Policy Department
Structural and Cohesion Policies

AQUACULTURE
IN THE EASTERN MEDITERRANEAN:
GREECE, TURKEY AND CYPRUS

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Content:
This note describes aquaculture production in Greece, Turkey and Cyprus. It gives an analysis of developments in production, the market and corporate structure. In particular, it examines the main products (seabream and seabass) and the production of bluefin tuna as an emerging activity based on a fragile resource. The note was drafted for the Committee on Fisheries delegation, 12 to 14 April 2007.
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CONTENTS

1. Introduction 3
2. Geographical framework of production 4
3. Reliability of aquaculture production statistics 5
4. Historical development of production. The predominance of seabream and seabass 7
5. Production characteristics 8
6. Diversification of production 11
7. Markets and external trade 13
   Greece 15
   Turkey 16
   Cyprus 17
8. Role of state aid in the development of the sector 18
9. The market crisis in 2001 and 2002 19
10. Corporate structure 21
11. Regulations 23
   Greece 23
   Turkey 24
   Cyprus 25
12. Organisation of the sector 25
   Greece 25
   Turkey 25
13. Research and training 25
   Greece 25
   Turkey 26
   Cyprus 26
14. Bibliography 28
1. INTRODUCTION

Most Mediterranean production is concentrated in Egypt, Spain, France, Greece, Israel, Italy and Turkey. Although the main producers in Western Europe are France, Italy and Spain, most of their production focuses on bivalve molluscs. Central Europe (Albania, Bosnia-Herzegovina, Bulgaria, Romania, Serbia and Slovenia) is only at an initial stage of production. However, Croatia, Greece, Cyprus, Malta and Turkey are significant aquaculture producers. The majority of production in the eastern part of the Mediterranean basin comes from Greece and Turkey. With the exception of Egypt and Israel, production by other Middle Eastern and North African countries (Algeria, Lebanon, Libya, Morocco, Syria and Tunisia) is not very significant.

Although Egypt’s aquaculture production is considerable, it is mostly focused on freshwater species. In Cyprus, Greece and Turkey, seabass (Dicentrarchus labrax) and seabream (Sparus aurata) represent the bulk of production. However, significant quantities of trout are produced in Turkey, and mussels in Greece. Cyprus produces considerably less than Greece or Turkey. In any case, 70% of world production of seabass and 65% of world production of seabream comes from these three countries.

In world production terms, therefore, this seabream and seabass production is significant and both species are very important to each of these countries: the two species account for 76% of the total value of aquaculture production in Greece, 48% of the value of Turkish production, and 64% of the value of Cypriot production. Production of bluefin tuna is developing rapidly throughout the Mediterranean, although the situation as regards this resource is delicate. In general, most aquaculture production in the region is highly dependent on exports.

Marine aquaculture developed rapidly in the 1990s, thanks to good climatic conditions, an extensive, sheltered coast and the proximity of markets such as Italy, with growing demand. Abundant funding (subsidies and loans) also contributed to the growth in production. When the crisis in the market came about, debt made it worse and created the conditions for corporate restructuring and business concentration.

The crisis hit between 2001 and 2002. Its causes included oversupply and a failure to adjust to the seasonal nature of supply and demand. The crisis can also be partly ascribed to unregulated growth in a sector heavily dependent on credit and short on commercial and financial planning. The financial crisis in Turkey and the devaluation of the Turkish lira in 2001 contributed to market congestion. In addition, the fall in purchasing power in Italy and Spain reduced demand from catering and restaurant businesses.

The crisis and the financial weakness of the majority of businesses gave rise to corporate restructuring. In the course of this, many of the smaller businesses were acquired by larger ones, but there were also mergers and vertical integration processes. Since then, the large commercial groups have been diversifying their activities and expanding into other countries.

The development of aquaculture in the eastern Mediterranean shows how State support in the context of growing demand can act as a catalyst for an increase in corporate assets. It also demonstrates the fragility of a sector as a result of this process in the absence of strategic planning or control over the increase in production.
2. GEOGRAPHICAL FRAMEWORK OF PRODUCTION

The majority of production from marine fish farming in the eastern Mediterranean comes from the Aegean Sea. Moreover, the environmental conditions in the Ionian Sea, where a significant part of productive capacity is also located, are very similar to those in the Aegean.

In both seas, the coast is very irregular with a great many bays protected from the prevailing winds, which can be strong, particularly in the Aegean. In the Aegean the prevailing winds are from the north although in some winter periods they can come from the south. However, in the Ionian Sea the prevailing winds are from the south-west. In addition, although the tides are not significant, there are strong currents which cause considerable temperature differences. As a result, intensive aquaculture competes with tourism for the use of the areas most sheltered from the winds and currents.

Moreover, the environmental impact of fish farming is an issue of increasing importance, particularly in the shallowest and most sheltered areas. In Cyprus, the environmental impact of aquaculture was the subject of public debate much earlier than in other countries, with the Cladophora case. Between 1990 and 1991 there was a massive increase in Cladophora patentiramea, a filamentous alga from the Indian Ocean which had arrived through the Suez Canal. This alga grew on indigenous algae (mainly Cystoseira spp.) and the dead algae accumulated on tourist beaches. Public reaction was in response to pressure from the catering and real estate sectors, placing blame for the incident on a land-based fish farm located in Liopetri. Although it was later demonstrated that tourism and agriculture produced three times more nitrates and that the massive growth of Cladophora had been caused by a series of warm winters, the government launched a policy of gradually moving aquaculture production centres away from the coast. Thus, the Cladophora case had a positive result, encouraging the location of production plant in the open-sea, but it gave aquaculture a negative image.

In Greece, the 309 authorised production centres are distributed more or less all along the coast, but are concentrated in the centre, which has better infrastructure for exporting products. In this connection, good communications with Patras are important as this is the main port of shipment for exports to Italy.

In Turkey, 95% of seabream and seabass production is concentrated along the Aegean coast (45% of total production). In this region, the province of Muğla is particularly important, with 16% of farms and 40% of total production. Approximately 13% of the total is produced in the province of Izmir. Tourist development is concentrated in these two provinces and there are often conflicts over use of the coastline. Approximately 25% of total production takes place in the Black Sea. There is output on a smaller scale in the Sea of Marmara, the Mediterranean and central Anatolia.

The geographical location of Cyprus and the nature of its coast give rise to environmental conditions that differ from those in the Aegean and Ionian Seas, with very few protected bays. In addition, its geopolitical situation restricts the possibilities for the geographical spread of aquaculture production and makes competition with other uses of the coast (tourist and military) more acute. Thus, marine aquaculture has developed only on the southern coast and, even so, at a distance from the coast.
3. RELIABILITY OF AQUACULTURE PRODUCTION STATISTICS

Statistics need to be used to evaluate production. There are circumstances in which, despite the obligations set out in Community rules, Eurostat does not have all the information which the Member States ought to have sent. This is the case for production of bluefin tuna by aquaculture in Greece. Spain is the only Member State which has regularly communicated information on the production of bluefin tuna by aquaculture. Cyprus provided information in 2004 and 2005 and Italy began to provide it only in 2005. This is a surprising situation in view of the poor state of bluefin tuna resources and the development of on-growing in various Member States.

The table opposite shows capacity in the production centres included on the ICCAT positive list, production in 2005 and the estimates for 2005 included in Tables 059 to 067 of the ATRT study. In the absence of reliable statistics production from on-growing bluefin tuna could be indirectly estimated using the statistics for purse seine catches collected by ICCAT and the trade in live bluefin tuna. However, Eurostat does not have statistics for category 0301 94, corresponding to external trade in live bluefin tuna.

Although the case of bluefin tuna is more marked, there is also a lack of statistics in Eurostat on Greek production of sharpsnout seabream (*Diplodus puntazzo*), common dentex (*Dentex dentex*), common seabream (*Pagrus pagrus*), Moroccan white seabream (*Diplodus sargus*) and common sole (*Solea solea*). Although the total amount produced is not large in quantitative terms (less than 5% of total production), it is important since it represents the trend for diversification in the sector, and various sources testify to its existence.

Any differences between Eurostat’s production statistics and the results from other sources must also be taken into account. The tables below compare the Eurostat statistics with the amounts marketed at first sale shown in the Stirling Report on production of seabream and seabass for 2002.

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Trade in seabream and seabass fry could provide a basis for a more accurate estimate of actual production. The Stirling Report\(^4\) uses data for fry exports amounting to 250\% of imports, which is an impossible situation, in view of the concentration of production of seabream and seabass in a limited number of countries. In any case, Eurostat does not provide data for trade in seabream and seabass fry.

Whichever country we consider, the production data are unreliable in absolute terms. Nevertheless, we need to use a homogeneous source of information to obtain a picture of the sector’s development. For this reason, throughout this note we will use the available Eurostat data series.

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\(^4\) Table 16.
4. HISTORICAL DEVELOPMENT OF PRODUCTION. THE PREDOMINANCE OF SEABREAM AND SEABASS

In Greece, production of rainbow trout (*Oncorhynchus mykiss*) began in the 1950s. Production gradually increased until the 1980s. Since then, it has varied between 2000 and 2500 tonnes per year, although there have been significant variations. In some marshes on the Turkish coast a form of extensive aquaculture (‘*dalyan’*) has traditionally been practised. Turkey began to produce trout and common carp (*Cyprinus carpio*) in the late 1960s. Cypriot aquaculture started in 1969 with the production of trout in the Troodos mountains.

Experiments carried out in France, Italy and Spain during the 1970s made it possible to control the life cycle of the seabream and seabass. Later, the introduction of cage culture technology, already used for salmon, made it possible to develop commercial production.

Marine aquaculture started to develop in the mid-1980s when technical problems for fry growth caused by pollution were resolved. The 1990s saw rapid development. This was possible because of good climate conditions, an extensive, sheltered coast and the proximity of markets such as Italy's, with growing demand.

In Greece, the availability of abundant funding played a decisive role in the increase in production. In fact, EU aid encouraged the creation of these financial resources and formed part of them. Faced with significant demand, the banks and, in particular, the *Agricultural Bank of Greece* granted funding with minimal guarantees and the businesses supplying factors of production (fry, feed, etc.) gave credit purchasing facilities. When the crisis in the market occurred, debt made it worse and created the conditions for corporate restructuring and business concentration.

In Turkey, although conditions on the Aegean coast are similar to those in Greece, production developed without EU aid. As a result, the sector initially developed on a small-scale, traditional basis. The use of wooden cages with fry captured in the wild was frequent. At first, production was carried out in locations close to the coast without being subject to any authorisation procedure, and quality control was weak. In 1998, the European Union suspended imports from Turkey. Since then, Turkish production has developed considerably. The use of wild fry has been banned, the establishment of new production sites is subject to authorisation, marketing meets Community standards and technology has been modernised. This process has been carried out under difficult circumstances since as well as having to deal with the crisis in the markets in 2001 and 2002, the sector suffered the impact of the financial crisis and the devaluation of the Turkish lira in 2001.
Aquaculture in the Eastern Mediterranean

The availability of funding was also crucial for the sector’s development in Turkey. Until the financial crisis of 2001, interest on loans for the aquaculture sector had been subsidised to the tune of 50%. In a context of high inflation and high interest rates, this method of support gave a significant impetus to the sector and stimulated the granting of credit facilities by banks and suppliers.

In addition, the 1990s saw significant increases in survival rates and the conversion rate. However, by 2000, a biological limit was reached with these two parameters, and they ceased to be cost reduction factors. The 1990s also saw the start of a quest for economies of scale.

Thus, between 1990 and 2004, world production of seabream and seabass increased twenty-fold. Whilst in Greece and Cyprus seabream production predominates, in Turkey seabass production has greater relative importance.

The explosion in production was accompanied by a price crisis in 2001 and 2002. Thus, in 2002 average prices were only 20% of the prices being achieved in 1990. As a result of the fall in prices, production decreased. World production of seabream and seabass started to recover in 2003, reaching levels slightly above those of 2000.

5. PRODUCTION CHARACTERISTICS

The seasonal nature of the production of seabream and seabass is a universal characteristic, although growth conditions in the various countries give rise to some differences. In Greece, the on-growing of fry begins in spring and production reaches the market in the following autumn, coinciding with a fall in demand.

In Greece, winter water temperatures are lower than those in Turkey or Cyprus, and the seasonal nature of production is more marked. To avoid the market congestion resulting from seasonality, some producers bring forward the start of production in order to bring their products to the market in autumn.

The higher temperature of Turkish waters allows most production to enter the market during summer or at the beginning of autumn, before demand starts to fall. Production of seabream in Turkey begins in April, and production of seabass in June. Turkish production of seabass that has grown for two summers achieves good sizes and prices, including in autumn.

Feed, fry and labour account for approximately 70% of production costs. The competitiveness of the two main producers is based on different foundations. Traditionally, Turkey has relied on a foundation of lower labour costs, and the large Greek businesses on lower costs of some fry
produced in-house. In Turkey, although the situation is not comparable to that of Greece, vertical integration is also developing considerably.

Companies which include fry production among their activities have a financial advantage. The firms that depend on commercial fry production have to secure their supply with long-term supply contracts or cope with price fluctuations as the availability of fry varies. Another important issue is methods of payment, since purchases on credit incur a fairly significant risk premium. The price small producers pay for fry can be as much as 40% higher than the cost borne by the large integrated businesses.

Since production is intensive, the impact of feed cost is high, but is extremely variable, depending on efficiency in feed management, production technology, purchasing terms and the inclusion of feed production within the company group and fluctuations in the prices of raw materials. This last factor will be increasingly important in the future. The massive growth of aquaculture throughout the world, and particularly in Asia, is increasing demand and it is unlikely that the availability of resources will grow in the same way.

In fact, integration is being extended to the manufacture of products for animal feed as a cost reduction strategy. Such is the case with KEKO, whose majority shareholder (51%) is Nireus Aquaculture, which is seeking to acquire on the Athens Stock Exchange as many KEKO shares as possible. Before this acquisition, Nireus Aquaculture already had Feedus, its own feed manufacturing company. For its part, Ecofeed, a company manufacturing products for animal feed, holds 10.96% of the capital of Hellenic Fishfarming, and intends to acquire holdings in two other companies, following the construction of its new plant in Patras, which will be by far the largest plant in the Mediterranean.

The cost of labour is directly linked to the mechanisation or automation of feeding. Access to cages in the open-sea is increasingly difficult the further they are from the coast and the less protected their locations. However, in these circumstances the cages are bigger, the mechanisation of feeding is easier and more effective and labour is more productive.

In Greece, the majority of the production of seabream and seabass is carried out in marine cages 35 metres in diameter and with a capacity ranging from 250 to 300 tonnes. However, certain species such as flathead mullet (Mugil cephalus) are produced under an extensive system in swamps (‘limnothalasses’).

In Turkey, there are 1,659 fish farms, mainly owned by small businesses. Trout production accounts for 51% of total production and is distributed throughout the country. Nevertheless, production of seabream and seabass is carried out by much larger companies than those that produce trout.

In general, the cages used in Turkey are smaller than those used in Greece. Nonetheless, as a result of competition with other uses of the coast, farms tend to be located in less sheltered areas and, as a result, the cages’ dimensions and construction materials are changing. Thus, cages constructed of high-density polyethylene of up to 24 metres in diameter are replacing the small wooden cages initially used closer to the coast.

Most of the businesses which provide services and factors of production to aquaculture are concentrated on the Aegean coast and in the vicinity of Istanbul.
In **Cyprus**, as in Greece and Turkey, aquaculture is highly focused on the production of seabream and seabass, although production volumes are much smaller. Nevertheless, on-growing of bluefin tuna accounts for a much greater share, representing 39% of production.

The geographical situation, the partition of the island and the characteristics of the Cypriot coast have led to a decision to locate cages in the open-sea, where there are six farms. Two of these are in Limassol, three in Zygi (east of Limassol) and one in Liopetri (east of Larnaca).

The location of the cages in the open-sea (up to three kilometres from the coast) give rise to some production characteristics that differ from those adopted in Greece and Turkey. In general, the cages are located in areas with depths ranging between 20 and 45 metres. These depths and some strong currents contribute to the dispersal of surplus nutrients and reduce the environmental impact. However, the distance from the coast makes access to the cages difficult and increases production costs. In order to reduce them, it has been necessary to make intensive use of technology and automation. As a result, productivity per employee in Cypriot aquaculture is very high.

Greece is the largest fry producer, but it is also the largest fry importer. Turkey, for its part, is self-sufficient and exports seabass fry, and Cyprus, with a much smaller level of production, is self-sufficient and exports them too.

When production started, the availability of fry was a limiting factor. The production of seabream and seabass increased in parallel with the size of the fry production centres. Currently, there are no major availability problems and prices have fallen to less than half of their 1990 levels. However, fry still account for between 15 and 20% of production costs.

The availability of fry at reasonable prices and on favourable payment terms constituted a strong incentive for growth in production. In Greece, before the crisis, two thirds of fry were produced by large businesses quoted on the Athens Stock Exchange. Between 1998 and 1999 the share prices of these businesses increased spectacularly. To satisfy investors production was maximised with the aim of reducing the unit costs of production. To increase sales payment facilities were given to producers. They could postpone payment for fry until they sold their products. This system helped to stimulate production while keeping prices high.

In **Greece** there are 58 authorised fry production centres. However, this does not mean that they are all actually operating. The fry production structure has also undergone major changes. One of the main processes in the Greek business dynamic has been vertical integration. In addition, Greek production does not have the advantages of a labour force as cheap as that of Turkey, and availability of high-quality fry at a reasonable price has been the basis for cost reduction, at least for the large corporate groups. Moreover, the financial difficulties suffered by a large number of aquaculture companies were passed on to fry producers. This has resulted in significant concentration of fry production and its integration into the activities of the major producer groups.

The production of seabream and seabass in **Turkey** began with fry captured in the wild but this practice was banned in 2001. Currently Turkey has 17 companies producing fry of marine species but only eleven operate permanently. The availability of fry is not a limiting factor for Turkish production. Although the sale price of fry is lower than in Greece, particularly for seabass, mortality rates are quite a bit higher. **Kilic Aquaculture** is the largest company, with 60% of production in its four plants. A long way behind it is **Akvatur** (15% of production in two
Aquaculture in the Eastern Mediterranean

plants), Fjord Marin (10% of production in two plants), Camli (5% of production) and Egemar. In addition, there are approximately 120 companies producing trout fry.

Four fish fry producing companies operate in Cyprus (two in Limassol, one in Paphos and another in Liopetri), and one company producing white prawn larvae in Akrotiri (west of Limassol). Most fry produced are exported to Greece and Israel.

6. DIVERSIFICATION OF PRODUCTION

In Greece, production of mussels (Mytilus galloprovincialis) and eels (Anguilla anguilla) developed at the same time as production of seabream and seabass. Mussel production stabilised at around 25 000 tonnes from 2000 onwards. Although there was also strong initial growth, the increase in eel production slowed in the mid-1990s. Later, this production fell slightly until 2004, to around 500 tonnes. In 2005 there were signs of a crisis in eel production. In addition, in the mid-1990s Greece began producing flathead mullet (Mugil cephalus), but this production has never exceeded 500 tonnes.

Attempts to diversify production in Greece have had limited success, with small quantities of sharpsnout seabream (Diplodus puntazzo), common dentex (Dentex dentex), common seabream (Pagrus pagrus), Moroccan white seabream (Diplodus sargus), common pandora (Pagellus erythrinus), and common sole (Solea solea). Other species such as drum (Umbrina spp) also represent possibilities for diversification. In any case, the majority of species involved in diversification are Sparidae, which are very close in biological terms to seabream and seabass.

In Turkey, trout and salmon production began in the early 1990s on the Black Sea coast. Salmon production did not develop, but trout production has attained a significant level. Nevertheless, trout production also fell as a result of the crisis in the prices of seabream and seabass and has now regained maximum production levels, at about 45 000 tonnes per year. In the 1990s production of kuruma prawn (Penaeus japonicus) also began on the Mediterranean coast, and mussel production in the northern Aegean and the Sea of Marmara.

74% of Turkish fish farms produce trout, accounting for 51% of total production. There are 1 215 freshwater trout farms and eleven marine trout farms. Two thirds of production comes from the Aegean, the Black Sea and the Sea of Marmara, and a third from central Anatolia. Small businesses predominate; half of them produce less than 10 tonnes per year and very few produce more than 50 tonnes.

In general, attempts to diversify production have focused on the same Sparidae species as in Greece, although Black Sea turbot (Scophthalmus maeoticus) and grouper (Epinephelus spp.) have also begun to be produced.

There are some innovative projects such as Agrobay in Bergama for the production of eels using fry imported from Japan and geothermal energy to maintain the water at 28° C. It is hoped that annual production will reach 3 000 tonnes.

In Cyprus, as well as seabream, seabass and bluefin tuna, other production has been developed, but in all it does not exceed 2% of the total. Products include seabream such as the sharpsnout seabream (Diplodus puntazzo), the red seabream (Pagrus major) and the common seabream (Pagrus pagrus). Production of other species has also begun, such as the shi drum (Umbrina
Aquaculture in the Eastern Mediterranean

cirrosa), the Indian white prawn (*Penaeus indicus*) and the marbled spinefoot (*Siganus rivulatus*).

There are six small trout farms, but production has been stagnant since the beginning of the 1990s.

In all three countries recent years have seen a growth in the on-growing of northern bluefin tuna (*Thunnus thynnus*) in farms. This production began in collaboration with Spanish and Australian companies. In this case, there is a statistical problem. The Eurostat and FAO databases only record production for Cyprus, with 1 480 tonnes in 2005. No production data appears for Greece or Turkey. However, Annex III of Regulation (EC) No 788/96 imposes an obligation on Member States to communicate to the Commission the aquaculture production statistics for northern bluefin tuna.

However, according to the ICCAT positive list of on-growing centres, Cyprus has an installed capacity of 3 000 tonnes, Turkey 9 460 tonnes and Greece 1 000 tonnes. Moreover, in 2005 (its second year of operation) *Bluefin Tuna Hellas S.A.* was already ranked ninth of Greek aquaculture companies, with EUR 11.9 million in turnover. As well as its centre in Astakos, it also carries out activities in Croatia.

The twelve production centres on the ICCAT list for Turkey are concentrated in Antalya (5 centres, 5 200 tonnes, 55% of capacity), Izmir (5 centres, 3 560 tonnes, 36% of capacity) and Çanakkale (2 centres, 700 tonnes, 7% of capacity).

31% of on-growing capacity is owned by the *TSM Deniz Ürünleri As.* group of companies (*Sagun - Mavi Tuna*, 5 centres, 2 920 tonnes).

27% (2 centres, 2 540 tonnes) is the property of *Dardanel. Dardanel Önentaş Food Industry Corporation*, working together with *Ginés Mendez España*, introduced on-growing of bluefin tuna in Turkey in the late 1990s. Currently, 36% of *Dardanel su Ürünleri Üretim A. S.* is owned by *Tohto Suisan Co. Ltd.* (Japan). In addition, in 2002 *Dardanel* began on-growing tuna in the part of *Cyprus* not under the control of the Government of the Republic of Cyprus, with facilities in Rizokarpasso under the name of *Dardanel Cyprus*. Later, the on-growing centre was moved to Famagusta, with a capacity of 3 000 tonnes. However, this production centre does not appear on the ICCAT positive list of production centres.

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Aquaculture in the Eastern Mediterranean

Akua-Group accounts for 21% of capacity (2,000 tonnes in three centres. These are distributed between Akua-Dem with 13% (2 centres, 1,200 tonnes) and Akua-Kocaman with 8% (1 centre, 800 tonnes). Its on-growing facilities are in Izmir and Cesme. Lastly, Ak-Tuna represents 11% of total capacity (1 centre, 1,000 tonnes).

In the case of Greece, the only on-growing centre for northern bluefin tuna is in the Ionian islands (Cephalonia) and belongs to Bluefin Tuna Hellas S.A. This company was set up in 2003. 50% of its capital belongs to Australian Fishing Enterprises Spain - Sime Sarin SL, 25% to Selonda Aquaculture, and the remaining 25% to Nireus Chios Aquaculture.

In Cyprus there are three on-growing centres. Each of them has a capacity of 1,000 tonnes. Two of the centres (Kitiana Fisheries Ltd and Telia (Tuna) Ltd) are located in Vasiliko and one (Kimagro Fishfarming Ltd) in Limassol. On logistics and on-growing activities, Kimagro Fishfarming works together with the Grupo Ricardo Fuentes S.A. (Spain), while it collaborates with Médipêche (France) and its five vessels for purse seining.

7. MARKETS AND EXTERNAL TRADE

The Italian market is the preferred destination for exports from Greece and Turkey. In fact, it accounts for 55% of exports from Greece and 65% of those from Turkey to the entire 25-member European Union. Since the start of development of fish farming, the Italian market has offered good prices for species that are less in demand on the domestic market, as is the case for seabass in Greece or Turkey.

Italy is the largest market for seabass, with Spain and Turkey next, but with significantly smaller quantities; Turkey is, however, self-sufficient. For seabream, the main markets are Spain and Italy, although Spain has a high level of self-sufficiency. Greece and Turkey are also significant markets, but they do not absorb half the volume consumed in Spain or Italy.

Both in Italy and Spain the catering industry accounts for a very significant share of the market for seabream and seabass. This fact had some impact on the crisis in the market at the beginning...
of the decade. The catering industry is much less sensitive to product origin. However, consumers in producing countries, when buying directly in fishmongers or supermarkets, show a preference for products from their own countries.

The concentration of distribution has led to the large producer groups tending to expand their activities in the commercial sector.

The majority of production is destined for export. Both in Greece and in Turkey, exports of seabream and seabass play a strategic role in external trade as a whole. In fact, in Greece they come in third place for exports of products from agriculture and fisheries, after olive oil and tobacco. Fish-farming production in Cyprus does not appear to have consolidated markets for its exports.

In this section all the data come from the Comext database. It should be borne in mind that there are some inconsistencies between imports and exports. Also, care should be taken in making comparisons between exports from Greece and those from Turkey. Declarations of intra-EU trade are often made in a more lax way and, depending on the declaring country, they can be undervalued.

In the late 1990s, Greek production was clearly dominant on the EU market. However, since the 2002 crisis, Turkey has been increasingly playing a greater role as supplier of the EU market. For seabass, Turkish exports to the European Union are close to the volumes exported from Greece and may exceed them in the near future.

However, Turkish exports of seabream are much less significant. Imports of seabream are growing less spectacularly but in a more sustained fashion. In view of Spain’s level of self-sufficiency, the destinations of EU imports are more diversified than for seabass.

Almost all farm production of on-grown bluefin tuna
from the three countries is exported to Japan to satisfy the growing demand for sushi.

**Greece**

Approximately 80% of Greek aquaculture production by is destined for export. Of this quantity, more than 70% goes to the markets of Italy and Spain. Despite the fact that markets are diversifying, Italy is by far the main destination of Greek exports. One of the weaknesses of Greek fish farming is its dependency on exports. Above all, it is significant that the main destinations of Greek exports have their own production and that consumers, when making purchases at fishmongers and hypermarkets, demonstrate a preference for domestic products.

The 2002 market crisis marked a low point for Greek exports. In 2002 exports of Greek seabass fell considerably to all destinations. Since the crisis, the Spanish market has shown a tendency to absorb progressively smaller quantities of seabass, while France and the United Kingdom are increasingly significant destinations, although they import far less than Italy.

In the case of seabream, the situation is very different. The drop in exports in 2002 was much less marked than for seabass and the destinations are different. Italy continues to be the main market, but the Spanish market is much smaller, demonstrating the preference of consumers when there is domestic production available in reasonable quantities and at reasonable prices. France and Portugal are markets of some importance, but significant increases are not to be expected in any of the destinations.

In Greece, aquaculture products account for a much smaller proportion of fish consumed than aquaculture’s share in the total production. The origin of this situation can be traced to a certain
lack of confidence on the part of Greek consumers towards the raw materials used in aquaculture as a result of the crises in the mid-1990s (dioxins and Bovine Spongiform Encephalopathy). Although the majority of domestic consumption still supplies fishmongers and supermarkets, hypermarkets account for a growing share of the market.

Etanal (State Company for the Development of Fisheries), whose main shareholder is the Agricultural Bank of Greece, has set up a network of fisheries markets. However, products sold via the Etanal markets account for a shrinking proportion of the total.

Currently, of the eleven markets managed by Etanal, only Missolonghi and Preveza retain significant commercial activity in seabream and seabass. Nonetheless, except in exceptional market circumstances, their activities are declining. The main reason is the concentration of production within a smaller number of companies.

As the size of business groups grows, their commercial organisation develops and widens. In addition, the large producer groups enter into agreements with distribution companies, and there are also acquisitions of supermarket chains.

**Turkey**

The majority of Turkish trout production is consumed on the domestic market; a large part of seabream and seabass production is destined for export, mainly to EU markets. Nonetheless, the domestic market is seeing growing demand and absorbs greater quantities of seabream than of seabass.

The majority of Turkish trout production is sold directly to the catering sector and restaurants, although it is also sold in the wholesale markets of Istanbul, Ankara and Izmir. Many farms have their own restaurants. Owing to their large size, trout produced in marine cages are marketed as ‘salmon’, even though the flesh is not coloured.

As in other countries following the growth and vertical integration of large producer groups, penetration into the capital of supermarket chains began. Some, such as Camli (Pinar Fish) and Kilic Aquaculture, have set up their own chains of fishmongers, including other products in their range.

Around 60% of Turkish trout exports go to EU markets, particularly the Italian market, which absorbs 25% of the total value. However, exports to Asian markets are becoming increasingly
Aquaculture in the Eastern Mediterranean

significant. Thus, the value of exports to Japan was 28% of the total in 2005, exceeding exports to Italy, although in this case the increase in exports of bluefin tuna plays an important part.

Turkish exports of seabass took off in 2002, with the financial crisis. Nevertheless, the growth in imports took place in Italy, although exports to Spain increased significantly in 2005. The Dutch market remains stable, reflecting exports of fillets manufactured by a single company (Noordzee).

Exports of seabream from Turkey are much lower and developed later than seabass exports, because of a greater level of domestic consumption. Italy is the largest export market, with only small quantities being exported to Greece.

**Cyprus**

The domestic market cannot absorb Cyprus' growing aquaculture production. Exports are therefore growing at the same rate as production, and approximately 40% of production is exported. However, the export of Cypriot products has certain characteristics which differentiate it from Greece or Turkey.

Not only is the volume smaller, but exports outside the European Union predominate, primarily to the US and Russia. Except in the case of exports of seabream to Greece, which receives a stable annual amount, Cyprus has not managed to win the loyalty of EU markets.

Until the start of vertical integration of production, trade squeezed commercial margins, leading to weak growth in domestic consumption. However, following the development of integration, the producer companies have penetrated the distribution sector and have developed new commercial techniques.
8. ROLE OF STATE AID IN THE DEVELOPMENT OF THE SECTOR

The use of EU Structural Funds has played a decisive role in the development of intensive aquaculture by financing new production centres. In autumn 2002, in response to the crisis on the markets, the Commission called on the Member States to suspend funding of projects which might contribute to increasing the surpluses in seabass and seabream\textsuperscript{6}.

In the 1994-1999 period, EU structural interventions in \textbf{Greece} financed the creation of 162 production units in inland waters and the modernisation of a further 45. The original plans envisaged the creation of 104 units and the modernisation of 58. As a result, the creation of units attained an implementation rate of 156\% and modernisation a rate of 84\%.\textsuperscript{7} It had been planned that the measures funded by the FIFG would make it possible to increase production of seabream and seabass by 6 200 tonnes, but the increase in production was in fact 8 754, or 141\% of forecasts.

Between 1994 and 1999, the FIFG dedicated EUR 126.04 million to Greece, of which EUR 34.76 million (28\%) went to aquaculture. In addition, aquaculture received EUR 11.56 million of national public funding and EUR 54.97 million of private funding. Almost 90\% of funding went to increasing capacity, and the rest to modernising farms without increasing capacity.

During the 2000-2006 period, Measure 3.2. of the ALIEIA programme managed by the Ministry of Rural Development and Food used FIFG funds in support of aquaculture. Its objectives were:

- Improving the quality and hygiene of aquaculture products, and of the management of aquatic resources.
- Improving the competitiveness of companies in the sector, by applying modern technology and reducing production costs.
- Creating new production and consumption conditions, via the diversification of the species produced.
- Promoting aquaculture products with a high nutritional value.
- Promoting employment, improving working conditions, promoting gender equality on the employment market and promoting economic activity in depressed and remote regions.
- Technology transfer and modernising production in inland waters.
- Rational management and sustainable growth of farms in inland waters.
- Support for viable and competitive companies.

Up to 2006, the Single Programming Document for \textbf{Cyprus} included two measures connected with aquaculture:

- Development of aquaculture.
- Development of processing and marketing of fisheries and aquaculture products.

\textsuperscript{6} COM(2002) 511 final
The first measure included actions for the promotion of the modernisation of equipment, but also to provide incentives for the creation of new farms. The second measure contained promotion actions and incentives for investment in marketing and processing creating added value, to comply with EU standards and to increase the competitiveness of the products.

**Turkish aquaculture** did not of course receive EU aid for its development. However, in contrast to EU production, it will continue to receive assistance until at least 2010. Up until 1995 new facilities received assistance up to a ceiling of 25% of the investment. High inflation led to high interest rates which, up until 2001, meant a 50% subsidy for aquaculture producers. In 2001 this practice was discontinued. In 2003 a support system was set up whereby assistance of EUR 0.09 was given for each kilo produced, based on authorised capacity and invoiced sales. Currently, the only assistance consists of a one-year moratorium on loan payments.

### 9. THE MARKET CRISIS IN 2001 AND 2002

After a period of growth, the January 2001 crisis lasted until March 2002. During this period prices for seabream and seabass fell spectacularly, by up to 45%, causing a general crisis in fish farming. The crisis in the prices for seabream and seabass spread, also leading to a fall in prices for other species such as trout.

Although the main cause of the crisis was the huge growth in production seen in the 1990s, particularly in Greece, a number of different factors contributed to widening and prolonging the crisis. The majority of problems relating to the increase in production arose in Greece and Spain in the autumn of 2001, when demand for seabream fell. The reduction in prices hit seabream hardest. Production prices in Italy, Spain and France were not affected by the crisis to the same extent as in Greece.

![Imports of seabream and seabass](chart.png)

However, in 2001 and 2002 there was not such a great contraction in imports as to justify a price reduction of such a size. Italian imports continued to grow. It is clear that Spanish imports of seabass fell, but only from 2003. In addition, the average unit value of imports had begun to fall, but this process had already started in the mid-1990s.

The price crisis cannot be attributed exclusively to the increase in production. A large number of producers with little coordination and weak marketing also contributed. The availability of capital in a context of advantageous prices helped to create a misleading climate in which commercial and financial planning were relegated to the background. However, when prices fell, many producers attempted to deal with their repayments by flooding the market with their production, exacerbating the price crisis.
In general, the depression of the market was attributed to a rapid growth in Greek exports in autumn, in order to get all the fish still in the cages onto the market at a time of year when demand was falling.

However, other factors had an effect on the scope and duration of the crisis. The introduction of the euro led to an increase in prices and a reduction in purchasing power. This reduction was particularly significant in countries such as Spain and Italy, where a section of the working population usually eats in restaurants for the midday meal. The fall in purchasing power was confirmed when housing prices went through the roof, so that it was no longer to be expected that demand would fuel the market. This factor, although it exacerbated and prolonged the crisis, does not seem to have played any part in its origin.

In addition to the problems listed above, the financial crisis experienced by Turkey in 2001 and 2002 merits special attention. The small farms, dependent on bank loans to purchase fry and feed, had to abandon their operations as a result of the banking crisis. In addition, the weak Turkish lira following the devaluation in February 2001 and subsequently in 2002 encouraged producers to export in search of foreign currency. In 2003 the Turkish economy stabilised and sales to meet Turkish domestic demand recovered. In view of the sequence of events, we must conclude that the financial crisis in Turkey played a major role in triggering the problems in the seabream and seabass market.

The role of the financial crisis in Turkey does not mean that imbalances on the EU market were not also responsible. Quite the reverse: there are common characteristics in the factors which contributed to the crisis both in Greece and Turkey. Among the small producers in both countries there was, and still is, albeit to a lesser degree, a huge reliance on loans to buy the factors of production.

One of the results of the fall in prices was a major corporate restructuring and a restrained move towards diversification of production. Growing competition, as well as stimulating business concentration and vertical integration in the quest for economies of scale, also led to attempts to reduce production costs. With regard to production technology, in the large farms we can see a tendency to increase cage size and to use automated feeding methods. In addition, in salmon production biomass management and feed optimisation methods have developed which could be transferred across to the intensive production of seabream and seabass.

The corporate structure and dynamics of aquaculture in this region is the product of the crisis in prices for seabass and seabream in 2001 and 2002. During the crisis, many smaller companies were acquired by larger ones, but there were also mergers and vertical integration processes. Thus, feed manufacture, fry production and commercial distribution are being integrated within single corporate structures. There has also been some expansion, with facilities and acquisitions of companies in other countries.

In 2000, before the price crisis, there were 269 aquaculture companies active in Greece. In 2003, there were only 167 companies left, and in 2005 only 114. Given that production has recovered and the number of authorised production centres has not decreased, it is clear that in only five years there has been a veritable revolution in the corporate landscape, with a large number of acquisitions and mergers. One of the first business concentration processes was the absorption of some of the small producers by their creditors.
As production has increased, prices have fallen. Thus, three processes have been triggered: cost reduction, product differentiation and diversification of production.

Before the crisis at the start of this decade almost all production consisted of fish with weights of between 300 and 500 grams. In the face of the reduction in prices, in some companies a certain tendency could be seen to prolong growth, in a quest for greater size, continuity of supply to customers and output onto the market at times when demand was higher. This strategy involves higher costs, due both to feed and the greater incidence of illnesses during the winter (*Pseudomonas anguilliseptica*), or the loss of body weight following maturation. Moreover, it would become less attractive the more generally it were adopted.

Today it can be seen that the strategy of increasing weight has been more successful in Greece than in Turkey. In Turkey a very large proportion of production, especially of seabream, is sold in the range between 200 and 300 grams, and this is definitely in response to domestic demand. However, in Greece a significant percentage of production is sold in the range between 400 and 600 grams, especially in the case of seabream. 3% of Greek production of seabass is sold at weights equal to or greater than 800 grams.

**10. CORPORATE STRUCTURE**

The current corporate structure is intimately linked to the historical development of the sector, which, although it still has characteristics peculiar to each country, has some features which are common to every country. After a first phase of expansion of production there was a process of integration involving the production of fry, resulting in the formation of corporate groups. The crisis in 2001 and 2002 destabilised small firms, which were absorbed into the larger firms as mergers occurred. The result was an increase in the size of the larger groups, which gradually expanded their activities in distribution and began expansion into production in other countries.

The availability of EU and private funding, together with growing demand, are the reasons for the spectacular expansion of Greek aquaculture from the mid-1980s to the beginning of the present decade. The number of firms grew in this period from 2 to 250.

Following business concentration, vertical integration, diversification into other activities and expansion into other countries, an analysis of the production figures does not entirely reflect the business landscape in Greece.
The table above shows some indicators for the twenty major Greek firms up until 2005. Business concentration is enormously high, since the twenty top firms represent 78% of assets and 79% of turnover in the sector. Moreover, the most recent data in the table comes from 2005. However, we should take into account that 25% of Bluefin Tuna Hellas belongs to Nireus Aquaculture and another 25% to Selonda Aquacultures. 17% of Seafarm Ionian belongs to Nireus Aquaculture. Moreover, in 2006 Selonda Aquacultures acquired 49.83% of Interfish Aquaculture and 75% of Koronis Aquaculture, firms which are in eighth and thirteenth places respectively in terms of assets.

If we take into account these acquisitions, we can see that the three largest firms account for 47% of the assets and 48% of turnover in the sector. Notwithstanding this, it is possible that the largest firms are majority shareholders in other firms not included in the above table, which would result in an even higher concentration. In addition, considering the results of some of the major firms, it is to be expected that in the near future some additional acquisitions or mergers will take place.

The Greek groups are expanding fully into other countries. Thus Nireus Aquaculture has a presence in Abu Dhabi and Tanzania and has acquired a 44.5% stake in Ilknak S.A. (Turkey) and a 100% stake in Preengorde de Doradas para Maricultura S.L. (Predomar, Spain). For its part, Selonda Aquacultures has established a presence in Singapore, supplies technology and management to firms in Kuwait and owns the Turkish company Elektrosan. Selonda Aquacultures has entered into partnership with the Jazan Development group from Saudi Arabia, which holds a 10% stake in its capital. This partnership has started up production of seabass in Wales and has established two production centres in Saudi Arabia.

In Turkey’s aquaculture production a majority of small family businesses coexist with some large groups, which, as in Greece, have undergone their greatest development following the
Aquaculture in the Eastern Mediterranean crisis at the beginning of this decade. It is worth pointing out that the oldest firm (*Camli*) was founded in 1985 under the name *Pinar Fish*.

<table>
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<th>Capacity in mt</th>
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<th>%</th>
<th>Production in mt</th>
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<td>50</td>
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<td>41</td>
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Source: *Ministry of Agriculture and Rural Affairs, 2005*

The largest firms are *Kilic Aquaculture* (12 000 tonnes, 12 production centres), *Fjord Marin* (6 000 tonnes) and *Camli* (initially called *Pinar Fish*, 2 500 tonnes). *Ilknak*, in which *Nireus Aquaculture* (Greece) holds a 44.5% stake, produces 1 000 tonnes, as well as eggs and fry. All the capital of the formerly Dutch firm *Noordzee* is now Turkish and the company produces around 2 500 tonnes annually. This firm has two peculiarities which distinguish it from other firms in the sector: firstly, it focuses its exports on northern European countries and secondly, almost half its exports are in the form of fillets.

Although trout production is much more fragmented than seabream and seabass production, there are also some large firms in the sector. *Bagci* is the biggest trout producer in Turkey (9% of the total) and it exports 95% of its production to the European Union after primary processing. For its part, *Liman* produces around 5% of the trout produced in Turkey; in addition, it produces a large amount of trout eggs and fry.

**11. REGULATIONS**

*Greece*

Aquaculture in Greece is regulated by the Ministry of Rural Development and Food through the Department of Aquaculture and Inland Waters. This department is responsible for drawing up the national strategy for aquaculture and specifying the production quotas. It also manages all the national and European Union funding, through the ALIEIA programme.

On the regional scale, the prefectures are responsible for issuing permits and drawing up the boundaries of production zones. The regional veterinary services, which also come under the jurisdiction of the prefectures, are responsible for health aspects and carry out checks on hygiene procedures and conditions.
Aquaculture in the Eastern Mediterranean

**Turkey**

Aquaculture comes under the jurisdiction of the Ministry of Agriculture and Rural Affairs. The Directorate of Agricultural Production and Development is responsible for the development and management of aquaculture, while the Directorate of Agricultural Research is responsible for research. The Directorate of Civil Defence is responsible for the movement of live fish and the health and safety of the food chain.

The Ministry has 81 provincial departments which issue aquaculture licences and carry out inspections. Notwithstanding this, the Ministry of the Environment and Forests, the Ministry of Culture and Tourism, the Department of Shipping and Oceanography, the Undersecretariat of Maritime Affairs and the State Directorate of Hydraulic Works (DSI) are all involved in granting the licences.

In accordance with the Regulation on environmental impact (No 25318 of 16 December 2003), aquaculture projects with an annual production greater than 1 000 tonnes require an environmental impact assessment. However, production volumes of between 30 and 1 000 tonnes need only send a preliminary assessment.

Production statistics are collected by the State Statistics Institute in cooperation with the Ministry of Agriculture and Rural Affairs.

The main regulations are Fisheries Law No 1380/1971 (amended by Fisheries Law No 3288/1986) and Regulation No 25507 of 24 June 2004 on Aquaculture.

Some specific aspects are regulated by ministerial decrees. Thus the Turkish Government has issued a decree obliging firms which exceed a specified size to hire technical staff.

The Turkish Parliament is currently debating an amendment to Law 1380. At present, the law prohibits foreign boats from fishing in Turkish territorial waters and prohibits aquaculture firms from being wholly foreign-owned. This amendment forms part of the process of harmonising Turkish legislation with Community rules with a view to Turkey’s possible accession. The Government’s draft law revokes both restrictions for those countries which establish reciprocal conditions with Turkey. This amendment coincides with the dispute with the European Union over access for Cypriot vessels and aircraft to Turkish ports and airports. In any case, the debate has stimulated the acquisition of holdings by foreign firms, especially Greek firms in Turkish aquaculture firms.

In 2000, **Coastal Management Plans** were published in association with various Ministries and other institutions in order to define **Zones of Potential Aquaculture Development**. However, conflicts within aquaculture still exist, especially in the province of Muğla. Aquaculture producers claim that the law fails to define concepts such as ‘environmentally sensitive zones’ and ‘zones used for tourism’.
Aquaculture in the Eastern Mediterranean

Cyprus

In Cyprus, aquaculture falls under the jurisdiction of the Ministry of Agriculture, Natural Resources and Environment, through the Department of Fisheries and Marine Research. There are five administrative districts: Paphos, Limassol, Larnaca, Paralimni and Latsi.

In 2000, aquaculture was regulated by a law which was amended in 2002. In 2002, the law was developed by regulations which, in their turn, were amended in 2003. The law on the control of fishing was amended in 2005.

Law 57(I) 2001 on environmental impact requires environmental impact assessments to be carried out before authorisation is granted for fish farms.

12. ORGANISATION OF THE SECTOR

Greece

The Federation of Greek Mariculture was founded in 1991 to support the development of the sector in its initial phase. Its aim is the coordination of marine aquaculture production and it participates in drawing up policy for the sector. It is a member of the FEAP (Federation of European Fish Producers).

Turkey

In Turkey there are more than 400 fish-farming cooperatives, and a smaller number of fishermen’s cooperatives. In recent years various associations have sprung up: the Turkish Aquaculture Association (a member of the FEAP), the Muğla Aquaculture Association and the Tuna Fattening and Exporters’ Association.

Since the publication of the legislation on agricultural producers’ organisations, various aquaculture producers’ organisations have sprung up at a provincial or district level, and they have banded together as a federation, the Federation of Turkish Aquaculture Producers.

13. RESEARCH AND TRAINING

In general, the major groups of producers have structures in place to produce fry, and, in order to maintain their position in the marketplace, need their own strands of research and development. Even so, public bodies are still important.

Greece

The Hellenic Centre for Marine Research is the result of the merger of the National Centre for Marine Research with the Institute of Marine Biology of Crete. One of its sections is the Institute of Aquaculture, whose specialisations include the biology of new species, aquaculture engineering, nutrition and pathology.

The National Agricultural Research Foundation (NAGREF) is another state institution which has a centre for fisheries and aquaculture research in Kavala.
In addition, there are research centres in spheres relating to agriculture at the Kapodistrian (Athens), Aristotle (Thessaloniki), Agricola (Athens) Universities, the Universities of the Aegean, Crete, Patras, Thessalia (Volos and Karditsa), and at the Technological Institutes of Education of Epirus and Missolonghi.

The Missolonghi and Igoumenitsa technical institutes (TEI) provide technical training in aquaculture through specialist and postgraduate courses.

**Turkey**

The State Planning Organisation draws up five-year development plans and annual plans, and coordinates various ministries’ activities. The Scientific and Technical Research Council of Turkey (TÜBİTAK) supports priority research projects.

In Turkey there are four research institutes reporting to the Ministry of Agriculture and Rural Affairs. The activities of the Central Fisheries Institute (Trabzon) cover the area from the border with Georgia to the Sea of Marmara. It has sea trout (*Salmo trutta*) and turbot (*Psetta maxima*) incubation tanks and production facilities. The strand of research on the turbot is the fruit of bilateral cooperation with Japan. Research is also underway into rearing sturgeon (*Acipenser spp*). In 2004 the development centre that the FAO had created on the Mediterranean coast at the end of the 1980s became a research centre.

Turkey has sent the FAO a technical cooperation project for the conservation, repopulation and development of the commercial aquaculture of sturgeon.

The other two institutes (Egirdir-Isparta and Elazig) focus their activities on fisheries in inland waters and research into aquaculture is largely irrelevant. On the other hand, the Centre for Fisheries Development and Production (Antalya) is working on the production of carp fry and repopulation activities, and produces trout eggs and fry.

In Turkey there are three university faculties of fisheries and five faculties of agriculture which provide training related to fisheries and aquaculture.

**Cyprus**

An attempt was made to stimulate marine aquaculture with the construction of a research centre in Gastria, north of Famagusta. However, following the events of 1974, the Cypriot government lost access to the centre and the Paphos Bay centre experimenting in the reproduction of seabream, seabass, Moroccan white seabream (*Diplodus sargus*) and marbled spinefoot (*Siganus rivulatus*) did not begin operations until 1978. In 1989 the Meneou (Larnaca) experimental station was set up, where all aquaculture research activities are concentrated.

Research into marine aquaculture is focused on reproduction and rearing of fry. In addition to the species mentioned above, work is being carried out on the sharpsnout seabream (*Diplodus puntazzo*), the common pandora (*Pagellus erythrinus*) and the greater amberjack (*Seriola dumerilii*). There are other strands of research, including the introduction of new technologies in open-sea cages and recirculation systems. The impact of culture in open-sea cages on the marine environment is an additional line of investigation.
The Kalopanayiotis centre carries out research into freshwater aquaculture. This centre works mainly on the production of trout fry for private operators. Research is restricted to new species like the Siberian sturgeon (*Acipenser baerii*).

Some companies collaborate on the genetic improvement programmes run by the Department of Fisheries and Marine Research. The aim of these programmes is to improve the survival and growth rates of fry.
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