relatively small-scale salmon production system. Each of the four selected variables needed to be assessed and scored according to this farming system and the species to be grown. The knowledge required to achieve this reclassification is crucial and it is what makes this an expert system rather than simply a geographical mapping exercise. Participants had to select a site and give reasons for their decision. Finally, the real conclusion of the case study was presented, explaining that due to social reasons the farm was taken away from the original site. The exercise was very welcome by participants and the experience gained was mainly on the aspects of participation, consensus and identification of best criteria for site selection.

OVERVIEW OF THE MEDITERRANEAN EXPERIENCE

Experience for site selection and AZA in Turkey (*by Yücel-Gier, G.*)

24. Abstract: The AZA case of Izmir Bay in Turkey was presented. Located extensively in the Aegean coastal region, marine finfish aquaculture had become a well-established industry in Turkey. Coastal aquaculture had been developing strongly and there was a need for a proper coastal management among the different users of this zone. To this end, in 2007 a new legislation on the protection of coastal waters (especially in enclosed bays and gulfs) affected by fish farming was enacted. Under this environmental legislation only fish farm siting and zoning was subjected to new rules which did not apply to any other stakeholder in the coastal zone. The effective integration of such regulatory assessments into the formulation of policy, investment strategies, spatial plans and natural resource management for coastal areas was essential. In this context GIS was considered an important tool and was applied on land and water use in the Izmir Gulf and Gulluk Bay, the largest enclosed water body on the west coast of Turkey. Before relocation, 127 fish farms had been established close to shore with a reported 60 284 tonnes production capacity in 2006 in Gulluk Bay. Within the terms of the new law, these farms were relocated to open water between Milas and Bodrum in two large AZAs, covering about 20 percent of the total water-surface area available. After relocation took place, the maximum total production capacity (now of 81 fish farms) was readjusted to 88 000 tonnes in Gulluk Bay. Licensed cage areas were restricted to a maximum of 0.5 percent (i.e. 3.03 km²) of the total Gulluk Bay area. Most of the 48 fish farms had a capacity of between 500-1 000 tonnes. In 2011 the production from Gulluk Bay reached 52 000 tonnes, thus making it the premier production area in Turkey. This important area for seabass and seabream production around Gulluk contributed for about 70 percent of total Turkish marine aquaculture production.

Experience for site selection and AZA in Tunisia (*By Hamza, H.*)

25. Abstract: The Tunisian experience on site selection, ICZM and case study for AZA implementation were presented. The choice of Monastir area as case study for AZA was to provide evidence to aquaculture decision-makers and managers in Tunisia on how AZA could be a tool for marine space planning and how it could contribute to a sustainable cages aquaculture. The exercise began by preparing a geographical database by using GIS to map information, existing coastal activities, and the biodiversity of the area as well as environmental parameters. Subsequently a spatial analysis was performed by crossing the several layers to identify suitable sites for AZA and producing visual supports (maps) practical and easily understandable. The identified sites for AZA met the ecological requirements of the species raised (European seabass and gilthead seabream) and marine water quality standards. An 'index of ability' (also called *index of aquaculture potential*) with values ranging between 0 and 4 was employed to introduce the concept of suitable site and absence of conflicts with other users.

Experience for site selection and AZA in Spain (*by Macias J.C.*)

26. Abstract: The case study and experience in Andalucía in Spain were presented. The results obtained from more than 10 years' work on localization studies and experiences in AZA carried out by the Regional Government in the South of Spain were outlined. During this time,

four studies or phases for establishing AZA along the coast of the Andalusia region were performed. It began with the analysis of the coastal zone and lagoons areas followed by off-shore sites. An administrative approach for the identification of possible conflicts of competences and selection of sites with no overlapping of uses was carried out, followed by the selection of criteria and data concerning environmental compatibility of the aquaculture activities. Methods and tools used in each phase of study were explained. Special attention was given to the GIS support tool in which all the field and data work were synthesized. Results, conclusions and the state of the work were presented as well as lessons learned. It was concluded that, while the model for AZA is relatively well developed, informative processes and models for AZA management should be the next focus.

Experience for site selection and AZA in Morocco (by Nhhala, H.)

27. Abstract: The case study presented was one of many others that have been undertaken in Morocco, before the national strategy for fisheries development “Halieutis Plan” was elaborated and adopted. The different planning actions undertaken in the past years were presented with the methodology used for site selection for those areas suitable for aquaculture development. The methodology used was similar to that used for the implementation of AZA. An introduction with the general information describing the areas, followed by more specific information and data concerning environmental conditions and criteria for site selection were explained. After identification of potential sites, the organization of the aquaculture systems within the public domain was established, the aquaculture production systems were explained and some data concerning economic feasibility of projects were presented. In conclusion it was recalled the evolution of the aquaculture industry in Morocco which had suffered in the past years. It was then emphasized that nowadays there is a renewed commitment by the Government to develop managerial and coordination tools for aquaculture based on the knowledge from the research institutions such as INRH with the promotion of activities through the Agence Nationale pour le Développement de l'Aquaculture (ANDA).

MANAGEMENT OF AZA

Management plan for AZA (by Macias J.C.)

28. Abstract: The rationale for a management plan after implementing AZA was introduced. The objectives of a management plan were defined as well as the main aspects to be considered such as: Allowable Zones of Effect (AZE), as a new concept of declared zone with a certain degree of acceptable environmental effects; Environmental Quality Standard (EQS), as the minimum set of parameters to be measured as indicators of the effects on the environment; Environmental Quality Objectives (EQO), as the aims for environmental preservation; Environmental Impact Assessment (EIA), as the basic study to determine the environmental status of an area before setting up any aquaculture activity; and Environmental Monitoring Programme (EMP) for the monitoring of the effects of the aquaculture activity on the environment. The specific content of the management plan was identified and defined, considering aspects such as: definition of an area, description of environmental resources, uses, products and activities, maintenance of structures, external consulting for health and security,

contingency plans, and good practices. Special attention was given to the rights and responsibilities concerning users of the AZA and the legal framework to be considered.

Carrying capacity and AZA (by Karakassis, I.)

29. Abstract: The concept of carrying capacity in the aquaculture context, the interlinks between tools-components of site selection and carrying capacity as well as a brief overview of the environmental interactions of aquaculture in the Mediterranean were presented. Furthermore, a methodology used for the adaption of the aquaculture production levels to environmental characteristics of the receiving environment and the development of EQS for the AZE from the SHoCMed project team were also outlined.

Allowable zone of effect (AZE) (by Tomassetti, P.² and Marino, G.)

30. Abstract: A detailed definition and explanation of the concept of AZE and its role and importance in the environmental monitoring of marine fish farms were presented. Some aspects related to environmental effects of fish farms were given, especially those related to effluents from fish cages. Some concepts such as mixing zone, environmental quality, different types of capacities; carrying, holding, production, environmental, were also defined. Spatial planning and the importance of sizing in relation to the farm dimensions were explained. Relationship between monitoring and AZE was established. Indicators and some case studies showing different effects and determination of area of influence gave a practical view of the concept. Finally and as a summary, some answers were provided to key questions such as: what is AZE? What is the aim of AZE? Who should establish it? Who should be responsible for the monitoring programme? Who will define the EQS? What it should contain? What temporal and spatial definition of monitoring programme around AZE are?

ENVIRONMENTAL ISSUES RELATED TO AZA

Environmental Impact Assessment (EIA) and Environmental Monitoring Plans (EMP) (by Yücel-Gier, G.)

31. Abstract: A series of underwater photographs showing the effect of fish cages on the environment below the farm were presented. This was followed by an examination of monitoring techniques, theoretical models and effects of fish farming on the water column and in the sediments. As aquaculture is very vulnerable to pollution and has a vital interest in maintaining a clean environment, it was emphasised that more than any other coastal zone activities fish farming relies on high quality ecosystems and thus must take better care of them as compared to other marine-based industries. It was argued that this sector must carefully study the causes that adversely affect ecosystems and consequently also affect itself. It is in the interest of all parties that a clear programme of environmental monitoring, with well-defined indices and parameters, is adapted to environmental conditions using scientific criteria, and is objectively enforced. By using a well-developed set of diagrams and maps it was made clear that monitoring plans should be flexible and adaptable taking into account scale (time and space) approach, and it was further

² Mr Tomassetti delivered the presentation.

emphasised that monitoring results should be made public. Monitoring results would help judging the success of mitigation measures in protecting the environment and in the management of AZAs and AZEs.

Exercise concerning global aspects on AZA

32. A questionnaire was submitted to participants concerning key aspects about AZA and other issues related to be presented by country group on the following day. The questionnaire is shown in Appendix E. The results were discussed and are reported under the following Discussion and Conclusions session.

Sub-regional workshop on Aquaculture in the Northern African Countries – Monastir, Tunisia, 8-11 October 2012

33. A final presentation provided a brief summary of the recommendations stemmed at the Sub-Regional meeting of northern African countries held in Monastir in October 2012. Taking into consideration the recommendations from the Committee on Fisheries (COFI) and the conclusions of the previous meeting in Tangier about aquaculture fish pathology, some recommendations and queries from countries were shown. Some recommendations at national level included, among others, the elaboration of strategies, harmonized legal texts, institutional reinforcement, development of small-scale aquaculture, guides of good practices, sanitary conditions and certification. Some aspects concerning market studies, strengthening of producers' organizations and their role and participation on the decision-making process were highlighted as well. Some recommendations at regional level included the establishment of a collaborative framework among countries to share knowledge and know-how. The harmonization of environmental and sanitary monitoring procedures was considered essential. Site selection processes were considered needed as well as the definition of carrying capacity. Finally some remarks from participants were presented such as the recognition of the support from the GFCM to the sub-regions, the reinforcement of women participation, and the cooperation among governments and the GFCM for the sustainable development of aquaculture at national and regional level.

RESULTS DISCUSSION AND CONCLUSIONS

34. The main common points raised from the questionnaires filled by the participants during the T/W and from the discussion are hereunder summarised:

- The T/W established a dialogue among participants in order to obtain feedback about the possibility of implementing AZA in their respective countries and was an opportunity to gather end-users (producers) opinions, suggestions as well as indications about limiting factors for the AZA concept and process.
- Practical sessions have been performed splitting participants into groups in order to facilitate dialogue on the different proposed issues. General expositions from groups and

global discussion of the questions proposed were carried out in order to achieve consensus on results. Simple didactic tools, such as image through Internet or paper work were used to help participation of all trainees. Interventions and questions from participants arose throughout the T/W thus enriching the dialogue and exchange of information among trainees. Special effort was made to translate the lectures-presentations in English and French as main languages, but also Arabic was used for particular topics.

- A final practical session with a questionnaire on main issues related to AZA and AZE was passed to participants who decided to split into country groups.

35. Conclusions and recommendations were extracted from the common discussion on the questionnaire. GFCM training evaluation test model was passed on to participants

Common points raised from the questionnaires (Appendix E) and discussion and conclusions reached

Concerning the definition and concepts on AZA

36. The concept of AZA was considered well understood but different definitions and points of view were reached by each country. The following '*a space reserved for an environmental friendly aquaculture activity, that has been selected through a participatory approach and supported by scientific data*' could be proposed as the global definition.

37. The concepts of EQS, EQO, EMP and EIA were well understood, but some clarifications were asked about EQS and EQO, and reference values were deemed necessary. They should be supported by strong scientific work and adapted at regional and national level.

38. From the point of view of the environment and governance, it is clear for all participants that AZA will highly contribute to those aspects, facilitating the preservation and monitoring of the environment and contributing to the management and better governance practices. On the other hand AZA would not contribute to a great extent for the economic and social aspects for which a better communication and data collection strategy would be needed.

Constraints concerning the implementation of AZA and the solutions

39. The lack of legal framework, the political willingness, capacity of administrators, financing, data availability and conflicts on the occupation of marine space were the most common identified constraints. As solutions for those aspects, legal framework for AZA should be developed, participatory approach enhanced, capacity building at administrative level improved and benchmarking on previous Mediterranean experiences used.

40. Availability of data is a global concern. All participants agreed that data exists (although in very different formats), but accessing to it is complicated. It was considered that coordination and communication among different data holders should be improved. Data format should be standardized and communication strategies implemented.

Capacity and actions for AZA development

41. Depending on the state of aquaculture development in each country, the capacity to implement AZA is different. In general terms, it was considered that the integration of AZA within the coastal planning supported by a legal framework is needed. Communication plans and training as well as capacity building programmes for administrators and decision-makers would help understanding the concept and would contribute to the establishment of AZA. Cooperation programmes and benchmarking among member countries to share experience from those who have already established AZA were considered necessary also towards the harmonization of the concept and for future actions.

42. Some other aspects were pointed out such as:

- The establishment of an *AZA Network* at sub-regional level supported by those countries in which AZA has been already implemented for capacity building, communication and training.
- The setting up of an action plan towards the harmonization of concepts, parameters and methods in order to define common standards.
- The development of a legal framework to fill the gaps and give support to the end-users of AZA.
- The development of pilot actions was also suggested by participants to help on the implementation of AZA.

43. Finally participants considered that T/W are necessary and give the opportunity to share experiences and find out common aspects related not only to AZA but to many other issues concerning the sustainable development of aquaculture in their respective countries.

PART II AD HOC MEETING ON ‘ENVIRONMENTAL MONITORING SCHEME FOR MEDITERRANEAN AND BLACK SEA MARINE AQUACULTURE ACTIVITIES’

OPENING OF THE MEETING

44. The back-to-back ad hoc meeting on ‘Environmental monitoring programme for Mediterranean and Black Sea marine aquaculture activities’ was considered as follow-up of the previous TT/W on site selection, allocated zones for aquaculture and site management for coastal marine aquaculture. It was attended by experts from Algeria, Libya, Morocco and Tunisia, as well as by experts from Spain, Greece, Italy, Tunisia and Turkey. The list of participants is provided in Appendix C to this report.

45. The meeting was opened by Mr Hussein Hamza (acting as facilitator of the group) and by Mr Ioannis Karakassis (coordinator of the WGSC). Mr Hamza introduced the main objectives of the event which included: (a) present the state of the art for environmental monitoring programme for the North African countries with the major improvement needed within the AZA;

(b) enhance the participants' awareness for the monitoring in marine cages aquaculture and the importance of the identification of Environmental Quality Standard (EQS); and (c) and identify priority actions according to the needs of each country concerning Environment Monitoring Programme (EMP).

46. Mr Hamza presented the agenda of the meeting which was adopted and is provided in Appendix B to this report, and invited the participants to contribute actively to the exercise about EMP and EQS identification.

Insights from SHoCMed project *(by Karakassis, I.)*

47. A short overview about the results of the SHoCMed and the importance of cooperation and sharing experience in the field of environmental monitoring were presented. The results and main achievements of the WGSC and SHoCMed on the technical aspects related to the Environmental Monitoring Programme (EMP) of areas surrounding the cages at sea and the variables and EQS considered in such monitoring activities were outlined.

48. It was recalled to participants that, as result of a regional Delphi exercise it was considered that for marine fish cages aquaculture, EMPs should be implemented in the areas surrounding the fish farms or in the immediate vicinity of the farms called Allowable Zone of Effect (AZE).

49. The selected EQS variables for an EMP should at least include the following:

- (a) Total Organic Matter in Sediments (%);
- (b) Total Nitrogen in Sediments (%);
- (c) Redox Potential Eh (mV);
- (d) Percentage of Capitellid polychaetes over macrofaunal biomass (%);
- (e) Gas bubbles;
- (f) Dissolved Oxygen (mg/l);
- (g) Turbidity (m);
- (h) Percentage of silt/clay in sediments (%);
- (i) Litter surrounding area.

50. The specifications on the methodology to be applied in monitoring the above variables were also given. Participants were asked to consider and discuss the implementation of the EQS in a given EMP.

General context *(by Hamza, H.)*

51. Abstract: The general background of aquaculture in North Africa was presented in the context of sustainable development. It was emphasized that the development of aquaculture is considered by North African countries as a priority and many development plans and strategies have been implemented to increase the production and diversify the species and aquaculture farming technology.

52. The need for a sustainable aquaculture requires suitable tools for governance to avoid conflicts over marine space use and/or damage to the local marine environment. The Allocated Zones for Aquaculture could be, if well implemented, a powerful procedure which would allow aquaculture to be a legitimate way of using the marine space in a sustainable manner.

53. The Environmental Monitoring Programme as a part of the “toolbox” of AZA management contributes with the EIA and the GIS to minimise the impact of aquaculture activities on the environment and to foster social acceptability. Prior implementing AZA, countries would need to undertake a process to upgrade the common EMP procedures with well identified EQS.

ENVIRONMENTAL MONITORING SCHEME FOR MEDITERRANEAN AND BLACK SEA MARINE AQUACULTURE ACTIVITIES

54. The presentation on the state of the art of EMP in the North African countries showed that the lack of an appropriate legal framework promoting the aquaculture industry contributed to the slow development of aquaculture. In fact the involvement of many different authorities at different levels and the long confusing procedures for granting aquaculture licenses reduce the attractiveness of aquaculture for potential investors and Banks.

55. The legal framework related to environment protection exists for all North African countries (Libya, Algeria, Tunisia, Morocco, and Mauritania) which have in place similar guidelines for EIA. However there is not a dedicated guideline to carry out EIA or EMP for aquaculture. There is also an absence of specific EQS related to aquaculture.

56. The political will to develop aquaculture in those countries is a major positive factor whilst the threat is that the same countries reduce the EMP and EIA to a simple procedure or paperwork needed to start an aquaculture initiative. A specific agency with skilled staff and experts should be in charge for the aquaculture EIA and EMP with clear EQS regulated by law.

PRACTICAL SESSION

57. For the exercise about the EQS, participants were asked to propose the parameters that they thought would be relevant for environmental monitoring. Three parameters should be identified for water column and for sediment according to the list from the SHoCMed exercise conducted in 2012 as follows: Dissolved Oxygen, Turbidity and Chlorophyll-a were the parameters which participants selected to monitor the water column. Total Organic Matters, Number of Species and Grain Size (% silt-clay) were the EQS selected to monitor the sediment.

58. A second exercise was conducted with the participants for the identification of the specific needs of each country in term of EMP. The proposition of the panel aimed to draw the future work plan for training and cooperation in the field. The recommendations proposed by the participants were the following:

- Organize a sub-regional Workshop with field work

- Harmonize EMP across the Mediterranean (EQS parameters, sampling methods, sampling frequency)
- Adapt the level of monitoring to the scale of the farm and type of environment
- Identify a minimum set of indicators to be applied in the field
- Strengthen information sharing between countries
- Identify a cost effective monitoring
- Harmonize Mediterranean legal frameworks concerning aquaculture in general and monitoring in particular
- Build capacity for the administration and research
- Help countries to implement AZA also through pilot project (funds, training, case study)
- Promote South-South cooperation with sub-regional programmes of training exchanges
- Promote EIA, EMP and EQS concepts and raise farmers' awareness
- Promote further research to optimize AZA implementation procedures and management

DISCUSSION AND CONCLUSIONS

59. The main results and discussion coming from the meeting on Environmental Monitoring Programme on aquaculture:

- Environmental Monitoring Programme must be considered as part of the “toolbox” of AZA management; should contribute with the EIA and the GIS to minimise the impact of aquaculture activities on environment and to promote social acceptability
- Countries would need to upgrade the common procedures for EMP with well identified EQS before implementing AZA
- The state of the art of EMP in the North African countries show that the lack of an appropriate legal framework promoting aquaculture contribute to slow the development of the sector. The involvement of many different authorities at different levels and the cumbersome procedures to grant aquaculture licenses reduce the attractiveness of aquaculture for potential investors and Banks
- The legal framework related to environment protection exists for all North African countries (Libya, Algeria, Tunisia, Morocco, and Mauritania) which display a similar guideline to carry out EIA. On the other hand, there are not yet any guidelines to perform EIA and/or EMP for aquaculture. Specific EQS for aquaculture are also absent
- A considerable strength is the North African countries' political commitment to develop aquaculture. On the contrary, there is a perceived risk that those countries would reduce the EMP and EIA to simple procedures or paperwork needed to start an aquaculture initiative
- A specific agency with skilled staff and experts should be in charge for the aquaculture EIA and EMP with clear EQS regulated by law

Selected EQS parameters

60. Participants were asked as an exercise and through a Delphi approach, to propose the EQS parameters that they considered relevant for an EMP. Three parameters each were

respectively identified for monitoring the water column and sediments, and according to the EQS list from the WGSC-SHoCMed activity carried out in 2012 and indicated above.

APPENDIX A

AGENDA

Training Workshop on site selection, allocated zones for aquaculture and site management for coastal marine aquaculture

Introduction and background

- Opening and arrangements of the training/workshop
- 1st sub-session – Introduction to the allocated zones for aquaculture (AZA) context
- 2nd sub-session – Basic concepts for AZA: introduction and main principles applied to the process.

Establishment of allocated zones for aquaculture (AZA)

- 1st sub-session - Relevance of legal framework to support the establishing and implementation of AZA
- 2nd sub-session – Methodological aspects
- 3rd sub-session - Spatial tools for aquaculture site selection and planning (Geographic Information System – GIS)
- 4th sub-session - Overview of Mediterranean experience, AZA Fact Sheets

Management of AZA

- 1st sub-session – Management plan for AZA
- 2nd sub-session – Carrying capacity and AZA
- 3rd sub-session – Allowable zone of effect (AZE)
- 4th sub-session – Environmental issues related to AZA: environmental impact assessment (EIA) and environmental monitoring programme (EMP)
- 5th sub-session – Delphi exercise on AZA

Training Workshop conclusions

- 1st sub-session – Implementation of an AZA (summary session)
- 2nd sub-session – Discussion and conclusions

APPENDIX B**AGENDA****Ad hoc meeting on ‘Environmental monitoring scheme for Mediterranean and Black Sea marine aquaculture activities’**

- Opening and arrangements of the meeting
- Updating on environmental quality standards (EQS) within SHoCMed activities
- General overview of environmental monitoring scheme applied for aquaculture monitoring within Mediterranean countries
- Key aspects on the environmental monitoring scheme and related guidelines for aquaculture in the Mediterranean region
- Conclusions and recommendations

APPENDIX C

LIST OF PARTICIPANTS

Pablo ÀVILA-ZARAGOZA

Agencia de Gestión Agraria y Pesquera de Andalucía Oficina Provincial de Málaga C/ Severo Ochoa, 38 Parque Tecnológico de Andalucía, Campanillas 29590

Málaga, Spain

Tel: +34 670 944 050 Corp. 744050

Fax: +34 951 924 083 Corp. 975083

E-mail: pablo.avila@juntadeandalucia.es

Azeddine ABREHOUC

Institut National de Recherche Halietique

Centre Aquacole

(INRH) Port de M'diq,

BP n°31, M'diq, Morocco

Tel.: +93 200212667038800

E-mail: abraze1@yahoo.fr

Zidi ABDELKADER

Ministere de la pêche et de ressources halieutiques

Rue des quatres canons 16000

Algiers, Algeria

Tel.: +213 0771739524/043603800

E-mail: bladidjz@gmail.com

Ali AIT ALI

Institut national de recherche halieutique (INRH)

2, Rue Tiznit

Casablanca, Morocco

Tel.: +212 678047869

E-mail: a.aitali@yahoo.fr

Nadia AKLIL

Ministère de la pêche et des ressources halieutiques

7 Rue AbdElkrim Seghir ElMouradia

Algiers, Algeria

Tel.: +212 791723807

Email: guerni.nadia@gmail.com

Nadir BAŞÇINAR

Karadeniz Technical University, Faculty of Marine Sciences, Fisheries Tech. Engineer.

Dept. Çamburnu, Sürmene,

Trabzon, Turkey

Tel.: +90 4627522805

E-mail: nbascinar@gmail.com

Abdellatif BELKOUCH

Centre for Marketing Information and Advisory Services for Fishery Products in the Arab Region "

INFOSAMAK

71, Bd Rahal El Meskini

Casablanca, Morocco

Tel.: + 212 522540856

E-mail: abdellatif.belkouch@infosamak.org

Hachem BEN HACHEM

Agence Nationale pour le Développement de l'Aquaculture Avenue Annakhil.

Immeuble les Patios. 4ème étage

Hay Ryad, Rabat, Morocco

Tel.: +212 662796334

E-mail: hbenhachem@anda.gov.ma

Khaled BELLASSOUED

Animal Physiology Laboratory,

Life Sciences Department,

Sfax Faculty of Science,

BP1171, 3000

Sfax, Tunisia

Tel.: +216 22354096

E-mail: khaledbra3@gmail.com

Abdealloui BENYOUES

INRH Tanger

B P5268 Dredeb

Tangier, Morocco

Tel.: +212 663233341/539945675

Email: byounes2011@gmail.com

Bechir BERGAYA
DGPA
Kelibia fishing port
Nabeul, Tunisia
Tel.: +216 24281842
E-mail: bechirbergaya@hotmail.com

Nada BOUGOUSS
Centre for Marketing Information and
Advisory Services for Fishery Products in
the Arab Region
INFOSAMAK
71, Bd Rahal El Meskini
Casablanca, Morocco
Tel.: +212 522540856
E-mail: n.bougouss@infosamak.org

Hicham CHAIRI
Faculty Polydisciplinary of Larache
B.P 745, Poste Principale 92004
Larache, Morocco
Tel.: +212 662864524
E-mail: hicham.chairi@yahoo.fr

Jamal CHIOUA
INRH
B.P. 5268. DRADEB
Tangier, Morocco, 90000.
Tel.: +212 539946586
E-mail: jamal.chioua@uca.es

Hayri DENIZ
Ministry of Food, Agriculture and Livestock
Eskisehir Yolu, 9 km, Cankaya,
Ankara, Turkey
Tel.: +90 5447303622
E-mail: hayrideniz@hotmail.com

Atig DRAWIL
Faculty of Science,
University of TRIPOLI
Dept. of Zoology,
P.O.Box 13227218
Libya
Tel.: +1913224580
E-mail: atigdrawil@yahoo.co.uk

Amine EL JABORI
Agence Nationale pour le Développement de
l'Aquaculture Avenue Annakhil.
Immeuble les Patios. 4ème étage
Hay Ryad. Rabat, Morocco
Tel.: +212 538 099 700 –
Fax: +212 537 717 181- 212 661791334
E-mail: amine.eljabori@gmail.com

Bouchta EL MOUMNI
Abdelmalek ESSAADI University
FP-Larache
BP 745 poste principale
92 004 Larache, Morocco
Tel.: +212 661653293
E-mail: elmoumni@fpl.ma
moumni@yahoo.fr

Khaled Salem ETAYEB
Tripoli University
Zoology Dept. Faculty of Sciences.
P.O.box:13227
Tripoli, Libya
Tel.: +218 918592955
E-mail: khaledetayeb@yahoo.com

Aymen HADJ TAIEB
Institut National des Sciences et
Technologies de la Mer (Centre de Sfax)
BP 1035 – 3018
Sfax, Tunisia
Tel.: +216 97180961
E-mail: aymen.haj.82@gmail.com

Rym HADDAOUI
Agence de promotion des investissements
agricoles
62, rue Alain Savary,
Cité Kadhra
Tunis, Tunisia 1003
Tel.: +216 98431992
E-mail: heddaoui.rym@apia.com.tn

Nabil HADJADJI
 Algeria National Center of Research and
 Development of Fishery and Aquaculture
 (CNRDPA)
 11 Bd Colonel Amirouche Bouismaïl
 W- Tipaza, Algeria 42415
 Tel.: +213661542416
 E-mail: laminabil1@yahoo.fr

Houssam Auadh HAMZA
 Head of Department, General Direction of
 Fisheries and Aquaculture
 Tunis, Tunisia
 Tel: +216 71782635
 Fax: +216 71799401
 E-mail: houssam.hamza@gmail.com

Karim HILMI
 Head of Oceanography Division
 Institut National de Recherche Halieutique
 (INRH)
 02 Rue Tiznit,
 Casablanca 20030, Morocco
 Tel.: +212 661 330439
 E-mail: hilmi_inrh@yahoo.fr

Leila HMIDA
 Institut Supérieur Biotechnologie
 5000 Monastir, Tunisia
 Tel.: +216 99 98 14 21
 E-mail: hmidaileila@yahoo.fr

Mohammed ICHIBANE
 COFMA
 12, rue Jebel Moussa,
 Appt n°13, 10080
 Rabat Agdal, Morocco
 Tel.: +212 537673167
 E-mail: michibane@cofma.ma

Cherif KADRI
 Ministère de la pêche et des ressources
 halieutiques - Dprh Boumerdes
 BP 229 wilaya de Boumerdes 35000
 Algeria
 Tel.: +213 772746155
 E-mail: boumerdes@mpeche.gov.dz

Ioannis KARAKASSIS
 Professor - Biology Department
 University of Crete
 PO Box 2208
 Heraklion 714 09 Crete, Greece
 Tel.: +30 2810 394061
 Fax: +30 2810 394408
 E-mail: karakassis@biology.uoc.gr

Jose Carlos MACIAS
 Empresa Publica Desarrollo
 Agrario y Pesquero
 C/Bergantin 39 – Sevilla, Spain
 E-mail: josecarlosmacias1@gmail.com

Mohamed Amine MANSOURI
 Agence Nationale pour le Développement de
 l'Aquaculture
 Avenue Annakhil. Immeuble les Patios.
 4ème étage
 Hay Ryad, Rabat, Morocco
 Tel.: +212 673277358
 E-mail: amansouri@anda.gov.ma

Giovanna MARINO
 Head of Aquaculture Department
 ISPRA - Istituto Superiore per la Protezione
 e la Ricerca Ambientale
 Via di Casalotti 300
 00168, Rome, Italy
 Tel.: +39 06 61570495
 Fax: +39 06 61561906
 E-mail: giovanna.marino@isprambiente.it

Walid MATHLOUTHI
 Centre Technique d'Aquaculture
 05 Rue du sahel Montfleury
 1009 Tunis, Tunisia
 Tel.: +216 71492012
 E-mail: walidmathlouthi.aqua@gmail.com

Idhalla MOHAMED
 INRH
 2 Rue Tiznit,
 Casablanca 20300, Morocco
 Tel.: +212 661478558
 E-mail: midhalla@yahoo.fr

Chiheb MOUNIR
 Aquapecche Algérie
 Algiers, Algeria
 Tel.: +213 771 656815
 E-mail: aquapecchealgerie@yahoo.fr

Nadia MOUSSI
 Ministère de la Pêche et des Ressources
 Halieutiques
 Rue des quatre canons
 Algiers, Algeria
 Tel.: +213 21433164
 E-mail: moussinad@hotmail.com

Hassan NHHALA
 Institut National de Recherche Halietique,
 Centre Aquacole (INRH)
 Port de M'diq, Morocco
 BP n°31 M'diq 93.200
 Tel.: +212 623695260
 E-mail: nhhalahassan@yahoo.fr
nhhala@gmail.com

Anouar OUIZGANE
 Faculté des Sciences et techniques Beni-
 Mellal
 Faculté des Sciences et techniques BP 523
 Beni-Mellal, Morocco
 Tel.: +212 668102460
 E-mail: anouarouizgane@hotmail.fr

Mohamed Salah ROMDHANE
 University of Carthage
 43 Av. Charles Nicolle
 1082 Tunis, Tunisia
 Tel.: +216 97325090
 E-mail: ramadhanms@gmail.com

Esmail SHAKMAN
 Tripoli university
 Al-amria
 Tripoli, Libya
 Tel.: +218 922761703
 E-mail: shugmanism@yahoo.com

Mounia TAHIRI
 National Agency for Development of
 Aquaculture
 N°5, Avenue Nakhil
 Rabat, Morocco
 Tel.: +212 666321454
 E-mail: mouniatahiri@yahoo.fr

Paolo TOMASSETTI
 ISPRA - Istituto Superiore per la Protezione
 e la Ricerca Ambientale
 Via di Casalotti 300
 00168, Rome, Italy
 Tel.: +39 06 61570553
 E-mail: paolo.tomassetti@isprambiente.it

Güzel YÜCEL-GIER
 Dokuz Eylül University
 Institute of Marine Science and Technology
 Bakü Bulvari No. 100
 35340 Inciralti, Izmir, Turkey
 Tel.: +90 232 2786515
 Fax: +90 232 2785082
 E-mail: yucel.gier@deu.edu.tr

FAO

Doris SOTO
 Senior Aquaculture Officer
 FAO Fisheries and Aquaculture Department
 Aquaculture (FIRA)
 Via delle Terme di Caracalla
 00153 Rome, Italy
 Tel.: +39 06 57056149
 E-mail: doris.soto@fao.org

Jose AGUILAR-MANJARREZ
 Aquaculture Officer
 FAO Fisheries and Aquaculture Department
 Aquaculture (FIRA)
 Via delle Terme di Caracalla
 00153 Rome, Italy
 Tel.: +39 06 57055452
 E-mail: jose.aguilarmanjarrez@fao.org

GFCM SECRETARIAT

Fabio MASSA
Aquaculture Officer/
GFCM-CAQ Technical Secretary
International Institutions & Liaison Service
Fisheries and Aquaculture Economics and
Policy Div. - Fisheries & Aquaculture Dpt.
Via Vittoria Colonna 1
00193 Rome, Italy
Tel.: +39 06 57053885
Fax: +39 06 57056500
E-mail: fabio.massa@fao.org

APPENDIX D

PRACTICAL SESSION TO IDENTIFY AND PRIORITIZE KEY ISSUES

Prioritized issues	Group A	Group B	Group C
Socio-economic			
1	Conflicts with other users	Involvement of the local community	Need to locate all existing complimentary/conflicting activities
2	Physical access to site	Markets study	Proximity to markets are a primary consideration
3	Lack of qualified human resources	Financial study	Access to the culture site is essential
4	-	Basic infrastructures	-
Environmental			
1	Lack of models to estimate carrying capacity	Physical, chemistry, basic weather data	Aquaculture zones need to be free from pollution sources
2	Far from pollution hotspot	Bathymetry, sedimentology	Depth and current speed as the fundamental criteria characterizing the technical limits
3	Far from biodiversity hotspot	Hydrodynamic	Favourable grow-out conditions are based on environmental criteria such as temperature, chlorophyll-1, etc.
4	-	Biodiversity	-
Governance			
1	Overlapping responsibilities between institutions	Public will	Institutional support to implement and support EIA and monitoring is essential
2	Cumbersome licensing process also time consuming problem	Development plan	Increased communication of existing management plans from of all relevant sectors are needed
3	Lack of monitoring system	Clear administrative procedure	Need to create multi-disciplinary steering Committees to discuss and analyse the information compiled for zoning
4	-	-	Aquaculture zones need to be adopted by national legislations to become effective

QUESTIONNAIRE FOR PRACTICAL SESSIONS

1. What do you consider are the main constraints for the development of marine aquaculture in your country?
2. How would you define AZA in a few words?
3. How do you consider that AZA will contribute to the Sustainable Development of Aquaculture in the following aspects:

a. Environment?	No	Low	Medium	High
Comments:				
b. Economics?	No	Low	Medium	High
Comments:				
c. Social?	No	Low	Medium	High
Comments:				
d. Governance?	No	Low	Medium	High
Comments:				
4. Do you have a clear idea of the concepts related to AZA, such as:
 - a. Allowed Zone of Effect (Y/N)
Define in short sentence:
... if NO, why?
 - b. Environmental Quality Standards (Y/N)
Define in short sentence:
... if NO, why?
 - c. Environmental Quality Objectives (Y/N)
Define in short sentence:
... if NO, why?
 - d. Environmental Monitoring Programme. (Y/N)
Define in short sentence:
... if NO, why?
 - e. Environmental Impact Assessment (Y?N)
Define in short sentence:
... if NO, why?
5. What do you consider as the main constraints (obstacles) to implement the AZA in your country?
6. How would you consider those constraints to be solved?
Discussion comments:
7. What kind of action do you consider could be useful for the taking off of an AZA process in your Country? Please give some specifications to...
 - ...Pilot actions?
 - ... Training?
 - ...Cooperation (which field)?
 - ...any other suggestions...?

AVAILABLE DOCUMENTS AND MATERIALS TO PARTICIPANTS

- Power Point Presentations
- Documents:
 - *Several Technical FAO documents on Ecosystem Approach Aquaculture FAO.*
 - *IUCN. 2009. Guide for the Sustainable Development of Mediterranean Aquaculture 2. Aquaculture site selection and site management. Gland, Switzerland and Malaga, Spain, IUCN. 303 pp.*
 - *Zonas de interés para el desarrollo de la Acuicultura en el litoral andaluz. Junta de Andalucía.*
 - *Localización de zonas idóneas para el desarrollo de la acuicultura marina en Andalucía. Junta de Andalucía.*
 - *Zonas idóneas para el desarrollo de la acuicultura marina en las provincias de Huelva, Cádiz y Sevilla. Junta de Andalucía.*
 - *Zonas idóneas para el desarrollo de la acuicultura marina en el litoral andaluz. Junta de Andalucía.*