



National Aquaculture Sector Overview Greece



Replaces: Arabic version (2005), Spanish version (2005), French version (2005), Chinese version (2005)

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Characteristics, structure and resources of the sector

Summary

Greek aquaculture is dominated by the farming of marine finfish in offshore cages, specifically of gilthead sea bream and European sea bass with the combined production capacity of about 110 000 tonnes in 2015. This is followed by the culture of Mediterranean mussels with an annual production capacity up to 35–40 000 tonnes in 2015. After several crises mainly as a result of imbalance between supply and demand, the marine fish sector has been restructured, with the aim of doubling its production by 2030. To meet this aim, strategies including: targeted research, development and innovations to optimize production; diversification of products; and concerned marketing actions through development of new schemes, such as producers organizations, are under consideration. Freshwater species and extensive lagoon aquaculture have a limited growth potential mainly because of the lack of natural resource (water, wild stocks) availability. Marine fish is the top Greek exported animal product and contributes about 11 percent of the total national agricultural exports (which together account for 19 percent of the total Greek exports).

History and general overview

Modern aquaculture in Greece is dominated by Mediterranean marine species such as European seabass (*Dicentrarchus labrax*), gilthead seabream (*Sparus aurata*) and Mediterranean mussels (*Mytilus galloprovincialis*). Marine fish farming was established in the early 1980s with strong European Union (EU) support in establishing pilot-scale farms, and through the transfer of cage technology and knowledge from salmon industries, especially those in Scotland, and rearing technology from France and Spain. In the early 1990s, mass production was achieved after the major zoo-technical problems for rearing these species had been solved. As a consequence, there was exponential growth in the industry, with several crisis periods (1999–2002 and 2007–2008) inducing extended periods of low prices mainly as a result of uncontrolled production, which reached 140 000 tonnes at the beginning of the Greek financial crisis (2008), and the lack of adequate

efficient marketing support. As of 2015, the industry entered a phase of restructuring and consolidation, with 63 companies and a production of around 110 000 tonnes. Mussel farming, after its mechanization in the 1990s, increased its production volume in the decade following but it remained under the upper limits of the farming capacity (35 000–40 000 tonnes gross weight). The growth of the sector is dependent on the availability of suitable space, which is limited. Traditional lagoon aquaculture and freshwater culture both have a limited potential capacity for expansion. Lagoon aquaculture, as a capture-based activity, is exposed to the vulnerability of the wild stocks of fry and juveniles, and natural conditions. Freshwater aquaculture is less suitable because of lack of freshwater sources.

Human resources

Marine fish farming in Greece provides 12 000 jobs (scientific, technical, workers) mainly in remote and isolated areas. In several cases, it is the major employer, and the wealth of the local society strongly depends on its activities. An additional 5 000 jobs exist in the value chain and peripheral activities. Within the aquaculture sector, marine finfish and mussels account for 85 percent of the direct labour employment, with 7 percent in the freshwater and 8 percent in the lagoon aquaculture activities.

In contrast with the high levels of national unemployment, which rose to 26 percent in 2014, the total employment in aquaculture decreased by only 8 percent in 2011 (STECF 2013).

Farming systems distribution and characteristics

Marine fish farming

Land-based breeding stations provide fry to the ongrowing facilities, which are mostly fish cages located in areas protected from severe weather. Large cages of about 120 m in perimeter, suitable for holding up to 250–300 tonnes of finfish, are available to escalate production and move the industry further offshore in order to avoid environmental problems. Fish reach marketable size (350–450 g) in 12–24 months, depending on the local water temperature which varies between sites.

Mussel farming

Traditionally, mussel farming was carried out in hanging parks located in shallow waters close to estuaries in the northern part of Greece. The use of single longline floating ropes provided an opportunity to expand further offshore and mechanize the production process as much as possible.

Lagoon aquaculture

Extensive aquaculture is carried out in coastal lagoons mostly located in the western and northern part of Greece. As a capture-based activity, the fry is collected from wild stocks, usually euryhaline species, such as flathead grey mullet (*Mugil cephalus*), sparoids, seabass and eels. The juveniles then mature naturally until they reach harvest size.

Freshwater aquaculture

Freshwater aquaculture is limited to the few areas where rivers are available, and are usually focused on trout and limited quantities of carp in raceways. There are a few niche businesses with closed recirculation systems to grow eels, but these have a limited capacity. More recently, some installations produce spirulina (a high-value cyanobacterium of the genus *Arthrospira*). Most of these businesses are vertically integrated and directly provide products for the nutraceutical industry. Five land-based installations with a total surface of 4.8 ha are used for spirulina farming with a yearly production of 12 tonnes at a value of EUR0.51 million (USD0.58 million).

Number of Installations

In Greece, as of 2012–13, there were 1 045 aquaculture installations of which 57 percent were mussel farmers, 36 percent were marine fish farm sites including hatcheries and the remaining 7 percent were inland installations.

In the mussel farming sector, there were 595 farm sites, most of them in northern Greece

In the marine finfish sector, there were 63 companies with 336 farm sites spread around the country and 36 land-based hatcheries. Marine on-growing farms can be categorized according to their annual production into small (<300 tonnes), medium (300–1 200 tonnes) and large (>1 200 tonnes). The large category is often made up of groups and producer organizations of individual companies. In Greece, most of the producers are small to medium-sized family businesses.

There were 78 farms focusing on freshwater aquaculture on the mainland. There were 72 organizations working with lagoon aquaculture, mostly working as cooperatives, which occupied a space of 40 000 ha with a production of around 600 tonnes. The number of farms has been relatively stable and did not expand during the crisis period. (Source: MRDF 2015).

Cultured species

The main species farmed today are shown below, in order of importance in terms of tonnage produced:

- Gilthead seabream (*Sparus aurata*)
- European seabass (*Dicentrarchus labrax*)
- Mediterranean mussels (*Mytilus galloprovincialis*)
- Rainbow trout (*Onchorynchus mykiss*)
- Red porgy (*Pagrus pagrus*)
- Meagre (*Argyrosomus regius*)
- Sharpsnout seabream (*Diplodus puntazzo*)
- European eel (*Anguilla anguilla*)
- Flathead grey mullet (*Mugil cephalus*).

The top three farmed species (seabream, seabass, and mussels) are the success story of Greek aquaculture, representing up to 97 percent of the production volume.

Freshwater species such as trout and eel are limited to 1 630 and 285 tonnes, respectively, and flathead grey mullet to 264 tonnes, of which some were used to produce 6.5 tonnes of roe, a high-value caviar product called “augo-taraxo” with a value of up to EUR0.9 million (USD1 million) in 2014 (GNSS 2015).

The recently established cultivation of spirulina microalgae is significant because despite its small production volume (12.6 tonnes in 2014) it had a significant value. It is oriented to the nutraceutical industry and is a promising sector of freshwater aquaculture.

The diversification of aquaculture species, including meagre, sharpsnout seabream and red porgy, has recently experienced an increase in production.

Practices/systems of culture

Marine Fish Farms

Most of the marine fish fry were produced in hatcheries that adopted semi-closed and closed recirculating systems. These technologies improve larvae quality and the operational efficiency of the hatcheries.

Cage technology supports large production volumes offshore, giving the advantages of mass production. These installations, fully supported by pneumatic feed distribution systems and feed barges, maintain stocking densities between 10–15 kg of fish per cubic meter. Improvements in feed formulas and technologies have reduced the feed conversion ratio to around 1.6.

Mussel Farms

Large boats, 15–20 m long and up to 6–7 m wide, are equipped with star wheels, loaders, mechanical French-type graders, and packing machines in order to cultivate mussels on single floating longlines. However, despite

being partly mechanized, the work is still labour-intensive.

Freshwater Farms

Traditional raceways are used in most small trout-farming installations. Closed recirculating technology has been successfully used in two high-tech farms for the production of high-value species such as eels.

Lagoon Aquaculture

This sector is mostly managed with traditional techniques. There are several legislative barriers as most of these extensively farmed regions are located within protected areas.

Sector performance

Production

Greece was the leading European producer, exceeding 120 000 tonnes, before the beginning of the Greek crisis in 2008. Even since the crisis, Greece is a significant world producer with yearly production of 110 000 tonnes of fish, even though the sector is operating below the existing capacity of the farms.

A similar trend characterizes the fingerling production, which is estimated to have reached 421 million fry in 2014, of which 98 percent were European seabass and gilthead seabream and 2 percent were the species of secondary importance (red porgy, meagre, sharpsnout seabream). The sales price of European seabass and gilthead seabream, per fry, is EUR 0.21 (USD 0.24). The cost per fry of sharpsnout seabream is EUR 0.26 (USD 0.29), red porgy is EUR 0.28 (USD 0.32), and meagre EUR 0.40 (USD 0.45).

The graph below shows total aquaculture production in Greece according to FAO statistics:

Market and trade

Marine fish

Up to 78 percent of the Mediterranean marine fish (seabass and seabream) produced in Greece was exported to 32 countries, leaving the rest to be consumed locally (GNSSS 2015). The major destinations of the Greek exports were the EU countries (93 percent), with Italy, Spain, France collectively absorbing about 50 percent, while a significant volume was also oriented to new markets such as United States of America and Canada (4 percent), and the rest of the world (3 percent).

Significant, but much lower, quantities of other marine fish species, such as red porgy (1 150 tonnes), meagre (1 050 tonnes), sharpsnout seabream (280 tonnes), and others (350 tonnes), were also supplied to the market in 2014; a positive market reaction by consumers suggests future potential of these species.

Three companies made the effort to diversify their products by introducing organic aquaculture standards in five certified farm sites. In 2014, more than 1 600 tonnes (39 percent seabass and 61 percent seabream) were marketed as organic at an average price of EUR8.00 (USD9.00) per kg, 60 percent higher than that of conventional products.

Mussels

Mussels are sold to similar major export market destinations in the EU. They are sold as whole, live, and fresh mainly to Italy, and followed by France and Spain. Other markets such as the Netherlands are niche markets and absorb limited quantities.

Contribution to the economy

Since 2003, marine fish farming has a larger market share than wild caught fish. In 2013, 69 percent of total

fisheries products came from farming, and this trend is set to increase in the future. The number of wild fisheries is on the decline, and the only alternative is aquaculture.

Greek export of agriculture products contributes about EUR555.8 million (USD 628.4 million) to the Greek economy, which accounts 19 percent of total Greek exports. The export of farmed fish products, including processed products, makes up about 11 percent of total Greek agricultural exports. Fish is the most exported Greek animal product, with a net trade balance of an estimated EUR172.2 million (USD 194.7 million) to the national economy in 2014. Its contribution to the Gross National Product was about 0.32 percent.

Mussel farming, despite the large production volume, had a limited contribution on account of the low sale prices. Mussel sales contributed in excess of USD6.36 million. It is estimated that this could be more than doubled if the industry operated under optimal production conditions.

Promotion and management of the sector

The institutional framework

The Ministry of Rural Development and Food (MRDF) is responsible for aquaculture in Greece. It defines the National Aquaculture Strategy, allocates production quotas, and, through EU funding programmes, manages all the national and EU funds allocated to the sector. At local levels, the Prefectures license aquaculture operations and allocate coastal and sea areas for use by the operating companies. The regional veterinary services, also part of the Prefectures, are responsible for the health and safety aspects, and check the operating procedures and hygiene conditions of farms on a regular basis.

Marine fish farmers are associated with the Federation of Greek Maricultures (FGM), which represents about 70 percent of the total Greek production. Smaller producers are represented by the PanHellenic Union of Small-Medium Fish Producers (PANEMI), and mussel farmers by SEMYO (Association of the Greek Mussel Farmers).

The governing regulations

The recent Framework for Common Spatial Planning for Aquaculture (Common Ministerial Decision No 31722/2011, FEK 2505, ratified on 4 November, 2011), provides guidelines, directives and criteria for the development of aquaculture, and ensures protection for the environment and the competitiveness of the sector. With specific guidelines for each type of aquaculture practice (offshore, inshore, intensive/extensive systems in marine and freshwater environments), the framework also accounts for legal and administrative changes to the action plan in the future.

Acquiring a license for aquaculture currently takes about 25 months and costs up to EUR25 000 (USD28 000), and even then only 25 percent of applications are approved. In order to simplify the complex administrative procedures, the law for the Development of Aquaculture was passed in 2014. The National Council for Aquaculture was established to promote priorities in aquaculture, simplify access to public land and waters and the procedures to establish aquatic farms and introduce penalties to the offenders.

For more information on aquaculture legislation in Greece please click on the following link:

National Aquaculture Legislation Overview - Greece

Applied research, education and training

Major contribution to the aquaculture sector include the research and development conducted at the Hellenic Centre for Marine Research (HCMR) as well as the Department of Fisheries and Aquaculture Technology in the Technical Education Institute (TEI) of W. Greece at Mesolonghi, from where most of the technical staff working in aquaculture companies graduated.

Today there are several university departments and laboratories that offer training in aquaculture. These include:

- National and Kapodistrian University of Athens, Department of Biology, Section of Zoology and Marine Biology.
- Aristotle University of Thessalonica, Faculty of Geotechnical Sciences, School of Agriculture and School of Veterinary Medicine.
- Agricultural University of Athens, Department of Applied Hydrobiology.
- University of the Aegean, Department of Marine Sciences.
- University of Crete, Department of Biology.
- University of Patras, Department of Biology.
- University of Thessaly, School of Agricultural Sciences, Department of Ichthyology and Aquatic Environment (Volos), and the Faculty of Veterinary Medicine, Department of Aquaculture and Fish Diseases (Karditsa) .

Most of these academic institutions offer postgraduate studies at an M.Sc. and Ph.D. level in aquaculture or related fields in marine and veterinary sciences.

Aquaculture research for the Greek Ministry of Rural Development and Food is carried out by the Fisheries and Aquaculture Research Center in Kavala under the umbrella of the National Agricultural Research Foundation (N.AG.RE.F.).

Greek researchers have access to the European aquaculture research infrastructure through the AQUAEXCEL network. Greece contributes to the European Aquaculture Innovation Platform (EATiP), which is supported by the EU FP7 Supporting Action AQUAINNOVA, through the regional Hellenic Aquaculture Technology and Innovation Platform (HATiP). This framework links the industry vision for sustainable future growth that meets the demand for seafood with research and development targets. The expected result is the enhancement of the Greece's leading position.

Despite this, the average education level for most of the workers employed in aquaculture is still poor and the industry is still seen by many as a primary, non-specialised industry.

Trends, issues and development

Aquaculture Development

There are no radical changes expected in mussel farming and freshwater and lagoon aquaculture. Despite remaining relatively stable during the previous several years, marine finfish aquaculture is expected to grow.

Following the EATiP platform, it is forecast that throughout the EU there will be a 4 percent annual production increase of Mediterranean species up to 2030, producing 305 000 tonnes for a value of EUR 1.5 billion (USD 1.7 billion). Only 2 000 ha seawater will be required, and the burgeoning industry will create 10 000 jobs. Greece will be responsible for a major share of this growth as it is expected to double its production, generating up to 235 000 tonnes for a value of EUR 1.2 billion (USD 1.4 billion). Exports will increase up to 85–90 percent of the product, with a turnover exceeding EUR 1.0 billion (USD 1.1 billion). In order to support this growth, it is expected that 3 000 new jobs will be created.

Technology and performance

In order to achieve future growth targets and ensure the sustainability of the sector, marine fish farming must be supported by targeted research and development. Knowledge development priorities are: i) minimizing the production costs through improvement of the production process; ii) species diversification through new species technology development to meet market demands; iii) fish feed production through sustainable

resources; and iv) new species-specific processing technologies and traceability of the farmed products.

Marketing and Competition

There are a concerted efforts to develop a national brand image, linking the quality aspects of the seafood with its origin. As the creation of a global brand is complex, fish farmers, through the organization FGM, are planning to establish a producer's organization specifically focused on promoting the already established markets and investigating new opportunities for expansion of the distribution channels and market destinations. Greek aquaculture produces fish following EU directives and standards for environmental protection, health and welfare, and consumer protection which collectively add extra costs to their products. These points ought to be promoted to consumers in order to address the competition from cheaper imports from non-EU countries without these standards and which, in some cases, are subsidized.

References

Bibliography

FAO publications related to aquaculture for Greece.

Barazi-Yeroulanos, L. 2010. Regional synthesis of the Mediterranean marine finfish aquaculture sector and development of a strategy for marketing and promotion of Mediterranean aquaculture. (MedAquaMarket). Studies and Reviews No. 88. General Fisheries Commission for the Mediterranean. Rome: FAO.

Barazi-Yeroulanos, L. 2011. The importance of aquaculture for EU food production. In EAS Aquaculture Europe 2011, 18–21 October, Rhodes, Greece.

Barazi-Yeroulanos, L. 2013. Greek marine aquaculture today. In International seminar: The future of Greek aquaculture: Building a sustainable industry in the framework of integrated coastal zone management/PEGASO Project, Athens, Greece.

Operational Programme “FISHERIES 2007-2013”

European Parliament. Directorate general for internal policies. Policy Department B: Structural and cohesion policies. Fisheries. 2009. European aquaculture competitiveness: Limitations and possible strategies. European Parliament, Brussels.

FEAP. 2013. Annual reports 2012 – 2014 - 2015.

Federation of Greek Maricultures 2015. The Greek Aquaculture 43 p.

Frentzos, A.. 2013. Greek mariculture: Present and future. Proceedings of the Hellenic Conference of Ichthyologists 15:331–334.

Stephanis, J. 2013. A case study: Mediterranean fish farming. Annual FEAP report 2012, 22–23.

Theodorou, J., and G. Charalambakis. 2001. Review on the fish farming development in Greece. In The implications of directives, conventions and codes of practice on the monitoring and regulation of marine aquaculture in Europe, ed. A. Read, T. F. Fernandes, K. L. Miller, A. Eleftheriou, M. Eleftheriou, I. M. Davies, and G. K. Rodger, 49–54. Aberdeen, Scotland: Fisheries Research Services Publications.

Theodorou, J. 2002. Current & future technological trends of European sea bass-sea bream culture. Reviews in Fisheries Science 10(3–4): 529–543. doi:10.1080/20026491051776

Theodorou J.A., Viaene J, Sorgeloos P. & Tzovenis I. 2011. Production and Marketing Trends of the cultured Mediterranean mussel *Mytilus galloprovincialis* L. 819, in Greece. Journal of Shellfish Research, 30(3): 859–874.

Theodorou J.A., Tzovenis I., Adams C.M., Sorgeloos P. & Viaene J. 2014. Risk factors affecting the profitability of the Mediterranean mussel *Mytilus galloprovincialis* Lamarck 1819, farming in Greece. Journal

of Shellfish Research 33(3): 695–708.

Theodorou J.A., Perdikaris C. & Filippopoulos N.G. 2015. Evolution Through Innovation in Aquaculture: The Case of the Greek Mariculture Industry. Journal of Applied Aquaculture 27 (2):160-181.

Related links

[Agricultural Products Certification and Supervision Organization - AGROCERT](#)

[Aquamedia](#)

[FAO FishStatJ – Universal software for fishery statistical time series](#)

[Federation of European Aquaculture Producers - FEAP](#)

[Federation of Greek Maricultures](#)

[Hellenic Statistical Authority](#)

[Ministry of Rural Development and Food](#)

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