

Mediterranean Marine Aquaculture Sector. Present State of Development and Perspectives on Cooperation

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Abstract: Due to good natural conditions and political will, marine aquaculture has developed recently around the Mediterranean sea and particularly in the non European Mediterranean countries. Both private entrepreneurship and public international cooperation have participated in this development. Most of its products are aiming at supplying European markets, where they compete not only with similar products from the European Mediterranean countries but also with other aquaculture products from the northern European countries. Advantages and constraints of aquaculture in the Mediterranean countries are analysed with regard to the project of "Euro-Mediterranean partnership" which should give birth within 25 years to a large free trade area. In order to develop a competitive aquaculture sector on both sides of the Mediterranean, a cooperation is necessary between the different Mediterranean countries. The implementation of networks for research and information purposes seems the best way to achieve this goal.

1. The Euro-Mediterranean cooperation

1.1. General context

The cooperation between the European Union and the Mediterranean countries has to be considered in a world-wide context where regional organisations are developing like in North America (NAFTA), South America (MERCOSUR) or south-east Asia (ASEAN). The European Union has been developing for a few years a global strategy with the Central and Eastern European countries, with a view to their future adhesion to the Union. But a special attention has now to be turned on the Mediterranean countries given the historical, cultural and economic links between the countries all around the Mediterranean sea. That is the reason why the European Commission has initiated the construction of an "Euro-Mediterranean partnership" with the Mediterranean countries. The Mediterranean area, which represents an equivalent population to that of the European Union, is faced now to demographic, social, environmental and economic problems which have to be taken into account from both sides of the Mediterranean sea.

The general objectives assigned to this project of an Euro-Mediterranean Economic Area (EMEA) are to give birth within 25 years to a large exchange of goods, services and capitals based on the principles of freedom, solidarity and fair regulation within a community of over 700 millions persons. Given the disparity between the economic situations of the Mediterranean countries and the difficult adaptations which will be required by the

implementation of free trade, the European Union is aware that an ambitious and progressive support policy is necessary. As the creation of an economic area may not be limited to free trade agreements, a wide range of actions will be considered including agreements for political stability, new scientific and technological cooperations, programs for better natural resources management and incentives to the implementation of socio-economic reforms. The final scope of such a cooperation is to mix the economies, to conciliate the cultural differences and to get a better socio-economic balance inside the Mediterranean area (Bistolfi, 1995).

In that purpose, the economic and financial agreement ratified by the fifteen European countries and by twelve Mediterranean countries¹ in 1995 at the Barcelona conference has listed several fields for cooperation : transports, technology, energy, water supply, environment preservation, services to enterprises, integrated rural management...In the framework of the World Trade Organisation, free-trade agreements are planned to take place progressively until 2010 between the European Union and the Mediterranean countries, and between the Mediterranean countries themselves as well.

In order to achieve such an Euro-Mediterranean partnership, the European Countries have decided during the Cannes summit in June 1995 to allocate an amount of 4,7 billion of ECU's for the period 1995/1999. This funds will be enhanced by a same amount of loans from the European Investment Bank and by the bilateral contributions from the European Union members.

These ideas are not totally new since a lot of punctual agreements have been linking Europe and the Mediterranean since the sixties, but few of them have turned out to fulfil the expectations. The share of European Community in the external trade of the Mediterranean countries has been steady for the last ten years. Moreover, from 1978 to 1992, Europe has provided less than 25% of the public funding to the Mediterranean countries (i.e. 10% of the financing from European Union towards developing countries) whilst the United States of America have been providing more than 40%. What is new in the Barcelona agreement is that priority is given now to everything which can enhance competitiveness and help the private sector.

1.2. The specific issue of agriculture and of agricultural products

The general trend of agriculture in the Mediterranean countries is the development of exportable typically Mediterranean goods at the expense of basic goods which have to be imported in larger quantities. At the present time, the terms of trade are favourable to such a specialisation since Mediterranean products like fruits, vegetables and olive oil got higher prices, especially in Europe and in the Gulf, than products like cereals, sugar and milk coming from Atlantic countries (Février, 1993). But it may induce a dangerous dependency

¹ Cyprus, Malta, Turkey, Israël, Jordania, Syria, Lebanon, Egypt, Marocco, Tunisia, Algeria, Palestinian Authorities

on foreign markets, especially in countries where the population rate of increase is very high. Water supply may be also a limiting factor to such an agricultural policy.

Agriculture is still a major issue for the Mediterranean countries, but the share of agricultural products in their external trade has been regularly decreasing during the last thirty years. In 1993, agriculture has accounted for only 12% of the export and 10% of the import of the area (source Eurostat). The importance of the European Union in this external trade has been reduced too. From 1980 to 1994, the share of E.U. countries as a target for the agricultural exports from the Mediterranean countries has remained around 50%, but the share of E.U. countries in the agricultural imports of the Mediterranean countries has decreased from 45% to 30% (Bensidoun, 1996). Moreover, the European market for fruits and vegetables, which used to be reserved to Mediterranean countries, is now opened to Lome signatory countries and to South American countries.

In order to protect the agriculture of the Southern European states, which are also important producers of Mediterranean products, the signatory countries have agreed to reach gradually a free trade status for agricultural goods in the respect of the Common Agricultural Policy. So, taking into account the present exchange flows and the different national policies, tariff and non-tariff barriers should be progressively eliminated and convenient sanitary regulations should be adopted. In the framework of the World Trade Organisation, three Euro-Mediterranean agreements of association concerning agricultural trade have already been clinched in 1995 with Morocco, Tunisia and Israel, adding to the existing agreements with Cyprus and Malta and to the just beginning process of customs union with Turkey.

2. Mediterranean marine aquaculture : international exchanges and economic issues

Inside the agricultural sector, aquaculture does not represent a major activity as far as economic weight is concerned. Nevertheless, it is an interesting sector to take into account because such important and diversified issues as traditional rural activity, new technologies for exportable goods and coastal management are at stake.

2.1. Present state of development

Production

Total aquaculture production

Aquaculture production in the countries all around the Mediterranean sea has increased from 685 000 tonnes in 1988 to 790 000 tonnes in 1994 (Table 1). Such a slow annual growth rate of 2% in comparison with the world average growth rate of 9% is due to the stabilisation of the traditional productions, i.e. bivalves and extensive fresh water fish, which are still the bulk of the production. On the contrary, intensive fish farming both in fresh water and in marine water have reached a significant state of development, but represent only 20% of the

total aquaculture production. These data include all the aquaculture productions of the Mediterranean countries (E.U. and non E.U.), are they produced inland, on the Atlantic coastline or on the Mediterranean coastline (Lacroix, 1995).

Given the importance of the exchanges in goods, technology and capital, the evolution of the Mediterranean aquaculture has to be analysed within a wide Euro-Mediterranean economic and politic area including not only the European Union and the Mediterranean countries but also Norway, Iceland and the eastern European countries (Table 2). Almost half of the production of this wide area is still realised by the European Mediterranean countries, especially France, Italy and Spain, despite their very slight production increase between 1988 and 1994 (from 630 000 tonnes to 710 000 tonnes). Meanwhile, thanks to the soaring development of salmon farming, Norway and the northern European countries have caught up with the Mediterranean European countries, with a production above 700 000 tonnes. Despite a production increase of 39% in volume, the share of the non E.U. Mediterranean countries is still around 5%. However, this assessment has to be considered cautiously, given the difficulty to obtain reliable statistics in Egypt, which is the major producer of the southern Mediterranean area.

Marine aquaculture

Marine aquaculture is the most dynamic sector among the Mediterranean aquaculture, with an important mussel production and a fast increasing sea-bass and sea-bream production. In both cases, the whole production of the Mediterranean countries has to be taken into account because the same products are produced in the Mediterranean sea and along the Atlantic coast. For instance, Spanish mussels from Galicia compete with Italian and Greek mussels on the same markets and more than 1 000 tonnes of sea-bass are produced in north of France. In 1994, the total value of the Mediterranean marine aquaculture may be assessed at 1 billion US \$, i.e. 55% for bivalves (mainly mussels) and 45% for fish (mainly sea-bass, sea-bream and mullet). European countries are still dominant for bivalves, but southern countries realise more than 20% of the fish production (Table 3). The production of sea-bass and sea-bream is about 30 000 tonnes. The production of other species is much lower. France, Spain and Portugal produce turbot (2 500 tonnes) and salmonids (3 000 tonnes) on their Atlantic coasts and Turkey sea-trout in the Black sea (1 000 tonnes). Italy and Greece produce other Mediterranean species in small quantities (less than 1 000 tonnes).

Most of the production (70 %) is realised in cages in sheltered bays or in open sea. On-shore intensive farms using race-ways account for only 15% of the total production. The remaining 15% are produced in traditional earth ponds or in valli. Almost 500 intensive farms were operating in 1994, with an average production capacity of 75 tonnes per year. This figure hides a disparity between numerous small scale farms below 20 tonnes, a small number of semi-industrial farms around 250 tonnes and a very limited number of industrial farms over 500 tonnes. Only 60 enterprises are equipped with a hatchery and realise their own fry production, but no enterprise has integrated a processing activity. The share of E.U. countries in that production has been steady around 80% for the last five years (Table 4). For 1995, a production around 37 000 tonnes is expected (25 % more than in 1994). As for the near future, given the number of fry which has been produced in 1994 (170 millions units), a

reasonable increase may be considered to reach 45 000 tonnes in 1996. The share of sea-bream is in the process of being dominant, due to pathological problems encountered by sea-bass (nodavirus).

Trade flows

Trade flows of Mediterranean aquaculture products have to be considered with regard to the general situation of sea-products trade in the area (Table 5). Most of the countries have a negative balance for sea-products, except Morocco and at smaller extent Tunisia. Among these importing countries, three of them turn out to be some of the major sea-products consumers and importers in the world, i.e. Spain, Italy and France. So, they are obvious outlets for Mediterranean aquaculture.

Traditional exchange of mussels exists from Spain to France (4 000 tonnes par year) and from Spain to Italy (7 000 tonnes per year), in order to alleviate the lack of Mediterranean production of mussels during winter time. More recently, new flows have been developed from Greece (6 000 tonnes per year) and from Turkey (3 000 tonnes per year) towards Italy, in order to provide an increasing demand of product at low price. Besides, France imports more and more processed mussels from Northern Europe, following the new trends of consumption for ready to cook products. As for clams, Spain is a major importer especially from Italy (around 10 000 tonnes a year, both fresh and frozen). The more recent activity of sea-bass and sea-bream farming has been developed in the aim of supplying the Italian market, where a tradition has been existing for a long time to consume these species. In 1994, 55% of the Mediterranean production has been exported, mainly to Italy, but also a little to France and Germany. Till now, all the fish has been traded as plain raw guts-on fish, at a size between 300 and 500 g. But some producers try to sell bigger ungutted fish for the Northern markets. International trade of sea-bass and sea-bream has been so far very difficult to assess because these products did not use to be differentiated in the official statistical data. This situation will change from 1996 on, since sea-bass and sea-bream have received a specific status in these statistics. There is no significant exchange for the other aquacultured species in the Mediterranean area.

On the opposite, trade flows for fingerlings of sea-bass and sea-bream exist from Italy, Spain and France but they do not account for more than 20% of the production of these countries. They are aimed mainly at supplying farms operating in Greece (where 9 million fingerlings have been imported in 1992) Malta and Croatia. At a smaller extent, flows exist also from Tunisia to Greece, from France to Spain and from Greece to Italy. Most of the countries are now self sufficient for fry production since many hatcheries have been built during the last five years thanks to technological transfers and to the development of national research sectors in aquaculture (Table 4). Only Egypt relies still on wild juveniles of sea-bream for intensive ongrowing in floating cages. Like for ongrowing, the share of the E.U. countries for the production of sea-bass/sea-bream fry is stabilised around 80%. Due to productivity gains obtained in hatchery, the price of fingerlings has been reduced from 1 ECU each ten years ago to 0.25 ECU for sea-bass and 0.3 ECU for sea-bream. Given the cost of freight, it is less and less worthwhile to export fingerlings from north to south of the Mediterranean. That is the reason why the big industrial hatcheries in France, Italy and Spain try to promote the quality

of their production, especially concerning the prevention of pathologies, in order to keep their foreign markets.

Technological transfers and international investment flows

Initiated in France and Italy on the basis of an important and mostly public research effort which started as soon as the seventies, sea-bass and sea-bream farming has been developed then all around the Mediterranean sea in the late eighties and the early nineties. Private entrepreneurship and international cooperation have both taken part in this development. As far as private sector is concerned, two forms of technological transfer can be observed. Either purchase of technology from consultants by national investors or joint-ventures with technology brought by the foreign partner as part of his equity. Moreover, some international research programs may be carried out by private companies, especially on nutrition and off-shore technology, involving food and equipment suppliers.

From the public side, the major role has been played by the MEDRAP (Mediterranean Regional Aquaculture Project) programs of the FAO which used to be based in Tunis. Between 1983 and 1995, MEDRAP I and II have organised seminars and training courses about aquaculture in the fields of biology, technology and management throughout the Mediterranean countries. In the framework of the Commission of the European Communities, General Directory XIV for fisheries, funds have been provided for research programs carried out between countries. The main research centres of France, Greece, Italy and Spain are deeply involved in such a cooperation. Till now, the only non E.U. country having participated in these actions is Cyprus, in the fields of species diversification and technology. Table 6 summarises the various forms of private and public cooperation in sea-bass/sea-bream farming in the cases of Greece, Cyprus, Tunisia, Morocco and Malta.

2.2. Comparative advantages and disadvantages of the Mediterranean countries for marine aquaculture

In the perspective of a cooperation between Europe and the Mediterranean countries, it is important to have an idea of the comparative advantages and disadvantages of these areas concerning aquaculture. Indeed, cooperation may not be considered without the awareness of potential competition. Very little economic information is available about the traditional productions of extensive fish farming, either in marine water or in fresh water. These productions are integrated in local agricultural economic systems the viability of which depends on a lot of different factors, far beyond the aquacultural activity itself. As for intensive sea-bass/sea-bream farming, it is amazing to note that its development has taken place in so different environmental, economic and institutional contexts. Each of these contexts is characterised by some key factors which may induce comparative advantages or disadvantages.

Environmental factors

From the environmental viewpoint, the temperature regime and the quality of the water are important, but no more than the availability of sheltered embayments where fish farming in

floating cages is possible. Norwegian aquaculture has succeeded in lowering its production costs thanks to this technique, which has proved to be much more economical than on-shore farming for small scale farms. Even at a semi-industrial level, around 300 tonnes par year, a study carried out by IFREMER in France (de La Pomélie, 1995) indicates that production costs are still slightly higher for an on-shore farm using concrete race-ways and pumping than for an off-shore farm using floating cages in a sheltered bay. Onshore farms have a better labour productivity but are much more energy consuming because of the pumping system. Nevertheless, at that level of production capacity, depreciation costs are similar. Indeed, initial investment for raceways is much higher but cages and nets have to be renewed more often. As for aquaculture in the open sea involving rigid structures (like anchored boats or petroleum platforms) and on-site manpower, all the attempts have faced extremely high operating costs.

Economic factors

From the economic viewpoint, the costs of such production factors as inputs (seed, feed), labour and credit have to be taken into account. All the Mediterranean countries, except Portugal, are net importers of sea-products for non-human food uses (Table 5), and none of them may be considered as having a comparative advantage for the feed issue, as far as feed production depends on fish meal supply. National Gross Product per inhabitant and Inflation Rate are two indicators which show the disparity of the economic situations within the Mediterranean countries and which may help to compare the costs of labour and of capital (Table 7). Despite these variations, the breakdown of production costs in different countries shows that feed accounts for 25% to 35% and labour 10% to 15%. These data are significant of a young aquacultural activity, not mature yet. In salmon farming for instance, labour is below 8% while feed is usually over 60%, as a consequence of the better zootechnical performances (food conversion ratio, labour productivity, high rearing density). The share of fingerlings in production costs is decreasing rapidly, due to a better control of hatchery techniques, and is estimated now between 15 and 20 %. On the contrary, inflation rates and consequently interest rates for loans are still very variable. That is the reason why financial expenses have been up to 15% in 1992 in Greek farms, while they rarely exceed 8 to 10% in France for instance. In the case of Greece, the role of the banks has been of primary importance, since almost 80% of the total investment has been realised with loans (Table 8).

Institutional factors

As for the institutional context, on which the economic context depends a lot, it includes national or international incentive policy, regulatory aspects concerning aquaculture and environment and legal measures for water and coastline uses. In the countries belonging to the European Union, the sector of aquaculture has benefited of a strong incentive policy from the European Commission. In the framework of the regulation number 4028/86, aquaculture projects have been receiving subsidies for their initial investment. These subsidies may be associated with national or local subsidies, if the total stays below 40% of the investment (60% in some regions encountering high economic difficulties). The annual amount of these subsidies has been quite regular from 1988 to 1994, providing around 42 million ECU's per year (Table 9). Spain, France and Italy have been the principal recipients of these subsidies

from 1988 on, especially for sea-bass/sea-beam and bivalves projects. In 1993, Greece became by far the first country to receive European subsidies for aquaculture (almost 50% of the total amount), which proves the dynamism of the Greek sector. This incentive policy may be considered as having been successful for sea-bass and sea-bream, and for mussels on long-lines also. On the contrary, most of the projects aiming at shrimp farming have been a disaster, because the rearing techniques in semi-intensive conditions are not really under control and because of the very short duration of the growing period. Eel or sturgeon projects have not been very successful either, because of high production costs. Except in Italy where new stocks of clams have been settled thanks to spat from hatcheries, projects of clam culture have been failures anywhere else, because of diseases problems and of high production costs.

Most of the regulation applying to marine finfish aquaculture are based on freshwater aquaculture regulation. But those are not fitted to marine aquaculture conditions where emissions are more rapidly diluted. Effluents are difficult to measure as they rapidly disappear. The nitrogen or phosphorus contribution of Mediterranean species are not so well known as for trout and salmon for which scientific data exist (Kempf et al.). As the dispersion potential of coastal waters varies largely from one place to another, standards would need to be defined almost case by case. Coastal waters being a State property, a license or a permit is requested in all Mediterranean countries to start a fish aquaculture farm. In the decision to allow farming activity, the weight of environmental concerns varies from one country to another, which may be the cause of unfair competition and price distortion. Because of the lack of sufficient knowledge, the definition of proper environmental protection and monitoring is usually set case by case in dialogue with research organisations, which is a very expensive and time consuming procedure at present (Bailly and Paquette, 1996). In Greece for instance, an impact study is requested and a minimum distance from other farms should be left. Other criteria are set concerning the rearing density, the feed quality, the monitoring of sea bottom and site rotation. But these criteria are more indicative than effectively controlled (Zanou, 1994). In Mediterranean finfish farming there seem to be no major problem of negative impact on an aquaculture farm by another farm. Few cases of self-pollution by degradation of the bottom condition are recorded in Greece (Klaoudatos, 1994). But the major environmental conflict is with the tourism industry. The economic importance of tourism makes it is a strong interest group that opposes in many locations against the development of aquaculture. The preservation of marine landscape is argued to refuse licenses or to obtain their withdrawal. Such conflicts are numerous. They sometime prevent completely the development of aquaculture, like in France as far as farming in floating cages is concerned, or go to court in order to forces farms to close down.

Variability of production costs

Given the variety of countries, of sites, of technologies, and of farm sizes which are involved in Mediterranean sea-bass and sea-bream production, production costs are also very variable. This variety of production costs is all the bigger as most of the enterprises are not five years old and have not reached routine yet. Nevertheless, the question of economies of scale is relevant in Mediterranean fish farming, as it is shown by a study carried out by SELONDA in Greece. Productions costs in small scale farms using floating cages (production capacity around 50 tonnes) are 30% higher than in semi-industrial farms (over 350 tonnes). This

difference is due before all to a better labour productivity in big farms, since the investment in cages is roughly proportional to the production capacity. But the diversity of techniques, of know-how and of socio-economic contexts (family or salaried labour force) makes the existence of such firms possible. In fact, these firms can develop their own competitive advantages and enhance their productions on the different markets. Convenience markets (markets of proximity), which are more profitable, are the target of small scale familial firms while industrial firms focus on export markets and new distribution means.

The differences between countries are much more difficult to assess, because of the variety of conditions of production. Nevertheless, the comparative study realised at the occasion of the SELAM seminar on aquaculture economics held in Montpellier in May 1995, has not shown very important differences. For a same size of production unit, the highest production costs are only 20% more than the lowest. Indeed, from 1986 to 1994, the production costs have decreased from 7 to 10 Ecu/kg in 1989 to 5 to 7 Ecu/kg in 1994 (Stephanis, 1995). So the international differences are apparently not so large as the differences due to the size of the production units. That is the reason why the evolution of the Mediterranean aquaculture may not be considered as totally determined by the existence of national comparative advantages or disadvantages. Indeed, many of these factors are likely to change, as for instance labour costs, especially in the view of an economic integration, or water quality which may be damaged forever by exogenous inputs or by aquaculture self pollution. Moreover, the enterprises are able to look for their own competitive advantages through marketing control or product differentiation.

2.3. Marketing constraints and perspectives

The Mediterranean aquaculture industry is using almost exclusively the traditional marketing channels. During the last 3-5 years we have been watching the invasion of the supermarkets to the fresh fish trade. They are increasing year after year their market share all across Europe, while the traditional channels (mainly fish mongers) are loosing the pace. With their supply power and a huge turnover, they can offer substantially lower prices than traditional fish shops. Those powerful super-market chains could squeeze Mediterranean aquaculture producers for lower prices as they are continuously doing with other manufacturers and producers.

For future growth, the Mediterranean aquaculture industry should put a lot of emphasis adopting more sophisticated methods of marketing. This is a "must" for penetrating new markets, but is also necessary for enlarging the existing ones. The need for the producers to get organised is a pre-requisite and the advantages of cooperation should be taken very seriously into account. Especially for the smaller scale producers, the principles of Cooperation would facilitate a lot their marketing and distribution, by eliminating the various penetrating problems (especially to large European markets) due to their size. This also implies that deeper and better knowledge of the various marketing constraints and perspectives should be taken into account.

Seasonality of the demand in major European markets

The larger European markets get activated twice a week, more specifically on Monday morning and Wednesday morning. During these days the wholesalers deliver the products and the retailing starts taking place. It should be clarified though that at the same time both fisheries products, and aquaculture products, are distributed (i.e. Norwegian Salmon, trout, fishery products from Morocco, Tunisia and Turkey etc.). The high demand in the European markets starts from the 2nd half of March until the first half of August. Especially in September the demand is declining until the first half of December. During Christmas time, the demand reaches a pick, especially on the Italian market, as, due to traditional reasons, these kinds of products are highly consumed at that time. After the first half of January, the market declines dramatically until March. It is obvious that during the period of high demand, the prices are equally high. The most strange phenomenon is that, although above described fluctuations are already known to the producers, every year from April up to June, there are very few quantities to be distributed, compared to the rest of the year. Zootechnical constraints may explain this situation.

Awareness of the consumption habits of the target markets

Through extensive market research, the consumption habits of the target consumers have been traced, fact which enforces the possibilities of enlarging the existing markets and penetrating to new ones. Italians have substituted the Christmas turkey with sea-bass and especially of larger sizes. It is considered a special honor to serve fish during weddings. In U.K., sea-bass is extensively served in Chinese restaurants with preference to large sized fish. In Germany and Switzerland the consumers are targeted towards easy-to-cook fish, (without bones and ungutted, fillets etc.) Japanese consumers are eager to pay a lot for special parts of some fish. In Greece and Spain, sea-bream is the favourite, while sea-bass (especially in Greece) is considered as non valuable fish. In France the demand is targeted towards large sized sea-bass for restaurants and fishmongers, but the portion sized bass is better for supermarkets.

Regarding the scale on the commercial sizes of the products, it is graded as follows:

Piccolo	100-200 g
Small	200-300 g
Normal	300-450 g
Extra	450-600 g
Extra-large	600-800 g
Super	800-1,000 g
Extra super	1,000 and up

Regarding the preferences per major market it is noticed that France, Spain, U.K. Switzerland prefer large fish(extra, extra large) while North Italy prefer normal, extra and super. In South Italy, the market is 70% small, 20% piccolo and 10% normal. In Greece, the preference is to normal and extra. Especially the super markets were recently interested in small sizes, because while these are purchased in lower prices, by mixing them with the normal sizes, they can get higher average price per kg. In Germany, the preference is to normal and extra.

Another very important perspective not only for enlarging the existing markets but also for developing the prospects for new markets penetration, is the enrichment of the range of products and sizes, in other words the new species and the various possibilities for product differentiation. More specifically, the ability of the producers to distribute other species than those traditionally marketed, would obviously attract new consumers and acquire higher prices, especially for species under innovation in their culture. Species under development, which are at a small scale cultured and marketed, are common sea-bream (*pagrus*), white bream, striped bream, while others which are at experimental stage but with good possibilities are *dentex* and *epinephelus*. Regarding the product differentiation, producers are targeted towards filleting of sea-bream and sea-bass. These kinds of products are highly absorbed by the German market, at very high prices. Other Mediterranean species very similar to sea-bass and sea-bream (*pagrus*, *dentex*, *puntazzo*) compete with the traditional aquaculture products (sea-bass and sea-bream), as the majority of the quantities marketed are products of fishing activity. On the other hand the pelagic species (*tuna*, *seriola*, *coryphaena*, *epinephelus*) could be perceived as opportunities with a very high growth potential in aquaculture development.

Greek producers are trying to promote sea-bream and sea-bass into the form of value added products. More specifically the investigation of the potentiality of introducing a line of branded fish-by-products in the Greek and European market, is one of major targets of Greek aquaculture market leaders. This plan has as a principle to take advantage of fish with various deformities, which in reality do not lack taste or nutritional characteristics. The processing of these products, -which could not be marketed to the fresh fish market due to deformities-in the form of fish salad, is a promising plan underway, safeguarding additional profit to the fish-farmers.

Another very important aspect is the variety of packaging materials utilised during the marketing of the aquaculture products. This should be perceived again in connection to the different preferences in the various European markets. More specifically in Greece the marketing of standardised products (fish into small carton packs of 2 or 3 pieces) is not preferable. Consumers would like to see the fish distributed on ice, with bright colours, like it has just been fished. Other markets though, demand such kind of packaging, as it facilitates the housewife to carry it easily and even store it like this into the refrigerator. Some tricks which the producers apply many times in order to increase the average selling price per kg, is that they push together with high demand species (high prices), others with lower demand. In other occasions they prefer to sell certain products in lower prices, by blackmailing in this way the sale of species with remarkable profit margins.

Awareness of the competition between Mediterranean countries and Northern European countries

The investigation of the existing situation in major export markets assists a lot the producers to have a spherical view of the competition. Also the participation in many international exhibitions helps a lot to contact new potential customers, evaluate the dynamics of the competitors as well as penetrate to new markets. Direct competition does not exist between

North-European fishery products and Mediterranean aquaculture products, for the very simple reason that sea-bream and sea-bass are not cultured in northern Europe. Nevertheless, the price of farmed salmon is now a reference price and the consumers are not eager to pay much more for any kind of fish, even specific Mediterranean species. We could conclude in general that there is no substitution effect in the consumption of these products only for connoisseurs who perceive them as high price delicacies and go directly to purchase them.

The type of competition which is faced in the major European markets is the one between European Mediterranean aquaculture products and South Mediterranean aquaculture products. More specifically, Greek aquaculture products, being the market leaders compete with products from Tunisia, Morocco and Turkey, while the expected development of Croatian aquaculture units is estimated to be a future threat. This kind of competition is concentrated to lower prices especially due to lower production costs (fish from semi-extensive farming and fish from purely intensive farming with higher operating costs). The competition between European producers is concentrated between Greek and Spanish aquaculture products mainly, while French products have lost the pace on the Italian market.

Tariff and non-tariff barriers for non-European countries

The Customs situation for imports of fishery and aquaculture products to E.U. refers to a variable tariff according the species for non European countries. This tariff is fixed at 15% for sea-bass and sea-bream, 14.4% for shrimp, 12.6% for cup oyster, 12% for trout, 10% for mussel and 2% for salmon (13% when smoked). Cyprus and Malta are subject to the regular tariff. Countries like Morocco, Tunisia, Senegal and Algeria (among others called ACP countries) are excluded from this tariff due a certain preferential status in exporting fishery and aquaculture products in Europe. Only "Euro 1" certificate is issued. In addition to the above, Turkey is also excluded from the regular tariff for exports to E.U. member states. A phenomenon which has disturbed last year the Italian market was that aquaculture products from Malta were transported to Italy with a lower invoice, in order to avoid the 15% tariff on the real value.

Customer Service

Customer Service should be perceived as one of the major perspectives as well as constraints in the marketing of aquaculture products. The producers should always be ready to satisfy the need of their customers. This implies that the producers should have disposable production through out the year, while at the same time the quantities to be distributed should be prepared (i.e. no food for 2 days, no antibiotics etc.) The selection of the disposable quantities according to the sizes of the fish is also essential, in order to be able, as far as possible, to satisfy the orders of the customers. It is evident of course that there should always be adequacy of raw materials, like fish crates, ice, labelling etc.

Finally the service to the customer should be complete both by delivering the product to his door while each crate should have written indications on, like the species, the size (small-extra...), the total weight of the crate, the number of the pieces included, the fishing date, the packaging code of E.U., the fishing temperature and the brand name of the product. All above

mentioned aspects of customer service presuppose a very good planning of the operation of a farm, in order to be able to adopt itself to the dynamic environment of the international demand of fishery products.

Another phenomenon recently applied in the aquaculture products' industry is the factoring on exports. Producers get financing, through factoring companies or through bank affiliates, as a pre-payment of 70-90% of the total invoice of the export, of course by paying a small fee to the company. This assists the firms to safeguard liquidity while, at the same time, they gather information about their customers, as this is one of the major marketing services that the factoring companies offer to their customers.

3. Perspectives for cooperation

The question now is to assess the position of marine aquaculture in the framework of this project of Euro-Mediterranean Economic Area. As far as intensive aquaculture aiming at exporting high-priced products is concerned, several issues have to be pointed out. Indeed, the recent projects in the non E.U. Mediterranean countries have focused till now on mussel and sea-bream/sea-bass production and compete directly with the same productions from the European countries. In the same way as it has been discussed for some agricultural productions like tomatoes, citrus fruits or olive oil, special agreements should be negotiated in order to conciliate interests from both parts of the Mediterranean. Besides, these products arrive on North European markets which are saturated in animal proteins for human consumption and where the competition is very strong for sea-products. The huge and continuous development of salmon farming, as well as the increasing imports of tropical sea-products (shrimp and fish) provide the market with large quantities of diversified products at low price.

In this highly competitive context, despite recent unquestionable productivity gains, the profitability of marine Mediterranean aquaculture is low. Indeed, the average estimated profitability of semi-industrial sea-bass farming projects is not much over 5 to 10%, with a pay-back from 3 to 5 years. In these conditions, this activity does not look very appealing to investors. Moreover, potential investors would likely ask for a risk premium given the unsteady political and social situation of many Mediterranean countries. So, if we refer to one of the official goals of the Euro-Mediterranean partnership which is to support private investment, marine aquaculture is not an easy sector of activity to promote. In some cases, additional public incentives turn out to be necessary in order to attract investments. In Tunisia, for instance, the government has decided to take in charge the cost of the infrastructures (pumping and pipes) of an on-shore fish farming complex in order to alleviate the financial burden for investors.

Last but not least, attention has also to be given to the socio-economic context when assessing the opportunity of an investment in marine aquaculture. The socio-economic context appears to be one of the key elements on a par with site quality and market conditions which must be taken into account by promoters of new projects. A study carried out by Duché from SEPIA Conseil (1995) on the basis of three examples of aquacultural projects in countries surrounding the Mediterranean sea (Greece, Croatia and Tunisia) has identified some of the

most important issues. In the case of the Greek project which has been for sale after only five years in operation, the reason of the failure may be imputed to the little financial involvement from local investors. Being considered as a foreign project, it has received no local political support and has been accused of endangering the environment. On the contrary, the Croatian and Tunisian projects have taken advantage of a good local financial partnership and of a clear share of duties in the farm management to develop the enterprises according to the expectations. In Tunisia, a major ecological impediment has obliged the farm to reduce its activity, but it is not due to managerial problems. Taking lessons from these experiences, the key elements for success seem to be the sharing of initiatives and the pooling of financial and political assets, in a structure beneficial for both parts. In the same way of thinking, the question of transferring the technologies for off-shore mussel farming on long lines has often been discussed. Although the techniques seem easily transferable, a deeper analysis shows that two elements which have been the keys of the success in Italy and in France, i.e. the existence of a traditional mussel farming sector in lagoon and the availability of European subsidies for investment, are missing in most of the countries where such projects are planned.

The development of more extensive forms of aquaculture, like in marshlands or in valli, could be an alternate in order to reduce the requirements for capital and technology. The traditional, long-time integrated rural management aquaculture practices in fresh water are able to provide proteins for domestic consumption in developing countries. But most of the new projects in marine water, as well for fish as for shrimp, have shown that the semi-intensive aquaculture techniques are too costly to produce low-priced proteins. Moreover, given their great dependence on natural conditions, they are not totally reliable and have proved till now to be profitable only as a part-time activity. Nevertheless, these forms of aquaculture could participate actively in a programme of integrated coastal management by contributing to the maintenance of the landscape and of human activity in depopulating areas. But their development requires a better zootechnical control and the implementation either of incentive policies in order to make up for their lack of profitability, or of regulations making possible to valorise the specific qualities and the environmentally friendliness of their products.

Conclusion

After taking into account all these constraints, it turns out that a great research effort is still needed in order to develop marine aquaculture and attract new investors on both sides of the Mediterranean. This includes not only zootechnical research (including genetics, nutrition, physiology and technology) but also marketing research and socio-economic research in order to adapt the products of this industry to the characteristics of the demand, which means bigger fish and more diversified presentations at lower price. Coastal use conflicts and impact on the environment are issues which have to be taken into account also in the research programmes.

To achieve such an ambitious goal, a cooperation between the different Mediterranean countries is necessary. But beyond the traditional bilateral forms of cooperation, which usually suffer absence of coordination, both nationally and regionally and from absence of medium and long-term programming, the establishment of Euro-Mediterranean networks

would be the best way to enhance the collective expertise of the area and reinforce international cooperation (Ferlin, 1995). Three kinds of networks should be considered :

- networks for information, like SIPAM and its thematic associated networks SELAM, TECAM and EAM,
- scientific networks for research programmes,
- and business network for marketing information like the one which has been established by the Federation of Greek Mariculturers in association with the Scottish Salmon Growers Association, the British Trout Association, the Association of Italian fish farmers and with the cooperation of the European Federation of Aquaculture Producers. This project is aiming at updating every two weeks on prices and volumes marketed. The pilot stage has been subsidised by the European Commission and after the evaluation of the first results, procedures will be determined for the incorporation of other member-states into this project, like Spain, France and Germany.

The development of networks, the implementation of common regulations and of free trade areas, the economic prosperity are relevant goals we have to strive for. But from a larger point of view, the ultimate goal we can dream of is the political stability of the Mediterranean area and the end of any form of war. Unfortunately, Economics and Laws have proved too often not to be strong enough to give back to people the sense of living together despite their differences, which only legitimated States and Institutions can do (Delmas, 1995).

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Table 1 : Evolution of the aquaculture production in the Mediterranean countries

(tonnes)	1988	1994	increase
Bivalves	525,000	545,000	4%
Marine finfish (extensive rearing)	7,000	11,300	61%
Marine finfish (intensive rearing)	3,500	37,700	977%
Freshwater finfish (extensive rearing)	65,000	73,000	12%
Freshwater finfish (intensive rearing)	83,000	131,700	59%
Total	683,500	798,700	17%

source : SIPAM, IFREMER, FAO

Table 2 : Evolution of the aquaculture production in the Euro-Mediterranean area

(tonnes)	1988	1994	increase
non E.U. Mediterranean countries (1)	57,500	80,000	39%
E.U. Mediterranean countries (2)	644,000	720,000	12%
E.U. non Mediterranean countries (3)	336,000	480,000	43%
European Free Trade Association (4)	116,000	250,000	116%
Eastern and Central European countries (5)	117,000	60,000	-49%
Total	1,270,500	1,590,000	25%

source : SIPAM, IFREMER, FAO

(1)Albania, Algeria, Cyprus, Croatia, Egypt, Israel, Lebanon, Malta, Tunisia, Syria, Turkey

(2)France, Greece, Italy, Portugal, Spain

(3)Germany, Austria, Belgium, Denmark, Finland, Ireland, Netherlands, United Kingdom, Sweden

(4)Norway, Switzerland, Iceland, Lichstenstein

(5)Bulgaria, Hungaria, Poland, Tcheck republic, Romania, Silovakia (data from 1993)

Table 3 : Marine aquaculture production in the Mediterranean countries in 1994*

(tonnes)	Bivalves	Marine finfish
Albania	300	
Algeria	20	40
Croatia	1,600	1,100
Cyprus		210
Egypt		8,000
Israël		900
Lebanon		
Libya		
Malta		900
Morocco	1,400	610
Syria		
Tunisia	60	860
Turkey		3,000
<i>non E.U. Mediterranean countries</i>	<i>3,500</i>	<i>15,620</i>
Spain	150,000	6,000
France	220,000	6,000
Greece	21,000	12,000
Italy	124,000	8,000
Portugal	2,600	600
<i>E.U. Mediterranean countries</i>	<i>545,000</i>	<i>32,600</i>
<i>Total Mediterranean countries</i>	<i>550,000</i>	<i>49,000</i>
<i>Value (million US\$)</i>	<i>550</i>	<i>400</i>

source : SIPAM, SELONDA, IFREMER, FAO

*data from 1993 when not available for 1994

Table 4 : Production of sea-bass and sea-bream in the Mediterranean countries

Commercial size fish					
(tonnes)	1990	1991	1992	1993	1994
Spain	600	1,100	2,000	2,600	3,200
France	380	750	1,250	2,350	3,400
Greece	1,600	2,500	6,000	8,500	12,000
Italy	1,900	2,500	2,900	3,400	4,000
Portugal	100	300	380	500	600
<i>Total E.U.</i>	<i>4,580</i>	<i>7,150</i>	<i>12,530</i>	<i>17,350</i>	<i>23,200</i>
Croatia					1,200
Cyprus	50	60	70	190	210
Malta		50	300	500	1,000
Morocco	100	180	300	500	650
Tunisia	200	300	400	600	700
Turkey	180	250	1,200	1,500	3,500
<i>Total non E.U.</i>	<i>530</i>	<i>840</i>	<i>2,270</i>	<i>3,290</i>	<i>7,260</i>
All countries	5,600	8,500	15,400	21,500	30,500
Fry					
(million units)	1990	1991	1992	1993	1994
Spain	13	17	18	23	28
France	9	12	15	16	18
Greece	14	23	37	60	70
Italy	9	11	15	23	20
Portugal			3	3	4
<i>Total E.U.</i>	<i>45</i>	<i>63</i>	<i>88</i>	<i>125</i>	<i>140</i>
Croatia					5
Cyprus	6	6	6	6	9
Morocco		1	2	2	2
Tunisia	3	3	3	4	4
Turkey	2	2	2	3	5
<i>Total non E.U.</i>	<i>11</i>	<i>12</i>	<i>13</i>	<i>15</i>	<i>25</i>
All countries	56	75	101	140	165

*data from 1993 when not available for 1994
 source : SIPAM, Selonda, IFREMER, Ewos

Table 5 : Foreign trade of sea-products for Mediterranean countries in 1993

	For food uses			Exports			Trade balance	
	tonnes	Imports 1000 \$	price \$/kg	tonnes	1000 \$	price \$/kg	tonnes	1000 \$
France	720 748	2498 621	3.5	352 326	833 857	2.4	-368 422	-1664 764
Greece	54 411	146 523	2.7	26 271	128 907	4.9	-28 140	-17 616
Italy	574 383	2072 799	3.6	85 620	250 085	2.9	-488 763	-1822 714
Portugal	247 853	624 914	2.5	75 832	202 524	2.7	-172 021	-422 390
Spain	992 839	2601 239	2.6	353 311	797 717	2.3	-639 528	-1803 522
Israel	41 615	86 200	2.1	316	7 180	22.7	-41 299	-79 020
Albania	358	420	1.2	1 272	2 590	2.0	914	2 170
Algeria	172	290	1.7	576	2 320	4.0	404	2 030
Cyprus	6 894	24 144	3.5	756	3 466	4.6	-6 138	-20 678
Egypt	138 072	71 246	0.5	1 262	5 227	4.1	-136 810	-66 019
Lebanon	-	-	-	-	-	-	-	-
Libya	6 946	18 460	2.7	-	-	-	-	-
Malta	4 768	16 460	3.5	1 092	2 290	2.1	-3 676	-14 170
Morocco	905	1 914	2.1	193 984	538 513	2.8	193 079	536 599
Syria	241	720	3.0	52	60	1.2	- 189	- 660
Tunisia	750	2 200	2.9	15 112	85 857	5.7	14 362	83 657
Turkey	17 874	11 291	0.6	9 808	29 021	3.0	-8 066	17 730
Croatia	6 275	12 676	2.0	212	96	0.5	-6 063	-12 580
Slovenia	8 283	17 312	2.1	2 588	5 833	2.3	-5 695	-11 479

Country	For non-food uses		Exports		Trade balance	
	Imports tons	1000 \$	tons	1000 \$	tons	1000 \$
France	127 860	57 530	41 484	23 895	-86 376	-33 635
Greece	26 471	16 434	5 665	3 158	-20 806	-13 276
Italy	122 259	58 382	20 713	11 522	-101 546	-46 860
Portugal	5 266	2 799	2 289	7 902	-2 977	5 103
Spain	59 515	28 560	26 802	16 033	-32 713	-12 527
Israel	40 835	15 590	-	-	-	-
Albania	-	-	-	-	-	-
Algeria	2 414	920	-	-	-	-
Cyprus	6 996	4 139	100	32	-6 896	-4 107
Egypt	6 379	3 730	-	-	-	-
Lebanon	-	-	-	-	-	-
Libya	1 927	1 060	-	-	-	-
Malta	2 514	1 410	-	-	-	-
Morocco	10 437	5 861	515	175	-9 922	-5 686
Syria	1 966	840	-	-	-	-
Tunisia	29	38	-	-	-	-
Turkey	16 033	7 199	80	46	-15 953	-7 153
Croatia	17 998	10 746	212	96	-17 786	-10 650
Slovenia	4 674	2 341	113	81	-4 561	-2 260

source FAO

Table 6 : Some examples of technological transfers and international investment flows in Mediterranean marine aquaculture

	TECHNOLOGY				INVESTMENT					
	technology transfer through MEDRAP	purchase from private consultant	international research programs		in the country		abroad			
			fields of cooperation	countries involved	private sector	bilateral agreement		E.U. funded program	farms with no foreign capital	joint ventures (including transfer of technology)
Greece		yes	hatchery diversification	E.U. countries Cyprus	yes	yes	yes	yes	yes	yes (Kuwait Albania)
Croatia	yes	yes	hatchery				yes (Italy, France)			
Cyprus	yes	yes	cages hatchery diversification	Greece Scotland Ireland	yes	yes (Greece)	yes	yes	yes	yes (U.K., Greece) (U.K.*)
Malta	yes	yes	hatchery cages nutrition	U.K. Greece Sweden	yes		yes			
Morocco	yes	yes	hatchery	France	yes		yes			
Tunisia	yes	yes	hatchery race-ways diversification	France Italy Japan Arabic countries		yes (France)	yes	yes (France, till 95)		

Table 7 : Inflation rate (1994) and NGP per inhabitant (1993)

	inflation rate (%)	NGP per inhabitant (US \$)
Albania	22.6	3500*
Algeria	38.5	4,390
Croatia	-	1,943
Cyprus	5.6	15,470
Egypt	12.0	3,530
Israël	14.4	14,980
Lebanon	10.6	2500*
Libya	30.0	7000*
Malta	3.5	7575*
Morocco	5.7	3,270
Syria	15.0	5,220
Tunisia	5.3	5,070
Turkey	125.5	5,206
Spain	4.3	13791**
France	1.6	19403**
Greece	10.8	8360**
Italy	3.8	18520**
Portugal	4.0	12313**

source : L'Etat du Monde, 1996

* 1991

** 1994

Table 8 : Investment flows in Greek mariculture units

(million drs)	1990	1991	1992	1993	1994
Total investment	3.31	4.39	1.59	2.00	1.44
Agricultural Bank of Greece loans	2.04	2.71	0.91	1.14	0.82
Loans from other banks	0.55	0.73	0.37	0.46	0.33

source : Agricultural Bank of Greece

Table 9 : Evolution of the European subsidies in aquaculture (regulation 4028/86)

(1000 ECU's)	France	Greece	Italy	Spain	Portugal	Other countries	Total
1986	1,721		1,231	7,304	414	6,752	17,422
1987	1,268	2,896	4,094	8,940	2,225	4,012	23,435
1988	2,609	4,970	5,768	11,657	2,032	12,941	39,977
1989	3,997	4,087	6,094	6,842	3,783	7,629	32,432
1990	4,795	6,198	11,416	9,340	6,816	7,943	46,508
1991	5,616	7,506	8,125	8,289	2,893	6,565	38,994
1992	6,950	7,422	8,481	5,340	4,709	5,465	38,367
1993	3,429	21,257	14,655	3,429	2,001	6,441	51,212

source: European Commission DGXIV