Strategic Sectors | **Economy & Territory**

Aquaculture in the Mediterranean

Natacha Carvalho
Jordi Guillen
European Commission, Joint Research Centre, Ispra

The Sustainable Development Goals of the United Nations (UN) recognize food security and nutrition as priorities for the global development agenda. Fish[1] plays an important role in global food provision and is a key source of protein, accounting for 20% of animal protein consumed by humans.

The UN Food and Agriculture Organization (FAO) estimates that in 2019, world capture fisheries and aquaculture production (excluding aquatic plants) was 178 million tonnes; with aquaculture production reaching 48% of the total, up from 13% in 1990.

In fact, while world capture fisheries have remained stagnant at around 90 million tonnes yearly over the last few decades, aquaculture production has continued to grow. Most of the aquaculture production and growth has taken place in East Asia, although, southern and eastern Mediterranean countries[2] have also seen a significant development, collectively increasing production in the region by 160% over the last decade. In contrast, the European Union (EU) Mediterranean countries saw only a 7% increase since 2010.

According to the FAO, Mediterranean countries produced over 6.6 million tonnes of fish in 2019[3] from aquaculture and capture fisheries, including inland activity and in other seas. Of this total production, 31% was from the Mediterranean Sea.

Marine Aquaculture in the Mediterranean Sea

Of the 2 million tonnes of marine fish production in the Mediterranean region in 2019, 43% came from aquaculture. Despite the slight predominance of capture fisheries as the main production source, aquaculture is highly significant for several Mediterranean countries and plays an increasing role in fish supply. In fact, while marine fish production in the region increased by 15% compared to 2010; this was entirely due to aquaculture (+71%) as capture fisheries declined by 8%.

Mediterranean marine aquaculture is dominated by finfish, comprising 83% of the total production, followed by molluscs (16%). This contrasts with the situation back in 2000, which saw a more balanced production between fish and molluscs. The sector is also heavily concentrated in the region, with Egypt producing 31% of the total quantity in 2019, followed by Turkey (29%), Greece (14%) and Italy (12%).

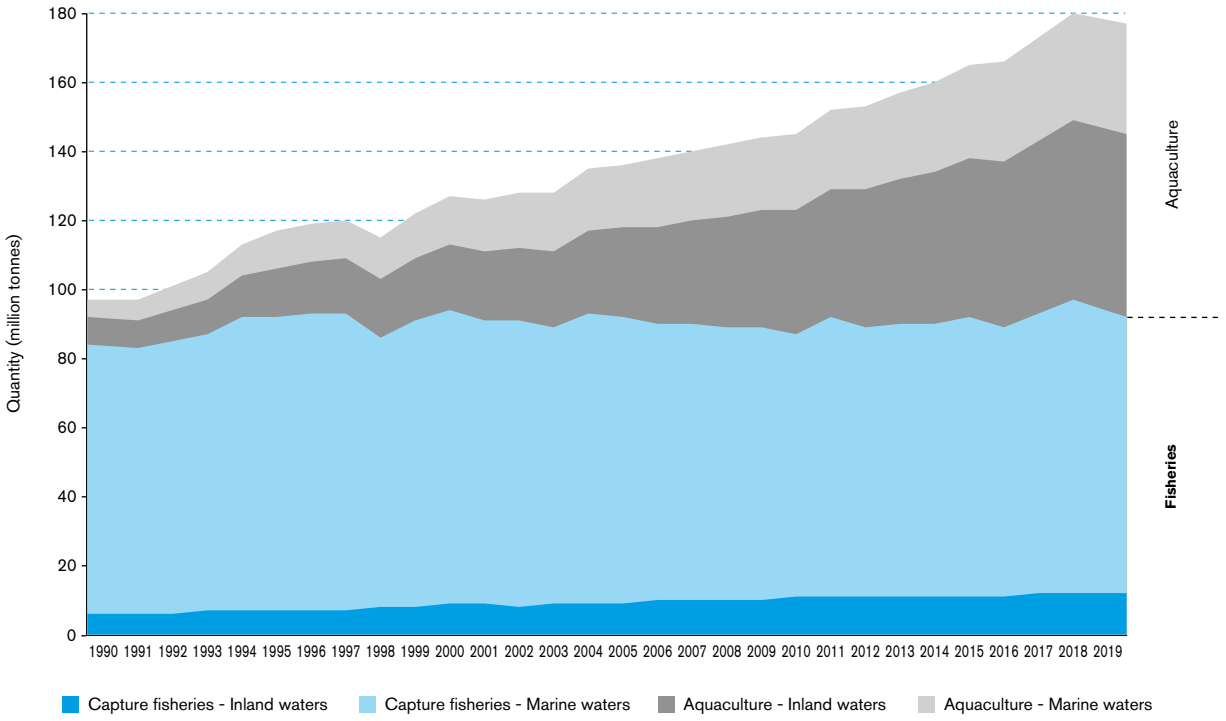
Main Marine Aquaculture Species in the Mediterranean Sea

Gilthead seabream (*Sparus aurata*) and European seabass (*Dicentrarchus labrax*) are the most commonly farmed species in the Mediterranean Sea, at 464,000 tonnes and USD 2.24 billion in 2019.

More than 95% of the world's seabream and seabass production comes from aquaculture, of which

[1] In this article, fish includes seafood, and both words are used indistinctly.
[2] In this article, we focus on the Mediterranean Sea without considering the Black Sea because of the significant differences between the two basins; we also consider all the Turkish marine aquaculture as Mediterranean even if part of its production takes place in the Black Sea.
[3] It should be noted that several Mediterranean countries have capture fisheries and aquaculture production in other sea basins (e.g. France, Morocco and Spain).

CHART 32 **World Capture Fisheries and Aquaculture Production by Environment 1990-2019**



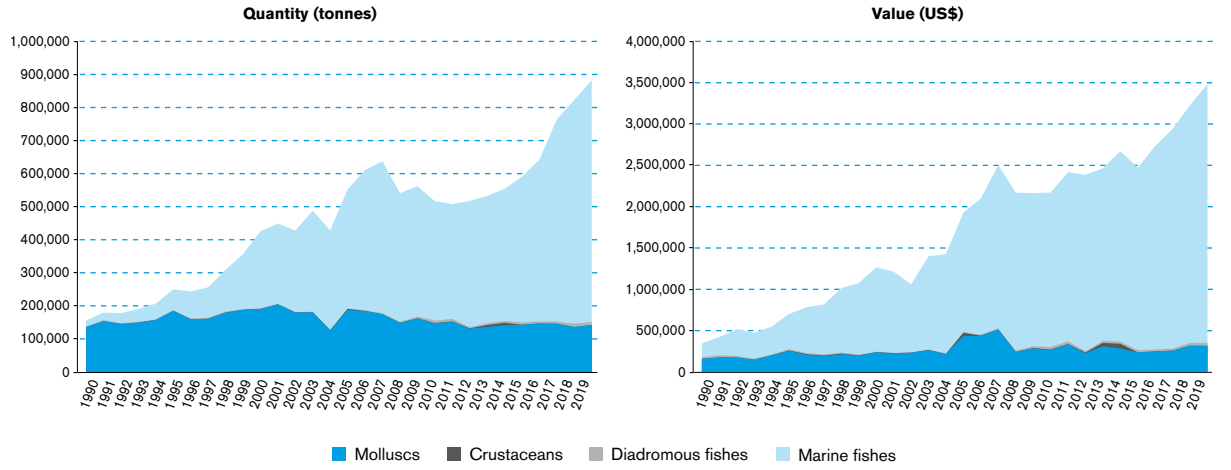
Source: FAO.

TABLE 11 **Capture Fisheries and Aquaculture Production in Mediterranean Countries (2019)**

Country	Mediterranean aquaculture		Other seas and inland aquaculture		Total aquaculture production		Mediterranean aquaculture over total aquaculture production		Mediterranean capture fisheries	Other capture fisheries	Total seafood production	Mediterranean aquaculture over total production
	(tonnes)	(USD 1000)	(tonnes)	(USD 1000)	(tonnes)	(USD 1000)	(tonnes)	(value)	(tonnes)	(tonnes)	(tonnes)	(%)
Albania	4,541	16,769	-	-	4,541	16,769	100%	100%	5,938	2,772	13,251	34%
Algeria	2,180	13,360	446	2,136	2,625	15,496	83%	86%	100,149	-	102,774	2%
Bosnia and Herzegovina	176	1,108	-	-	176	1,108	100%	100%	5	300	481	37%
Croatia	15,925	109,260	-	-	15,925	109,260	100%	100%	64,019	562	80,506	20%
Cyprus	8,025	48,460	-	-	8,025	48,460	100%	100%	1,480	20	9,525	84%
Egypt	272,223	773,353	1,060,739	1,618,766	1,332,962	2,392,118	20%	32%	48,018	349,024	1,730,004	16%
France	15,617	84,555	139,340	590,063	154,957	674,618	10%	13%	17,562	464,028	636,548	2%
Greece	126,383	560,905	-	-	126,383	560,905	100%	100%	82,232	940	209,555	60%
Israel	3,545	31,498	-	-	3,545	31,498	100%	100%	1,070	976	5,591	63%
Italy	106,632	360,384	-	-	106,632	360,384	100%	100%	174,689	9,849	291,170	37%
Lebanon	19	220	-	-	19	220	100%	100%	2,610	10	2,639	1%
Libya	-	-	-	-	-	-	-	-	32,450	-	32,450	0%
Malta	4,041	37,620	-	-	4,041	37,620	100%	100%	2,226	-	6,266	64%
Montenegro	379	1,531	-	-	379	1,531	100%	100%	1,130	145	1,654	23%
Morocco	192	1,715	430	1,767	622	3,483	31%	49%	23,651	1,434,945	1,459,218	0%
Palestine	560	6,170	-	-	560	6,170	100%	100%	3,943	-	4,503	12%
Slovenia	914	1,546	-	-	914	1,546	100%	100%	135	146	1,196	76%
Spain	43,843	327,346	246,705	317,374	290,548	644,720	15%	51%	75,926	803,892	1,170,367	4%
Tunisia	21,848	90,431	-	-	21,848	90,431	100%	100%	107,477	520	129,845	17%
Turkey	255,068	1,015,522	-	-	255,068	1,015,522	100%	100%	431,572	31,596	718,236	36%
Total	**882,111**	**3,481,754**	**1,447,660**	**2,530,106**	**2,329,771**	**6,011,860**	**38%**	**58%**	**1,176,283**	**3,099,726**	**6,605,779**	**13%**

Source: FAO.

CHART 33 **Aquaculture Production by Species in Weight (left) and Value (right)**



Source: FAO.

97% is produced by Mediterranean countries. The main producers are Turkey and Greece, while the main consumers are Spain, France, Italy, Greece and Turkey. Initially, this activity suffered from slow development due to difficulty in producing large quantities of good quality fry. Improvements at hatcheries in the late 1980s lead to the increased supply of juveniles, and since 2009, the production of seabass has increased by 115% and seabream by 95%. This increase was mainly due to Turkey, which increased production of both species (+217%).

Despite the slight predominance of capture fisheries as the main production source, aquaculture is highly significant for several Mediterranean countries and plays an increasing role in fish supply

Other important farmed species in terms of quantity are mullets and mussels. Mullets *(Mugil cephalus)* are farmed almost exclusively by Egypt. The expansion of mullet farming is limited because it depends mainly on wild fry. Mediterranean mussel (*Mytilus galloprovincialis*), at 99,200 tonnes in 2019, is the fourth most farmed species in the region. The main producers are Italy (62% of the region's production) and Greece (24%).

In terms of value, bluefin tuna represents 6% of the total production value, while overall contributing to less than 1% of the quantity.

Country Profiles

EU Countries

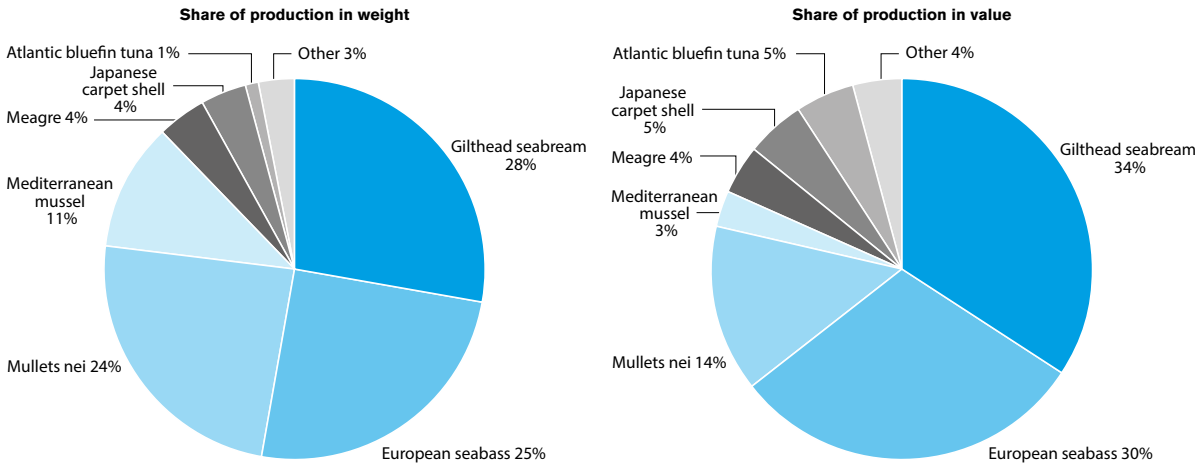
While seafood consumption in EU countries has traditionally been high, averaging around 25 kg per capita per year, only around one third of the seafood consumed is produced in the EU. The main species consumed are tuna, cod and salmon.

Greece is the third biggest producer in the Mediterranean region, accounting for 14% of the total production in weight (126,400 tonnes) and 16% in value (USD 561 million) in 2019. The production of seabream and seabass amounted to 55,452 tonnes and 41,237 tonnes, respectively. Other significant productions include Mediterranean mussel and red porgy.

Italy is also one of the top producers in the region, contributing 12% in weight and 10% in value in 2019. The main species are mussel (62,000 tonnes), rainbow trout (33,000 tonnes), Japanese carpet shell (31,000 tonnes), seabream (7,400 tonnes) and seabass (5,700 tonnes).

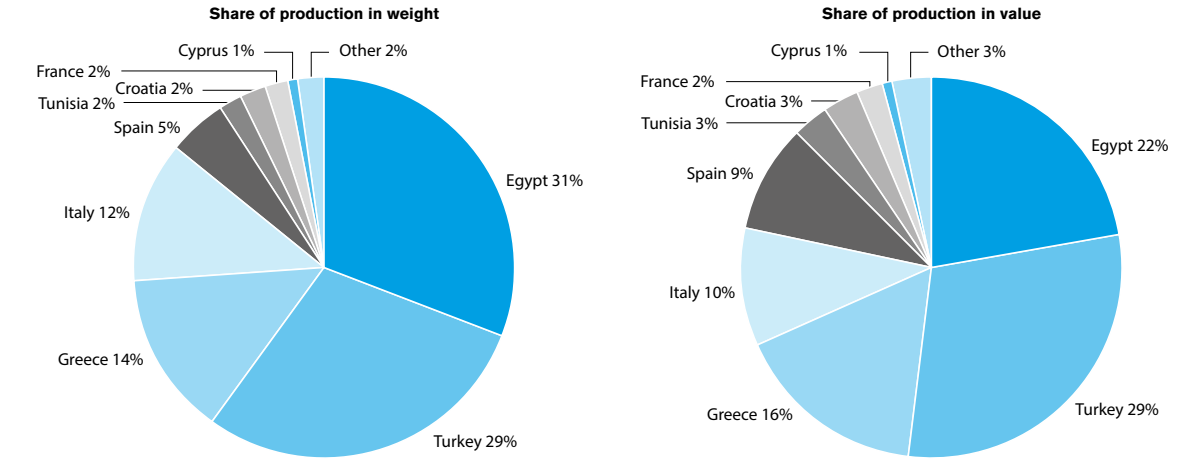
Spain is the fifth most important producer in the region, accounting for 5% of the total production in weight and 9% in value in 2019. Around 20% of Spain's total aquaculture production comes from the Mediterranean Sea. Important Mediterranean prod-

CHART 34 **Aquaculture Production in the Mediterranean Sea by Species**



Source: FAO.

CHART 35 **Aquaculture Production in the Mediterranean Sea by Country**



Source: FAO.

ucts include seabass (16,300 tonnes), seabream (9,700 tonnes) and bluefin tuna (above 1,000 tonnes in recent years). Three-quarters of the seabream and seabass production takes place in the Mediterranean, while the majority of mussel and turbot production is in Atlantic waters.

In **Croatia**, the main farmed species include seabream (6,750 tonnes), seabass (6,100 tonnes), common carp (2,450 tonnes), and bluefin tuna (1,400 tonnes). **France** contributes to 2% in weight and value of the aquaculture production in the region (like Spain, most aquaculture production takes place in Atlantic waters). In the Mediterranean Sea, the chief species produced are mussel and Pacific cupped oyster. **Cyprus** produces mainly seabream and seabass; 5,200 tonnes and 2,800 tonnes in 2019, respectively. **Malta**'s farmed bluefin tuna production has stood at over 8,000 tonnes in recent years, while seabream production reached around 2,000 tonnes. **Slovenia** relies mainly on imports for its seafood supply, largely due to the country's short coastline (46 km). In addition to trout farming, aquaculture comprises mainly mussel (800 tonnes) and seabass (90 tonnes) production.

North African Countries

The main fish production in most North African countries comes from capture fisheries, while for Egypt and Israel, aquaculture is the main source of seafood. Seafood consumption varies greatly by country.

Egypt is the largest producer of marine aquaculture in weight and second in value in the region. The main species are Nile tilapia (876,000 tonnes), mullets (157,000 tonnes), other cyprinids (65,000 tonnes), common carp (30,000 tonnes), seabream (16,000 tonnes) and seabass (14,000 tonnes).

Morocco's seafood production comes mainly from capture fisheries, with aquaculture representing less than 0.1%. **Tunisia** produces about 18,000 tonnes of seabream and almost 3,000 tonnes of seabass. **Algeria** produces almost 1,000 tonnes of freshwater cyprinids; the production of other species is very limited.

Other (Eastern) Mediterranean Countries

This group represents a very heterogeneous set of countries, characterized by low to medium seafood consumption per capita.

Turkey is the top marine aquaculture producer in terms of value and second in quantity, producing 255,000 tonnes valued at USD 1 billion in 2019. The main species cultured are seabass (137,000 tonnes), seabream (99,700 tonnes), rainbow trout (9,400 tonnes) and mussels (4,170 tonnes), all showing increasing production trends. The sector has undergone significant development over the last few decades (+615% compared to 2000) and has become a key source of exports.

Of the 17,000 tonnes of **Israel**'s aquaculture production in 2019, 3,500 tonnes were marine and almost entirely of seabream (3,000 tonnes) and red drum (370 tonnes). **Albania** has expanded its aquaculture production over the last decade, from 300 tonnes in 2000 to 6,300 tonnes in 2019. Essentially, three marine species are cultured: seabream (2,450 tonnes), mussels and seabass (around 1,000 tonnes each). **Bosnia and Herzegovina**, **Lebanon**, **the Occupied Palestinian Territories**, **Montenegro** and the **Syrian Arab Republic** are all minor players, together contributing less than 1% of the total marine aquaculture production in the region.

Key Economic Indicators of the Mediterranean Aquaculture Sector

Based on data from the latest STECF report on the EU aquaculture sector, there are an estimated 1,500 aquaculture companies, employing more than 12,000 people in the EU Mediterranean region. With a production of around 330,000 tonnes and a value of over USD 1.5 billion, the sector generates a gross value added (GVA) of USD 375 million and a gross profit of USD 110 million.

Growth in the seafood industry will continue to be fuelled mainly by aquaculture, despite criticism from environmental groups and consumer concerns regarding the health and safety aspects of farmed products

Considering that EU aquaculture represents slightly less than 40% of the total marine aquaculture in the Mediterranean and that the species cultured and techniques used by the big producers are rather similar, with perhaps the exception of Egypt, it can be assumed that the Mediterranean aquaculture sector employs more than 30,000 people, generating a GVA of around USD 1 billion and a gross profit of USD 300 million. Not to mention the important contribution of aquaculture to food and nutrition in the area.

Prospects for the Future

In December 2019, the European Commission launched the European Green Deal, the EU's new growth strategy, which aims to cut pollution and carbon emissions, boost the efficient use of resources and restore biodiversity. The European Green Deal, the Farm to Fork Strategy, and the strategic guidelines for a more sustainable and competitive EU aquaculture emphasize the potential of aquaculture as a major contributor to building a sustainable and responsible food system, in particular as a low-carbon footprint source of protein. As such, the aim is to fur-

ther boost low environmental impact aquaculture, such as the production of low trophic species (micro and macro-algae), unfed production systems (such as filter feeders, e.g., molluscs), organic aquaculture and integrated multi-trophic aquaculture (IMTA).

The global seafood market has been severely impacted by the COVID-19 pandemic throughout most of 2020 and early 2021. Yet, while the HORECA sector worldwide has been hard hit by enforced lockdowns and other restrictions imposed to reduce the spread of the virus, per capita fish consumption rates remain high and are expected to continue to grow, in particular in developing nations. Growth in the seafood industry will continue to be fuelled mainly by aquaculture, despite criticism from environmental groups and consumer concerns regarding the health and safety aspects of farmed products. As the main costs in aquaculture are feed and fingerlings, the sector has the opportunity to reduce costs through technology, research and innovation (e.g., genetics, feed substitution and disease management). Lower production costs will allow for an increase in supply, while keeping prices down. Concerns about the impact of fish meal are being addressed by harvesting from sustainable sources and improving the feed conversion, thanks to new technologies and substitutions in the feed ingredients. Increased use of labelling and certification programmes (Marine and Aquaculture Stewardship Councils, organic production, etc.) also help to reduce the impact of the sector and promote consumer confidence in aquaculture products.

Bibliography

Bjørndal, Trond & Guillen, Jordi. "Market integration between wild and farmed fish in Mediterranean countries." *Fisheries and Aquaculture Circular* No. 1131. FAO. Rome, Italy. 2018.

FAO. *The State of World Fisheries and Aquaculture 2020. Sustainability in action*. Rome, FAO. 2020.

Massa, Fabio; Onofri, Laura, & Fezzardi, Davide. "Aquaculture in the Mediterranean and the Black Sea: a Blue Growth perspective." In the *Handbook on the economics and management of sustainable oceans*. Edward Elgar Publishing. 2017.

STECF (Scientific, Technical and Economic Committee for Fisheries). *The EU Aquaculture Sector – Economic report 2020*. Publications Office of the European Union, Luxembourg. 2021.