

CENTER FOR MEDITERRANEAN COOPERATION



Photo: Basurco (CIHEAM)

MEDITERRANEAN MARINE AQUACULTURE AND ENVIRONMENT

Identification of issues

June 2004

PREFACE

This note has been produced by David de Monbrison (Fr) in prevision of the workshop on Mediterranean aquaculture and environment organized by the IUCN Centre for Mediterranean Cooperation in Barcelona : 29-30 April 2004.

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I - INTRODUCTION

“It seems likely that many policy makers will find aquaculture conforming better than capture fisheries to public policy objectives for reduction of poverty, employment, environment and non-food use of aquatic resources. In concrete terms, fishes produced by capture fisheries will become increasingly costly and rarer, while fish produce by the aquaculture channels will become more common and price trends, if may start high, are likely to fall later on” (FAO reports (2002)).

During the past three decades, aquaculture has expanded, diversified, intensified and made technological advances. The potential of this development to enhance local food security, alleviate poverty and improve rural livelihoods has been well recognized. The Bangkok Declaration and Strategy (Network of Aquaculture Centres in Asia-Pacific [NACA] and FAO, 2000) emphasizes the need for the aquaculture sector to continue development towards its full potential, making a net contribution to global food availability, economic growth, trade and improved living standards. This evolution is supported by recent European Community statements towards Aquaculture facing decrease of fisheries stocks and fisheries employments while increasing of aquaculture sector.

Nowadays it is increasingly recognized that **environmental interactions** of aquaculture should be viewed and resolved within a wider environmental and political context, with due account of the socio-economical circumstances in which aquaculture is taking place. Aquaculture corresponds to **various aquacultures** and the analysis should be made on both sectors:

- **Traditional aquaculture** in many developed countries of the south. Major characteristics of such aquaculture include family ownership, polyculture, integration with crops and animal farming activity, waste recycling and beneficial use of farm wastes. Southern Mediterranean countries, to some extent corresponds for freshwater aquaculture to this type of activities.
- **Modern aquaculture** is using modern tecnics for controlling the biological cycle and corresponds to highly qualified manpower managing modern production companies and international markets.

In the **Mediterranean Sea** these two types of Aquaculture exist with predominance and development of the modern aquaculture model specially in the marine sector with the following **questions** :

- How to integrate sustainability in aquaculture development for the Mediterranean, for the northern countries?
- How to prepare southern countries not to repeat northern countries errors?
- What are the main priorities for Mediterranean aquaculture and environment?

In 2004-2005, UICN would like to develop new plans of actions and programs on aquaculture and environment to support sustainable aquaculture and develop closer relations with private sector.

In this context the Malaga UICN Centre for Mediterranean Cooperation invited 9 experts descended of surroundings and varied origins (5 Mediterranean countries) in order to lead a first informal workshop to prepare definition of a new program as well as cooperation with private sector.

The content of this note was presented as support to discussion. It summarizes a rapid analysis of Aquaculture trends in the Mediterranean, specific issues of aquaculture and environment and draft preliminary recommendations as basis for a possible action plan for 2004-2005 for the UICN. The note present review and short description of :

- Main problems in the Mediterranean aquaculture-environment interactions,
- Some positive actions developed locally or internationally,
- Definition of sustainability for marine aquaculture
- Possible priority of actions to improve sustainability and facing the problems in the next future.

II - CONTEXT OF AQUACULTURE IN THE MEDITERRANEAN

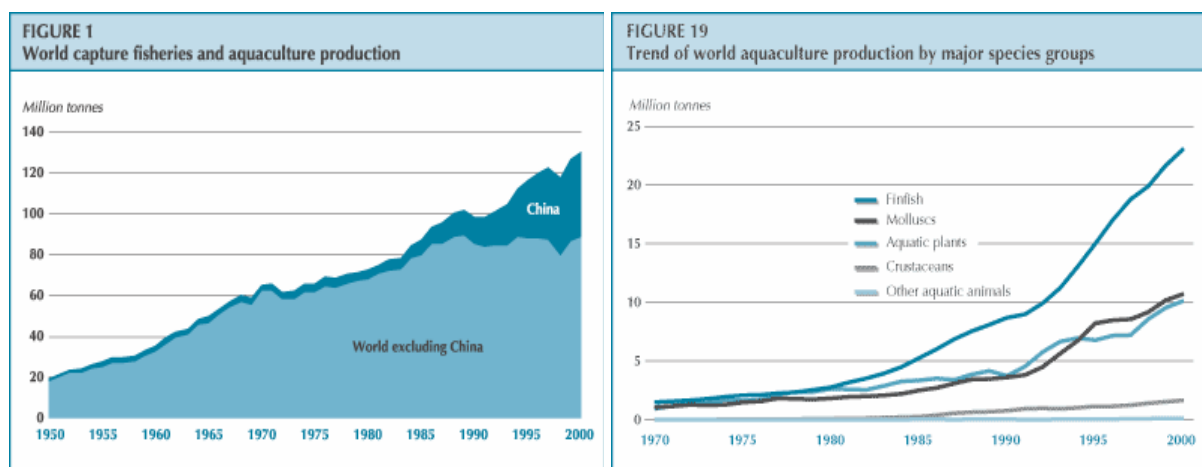
II.1 World production

According to FAO statistics, aquaculture's contribution to global supplies of fish, crustaceans and molluscs continues to grow, increasing from 3.9 percent of total production by weight in 1970 to 27.3 percent in 2000. Aquaculture is growing more rapidly than all other animal food producing sectors. Worldwide, the sector has increased at an average compounded rate of 9.2 percent per year since 1970, compared with only 1.4 percent for capture fisheries and 2.8 percent for terrestrial farmed meat production systems.

In contrast to terrestrial farming systems, where the bulk of global production is based on a limited number of animal and plant species, more than 210 different farmed aquatic animal and plant species were reported in 2000.

In 2000, more than half of global aquaculture production originated from marine or brackish coastal waters. The mean annual growth rate (for the period 1970-2000) was, however, highest for freshwater aquaculture production. Although brackish water production represented only 4.6 percent of total global aquaculture production by weight in 2000, it comprised 15.7 percent of total production by value.

Fisheries and Aquaculture in the world (FAO, 2002)



The share of the animal protein intake of the whole human population derived from fish, crustaceans and molluscs increased from 13.7 percent in 1961 to 16.1 percent in 1996 and then showed a slight decline to 15.8 percent in 1999. In industrialized countries, where diets generally contain a more diversified range of animal proteins, the supply increased from 13.2 million tonnes in 1961 to 25.4 million tonnes in 1999, implying a rise in per capita provision from 19.9 to 28.3 kg. The growth rate was steady until the late 1980s and has stabilized again since then.

On average, for all countries in the world except China, aquaculture's contribution to per capita food availability grew from 0.5 kg in 1970 to 1.8 kg in 2000 - representing an average annual rate of 4.5 percent.

Total and per capita food fish supply by continent and economic grouping in 1999 (Source: FAO 2002)

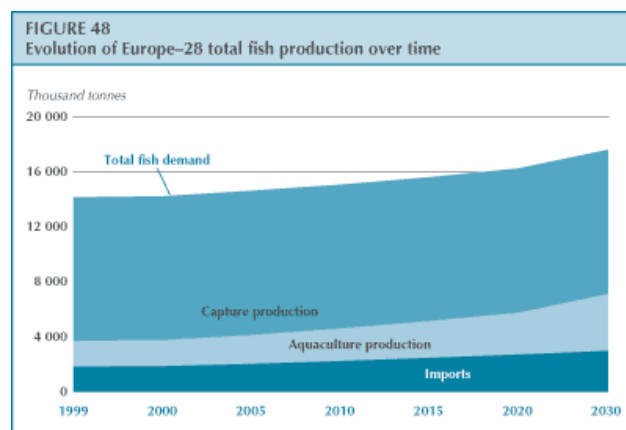
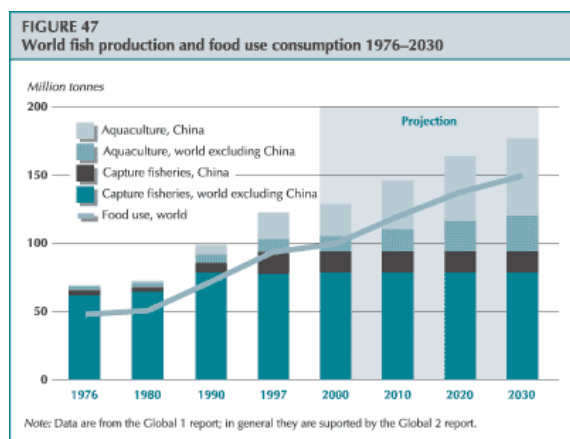
	World	World excluding China	Africa	North and Central America	South America	Asia (excluding China)	Europe	Industrialized countries	Economies in transition
Total food supply (million tonnes live weight)	95,5	64,3	6	8,1	2,9	32,5	13,9	25,4	3,7
Per capita food supply (kg per year)	16	13,6	8	16,8	8,5	13,7	19,1	28,3	12,7

Increases in world aquaculture production will be driven by increases in Chinese production, with South Asia, Latin America and the Caribbean and Europe providing smaller increases. Freshwater species and molluscs will dominate aquaculture production.

In February 2004 the 9th fish trade meeting established summary of the international situation. The international Market for fisheries products passed from 130 million tons to 133 millions with an increasing development of aquaculture product trade (30% of exportation in 2002). World exports represents 57,7 billions US \$ in 2002.

In order to meet growing projected consumption needs in Europe, total production increases in volume are estimated to result primarily from increases in aquaculture production. Indeed, the model estimates that farmed production will likely double by 2030, exceeding 2.5 million tonnes in 2015 and reaching 4 million tonnes in 2030. Towards 2015/30 projected annual per capita consumption is between 19 and 20 kg.

In conclusion, between 1988 and 2000 the Marine fish culture increase of 300% reaching 30% of total consumption products and 50% in value.



II.2 Aquaculture in Europe

Europe, including the EC, is one of three important markets for fish products. Of Europe's more than 480 million consumers, 370 million live in EC member countries, making the EC as important importer of fish as Japan and the United States are. European markets represent the largest one for importations since its demand increase and reach 35% of total aquatic products importations.

The aquaculture in Europe represents more than 80 000 workers corresponding to 57 000 full time jobs. Principals produced of aquaculture are fishes (trouts, salmon, seabream and seabass) and molluscs (mussels, oysters, clams). In 2000, the production rose to 315 000 tons, corresponding to 2

500 millions euros which represent 17% of volumes and 27% of values of total European production. For 15 years it follows a 4% increase/year.

Exports of high-value products from developing countries may serve as important sources of income and may compensate for the decline in local market access to high-value species. However, additional research is necessary before the implications of these trade patterns on food security can be evaluated.

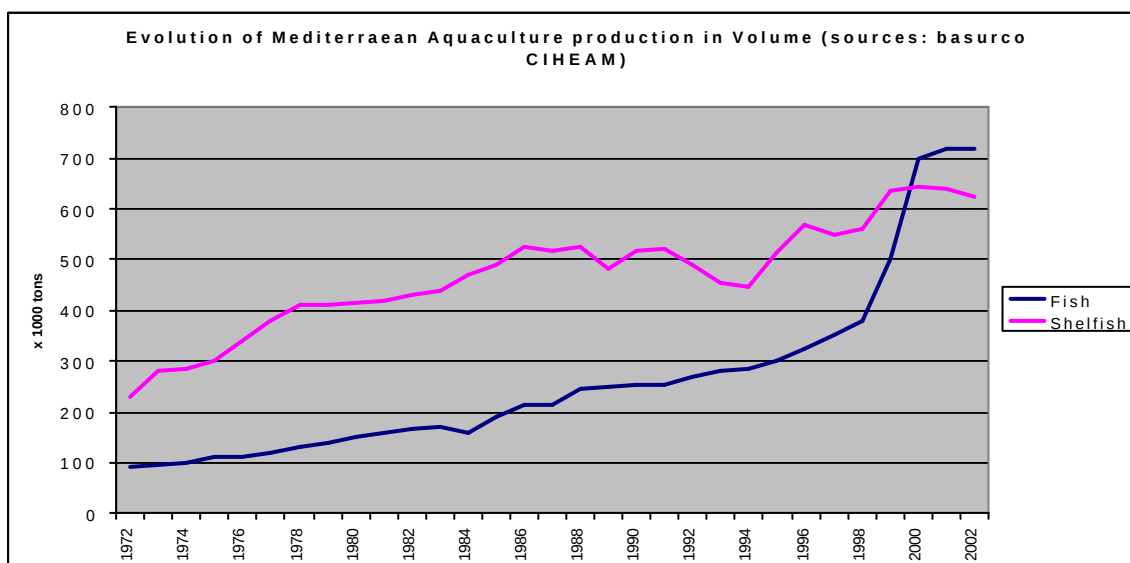
Estimated percentage changes in European fish production and consumption, 1994-1998 to 2030 (Source FAO 2002)

	Detailed countries %							Averages %		
	France	Spain	Portugal	Italy	Cyprus	Greece	Malta	Eastern Countries	Med	Northern Europe
Fish for food use Production	-6	4	-6	3	11	-1	27	-18,4	4,104	10,4
Fish for non-food use	16	-2	2	21	40	12	49	47,1	19,1	11,4
Fish production by source Production	-1	26	-42	13	-	-58		-39,0	-12,4	4,5
Aquaculture	109	222	35	136	261	160	159	104,4	154,5	285,8
Total production	33	39	1	52	58	33	98	15,4	43,75	26,8

The EU dependency on importations increased in recent decades and is now the largest market for fish importation. The issues for trade between 2002 and 2003 presented in the 9th World Trade conference are major since the following changes occurred: Changes in quality and Safety controls in importing countries; Introduction of new labelling; Tracability in most markets; Residues in products from aquaculture; Increasing public concerns about overexploited fish stocks; Sustainability of aquaculture including future fee requirements; Illegal fishing; Regional trade expansion; Additional value processing in the developing countries.

II.3 Aquaculture in the Mediterranean

With an average development factor of 7,1% between 1990 and 2000 the Mediterranean aquaculture presents, in the last two decades, a strong development (specially on fishes with 25,7% growth rate) and an annual growth rate that passed from 4% to 13% in twenty years.



The world's population is predicted to reach 8.5 billion by the year 2050 and the growth in coastal areas is estimated to be disproportionately higher (IPCC, 1994). Estimations for Mediterranean development of populations present also an interest in terms of consumption and potential markets. It is expected to pass from 133 to 200 millions between 1985 to 2025 (FAO, 2002).

In shellfish culture, France, Italy and Spain are main producers of shellfish with between 150 000 tons to 250 000 tons annual production per country. While oyster is in regression, Mediterranean mussel production is regularly increasing passing from 25 000 tons in 1971 to 125 000 tons in 2001.

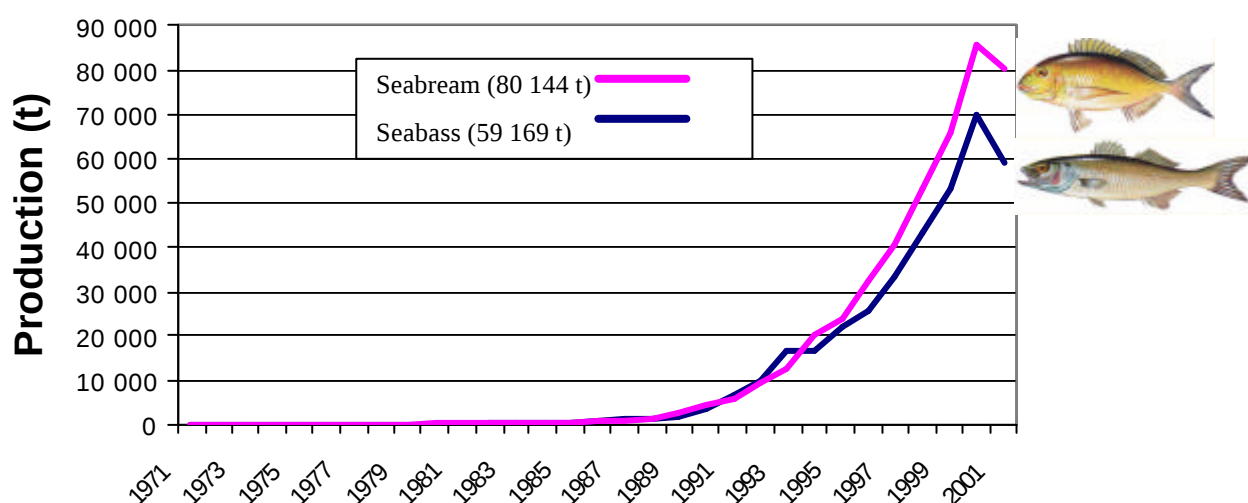
Fish production developed strongly specially with Greece and Turkey marine aquaculture burst in the 90s (Seabream and Seabass). Mediterranean fish culture is now clearly in front of shellfish culture with more than 700 000 tons/year where Greece and Turkey reach in 2001 respectively 68 000 tons and 28 458 tons/year respectively (see annex 1).

The growth rate between 1992 and 2001 analysis shows that Greece and Turkey are leading with 20,5% and 26,5 % respectively as well as Cyprus (34,1%) or Egypt (24,6%) that developed strongly its fresh water production with Nile perch and integrated production systems supported by Eastern Europe Chinese Carp production. However the most tourist country, France, presents the slowest development factor for the Mediterranean with only 0,2% (Sources: CIHEAM- Basurco). The Marine sector is the one that increased the most in the last decade because of Greece and Turkey Seabream and Seabass farming but also because of Turbot farming passing from 0 in 187 to more than 4300 tons in 2001) and Tuna fattening activity (passing from almost 0 in 1996 to more than 6000 tons in 2002) which is more a fattening valorisation of fishing products than real aquaculture. Characteristic of Mediterranean aquaculture evolution is also a strong diversification of productions passing from 18 species in 1981 to 40 in 2001 (Basurco. Personal data).

The Seabream and Seabass production reached 120 000 tonnes in 2001 most of which was exported (70% of Greece production), mainly to Italy and Spain. Greek exports have now expanded into new markets, such as the United Kingdom, Germany and France.

Seabream and Seabass production evolution is reaching of a limit in the Mediterranean where production is mainly directed by market concerns. A recent European Study (Stirling University-EU 2003) present that from estimated 200 000 tons in 2003 it would decrease in the next years up to 2005 while increasing probably again after improvements on production standardisation in Greece and Turkey.

Evolution of Seabream and Seabass production (Sources: CIHEAM)



III - PROBLEMS, ISSUES AND POSITIVE EXAMPLES IN MEDITERRANEAN MARINE AQUACULTURE

In order to resume the main problems of aquaculture sector from the producer point of view, the policy maker or the environmentalist we are presenting a general description of main problems affecting sustainability of aquaculture development.

III.1 Image deficiency and strong lobbying pressure

III.1.1 Image depreciation: environmental impacts and space competition

Fish production presents very different image from one country to the other. A recent European study presented some of these differences: In Northern countries aquaculture appears as a secure manner to control product quality while in Italy it is hardly accepted that a fish in the plate is not wild. In France capture fishes (considered “wild and nature”) receive better image than aquaculture.

Even though the perception of Aquaculture is very different from one country to the other, in general marine aquaculture suffers from a bad image in the public with various recriminations: “Polluting activity”, “no control of chemicals discharge in the environment”; assimilation for a time with the problems of “Mad Cow”; “It has a visual impact that affect our coasts”; it can represent a “genetical pollution to the environment”, etc...

All the critics have to be considered with respect to sites and real impacts. As an example we can present the situation of the 1000 tons farm on the northern coastal zone of France (St Brieuc) that have been closed for public pressure and image reasons. It was accused of producing algal blooms in summer. After closing the farm, a compared scientific survey showed that this farm produced 1/10 000 times less nitrates and phosphates than the local pork production that was finally responsible of the blooms. In the Mediterranean shore of Cote d’Azur (France), we can report the case of a fish farm where (at a distance of 50 m from the farms) the dilution was so important that the local small town of Cannes aside was producing more damage to the complete coastal shore than the farm could do at 50 m from its centre (Thomassin et al. personal data).

The image issue is a major one for producers and coastal zone management planners since lack of knowledge on marine and coastal environment, weakness of a small industry, competition with tourism in the most touristy areas of the world (the Mediterranean) and increasing political power of local environmental lobbies and associations brings to non-sustainable situations for the producers (loss of markets, end of renewing licensing, loss of small artisanal companies, etc...) and reduction of diversity in coastal economy.

Image is not rational for aquaculture but definitely represent a real issue to be managed in order to face sustainability, integrate communication by presenting real communication and technical solutions.

III.1.2 Some positive initiatives and actions developed on image

- Valorisation of a quality procedure: the salmon industry as well as French aquaculture anticipated the ESB sickness and forbid since 1996 (prior to the crisis of mad cow in Europe) the use of extra proteins from animal in all formulated food for aquaculture.
- Increasing integration of environment management in fish culture: as example, the reduction of the use of antibiotics in Norwegian salmon culture from 1.065 grams to 0.003 grams/ Kg in recent years or the non use of chemicals in cages in most Mediterranean farms.

- The development of Code of conduct by the profession (FEAP) and integration of its guidelines via the development of code of practices in various Mediterranean countries (Greece, Italy)
- CRAFT European programs: involvement of research centres and producers in order to develop scientific data and scientific objections to all irrational critics as well as to develop various joint research.
- Producers organisation via European bodies, increasing capacity of lobbying is becoming part of the industry capacity of moderation and adaptation to local or international pressing and legislations.
- Various education programs on aquaculture are developed locally around small farms or research centres.
- Application of ICZM via spontaneous or organized positive interactions with local actors (tourism, diving, fishermen) are improving aquaculture image. As an example, the employment of fishermen in the Blue fin tuna fattening industry, the improve of small fishermen catches around fish cages in Greece or the Tuna feeding as a diver spot site in Cyprus below sea bream and sea bass cages.

III.2 Markets fluctuation and adaptation

III.2.1 A producers concern:

The market issue is a major one and mainly for producers. Its impact on sustainability of their activity is a real asset. Efforts on developing new markets and species are still important, but delay between “niche” specie production (at high price) to large scale commercialisation (at low price) for a same product is getting shorter and shorter.

To illustrate two examples are presented: Blue Fin Tuna fattening production and Sea Bream-Bass production.

- Attracted by the Japanese Blue Fin Tuna (BFT) market demand and without professional or international enough regulation, the BFT industry suffered in 2003 from overproduction and lack of anticipation on Japanese market evolution. Some major companies in Spain bankrupted leading to new situation for the next years with weaker fatteners and fishermen.
- The Evolution of Seabream and Seabass market reflects the present situation of Mediterranean aquaculture development. As Seabass/Seabream output has grown, costs have been driven down, and market prices declined by more than two-thirds between 1990 and 2002 - from US\$16/kg to about US\$4 to \$5/kg. The rapid saturation of the market and the parallel rapid price decline (60 to 70 percent in ten years, compared with 50 percent for Atlantic salmon) are attributed to the much smaller traditional market for these species (mainly southern Europe) compared with the Atlantic salmon market, the lack of diversified products and limited market development and promotion. A recent produced studies¹ presents the main problems (lack of rationalisation, lack of anticipation and bad management of selling periods). Optimist forecasts assume that after a decrease between 2003 and 2005, rationalisation of production mainly in Greece and Turkey as well as better management of seasonality and increase demand up to 322 000 tons by 2008.

III.2.2 Some example of positive initiatives on market:

- Species diversification: Mediterranean aquaculture developed for years diversifications programs with various success (groupers, dentex, tuna, japanese bream, snappers, etc...). To face seabream/bass mass production, diversification is a real asset for each national industry.

¹ Study of the Market for aquaculture seabass and seabream (April 2004) – DG Fisheries 83 p.

- Developing communication tools on salmon fat content quality supported the salmon market stability after strong critics in 2003.
- National bodies supporting programs or communication for regional professional organizations (ex. OFIMER in France)
- Involvements of researchers and producers in developing global market analysis and company installation tools (DOTT programs, MERAMED. EU programs²)
- Developing high quality and eco-labelling tools for niche markets represent a limit (3-8% of the production) but is of real interest for some companies.

III.3 Fishmeal formulation aquaculture feeding process and sustainability

III.3.1 Fish oils and fish feed processing

Fish meals and fish oils are essential constituents of fish feeds. In 2000 more than 35% of world fish meal production went into fish feeds. In 2003, 5,4 millions tons were sold representing 12% reduction from the year 2000 because of BSE disease and the phenomenon del Nino) from about 33,7 million tons coming from natural stocks (Sources FAO, 2002).

Intensification of freshwater aquaculture in Asia may absorb by the end of this decade 70-80% of world fish oil production and at least 50% of fishmeal production. This resource being limited, evaluation of wild stocks used for this protein source is still inaccurate by lack of research. The need for research and efforts on substitute protein represent one of the most present and future targets (EU strategy for sustainable aquaculture, 2004).

In addition, some remaining bad feeding management at farm levels or using bad formulated food can lead to increasing local pollutions below the cages.

III.3.2 Some example of positive initiatives on fish meal

- Some new research programs on food improvements (PEPA – EU program) are presenting that introduction of other protein sources (vegetal proteins) in food formulation can lead to 90% replacement for salmoniculture and 60% for marine fish without changes in growth performances.
- Integrative aquaculture and research on various integrative aquaculture focusing on social, environmental, economical and technical feasibility and benefits present strong alternative for better production. As a list of example we can present: integrated cultivation of salmon and seaweed: productive, environmental and economical issues³ or conferences at the aquaculture Europe 2003 conference (EAS – 12-15th of august 2003) or various programs of IOLR (www.iolr.it) on integrative ponds with production of bivalves, Seabream or Groupers and algae.
- ISO 14000 or organisational quality process is developing inside the aquaculture industry
- Farmers training and professional organizations awareness as well as national regulations on feeding monitoring are leading to better practices.

² www.dott.org -

³ Alejandro H. Buschmann (2000)

III.4 Local environmental impacts of marine aquaculture

III.4.1 Localized impacts:

Environmental concern for marine aquaculture is generally localized and on a limited area around the farms:

- Local enrichment of the water column and anoxia of sea bottom : specially focussed by salmonid culture in close fjords where water circulation is rare, this problem appears also in some Croatia areas and Greek aquaculture. Anoxia of the bottom can occur if not managed or not well positioned. Foot print impacts on sediments or reduction of benthos biodiversity is limited below the cages. Sometimes the local effect is too small to be taken in consideration on long term because of winter recovery of the sites (storms). In addition marine aquaculture recovery of the sites is rapid (between 3 month to 10 months depending on scientific sources: Gowen et. al. 1988).
- Impacts on specific seagrass like Posidonias. Fish farming because of fishes densities leads to shadowing the bottoms and limit photosynthesis. For farms with maximum 35 m bottom depths the shadow effects on posidonias exists even if remained local on the area of the cages.
- Escape of fishes and genetical impacts: in salmonids where homing specific behaviour leads to progressive impacts of aquaculture, the problem became accurate. Up to now and after more than 20 years production, no specific indications of impacts on wild Seabream and Seabass have been published.
- Bad farmer management and sickness transfer to wild species: high concentrations of fishes and stress can lead to sickness, environmental and economical disasters like for shrimp culture in Thailand and Ecuador. No such impacts have been observed in Mediterranean. In Australia, national policy makers decided to concentrate the Tuna fattening farms in one geographical bay for limiting space conflicts leading to sickness concentration and stronger impact on the local environment.
- Visual and odour impacts: visual impact has been reduced by the type of buoys and nets since they are more and more simple structures to minimize costs and visual impacts. In Croatia because of some bad management at the burst of BFT fattening activity some negative odours effects could be felt by tourists because of fresh fish feeding and not pellets. These defects have been rapidly corrected. Marine aquaculture does not present olfactive impact. Inland installations are under European sanitary regulations and no olfactive impact is presented.
- Increase mineral and organic materials for shellfish culture: shellfish culture can also impact a closed area (like basin d’Arcachon or brackish water coastal semi-closed lakes) by mineral accumulation. Management of wastes is for this industry a major issue. Valorisation into artificial reefs can be of interest as well.
- MEDWEG (effect of nutrients release from Mediterranean fish farms on benthic vegetation in coastal ecosystems: www.medveg.dk) as well as other programs on environment and aquaculture⁴ presents results confirming that some minimum criterias are required not to impact the local environment:
 - At 200 m off the farm site, the impact is minimized and dilutions are far below incidence
 - farms must be at same distance from posidonias or endangered species like maerl beds.
 - Positioning farms in proper current patterns is of importance (dispersion). On this specific aspect we can emphasize that a farm producing 100 tons can be more harmful to local environment if positioned on shallow water without circulation than a farm of 1000

⁴ marin et.al 2002

tons positioned under deep bottoms or with appropriate currents diluting towards the offshore direction. This characteristic is a specificity of marine aquaculture compared to other productions.

Barg et. Al. (1997) review environmental impacts and aquaculture for FAO and present also that: *“However, pressure on resources continues to increase due to population growth, coupled with unequal distribution of food, other goods and services, and increasing degradation of aquatic environments (e.g. Chua et al., 1989; Petr and Morris, 1995; Muir, 1995; Barg et al., 1997b). Regulatory measures to reduce environmental degradation by major offenders are sometimes lacking or not enforced. In contrast, aquaculture, a relatively minor offender, is often not recognized as a legitimate resource user, whether by government authorities, other resource users, major polluters, or the public in general. This has produced a climate under which there is little protection of the aquaculturists' needs for adequate quality and quantity of resources (Van Houtte, 1994; FAO/NACA, 1995), and may increase the investment risks in the sector. Long-term consequences of uncoordinated resource use in river basins or coastal areas are sometimes ignored or neglected, particularly with regard to the social and economic value of goods and services provided by aquatic ecosystems, their genetic resources and biodiversity. Neglecting these considerations may affect not only the sustainability of aquaculture and culture-based fisheries, but also the sustainability of many inland and coastal fisheries.”*

III.4.2 *Some example of positive initiatives on local impacts of Aquaculture.*

- Reserve effect in Greece and positive impacts on local fisheries: IMBC researchers present results on the impact of aquaculture on small-scale fisheries. Because of existence of various fish farm cages on Greece coast (under which fishing is prohibited) it created a reserve effect (protected area) positively affecting local fish stocks and fishing statistics as presented by landings statistics and incomes for fishermen.
- Comparison of impacts of town of Cannes (Fr) compared to local farm showed that impact of fish farm was so minor compared to tourism and town pollution of the bay that no trial could be developed against the presence of this farm (Thomassin et.al unpublished data).
- European programs on methodology and harmonisations of aquaculture analysis: MEDWEG and AQCESS are presenting scientific results supporting a more adequate vision of what is the real impact of aquaculture farms locally. This should support better communication and better understanding from the public and stakeholders.
- Recovering of sites scientific studies (Gowen et.al. 1988; Frid J. 1995) show that in most difficult environments with small recirculation of water, maximum recovery sites after aquaculture production takes 10 months and can take only three month due to water storms and recirculation in winter time. Time of recovery to initial state is 10 times quicker for marine aquaculture than for industrial and urban discharge (Moore and roger, 1991; Johnson and Frid, 1995).
- Integrative aquaculture experiments are of great interest for reducing impacts and improving enrichment capacity of fish farms leading to a natural production of life and complementarities between species (Shpiegel.et al 1996; www.ocean.org.il)
- Artificial reefs like the biggest Mediterranean artificial reef in construction in Marseille golf (France) would develop very positive interaction with a local fish farm closeby because of fishes attractability impact of the fish farm and mutual potential benefits in terms of local colonisation plus side effects to tourism (diving attraction)⁵.
- Bio-labelling : bio and eco-labelling is developing in Europe and represent a niche market focussing on friendly to environment production practices with very strong regulations.

⁵ étude d'impact du programme RECIF PRADO 2006 (Mairie de Marseille -BRLi)

- Code of conducts and professionals anticipations: development of code of conducts transcribed into code of practices by professional organization represent one of the most positive advances in terms of precautions behaviour and long term benefits for aquaculture and environment through the improvement of producers knowledge and awareness.

III.5 Access to coastal zone - Administrative and political weakness

III.5.1 Competition for space in the Mediterranean coast- No patrimonial management ?

Major constraints for present and future aquaculture development in the Mediterranean are the competition for space, the competition between users of the coastal zone area. Conflicts can lead to heavy trials for small producers, vandalism on cage nets with loss of production leading to increase fragility for producer. As first world destination for tourism, with 30% of world tourism (180 millions tourists in 1985) and strong developments expected (340 millions in 2025), the Mediterranean aquaculture is and will face in all countries a strong competitor represented by tourism. The tendency is emphasized by local, national or international environmentalist lobbies and lack of political support.

Even though all tourism territorial development has been proved to be unsustainable (see Cyprus industry in last 3 years, impacts of international crisis), aquaculture is not valorised in terms of national or regional policies in general even though Aquaculture is creating permanent employment, source of tourism activity, valorisation of fresh production for local tourism period. If legal framework exists for Integrated Coastal Zone Management (ICZM), aquaculture is very seldom integrated or supported as a positive element of local development.

France did not developed its farm for years, becoming the first tourism country but the one with less growth factor in the Mediterranean for aquaculture (lowest with 0,2%). It represents an example of what could happen in other countries. New French policies develop for not renewing licensing or reducing licensing to 5-10 years leading to a situation of economical and social insecurity for producers reducing dynamism and adaptation capacity in a context of global market. One of adverse consequences is also the development of larger companies capable to face some of the risks but disappearance of all small producers (focussed on local markets and more integrated) with strong local impacts.

In a context of complex national regulations on coastal zone and land tenure, policy makers as well as local administrative officers do not have the proper trainings and tools to support sustainable development of aquaculture as well as integration in coastal zone (harmonization of laws, environmental scientific support and background, political support).

Compared to any economical activity where there is minimum security of private investment by creation of industrial zone, Concerted Active Zone (ZAC), agriculture and rural planning or land use planning, marine aquaculture suffers from the lack of appropriation of the sea territory, and lack of vision of the coastal marine areas as a space for organized development. The offshore or coastal “patrimonialisation” are only developed through some extraction activities or development of offshore wind mills new industry. For marine aquaculture, a lack of strong vision on space management and policy leads to increase weakness of European industry in the Mediterranean.

As example we can present a positive initiative of Murcia Region (Spain) that decided to produce a Regional planning for aquaculture development. After consulting with all involved sectors (tourism, environment, agriculture, navy, transport, etc...) and asking them to produce a spatial presentation of where aquaculture could develop, there were no matching between all the maps. The discussion stopped at this stage for 2 years. Finally all the farms were concentrated in offshore area and mainly after a political support for national aquaculture plan of development. The negative side effect of the

decision could be to concentrate risk of negative interactions between the farms (see Australian Tuna example or Shrimp industry).

The situation in the northern Mediterranean is a good example of what should not developed in the southern countries in this sense. Some environmental constraints are so high and sometimes not appropriate to small producers leading to their natural exclusion or illegality. Small producers cannot present proper documents or proper environmental monitoring results because of too highly scientific guarantee and inappropriate policies. This can be explained by a strong lack of knowledge from administrative officers and lack of interaction between research, administrative bodies and producers. As an example some producers in Spain are still asked to monitor 4 times a year water column impacts at 25, 50, 75, 100 m and 200 m distance even though all researches present that after 25 m and sometimes 50 m (in current direction) from the cage no impact is measurable on the water column.

III.5.2 Some example of positive initiatives on coastal zone management and aquaculture

Some positive examples are presented but too scarce to really overcome the problems of integration of aquaculture in sustainable coastal zone development.

- Adapting ICZM to Aquaculture: European fundings through FIGF and the new strategy for Sustainable aquaculture (see next chapters) should support development of new initiatives. Some national institutional tools can support integration of aquaculture in regional sustainable development like SMVM in France (Shema de Mise en Valeur de la Mer) or Plano de acuicultura in Spain, however real local support is nowadays too poor for a real coastal planning supportive to aquaculture, security of private investment, and a real sustainable development of the activity.
- Research on socio-economical impacts and interdisciplinary meetings with regional policy makers, fish farmers, researchers, etc... are producing proper frame for better global understanding, vulgarisation of wide range of scientific knowledge, leading to bringing bridges and support towards sustainability. As example we can present DOTT symposium in Cartagena 2002⁶.
- Local and regional agencies dedicated to aquaculture support and/or integration of the activity into coastal development is one of the best institutional response to actual constraints. They can support the sector with financial and technical tools, building bridges between the profession and environmental bodies as well as being in close relations with local deciders. CEPALMAR (France) or local Fishery departments (Spain and Cyprus) are some of these examples.
- Political support for sustainable development and planning. National council of Minister of Cyprus authorized development of Aquaculture respective to the environment by defining the minimum frame for its development: defining the maximum volume authorized, the space areas to be allowed for licensing, the environmental level of studies expected for getting a license, the procedures for monitoring. It gives total framework for producers to present sustainable projects.
- Integration of Aquaculture with local activities (diving, small scale fisheries, environmental education, professional tourism, etc...) is presented also in precedent chapter. We can add the positive possible interaction with offshore wind mills in a context of future development of alternative energies. These wind mills fields will be possible offshore supports for large aquaculture farms far from tourism pressure. It presents a security for farmers in terms of structures and survey.

⁶ CORDIS concerted action. "Domestication Of Thunnus Thynnus". Cartagena (Spain), February 2002:

III.6 Technical and biology aspects of aquaculture development

Technical and biological aspects concern mainly the producers in their search for diversification of species to improve their capacity of adaptation. These aspects will not be developed deeply even though it represents an important part of aquaculture constraints and conditions for dynamic European and Mediterranean competitiveness. Following examples can enumerate :

- Offshore tecnics for development of offshore fish farms
- Closing biological cycle and production cycle for new species (new markets, more sustainable species, fast growers)
- Research on new sickness and prophylaxis treatments.
- Etc...

IV - DEFINITION OF SUSTAINABILITY IN AQUACULTURE

In this context of pressure on aquaculture, definition of sustainability is necessary for defining what are the criterias for aquaculture sustainability and the type of priority actions to develop. Definition will help to support better integration of environmental aspects in the production but also would improve communication and concerted actions between producers and environmentalists.

The first key proposed here is the one used by aquaculture ecolabeling framework around the word “Respect”:

- Respect to the consumer: by providing quality and security
- Respect to the producer: by respecting his investment, his salary, his risk management
- Respect of the animal and the product: by treating all the production process with care and respect of animal welfare
- Respect of the environment by taking precautions and realistic measure to be friendly to the environment as much as possible.

Consequently Aquaculture production could be defined sustainable if respecting all the domains developed below and not only the environmental aspects :

- **Economically sustainable** : characterized by efficient and viable companies, with commercial perspectives, with minimum visibility, supported by harmonized and comprehensive legal and administrative apparatus, with capacity of reinvestment, taking care of their environmental space thus allowing duration of future production,
- **Socially sustainable** : characterized by actively practicing secure employment, supporting local manpower support, developing formation all-along professional life, gender valorisation, equitable wages, respect of working security rules (specially for divers), developing intersectorial connections and social innovations,
- **Environmentally sustainable**: characterized by respect of a minimum distance from the sensitive species (posidonies, maerl), improve permanently feeding intake and feeding practices as well as food formulations, support programs for reducing pressure on wild stocks, reduce impact on wastes, improving his own capacity in understanding local impact and monitoring it in standard ways, forbidding polluting chemicals or replace it by natural ones or controlling the one used and respecting security and laws, limit transportation by developing close to production market and establishing the farm close to infrastructure and markets (keep simple and fresh), supporting a change in image of aquaculture (building new products, develop anticipatory capacity, valorise bio-labelled companies as representative of the industry, develop local visits and local acceptance by its own behaviour), forbid introduction of foreign species, support research (on fast growers, marine vegetal proteins, integrative systems, etc...)
- **Territorially long lastly integrated**: characterized by an activity supported politically, recognized like a permanent activity that is creating permanent employment and incomes, diversity and with local positive image supporting all year round quality of production (local freshness). It implies that the farm is integrated via the existence of legal appropriate framework and simple administrative procedures supporting security of private investments. It is characterized as well by an activity that develops interactions with the other actors of the coastal area (tourism, windmills, fishing, etc...). Local and national financial tools supporting sustainable integrative approaches are proposed;
- **Sustainable for the consumer and respectfull to the product**: Characterized by development of the traceability, information and auto-control, flesh quality and sanitation control, animal welfare concern and improvement in the farm, public health monitoring and control.

V - INTERNATIONAL CONCERNS ON SUSTAINABLE AQUACULTURE

V.1 *International statements:*

During the last decade, issues such as sustainable development, environmental interactions and long term sustainability of aquaculture received increasing attention at local, national and international levels (e.g Chamberlain and Rosenthal; Bardach, 1997). Special attention is also given to these issues as relevant developing countries (FAO/NACA 1995; ADB/NACA 1996). The need to address environmental interactions and sustainable issues for the benefit of sustainable aquaculture development has been reiterated at several global intergovernmental conference, including the world Food summit (WFS, 1996), the International conference on Sustainable Contribution of Fisheries to Food Security (FAO/Japan, 1995), and the FAO Ministerial Conference on fisheries in 1995. Awareness of major beneficial and adverse environmental interactions of Aquaculture is also reflected in UNCED Agenda 21 (chapter 14, 17 and 18). The code of conduct for responsible fisheries was adopted in the 28th FAO conference in 1995 where the code for Aquaculture is on chapter 9.

From this period other international bodies integrated more and more aquaculture sustainability requirements in their policy and actions (see FAO introduction of this study). In September 2002, the Commission presented to the Council and to the European Parliament a communication on “Strategy for the sustainable development of European Aquaculture”. The aim of the strategy is the maintenance of competitiveness, productivity and sustainability of European aquaculture sector. The strategy aims to create the conditions that will enable the aquaculture producers to offer a healthy product in the quantities required by the market, while being environmentally non degrading. The strategies identify 3 main objectives:

- Creating secure employment: to create 8 to 10 000 jobs between 2003 and 2008, in particular in the dependant zones of fishing.
- Providing safe and good quality fisheries products and promoting animal health and welfare standards.
- Secure an environmentally sound industry: respectful of environment.

To meet these objectives, The commission proposes the following measures (see annex 2):

- Creating secure employment
- Increased production
- Tackling competition for space
- Stimulating the Market
- Social Considerations
- Improving governance
- Safety of aquaculture products and welfare
- Reduce impact of wastes
- Tackle the risk from alien species and genetically modified assessment
- Supporting research

The Actual FIG (Financial Instrument for Fisheries Guidance) allows the European community to co-finance numerous projects benefiting both fisheries and aquaculture sectors and the processing and marketing of their products. The instrument covers the programming period 2000-2006. However the Commission already adopted in February 2004 its budget for the new programming period running from 2007 to 2013 defining strongly the mainstream lines of budget and type of supports.

V.2 *International context supporting Sustainable Aquaculture*

Here are presented a summary of the various texts and conventions as well as international initiatives supporting or framing Sustainable aquaculture:

- **International conventions:** The OSPAR Convention(1972-1978) oriented at control on chemicals (medicines and antifouling) are defining the limits and the type of products to be used in marine environment. The Barcelona Convention (1975) is also focussing on prevention of pollutions and can refer to aquaculture.
- **EU legal framework:** The Mediterranean northern aquaculture is largely dependant on the evolution of European directives that are later on applied and adapted within the national legal frameworks. Thus sustainable aquaculture is dependant on the following texts and conventions:
 - EU Water Framework Directive;
 - EU Integrated Pollution Prevention Control Directive;
 - EU Urban Waste Water Directive;
 - EU Wildbirds Directive;
 - EU Species and Habitats Directive;
 - Ramsar Convention;
 - EU Strategic Environmental Impact Assessment Directive;
 - UNCED Biodiversity Convention / Agenda 21;
 - OSPAR Annex V Implementation;
 - European Community Biodiversity Strategy [COM (1998) 42];
 - Fisheries Management and Nature Conservation in the Marine Environment [COM (1999) 363 final];
- **Code of conduct:** Various initiatives for Production of Best Environmental practices and code of conduct exist. The FAO lead the development of this international framework basis in 1995 and it was recently adapted by the FEAP in 2000. from this time various federations are developing codes of practice in order to better adapt the sustainable approach to their regional or species specificity.
- **EU support to ICZM** from 1995 to 2003: Within ICZM, aquaculture usually plays a minor role and is not the centre of the ICZM process. Based on the experiences of the previous programs of the EU on ICZM and the actual new support to aquaculture, we can imagine new development of innovative integration of aquaculture in ICZM process supported by the new FIG budget proposed by the European Commission for 2007-2013.
- **Others:** USDA is developing ecolabeling procedure on the model of European and French system of eco-labelling for aquaculture. Asian Aquaculture sustainable action plan built by NACA + ADB in 1996 is also presenting Asiatic potential influence on international sustainable aquaculture developments.
- **In the Mediterranean:** International experts meetings through UNESCO (ICZM formalisation), or GESAMP (guidance documents on monitoring ecological impacts) (1996) as well as various research programs have been conducted in 1990-2003 (MEDWEG; AQCESS, etc...). They are producing results and arguments to support both environmental lobbies and policy makers to get closer to the producers and give to producers the best tools for a responsible development of their activity.

VI - WHAT IS LACKING FOR SUSTAINABLE AQUACULTURE - PRIORITIES

Analysing the problems and main concerns of aquaculture, integrating the definitions of sustainability expected for aquaculture, we are presenting the main actions and priorities in order to improve sustainable development of aquaculture.

VI.1 *Valorisation of Image of Aquaculture*

➤ From the Producers side

- Improve professional production practice and emphasizing transparency and communication
- Develop valorisation of farming best examples on environment, ecolabelled farms fish, culture quality sensors. Ecolabelled farmed fishes can be the illustration of all industry if communication well managed.
- Develop more educational programs on marine environment (special demonstration farms, schools programs): farmers have best facilities for presenting marine life cycle. Various local support for environmental education exist to support industrial or educational education.
- Develop involvement of farmers in research and researchers in providing tools for farmers. The target is to provide scientific knowledge on specific critical domains linked to environment.
- Develop more information to decision makers (local and national), opinion makers: develop policy of transfer of information after scientific knowledge production
- Be stronger in communication on the product (TV) + on the activity: be more effective and coordinated as inter-profession on modern communication tools.
- Be active in communication and go for mutual recognition of environmental associations needs and farmers.

➤ From national, international bodies and researchers:

- Develop more scientific data and comparative studies on impacts of aquaculture and impacts of other activities (tourism, agriculture) providing better understanding of global ecosystems impacts at the level of a bay. Develop systemic approach integrating not only environmental but as well socio-economical impacts to present new communication tools.
- Develop more involvement of farmers in research and of researchers in providing data and tools for farmers
- Develop information to decision makers (local and national) political support, opinion makers, develop valorisation of farming best examples (scientific and best practice knowledge is not enough diffused to the decision makers). Developing supportive criterias for sustainability, integrating aquaculture and marine environment specificity
- Develop better communication on positive aspects of nutritions
- Support educational programs: there are not enough educational programs for children and schools on marine biological cycle based on aquaculture production in order to improve public awareness and knowledge.
- Support development of medical aquaculture for diversification (molecules production from algae, etc....)

- Develop communication and mutual recognition between environmental associations and farmers: After years of fighting for environmental protection, producers integrated some of environmental constraints presented by environmentalists. Environmentalists have interest to come to complete integration of sustainability and private sector is now at a stage of real integration of environmental constraints and needs of preservation. The climate for mutual recognition of importance has arrived.
- Develop new and simpler administrative tools and regulations supporting integration of aquaculture in coastal zone management. ZAC, activity developing zones etc... These tool would support public acceptance when applied.

VI.2 *Improving Sustainable Feeding*

➤ From producers side

- Support development of education on feeding impacts in the production channel
- Improve communication to public on nutrition quality of fish formulations
- Improve consulting with fish formulation industry on the future of GMO in feed formulation for fishes
- Improve communication on the carnivorous characteristic of the fishes produced. It is natural that a carnivorous fish eats protein issued from fishes as it does in the wild.

➤ From national, international bodies and researchers:

- Stimulate research on digestibility, food formulation, flesh quality research: research is well supported by private sector and national governments and will develop more in the future pushed by prices of limited stocks of trashfish. Quotas for these small pelagic stocks should be considered in order not to affect the rest of wild food chain. Thus anticipation by supporting strongly this research on reformulated food is highly needed.
- Diffuse knowledge and research on trashfish for non-human consumption stocks evolution + proportion of aquaculture versus rest of animal production: lack of knowledge on stock exploitation levels is one of urgent needs in the near future to take better political decisions.
- Check a new system of production monitoring through analysis of the feeding channel instead of on the final production declarations. The feeding is directly connected to the volumes of fishes and the impacts on the environment. It would be more efficient system of monitoring efficiency and sustainability of each farm by comparing all producers, transporters and fish meal industry data emphasizing on quality and close farm monitoring.
- Support a continuous monitoring and improvement of practices for southern countries. Supporting management and training programs for Southern Mediterranean countries producers (accelerate professionalisation).
- Support education on feeding impacts at producer levels
- Support valorisation of fish wastes from industrial fisheries into the formulation production.

VI.3 *Improving Environmental local situation and impacts monitoring*

➤ From producers side:

- Support research and appropriation of tools that can be used for valorisation of best practices (explaining to producers why ? how? for whom ? when ?)
- Improve their feeding procedures and implement/monitor their codes of best practice
- Improve their monitoring of environmental impacts

➤ From national, international bodies or researchers:

- Review environmental issues on environment and national/international programs on aquaculture-environment and sustainability for the Mediterranean. Realize a State of the art for introduction of species in the Mediterranean through compilation of studies. Limitations are proposed on species introductions.
- Review and produce comparison on legislation and policy is realized in order to check what is the distance between regulations and practice via deep inquiries and comparison between countries. Unrespected regulation is useless and non-productive, thus the aim is to present to producers and administrative officers improved and simple legal and administrative frameworks for their activity and a basis for southern Mediterranean countries developments.
- Support comparative research on recovery of benthos and sites in the Mediterranean: very seldom studies on sites recoveries have been realized in the world. In the Mediterranean proper experiments are rare because of lack of example and sites to allow this type of studies. Initiatives are expected in this domain to present better figure of real impact. Organic degradation in the marine environment is a natural capacity of the sea unmonitored on aquaculture yet.
- Develop and valorise comparison impact studies with other productions: with agriculture, tourism pollution, industrial pollution, heavy metals etc...: One heavy study on aquaculture would serve as a basis for policy makers since other sources of pollutions are sometimes more affecting a bay than a fish farm. The objective would be to improve scientific data on local ecosystem management (at level of a bay integrating all inputs). It could present in addition to the results on comparative impacts in different regions of the Mediterranean a review of already existing local examples.
- Increase research, understanding and comparison between various programs on integrative aquaculture: integrative aquaculture for intensive or extensive culture at sea or in ponds is one of future trends for sustainable marine and fresh aquaculture using the benefits of aquaculture organic production for additional productions or water treatment through natural ways reducing thus local impacts (algae, medicine, etc...). Knowledge and support is still very limited. Develop a modern data base on this promising subject.
- Develop research on artificial reef combinations with aquaculture (tests): preliminary research on these topics would give relevant arguments for developing or not integrated devices for the fish farms. By providing organic production support, the fish cages represent an interesting area for multi-habitats structures like artificial reefs used for rehabilitations of degrader habitats. Scientific programs could precise best tools for this positive interactions for best benefit of coastal zone management.
- Create supportive financial tools for innovative environmental experiments-initiatives by farmers themselves: Private companies are not enough supported to developed new and original patents supporting better environmental practice. By being close to production and innovative they could propose themselves with research partners very effective

solutions. Supporting partnerships between research and producers and local authorities on environmental topics, devices linked to production would be of interest. No precise guidelines and financial tools neither publicity exists on these subjects.

- Promote education programs integrating aquaculture and environment for new generations and public (like in Agriculture sector). No strong policy for education on aquaculture and environment is coordinated at national educational or international levels despite the development of the industry and the tool aquaculture represent in terms of partners for showing the marine life cycle.
- Support simple, practical and feasible translation of code of conducts in each country of the Mediterranean starting from the level of the country and locals (regulations, habits, training knowledge). Developing a process of quality measures monitoring in order to improve regularly the code of conduct in this country and its code of practice.
- Improve EIA - Promote adapted impact studies criterias depending on countries and farm size but based on minimum rules: which criterias to use ? For small size farms the criterias are really too heavy and too expensive to see them applied in practice. This lead to illegal installation with long terms habits of illegality which brings to negative sides effects for the sustainable development of the activity and more for the environment itself. Develop an Ecosystem approach of impact study to aquaculture (social, environmental, economical impacts). Based on nowadays knowledge it is possible to present today a review of aquaculture EIA in the Mediterranean and suggest simpler monitoring procedures. Develop a system of public minimum guaranty (the regional/national authority could produce a general impact study of a zone) and limiting the private sector in providing complement information for installation and monitoring would improve local integration and security of private investment as well as sustainable development (system of concession, periodic general monitoring providing global and specific data).
- Develop research on what to do when mortality or major killing in sea cages aquaculture (compost, other solutions?)

VI.4 Improving coastal zone integration of Aquaculture

Coastal zone integration is mainly dependant on political support and developing a new way for controlled aquaculture areas planning.

➤ From producers side:

- Develop new interactions with local actors (Tourism, researchers, schools, small scale fishermen): producers could be more active in their communication with tourist industry (share with tourism actors organization on special diving diversification proposition and tourist visits on productions sites: type visit and taste). Develop educational plants aside the farms for school marine classes on biological cycle (70% of populations will leave on the coastal areas)
- Communicate on their actions for environment (shellfish culture: monitoring of quality of the environment)

➤ From national, international bodies or researchers:

- Promote and realise comparisons studies with other sources of sea enrichment (see former chapter description)

- Monitor the practical results of national ICZM policies and implementations of program for zoning areas to be dedicated to aquaculture (institutional experiences, practical results).
- Review/compare legal and administrative procedures on coastal zone management, social, environmental, territorial development in relation to aquaculture. This integrative large work is today not well documented to produce adapted propositions, simplifications for decisions makers or administrative officers. It could lead to propose new and simple adaptations for southern countries in their will of aquaculture development as well as providing more sustainable conditions for northern countries of the Mediterranean. Develop a comprehensive and practical system of leasing-licensing. The leasing/licensing processes are very different among Mediterranean countries according to the national laws. Some of them have very comprehensive systems, which include accurate environmental impact studies. Some others are just beginning to face the demand for allocation of sea surface for aquaculture. The allocation of aquaculture licenses in the national waters needs to be made on a sustainable way, with simple procedures and in respect with local environment and ecosystems.
- Do not develop aquaculture as a public funding supported activity, valorise the private sector dynamism using all sustainable criterias
- Reinstall the politic initiative: Develop Coastal marine zone Patrimonialisation to integrate aquaculture in coastal zone planning. Supporting national or local initiatives in coastal marine planning and aquaculture sustainable development like it is done in an industrial development areas or a local rural agriculture planning. This could be called Creating Coastal Development Areas (CZDA): minimum period for licence defined, minimum description of environmental characteristics, specific monitoring expectations, maximum logging capacity presented, control and supportive process, financial support to installation. This would lead to better local dynamism of the economy (local tax collection, increase private sector dynamism)
- Develop planning, providing minimum environmental data on the areas of aquaculture development. The idea is that National or Regional bodies would present the global environmental situation and environmental baseline studies of a global zone. This would secure investments for private sectors.
- Support public dynamism in terms of adaptation on the environmental monitoring regulations by transferring scientific knowledge to private and administrative bodies. Developing simpler and cheaper monitoring devices. Support regular feed-back and permanent evolutive monitoring of impacts studies. (Up to now poor feed-back and analysis of existing monitoring is leading to adaptations and communications).
- Develop dynamic policy and specific financial tools supporting tests, private sustainable and integrative initiatives with effort to the environment (integrative productions, specific environmental measures on a classical production) or with effort for coastal partnerships (coastal integrations with tourism, hotels, schools, etc...).
- Support fundamental research on following subjects: aquaculture interactions with offshore windmills, platforms, artisanal fisheries, artificial reefs, sanctuary areas and reserve effects, integrative aquaculture, tourism education, environmental associations

VII - SOUTHERN COUNTRIES AQUACULTURE DEVELOPMENTS

Inland aquaculture in the southern Mediterranean countries is well developed specially in Egypt while in Algeria it is still underdeveloped, however marine aquaculture is underdeveloped.

Marine aquaculture is characterized by its modernity in terms of technical needs, high level of professional training capacity (biologists, managers, divers), industrial management and international market. Thus for southern Mediterranean countries most of marine culture investments are done by foreign companies in capacity to master the technical requirements as well as the investments (Malta, Tunisia, Lybia).

The local market for actual marine species produced in aquaculture would be conditioned mainly by tourism activity in the country since most of marine productions are at a high price for local economy. However mullets aquaculture and mussel represent one of the best example of potential species in the Southern Mediterranean countries nowadays (depending on geographical conditions). Other new species of the Mediterranean (fast growers: groupers Tuna, etc...) would be of interest in the future as well.

Future of coastal sustainable development of aquaculture in southern countries of the Mediterranean is dependant of a much better analysis of environmental constraints (Algeria rough coasts do not present best conditions for minimum protected areas for production) as well as local potential market, existing infrastructures for exportation; security for investors by taxes and specific regulations; providing adapted support and improvements in local personal training qualification (support experience abroad, support joint research programs) ; defining minimum environmental regulations for installation and monitoring of the farms impacts.

It is also conditioned by the lessons from the northern countries mistakes. It would be strongly suggested to propose a complete coastal zone development program where aquaculture is one of the actors. Local and national authorities could in this sense get a complete northern country support in defining a supportive and dynamic system for installation providing:

- Information on environmental situation of the areas, critical points for aquaculture and study on the maximum capacity charge of the areas with reference to reality of aquaculture industry as well as minimum precautions criterias.
- Precise the informations on the conditions for leasing-licensing based on comparative studies in the Mediterranean
- Precise requirements for environmental monitoring depending on size of companies, using simple tools as learnt from northern experience
- Presenting special requirements on local other actors integrations in the activity (tourism, education, etc...)
- Presenting specific adaptations to their local situations and legislations
- Presenting specific research programs on integrative aquaculture that could be of interest for the country.

Southern Mediterranean countries workshops precizing local priorities and constraints as well as local legislations and coastal zone developments strategies could be a first step towards developing their sustainable aquaculture program and identifying northern Mediterranean best supportive measures.

VIII - TOWARDS AN INTERNATIONAL IUCN PROGRAM – PROPOSITIONS

After management for profit (European and northern countries) and management for survival (developing countries) there is a global need to move towards management for sustainability whatever in the south or in the north of Mediterranean sea.

A new program for IUCN could focus on providing tools for national and local institutions or producers concerned by sustainable aquaculture: sustainability criterias, adapted codes of conducts and practices, links between stakeholders.

VIII.1 Vocabulary demystification – common basis for common dialog

Because the program would be dedicated to publics with different concerns and culture, a demystification and acceptance of common minimum language is mandatory to avoid wasting time on partisan arguments. We propose illustration of some topics where consensus would be basis for all parties (the list is not ewhaustive):

- **Various production levels are needed:** industrial plants as well as small farms are two productions models corresponding to the present state of aquaculture in the Mediterranean. Both have a place on the coastal zone area. A bigger production in a proper current oriented site can arm less the local environment than a small farm on shallow water.
- **Coastal zone affected by various actors:** Tourism, transport, agriculture have negative impact on coastal zone environment quality
- **Image of Aquaculture negative impact is different between the countries and persons whatever their background knowledge**
- **Genetic pollution:** Nowadays aquaculture developing programs in the EU and Mediterranean are based or backed up by genetical scientific studies and programs. Introduction of new species present a danger for local ecosystems and is a concern for all. It is not a sustainable way of production.
- **Local impacts of aquaculture:** Aquaculture is a human activity with potential impact on the environment. Reduction of its impact is an aim for all. The marine aquaculture impact is restricted to local and mainly bellow the cages. MEDGWEG international program confirms its extending maximum impact is at 200 m from the cages. The sites for first activity has to be chosen in reference to current patterns and at minimum 300 m distance from sensitive or scarce endangered species (posidonia, maerl). Local impact is recognized temporary and recovery is rapid (10 times quicker than for industrial or urban discharge); more scientific data is needed on recovery issues in the Mediterranean)
- **Environmental awareness of the profession :** environmental awareness of the production channel actors is consistent and improved in the last years.
- **Environmentalists** are interested in supporting concerted sustainable production approaches and interested to understand producers constraints
- **Ecolabelling in aquaculture** does not have extensive market: ecolabelling market is estimated in aquaculture to 310% of the global market. No large extension of this activity is nowadays feasible

VIII.2 Objectives of the IUCN Program

The new program objective could be dedicated to:

- Promote the Best Environment Management of Aquaculture within the framework of Sustainable Development in the Mediterranean : e.g guidelines
- Develop and reinforce communication, partnerships and links between environmental representatives and the aquaculture sector in the Mediterranean.

VIII.3 Results and possible actions IUCN program

Chapter VI supports the establishments of priorities to support sustainable aquaculture for producers, policy makers and also for UICN policy in the frame of its Action Plan for the Mediterranean.

An attempt for defining first targets for the future UICN program could be to focus on the following priority results and actions.

Results	Possible Actions
1. Policy makers and stakeholders dispose of major guidelines on aquaculture sustainability	• Publish guidelines on sustainable aquaculture dedicated to deciders through a concerted actions between UICN, aquaculture experts, environmental experts and producers: give practical examples, solutions and research results
2. A new dynamic dialog between environmental bodies and producers is installed	• Produce major workshop between aquaculture producers and environmentalists. It resumes all knowledge and concern on the subject, detail examples and present first steps for regular exchange meetings on the subject.
3. Giving specific consultancy and technical Assistance on sustainable aquaculture for the producers in relations to their priorities	• Coordinate studies and facilitate production of studies on sustainable aspects and aquaculture: « valorisation of EIA data, recovery of sites, comparative studies, integrative modern aquaculture examples, etc...) • Capitalization of consultancy expertise (meetings, workshops, monitoring, database)
4. Develop an information networks on aquaculture and environment in the Mediterranean.	• To be defined
5. Produce a serious prospective analysis on Aquaculture and environment in the Mediterranean	• Identify financing resources • Identifying European and southern European experts, researchers, policy makers and producers • Produce the prospective analysis document
6. Develop extension of actions to world sustainable aquaculture and	• To be defined

freshwater production	
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VIII.4 Target groups for the future IUCN program

Building bridges between actors concerned by sustainable aquaculture needs to mobilize or communicate to the following groups of actors:

- Ministries of Environment
- Ministries of Fisheries and Agriculture, Ministries of Equipment and Tourism
- Regional and Local governments (coastal) + regional agencies supporting aquaculture
- NGO, environmental groups
- Medias
- Professionals (producers, food formulating industry, commercial channel)
- Research institutes and international scientific community
- International ICZM and coastal zone management offices (UNESCO, RAC/PAP)

VIII.5 Potential specific partners for IUCN program

A group of experts representing all parties (producers, researchers, policy makers and environmentalists) could present the base for the organization and management of a future program development.

In the future the minimum partners for UICN sustainable aquaculture program support should be:

- National Research Institutes (Ifremer, IEO, Icrum, INRH,...)
- Ministries of Agriculture and Fisheries (Greece, Algeria, Spain...)
- The Federation of European Aquaculture Producers (FEAP)
- European Aquaculture Society (EAS)
- FAO-Fisheries Department
- RAC/PAP/ Split
- CIHEAM - Copemed – Adriamed - MedSudMed
- IUCN Commissions

The CIHEAM, which objective are Co-operation between institutions and experts working on the technical, socio-economic and legal aspects of Mediterranean aquaculture and to contribute towards the development of aquaculture by encouraging the exchange of ideas and information on various technical and socio-economic aspects of aquaculture, would bring to the project a technical and collaborative support.

The professional and scientific organisation for aquaculture (FEAP and EAS) are specifically aware of the importance of the sustainability of aquaculture (from the FEAP website: "Aquaculture is an important and developing sector that aims to provide products of the highest quality to the consumer, while respecting its obligations to the environment and assuring sustainability .To this

purpose, the FEAP has developed a Code of Conduct for European Aquaculture, which was adopted unanimously by its Member Associations in July 2000. This initiative is constantly being reviewed in order that aquaculture can develop hand-in-hand with the expectations of the sector and the public.”).

RAC/PAP based in Split (Croatia) and financed by world bank and EU fundings is the Mediterranean Resource centre on Integrated coastal Zone management. Its involvement in integration and valorisation of Aquaculture inside coastal planning is of interest.

The main strengths of IUCN are its mixed membership and the scientific and technical knowledge and expertise provided by the voluntary experts within its six Commissions, notably the Commission on Ecosystem Management and the Species Survival Commission (European Sustainable Use Group of Specialists). Hence, the IUCN Mediterranean Programme would mobilize networking among those actors, and add value to the programme given its characteristics and experience in convening, acting as a policy catalyst, coordinating with partners, involving members to regional efforts, networking and establishing linkages between north and south members, and facilitating scientific advice and validation, as well as information exchange.

Governments in countries of the Mediterranean region are all members of the General Fisheries Council for the Mediterranean (GFCM) (Albania, Algeria, Bulgaria, Croatia, Cyprus, Egypt, European Community, France, Greece, Israel, Italy, Japan, Lebanon, Libya, Malta, Monaco, Morocco, Romania, Serbia and Montenegro, Slovenia, Spain, Syria, Tunisia, Turkey). They have all ratified the FAO Code for responsible fisheries and are responsible for undertaking national and regional initiatives to fulfil their commitments relevant to this code.

IX - ANNEX

IX.1 ANNEX 1 - Aquaculture production for principle groups of species and countries (2001)

Sources: CIHEAM

Pays	Mollusques	Poissons diadromes	Poissons marins	Poissons d'eau douce	Crustacés	Plantes aquatiques	Total	Croissance '92-'01	Taux annuel de croiss.
Egypte	-	1	98 890	243 964	9	-	342 864	436,6	24,6
Espagne	256 403	36 186	19 929	13	116	-	312 647	85,3	8,8
France	191 330	44 866	5 111	10 692	53	10	252 062	0,7	0,2
Italie	149 000	47 200	20 700	1 350	19	3 000	221 269	29,9	3,3
Grèce	25 970	3 252	68 082	498	-	-	97 802	381,6	20,5
Turquie	5	38 064	28 485	687	-	-	67 241	640,1	26,4
Israël	-	940	4 530	14 630	-	-	20 100	64,6	5,8
Roumanie	-	600	-	10 218	-	-	10 818	-56,1	-7,9
Croatie	3 000	1 261	2 500	3 405	-	-	10 166	49,5	9,3
Syrie	-	-	-	5 880	-	-	5 880	14,9	2,9
Chypre	-	83	1 725	-	75	-	1 883	1 114,8	34,1
Tunisie	46	11	1 304	507	-	-	1 868	117,5	13,3
Bulgarie	-	893	-	717	-	3	1 613	-80,2	-8,9
Maroc	156	120	506	580	-	-	1 362	83,8	11,0
Malte	-	-	1 235	-	-	-	1 235	147,0	14,0
Liban	-	300	-	-	-	-	300	130,8	13,2
Albanie	150	15	100	7	14	-	286	-28,0	9,0
Algérie	20	20	40	201	-	-	281	91,2	11,6
Libye	-	-	-	100	-	-	100	25,0	2,6
Total	626 080	173 812	253 137	293 449	286	3 013	1 349 777	81,8	7,1

IX.2 ANNEX 2: European strategy and specific measures for Sustainable aquaculture

As a result of its rapid growth in recent years, the European Aquaculture industry is facing a number of challenges in terms of market and of the environment. Its future will depend on its ability to become economically self-sufficient and its capacity to respond to environmental constraints.

In September 2002, the Commission presented to the Council and to the European Parliament a communication on "[A strategy for the sustainable development of European aquaculture](#)". The main aim of the strategy is the maintenance of competitiveness, productivity and sustainability of the European aquaculture sector. The strategy aims to create the conditions that will enable the aquaculture producers to offer a healthy product in the quantities required by the market, while being environmentally non-degrading. The strategy identifies three objectives:

- Creating secure employment
- Providing safe and good quality fisheries products and promoting animal health and welfare standards.
- Ensuring an environmentally sound industry.

To meet these objectives, the Commission proposes the following measures:

IX.2.1 Creating secure employment:

Employment in aquaculture offers alternative jobs for fishermen who leave the catching sector. The creation of new jobs in this sector will mainly be achieved by increasing production from 3.4% to 4% per year.

- **Increased production:** this increase must come from diversification in new species and from making aquaculture more environmentally friendly. To achieve this, public aid should be refocused on measures to strengthen existing businesses, encourage training, monitoring, research and development activities and promote clean farming technologies. Special assistance could be provided for aquaculture activities that are particularly beneficial for environmental protection. Existing legislation on organic products will be extended to include aquaculture.
- **Tackling competition for space:** in some areas, potential development is already hindered by competition for space between various users of coastal waters: small-scale fisheries, aquaculture, tourism... The Commission believes that aquaculture should be integrated in strategies based on Integrated Coastal Zone Management which is best adapted to tackle multi-uses of the coastal areas.
- **Stimulating the market:** demand for aquaculture products could grow from the development of quality labels and measures to improve the image of the industry. Member States are encouraged to provide support for measures to collect and transfer commercial information as better knowledge will help improve marketing. Fish farmers are urged to set up partnerships to co-ordinate supply as a way of making up for the lack of economy of scale of small farms.
- **Social considerations:** aquaculture has an important role to play in rural and coastal development and in reversing decline in coastal communities. Member States are encouraged to adapt funding opportunities for aquaculture in the context of the mid-term review of the EU structural funds in 2003-2004. The Commission underlines the role of women and encourages the use of European Social Fund programmes to improve opportunities in aquaculture.

- **Improving governance:** stakeholders must be more involved in the development of the aquaculture industry. Given the lack of specific legislation for aquaculture - though there are national measures implementing EU Directives - there is scope for the development of codes of conduct and codes of practice to reduce the risk of distortion of competition.

IX.2.2 Safety of aquaculture products and animal welfare

- **Public health:** the need to ensure a high level of health protection for the consumer has led to the adoption by the Commission of a recasting of legislation on hygiene of foodstuffs. Reviews of the levels of dioxin in feed and food are planned for 2004 and 2006 with the aim of reducing the maximum tolerated levels. Current monitoring and control of the presence of antibiotic and other residues in aquaculture products will be strengthened. More research on toxic algal blooms, which threaten public health and cause damage to fisheries and aquaculture is necessary as they represent one of the most serious limiting factors for the future of shellfish farming in Europe.
- **Animal health:** the Commission will carry out regular updates and simplification of the legislation on animal health. It also proposes to modify some of the existing pharmaceutical legislation in order to address the specific needs of aquaculture.
- **Animal welfare:** improvements in the welfare of captive livestock can improve public perception of intensive farming. The Commission is currently involved in an initiative by the Council of Europe to formulate a recommendation on farmed fish. When this recommendation is adopted, the Commission will consider proposing specific legislation.

IX.2.3 An environmentally sound aquaculture:

- **Reduce the impact of waste:** ways must be found to lessen the impact of waste from intensive fish farming to avoid the risk of deterioration of water quality around aquaculture sites. The Commission encourages Member States and fish farmers to implement a number of mitigating measures including recourse to FIG support for the installation of effluent treatment equipment.
- **Tackle the risk from alien species and genetically modified organisms:** to avoid the loss of bio-diversity, the Commission will propose measures to manage the introduction of non-indigenous aquatic species consistent with the code of practice developed by the international Council for the Exploration of the Sea (ICES). It is also examining the need for specific rules on transgenic fish.
- **Pollution prevention and control and environmental impact assessment:** the Commission will consider the inclusion of intensive fish farming into the scope of the Directive on integrated pollution prevention and control, which monitors industrial activities with a high pollution potential.
- **Research:** research is crucial to aquaculture. However, the costs of research and development preclude many aquaculture companies from investing the necessary resources into this field. It could be possible for FIG to provide support for small-scale applied research conducted by aquaculture businesses. Additional support should be made available under the 6th Framework Research Programme.

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