GENERAL FISHERIES COMMISSION
FOR THE MEDITERRANEAN

COMMISSION GÉNÉRALE DES PÊCHES
POUR LA MÉDITERRANÉE

GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

COMMITTEE ON AQUACULTURE

REPORT OF THE MEETING ON MEDITERRANEAN COASTAL LAGOONS MANAGEMENT: INTERACTION BETWEEN AQUACULTURE AND CAPTURE FISHERIES

CAGLIARI, ITALY, 28-30 June 2011

OPENING AND ARRANGEMENTS OF THE MEETING

1. The meeting on "Mediterranean coastal lagoons management: interaction between aquaculture and capture fisheries" was held in Cagliari, Italy, from 28 to 30 J-une 2011 and was organised with and hosted by the General Directorate of the Presidency, General Agriculture Directorate - Autonomous Region of Sardinia.

2. The meeting was attended by experts from Albania, Algeria, Egypt, France, Greece, Italy, Montenegro, Morocco, Spain, Tunisia and Turkey as well as representatives from IUCN (International Union for the Conservation of Nature) and RAC/SPA (Regional Activity Centre for Specially Protected Areas).

3. Mr Mariano Contu, *Assessore for Agricoltura e della Riforma agro-pastorale*, Regione Sardegna, opened the meeting welcoming the participants and stressed that, for a sustainable management of coastal lagoons, it is fundamental to trace shared paths which are able to preserve such fragile and ecologically vulnerable habitats. The challenge is to put together the aspects of biodiversity conservation and productive processes for a social and economic growth of the communities which depend on these activities.

4. He pointed out that the meeting was an important opportunity for a comparison, also through an intense cooperation among Mediterranean countries. Through the establishment of the *Gruppi di azione costiera* (coastal action groups), Sardinia wants to test a management model that promotes the sharing of development projects on coastal areas which are strongly dependent on fisheries. It is an approach based on a "public/private" partnership agreement to share the analysis of the needs and criticalities solution.

5. Mr Plinio Conte, from the Directorate General for Fisheries and Aquaculture of the Italian Ministry of Agriculture, Food and Forestry Policies, welcomed all participants. He recalled the historical, cultural and economical importance of coastal zones and expressed the interest of Italy on this issue as there are about 190 coastal lagoons (CLs) and coastal ponds in Italy where aquaculture is carried out. The Directorate General for Fisheries and Aquaculture also financially

supports other FAO regional projects such as AdriaMed, MedSudMed, EastMed, within the cooperation and exchange among countries all over the Mediterranean. Without an exchange of information, without a common data system, it is useless to open a debate and to formulate strategies. He pointed out that interesting results were expected from the meeting, and wished that clear, simple and sharable guidelines – applicable to all Mediterranean countries – would emerge, to improve and develop coastal lagoons productions.

6. Mr Fabio Massa, aquaculture officer of the GFCM Secretariat, thanked the Sardinian Authority for the kind hospitality and for the excellent organisation of the meeting. He briefly introduced the LaMed project, placing it in the context of the GFCM and of its subsidiary body dealing with aquaculture, the Committee on Aquaculture (CAQ). The project is funded by the Directorate General for Fisheries and Aquaculture of the Italian Ministry for Agriculture and Forestry Policies. He then presented the objectives of the meeting and introduced the Agenda of the workshop which was adopted by the participants. The agenda and the list of participants are attached to this report as Appendix 1 and Appendix 2 respectively.

RESPONSIBLE FISHERIES AND COASTAL LAGOON MANAGEMENT IN THE MEDITERRANEAN SEA

7. Mr Stefano Cataudella, GFCM Chairperson, from the "Tor Vergata" University of Rome, was nominated as chairperson of the meeting. He presented an overview on responsible fisheries in Mediterranean coastal lagoons, pointing out the main issues related to the management of Mediterranean coastal lagoons in the framework of the Code of Conduct for Responsible Fisheries (CCRF).

8. He explained the evolutionary process in coastal Mediterranean aquaculture, from coastal lagoons as simple fishing grounds to areas exploited for intensive aquaculture. According to the Ramsar Convention, coastal lagoons play a major role in coastal communities also through their ecosystem services – the benefits people obtain from ecosystems – ranging from flood control and groundwater replenishment to wetland products, cultural values and recreation and tourism. Coastal lagoons are also important reservoirs of biodiversity given their ecosystem & species richness, species abundance, uniqueness, genetic variation, economic value. However, these ecosystems are under severe threat, issue which raises the question of land management and use, as coastal lagoon areas along the Mediterranean have decreased in surface and several of them have disappeared, being reclaimed for other uses such as land conversion and excessive water abstraction, causing a faster decline of wetland species compared to those from other ecosystems.

9. Mr Cataudella stressed the importance of the cultural value of coastal lagoons, as "the wetland landscapes and wildlife result from complex interactions between people and nature over centuries" (Ramsar Convention, 1975). Nonetheless he raised the issue of who contributes to coastal lagoons degradation, who contributes to coastal lagoons conservation and which approach could ensure sustainability in use and conservation.

10. The impact of *ichthyophagous* birds, in particular the great cormorant, was brought to the attention of the participants to be discussed as an example of interaction in coastal lagoons between fisheries and the environment. According to GFCM tasks in this meeting, Mr Cataudella proposed to identify a series of reliable tools to support the decision making process: to save coastal lagoons as sensitive habitats (meaning of fisheries science), to weld wildlife conservation and sustainable traditional human activities, to stimulate the preparation of a plan for coastal lagoons conservation and management within the Mediterranean countries, based on a realistic evaluation of the institutional failure that partly affected the conservation strategy over the years.

COUNTRY REPORTS ON MANAGEMENT OF COASTAL LAGOONS AND INTERACTIONS BETWEEN AQUACULTURE, CAPTURE FISHERIES AND ENVIRONMENT

11. Mr Cataudella introduced this point of the agenda and invited the experts from several GFCM countries to report on coastal lagoons management in their countries**.** Technical presentations were made on the coastal lagoons of: Albania (Ms M.Cobani), Algeria (Mr A.Bounouni), France (Mr H.Farrugio); Egypt (Mr S.H.Abdel-Rahman), Greece (Ms S. Reizopoulou), Italy (Ms E.Ciccotti), Montenegro (Mr A.Joksimovic), Morocco (Mr H.Nhhala), Spain (Mr J.C.Macía), Tunisia (Mr M. Hadj Ali Salem), Turkey (Mr H.Deniz), pointing out the main aspects on lagoon management and on the main interactions between aquaculture, capture fisheries and environment.

12. *Ms Mimoza COBANI, from the Fishery Directorate, Ministry of Environment, Forestry and Water Administration, Tirana, Albania, presented the country report for Albania.*

The main Albanian coastal lagoons are Karavasta, Butrinti, Narta, Kune-Vaini, Orikum, Patogu, Viluni and Murtemsa, covering a total water surface of about 12 000 ha. All are national resources, managed by different government agencies. Extensive aquaculture is practiced in Albanian coastal lagoons and the fishermen use some facilities, like earthen ponds or confined areas in the lagoon for fish wintering or fattening. Other activities carried out in coastal lagoons are habitat and resource conservation, hunting, ecotourism, grazing, attraction park, urbanization, salt production, archaeological site, recreation. The negative environmental aspects are pollution from the urbanization of lagoons peripheral areas; over fishing; high pressure from the community around the lagoon, except of those licensed; and hunting in exceeded parameters. The presence of ichthyphagous birds can increase pressure on the fishery resources. Development perspectives and interventions by the public administration include improving Legislative Acts from the structures acting in lagoon areas (fisheries, environment and tourism) and upholding a Proper Management Structure to govern such areas together with local administration/organisation/associations.

13. *Mr AbdelKader BOUNOUNI, from the Ministry of Fisheries and Fishing Resources, in Algier, Algeria, presented the country report for Algeria.*

Only one coastal lagoon, Lake Mellah, is present on the Algerian coast. This lake covers a surface of 2 250 hectares. The lagoon belongs to the complex of El Kala National Park (PNEK) wetlands. Aquaculture is exploited by a private company and the main cultured species are sea bream, sea bass, sole, white bream, prawn and grey mullets. The main constraints are imposed by human activities other than aquaculture and fisheries. The mechanisms for the conservation of living aquatic resources compatible with the sustainable use of the hydrographic basins were identified through: i) the elaboration and establishment of plans ii) the rational use of space, coherently with activities, iii) the establishment of a control system for national parks. Lake Mellah is a site with great potential for the development of an integrated 'aquaculture/tourism' activity. The main activities to be developed are: shellfish culture, realisation of a centre for shellfish commercialisation, realisation of a fish hatchery, improvement of the fishing capture techniques.

14. *Mr Soliman H. Abdel RAHMAN ISMAIL, from the National Institute of Oceanography & Fisheries, Alexandria, Egypt, presented the country report for Egypt.*

The Mediterranean coastal area of Egypt is almost 1,100 km long and extends from the Libyan to the Gaza strip border. This area may be divided into three sectors, according to the coastal lagoons presence and typology. The western sector (west of Alexandria to Al Sallum) is an arid area with many touristic resorts along the shore with no coastal lagoons. The largest lagoon is Manzala (78,000 ha) followed by Bardawil (66,000 ha), Burullus (41,000 ha), Edku (8,000 ha), Port Fouad (6,000 ha) and the smallest is Maryout (5,000 ha). The most important activities in these lagoons are capture fishery and aquaculture. Other activities in the surroundings of these lagoons include cattle and sheep grazing, tourism in summer months, bird hunting and salt production.

As a result of the continuous freshwater flow into coastal lagoons, the most important aquaculture species are tilapias (Nile tilapia, *Oreochromis niloticus*, and blue tilapia, *Oreochromis aureus*) followed by grey mullets, carps and African catfish. European sea bass, gilthead sea bream, penaeid shrimp and meagre are produced in limited amounts in marine fish farms near sea inlets in Lake Manzala.

Fish aquaculture systems include: 1) traditional extensive system (*hosha*) with low level of intervention but high economic return, 2) semi-intensive pond culture which is the most abundant system congregated around the shores of coastal lagoons supplying about 86% of aquaculture production, 3) cage culture of tilapias and carps, and 4) to a lower extent the intensive pond culture of tilapia. Coastal lagoons contribute significantly to capture fishery production in Egypt. Coastal lagoons face a lot of problems with respect to ecosystem productivity and capacity to sustain fishermen livelihoods.

Each problem represents a serious constraint to the development of capture fishery production from these lagoons. These could be illustrated as: 1) land reclamation, degradation, habitat loss, filling up and drought which lead to a decrease in size of some coastal lagoons by over 70% of their original areas, 2) pollution of coastal lagoons as they receive great amounts of industrial, municipal and agricultural waste waters, 3) spread of aquatic plants which cover large areas of these lagoons limiting the access of fishermen, 4) over-fishing, illegal fishing practices and illegal harvesting of fish fry, 5) silting of Boughazes (connections with the open sea), 6) high levels of eutrophication resulting from the increased nutrient inputs from agricultural activities and fish farm drains carrying large amount of washed and leached fertilizers, chemicals and pesticides, and 7) low awareness of fishermen and aquaculture investors about environmental issues and the importance of fisheries and aquaculture regulation measures.

15. *Mr Henri FARRUGIO, from IFREMER, Sète, France, presented the country report for France.*

The French Mediterranean coast has 17 continental lagoons and 3 lagoons in Corsica, for a total of 53,000 hectares. Artisanal fisheries exist in all these lagoons whereas shellfish aquaculture and some fish aquaculture occur only in some of them, mainly in the Thau Lagoon (surface: 7,500 ha) and Leucate Lagoon: (surface: 1,540 ha). Lagoon fishing activities produces around 1,000 – 1,500 tonnes/year, with an average yield of 30 – 150 kg/ha/year. The main captured species are European eel clams, green crabs and European sea bass, gilthead sea bream, Atherina, Solea and Mugilidae. The shellfish aquaculture produces 12,000 tonnes/year of oysters and mussels. Other activities carried out in coastal lagoons are: recreational fishery (mainly on the sea bream spawning migration from lagoons to sea in autumn), tourism, sport activities (sailing, diving...) and hunting directed at the aquatic birds. Environmental issues: growing urbanisation, coastal sandbank very fragile, urbanistic, agricultural and industrial pollution, algal blooms producing anoxy, eutrophication and shellfish mortality. Blooms of toxic micro algae: DSP (Diarrheic Shellfish Poison) in Leucate lagoon and PSP (Paralitic S.P) in Thau lagoon. Shellfish mortalities due to herpes virus (OsHV-1) and the bacteria *Vibrio aesturianus* and *V. splendidus* represent an emerging problem.

16. *Ms Sofia REIZOPOULOU, from the Hellenic Centre for Marine Research, Anavyssos, Attiki, Greece, presented the country report for Greece.*

Coastal lagoons in Greece are defined as enclosed water bodies situated in coastal locations, with a wide range of temperatures and salinities and separated from the sea by narrow barriers with openings allowing limited water exchange. All biological components show great variability both in space and time, which is attributed to the environmental variability. The most important variable influencing species distribution and diversity is the degree of communication with the sea and the nutrient load introduced through fresh water inputs. There are divergent views about the number of lagoons in Greece, though the most recent data report 76 lagoons covering 34,500 ha. The most extensive lagoon systems are located in Western and Northern Greece, while the most important ones are protected under Ramsar convention or they are part of the Natura 2000 network.

The lagoons in Greece are not all equally explored scientifically. Almost all the lagoons operate as extensive fish farms and except for a few cases; they belong to the state and are leased to local fishing cooperatives. The fisheries exploitation is implemented through the use of nets and barrier fish traps.

The biodiversity and fish production of coastal lagoons is threatened by severe anthropogenic pressures such as damming, pollution, water flow modifications, overfishing, alien species introduction and so forth. The loss of sea-grass beds and the degradation of the water quality caused a decrease of species diversity and a decline of fish abundance. In some cases (Papas lagoon, Ionian Sea) anoxic conditions and release of hydrogen sulphide caused massive mortality of fish and shellfish communities.

17. *Ms Eleonora CICCOTTI, from the Università of Tor Vergata, Roma, Italy, presented the country report for Italy.*

Over 190 lagoons and coastal basins are present in Italy, for a total surface of 143,000 ha. Coastal lagoons in Italy are concentrated in four areas: North Adriatic, South Adriatic, Central Tyrrhenian and in the main islands, Sardegna and Sicilia. Lagoon typologies differ in the various regions. Lagoon (*laguna)* is a term used in Italy only for large lagoons, 5.000 – 50.000 ha wide. A lagoon sector can be enclosed for fish culture by means of earthen embankments, creating a confined area called *valle. Vallicultura* indicates the traditional management model carried out in the Northern Adriatic *valli*, based on hydraulic management, dredging, enhancing of fisheries by stocking, fish capture at the *lavoriero*. Their surface varies from very small (1-2 ha) to more than 10 000 ha (usually a complex of valli, such as the Valli di Comacchio).

In almost all Italian lagoons fisheries and/or aquaculture activities are carried out, with the exception of a few lagoons that are protected areas with some restrictions in their use. On the whole, production from lagoon environments in Italy amounts to 1,400 tonnes of fish and 125,000 tonnes of shellfish. Fisheries and extensive aquaculture carried out in coastal lagoons are activities partially overlapping with regards to culture techniques, and in statistics as well, therefore it is sometimes difficult to separate productions from the different typologies. Extensive farming is a rearing system based on the use of the trophic resources of coastal ecosystems targeting the production of fish and shellfish and excluding human intervention in feeding. Some problems are related to environmental constraints of these environments, and lead to consequences such as reduced recruitment of juveniles due to increased fishing in coastal areas, reduction of freshwater inputs, predation by ichthyophagous birds. Other constraints are linked to a progressive loss of the capacity to manage water exchanges sea/lagoon, or are linked to market, such as competition with intensive fish production, lack of continuity in market supply compared with the intensive product, lack of specific labels adding value to lagoon products, inadequate legislative framework.

18. *Mr Aleksandar JOKSIMOVIC, from the Institute of Marine Biology, in Kotor, Montenegro, presented the country report for Montenegro.*

There are only two lagoons in Montenegro, for a total surface of 1,642 ha: Tivat Salina (with a total surface of 150 ha, located in north-west part of Montenegrian cost in the Bokokotorska Bay) and Ulcinj Salina (with a total surface of 1,492 ha, located in south-east part of Montenegrian coast). No fisheries nor mariculture activities are present in these salinas, except for one part of Tivat Salina where there are two mussel farms with a small production of blue mussel (*Mytilus galloprovincialis*). The main activity in Ulcinj Salina is salt production from 1926 and small tourism in Tivat Salina which is the habitat for numerous endangered species of amphibians, reptiles and birds, it was declared a special flora and fauna reserve in 2007. Tivat Salina is an Emerald site under the Bern Convention and an important bird area in Montenegro. Ulcinj Salina from 1990 has become the first Important Bird Area (IBA) in Montenegro and later it became an Emerald site under the Bern Convention. Ulcinj Salina will soon be listed on the Ramsar List Wetland of International Importance, primarily as a bird site. Unfortunately, data for issues concerning environment, pollution, overfishing, emerging problems, weak points, land use do not exist. Development perspectives of lagoons in Montenegro are integrated development of these systems, primarily as a protected area, as tourist resorts and attractions, as well as a potential system of food production from the sea.

19. *Mr Hassan NHHALA, from INRH in Tangier, Morocco, presented the country report for Morocco.*

Morocco has a total coastline of about 3,500 km and counts six coastal lagoons. Two lagoons are located on the Mediterranean coastline, Nador lagoon in the east (11,500 ha) and Smir Lagoon in the west (300 ha). All these lagoons belong to the State (Maritime Public Domain). Most of them are listed as biological and ecological interest sites and wetlands of international importance under the Ramsar Convention. Some of them are also listed as national parks. Most of them represent wintering sites and reproduction areas for many species of migratory birds. They are also very productive areas for local communities, artisanal fishermen and/or aquaculturists.

Nador lagoon represents one of the coastal wetlands exploited in terms of artisanal capture fisheries and aquaculture activities in the country. This lagoon has been known as a semi-intensive aquaculture activities site, focusing mainly on finfish culture with local hatchery breeding and floating net-cages grow-out. The main cultured fish species were the gilthead sea-bream, and the European sea-bass. Since early 2006, just after the local aquaculture farm has ceased its activity because of its lack of competitiveness on the European market, many emerging activities have begun to be established and developed, mainly tourism and on-shore urbanisation. The Marine Fisheries Department is undertaking a locally integrated aquaculture planning in this lagoon to promote a sustainable aquaculture activities development, in respect with local environmental requirements and with existing and planning social and economical projects. The main constraints of coastal lagoons remain their vulnerability to diverse increasing pressure, particularly pollution, urbanisation, emerging economic activities such as tourism. These fragile and sensitive ecosystems require higher environmental awareness and a well concerted and integrated planning of their exploitation in respect of their local environmental characteristics. The need of multidisciplinary knowledge and collective involvement of interested partners becomes more crucial for establishing a well concerted and integrated planning of these areas. Although scientific knowledge of most lagoons in Morocco has already been elaborated, a synthesis work to assess what is already done and what is need to be done remains unachieved.

20. *Mr Jose Carlos MACÍAS, Fisheries and Aquaculture Advisor from Cadiz, Spain, presented the country report for Spain.*

Several small and medium coastal lagoons areas are found all along the Mediterranean Spanish coast to the borders of Portugal, all of them with different typologies, uses, human activities interrelation, etc. This area is influenced by the Mediterranean climate because the weather is similar. Only the existence of tides in the Atlantic coast provides different characteristics to the coastal lagoons located there. The strong modification and intervention of human activities in the coast of Spain has led to the reduction in lagoon number: indeed the Spanish coast has been directed towards other uses, in particular urban development and tourism.

Several other activities take place around the lagoons, ranging from aquaculture, artisanal fisheries, agriculture, industry, urbanisation, environmental tourism, sport fishing, setting the lagoons under a great environmental pressure. The main problems and threats are: pollution of waters, disruption of water regime, mainly in relation to springs availability, urbanism in the dune system, industrial pressure, all due to the increased pressure from tourism and recreation. Aquaculture also plays the role of maintaining the ecosystem: when aquaculture activities are abandoned, the marsh dries out and clogs.

Capture fisheries can have problems of control over the catch, and it is very difficult to obtain data on catches and therefore to estimate the use of natural resources. Most lagoons are protected by some environmental "figures of protection", with a different level of allowed activities; however, all of them must improve their integrated management for ecosystem sustainability.

Four Mediterranean coastal lagoons were selected and were presented: the "Albufera of Valencia" (21,120 ha), "Mar Menor"(13,500 ha), "Albufera of Mallorca" (1,700 ha) and "Delta del Ebro" a complex made of 10 coastal lagoons for a total surface of 7,736 ha, though reference to the Atlantic lagoons were also made. In fact lagoon areas as Veta la Palma in Seville or Cadiz Bay in Cadiz are two examples of how aquaculture contributed to the maintenance of the ecosystem due to flooding and water circulation. For this reason, these two lagoon areas will be analyzed from the point of view of the interactions between fisheries and aquaculture and environmental sustainability.

21. *Mr Mohamed HADJ ALI SALEM, SIPAM Coordinator, from Tunisia, presented the country report for Tunisia.*

Tunisia has 6 lagoons along the 13,000 km long coastline, for a total surface of about 52,000ha. Five of these lagoons (Bizerte, Ghar El Melf, Tunis, Monastir and El Bibane) are connected to the sea, the 6th, Ichkeul Lake, is communicating with the Biserte Lagoon through a channel. Capture fisheries is carried out in the lagoons, though often no official data of captures are available. In the summer, the high evaporation and the low input of freshwater (due to the dams upstream) lead to an increase in salinity, in turn affecting bird populations and the migration of fish fingerlings and juveniles. Lagoons are suffering pressures from the human community surrounding it (sewage waters, especially those coming from land based outfalls, poaching, socio-economical concerns), the lack of a fishery plan and a healthy management of natural resources. Aquaculture is carried out in Bizerte Lagoon, with an annual average shellfish production of around 200 tonnes (*Mytilus galloprovincialis* 130 tonnes and *Crassostrea gigas* 70 tonnes).

The main conflicts of interest are the interactions between artisanal fishermen and shellfish farmers. Tunis Lagoon is divided into two parts, separated by a channel. The north part received a huge volume of sewage waters from the town of Tunis and underwent decontamination works during the 80s to enhance its environmental quality, giving away 300 ha of water surface for urbanisation. The lagoon is attributed for a 30 year concession to a private company for the capture of eels, sea bream, sea bass and grey mullets. Monastir lagoons is close to the INSTM (*Institut National des Sciences et Technologies de la Mer*) research centre, established in 1985 and the main use of the lake as far as capture fisheries and aquaculture are concerned is mainly devoted to research activities. El Bibane is the largest lagoon, covering about 25% of the total

lagoon surface in Tunisia. It yields an important fish production, especially for prime marine species. Several NGOs are operating on the lagoon for environmental protection, sustainable development and international cooperation. The exploitation of the lagoon, previously assigned to a private company, has been transferred in spring 2011 to a public agency.

22. *Mr Hayri DENIZ, from the Aquaculture Department, Ministry of Agriculture and Rural Affairs in Ankara, Turkey, presented the country report for Turkey.*

Turkey has 72 lagoons along the 8,333 km long coastline. The main activity is traditional fishing, which is carried out in 43 lagoons, representing 64 % of the total surface. Different types of nature and wildlife protection have been declared for an outstanding 83 % of the lagoon surface, amounting to 23 water bodies, although the ban on this activity in protected areas is not fully enforced. Turkish lagoons as a whole represent a complex of approx. 37,000 ha with outstanding importance for wildlife, under-exploited fishing potential and severe threats from pollution, silting and human activities.

Most lagoons along the Turkish coastline would benefit from some rehabilitation intervention. For a large number of lagoons (51, covering 56% of the total surface) the pace of their environmental degradation and the importance of preserving the existing activities, as well as their rich wildlife, suggest that rehabilitation measures are not only necessary, but indeed pressing. However, in recent years, due to the development of touristic facilities, unconsciously and uncontrolled utilization, disposal of industrial and domestic wastes into the lagoons and siltation, many lagoons are not utilizable. For the lack of environmental awareness, lagoons have become discharge places for waste and polluted waters. At present the mistake of the destruction of a lagoon is generally acknowledged, but lagoons are nevertheless subject to a string of old and new threats, risks, not to mention constraints, all of which make them prone to ecological disasters and to a future that is far from certain. The enhancement of traditional fishing and the introduction of sustainable aquaculture practices is one of the most powerful means for preserving the lagoon environment from major damage while making a renewable use of the available resources.

MEDITERRANEAN COASTAL LAGOONS: CASE STUDIES AND POSITION PAPERS

23. The Chairperson introduced this point of the agenda, focussed on the presentation of species issues related to sustainable management of coastal lagoons.

24. Mr Henri FARRUGIO, from Ifremer, Sète, France, presented the exploitation of the European eel (*Anguilla anguilla*) in Mediterranean lagoons and the main results of the activities carried out by the Scientific Advisory Committee of the GFCM on this issue. In the Mediterranean, eels are exploited by the artisanal fisheries in inland waters (estuaries, lakes and rivers) and in the coastal lagoons of the border countries, mainly using various types of traps: fixed or mobile gears like fyke nets or fixed traps installed in the channels between the lagoons and the sea. Although in most countries the catch and effort statistics on eel are often absent or not regularly collected, according to the FAO FISHSTAT database the overall production of European eel has dropped drastically since the mid ‘80s. According to these data the Mediterranean production followed the worldwide trend and decreased from yearly catches of around 4,000-5,000 tonnes in the 80s to 1,000 tonnes in 2000 and 700 tonnes in 2007. The decline of eel populations is due to several additive factors. The causes of this decline could be of marine origin (changes in oceanic currents, reduction of the ocean productivity) or be due to changes in the continental part of the biological cycle of the species (obstacles to migrations, degradation of large parts of the habitats, fishing activities, pathologies). Eels can contain high levels of contaminants due to the bioaccumulation mechanisms existing in the trophic webs of various ecosystems (coastal zone, lagoons, estuaries, rivers).

25. The level of harvest of these species is unsustainable: in 2000 it was added to the list of species of the CITES Annex II, and was declared an endangered species by the IUCN. The commercial trade is submitted to the setting up of a management plan by the exporting countries showing for each sector of the distribution area the state of the eel population, the current regulations regarding its catches and its environment and also how to manage them in order to recover the species stock. Currently these data do not exist in the GFCM database; as a first step Mr Farrugio suggested that it would be important to feed it with some preliminary elements and then to complete the information after having chosen relevant factors in the frame of the activities of the four GFCM Scientific Sub-Committees. In order to set up a Regional Management Plan on eel the Scientific Advisory Committee at its 13th session (Marseille, France, 7-11/02/2011) advised to initiate the setting up of a network of Mediterranean experts on eel fisheries in collaboration with the working group on eel management.

26. Ms Eleonora CICCOTTI, from the Università of Tor Vergata, Roma, Italy, briefly reported on the *Management framework of eel* in Europe, with details on its current structure, status of advice and role of the ICES EIFAAC Working Group on Eel, as an action undertaken for the sustainable management of eel stocks. Concern about the conservation of the European eel has been growing in the last two decades and the need for conservation and management measures was clearly identified by scientists, managers, and even by the public opinion. Since October 2002 the International Council for the Exploration of the Sea (ICES) pointed out the urgent need for a recovery plan for European eel, with measures to reduce exploitation of all life stages and restore habitats.

27. The ICES/EIFAAC Working Group on Eels since 1975 has had a role in providing scientific and technical background information concerning eel. In 2007 the Regulation 1100 was issued by EU, aimed at the recovery of the European eel stock: the main objective of eel management actions was identified in allowing an adequate escapement of silver eels, corresponding to 40 % of the pristine escapement level. In 2008 all EU Member states submitted Eel Management Plans, and in 2009 all Plans were evaluated by ICES, modified accordingly and approved. At present, EMPs are being implemented in all participating Countries, and a first Report to EU is foreseen in 2012. The 2012 Reports should provide ICES the tools to proceed to a stock-wide assessment for eel. In this framework, the Eel Working Group is the expert group providing background for advice, while thematic Workshops are taking place to evaluate data and methods.

28. The need for a contribution of the Mediterranean area appears suitable and urgent, because a stock-wide evaluation needs to be comprehensively addressed to the whole eel distribution area. Some distinctive features of exploitation, in particular with regards to Mediterranean coastal lagoons, would provide a key to the setting up of a relevant geographical management unit. The international dimension of actions and the necessity to extend the existing regional agreements to the eel can also be considered, GFCM being indicated among others as an appropriate forum for such discussion.

29. Ms Maria COZZOLINO, from IREPA, Salerno, Italy, gave a presentation on the Green accounting experience in Italy: best practices in aquaculture management and development. The "Green Accounting" Italian experience derives from a Public research project which aimed at drawing a balance sheet incorporating environmental costs through a green accounting approach. The results acknowledge experiences acquired by fish farms through the analysis of the operating and application aspects of micro and macro activities.

30. The main activities developed by intensive aquaculture fish farms within the promotion of environmental communication and reporting activities were analyzed. The project used a panel group (researchers, stakeholders, fish farmers) and started with the discussion of the methodology to be adopted and the paths to follow to enhance environmental and social communication. This activity led to the compilation of five different Green Accountings, one for each farming company involved in the survey. The analysis of the legislative (governance), economic and

social context in which the organizations operate allowed to select a list of indicators in order to define and evaluate sensitive environmental aspects. Based on time series data, the resulting check list was used to evaluate the environmental impact for each farm. Following an integrated approach that involved experts in aquaculture and environment, the project allowed for the construction of an internal monitoring and environmental management system which led to the compilation of an environmental balance sheet for each of the farms involved.

31. Mr Pablo AVILA, from the Junta de Andalucia, Spain, as well as Coordinator of the Working Group of Sustainability of the CAQ, presented the concept of sustainability and the origin of the Principles for Sustainable Development identified at Rio Convention 1992, when the concept of "global perspective" was introduced. He described pillars of sustainability from this standpoint and made a reflection towards the integration of those pillars. From the Johannesburg conference (2002), the issue of Governance arose and a new dimension was presented as a transversal issue concerning the involvement of stakeholders as well as public and private partnerships to take part on the decision making. He also presented the PCI approach from the EVAD Project, provided the definition of Principles, Criteria and Indicators as well as some examples applied to coastal lagoon areas management and summarised the PCI framework as well as the nesting approach. To compare with the CAQ-InDAM work on indicators, conceptual framework used for the co-construction of the Indicators for sustainability of aquaculture in the Mediterranean were summarized and some relations and differences with the process to construct indicators for lagoons areas were mentioned. He ended his presentation on a proposal on the methodology for the co-construction process of indicators for Sustainable Management of Coastal Lagoons Areas, taking into consideration the participative approach and the co-construction process.

32. Mr Luca PALAZZO, from the ENPI CBC Med Programme, presented the ENPI CBC Mediterranean Sea Basin Programme, funded by the European Union within the Cross-Border objective of the European Neighbourhood and Partnership Instrument. The Programme involves 14 countries: Cyprus, Egypt, France, Greece, Israel, Italy, Jordan, Lebanon, Malta, Palestinian Authority, Portugal, Spain, Syria and Tunisia and focuses on six topics: Agro-food industry; Sustainable tourism; Integrated Coastal Zone Management; Water management; Waste treatment and recycling; Solar energy. Enhancing partnerships and addressing common challenges in the Euro-Mediterranean area are the main objectives of the Programme and of the new call for strategic projects published in May 2011 and open until the mid July.

33. The case studies on Mediterranean coastal lagoons (the area of Doñana in Spain, Venice Lagoon and Sardinian lagoons in Italy) were presented.

34. Mr J. Miguel MEDIALDEA, on behalf of RAC/SPA, presented the area of Doñana (SW Spain) as an example of sustainable aquaculture and coastal wetland conservation in the GFCM area. Extensive and semi-extensive aquaculture activities have become an integral part of Doñana, a vast protected coastal marshland strategically located in SW Spain and notable for its wide variety of landforms, fauna and vegetation types representative of the Mediterranean bioma, contributing to both environmental conservation and the development of a local economy. A total of 3,200 ha are currently devoted to sustainable aquaculture in an area that was designated as Wetland of International Importance under the Ramsar Convention and a Biosphere Reserve under the UNESCO Man & Biosphere Programme. Aquaculture activity is developed in large artificial earth ponds connected to each other and to the Guadalquivir River by means of a complex channel network. Sustainable aquaculture plays a fundamental role in the conservation of the rich and diverse Doñana avifauna, which includes several species listed as endangered or threatened in Annex II of the ASP/BD Protocol of the Barcelona Convention or included in the IUCN red list. The same principles could be applied to other coastal wetlands in the GFCM area, where aquaculture could effectively support a number of environmental services for the hydrology and ecology of many disturbed coastal areas, restoring the damage produced in the

original landscape by land misuses, minimizing its own ecological footprint and combining the economic benefits of aquaculture with environment conservation.

35. Mr Thomas GALVAN, from Agriteco, Marghera (VE), Italy, presented the fishery activities and management plan in the Venice lagoon, the largest Italian lagoon with a surface of 55,000 hectares. The two main fishery activities in Venice lagoon are the capture with fyke nets and Manila clam culture. The fyke net system has been regulated by the Venice Water Authority (*Magistrato alle Acque*) since the XIII century to define rules and sizes of fish. It counts 112 fishermen (2010), figure that is increasing, together with the average age given that young people don't want to work on fyke nets because they find it too hard, although the production of the fyke net system is declining. The other important fishery activity is Manila clam culture that involves around 700 fishermen. This activity is practiced with mechanical equipment such as dredges without teeth (*rusca*) or harvesting machines (*vibrante*); hydraulic systems are forbidden in Venice lagoon. Every 2-3 years the Venice Water Authority reviews the areas for Manila clam culture; at present they cover 2,577 hectares. The production of Venice lagoon after the explosion in the mid '90s (to almost 40,000 tonnes) decreased to around 25,000 tonnes in 2007 (last official data). These activities with other pressures (such as economic, demographic or other agents) concurred to create a management plan for the Venice lagoon with three principal objectives: preservation and enhancement of biodiversity, reduction of impacts and environmentally sustainable development of the territory. The management plan has a risk assessment model to provide a value to any pressure agent and to study the actions to be done. Three axes are used to calculate the risk: the intensity of the pressure factor, the influence and the vulnerability of the object of protection.

36. Mr Roberto DONEDDU, from the Fisheries Department of the General Directorate of Agriculture, Autonomous Region of Sardinia, reported on Sardinian (Italy) coastal lagoons. Right in the middle of the Mediterranean Sea, Sardinia could be defined the island of lagoons or wetlands in general. Along over 1,800 km of coastal line nearly 80 wetlands can be identified, with an overall extension not far from 15,000 hectares: 59 lagoons are productive, 31 are managed by fishermen cooperatives (or consortia of fishermen cooperatives), in 13 of them capture fisheries interact with bivalve mollusc production: mussels (*Mytilus galloprovincialis*), clams (*Tapes decussatus*), oysters (*Ostrea edulis, Crassostrea gigas*) and cockles (*Cardium spp*.). Most Sardinian lagoons have a muddy bottom, depth below 1 meter and high salinity levels.

37. As most lagoons are public domain areas (national/regional), exploitation by fishermen requires a public concession. At the beginning of the 90s coastal wetlands extension was wider, but public drainage carried out in order to recover land for agriculture caused important reductions of lagoon areas. In the 1980-1990 decade the Regional Administration enacted the most important environmental and productive restoration works on 26 lagoons, which included dredging, building of exchange channels, aquaculture pilot plants, modern capture structures ("*lavorieri*"), buildings for fishermen workshops, fresh and sea water regulation, deviations of polluted draining, arrangement and protection of sea mouths. In recent years, the Regional Government revised its institutional design in order to better cope with complexity and foster integrated management strategies.

38. Since January 2008, the Regional Fisheries Department, with a strong support from the Regional Technical Committee for Fisheries, has been engaged in updating Regional Policies, Delivery Strategies, Legal framework and financial tools to support the sustainable and responsible development of the sector. Thanks to the implementation of most strategic measures of European Fisheries Funds, Maritime Fisheries is now involved in an important change of perspective: from command and control with no direct involvement of the sector to active participation to pilot projects and self-regulation of fisheries areas through the preparation and implementation of local management plans by fishermen groups. At the same time, with the

implementation of EFF Axis IV1, local communities depending from fisheries have had a chance to propose "their" strategies for integrated development. Several ongoing transnational cooperation projects focus on Coastal lagoons management strategy.

39. Sustainable exploitation of coastal lagoon is a strategic objective according to the 2010-2014 Sardinian Regional Government Strategic Plan. According to Mr Doneddu, the Sardinia Region is looking for C.L.A.M.S. (Coastal Lagoons Advanced Management Strategies). He suggested that all Mediterranean countries should share a common need for a multidisciplinary approach to promote sustainable/responsible development of fisheries communities in coastal areas. If conservation and human development issues should be integrated, Mediterreanean countries should proceed "together" along a pathway paved of individual, social and territorial intelligence.

[1] https://webgate.ec.europa.eu/fpfis/cms/farnet/

DISCUSSION

40. The Chairperson introduced this point of the agenda by recalling the terms of reference of the workshop as well as those established for the LaMed project as discussed during the VI CAQ held in Tirana, Albania (2008). He also recalled that during that session the representatives of the member countries considered essential to revitalize the work focused on lagoon management, and recognized that environmental degradation has undergone in many coastal lagoons due to inadequate management. He reiterated that the CAQ agreed on the importance to study such interactions in these fragile ecological environments and pointed out that their management should also fall within an overall integrated coastal zone framework. Finally the Chairperson stressed that all the issues presented and discussed during the LaMed-2 workshop are to be considered completely in line with the requests of the CAQ.

41. The Chairperson also recalled that the main aspects and elements needed for the identification of a strategy toward an integrated vision of aquaculture and artisanal fisheries within Mediterranean coastal lagoons should consider the main international conventions and declarations (Ramsar Convention 1975; the 1978 Barcelona Convention; 1979 Bonn Convention on the conservation of migratory species and animals, the Convention for the Protection and conservation of marine environment in Mediterranean and the Protocol on Integrated Coastal Zone Management,1995; the Convention on Biological Diversity Rio Summit 1992; the Johannesburg declaration on Sustainable Development, 2002; the FAO Code of Conduct of Responsible Fisheries in the Mediterranean, 2003). In the above mentioned international agreements the role of management of natural resources as well as of the traditional activities of the coastal communities within these areas are reported.

42. This role in some coastal areas is also expressed through the maintenance of some extensive aquaculture and management practices that has remained unchanged for centuries through the application of traditional extensive aquaculture systems. These systems contributed to the whole production of Mediterranean marine aquaculture and have applied sustainable models of management and exploitation, vital for local economy and communities. In this context the conservation of traditional lagoon management linked to extensive aquaculture and artisanal capture fisheries certainly contributed to preserve the peculiar ecosystems of coastal lagoons throughout time.

43. The Chairperson also pointed out that when considering the ecological service provided by Mediterranean coastal lagoons, the main principles accounted by the Ramsar Convention should be taken into consideration. Among these, he stressed the importance of biodiversity conservation and of local knowledge that preserves unaltered the experiences and the common heritage for future generations.

44. In the discussion that followed, the participants confirmed the role of aquaculture and capture fisheries in the management of Mediterranean coastal lagoons towards their sustainable management. The meeting also concurred that the existing human capital and the local knowledge should be maintained among the main priorities by the countries and that these components should also be considered within any programme of lagoons restoring.

45. Several aspects related to lagoons such as the different case studies presented, the biodiversity and conservation, stock enhancement, nursery areas, eel management, environmental and economic accounts (just to mention some of them), as well as the priorities for a sustainable management of coastal lagoons, were also discussed by the participants.

46. The experts agreed that in many Mediterranean coastal lagoons, capture fisheries production and traditional aquaculture have exhibited a rapid decrease over the years, determined by many significant changes that had an impact on the management of these areas, including several environmental and socio-economic issues.

47. Both the national reports and the case studies presented by the participants also highlighted the lack of knowledge and the difficulties in collecting information related to the interactions among aquaculture, fisheries and environment. Discussion focused also on how the relationships between aquaculture, capture fisheries and environment are interrelated and strictly depending from the hydraulic management.

48. The experts further agreed that traditional extensive aquaculture and artisanal capture fisheries although representing different forms of management are linked by the common use of natural fishing resources. The sustainability of the two sectors depends on the quality of the natural environment and the lagoon ecological conditions. The two sectors should be considered as part of the main cooperation and evolution process, as a strategic part of the common Mediterranean traditional knowledge and as a contribution to the Mediterranean global fish supply.

49. A series of critical points for aquaculture and capture fisheries were stressed by the participants on the basis of the information available within the Mediterranean countries presented and discussed. Hereunder a summary of the critical points is provided:

- The lack of hydraulic management plans in many Mediterranean coastal areas have compromised the integrity of these environments. In particular the changes in hydrological regimes determined the loss of lagoons surface, that in some areas reached 30% and went up to 70%. The absence of a hydraulic management plan is determined by the absence of dredging of communications with the sea and by the decrease of water mass and in particular of freshwater input (volume lost due to water request for irrigations or damming) to the lagoons areas. These activities determine an excess of sedimentation and a decrease of water exchange followed by an increase of confinement, and consequently affectcommunities biodiversity (such as the case of replacement of some sea-grasses species by opportunistic green macroalgae).
- The traditional extensive aquaculture systems, that remained unchanged and vital for the local economic and fishing communities from centuries, risk to disappear. The lack of statistic information on the production as well as the absence of monitoring programmes in many areas cannot provide exhaustive information for describing such phenomena.
- During the last years, several Mediterranean lagoons areas suffered due to a great anthropic impact and to the intense application of competing uses. Consequently, the pollution recorded from different sources (from urbanisation, intensive agriculture, massive tourism development, etc...) determined a negative transformation of these environments provoking alteration of the physico-chemical parameters, in particular of nutrient enrichment, alteration of trophic level and consequently modification on fishing populations that strictly depend on water quality.
- The case study of European eels in the Mediterranean, for which the decline was also determinedby the alterations in the “continental part” of their biological cycle (obstacles to migrations, degradation of large parts of the habitats, fishing activities, pathologies, etc...) was also taken as an example.
- The unregulated increase of *ichthyophagous* seabirds over the years was also considered as one of the main impacts on fish populations.
- In many cases lagoon management regulations were introduced without taking into consideration the local conditions of coastal communities. No policies of consultation have been applied in some Mediterranean coastal areas, thus generating conflicts among the different users. The lack of participation of local communities and of all stakeholders in lagoon management plans consequently led to the lack of consensus. In some areas the non clear ownership status of the coastal lagoon and the scarce involvement of local communities

in development plans are registered; and this underestimates the importance of human presence as a factor that could be used against illegal and uncontrolled fisheries.

- There is a lack of awareness by the public opinion on the importance of capture fisheries and aquaculture in these areas and image building problems with the traditional activities. Lack of consensus has been generated on the traditional activities of aquaculture and artisanal capture fisheries in the coastal lagoons due to the absence of information on the role played by these two sectors in environmental conservation.
- Many of the above factors compromised the natural productivity of the coastal lagoons and contributed to the collapse of fisheries production. More generally, the absence of governance in these environment has been the main factor that negatively influenced their ecological integrity

CONCLUSION AND RECOMMENDATIONS

50. Participants agreed that the degradation occurred in many coastal lagoons has been determined by the lack of or inadequate management plans, including an unclear legal regulatory framework, its negative impact on fishing communities and concern on traditional knowledge and on biodiversity issues. Furthermore the participants noted an increasing awareness about lagoons areas and agreed on the following:

- The management approach for coastal lagoons in the Mediterranean and Black Sea should be in line with the main principle of the Code of Conduct of Responsible Fisheries (CCRF) and in particular with the provisions articles refering to the aquatic ecosystems, the fisheries habitats, the multiple uses of the coastal zone and integrated coastal zone management, the participation of fishworkers, environmental and other interested organizations, the role of artisanal fisheries and also to aquaculture including culture based aquaculture, in accordance with the international law.
- The management approach of coastal lagoons should also be based on the application of the principles of the main international conventions and declarations on the protection of coastal lagoon areas and more generally on the protection of sensitive habitats and conservation of biodiversity in which particular emphasis is given to the role played by the conservation of local communities in coastal areas.
- The activities of traditional aquaculture and artisanal capture fisheries should be considered a priority within the management plans of Mediterranean coastal lagoons and this in consideration of the ecological and economic services provided by these traditional activities that contribute to the conservation of the traditional knowledge and biodiversity;
- The local knowledge in the management of coastal lagoon should be considered as an element of common interest for Mediterranean communities and sharing the knowledge on the contribution of capture fisheries and aquaculture should be capitalized among coastal countries. Furthermore the positive impact of the lagoon management should be assessed and upgraded;
- The Management plans for coastal lagoon areas should be implemented taking into consideration the different dimensions of sustainability (economic, environmental, social, governance) and following a holistic approach and within Integrated Coastal Zone Management. In addition, the participatory and consensual approach among the different users should be considered using the involvement of the different local stakeholders and in particular with the involvement of the local fishing communities.
- The Working Group discussed on the necessity to have a common Mediterranean strategy for the sustainable management of aquaculture and capture fisheries in the Mediterranean areas.

The experts unanimously agreed that – due to the evident degradation that coastal lagoons areas are now facing and in particular the consequent negative impact on fish resources and fishing communities (socio-economic and environmental consequences) – an urgent common and integrated strategy is requested to the Mediterranean countries to be implemented in a cooperative approach.

51. Mediterranean countries are requested to prepare an integrated plan of action for the sustainable development of aquaculture and capture fisheries in coastal lagoons in the GFCM area. The first objective of this Mediterranean action plan is to prevent any further degradation of coastal lagoons and also consider elements for restoring the environment.

52. The Mediterranean action plan for lagoons management should identify suitable management strategies based on multifunctional approach that should be enhanced and should include the preservation of wetlands and of nursery areas for some species, the protection of traditional management practices such as artisanal capture fisheries and traditional aquaculture and should avoid any intensification of activities. The Mediterranean action plan for lagoon management should be considered for the protection of fisheries and aquaculture as an active component in the conservation policies of integrated coastal management.

53. The Mediterranean action plan for lagoon management should include, among others, elements on: governance and space utilization; traditional and historical heritage, restoration and mitigations measures; monitoring and data collection; reliable indicators for sustainable development; research and development; training and capacity building, multidisciplinary and multi-stakeholders approach.

54. Participants agreed that the discussion for the preparation and proposal for a Mediterranean action plan for coastal lagoon areas should be considered as a priority in the agenda of the Mediterranean countries, and should be considered by the GFCM at the most appropriate level.

OTHER MATTERS

55. The meeting discussed the follow up of the aspects related the eel's management plan. Experts agreed that as a mandate of GFCM/SAC/CAQ, an Eel Med Working Group could be established focusing on a joint analysis and an efficient assessment of the local eel stock. The Eel Med WG should also address issues such as the socio-economical dimension of eel fisheries in the area, the distinctive features of eel exploitation and management with particular reference to coastal lagoons, and the interactions among countries within and outside the Mediterranean area.

56. The meeting also discussed the necessity to prepare a glossary on coastal lagoon management to be included within LaMed activities. This glossary should include, among others, the different technical aspects and the different terms used by traditional aquaculture and artisanal capture fisheries in coastal lagoon areas.

57. The participants agreed on the need to involve GFCM member countries from the Black Sea, in order to obtain information of coastal lagoons in this area.

Appendix A

Agenda

1. Opening and arrangements of the meeting
2. Responsible fisheries and coastal lagoon management in the Mediterranean Sea
3. Country reports on management of coastal lagoons and interactions between aquaculture, capture fisheries and environment
4. Mediterranean coastal lagoons: case studies, position papers, presentations and discussion
5. Discussion and preparation of a synthesis on the main aspects related to the Interaction between Aquaculture and Capture Fisheries (IACF)
6. Conclusion and Recommendations

Appendix B

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