

ECONOMICS OF AQUACULTURE
DEVELOPMENT IN GREECE

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1. INTRODUCTION

- 1.1 General terms of reference for the project and conclusions reached by other consultants point out that Greece offers good opportunities to develop aquaculture to the level of a socially and economically significant industry. Aquaculture development is stated to contribute to Government aims such as food security, preservation of foreign exchange, social and economic development of remote rural areas and contribution to the gross national product by rational use of water resources.
- 1.2 The assessment of the contribution of a new industry to the national economy, as is the case for the aquaculture industry, is difficult to make in quantitative terms. There is a lack of historical records and figures on costs and benefits covering the first years of operation of aquaculture production units. Therefore only limited analysis is possible. Figures available from feasibility studies and projections have been shown to be misleading in the field of aquaculture in other countries. The over-optimistic projections based on such figures, as much as the lack of technical experience, are to be blamed for the delay of aquaculture development in many countries. The failure to achieve projected aquaculture production figures has often depressed the first enthusiasm of investors and banks.
- 1.3 For these reasons, and to avoid the problem of obtaining realistic figures, the consultant preferred to conduct a qualitative analysis, using figures only for an illustrative purpose. The analysis was based on a description of the present aquaculture situation in Greece. The main aim of this analysis was to point out

the basic requirements necessary for a coordinated and rapid development of aquaculture in its different components.

- 1.4 The conditions of financing of aquaculture in Greece will be analysed, followed by a short economic review of the main components of Greek aquaculture. At each step conclusions should lead to recommendations to overcome the constraints of aquaculture development, thereby strengthening its potential as a profitable industry.

2. AQUACULTURE ECONOMICS AND CONTRIBUTION TO THE GREEK ECONOMY

2.1 Aquaculture Economics

2.1.1 As in any industry, the total contribution of aquaculture to the national economy is the aggregate of the performances of individual aquaculture units. This contribution can be measured in terms of productive factor mobilization. Besides ordinary factors, such as labour, capital, and technological know-how, aquaculture requires a specific resource, i.e. a suitable aquatic environment. This aquatic resource should possess all the characteristics necessary to develop, in a more or less intensive way, production of aquatic animals or plants that would not occur in natural conditions without human intervention.

2.1.2 The rational use of the aquatic environment depends largely on access, the state of the art in production techniques, determining the areas appropriate to aquaculture, and the importance of other competing activities.

2.1.3 The availability of capital depends on the decision by private investors and banks, or on a voluntary choice by public authorities, to invest in this industry. The decision by private investors and banks is largely based on the anticipation of high profits and quick returns on their investments. This requires that production techniques must offer the opportunity to produce a product for which a market exists, or can be developed. Also, production costs must be low enough to realise a good profit on sales.

2.1.4 Labour depends on the availability of people trained in techniques of production and marketing, and of unskilled people needed to perform the work. Access

to technical aquaculture know-how, directly or through transfer, is of course a major prerequisite to development.

2.2 The Greek Economy and Aquaculture Contribution

2.2.1 The Greek government wishes to establish a mixed economy characterized by a strong public involvement in investment and an incentive policy to compensate the very low level of investments. The capital market in the country is very limited. The inflation rate remains high (16% in 1987). Interest rates are fixed by administrative decisions and are designed to support government subsidies and incentives policy. This control over financing systems should be progressively removed as part of the Government's five-year (1988-1995) development programme's targets, and also as a consequence of EEC policy. Presently the high cost of borrowing capital, the high cost of importation, and the lack of flexibility in state involvement are pointed out as the main constraints to private investment.

2.2.2 Fishery production accounts for less than one percent of the GDP. Aquaculture production is 4.8% in volume of fisheries total. Low productivity of adjacent waters and difficulties of access contribute to a large deficit in the supply of fish. Greece imports about one fourth of its total consumption of fishery products. However, this is still not sufficient to cover the strong demand, resulting in very high prices. Considering the local level of incomes, fish prices are perhaps the highest in Europe. High prices and shortages in some areas strongly limit the demand. Some markets, for example the tourist market, can be expanded. This, as well as export market opportunities, allows one to be optimistic regarding aquaculture development - however,

economic feasibility of each type of activity must be assessed in a realistic way and coordinated investment, incentives policies, and marketing actions must be set in motion.

2.2.3 If production from lagoons (to be enhanced by their rational management) is included in overall national aquaculture production, we can assess the present contribution of aquaculture to the Greek economy as follows:

Number of management units :	227
Number of employees :	3,059
Total value of the output :	700 million Drs
	+ 1,500 million Drs for lagoons

Detailed figures are given in Annex I. Available records do not permit the calculation of the net added value that expresses the real wealth created. The net added value is the part of the total value distributed to the productive factors and state: wages, net profits and taxes. We believe that such a calculation is the correct way to assess the real contribution of an activity to the economy and to allow for its comparison with other activities in terms of wealth created and distributed.

2.2.4 If the targets fixed by the Ministry of Agriculture for aquaculture development by 1992 are met, the contribution should then be a total output of Drs 13 billion, including Drs 5 billion from lagoon production (see Annex I).

2.2.5 Many sectors are concerned with the development of aquaculture. They include the cement industry, water use related industries (pipes, tanks, pumps, etc.), animal feed industry, wood industry (cages), chemical industry, net industry, etc. In some areas the demand by aquaculture is not yet large enough to create an interest among the industries. The feed industry, for

example, is now starting to design pelleted foods that can be substituted for foreign imports. We believe that such activities should be encouraged to reduce to the minimum the importation of products for aquaculture activities in Greece.

2.2.6 Despite its promising future, aquaculture is not developing in Greece as quickly as foreseen by the national authorities. A few of the constraints are: difficulties in access to the water resources and to the technological know-how, enthusiasm of potential investors depressed by lengthy administrative procedures, and the results of the existing production units being far below the expectations. Hence, there is a need for a qualitative economic study of the main constraints responsible for the slow development in the aquaculture sector.

2.3 The Investors in Aquaculture

2.3.1 The opinion that aquaculture will be developed by fishing people has been shown to be wrong. The experiences of Greece and other countries show that, except in the case of lagoon exploitation and management, the origin of the investors is very heterogeneous. Small scale producers, using well known techniques, may have other sources of income. Larger scale investments are often made by professional people, such as doctors, lawyers, engineers, etc. Very big investments result from diversification strategies of large industries or from activities of banks. Such big investors generally do not have any experience in fish related matters. They are merely looking for high profits on investments without always being fully aware of the risks involved. These sociological factors should be taken into account when discussing aquaculture with potential investors.

3. FINANCING OF AQUACULTURE IN GREECE

3.1 General

3.1.1 The high cost of capital and high risk appear to be among the main disincentives to large investments in aquaculture. It is difficult at present to evaluate risks - known to be very high in new technologies. The ability to mobilise a large amount of capital in the coming years is necessary to aquaculture development in Greece.

3.1.2 The common procedure for the establishment of a fish farm starts with a pre-feasibility study and a proposed set-up of financing. This pre-project is then submitted to all authorities involved in the granting of permission for access to water resources and to secure the availability of the land and sea areas to be used. A minimum of ten years is generally requested. All documentation must then be submitted, with a detailed report on technical features of the project and a technico-economic analysis, to the local or national authorities responsible for grants. After the decision on granting, all documents are given to the Bank for a loan decision. The investor may decide not to apply for eligibility for grants and/or loans. He can also decide, on his exclusive responsibility, to start construction of the unit after the submission of the relevant applications.

The complete procedure from permission decisions to loan decisions requires a minimum of 8 to 10 months. Due to the new character of some investments, and/or delays in administrative procedures, it requires 2 to 2 1/2 years in some cases. In particular, the procedure going through the EEC granting schemes needs more time than national schemes.

3.1.3 The full use of granting schemes provides 40-60% of the aquaculture investment, with a compulsory 15% of the investor's own participation. The remaining funds can be borrowed from the Agricultural Bank under a long term loan agreement at a basic interest rate of 17.5% per annum.

3.2 Description of Grants and Procedures

3.2.1 Applications for grants can be submitted through two different routes. Grants under the national productive investment incentive law (1262/82), as well as grants under the Integrated Mediterranean Programme (PIM), can be applied for through the Ministry of National Economy. Grants under the European Agriculture Guidance and Guarantee Fund (EAGGF) regulation and the Ministry of Agriculture fund must be submitted to the Ministry of Agriculture.

3.2.2 In both cases applications can be submitted to the Ministries' offices in Athens or to their Regional Departments in the region where the investment is projected. The Ministry of Agriculture publishes a list of standards of production scale for the main types of culture practiced. Projects of smaller size are usually considered by the regional authority. However, if the regional authority is not in a position to properly evaluate the projected investment, the decision is transferred to the national authority. All applications for EEC grants must go through the national authority.

3.2.3 Grants, in the form of capital aid, are available from the state for the purpose of promoting productive investments under the investment incentives law 1262/1982. The level of granting varies according to the nature of the investment, the area of localisation (four areas are defined A,B,C,D) and special considerations such as cooperative involvement or import of foreign currency.

3.2.4 Investments in aquaculture in all cases are subject to the highest level of granting, i.e. criteria applied to area D, considering the difficulties and interest in developing aquaculture. This provides for a 20-50% grant under the condition that the investor's own participation is not less than 15%, reduced to 10% in the case of cooperatives or of enterprises belonging to Local Government Organisations. The latter are also eligible for an additional grant of up to 15%, as are returning nationals and Greek seamen.

3.2.5 The application for any type of grant must contain a detailed description of the technical features of the project, a technico-economic feasibility study and all permissions requested to operate an aquaculture unit (see consultant's report dealing with aquaculture development planning). These documents are examined by technical experts, who may propose modifications in technical specifications or of economic evaluations. Investment grants are then supplied by the decision of the Minister of National Economy, following the opinion of a consultative committee.

3.2.6 The payment of the state grant starts only after the investor's own participation at 50% and the financing Bank's participation (if any) at 25% have been paid up and spent on the project. The period allowed for the completion of the work and the payment of each instalment of the grant is fixed in the act of approval.

3.2.7 The reference level of granting for aquaculture is high, from 35-40%, compared to a 25% average in agriculture. This can reach 55% in special cases referred to above. Regarding the delays in completing the work in most of the projects, the Minister has decided from August 1987 to add a 5% grant for projects completed within the planned period.

3.2.8 Grants are also available from the European Economic

Community under the Mediterranean Integrated Program (PIM). If the applicant wishes to do so, his/her project can be submitted to the EEC by the Ministry of National Economy. Projects funded under the PIM cannot receive a grant of more than 60% of the total investment. Regarding the 40% level of grants under national regulation, the Ministry proposes to the EEC a complementary grant of 20%. "Packages" of applications are to be submitted to the EEC at fixed dates in the year. The first "package" will be sent in March 1988. Presently there is only one project being proposed.

3.2.9 The Council Regulations (EEC) No. 101/76 and 2908/83 on "a common measure for restructuring, modernizing and developing the fishing industry, and for developing aquaculture" defines the participation by the European Agriculture Guidance and Guarantee Fund (EAGGF) in investment projects. Fund participation for investments in Greece is allowed to amount to 50%. Aquaculture projects with a maximum of 1.8 million ECU's for cages and 3 million ECU's for hatcheries receive 30-40%.

3.2.10 Applications for EAGGF grants must be submitted to the Ministry of Agriculture for examination and re-evaluation by the technical staff of the Ministry of Agriculture (Fisheries Department). They are then sent in an annual package to the EEC administration. The procedure is similar to the one within the Ministry of National Economy. All the information to be submitted is listed in the FORM AQUA/87 annexed to Commission Regulation (EEC) No. 970/87.

3.2.11 Since 1981 nine Greek projects have been funded by EAGGF, representing a total investment of Drs 577 million, and a total grant of Drs 231 million. In 1987, Drs 80 million had been paid for work already completed. Only one project (Cephalonia farm) has been fully completed and has received the total EEC grant of

Drs 37 million, for a projected investment of Drs 93 million. The total cost of the project in real terms is over Drs 200 million.

3.2.12 Grants have been available from a fund in the Ministry of Agriculture for the fisheries sector since 1972. This fund presently has two financial sources: an annual provision by the Ministry of Agriculture and a contribution from the Programme for Public Investment (P.D.E.). Its main use is for the transfer of national contributions to the EEC programmes and for granting of public investments. However, private projects can also be subsidised. Up to 1987 any investor in aquaculture could apply for a grant from this fund, independent of any application to the EEC. A new regulation to be enforced in 1988 will link grants from this fund to the previous acceptance of the project under the EAGGF programme. In practice this fund has been used in aquaculture as a bridging-fund and as a complementary subsidy to EEC grants. According to the present level of granting of aquaculture projects by the EEC, i.e. up to 40%, this fund is planned to be used for 20% complementary aid. This would reach the 60% limit imposed by the EEC. For fishing and aquaculture, this fund represented a total amount of Drs 763 million in 1984, Drs 677.5 million in 1985, Drs 278 million in 1986, and Drs 487.5 million in 1987 (which have been only partly used).

3.3 Description of Loans, Insurance and Procedures

3.3.1 Until now the Agricultural Bank has been the only banking institution involved in the financing of aquaculture. This situation is mainly due to the monopoly it enjoys in providing low interest rates in the

primary sector, and to the efforts it has made to develop competency in the field of aquaculture.

3.3.2 Long and middle term loans are available at a basic rate of 18.25%, including bank commission and insurance. In comparison, the basic rate fixed by the Central Bank of Greece is 22.5% for other industries. Generally loans account for 25-50% of the total investment and they are 5-15 year loans. A delay until the full completion of the work is proposed for the first instalment.

3.3.3 The Agricultural Bank will consider requests for loans after submission to the grant schemes, should it have been approved or not. According to the scale of the project, it will be examined at the national level or in local branches for evaluation of the economic figures and of the capacity of the investor to repay the loan.

3.3.4 Since 1984 the total amount of middle and long term loans given for investments in aquaculture by the Agricultural Bank has been as follows:

1984	Drs 30 million
1985	Drs 221 million
1986	Drs 152 million
1987	Drs 400 million (provisional)

3.3.5 To cope with the high risk of investments in aquaculture the bank asks for a security of 150%. In most of the cases assets of the unit and animal stock cannot be considered as securities. Other private assets must be offered by the investor. The reasons for this high rate is the lack of experience in this field and difficulties of aquaculture activities to prove the profitability quoted by feasibility studies.

3.3.6 Short term loans to cover operational expenses can be obtained from the bank, as well as bridging loans

until the payment of the grants. Due to the credit limitation policy of the Central Bank, there is a shortage of short term credit. This forces the investors to negotiate for small amounts of credit to cover their operation costs, resulting in the multiplication of credit accounts and complex book-keeping.

Investors met by the consultant quoted the above situation of permanent negotiations with their bankers as one of their main concerns. Limitations in the availability of credit led some investors to use commercial bank facilities, with an interest rate of 23%. This increased the burden of financial charges. According to Central Bank regulations, bridging loans for grants cannot be provided with low interest rates.

3.3.7 Extension or modernisation work in existing aquaculture units can be done with loans subsidised by the state. The rate for these loans is 14.25%, with a maximum of Drs 600,000 for trout farming, Drs 400,000 for carp farming, and Drs 200,000 for other species. These figures are very low and have remained unchanged since 1980. They will probably be reevaluated in 1988.

3.3.8 The Agricultural Bank's personnel specialised in aquaculture financing encounter many difficulties in securing loans for clients wishing to become involved in aquaculture activities. The Bank must offer long term support of aquaculture production units to enable them to realise a profit on their investments. This is a prerequisite for successful involvement of private investors and for the best financial return from a public grant.

Small projects are often left to the attention of local offices, resulting in delays due to lack of guidance.

3.3.9 Deregulation in the Common Market banking system is likely to result in other banks in Greece looking at

the aquaculture industry. Under present conditions the cost of lengthy procedures and troublesome negotiations of short term loans may affect the benefit of low interest rates and force investors to work more with commercial banks. Some of the big investors have already made contacts with commercial banks.

3.3.10 The agreement of an insurance company to provide cover for an aquaculture venture is strongly recommended for grants and loan applications. Until now no national insurance company provides insurance for the stock. Only foreign insurance companies have accepted to do so in some cases. The Agricultural Insurance is presently thinking about insurance cover and rates for aquaculture related activities.

3.3.11 Banks can play a very important role in book-keeping. Reference documents prepared by FAO can be used to provide guidance to private farms.

3.4 Summary

3.4.1 The system to fund (through grants) aquaculture projects has been formulated only in recent years. The establishment of efficient funding procedures has been difficult, due to administrative complexity. This results in delays, the discouraging of investors and an under-use of granting opportunities. In the opinion of the consultant, present regulations allow for a simpler "two ways" granting scheme based on common requirements - both offering up to a 60% granting possibility.

3.4.2 Among the various institutions and authorities involved in funding aquaculture, some have very good competence and others have little.

4. A SECTOR ANALYSIS OF THE MAIN COMPONENTS OF GREEK AQUACULTURE

4.1 A Basic Framework for a Sector Analysis in Aquaculture

4.1.1 The need of the aquaculture industry to prove its economic viability with only limited public support will determine its future. The performances of an economic sector must be measured, on the one hand, in macro-economic terms, i.e. the total benefit derived by the society through private and public investments. On the other hand, the micro-economics must also be considered, i.e. the conditions to maintain a rate of return on the invested capital in order to keep or increase the total amount of capital invested in the industry. Both levels are related. The condition for a healthy industry is the profitable management of production units, should they be private or public.

4.1.2 Production of aquatic animals and plants in controlled or semi-controlled conditions is not equivalent to an ordinary manufacturing sector. Each component of the aquaculture industry has specific characteristics. Defined under economic criteria, extensive aquaculture requires low investments, or investments to be supported by the public or by cooperatives, for example for lagoon management. Extensive aquaculture with even a limited production can provide a living to a great number of people. Other extensive activities, such as shellfish culture, can easily be managed by small scale units and with a small scale of investment. At the other end, intensive marine fish culture represents a large amount of capital and high production costs. Social and economic criteria can provide useful information for comparisons and decision-making at the farm level, regional and national levels.

4.1.3 Regarding the economic complexity of aquaculture development, a three step approach is proposed. The first step is a market and price analysis of technically feasible aquaculture products. Average, minimum and maximum prices of the marine species cultivated in Greece are listed in Annex II. Considering separately each sector, or type of culture, the second and third steps respectively are a cost and benefit analysis and a constraints analysis.

4.1.4 The cost and benefit analysis is a well-known technique used mainly in computing the economic figures of technico-economic studies. Ratios to be used in the financial and economic analysis have been described previously in various reports by FAO. The description is not repeated here but references are quoted in the bibliography. The main data required are :

- detailed investment costs and duration of life
- detailed fixed and variable costs of production, unit prices of input
- technical data such as water area used, growth rates, feed conversion rates, density, mortality
- production and marketing
- general economic information, such as interest rates, inflation, etc.

4.1.5 The constraints analysis is designed to ascertain the level of risk and uncertainty in developing aquaculture production. The main constraints to consider are:

- technical constraints
- factors availability
- legal constraints
- economic constraints, such as the assessment of adverse effects on profitability of increase in input costs, competition from other countries and from other products.

As part of this, the initiatives taken or needed to

remove the constraints must be described. Only qualitative considerations are discussed now.

4.1.6 Six sectors are discussed in the present report: 1) lagoon management; 2) semi-intensive earth ponds - polyculture; 3) trout culture; 4) freshwater fish culture; 5) shellfish culture; and 6) marine fish culture. Other sectors such as shrimp or prawns, clam culture or lake cage culture are planned or already exist. Due to lack of time and information they were not analyzed. Each new type of production (by species, by scale or by technique) calls for a complete analysis and should not be rejected a priori. Figures referred to in the following discussion should not be considered by the authorities as standards. The figures are based on observations by the consultant or individual cases and are used only as illustrations. Surveys and processing of such data on sample farms are still needed to produce a more precise analysis. Descriptions and constraints quoted in other consultants' reports are not repeated here.

4.2 Lagoon Management and Culture

4.2.1 Total production from lagoons in Greece is 2,500 tonnes, for an approximate value of Drs 1.5 billion. The main species are mullet (over 80%), sea bream, sea bass and eels. The main production from the lagoons is in the winter. If lagoon production of these species can be increased there do not seem to be problems for their marketing. A report published by FAO in 1987 indicates that there is a large demand in the European market and that this demand can be expanded further.

4.2.2 Price for sea bream at the producer's level is Drs 1,200-1,800 per kilo, according to the size, season and place. Average price for sea bass is Drs 1,300 - Drs 1,000 for fish less than 250 gr and Drs 1,500 for over 500 gr. There are three categories of mullet, ranging

from an average price of Drs 600 for the largest size to Drs 200 for the smallest. The average price of mullet in 1986 was Drs 346/kilo. The value of this species is very different from area to area. The higher price for eels in 1987 was Drs 1,280/kilo. Marketing of eels is very specific. Presale of about 400 tonnes is arranged through auctions; one under the Cooperative Federation authority and the other one organized by ETANAL, the management authority of fish markets.

4.2.3 The assessment of costs and benefits to develop aquaculture in Greek lagoons is very difficult. The actions can range from a simple water flow control, to partial feeding or restocking with hatchery produced fry. The investment cost must generally be shared among potential beneficiaries/investors or be supported by the public. Lack of international experience, except in Italy, calls for very progressive and scientifically controlled actions. A good knowledge of the lagoon is required, as well as a methodology to assess the effects of human intervention on the ecosystem.

4.2.4 The sharing of the benefits among local groups must be managed to avoid conflicts. Cooperatives are a good way to organise this. Presently the lack of support for lagoon management action and high taxation prevent any positive cooperation between local groups.

4.2.5 The projected value of lagoon production for 1992 is Drs 5 billion. This figure seems high in view of the amount of work (lagoon improvements, traps, canals, etc.) that would be required and the planning and development involved. Planned investments for lagoon improvements is Drs 9 billion through 1992.

4.3 Earth Ponds Polyculture

4.3.1 Greece has numerous areas of highly productive

brackishwater marshes and wet lands. Earth ponds could be constructed in such areas. Polyculture of species such as carp, mullet and eels can be developed in semi-intensive culture in large, simple earth ponds.

4.3.2 Carp has a very limited market, mainly in northern Greece. Locally cultured carp must compete with very cheap imported carp from the Central European countries. The best way to receive a good price is to provide the market with live carp. The price of live carp on the Ioannina market is Drs 270. Marketing action by all producers is needed to promote carp in other regions of Greece.

4.3.3 A basic investment of Drs 100 million on pond preparation (150 hectares) can yield a production of 100 to 150 tonnes of carp in semi-intensive conditions with an average production cost of Drs 200-250/kg (feed representing 50% and labour 30%). This cost means that this production technique can compete with imported carp. It also gives a very good profit for the culture of mullet. The main management problems are the maintenance of the ponds, the need to design easy to handle fishing techniques and the control of predators.

4.4 Trout Culture

4.4.1 At present 115 farms are engaged in trout culture. The total production is less than 2,000 tonnes. After a very good start, mainly by a majority of small farms, trout culture had a setback due to poor quality control (use of low quality feed and bad handling). The price has decreased in constant price, bringing the farms' management to the break-even point. Trout are presently sold for Drs 300-350/kg for a 300 gr size fish.

4.4.2 In a small-scale, 0.2 hectares, concrete raceway trout farm, the cost of production was Drs 240 (plus

Drs 80 given to the cooperative for transportation, marketing and other services). The imported feed accounted for Drs 200 of the production cost.

A large farm, using earth pond, showed better results - selling the fish to a smoking company. High mortalities were reported in some small farms located on the Louros river.

Investments under such conditions are difficult, and only the long duration life of facilities and their small scale allows these farms to survive.

4.5 Eel Culture

4.5.1 Limited eel culture is practiced in Greece at present. Each of the three producing or planned units in the Arta area have chosen different techniques. The projected figures for intensive culture in concrete raceways give an average production cost of Drs 700/kg. The total investment cost is Drs 30-40 million to build one hectare with a production capacity of 50 tonnes.

4.5.2 The main constraint to eel culture is the supply of elvers. Collection of young eels from lagoons can supply a few farms. To expand, the industry will have to import elvers initially. Ideally the collection of large numbers of wild elvers from lagoons would be better. This would require basic research on elver distribution. In case of importation, the cost of elvers will significantly increase the production cost. One unit in Greece has already introduced modern elver culture technology from Germany.

4.6 Shellfish Culture

4.6.1 Shellfish culture is limited to mussel farming with pergolari (an Italian technique). Recently long-line culture has been introduced. The price for mussels, mainly consumed in Greece from Easter to Summer, is low

despite a shortage of supply in Athens. This situation is due to a quasi monopoly of a few big buyers in the Salonica area. Flat oysters are exported to France via Spain, where no regulations exist. The price for flat oysters in France is very high, due to reduced stocks.

4.6.2 The figures for investment and production costs for the two main techniques are summarized in Annex III. They show a good profitability, but the projected increase in production raises questions regarding marketing and demand. There are limited economies of scale for each of the techniques. Especially in the case of export, transportation costs must be reduced by combining the exports of several producers.

4.6.3 Oyster culture techniques are easy to transfer. The management of spat collection can be a difficulty.

4.6.4 Three constraints must be considered regarding shellfish culture in general. The first arise when important stocks are located in a small area. This could lead to 1) the risk of too high a density, resulting in poor growth rates; 2) poor condition of the oysters; and 3) an increase in production costs. The second constraint is the need for strict sanitary controls to avoid poor quality oysters. The third constraint is poor extension services. Small oyster farms can easily manage shellfish culture technique but they need efficient and close cooperation with local extension officers.

4.7 Marine Fish Intensive Culture

4.7.1 The main marine species cultivated in Greece are sea bream and sea bass, which use the same technology. There are two basic types of management units: 1) integrated hatchery and on-growing facilities, and 2) cages for fattening with no hatchery facilities. The prospects for marketing these species are very good and

the demand is high. Some farms have already experienced a steady increase in buyer price as a result of being able to supply the market with a high quality product in the required quantities and at the right period.

4.7.2 Some references of investment costs and production costs are quoted in Annex IV. The main problems have developed from a difficulty to project the evolution of the production and to evaluate the difficulties in starting with a new technology like marine hatcheries. From the time of the investor's decision to start preliminary study to full completion of an integrated unit, an average of four years is needed. Then an additional five years are normally required for full scale production. Such a lengthy period to start-up puts these units in a very difficult situation regarding management.

4.7.3 Small scale on-growing farms must rely on a regular supply of high quality juveniles. Uncertainty of fry supply is a major constraint to the development of this activity, which shows the highest rate of profit in aquaculture and the quickest return on capital investment. A routine supply of high quality fry can be a main problem. Poor quality fry result in high mortality rates and poor growth. The high cost to import fish oil and meal make it difficult at present to develop domestic production of food (pellets) with a quality/price ratio better than imported feeds.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

5.1.1 The development of aquaculture in Greece is highly constrained by 1) the lack of capital available; 2) high cost of capital; 3) limited access to appropriate technology; 4) lack of trained and experienced personnel; 5) difficulty in properly projecting economic performances; 6) lack of market studies; and 7) administrative complexity and delays.

Despite these constraints a strong interest in aquaculture has developed among investors.

5.1.2 No records exist to allow an assessment of past economic performances of sample units to provide a quantitative analysis. But the qualitative analysis shows that each type of culture has different characteristics. In economic terms:

- Intensive sea bream, sea bass or eel culture and shellfish culture show good prospects of profitability.
- Trout, carp and mullet culture are easy to manage, even by small farms, but low market prices presently limit their expansion.
- Lagoon production can be - and should be - expanded to contribute to the local economy.

5.1.3 High technology, large and integrated units offer less flexibility than smaller scale production units. Real economies of scale are possible at present in marine fish hatcheries. Benefits to the local economy by numerous small or middle scale units are generally high. In some cases, the return on investment is faster and profitability by unit of capital invested is higher. Integration, by linking together the steps of production, greatly increases the risk factor in newly

designed technology.

5.1.4 The public sector is actively involved in aquaculture. Such direct involvement as hatcheries' construction and operation are necessary to provide the industry with fry. But considering the difficulties in management, mainly the need for quick decision-making, there are serious concerns about their efficiency. The association of the private sector and a more business-oriented attitude by the public banks are necessary to increase the chances of success.

5.1.5 Public money invested in supporting actions such as research, marketing, etc., brings shared benefits to the industry. This is also more efficient than direct intervention in the granting of investments.

5.1.6 There are several cases of conflicts in the use of aquatic resources and in the sharing of economic and social benefits among local communities. To resolve such conflicts more concentration and coordination are required.

5.1.7 The development of aquaculture in Greece is presently too politically and technically orientated. Not enough consideration is given to the characteristics of each type of aquaculture. The introduction of economic criteria is necessary for more efficient decision-making at the national level and to support the private sector.

5.2 Main Recommendations

5.2.1 That aquaculture be considered as a high risk activity, offering in some cases high profit opportunities but with a long term return on the investment.

5.2.2 That publicity on aquaculture used to attract capital be more realistic to avoid the risk of

frightening away private investors and banks.

- 5.2.3 That the strong preference for big and/or integrated projects be stopped and that the granting scheme be equally available to all types of aquaculture.
- 5.2.4 That clear, less complicated and shorter granting and loan procedures be formulated.
- 5.2.5 That part of the working capital be included in the granting scheme to overcome the difficulties of the first years of operation.
- 5.2.6 That the security level for loans be lowered and aquaculture facilities be eligible.
- 5.2.7 That the present situation of the Agricultural Insurance changes, and insurance for aquaculture be provided.
- 5.2.8 That the bank provides farms with guidance in bookkeeping and strongly recommends accurate records be kept.
- 5.2.9 That within a proposed National Aquaculture Coordination Committee, working groups conduct a sectional analysis of opportunities and constraints to the development of each main type of culture.
- 5.2.10 That economists, scientists, representatives from the Agricultural Bank, ETANAL and the private sector participate in making recommendations for aquaculture development of specific species based on market, costs and benefits, and constraints analysis.
- 5.2.11 That domestic and foreign market studies and marketing actions be developed by ETANAL and the Cooperatives Federation PASEGES.
- 5.2.12 That training in aquaculture business management be provided to the private sector.

5.2.13 That more attention be given to correct handling, processing and quality control of aquaculture products to increase their added-value.

5.3 Other Recommendations

5.3.1 That requirements for grant applications be the same for the Ministry of Agriculture and the Ministry of National Economy and that they be based on EEC regulations.

5.3.2 That detailed information on the sequence of procedures to establish an aquaculture unit, and granting schemes available, be published and distributed widely.

5.3.3 That links with the EEC administration be strengthened to systematically use the granting opportunities available.

5.3.4 That more realistic technico-economic data be used for feasibility studies.

5.3.5 That more publicity be given by the Ministry of Industry and Technology regarding funding opportunities for applied research programmes.

5.3.6 That full support be given to universities in Thessaloniki in developing research programmes in economics and technology of shellfish culture.

5.3.7 That priorities in research programmes on feeds, pathology, hatchery and on-growing techniques, handling, processing and quality control, etc., include economic data analysis.

ANNEX I

Present and Projected Production
of Aquaculture in Greece

	1986		1992	
	Quantity (tonnes)	Value (Drs 10 ⁶)	Quantity (tonnes)	Value (Drs 10 ⁶)
Sea bream and sea bass intensive culture	60	108	4.000*	6.000
Hatcheries			19M fry	
Shellfish	230	23	2.000*	200
Lagoons	2.500	1.500	6.000*	5.250
Eel	6	10	1.200*	} } } 900*
Salmon	-	-	80*	
Shrimp	-	-	60*	
Trout	1.800	540	2.000	600
Carp	100	30	200	60
Total	4.696	2.211	15.540	13.010

* Production targets according to the plan by the Ministry of Agriculture (other figures are projections made by the consultant).

ANNEX II

Average, Minimum and Maximum Prices of the Main Marine Fishes by Area in 1986 (Drs/Kg)

NO	REGION	SPECIES			
		Sea Bream	Sea Bass	Mullet	Eel
1	Alexandroupolis	-	-	284 (150-800)	650 (400-800)*
2	Komotini	1026 (700-1300)	-	275 (200-464)	883 (300-1019)*
3	Xanthi	1200 (1100-1300)	930 (850-1000)	350 (250-500)	810 (750-850)*
4	Kavala	1400 (1000-1800)	680 (500-1500)	377 (230-600)	765 (700-800)*
5	Thessaloniki	-	-	-	550 (250-700)*
6	Ioannina	-	-	-	450 (400-500)*
7	Corfu (Kerkyra)	-	1000 (900-1200)	500 (480-600)	725 (600-900)*
8	Arta-Preveza	1000 (800-1200)	900	500 (250-600)	1100 (900-1200)
9	Messolongi	1500 (1000-1900)	1300 (1200-1500)	400 (350-500)** 700 (600-800)***	940 (850-1100)
10	Patras	1100	1000	600	950
11	Nafplio	1100 (1000-1300)	1100 (1000-1300)	400 (300-450)	900 (700-1000)

Notes to Annex II

- * Minimum price is for frozen eels and maximum for live eels
- ** Mullet from freshwater
- *** Mullet from lagoons

Source: Agricultural Bank of Greece - Fisheries Department

MAP OF REGIONS DISCUSSED IN ANNEX II



ANNEX III

Economic Data on Mussel Cultivation*Year 1986

A. Long Line Cultivation on 2 Hectares

A.1 Investment Cost ('000 Drs)

Land Purchase (0.4 ha)	4.000
Buildings	4.500
2 Boats and Engines	4.000
Water Supply Work	1.600
Plastic Barrels	9.800
Ropes (3.000 kgs)	3.600
Buoys (44)	2.500
Others (nets, cold storage, generator, collectors, PC, etc.)	10.000
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Total	40.000

* Source: Agricultural Bank of Greece, Fisheries Department
Thessaloniki

A.2 Profit and Loss Account
(Full Scale Production) '000 Drs

Sales (500 tonnes, Drs 100/kg)	50.000
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Expenditures	
- Labour	5.500
- Repairs/maintenance	1.600
- Fuel (car, boat)	1.100
- Spat	900
- Insurance	300
- VAT	1.500
- Others	1.000
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Total Expenditures	11.900
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Interest on long and middle term loans	3.000
Interest on short term loans	1.700
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Profit before depreciation	33.400
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Depreciation	4.000
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Net Profit before taxes	27.400
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B. Pergolari Cultivation on 0.2 Hectares

B.1 Investment Cost ('000 Drs)

Land purchase (0.1 ha)	1.000
Pipes	1.100
Wires, ropes, nets	800
Boat (7 m) and engine	650
Car (second hand)	300
Workshop buildings	300
Others	350
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Total	4.500

B.2 Profit and Loss Account
(Full Scale Production) '000 Drs

Sales (30 tonnes, Drs 100/kg)	3.000
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Expenditures	
- Labour	1.600
- Repairs/maintenance	150
- Fuel	100
- Other	150
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Total Expenditures	2.000
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Interest on middle and long term loans	200
Interest on short term loans	100
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Profit before depreciation	700
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Depreciation	400
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Net profit before taxes	300
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ANNEX IV

Economic Data for a 2 Million Fry and 300 Tonne
Fattening Capacity Sea Bream and Sea Bass Farm*

A. Investment Cost

	('000 Drs)
Buildings	110.000
Equipment	41.000
Machinery installation	2.000
Electricity/water supply	90.000
Cages, tanks	110.000
Others	22.000
Vehicles (boat/car)	12.000
Land preparation	15.000
Studies, consultancies	23.000
Miscellaneous	25.000
Total Investment	450.000

B. Financing (two possibilities)

Own capital	90.000	Own capital	90.000
Grant under law 1262	184.500	Grant under PIM	270.000
Loan	175.500	Loan	90.000
TOTAL	450.000	TOTAL	450.000

* This is one example provided by the Ministry of National Economy.

C. Expenditures from the first year of production to full scale production (5th year)

	('000 Drs)				
	1st	2nd	3rd	4th	5th
Labour	20.000	25.000	30.000	33.000	33.000
Energy	5.000	8.000	12.000	17.000	17.000
Feed	20.000	35.000	80.000	120.000	140.000
Miscellaneous	1.000	2.000	3.000	4.000	4.000
Packing	-	1.500	4.000	6.500	7.500
Insurance (buildings)	3.500	3.500	3.500	3.500	3.500
Maintenance	7.000	10.000	12.000	12.000	12.000
Insurance (stock)	2.500	3.500	5.500	7.500	8.000
Total	59.000	88.500	150.000	203.500	225.000

D. Loss and Profit Account 1st to 5th Year

	('000 Drs)				
	1st	2nd	3rd	4th	5th
Sales	5.000	80.000	230.000	390.000	460.000
Expenditures	59.000	88.500	150.000	203.500	225.000
Gross profit	(-54.000)	(-8.500)	80.000	186.000	235.000
Other expenses	7.000	10.000	12.000	15.000	17.000
Royalties (3%)	-	-	6.000	10.000	12.500
Profit before financial charges & depreciation	(-61.000)	(-18.500)	62.000	161.500	205.500
Interest on short term loans	21.200	18.600	16.000	23.000	18.500
Interest on middle and long term loans	6.100	8.700	14.000	17.500	17.500
Profit before depreciation	(-88.300)	(-45.800)	32.000	121.000	169.500
Depreciation	50.000	50.000	50.000	50.000	50.000
Net profit before taxes	(-138.300)	(-95.800)	(-18.000)	71.000	119.500

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