

**CONCEPTUAL PAPER FOR THE RE-ESTABLISHMENT  
OF THE GFCM-CAQ NETWORK ON  
ENVIRONMENT AND AQUACULTURE IN THE MEDITERRANEAN (EAM)**

The Environment and Aquaculture in the Mediterranean network (EAM) was created in 1992 following a MEDRAP (Mediterranean Regional Aquaculture project) decision and that was temporally abandoned in 1996. The following document highlights some of the aspects and actions needed for its re-establishment General Fisheries Commission for the Mediterranean (GFCM) Committee on Aquaculture (CAQ).

**1. BACKGROUND ON EAM**

**1.1 Constitution of EAM**

In 1993, the GFCM took charge of the coordination of the four aquaculture related networks originating from the UNDP/FAO Mediterranean Regional Aquaculture Project, MEDRAP (1990-1995). These networks were:

- a) Information aspects for promotion of aquaculture in the Mediterranean (SIPAM);
- b) Technical aspects for promotion of aquaculture in the Mediterranean (TECAM)
- c) Economic and legal aspects for promotion of aquaculture in the Mediterranean (SELAM);
- d) Environmental Aspects of Aquaculture in the Mediterranean (EAM).

The constitution of EAM took place in a seminar held in Athens, Greece, in June 1993 (MEDRAP II 1993a) when it was proposed that MAP-PAP/RAC should undertake the coordination of EAM activities as a network. The objectives of this seminar were to elaborate proposals of activities for the implementation in 1994-95.

In this seminar there was the proposition of having a working group meeting in September of that year to elaborate a more specific programme of activities for 1994-95 (MEDRAP II 1993b) to be submitted to the MEDRAP II Network Steering Committee. The EAM network was coordinated at the time by Mr Ivan Katavić (Consultant to PAP/RAC) of Croatia.

In 1994, the GFCM established the Committee on Aquaculture in replacement of its Working Group on Artificial Reefs and Mariculture. To date the CAQ has held four sessions. The main objectives of the Committee were defined in 1995 (FAO 1996), being those to:

- a) To provide a forum for the exchange of information related to the networks;
- b) To provide coordination in dealing with the broader aspects of aquaculture in a more integrated manner using the networks as tools for this purpose and as a starting point.

As indicated in the External Evaluation report to CAQ and its Networks (FAO 2004), the only meeting of the EAM Coordinating Committee was held in April 1995 and was attended by its Coordinator and representatives from France, Lebanon and FAO. A number of new activities were proposed during this committee meeting, at a total cost of US\$ 245 000 (excluding the cost of an activity on lagoon management). However, in the absence of clear budgetary allocations, the Committee could not plan any clear follow-up actions. Finally, since there

was no funding the environmental aspects of Mediterranean aquaculture were absorbed by TECAM and SELAM activities since 1996.

## **1.2 Main EAM Objectives**

During the constitution seminar of EAM (MEDRAP II 1993a) the agreed objectives for EAM were:

- i) Contribute to optimization of aquaculture production through ecological characterization of coastal zones, set up of site identification methodology and management guidelines.
- ii) Contribute to protection of environment and aquaculture through monitoring, establishment of standards and frame for legislation
- iii) Provide information on the environmental performance of aquaculture to position it better within integrated coastal area management.

## **1.3 EAM Priorities**

During the EAM Network constitution seminar (MEDRAP II 1993a) four priority topics were selected:

- 1) Lagoon Management
- 2) Interactions between Aquaculture and Environment
- 3) Site evaluation and protection
- 4) Ecologically sound integrated management of mollusc culture

## **1.4 Main Activities and Goals Achieved by EAM**

According to the Report of the First CAQ session (FAO 1997) which took place in September 1996, EAM, reported several activities following priority areas which have been carried out during 1994-1995:

- (i) Workshop on "Impacts of intensive farming outfalls on the coastal ecosystem" (Jerba, Tunisia, April 1994; priority area on Interactions between aquaculture and environment);
- (ii) Workshop on "Environmental aspects of shellfish culture in the Mediterranean, with special reference to monitoring" (Dubrovnik, Croatia, July 1994; priority area Ecologically sound integrated management of mollusc culture);
- (iii) Two Working Group Meetings on lagoon management (Nador, Morocco, July 1994 and Montpellier, France, June 1995; priority area Lagoon management); and
- (iv) Workshop on the "Selection and protection of sites suitable for aquaculture" (Heraklion, Greece, November 1995; priority area Site selection and protection).

These activities were facilitated through collaborative efforts by MAP-PAP/RAC, MEDRAP II, INSTOP of Tunisia, ISPM of Morocco, IOF of Croatia, Montpellier University, IMBC of Greece, IFREMER and FAO.

Although the EAM Coordination Committee held its first meeting in April 1995, it was emphasized that no activities could be carried out in 1996, which was partly due to lack of funds at MAP-PAP/RAC resulting from delayed contributions by some countries supporting the Mediterranean Action Plan (MAP). It was also noted that the MAP allocations of US\$

53 000 in support of EAM related activities in 1996-97 were lower than in the previous biennium.

### 1.5 Reasons for lack of activity and “apparent disappearance” of EAM

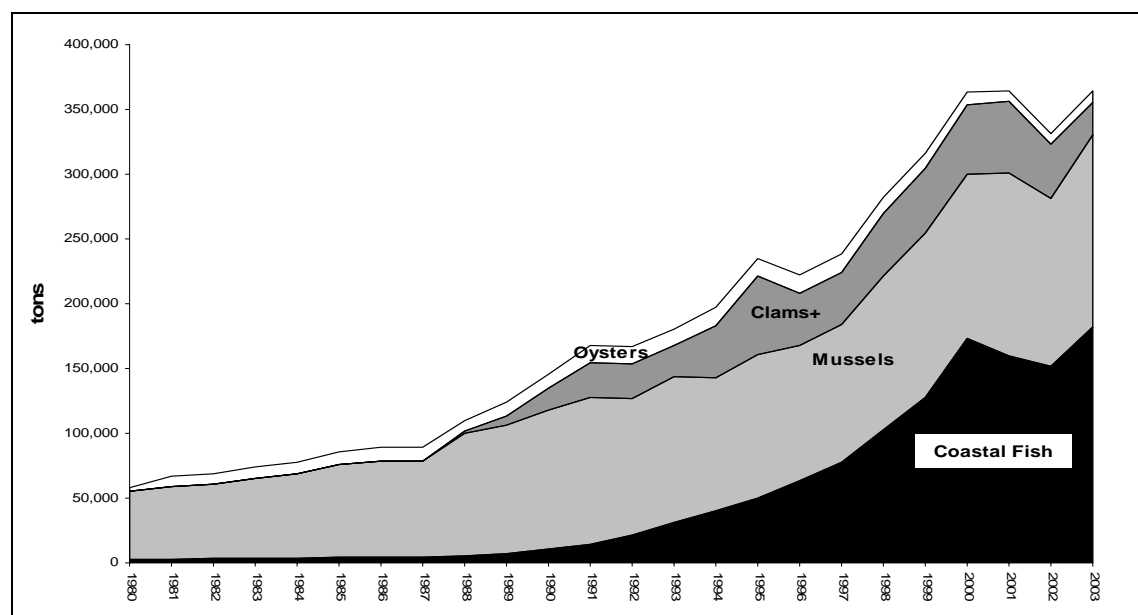
By 1996, when CAQ was established, EAM effectively ceased to exist since no budget for its operation was available. Since then its duties have been absorbed into the other aquaculture networks. Its Coordination Committee met only once in 1995 (FIRI/R770, FAO 2004).

The lack of activity has been connected to lack of financing and leadership, usually aquaculture and fisheries have been connected to the Fisheries Ministries but for the case of EAM the representatives to meetings have been more related to Environmental agencies in each country which have not been enthusiastic enough to promote EAM.

## 2. RELEVANCE OF CURRENT SCENARIOS AND FRAMEWORK FOR THE SCOPE OF EAM IN THE XXI CENTURY

### 2.1 Present state of aquaculture in the Mediterranean Sea and potential environmental effects

Marine and brackishwater aquaculture production in the Mediterranean and Black seas has increased steadily since the 1980s and in 2003 reached an estimated 371 000 tons (FAO, FIDI 2005 - Figure 1) of which the largest proportion is represented by marine finfish (49%). The main finfish species are the Gilthead seabream, *Sparus aurata*, the European seabass (*Dicentrarchus labrax*) and the Flathead grey mullet (*Mugil cephalus*). They are followed by mussels (40%), clams (7%) and oysters (2%).



**Figure 1.** Aquaculture production of species groups accounting for 98% of total production since 1980.

Among the most common and well studied environmental impacts of aquaculture are:

- i) excess nutrient loads to ecosystems;
- ii) use of chemicals which may accumulate in the ecosystem;
- iii) diseases transfer from aquaculture to wildlife;
- iv) interaction with fisheries including the effect of escaped cultured species; and
- v) interactions with other uses of coastal zones.

Both types of aquaculture produce loads of nutrient to the environment, bivalve cultures produce proportionally more particulate organic matter while intensive aquaculture produce both dissolved and particulate organic matter. However intensive aquaculture particularly that of carnivorous finfish cage farming produce the largest nutrient loads to aquatic systems (Gowen and Bradbury 1987), this issue has been well explored by Uriarte and Basurco (2001) in the CIHEAM special publication on the environmental impact assessment of Mediterranean aquaculture farms.

Furthermore, such loads have been calculated for the Mediterranean finfish aquaculture in the UNEP/MAP report (2004) where they used 110 kg of nitrogen (N) and 12 kg of phosphorus (P) as outputs per ton of fish produced. Considering that finfish (Figure 1) aquaculture production for 2003 in marine and brackishwaters reached 182 000 tons (latest FAO statistics), N and P loads could have reached 20 and 2.1 thousands tons, respectively.

A large proportion of this share is loaded on the Greek coast according to their largest proportion on finfish production followed by Turkey and Italy. However, according to Izzo (2001) such loads would be less than 1% of the present loads due to the likely impact of Agriculture. As pointed out by the UNEP/MAP (2004) report, mariculture could act as point source and could induce local eutrophication. This could be particularly relevant considering that the Mediterranean Sea is still considered rather oligotrophic.

Nutrient loading has been by far the best studied topic related with intensive fish farming both in the Mediterranean Sea (Karakassis *et al.* 2000) and elsewhere, particularly those effects on sediments. However, the Mediterranean Sea has a very particular condition which makes it very different from other studied ecosystems as pointed out by the UNEP/MAP (2004) report.

- High temperatures (annual minimum of 12°C, with peaks of 25°C during summer) include high metabolic rates, thus affecting both the production of the farm fish and the activity of microbial communities;
- The micro-tidal regime (tidal range is typically less than 50cm) reduces the potential for dilution and dispersion of solute and particulate wastes, especially in enclosed bays where wind driven currents are relatively weak;
- Oligotrophy: low nutrient, low primary production and low phytoplankton biomass are typical of most Mediterranean marine ecosystems, particularly in the Eastern basin (Bethoux, 1981; Azov, 1986). Low phytoplankton biomass induces high transparency of the water and light penetration deeper in the water column (Ignatiades, 1998) thus allowing photosynthesis at a greater depth;
- Primary production is considered to be phosphorus limited (Krom *et al.* 1991) as opposed to nitrogen limitation in the Atlantic and in most of the world's oceans. In this context, eutrophication could be expected only when phosphate is released in adequate quantities;
- The biotic component of the ecosystems i.e. the fauna and flora is highly diverse particularly in the coastal zone and consists of a large proportion of endemic species (Tortonese 1985; Fredj *et al.*, 1992) as a result of the dynamic geological past of the

Mediterranean. They are of low abundance and biomass as a result of the prevailing oligotrophic conditions (Karakassis and Eleftheriou, 1997).

- Finally, the morphology of coastal bays where most of mariculture is practiced is also very different from that of Scottish lochs and Norwegian fiords. They are typically not associated with permanent freshwater supply.

To the points made by this report it should be added the relevance and uniqueness of sea grass (*Posidonia oceanica*) in the Mediterranean Sea and the damage to sea grass beds caused by fish farming. Such effects could also be caused by bivalve aquaculture.

## **2.2 Missing information for the decision making and potential scope for EAM**

In general, while local effects of nutrient enrichment are very well covered by the mentioned report (UNEP/MAP, 2004) and by other recent studies (Karakassis *et al.*, 2005), there is little or no information on ecosystem carrying capacity at regional levels, for example in the Adriatic Sea, or along the coasts of Greece, etc. Such information is very relevant to prevent regional eutrophication, hypoxic conditions, outbreak of red tides, toxic outbreaks, etc.

Other potential impacts are not well studied such as the effect of escaped fish and their interaction with wild species and fisheries. In a similar case are the potential effects of species introductions and transfers. Similarly, although the use of chemicals of diverse sort, such as antibiotics, pesticides, vitamins, etc., it is acknowledge that there is limited or no information on their effects in the Mediterranean Sea, while effects are well documented elsewhere.

There is interesting information on fish communities and population increases around fish farming (Machias *et al.*, 2005) which at some point could be considered a positive effect. However, the evidence is insufficient to proof increased fish production. There is as well information available on the Interaction between Aquaculture and Capture Fisheries (GFCM 2005), but all this information needs to be integrated and analyzed under an ecosystemic perspective.

There is comparatively less information on the effects of bivalve aquaculture on the Mediterranean Sea and such effects should not be underestimated. However, one of the first activities of EAM included a seminar on "Environmental aspects of shellfish culture in the Mediterranean, with special reference to monitoring" (Dubrovnik, Croatia, July 1994). This subject has been addressed in Europe (ICES CM 2003) yet, the particular conditions of the Mediterranean may require a more focused approach.

## **2.3 Opportunities**

Perhaps the most relevant event during the past decade was the formulation of the Code of Conduct for Responsible Fisheries (CCRF) in 1995. One relevant activity which has taken place during the past decade was the Consultation on the Application of Article 9 of the FAO CCRF in the Mediterranean Region which took place in FAO, Rome, from 19 to 23 July 1999 (FAO R606). The report of this meeting is an important step forward and should serve as a guide to future actions of EAM.

The active presence of the ADRIAMED Project in the Adriatic Sea could also provide with opportunities for interactions, joint activities, coordination, etc.

As mentioned above, other networks under or within the GFCM-CAQ realm are partially taking environmental “responsibilities”. Such is the case of TECAM and SELAM under the coordination of CIHEAM. As an example of such activities there was the CIHEAM sponsored seminar on the “Impact assessment of Mediterranean aquaculture farms” (Uriarte and Basurco, 2001) already referred to. Also the UNEP/MAP 2004 report which is the latest synthesis of environmental issues related to aquaculture in the Mediterranean provides important baseline information and advance in the understanding of the environmental problems in the Mediterranean (or evidence of the lack of it). Another noticeable initiative have been developed by IUCN who held a special seminar on environmental issues in the MED (De Monbrison 2004).

Numerous scientific groups are doing research related to aquaculture and environment in the Mediterranean Sea with an ecosystemic perspective (e.g. ASLO special session, <http://www.sgmeet.com/aslo/santiago2005/sessionschedule.asp?SessionID=SS19>; and the EU project ECASA, [www.ecasa.org](http://www.ecasa.org)). The presence of these groups, networks, NGOs, etc., with potentially common interests could be considered as a great advantage for partnerships.

Clearly there are not only opportunities, but also strong demands such as the recommendation as a matter of priority of the extraordinary session of the GFCM (FAO 2004b) to allocate funds and re-establish the EAM. Such proposition had been strongly endorsed earlier by the External Evaluation of the CAQ (2004a).

Another opportunity relies on the SIPAM activities, such network could serve as a dissemination of synthesis information on environmental issues and conditions of sub-regions, coastal areas, etc., produced by EAM if the later could operate as a real network.

## **2.4 Threats**

The external evaluation of the Committee of Aquaculture (CAQ) and its Networks (FAO 2004) also provided a view of the weakening of EAM and the intake of some of its supposed activities by the other networks. The lack of economical support to EAM became evident and considering a re-activation of it we should stress the need of making clear why EAM is important, why is there an associated value for such network (or subcommittee?). Indeed one of the criticisms of the external evaluation to CAQ (FAO 2004) was that the other two networks, i.e. TECAM and SELAM, were rather subcommittees than actual networks and this could be easily the case when there are not real network activities and lack of operational orientation.

Other major issue is that the provision of funds for the operation of the network may not be sure.

## **3. ACTIONS FOR THE RE-ESTABLISHMENT OF EAM**

### **3.1 Do we need the EAM?**

Before defining the actions it is necessary to define clearly why we need such a network.

Although there are several environmental initiatives related to aquaculture in the Mediterranean, there is a need to integrate all actions and existing networks to provide more

and better guidance to GFCM regarding “recommendations” for decision making on aquaculture environmental issues by countries. This is relevant particularly considering that the Mediterranean is one ecosystem even though it may be necessary to consider different basins carrying capacities in order to protect the whole ecosystem. On the other hand the need for uniformity in regulations on a regional scale has been strongly recommended by the UNEP/MAP 2004 review.

Some countries may be easily able to implement Article 9 of the CCRF, however this may be more difficult for others. Making sure that this is done in a more uniform way is another important goal for EAM.

In general from the experience of other working networks such as NACA it is very important to underline clearly which are the services to be provided by EAM and establishing some sort of “Value” for such services. Such services shall be discussed within an Experts Meeting.

These are complex issues since there are numerous initiatives which are somehow networking on environmental issues in the Mediterranean (e.g. UNEP/MAP, ECASA, etc.). However EAM can play a role coordinating these actions under the CAQ and GFCM umbrella.

### **3.2 Important aspects about structure and functioning of EAM**

a) EAM funding; b) more detailed institutional structure c) leadership for EAM; d) operational organization.

### **3.3 Experts meeting**

The main objectives of this meeting are:

- i) To involve principal experts on the environmental issues around aquaculture, as potential members of a steering Committee (?).
- ii) To clarify the TORs for the EAM, eg. main goals, objectives and scope of Network.
- iii) To define the best working structure of EAM.
- iii) To define actions and Work Plan.

**Regarding Objectives of a new EAM they should be no so different from those defined in 1993:**

a) defining priority issues (common issues) to the Mediterranean aquaculture. Priorities may not be exactly the same as in 1993 as time has passed and many of the issues have been moving along. For example, the assessment of fish cages on the ecosystem, there have been numerous studies in the Mediterranean including an integration of such “potential “impacts as reported by UNEP/MAP (2004).

b) Providing coordinate actions to improve aquaculture environmental management including initiatives developed by existing networks and other organizations. c) Providing GFCM with guidelines and recommendations for decision making regarding aquaculture environmental issues.

### **Regarding Actions and Work Plan**

EAM should define some a) immediate action activities such as problem solving - responses to immediate issues (e.g. eutrophication problem in certain area, massive escape of culture

fish, etc.); b) mid-term action such as defining and implementing a Mediterranean Aquaculture Clean Production Agreement (MACPA) which can be reached step by step within a c) longer term plan which is the full implementation of the CCRF, Article 9.

Within a mid term plan it could be possible for example to improve site selection not only considering local conditions but carrying capacities for coastal areas. For example MACPA could consider site evaluation prior to establish the aquaculture activity (for new projects) and could consider annual monitoring for example starting with (some of) the oldest sites.

#### **3.4 - TOR for re-establishment of EAM (to be revised and adopted in the Experts meeting)**

- **Objectives**
- **Outputs**
- **Structure and Leadership**
- **Work Plan**
- **Financing**

## REFERENCES AND RELEVANT DOCUMENTS

**De Monbrison.** 2004 Mediterranean marine aquaculture and environment: Identification of issues, IUCN document.

**ICES CM 2003/F:05 Report of the Working Group on Marine Shellfish Culture 2003.** International Council for the Exploration of the Sea Conseil International pour l'Exploration de la Mer Palægade 2–4 DK–1261 Copenhagen K Denmark

**FAO (1999).** Report on the consultation on the application of article 9 of the FAO code of conduct for Responsible Fisheries in the Mediterranean, Rome, 19-23 Jul. 1999. FAO Fisheries Report No. 606 FIRI/R606(Bi).

**GESAMP (IMO/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP) Report (1991).** Reducing environmental impacts of coastal aquaculture Rep. Stud. GESAMP, NO. 47:35p.

GFCM/ XXIX /2005/Dma.6                      Interaction between Aquaculture and Capture Fisheries: methodological perspective. Draft GFCM Studies and Reviews No 78. (English only)

**Izzo, G.** (2001). Monitoring of Mediterranean marine eutrophication: strategy, parameters and indicators. UNEP(DEC) Report (draft) presented in Review meeting of MED-POL, Rome 5-7 Dec. 2001

**Karakassis, I., P. Pitta, and M. D. Krom. 2005.** Contribution of fish farming to the nutrient loading of the Mediterranean. *Scientia Marina* 69: 313-321.

**Macchias, A., I. Karakassis, M. Giannoulaki, K.N. Papadopoulou, C. J. Smith and S. Somarakis.** 2005. Response of demersal fish communities to the presence of fish farms. *Marine ecol Progress Series*. 288: 241-250.

**PAP/RAC (1996).** Approaches for zoning of coastal areas with reference to Mediterranean aquaculture. PAP-IO/EAM/GL.2 Split. 35p.

**Uriarte, A.and Basurco, B. (Eds), 2001.** Environmental impact assessment of Mediterranean aquaculture farms: Proceedings of the seminar of the CIHEAM network on technology of aquaculture in the Mediterranean (TECAM), CIHEAM and FAO.

**In:** Cahiers Options Mediterraneennes (France), v. 55 / International Centre for Advanced Mediterranean Agronomic Studies, Zaragoza (Spain). Mediterranean Agronomic Inst.; FAO, Rome (Italy). Plant Production and Protection Div. 213 p.

<b>ADRIAMED:</b>	Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea (FAO Regional Project)
<b>CAQ:</b>	Committee on Aquaculture
<b>CIHEAM-IAMZ:</b>	International Centre for Advanced Mediterranean Agronomic Studies-Mediterranean Agronomic Institute of Zaragoza
<b>COPEMED:</b>	Cooperation Networks to facilitate Coordination to Support Fisheries Management in the Western and Central Mediterranean (FAO Regional Project)
<b>EAM:</b>	Environment and Aquaculture in the Mediterranean (Network)
<b>EASTMED:</b>	FAO Regional Project in Near East.
<b>GFCM:</b>	General Fisheries Commission for the Mediterranean
<b>MEDRAP</b>	Mediterranean Regional Aquaculture project
<b>MAP/PAP</b>	Mediterranean Action Plan of UNEP Priority Action Plan
<b>MAP/RAC</b>	Mediterranean Action Plan of UNEP Regional Activity Centre
<b>MEDFISIS:</b>	Mediterranean Fishery Statistics and Information System (FAO Regional Project)
<b>MEDISAMAK:</b>	(Association of professional fishers of the Mediterranean coastal countries)
<b>MEDSUDMED:</b>	Assessment and monitoring of the fishery resources and ecosystems in the strait of Sicily (FAO Regional Project)
<b>SAC</b>	Scientific Advisory Committee
<b>SELAM:</b>	Socio-economic and Legal Aspects of Aquaculture in the Mediterranean (Network)
<b>SIPAM:</b>	Information System for the Promotion of Aquaculture in the Mediterranean (Network)
<b>TECAM:</b>	Technology of Aquaculture in the Mediterranean (Network)