AQUACULTURE IN SPAIN

2022

APROMAR

Índice

Executive Summary

1. Executive Summary

1.1. Aquaculture production in Spain

- For 2021, according to the data collected by APROMAR, the aquaculture production in Spain has been 327,309 tonnes and it reached a value in first sale of 629.0 million Euros. Divided by mussels (255,303 t), sea bass (23,924 t), rainbow trout (15,357 t) and sea bream (9,632 t) as main species.
- In 2020, a total of 5,102 aquaculture facilities were in operation and with production in Spain, 160 less than in 2019. Of these, 4,842 (138 less than in 2019) were for molluscs production, 150 freshwater aquaculture, for fish such as rainbow trout and sturgeon. The number of facilities on the coast, beaches, intertidal zones and estuaries was 67 and pens in the sea 43.
- Employment in aquaculture in Spain in 2020 was 5,656 UTA, although this figure was distributed among 12,478 people. Most of these, 6,582 people, were non-salaried, mainly from the mussel subsector. It was followed by 3,030 specialized operators, 1,846 non-specialized operators, 639 technicians with higher or intermediate degrees, 263 administrative workers and 118 people with other professional categories. The estimation of associated indirect employment was 31,195 jobs.
- Employment in aquaculture continues to be dominated by men, and there are also notable differences in the distribution of jobs between genders. In 2020, the total number of women employed was 3,164 (18.8%) compared to 9,314 men (74.6%).
- In 2021, 139,526 tonnes of feed were used in Spain, 85.3% for marine fish and 14.7% for freshwater species. The amount of aquaculture feed used in Spain barely reach to 1% of the total livestock feed consumed in this country.
- The total production of marine fish in Spain in 2021 was 58,761 tonnes, 13.7% more than in 2020 with 51,664 t. Fish farmers have made an important effort in 2020 and 2021 to recover the production that was affected by the previous climatic and epidemiological episodes. It is expected to reach 54,500 tonnes in 2022.
- The production of aquaculture sea bream in Spain in 2021 was 9,632 tonnes, 46.2% more than the previous year. By 2022 it is estimated to reach 11,000 tonnes. The Valencian Community has led the production of aquaculture sea bream in Spain with 5,486 t (57% of the total), followed by the Region of Murcia (2,461 t, 26% of the total), Andalusia (960 t, 10%) and the Canary Islands (720 t, 8% of the total).
- The production of juvenile sea bream in Spain in 2021 has been 27 million units. It is estimated that production in 2022 will decrease by around -9% and reach 24.5 million units. The production of juvenile sea bream was concentrated in 2021 in Andalusia (36%), the Valencian Community (30%) and Balearic Island (30%).
- The production of aquaculture sea bass in Spain in 2021 was 23,924 tonnes, -10.2% less than in 2020. Andalusia has led the production with 7,365 tonnes (31% of the total), followed by the Region of Murcia (7,285 t, 30% of the total), the Canary Islands (4,951 t, 21%), the Valencian Community (4,228 t, 18%) and Catalonia (90 t, 0.4%). For 2022, a growth of 6.9% is expected with a production in Spain of 25,576 t.
- The production of juvenile sea bass in Spain in 2021 was 58.3 million units, which represents an increase of 27.1% over the figure for 2020. The production of juvenile sea bass in Spain was carried out in the Balearic Islands (55%), the Valencian Community (14%) and Andalusia (31%). By 2022 it is estimated that the production of juvenile sea bass in Spain will fall slightly to 55.3 million units.
- The production of rainbow trout in Spain in 2021 is estimated to have been 15,357 tonnes, -20.8% less than in the previous year. By 2022, a slight increase is expected to reach 16,631 t.
- The production of aquaculture turbot in Spain in 2021 was 7,629 tonnes, -0.7% lower than the previous year. It is forecast to increase in 2022 to 7,800 tonnes. Galicia was the only autonomous community producing turbot in Spain.

- The production of juvenile turbot in Spain in 2021 was 14 million units.
- The production of meagre in Spain in 2021 was 6,167 tonnes, 25.2% more than in 2020. The production comes from the Valencian Community, Region of Murcia and Andalusia. By 2022, a higher production is estimated reaching 9,343 tonnes.
- In 2021, 1.020 tonnes of senegales sole were produced in Spain, 64.5% more than in 2020. This production was located in Galicia (67%) and Andalusia (33%). The production in 2022 is estimated to be similar

1.2. Aquaculture in the European Union and in the world

- In 2020, aquaculture put 122.6 million tonnes on the market, 2.3% more than the previous year (119.8 million tonnes) and surpassing capture fisheries by 31.2 million tonnes for the seventh consecutive year. The value of the production reached 225.2 billion Euros.
- The aquaculture production of the European Union (27) in 2020 was 1,094,315 tonnes, with a value of 3,777.7 million Euros. The main species produced in the EU are mussels, with 537,570 tonnes in 2020, of which two species are produced, followed by rainbow trout with 183,506 tonnes.
- Spain is the Member State of the European Union (27) with the highest aquaculture production with 276,571 tonnes in 2020 (25.3% of the Union total). However, its production has fallen by -11.1%. When the value of production is considered, it occupies the second position behind France, with 525.8 million Euros (15.6% of the total).
- Aquaculture in the EU (27) was mostly developed in marine waters, 72,6 % and 27,4 % in freshwater.
- In the European Union (27) 552,625 tonnes of aquaculture fish were produced in 2020, -0.5% less than in 2019 with a first-sale value of around €3,050.1 million.
- The main species of farmed fish produced in the European Union (27) was rainbow trout, of which 183,506 tonnes were produced in 2020, -0.2% less than the previous year. In second place was the sea bream with 93,131 tonnes, -0.6% less than in 2019. Sea bass was in third position with 81,369 tonnes, -5.5% less than the previous year.
- After the departure of the United Kingdom from the EU, Greece went on to occupy the first place both in volume with 112,153 tonnes, and in value with 499.6 million Euros generated in first sale in 2020. Spain was in the second position in volume with 77,066 tonnes and also in value with 446.2 million Euros.
- The growth rate of fish aquaculture in the European Union (27) since 2000 has been very low. In fact, in the last 10 years, fish aquaculture has grown by only 1.1% per year compared to 4.3% globally.
- Total aquaculture production of sea bream in Europe and the rest of the Mediterranean is estimated at 2021 at 321,912 tonnes, 12.6% higher than that of 2020. The total value in first sale is estimated at 1,448.6 million Euros. By 2022, growth of 1.8% is estimated to reach around 328,000 tonnes.
- The total production of juvenile sea bream in 2021 in Europe (including Turkey) is estimated to be 709,417 million units, 8.9% more than in 2020.
- The total aquaculture production of sea bass in Europe and the rest of the Mediterranean arc in 2021 has been 298,083 tonnes, 4.4% higher than the previous year. The total value in first sale has been 1,490.4 million Euros. For 2022 an increase of 3.7% is estimated to approximately 309,226 tonnes.
- The production of juvenile sea bass in 2021 in Europe (including Turkey) amounted to 598 million units, 8.8% less than in 2020.
- The total production of aquaculture turbot in the world in 2021 was 75,651 tonnes, -0.7% less than the previous year.
- In 2021, the world production of senegalese sole was 1,480 tonnes, 37% more than the previous year.
- The production of meagre in the Mediterranean area in 2021 is estimated at 56,256 tonnes, representing a growth of 4.1% over the previous year.
- Global aquaculture production of rainbow trout in 2020 was 959,694 tonnes, an increase of 6.3% over the previous year.

1.3. Marketing of aquaculture products

- The EU (27) is the world's leading and most important market for aquatic products. The per capita consumption of aquatic products in the European Union in 2020 was 23.5 Kilograms (in whole fish equivalents) compared to 24.1 kilograms in 2019, -2.6% less than the previous year.
- The EU's internal supply integrates catches and aquaculture production. In 2020, 79% was supplied by EU catches (27) (4,302 million tonnes) and the rest from aquaculture (1,120 million tonnes). The share of catches destined for food use was 4.1 million tonnes in 2020.
- In 2020, dependence on imported aquatic products was 68.7%, which grew mainly due to a reduction in catches from capture fisheries and the United Kingdom's exit from the EU.
- The positive evolution of the pandemic has meant a decrease in consumption within the home and increased extra-domestic consumption. Adding both, each Spaniard ingested an average of 731.89 Kg/L of food and beverages in 2021.
- In 2021, Spanish households allocated 13.1% of the average budget to the purchase of aquatic products. Per capita expenditure was about €221.6/kg, which is -4.6% less than in 2020. The sector in general loses consumption intensity in households in 2021 and despite the fact that prices are 4.3% higher than in 2020, it does not compensate for the decline in purchases.
- On average, some 22.7 kg of fishery products were consumed, 8.5% less than in 2020 due to the shorter time spent in households after the return to normality. The average price of aquatic products was 9.3€/Kg, therefore, it increased by 4.3% compared to 2020 (8.92€/Kg).
- The supermarket and self-service were the favorite channels for the purchase of seafood products in 2020, accounting for 49.8% of the total volume. It increases by 6.5% but does not reach the average growth of the market. On the other hand, the traditional storegains relevance with 12.6% and a proportion of 23.7% of purchases. E-commerce stands out with a growth of 93.9% in volume.
- The average price in first sale of aquaculture sea bream produced in Spain in 2021 was 4.18 Euros/kg. This figure is -0.5% lower than the average price of 2020 (4.2 Euros/kg). The total value of the 9,632 tonnes of Spanish sea bream marketed was 40.3 million Euros.
- The average price in first sale of aquaculture sea bass produced in Spain in 2021 was 4.7 Euros/kg. This figure is 8.5% higher than the average price of the previous year, 4.3 Euros/kg. The total value of the 23,924 tonnes of Spanish sea bass marketed was 112.4 million Euros.
- The average price in first sale of aquaculture turbot produced in Spain in 2021 was 9.5 Euros/kg. This figure is 13.3% higher than the previous year and represented a total amount of 48.5 million Euros.

INFORMATIVE NOTES:

- This study refers only to quantities produced and placed on the market of species by aquaculture undertakings. All references to the term "production" refer to quantities produced and marketed. The volumes of product in the process of production (increase in biomass), but without having yet been harvested, are not considered.
- The weight of the species produced refers to the live weight. All references to production volumes refer to weight prior to its evisceration or processixng, in the event that this comes to be done.
- The value of global aquaculture productions offered by FAO is given in US dollars. In this report, US dollars have been converted into euros at the exchange rate of 1.0 dollars = 0.80 euros.
- In the time series of prices, no adjustment has been made based on changes in the price of money (CPI). All prices indicated are in nominal values.
- The annual publication of FAO and FEAP production statistics sometimes includes the revision of data from past years. This circumstance may mean changes on the figures published for the same years in previous editions of this same report.
- "First sale" means the sale made by the primary producer (fish farmer) to the first commercial link in the value chain.

NOTES ON STATISTICS

- The data that have been used for the preparation of this report of 2022 refer to last year, and even to 2 previous years, depending on the source consulted. Thus the most recently published FAO and MAPA data refer to 2020. While the data resulting from the surveys carried out by APROMAR and FEAP refer to 2021. Where possible, a forecast for 2022 is provided.
- The statistical compilation of aquaculture productions in Europe for this report sets out the data for the European Union (27) separately, in order to disaggregate them from those of Norway and Turkey.

Introduction

2. Introduction

The year 2022 will historically be marked by a global food crisis. Russia's invasion of Ukraine, led by its President Vladimir Putin, is causing high and unjustifiable human losses, as well as very serious economic and environmental damage.

Until February, with the beginning of the assault on Ukraine, the vast majority of the inhabitants of the European Union and beyond its borders, were unaware that this country was their main supplier of basic and hardly replaceable products such as sunflower oil, corn and wheat. These foods are the basis for global human food, as well as for feeding farm-raised animals in both terrestrial and aquatic environments. Currently, quantities of these essential foods that have not been destroyed by the attacks are blocked at the Ukrainian borders. The impossibility of agricultural activity recovering in a short-term time horizon is already visible. In fact, the Ukrainian government estimates that the planting of wheat and maize in spring will be between 30-50% possible. Therefore, countries dependent on their imports are facing a major challenge now and in the future.

An inevitable consequence of this situation is the increase in the prices of these raw materials, the increase in tensions between countries to distribute the quantities of these products that are in world markets and, of course, the chain of adverse consequences triggered for the correct maintenance of activity in all agri-food sectors. The situation is critical and highlights the need, which was already highlighted with the Covid-19 crisis, to strengthen the global food system by betting on the food self-sufficiency of each of the countries.

Linked to the food crisis, the war brings uncertainty in energy supply systems. Russia is a key producer of natural gas and oil for Europe, contributing 40% and 27% of the total, respectively according to the BBC. Consequently, the prices of fuels, electricity, gas and in general, all the products that reach our horizon to propose, have suffered a high increase that has triggered inflation.

We must not lose sight of the global baseline situation prior to the start of the conflict, that is, the pandemic caused by the coronavirus. This health crisis was already making a dent in our global economic system causing shortages of raw materials and supplies, delays in production, closure of restaurants, brake on tourist activity and a long list of brakes on usual activity in all its aspects. As in these situations, there is a notable widening of the social gap, making people in situations of poverty and social inequality the ones who are strongly hit by this hurricane of events.

If the pandemic already raised to priority the objective of achieving a fairer and more sustainable world without leaving anyone behind, as the European Green Deal points out, in recent months it is an issue that has quickly climbed the priority lists of practically all political parties, economic sectors and practically, those of every inhabitant of the world.

The World Bank is preparing a package of aid aimed at guaranteeing food insurance in the most vulnerable countries; and in the European Union, cost compensation initiatives are being launched, thanks to several financial funds (e.g. NEXT Generation Funds EU-NGEU, European Maritime Fund for Fisheries and Aquaculture-EMFAF, etc.) for the different sectors adapted to the particularities of the economic activities of each State Member. At the same time, we are looking for new ways to adapt to the situation across the board.

This wave of events also generates a future of possibilities, changes and improvement of adaptation to the reality of our planet and our relationship with it. In fact, it is these moments of greatest uncertainty and need for adaptation in which society sets foot on the ground and work on the table to squeeze itself into applied innovation and sustainable development.

For aquaculture, it is an opportunity to obtain the recognition it deserves as the livestock activity that generates the lowest carbon footprint, that efficiently takes advantage of aquatic resources and that provides the best animal protein for

human nutrition. It should be noted that it also generates benefits in different ecosystems such as the maintenance of biodiversity, being a carbon sink and offering opportunities in remote rural and coastal areas that have a positive impact on the quality of life of its inhabitants. That is why this activity has been placed as a pillar of the economy and is included in the European strategies of Farm to Fork, Biodiversity, Circular Economy and Climate Change, among others.

In each new edition of APROMAR's annual report, it is worth remembering that aquaculture is the production in water of animals and plants through techniques aimed at making more efficient use of natural resources. It is an activity equivalent to what livestock and agriculture are on the mainland. It encompasses varied practices and a very wide range of species and production systems. One of the differential characteristics of fishing is that, throughout all, or at least part, of its life cycle, the organisms produced are the property of some person. Aquaculture has a history of 4,000 years, but it has been since 50 years ago when it has become a relevant socio-economic activity, employing more than 14 million people in the world.

Aquaculture is not a complement to fishing, but its natural evolution, as farming once replaced hunting as a form of sustenance for humanity. Aquaculture has a huge future projection since the resources needed to produce a kilogram of feed in the water are less than on land. It also has in its favor that 70% of the planet's surface is water, that its freshwater requirement is minimal, that the reproduction rates of aquatic animals are several orders of magnitude higher than those of terrestrial vertebrates, and that aquatic animals are more efficient converters of their food because they float in water and do not consume energy to maintain their body temperature.

To successfully solve the major challenges facing aquaculture, research and innovation initiatives must be directed to optimize its efficiency and productivity, both in small and large-scale systems. These investigations should lead to improved knowledge to ensure the good health of the animals raised, the optimization of feed and its raw materials, improvements in the management of farms, as well as for the domestication of new species. However, the real challenges for the development of aquaculture in Spain continue to be to make the administrative framework in which it must operate more efficient, as will be seen later in this report, as well as the legal certainty of operations.

Never in the past has humanity consumed such a quantity of aquatic products as in the present. On the other hand, globalization and the interconnection between markets mean that changes in food supply affect all countries in the world without exception, even if their population in a particular place neither increases in size nor changes their level of wealth. This situation will probably be aggravated by Climate Change, which is already causing alterations in traditional production models and trade flows.

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Fish is an extraordinarily nutritious food, a vital source of protein, fatty acids and essential nutrients. The consumption of aquatic products and their incorporation into the diets of pregnant and lactating women, as well as young children, represents an important way to improve food security and nutrition. First, because the lipid composition of fish is irreplaceable by understanding long-chain polyunsaturated fatty acids (Omega-3 DHA and EPA) that offer multiple beneficial effects for health in adulthood and for child development. Second, fish protein has a higher bioavailability, approximately 5% to 15%, than that derived from plant sources, in addition to containing amino acids essential for human health. And thirdly, because fish is an exceptional source of vitamins (D, A and B) and mineral micronutrients (calcium, phosphorus, iodine, zinc, iron and selenium).

Aquaculture will continue to rely on the Common Fisheries Policy (CFP) and the Common Organisation of the Markets (CMO) as key tools for its development. These can be carried out supported by the European Maritime Fisheries and Aquaculture Fund (EMFAF) that will enter into force in 2023 for a period of 7 years (initially planned between 2021-2027). And when this EMFAF fund is mentioned, Producer Organizations (POs) directly appear in the collective imagination as driving forces of change for the collective benefit of their sectors. APROMAR as a producer organization nº30 has been since

1986 bringing together the voices of aquaculture companies in Spain, mainly producers of fish in seas, rivers and lagoons with the aim of making them more competitive and sustainable. APROMAR is very present in the difficulties that the sector has been accumulating for several years and thanks to its Production and Marketing Plans (PMP) and the help of the General Secretariat of Fisheries of the Ministry of Agriculture, Fisheries and Food is making important use of this fund obtaining innovative results for companies in terms of health and welfare of fish, sustainability of feed, veterinary treatments, market observatory, communication and promotion of aquaculture products.

As aquaculture is a model of local development that respects the environment and allows obtaining nutritious, safe and affordable food for all pockets, it is an activity that is significantly punished in two aspects: (1) by society that does not know it or that, even knowing it, attributes negative characteristics to it, and (2) by the management bodies, especially at the local and regional level. For this, it is key to work to improve the perception of society in general by offering quantitative data and transparent information on the activity. And from this need, the opportunity arises and Acuicultura de España is born, the communication project of APROMAR in which all its associated companies participate with a particularly relevant milestone in 2021, the publication of the first Sustainability Report of aquaculture in Spain.

Despite recent and past barriers and difficulties, an important effort is being made with the aim of promoting the knowledge and growth of this sector essential for the sustainable future and resilience of the global food system. And also to that conscious consumer, who is making a responsible purchase and who cares about creating a better environment with his commitment to the consumption of aquaculture products, aware that it benefits in addition to his health and that of his own, the environment and the economic-social development of his territory.

Scope of the report

The preparation of this annual report on the evolution of the aquaculture sector is important to know the state of the activity and promote its sustainable development. The target audience is companies and professionals in the sector, but also public administrations, legislators, politicians, researchers, the media, liberal professionals, trade unions, students and society in general.

Although this report focuses on aquaculture as a supplier of food for people, there are other important purposes for the products of this activity, such as the production of pharmaceutical products, the release of specimens for sport fishing, the repopulation of the natural environment, aquarium or scientific research.

This publication is an exercise in sectoral transparency that respects the right to free competition. In its drafting, the publication of confidential information relating to the strategies of the producing companies from which anti-competitive practices could be derived has been avoided. It aims to provide only aggregate basic information that may be of interest to anyone interested in aquaculture, both producers and researchers, non-governmental organisations, suppliers, public administrations, trade unions, trainers and students.

The collection and processing of the data contained in this report has been carried out by APROMAR. In addition to the information collected by the association itself among its partners, information from the European Commission, the Spanish Ministry of Agriculture, Fisheries and Food (MAPA), the European Federation of Aquaculture Producers (FEAP) and the Food and Agriculture Organization of the United Nations (FAO) has been used. The National Aquaculture Advisory Board (JACUMAR-JACUCON) has also been a relevant source of data.

Aquaculture in the world

3. Aquaculture in the world

3.1. Worldwide availability of aquatic products

Aquaculture and sustainable capture fisheries are key to responding to the growing global demand for healthy and nutritious aquatic products. The increase of the population and the need to feed it with good quality animal protein makes essential that these activities be maintained in the future. As can be seen in the following graph, capture fishing has been with a stable production for more than 30 years, because it has reached its maximum sustainable level. On the other hand, aquaculture has been experiencing a significant exponential growth since the 80s, and currently, it exceeds the catches of fishing. Therefore, it is aquaculture that plays the most important role in increasing world production to meet future needs.

The latest published data on fisheries and aquaculture from the Food and Agriculture Organization of the United Nations (FAO) are from the year 2020. Global aquatic production (fisheries and aquaculture) in 2020 was 214 million tonnes, 0.4 % more than in 2019. This production has remained around 213.5 t between 2018 and 2020. However, looking at the past 30 years, production has grown at an average rate of 2.5% per year, exceeding the rate of growth of the world population which has been 1.0% according to World Bank data in 2020.

Global per capita consumption of aquatic products has gone from 9.0 kg in 1961 to an all-time high of 20.5 kg in 2019, while it fell slightly to 20.2 kg in 2020 according to FAO's Sofia 2022 report. Consumption of aquatic food (excluding algae) has grown at a rate of 3% since 1961, compared to 1.6% at the rate of world population growth.

World aquatic production (aquaculture + fisheries) in 2020 was 214 million tonnes, 0.4% more than the previous year.

It is expected that the consumption of aquafeed can supply an average of 21.4 Kg per capita in 2030 (15% more) promoted by increased incomes and urbanization, improvements in post-harvest practices and changes in food trends. FAO

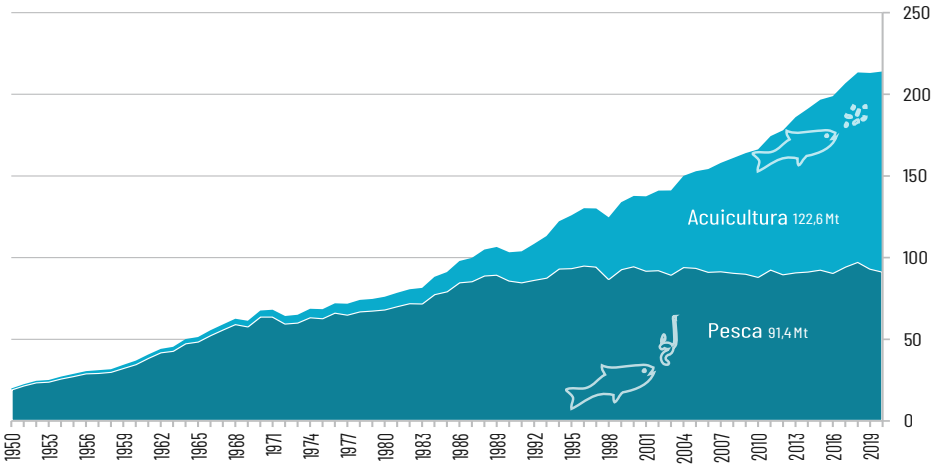


Figure 3-1. Evolution of world aquatic production (aquaculture plus fisheries) in the period 1951-2020 (FAO).

forecasts an increase in production, consumption and trade in fisheries and aquaculture in 2030, albeit at lower growth rates.

It is estimated that the total production of aquatic animals will reach 202 million tonnes in 2030, mainly due to the sustained growth of aquaculture that is expected to reach 100 million tonnes in 2027 and 106 million in 2030. Global capture fisheries are projected to recover and increase by around 6% by 2030 to reach 96 million tonnes. To this end, FAO considers it essential to improve global fisheries management to achieve both ecosystem restoration and to protect the long-term supply of aquatic food.

Seafood is one of the most important sources of animal protein in the world. According to FAO, aquatic products provided 17% of the world's animal protein and 7% of the total protein, exceeding 50% in some countries on the African and Asian continents. Aquatic products have accounted for 20% of the average per capita intake of animal protein for 3.3 billion people and up to 50% in countries such as Bangladesh, Cambodia, Sierra Leone, Indonesia, Ghana, Mozambique and several Small Island Developing States (SIDS).

In addition to offering high-quality protein, easily digestible and containing all the essential amino acids, seafood contains Omega3 essential fatty acids (EPA and DHA), vitamins (D, A and B) and minerals (calcium, iodine, zinc, iron and selenium). With these nutritional values, fish and other aquatic species play an important role in correcting unbalanced diets.

In 2020, aquaculture put 122.6 million tonnes on the market, 2.3% more than the previous year (119.8 million tonnes) and surpassing capture fisheries by 31.2 million tonnes for the seventh consecutive year.

Aquatic food systems support millions of lives and are key as a means of subsistence. At the same time, many small producers, especially women, have precarious working conditions and are vulnerable. It is estimated that 58.5 million people work in activities related to fisheries and aquaculture, being around 35% in aquaculture, a figure that has been maintained in recent years according to FAO. Of the total, 21% per cent of workers are women (28% in aquaculture and 18% in capture fisheries). These

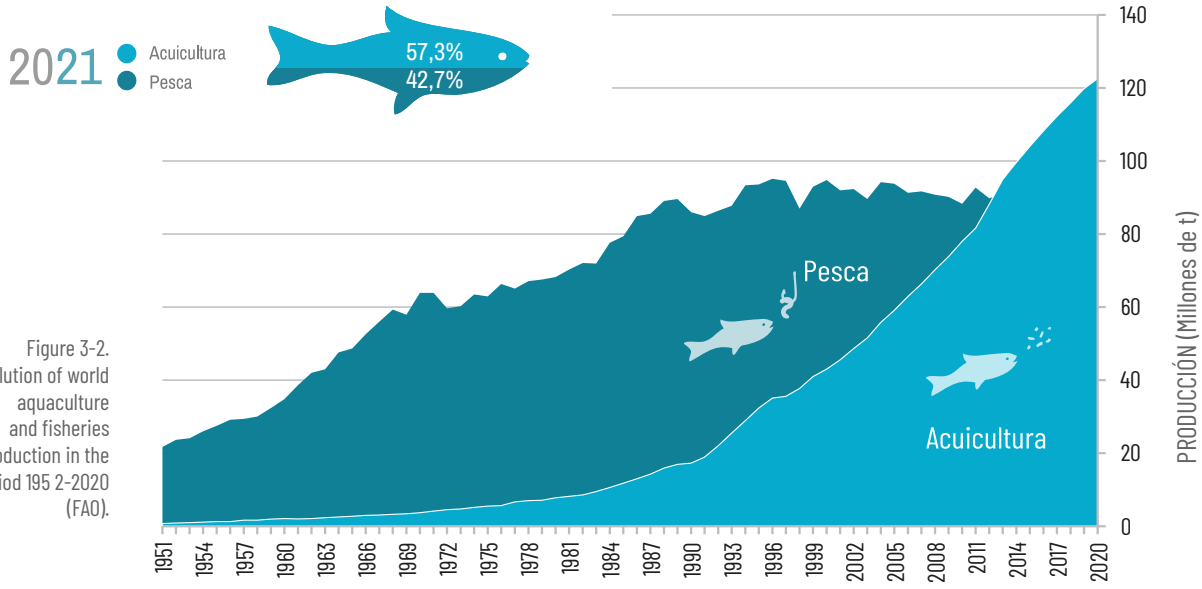


Figure 3-2. Evolution of world aquaculture and fisheries production in the period 195 2-2020 (FAO).

low figures are accompanied by greater job instability, representing only 15% of full-time jobs adding both activities, according to FAO.

Of the total seafood products, the proportion directed to direct human consumption has risen from 67% in 1960 to 89% in 2020. The rest is mainly used as raw material for animal feed, including aquaculture. Importantly, more and more by-products are used for food and non-food purposes (more than 27% of the world's fishmeal production and 48% of total fish oil production), according to FAO.

Although aquaculture has a positive growth rate, it can be seen that the growth rate has decreased considerably in the last 3 decades from 9.3% in the 90s to 4.6% in the last 10 years.

International trade in aquatic products has grown markedly in recent decades, although there has been a decline in 2020 of 7% compared to 2018. China remains the world's largest exporter followed by Norway and Viet Nam, according to FAO. In 2018, 38% of global production of aquatic products was traded internationally, or about 67 million tonnes, according to FAO. In 2018, the demand for aquatic products increased and led to an increase in prices, increasing the value of global exports by 5%.

Sustainable capture fisheries have reached maximum levels of sustainable catch of fishery resources in recent years standing at an average of 90 million tonnes since 1986, with a peak in 2018 of 97.6 million catches. World catches from capture fisheries reached 91.4 million tonnes by 2020, -2.0 % less than in 2019 (93.3 million tonnes).

World aquatic production (aquaculture + fisheries) in 2020 was 214 million tonnes, 0.4% more than the previous year.

However, the increased demand for aquatic products has continued to drive the promotion of aquaculture for the global supply of these foods. In 2020 aquaculture put on the market 122.6 million tonnes, 2.3% more than the previous year (119.8 million tonnes) and surpassing capture fisheries by 31.2 million tonnes for the seventh consecutive year. Although aquaculture has a positive growth rate, it can be seen that the pace has slowed considerably in the last 3 decades, going from an annual average growth of 9.3% in the 90s, to 6.0% between 2000 and 2010, and 4.6% in the last 10 years.

3.2. Situation of aquaculture in the world

Global aquaculture is a very diverse activity both in production methods and in species produced. Each region of the world has an aquaculture adapted to the characteristics of its environment and the species that are bred.

Aquaculture, according to the FAO (Food and Agriculture Organization of the United Nations), is an activity aimed at producing and fattening aquatic organisms in their environment. It is also defined as the cultivation under controlled conditions of species that develop in the aquatic environment (fish, molluscs, crustaceans and algae) and that are useful for humanity.

Aquaculture establishments are key to the development of local communities, especially in many developing countries. It is an activity that contributes to eradicating hunger and malnutrition by providing foods rich in proteins, vitamins, minerals and essential oils, especially noteworthy the contribution of omega-3 polyunsaturated long-chain fats (EPA and DHA) contained in seafood to the health and quality of life of people. In addition, it contributes to generating employment, reducing poverty and improving the quality of life in areas that experience adverse situations that hinder entrepreneurship and the generation of jobs. It therefore favours local and international trade and improves returns on the use of resources.

In addition to direct employment on farms, there are jobs generated by the large number of auxiliary activities supporting aquaculture, such as processing and processing, packaging, marketing and distribution, the manufacture of equipment, networks and technologies, the production and supply of ice, the construction and maintenance of aquaculture vessels and facilities, consulting services, scientific activity and that of the administrations involved in the monitoring and development of aquaculture.

Aquaculture is an innovative activity, based on scientific knowledge and that makes efficient use of resources while respecting the environment in which it is developed. It is the activity with the lowest carbon footprint of livestock production activities and that is why FAO considers that aquaculture contributes to the efficient use of natural resources, food security and economic development, with a limited and controllable impact on the environment.

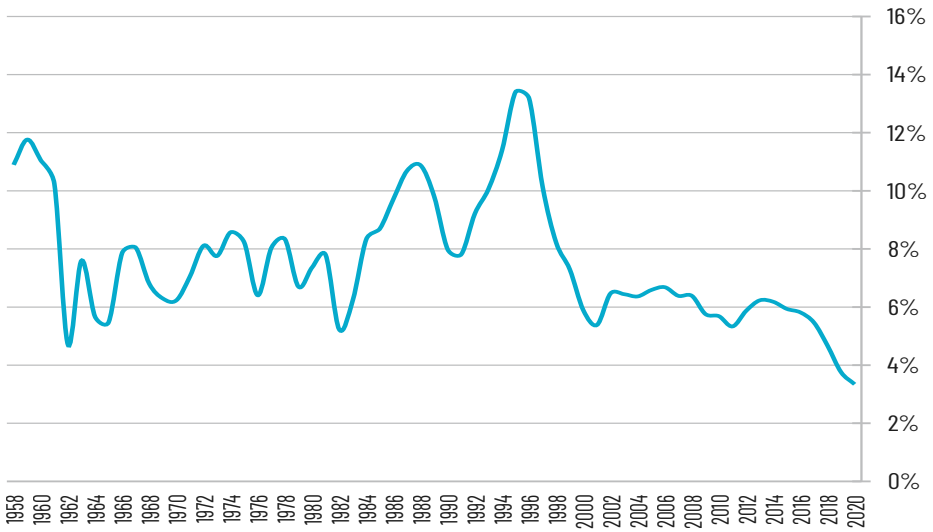


Figure 3-3. Evolution of the year-on-year growth of world aquaculture production in the period 1957-2020, calculated on arithmetic averages by 5-year mobile tranches to attenuate short-cycle oscillations (from FAO).

3.3. Aquaculture productions in the world

World aquaculture has experienced in the 80s and 90s the highest average annual growth rates, of around 9%, although it has grown steadily since the 50s. Over the past 10 years, the pace of growth has slowed, averaging 4.7% (with 2020 as the most recent benchmark year). In 2020, global aquaculture production was 122.6 million tonnes, 2.3% higher than in 2019 (119.8 million tonnes). From a production of less than 0.8 million tonnes in 1951, it has reached the aforementioned 122.6 million tonnes in 2020, with a global value in first sale of more than 225.2 billion euros.

The distribution of world fish production has remained similar in the last 5 years. In 2020, Asia continues to lead global production in aquaculture with 91.6% (112.3 million tonnes) and in capture fisheries with 52.5% (48 million tonnes). With regard to aquaculture, the second largest producer in the world is America (3.6%, 4.4 M t), followed by Europe (2.7%, 3.3 M t), Africa (1.9%, 2.4 M t) and Oceania (0.2%, 0.24 M t), very similar percentages to the previous year.

When analyzing the production in volume by countries, it is observed that the first 10 countries concentrate 90.1% of the

total production, that is, 110.4 million tonnes of the 122.6 total in 2020. The growth rate with respect to the previous year is 2.2%. The rest of the countries jointly produced 12.2 million tonnes and have experienced a growth of 3.5%.

The value of the global aquaculture harvest in 2020 reached €225.2 billion.

India and Chile are the countries that have experienced the highest growth in 2020, with 8.9% and 7.0%, respectively. The development of this activity is occurring mainly in countries of the south, and to a lesser extent in those of the north, despite the fact that the former have less access to technologies. The first aquaculture producing countries are in Asia. They are developing countries and suffer from food shortages. Although sometimes these Asian countries have intensive aquaculture industries and high-value products, such as prawns, to export to other markets, the largest proportion of their aquaculture is traditional, extensive and for local consumption, with species such as carp and other cyprinids, in addition to algae.

China remains the undisputed leader in world aquaculture production with 70.5 million tonnes of production in 2020, 3.0% higher than in 2019, and by far over the second country in production, Indonesia, which harvested 14.9 million tonnes. Despite China's large size (9.3 million km2),

China continues to stand out as the world's leading aquaculture producing country, with 70.5 million tonnes harvested in 2020, representing 57.5% of world production.

it represents only 6.26% of the world's land area, and its 14,500 km coastal coastline accounts for just 4% of the world's entire coastline. This leadership with such an advantage over the rest of the countries is due, on the one hand, to the enormous population of that country (1,398 million inhabitants in 2019) associated with an outstanding culture of consumption of aquatic products. And, on the other, to the thousands of years of practice of a subsistence aquaculture. The first recognized form of aquaculture in the world was the cultivation of carp and its references date back to 3,500 BC, precisely in ancient China. The three main species produced in aquaculture today in China are Japanese laminary algae, grass carp and Japanese oyster.

Indonesia remains the second producing country with 14.9 million tonnes, with a negative annual variation of -3.8% compared to 2019. In Indonesia the largest productions are Eucheuma algae and Japanese laminaria, along with Nile tilapia. It is followed by India with a production of

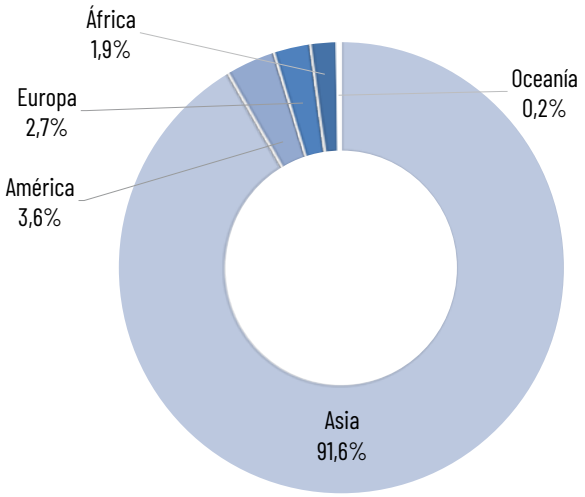


Figure 3-4.
Distribution of aquaculture production by the five continents (from FAO).

8.6 million tonnes and an annual increase of 8.9%, and Vietnam with 4.6 million tonnes and a growth compared to 2019 of 2.5%.

If the European Union (27) were considered as a unit, its aquaculture harvest would stand at 1.09 million tonnes in 12th place, between Myanmar and Japan.

Spain falls to the 2nd position, 4 places below compared to 2019 with 276.6 tonnes and a decrease of -11.1%.

If the European Union (27) were considered as a unit, its aquaculture harvest would be 1.09 million tonnes in 12th place, between Myanmar and Japan.

In relation to the value of their harvest in first sale, the top 10 aquaculture producing countries worldwide increased their figures of 2020 compared to the previous year by 4.7% on average coinciding with the rest of the countries. With this, the top 10 aquaculture producing countries in the world produced in 2019 worth 190.9 million euros, 86.9% of the value of the total world harvest.

Also from the point of view of the value of the harvest, China's aquaculture production is significantly higher than that of the rest of the countries, reaching 134.295 million, 4.2% more than in 2019. The second place was occupied by India with 12.451 million euros (5.9% annual increase) very close to Viet Nam with 11.200 million (4.2% annual increase). The significant increase in the value of Ecuador of 26.3 % with 2 stands out. 628 million euros and also, that of Egypt with an increase of 14.1% with 2,612 million euros. Chile experienced a sharp decline of -22.8% with 5.840 million euros, occupying the fifth position. Norway decreased by -10.4% with 6.522 million occupying the sixth position.

Spain drops one place, to 31st with a production value of about 526 million euros, -8.1% less than in 2019 according to FAO.

As in previous years, in 2020 the main aquaculture species produced in the world are the Japanese laminaria algae or kombu *(Saccharina japonica)* with 12.5 million tonnes and the eucheuma algae (genera *Eucheuma* and *Kappaphycus*) with 8.1 million tonnes. The third and fourth species also remain and are the Japanese oyster (*Crassostrea gigas*) with 6.1 million tonnes and the grass carp (*Ctenopharyngodon idella)* with 5.8 million tonnes. The first 10 species accounted for 46.6% of total production, and increased their production compared to the previous year by 1.7%, while the rest of the species increased it at a higher rate, by 2.9%.

Table 3-1.
Top aquaculture producing countries by annual tonnes in 2020 and year-on-year rate of change (FAO).

País	Cantidad (t)	% Var. anual
China	70.483.538	3,0%
Indonesia	14.845.014	-3,8%
India	8.641.286	8,9%
Viet Nam	4.614.692	2,5%
Bangladesh	2.583.866	3,8%
República de Corea	2.327.903	-3,0%
Filipinas	2.322.831	-1,5%
Egipto	1.591.896	-3,0%
Chile	1.505.486	7,0%
Noruega	1.490.412	2,6%
TOTAL 10 PRALES. PRODUCTORES	110.406.924	2,2%
RESTO DE PAISES	12.173.262	3,5%
TOTAL MUNDIAL	122.580.186	2,3%
España	276.571	-11,1%

Table 3-2.
Main aquaculture producing countries by value of annual production (million euros) in 2020 (FAO) and year-on-year rate of change.

País	Valor (M€)	% Var. anual
China	134.295	4,2%
India	12.451	5,9%
Viet Nam	11.200	4,2%
Indonesia	9.669	-9,0%
Chile	6.770	-22,8%
Noruega	5.840	-10,4%
Bangladesh	5.043	4,5%
Japón	4.287	3,9%
Ecuador	2.628	26,3%
Egipto	2.612	14,1%
TOTAL 10 PRALES. PRODUCTORES	194.795	2,2%
RESTO DE PAISES	30.405	4,2%
TOTAL MUNDIAL	225.199	2,5%
España	526	-8,1%

Of the species produced in Spain, the production of rainbow trout stands out in the world context, 29th species produced, with 903,225 t in total; the sea bream, 56th species, with 259,443 t; the sea bass, 58th species, with 263.781 t; European mussels, 62nd place, with 264.875 t; and turbot, 95th species, with 77,710 t. Therefore, the golden one goes up 3 positions and stands above the sea bass, and instead, the mussels go down 10 positions.

The white prawn (*Litopenaeus vannamei*) remains the main species produced in value in aquaculture in the world with a value in first sale in 2020 of 26.929 million euros. Next, the crawfish (*Procambarus clarkii*) is maintained, which continues, after 2 years, to experience a strong flood of 14.4% in 2020 generating a total of 16.814 million euros. The third place is occupied by the Atlantic salmon (*Salmo salar)* with 12.221 million euros, experiencing a notable decrease of -10.5% per year. China carp (*Ctenopharyngodon idella)* ranks fourth with 10.597 million. The first 10 species accounted for 50.8% of the 225.199 million in value from the total world aquaculture harvest, 108.670 million euros.

Especie	Nombre científico	Toneladas	% Var. anual
Laminaria japonesa	*(Saccharina japonica)*	12.469.807	1,6%
Alga Eucheuma	*(Eucheuma y Kappaphycus)*	8.129.404	-4,2%
Ostión japones	*(Crassostrea gigas)*	6.060.567	2,6%
Langostino blanco	*(Litopenaeus vannamei)*	5.812.180	1,1%
Carpa china	*(Ctenopharyngodon idella)*	5.791.541	6,5%
Carpa plateada	*(Hypophthalmichthys molitrix)*	5.180.416	1,6%
Tilapia del Nilo	*(Oreochromis niloticus)*	4.896.612	-4,7%
Carpa común	*(Cyprinus carpio)*	4.514.615	6,2%
Almeja japonesa	*(Ruditapes philippinarum)*	4.266.174	-3,8%
Alga Gracilaria	*(Gracilaria sp.)*	4.236.326	9,3%
TOTAL 10 PRALES. ESPECIES		57.121.316	1,7%
RESTO DE ESPECIES		65.458.869	2,9%
TOTAL ACUICULTURA MUNDIAL		122.580.185	2,3%
Trucha arco iris	*(Oncorhynchus mykiss)*	903.225	6,3%
Dorada	*(Sparus aurata)*	259.443	8,7%
Lubina	*(Dicentrarchus labrax)*	263.781	4,8%
Mejillones europeos	*(Mytilus galloprovincialis y edulis)*	264.875	-12,5%
Rodaballo	*(Psetta maxima)*	77.710	-7,3%

Table 3-3. Main species produced by aquaculture in the world (in tonnes) in 2020 (FAO) and year-on-year rate of change.

Especie	Nombre científico	Valor (M€)	% Var. anual
Langostino blanco	*(Litopenaeus vannamei)*	26.929	5,3%
Cangrejo de las marismas	*(Procambarus clarkii)*	16.814	14,4%
Salmón atlántico	*(Salmo salar)*	12.221	-10,5%
Carpa china	*(Ctenopharyngodon idella)*	10.597	1,0%
Carpa plateada	*(Hypophthalmichthys molitrix)*	8.350	0,8%
Cangrejo de canal chino	*(Eriocheir sinensis)*	7.885	-0,4%
Tilapia del Nilo	*(Oreochromis niloticus)*	7.278	-1,3%
Carpa común	*(Cyprinus carpio)*	7.003	-2,5%
Carpa cabezona	*(Hypophthalmichthys nobilis)*	5.921	0,9%
Ostión japones	*(Crassostrea gigas)*	5.664	2,3%
TOTAL 10 PRALES. ESPECIES		108.670	2,2%
RESTO DE ESPECIES		116.529	2,7%
TOTAL ACUICULTURA MUNDIAL		225.199	2,5%
Trucha arco iris	*(Oncorhynchus mykiss)*	3.443	4,8%
Dorada	*(Sparus aurata)*	1.164	13,7%
Lubina	*(Dicentrarchus labrax)*	1.089	5,7%
Rodaballo	*(Psetta maxima)*	383	-9,8%
Mejillones europeos	*(Mytilus galloprovincialis y edulis)*	285	-11,0%

Table 3-4.
Main species by value (millions of euros) produced by aquaculture in the world in 2020 (FAO) and year-on-year variation.

3.4. Aquaculture productions by groups and environments

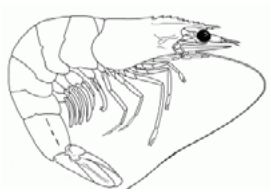
46.9% of world production was fish, about 57.5 million tonnes. The next group in production was algae which accounted for 28.6 % of tonnes (35.1 million tonnes), molluscs 14.5 % (17.7 million tonnes), crustaceans 9.2 % (11.2 million t), while the production of amphibians and reptiles and other invertebrates has been very low, 0.4% in both cases.

The harvest of aquaculture fish accounted for a first-sale value of more than 146.055 million euros in 2020, equivalent to 51.9% of the value of all aquaculture production. The crustacean harvest accounted for 81.481 million euros (28.9 %), molluscs 29.972 million (10.6 %) and algae 16.541 million (5.9% of the total) and amphibians and reptiles 5 million (1.8%) and 2.5 million euros (0.9%), respectively.

Contrary to terrestrial farming systems in which most of the production is obtained from a small number of highly domesticated species of animals and plants, in the year 2020 some 444 different aquatic species were being bred in the world, including fish, molluscs, crustaceans, algae and others, according to FAO. Of these, about 322 are in significant quantities (more than 100 tonnes per year). This diversity is due to the species richness of the aquatic environment, the adaptability of these organisms to controlled production systems and the ingenuity of people.

By 2020, some 444 different aquatic species were being farm in the world, including fish, molluscs, crustaceans, algae and others, according to FAO. Of these, about 322 are in significant quantities (more than 100 tonnes per year).

The 56.4% of world aquaculture production takes place in marine waters, it means 69,085 million tonnes and 43.6% in freshwater, 53,495 million tonnes.



Litopenaeus vannamei

LANGOSTINO

WHITE PRAWN *(Litopenaeus vannamei)*

Kind: Crustaceous Order: Decapod · Family: Penaeoidae

Significant characters and morphology: The white prawn, also called equatorial prawn, is a species characterized by having whitish legs, and has a raw greenish-gray color (red when cooked). It can reach a maximum size of 230 mm.

Cultivation: Its production is carried out on the **coast**, in ponds located in intertidal zones and with different levels of intensification.

Product Presentation: **It is presented on the market fresh, frozen, whole or headless.**

Saccharina japonica

KOMBU

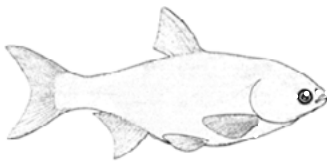
JAPANESE LAMINARIA *(Saccharina japonica)*

Class: Phaeophyceae Order: Laminariales · Family: Laminariaceae

Significant characters and morphology: **Brown algae formed by a sheet and a brown-gold stipe. The edges of the central nerve expand in a pyantiphid shape along with the lamina.**

Cultivation: It is one of the species with the highest production in the world due to its high growth speed, facilitating its large-scale cultivation. It can occur on both exposed and calm coasts.

Marketing and consumption: **Grown for human consumption, it takes advantage of practically everything, even the stem. For each meter of rope can be obtained about 10.6 kilos.**



Hypophthalmichthys molitrix

CARPA

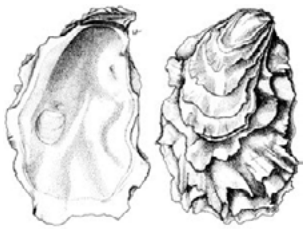
SILVER TENT *(Hypophthalmichthys molitrix)*

Class: Osteictios Order: Cypriniformes. · Family: Cyprinidae

Significant characters and morphology: **Robust fish with a slight elevation in its dorsal part. The body is laterally compressed fusiform and the ventral part forms an acute keel, which goes from the chest to the belly.**

Cultivation: It is widely used in polyculture for the greater use of the systems, when they do not contain fish that use the trophic level of phytoplankton. It is used in waters affected by eutrophication from anthropic action. Its reproduction is obtained induced in the laboratory, not spawning spontaneously in naturalized or closed environments.

Products and consumption: **Species suitable for consumption, but with a large number of thorns that hinder its commercialization**



Crassostrea gigas

OSTRA

JAPANESE OYSTER *(Crassostrea gigas)*

Class: Bivalvia Order: Ostrina · Family: Ostreidae

Significant characters and morphology: **Bivalve mollusc, filtering, dirty white or grayish. The leaflets are slightly elongated on the anteroposterior axis with one of the ends (where the charnela is) ending in point. The right or upper leaflet is relatively flat and the left or lower is concave and with it adheres to the substrate. The average size is 9-10 cm and reaches a maximum size of 20 cm.**

Cultivation: The breeding method used depends on the environment, in addition to tradition. In "over-elevation" cultivation, oysters are placed in plastic meshes fixed to easels above the ground. In "bottom" cultivation they are placed directly on the shore or in shallow water. "Rope" cultivation is done with oysters on ropes. And in the cultivation in "deep waters" oysters are placed in parks located at depths of up to ten meters.

Marketing and consumption: **It is marketed fresh, frozen (meat and half shell) and preserved.**

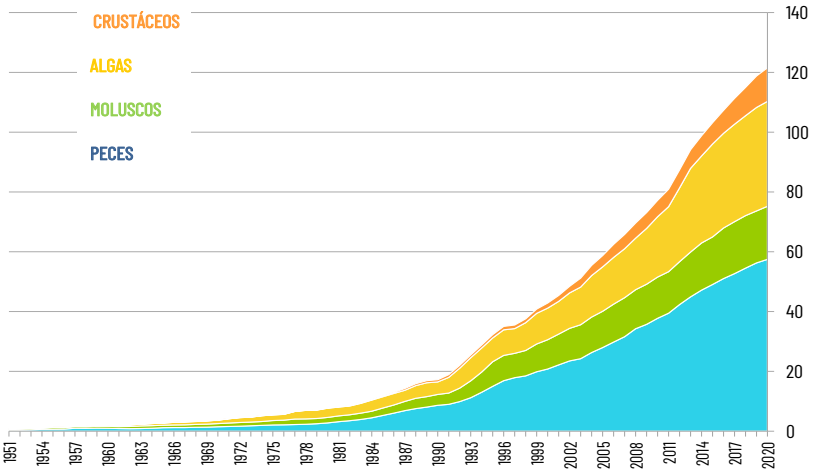


Figure 3-5. Evolution of world aquaculture production (million tonnes), by group, for the period 195 1-2020 (FAO).

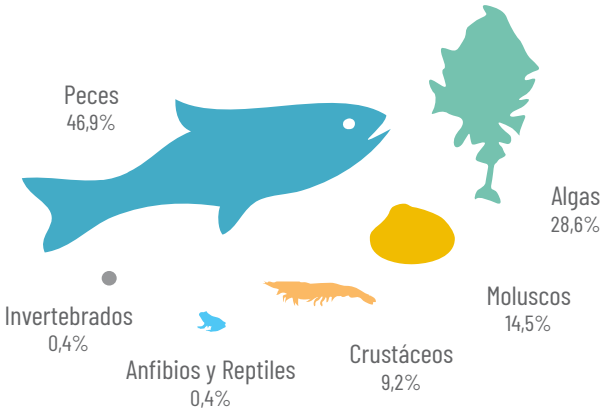


Figure 3-6. Percentage distribution of world aquaculture production (t) in 2020 by group (FAO).

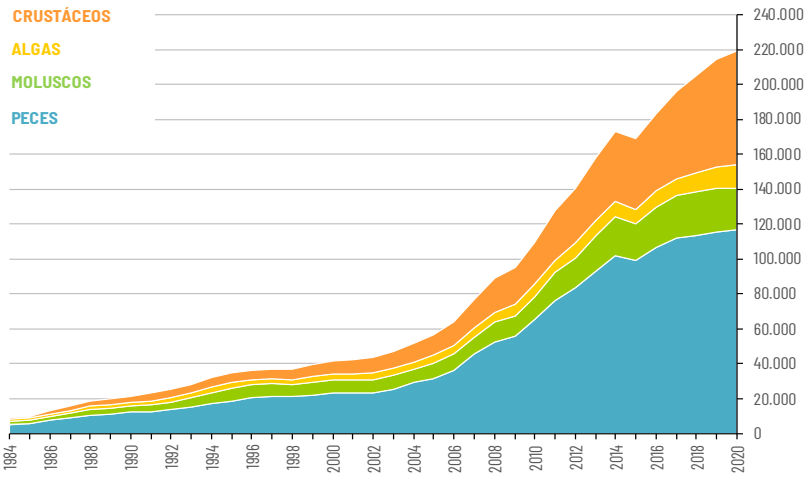


Figure 3-7. Evolution of the value of world aquaculture production, by group, for the period 1984-2020, in millions of euros (FAO).

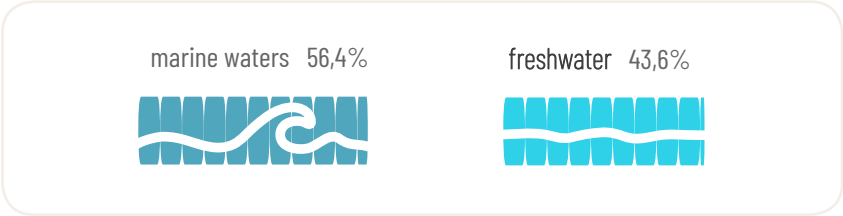


Figure 3-8.
Percentage distribution of global aquaculture production (t) in 2020 by production environment (FAO).

3.5. Aquaculture potential and sustainable development

Over the past five decades, aquaculture has developed, diversified and registered remarkable technological and scientific advances. The success of modern aquaculture is based on the proper management of the biology of cultivated species, the introduction of technological innovations, the development of specific feeds and business organization. The potential of these advances for economic growth in both developed and developing countries, for improving living standards and for increasing food security was already recognized by FAO in its 2000 Bangkok Declaration and Strategy, which stressed that aquaculture must continue its development to offer its full potential to humanity. And so it has been observed over the years.

To provide guidelines for better governance of the sector, FAO is advocating its Blue Growth programme as a framework for the sustainable management of aquatic resources, for the balance in their use and for their conservation in a way that is economically, socially and environmentally responsible. This programme builds on the 1995 FAO Code of Conduct for Responsible Fisheries and addresses fisheries, aquaculture, ecosystem services, trade and social protection. It seeks the balance between growth and conservation, between industrial and artisanal activity, to ensure fair benefits between societies. Blue Growth is integrated into the United Nations 2030 Agenda for Sustainable Development.

The European Commission's Scientific Advisory Mechanism (SAM) published its report "Food from the Oceans" in 2016. It indicates that, although the oceans represent about 50% of the new animal and plant biomass that is created annually on the planet, food from the oceans only reaches 2% of daily calorie consumption per person and 15% of protein consumption on a global scale. Food from the oceans can and should make up a much larger percentage of the total amount of food consumed. They are foods that, in addition to being generally very healthy, are essential for the fight against hunger and malnutrition in some parts of the world. In addition, the resources needed (energy, nutrients, space, water) to produce one kilogram of food fit for consumption are less in the oceans than on land. Therefore, increasing the proportion of food from the oceans will help reduce the pressure of agriculture on land's natural resources.

The success of modern aquaculture is based on the proper management of the biology of cultivated species, the introduction of technological innovations, the development of specific feeds and business organization.

The United Nations Summit held in 2015 endorsed the 2030 Agenda for Sustainable Development. It includes 17 Sustainable Development Goals (SDGs) and 169 targets, covering a broad set of issues related to the technical, institutional and policy changes required to achieve

sustainable development. The 2030 Agenda applies to all countries, integrates the three dimensions of sustainable development (economic, social and environmental) and provides guidance to Members, the United Nations and other intergovernmental organizations.
Civil society organizations and other institutions on future opportunities, challenges and needs related to sustainable development in all sectors, with the ambitious aim of eradicating extreme poverty and hunger. The 2030 Agenda and the Sustainable Developments Goals (SDGs) are very important for policy-making, planning and management of sustainable aquaculture development. In particular, SDG 1 (end poverty); SDG 2 (end hunger), SDG 5 (gender), SDG 8 (growth, jobs), SDG 12 (production and consumption), SDG 13 (climate change), SDG 14 (marine resources and ecosystems) and SDG 15 (biodiversity) will be highly relevant to aquaculture, although other SDGs will also influence the work of promoting sustainable development of aquaculture.

The translation into aquaculture of the European Green Deal and the Farm to Fork strategy has been materialised in the European Commission's Communication on Strategic Guidelines for a More Sustainable and Competitive EU Aquaculture for the Period 2021-2030 which was published in May 2021. These guidelines aim to contribute to the development of an EU aquaculture sector that is competitive and resilient, ensures the supply of nutritious and healthy food, reduces the Union's dependence on seafood imports, creates economic opportunities and jobs, and becomes a global benchmark for sustainability. APROMAR has positively valued these strategic guidelines and expects them to serve to revive Spanish aquaculture.

In 2021, APROMAR published its first sectoral Sustainability Report that can be downloaded from this link:
https://apromar.es/wp-content/uploads/2021/12/MEMORIA-DE-SOSTENIBILIDAD-2021-de-Acuicultura-de-Espan%CC%83a.pdf
A document in which we analyze the Spanish aquaculture sector, putting on the table data of the activity and commitments of improvement in line with the improvement of the health of our ecosystems, the nutritional quality of our products, the development of rural areas, the health and welfare of animals, gender equality, etc. And short, medium and long-term goals are set.

Aquaculture in the European Union

4. Aquaculture in the European Union

4.1. Situation of aquaculture in the European Union

In 2020 in the European Union (27) 1,094,315 tonnes were harvested of aquaculture products. This represents a decrease of -4.3% compared to what was put on the market in 2019, although it is still below the maximum production of European aquaculture that took place in 1999, when they exceeded 1,435,350 tonnes. On the other hand, aquaculture accounts for 21.4% of the volume of total aquatic production (aquaculture and fisheries) in the European Union. The remaining 78.6% of production came from extractive fisheries, i.e. 4,018,658 tonnes according to FAO.

The aquaculture production of the European Union in 2020 was 1,094,315 tonnes, with a value of 3,777.7 million euros.

Aquaculture production in the European Union had a value in first sale in 2020 of 3,777.7 million euros, which meant a slight increase in the annual variation of 0.7%. However, the importance of aquaculture is not the same in all EU countries. In some, its economic and social relevance already exceeds that of fishing, as is also the case in Spain in some autonomous communities. Aquaculture plays a very significant role in the social and economic development of certain coastal and river areas, as well as in the preservation of the maritime-fluvial and fishing culture of those same areas.

Aquaculture plays a very significant role in the socio-economic development of coastal and river areas, as well as in the preservation of maritime-fluvial and fisheries culture.

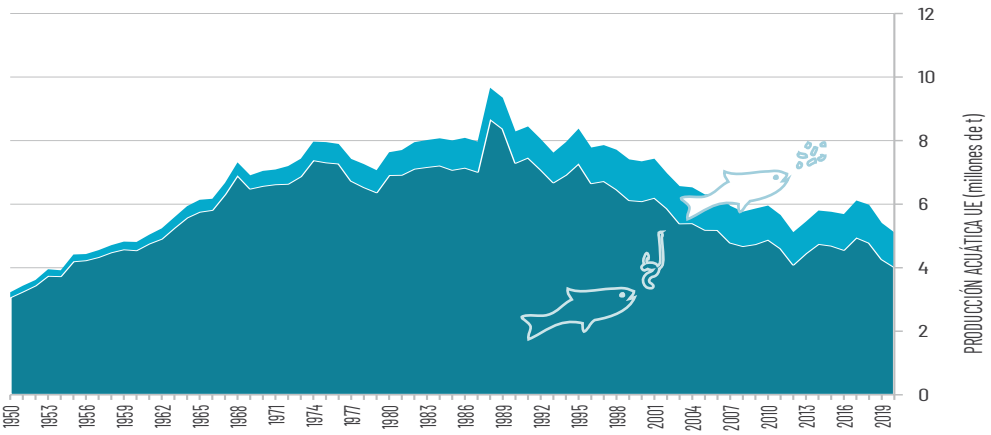


Figure 4-1. Evolution of the total aquaculture and fisheries production of the 27 Member States of the European Union between 1950 and 2020, in million tonnes (FAO). .

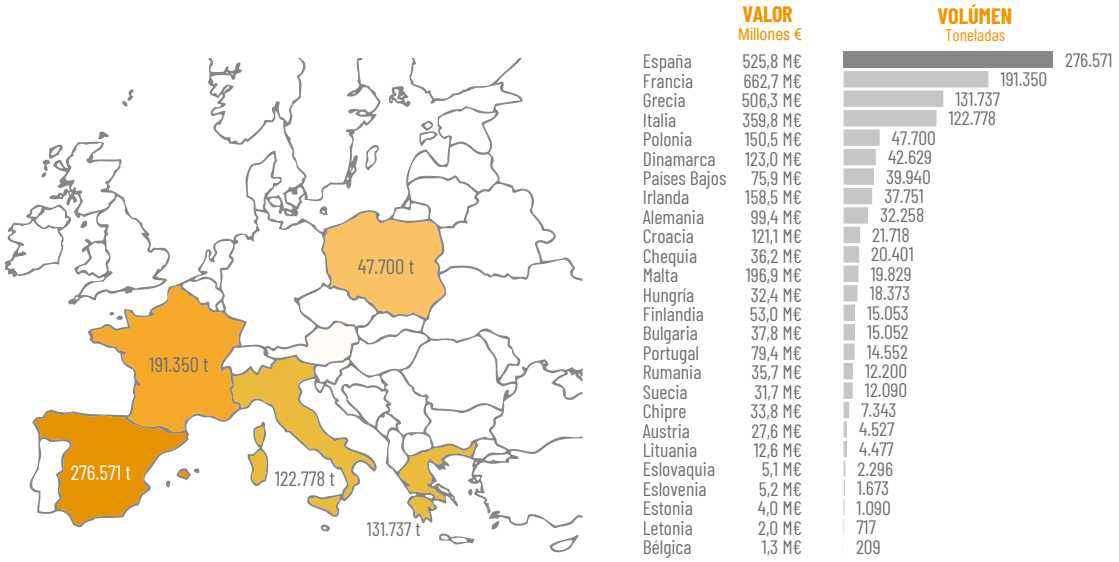


Figure 4-2. Distribution of aquaculture production in the Member States of the European Union (27) by quantity (tonnes) and value (million euros) in 2020 (FAO).

The total production of aquatic products (aquaculture plus fisheries) in the European Union in 2020 was 5,112,973 tonnes, experiencing a decrease of -5.5%. The maximum production was reached in 1988 with a production of 9,664,197 tonnes and from that year to 2020, it has decreased by -47.1 %. Despite its promising expectations, aquaculture production in the EU has not, in any case, been able to compensate for the sharp reduction suffered by European extractive fisheries in the last two decades.

Spain is the Member State of the European Union with the highest aquaculture harvest, with 276,571 tonnes in 2020 (25.3% of the Union total), followed by France with 191,350 tonnes (17.5 %), Greece with 131,737 (12.0%) and Italy with 122,778 (11.2%). Spain has lowered its production by -11.1% compared to 2019, France by -2.4% and Italy by -7.3%. Greece has been the only one to slightly increase production by 2.3% compared to 2019.

However, when the value of production is considered, France is the main producing Member State with EUR 662.7 million (19.6% of the total value), followed by Spain with EUR 525.8 million (15.6%) and Greece with EUR 506.3 million (15.0%) and Italy with 359.8 million euros (10.7%).
Greece was the only country that grew compared to 2019 (10.5%). France, Spain and Italy have decreased in the value of their production by -3.4%, -8.1% and -9.2%, respectively.

In the European Union (27) the main aquaculture products are mollusks and fish. Aquaculture of crustaceans, algae or other invertebrates is very small. Fish farming in 2020 meant 552. 625 tonnes representing 46.97 % by weight of total aquaculture, and reached a value of 2 in the first sale. EUR 440 million (72.24% of the total value of aquaculture production). The mollusks harvested totaled 537,570 tonnes, 45.69% of the total weight, reaching a value of 903.9 million euros (26.76% of the total).

In terms of means of production, aquaculture in the EU (27) was mostly developed in marine waters (72.6 %) and 27.4 % in freshwater.

The mussel continues one more year to be the most produced species in the EU (27) with 409,621 tonnes, -9.7% less than in

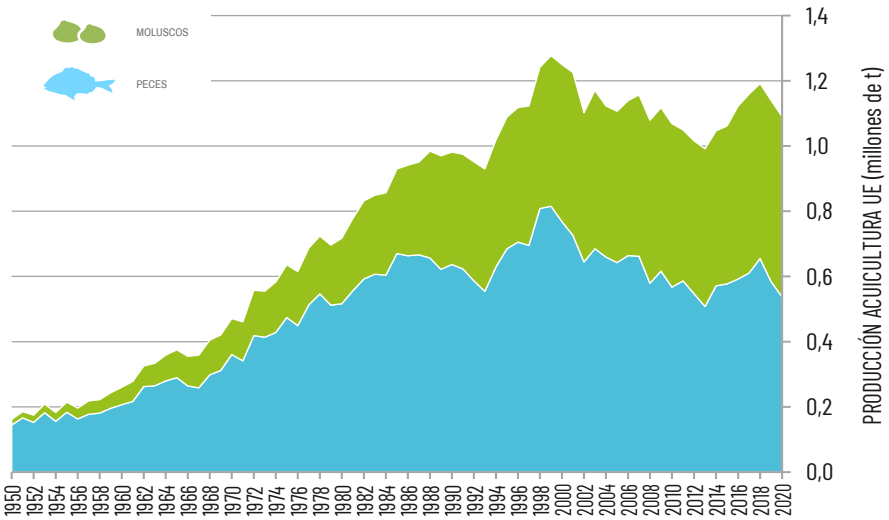


Figure 4-3
Evolution of aquaculture production (million tonnes) in the European Union by group for the period 1950-2020 (FAO).

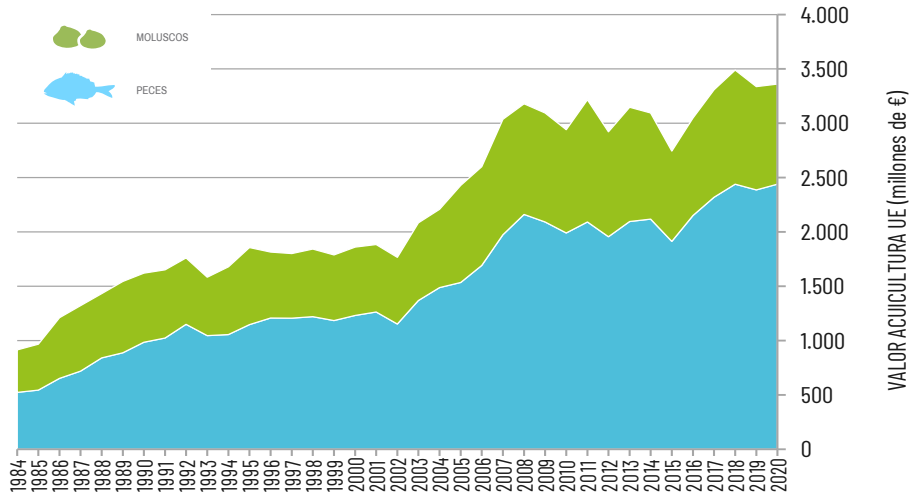


Figure 4-4.
Evolution of the value of aquaculture production in the European Union in millions of euros, by group for the period 1984-2020 (FAO).

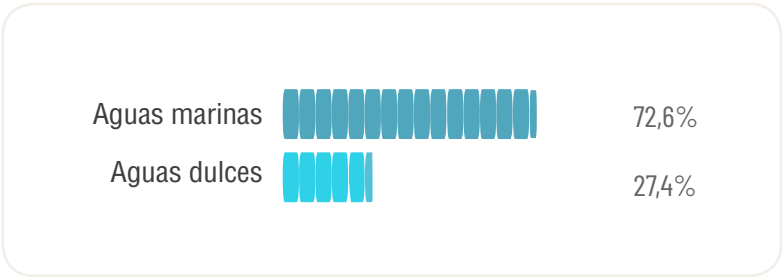


Figure 4-5.
Percentage distribution of aquaculture production (tonnes) in the European Union in 2020 by production environment (FAO).

2019 (477,293 tonnes). Two species of mussel are produced, the common and the Mediterranean, not always adequately differentiated in the statistics. It is followed by rainbow trout with 183,506 tonnes, -0.2% less than in 2019. The third place is occupied by the sea bream with 93,131 tonnes, -0.6% lower than the previous year. The Japanese oyster ranks fourth with 93,100, -5% less than last year, sea bass the fifth place with 81,369 tonnes, -0.7%. In sixth place is the common carp with 72,524 tonnes. These productions have decreased, but instead, the next positions on the list have experienced remarkable growth. In seventh position is the Atlantic bluefin tuna with 28,853 tonnes, 26% more than in 2019, thanks to the fact that an increase in catches has been achieved due to the positive effect on the population that its management plan has had. Then there is the Japanese clam with 26,056 tonnes, 20.4% more than the previous year, the Atlantic salmon with 14,810 tonnes, 15.6% more and the croaker with 9,200 tonnes, 9.2% more than in 2019.

The total production of the top 10 species produced in the EU (27) in 2020 was 1,012,170 tonnes, -4.2% less than the previous year (1,065,313 tonnes). These 10 species account for 92.5% of the total (1,094,315 tonnes). Total production decreased by -4.3% compared to 2019.

The total value of the top 10 species in the EU (27) in 2020 was 2,982.2 million tonnes, up 0.8% from the previous year. These 10 species accounted for 88.3% in value in first sale of the total produced. The total value was 3,377.7 million euros, with a slight increase of 0.7% despite the fact that production in volume was lower.

4.2. Situation of fish aquaculture in the European Union

In the European Union (27) 552,625 tonnes of aquaculture fish were harvested in 2020, -0.5 % less than in 2019 (555,475 tonnes). The sum of the harvest volumes of the first 10 species of fish amounted to 512,686 tonnes, -0.5 % more than the previous year (509,874 tonnes). The top 10 species accounted for 92.8% of production. On the other hand, the harvest of the rest of the fish species decreased by -12.4%.

The total value at first sale of aquaculture fish produced in the EU (27) in 2020 was about 3,050.1 million euros an increase of 2.2% compared to 2019. The average value per kilo of aquaculture fish on first sale was 4.42 euros/kg, a 6.7% more than the previous year (4.14 €/Kg in 2019).

The main species of farmed fish produced in the European Union (27) was rainbow trout, of which 183,506 tonnes were produced in 2020, -0.2 % less than the previous year. In second place was the see bream with 93,131 tonnes, -0.6 % more than in 2019. The sea bass was in third position with 81,369 tonnes, -5.5% less than the previous year. Bluefin tuna and Atlantic salmon experienced remarkable growth in 2020 as mentioned above, and turbot is the species that has experienced the greatest fall in 2020, of -38.1%, that is 7,063 tonnes compared to 11,409 tonnes in 2019.

As for fish production in 2020, the top 3 production positions coincide in volume and economic value. The species produced that generated the greater income was the rainbow trout with 593.1 M€, followed by sea bream with 432.5 M€ and sea bass with 432.0 M€, with a variation with respect to 2019 of 2.0 %, -0.3 % and -4.0 % respectively.

The top 10 species produced generated 2,248.9 million, 3.6% more than in 2019. These top 10 species accounted for 92.2% of the total value of production.

Following the departure of the United Kingdom, which occupied the position of the EU Member State (28) with the highest production of aquaculture fish, the positions of the Member States in the European Union (27) changed. Greece pas to occupy the first place in volume (112. 153 tonnes) with an increase of 6.9% compared to 2019, as in value with 499.6 million euros generated in first sale in 2020, 11.5% more than the previous year. Greece accounted for 20.2% of fish production, both in volume and value, in the EU (27).

Spain was in the second position in volume with 66.545 tonnes, -13.7 % less than in 2019 according to FAO data and also the second place in value of first sale with 408.1 million

Table 4-1.
Main species produced by aquaculture in the European Union, by tonnes, in 2020 (FAO).

Especie	Nombre científico	Toneladas	% Var. anual
Mejillones	*(Mytilus spp)*	409.621	-9,7%
Trucha arco iris	*(Onchorynchus mykiss)*	183.506	-0,2%
Dorada	*(Sparus aurata)*	93.131	-0,6%
Ostión japonés	*(Crassostrea gigas)*	93.100	-5,0%
Lubina	*(Dicentrarchus labrax)*	81.369	-5,5%
Carpa común	*(Cyprinus carpio)*	72.524	-0,7%
Atún rojo del Atlántico	*(Thunnus thynnus)*	28.853	26,4%
Almeja japonesa	*(Ruditapes philippinarum)*	26.056	20,4%
Salmón del Atlántico	*(Salmo salar)*	14.810	15,6%
Corvina	*(Argyrosomus regius)*	9.200	9,2%
TOTAL 10 PRALES. ESPECIES		1.012.170	-4,2%
RESTO DE ESPECIES		82.145	-37,7%
TOTAL ACUICULTURA UE		1.094.315	-4,3%

Table 4-2
Main species produced by aquaculture in the European Union, by value, in 2020 (FAO).

Especie	Nombre científico	Valor (M€)	% Var. anual
Trucha arco iris	*(Onchorynchus mykiss)*	593,05	2,0%
Dorada	*(Sparus aurata)*	432,49	-0,3%
Lubina	*(Dicentrarchus labrax)*	432,02	-4,0%
Ostión japonés	*(Crassostrea gigas)*	368,31	-8,3%
Mejillones	*(Mytilus spp)*	335,08	27,7%
Carpa común	*(Cyprinus carpio)*	351,68	-7,4%
Almeja japonesa	*(Ruditapes philippinarum)*	165,31	1,7%
Atún rojo del Atlántico	*(Thunnus thynnus)*	141,89	37,3%
Salmón del Atlántico	*(Salmo salar)*	117,50	14,2%
Rodaballo	*(Psetta maxima)*	44,90	-43,8%
TOTAL 10 PRALES. ESPECIES		2.982,2	0,8%
RESTO DE ESPECIES		395,5	-0,5%
TOTAL ACUICULTURA UE		3.377,7	0,7%

especies

Salmo salar

SALMÓN

ATLANTIC SALMON *(Salmo salar)*

Class: Osteictios Order: Salmoniformes. · Family: Salmonidae

Significant characters and morphology: TBlue-gray fish on the dorsal part with some points, lighter on the flanks and with a silver belly. Elongated body covered with small scales. Large mouth provided with strong teeth. Second adipose dorsal fin. Narrow caudal peduncle.

Cultivation: Atlantic salmon farming has an initial stage in freshwater that is carried out in onshore facilities. When they are between 1 year and 18 months, and reach a weight of 50-90 g, they are transferred to nurseries at sea. There they are bred for 12 to 18 months, until they reach a harvest weight of 4 to 5 kg.

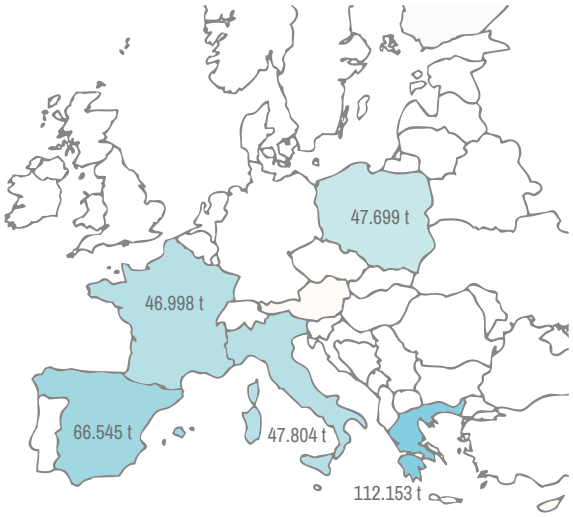
Product Presentation: **The main final product is fresh fillet, although it is also marketed whole (or gutted) fresh. Frozen fillets and other products with higher added value, such as whole smoked salmon or thin slices, are also marketed.**

Especie	Nombre científico	Toneladas	% Var. anual
Trucha arco iris	*(Onchorynchus mykiss)*	183.506	-0,2%
Dorada	*(Sparus aurata)*	93.131	-0,6%
Lubina	*(Dicentrarchus labrax)*	81.369	-5,5%
Carpa común	*(Cyprinus carpio)*	72.524	-0,7%
Atún rojo del Atlántico	*(Thunnus thynnus)*	28.853	26,4%
Salmón del Atlántico	*(Salmo salar)*	14.810	15,6%
Corvina	*(Argyrosomus regius)*	9.200	9,2%
Rodaballo	*(Psetta maxima)*	7.063	-38,1%
Pez-gato	*(Clarias gariepinus)*	5.776	-7,0%
Anguila europea	*(Anguilla anguilla)*	4.993	0,0%
TOTAL 10 PRALES. ESPECIES		512.686	-0,5%
RESTO DE ESPECIES		39.939	-12,4%
TOTAL ACUICULTURA PECES UE		552.625	-0,5%

Table 4-3.
Main fish species produced by aquaculture in the European Union, by tonnes, in 2020 (FAO).

Especie	Nombre científico	Valor (M€)	% Var. anual
Trucha arco iris	*(Onchorynchus mykiss)*	593,1	2,0%
Dorada	*(Sparus aurata)*	432,5	-0,3%
Lubina	*(Dicentrarchus labrax)*	432,0	-4,0%
Atún rojo del Atlántico	*(Thunnus thynnus)*	335,1	27,7%
Carpa común	*(Cyprinus carpio)*	165,3	1,7%
Salmón del Atlántico	*(Salmo salar)*	117,5	14,2%
Rodaballo	*(Psetta maxima)*	44,9	-43,8%
Corvina	*(Argyrosomus regius)*	44,5	8,9%
Anguila europea	*(Anguilla anguilla)*	44,2	-1,3%
Peces marinos nep	(Varias)	39,8	243,8%
TOTAL 10 PRALES. ESPECIES		2.248,9	3,6%
RESTO DE ESPECIES		191,2	-12,0%
TOTAL ACUICULTURA PECES UE		2.440,1	2,2%

Table 4-4.
Main fish species produced through aquaculture in the European Union, by value, in 2020 (FAO).



	VALOR Millones €	VOLÚMEN Toneladas
Grecia	499,6 M€	112.153
España	408,1 M€	66.545
Italia	189,2 M€	47.804
Polonia	150,5 M€	47.699
Francia	190,4 M€	46.998
Dinamarca	119,9 M€	36.290
Croacia	120,3 M€	21.207
Chequia	36,2 M€	20.401
Malta	196,9 M€	19.829
Alemania	77,7 M€	18.693
Hungría	32,4 M€	18.373
Finlandia	53,0 M€	15.053
Irlanda	110,4 M€	13.474
Bulgaria	36,1 M€	12.892
Rumania	35,7 M€	12.200
Suecia	30,5 M€	9.793
Chipre	33,7 M€	7.327
Portugal	35,5 M€	6.215
Países Bajos	26,6 M€	5.090
Austria	27,6 M€	4.527
Lituania	12,6 M€	4.477
Eslovaquia	5,1 M€	2.296
Eslovenia	4,8 M€	1.269
Estonia	3,9 M€	1.089
Letonia	2,0 M€	717
Bélgica	1,3 M€	209

Figure 4-6. Distribution of aquaculture fish production in the Member States of the European Union by volume (tonnes) and value (million euros) in 2020 (FAO).

Figure 4-7. Relative evolution of increases in total aquaculture production at European Union, European (including Turkey) and world levels between 2000 and 2020. Cumulative percentage increases are shown, based on the reference base (100) for the year 2000 (on FAO data).

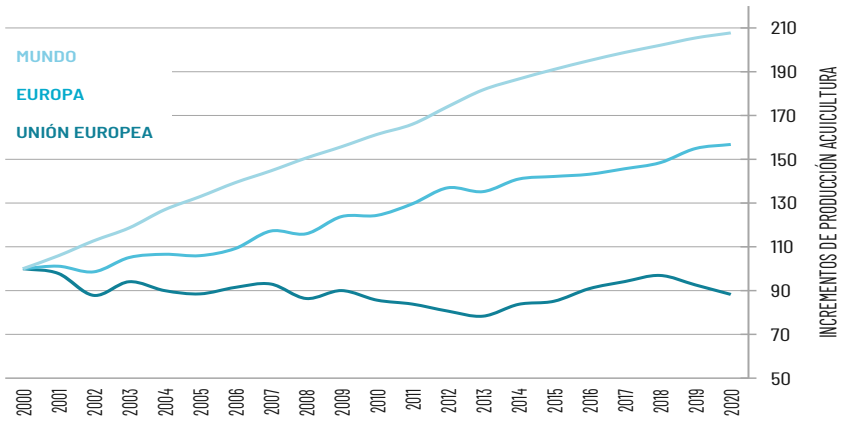


Figure 4-8. Relative evolution of increases in aquaculture fish production at European Union, European (including Turkey) and world levels between 2000 and 2020. Cumulative percentage increases are shown, based on the reference base (100) for the year 2000 (on FAO data).

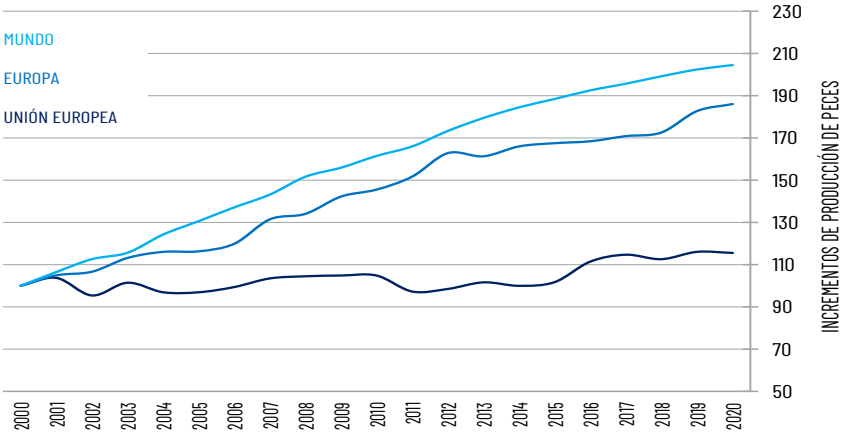
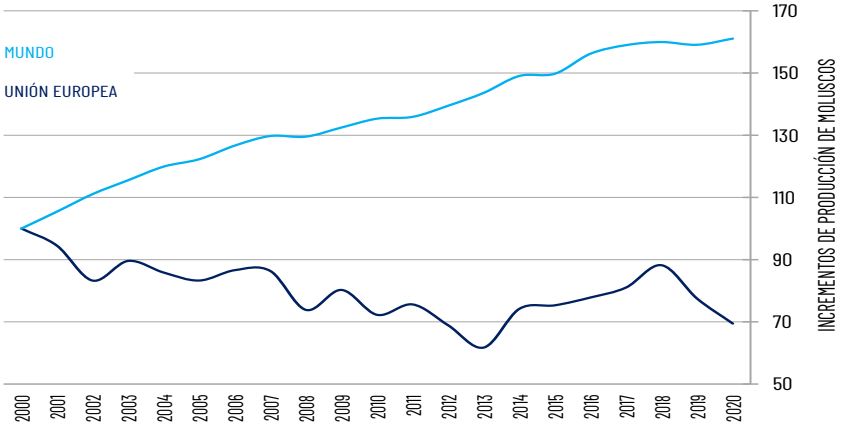


Figure 4-9. Relative evolution of increases in aquaculture mollusc production at European Union and world levels between 2000 and 2020. Cumulative percentage increases are shown, based on the reference base (100) for the year 2000 (on FAO data).2000 (sobre datos FAO).



euros, -8.5 % less than in 2019. Spain contributed with a 12% of the volume to total EU fish production (27) and 16,7 % of the total value.

The third and fourth in volume position is occupied by Italy and Poland. Poland has overtaken France in 2020. Italy produced in 2020 a total of 47,804 tonnes of fish, -19.4% less than in 2019 representing 8.6% of the total produced in the EU (27) and Poland 47,699 tonnes, 6.7% more than the previous year representing 8.6% of total production.

In value, Malta ranks third with 196.9 million €, a remarkable growth of 52% more than in 2019 and representing 8.1% of the value of total production. France ranks fourth with 190.4 million euros, with a slight decrease of -0.8%, followed by Italy with 189.2 million tonnes, -27.2% less than in 2019.

Fish production through modern aquaculture systems has been a success story in the development of a new and innovative economic activity in Europe. Despite its current limited growth, aquaculture in the European Union is a model of sustainable progress led by companies of all sizes with strong scientific and technological support. It should be meant that in parallel there are aquaculture systems plus traditions perfectly adapted also to ecosystems and social uses.

The growth rate of fish aquaculture in the European Union (27) since 2000 has been very low. In fact, in the last 10 years, fish aquaculture has grown by only 1.1% per year compared to 4.3% globally. This situation has occurred in the same way for the mollusks species produced, i.e. in the EU (27) the rate of growth has decreased, -2,8 % compared to 2,61 % in the rest of the world. Thus, total EU aquaculture (mainly fish and mollusks) has decreased since 2000 by an average of -0.6% per year, while in the world aquaculture has grown by an average of 4.6% in that time. It should be clarified that those production figures from the Member States of the European Union do not logically include data from other European countries such as Norway or, where appropriate, Turkey. The annual average growth in the last decade of aquaculture across Europe was 3.2% covering all aquaculture and 4.0% for fish farming (including Turkey, but especially taking into account Norway). These data confirm the existence of severe limitations for the development of aquaculture in the European Union and that do not occur in other countries or occur to a lesser extent.

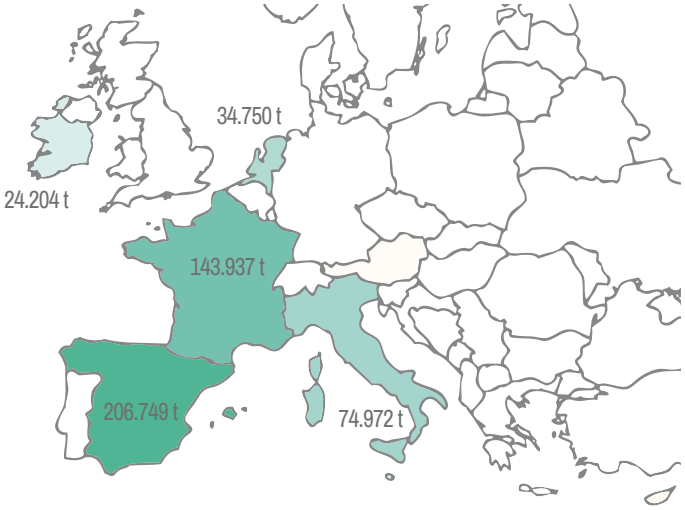
4.3. Situation of mollusks aquaculture in the European Union

In the year 2020 were harvested in the world 17,742,209 tonnes of aquaculture mollusks. The European Union (27) contributed 537,570 tonnes, or 3.0 %, to this production, with a value of EUR 903.9 million on first sale.

In 2020, 17.7 million tonnes of aquaculture mollusks were harvested worldwide. The European Union contributed to this production 0.5 million and with a value in first sale of 903.9 million euros.

The main producing country is Spain, based on mussel cultivation, followed by France (oysters) and Italy (clams). These three countries accounted for 79.2 % of the total European harvest of aquaculture mollusks in 2020, i.e. 425,658 tonnes.

In Spain, 206.749 tonnes were produced, therefore, it was the first producing country and obtained a value in first sale of 111.6 million euros in 2020 according to FAO. The second place in volume was occupied by France with 143.937 tonnes but in terms of value it is by far the first place in the ranking with 463.4 million euros. The third place in volume is occupied by Italy with 74.972 tonnes, on the other hand, it is the second in value with 170.5 million euros in first sale.



	VALOR Millones €	VOLÚMEN Toneladas
España	111.618	206.749
Francia	463.394	143.937
Italia	170.506	74.972
Países Bajos	48.843	34.750
Irlanda	47.873	24.204
Grecia	5.868	19.411
Alemania	21.315	13.540
Portugal	43.873	8.337
Dinamarca	3.028	6.317
Suecia	1.197	2.297
Bulgaria	1.562	2.143
Croacia	738	511
Eslovenia	428	403

Figure 4-10. Production of aquaculture mollusks in EU Member States by volume (tonnes) and value (million euros) in 2020 (on FAO data).

Table 4-5. Main species of mollusks produced by aquaculture in the European Union, by tonnes, in 2020 (FAO).

Especie	Nombre científico	Toneladas	% Var. anual
Mejillones	*(Mytilus spp)*	409.621	76,2%
Ostión japonés	*(Crassostrea gigas)*	95.594	17,8%
Almeja japonesa	*(Ruditapes philippinarum)*	26.056	4,8%
Almeja fina	*(Ruditapes decussatus)*	2.523	0,5%
Ostra europea	*(Ostrea edulis)*	1.949	0,4%
Almeja babosa	*(Venerupis pullastra)*	1.340	0,2%
TOTAL 6 PRALES. ESPECIES		537.083	16,7%
RESTO DE ESPECIES		487	0,1%
TOTAL ACUICULTURA MOLUSCOS UE		537.570	-8,0%

Table 4-6. Main species of mollusks produced by aquaculture in the European Union, by value, in 2020 (FAO).

Especie	Nombre científico	Valor M€	% Var. anual
Ostión japonés	*(Crassostrea gigas)*	368,3	40,7%
Mejillones	*(Mytilus spp)*	194,6	21,5%
Almeja japonesa	*(Ruditapes philippinarum)*	141,9	15,7%
Almeja fina	*(Ruditapes decussatus)*	97,9	10,8%
Ostra europea	*(Ostrea edulis)*	59,2	6,6%
Almeja babosa	*(Venerupis pullastra)*	32,4	3,6%
TOTAL 6 PRALES. ESPECIES		894,3	16,6%
RESTO DE ESPECIES		9,6	0,5%
TOTAL ACUICULTURA MOLUSCOS UE		903,9	-8,5%

European aquaculture mollusks production has remained virtually constant, with a year-on-year variation of 1.0% over the last decade. From a peak of 826,140 tonnes in 1999 to 537,570 tonnes of 2020. Its economic value has experienced an average year-on-year variation of -0.9% in the last 10 years.

Mussel aquaculture in the European Union (27) placed 409,621 tonnes on the market in 2020 tonnes, representing 76,2 % of the total mollusks harvest. It is followed in production by the Japanese oyster, with 95,594 tonnes (17.8% of the total) and the Japanese clam, with 26,056 (4.8%). Another species with significant productions is the fine clam (2.523 tonnes).

Although the production volume of the Japanese oyster is much lower than that of the mussel, its value is higher and that is why, in 2020 it represented in value 368.3 million euros, to approximately 4.04 €/kg. The total value of mussels produced in the EU in 2020 was 194.6 million €, at an average of 0.85€/kg on first sale. And that of the Japanese clam 141.9 million, at an average of 4.72 €/kg.

4.4. Potential of European aquaculture

Europe has 55,000 km of coastline, the second longest coastline in the world after Canada, and offers environmental, physical and oceanographic conditions conducive to aquaculture. On the other hand, the business fabric of European aquaculture has demonstrated the knowledge, experience and technical means to be an environmentally sustainable activity, economically profitable, offering safe, healthy and quality food, and socially welcome with stable and quality jobs.

In addition, the European Union enjoys other advantages. The Member States of the Union are leaders in technology and research, have well-trained human resources, and as mentioned, the environmental conditions are appropriate for the cultivation of many of the species that consumers currently demand the most. But, on the other hand, the high regulatory standards with which the European Union has endowed itself aimed at ensuring that the aquaculture products grown in it are as safe as a food can be, that the natural environment of its production is scrupulously respected, that workers have safe and motivating working conditions, and that the welfare of the animals raised has been complied with, they offer an added value that society should know.

The European Commission's Scientific Advisory Mechanism (SAM) recommends making aquaculture an explicit priority of the EU and global policies through the integration of its policies into a comprehensive food production policy framework that takes into account the needs of producers and consumers.

However, aquaculture in the European Union, both fish and mollusks, has been practically stagnant for the last fifteen years for various reasons and is not exploiting its potential creator of wealth and employment, as the FAO has been insistently recommending. This situation, together with the lower catches of extractive fisheries, has consolidated a situation of great dependence on fish imports to meet the growing European demand for seafood. Today the import and processing industries of the European Union are more relevant in terms of their turnover and employment than the fisheries and aquaculture producers combined.

Having a demanding but tight legal regulatory framework is a plus of competitiveness that no one disputes. But when these rules are taken to higher levels without sufficient justification, or without that higher requirement providing added value to society, then they become a slab for the non-compensable economic costs they entail. This circumstance of sublimation of the regulations occurs, for example, in environmental matters. However, the opposite is true in consumer information, where the requirements are clearly lower than those demanded by society (for example, indicating at the final points of sale the date of capture or harvest of unpackaged fresh fish).

The sublimation at national or regional level, also called galvanized in gold, of European regulations has the consequence that the procedures to obtain an authorization to carry out aquaculture, or achieve the granting of a concession of a space in the public domain, last up to 8 years and unnecessarily raise business costs. With this, the

possibility of growing and taking advantage of economies of scale, or of simply producing, entails anomalously high costs when you want to operate within the European Union. And with these higher costs it is complex to compete with imported fish from developing third countries. On the other hand, the growing demand for the use of spaces in coastal and river environments by other activities causes an increase in competition that confronts aquaculture with these other activities, including those related to the construction of residential housing, tourism or fishing. The organization of these spaces in search of synergies is a social and political necessity.

Finally, even today there are occasional problems related to the image of aquaculture, mostly unfounded, which continue to prevent this activity from taking advantage of all the benefits of the rigorous legal standards to which it must conform, both related to the environment, public health or animal health.

While at the level of the European Commission and the European Parliament the regulatory framework for aquaculture has improved markedly in recent years, at national level, and especially at regional (subnational) level, there is still considerable work to be done in relation to the establishment of a framework conducive to the development of this activity that guarantees a level playing field for entrepreneurs vis-à-vis imports, and provide a solid foundation of trust for both consumers and neighbors of aquaculture farms.

4.5. Videos of interest.

Video of MINISTRY OF AGRICULTURE, FISHERIES AND FOOD 2022

#alimentosdespaña

The Ministry of Agriculture, Fisheries and Food launched a communication campaign, under the Food From Spain (Alimentos de España) strategy, with the aim that the consumer feels the greatness and diversity of our products.

https://youtu.be/g0w0R96gUSI

Dissemination Day of Innovation projects: FOULACTIVE, FISHFLOC, ACUFLOT and AQUAHUB-OFFSHORE

APROMAR, CTAQUA, CETGA, IH Cantabria

Day 4 November 2021 in Madrid. In this day the dissemination of the projects was carried out: - FOULACTIVE of CTAQUA: antifouling in pens in the sea, - ACUFLOT of IH Cantabria: synergies between offshore aquaculture and wind energy, - AQUAHUB-OFFSHORE of APROMAR-REMA: of offshore aquaculture in Spain, - FISHFLOC of CETGA: cultivation in Biofloc systems.

https://youtu.be/0xmJqIyr5Ic

Video of AQUACULTURE OF SPAIN

You don't know me

We give voice to seas, rivers and oceans to discover the Aquaculture of Spain.

https://youtu.be/8UeVwbA7b10

Video of the PRESENTATION OF THE SOFIA REPORT 2022

#SDGs #Agenda2030 #GlobalGoals

Presentation of the biannual report the State of World Fisheries and Aquaculture (SOFIA 2022) of FAO.

https://youtu.be/SYPtTD-9Uic

Aquaculture production in Spain and Europe

5. Aquaculture production in Spain and Europe

5.1. Aquatic Food Production in Spain

At the end of the 60s of the twentieth century Spain occupied a prominent position on the world stage of production of aquatic products. This situation was based on capture fishing in the waters of third countries. From the 70s the volume of capture activity began a progressive decrease due to the reduction of fishing opportunities. Aquaculture, which in Spain began in the same 60s, despite the progressive increase in its specific weight and the expectations generated, has not been able to compensate for the fall in fishing activity and to counteract the decrease in catches.

The primary production in Spain in 2020 of aquatic products from aquaculture and capture fishing, decreased by -9.6% compared to 2019, to remain at 1,080,967 tonnes, according to FAO. It decreased for the second consecutive year from 1,296,358 tonnes in 2018 to 1,080,967 tonnes in 2020, that is 215,391 tonnes less produced in those two years. In Spain, aquaculture contributed to 276,571 tonnes in 2020, -11.1% less than in 2019 (311,033 tonnes) and capture fishing obtained a total of 804,396 tonnes, -9.1% less than the previous year, 884,726 tonnes. If we take into account the last ten years, the average year-on-year variation in aquaculture has been 1.5% and in capture fisheries -1.7%.

The mussel (*Mytilus spp.*), of which 255,303 tonnes were produced in 2021, was the main living aquatic resource in Spain in terms of weight. On the capture fishing side, the main species caught by the Spanish fleet were skipjack tuna (Katsuwonus pelamis) with 135,143 tonnes and Argentine hake (Merluccius hubbsi) with 77,628 tonnes in 2020 according to FAO.

The aquaculture production in Spain in 2021 is estimated at 327,309 tonnes with a total first sale value of 629.0 million euros.

For 2021, according to data collected by APROMAR, the aquaculture harvest figures in Spain reached a total of 327.309 tonnes and a value in first sale of 629.0 million euros. Broken down into mussel (255,303 t), sea bass (23,924 t), rainbow trout (15,357 t) and sea bream (9,632 t) as main species.

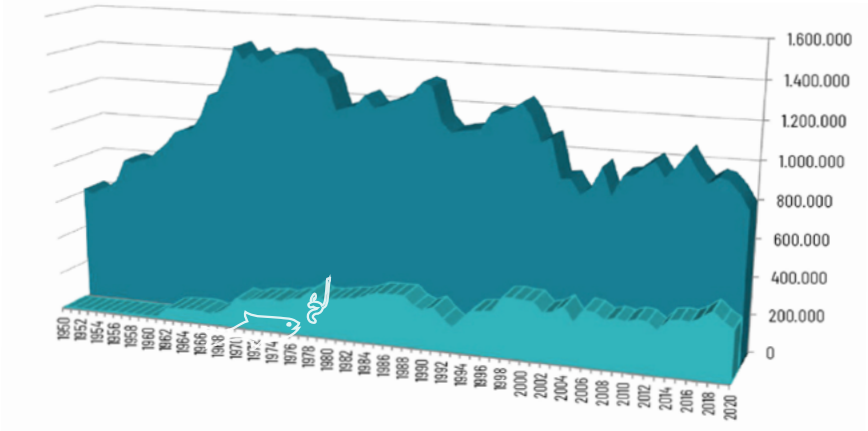


Figure 5-1. Evolution of the total aquatic production (aquaculture + fisheries) in Spain (tonnes) in the period 1950-2020 (FAO).

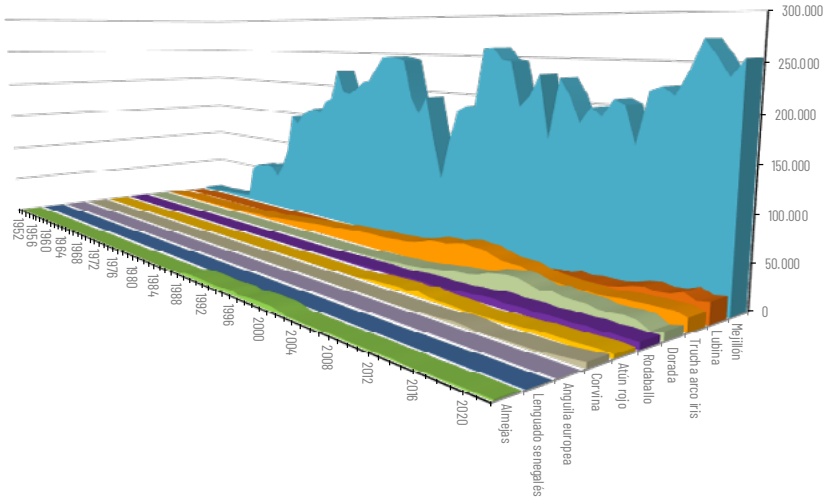


Figure 5-2. Evolution of the aquaculture harvest in Spain, in tonnes and by species, in the period 1952-2021 (MAPA and APROMAR data).

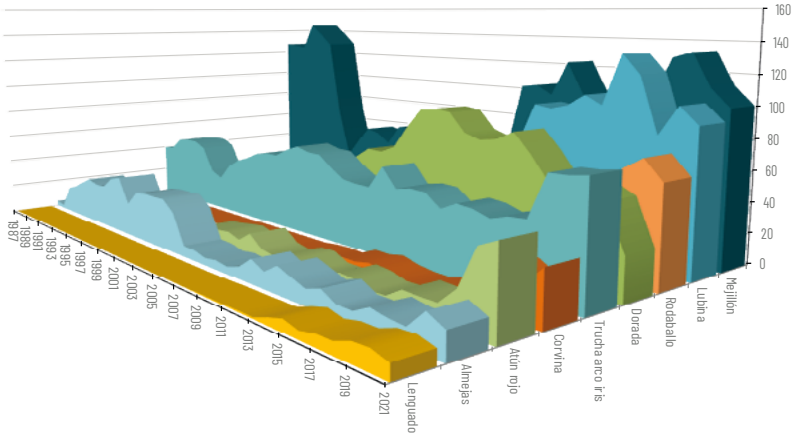


Figure 5-3. Evolution of the value of the aquaculture production in Spain, in millions of euros and by species, in the period 1987-2021 (MAPA and APROMAR data)

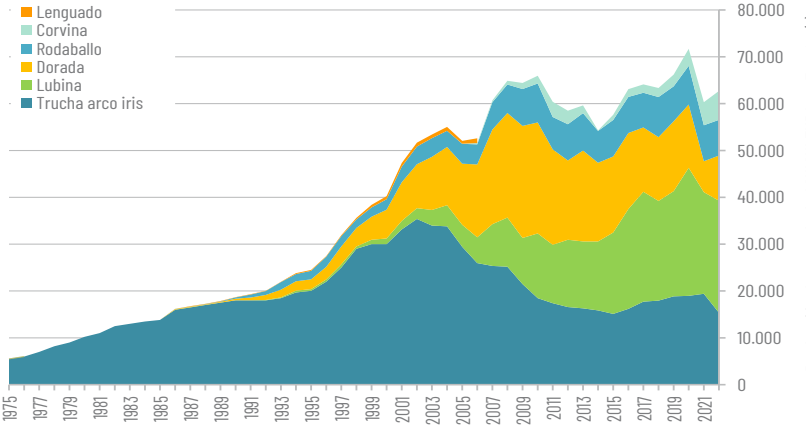


Figure 5-4. Evolution of the production of finfish aquaculture in Spain, in volumen for the main species, in the period 1975-2021 (MAPAMA and APROMAR).

5.2. Types of aquaculture facilities in Spain

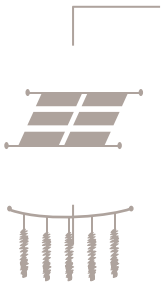
Spain has a varied availability of water resources on which it is feasible to carry out aquaculture, both in the marine and continental fields (fresh waters). Thus, to the almost 8,000 km of coastline are added nine large rivers, numerous minor river courses, lakes and a reservoir water capacity of more than 55,000 hm3, in addition to an orography and diversity of climates that provide environmental and physico-chemical characteristics suitable for the development of aquaculture.

Aquaculture establishments are designed and built to meet the needs of the species produced and adapt to the conditions of the physical environment. In this way, the following categorization of aquaculture establishments in Spain can be made:

TYPES OF AQUACULTURE FACILITIES IN SPAIN

- At sea in pens

  These facilities consist of rigid plastic rings that support and float net bags inside which fish such as bream, sea bass or meagre are stabled and raised.



- At sea in platforms and long-lines.

  These are floating structures for the cultivation of bivalve molluscs, mainly mussels. The platform consists in structure from which the cultivation ropes hang, and the long-lines are non-rigid structures consisting of a mother line, arranged between buoys linearly on the sea surface, from which the culture ropes hang in turn. The platform operates better in sheltered waters, as in the case of the Galician estuaries, while the long-lines offer better results in open water, as is the case of mussel cultivation in Andalusia.

- On the coastline (salt water). These are facilities built on site, on land or on the coast and that obtain their water by pumping from sea water or wells. It is the kind of farm in which the production of turbot, for example, or sole is carried out.

- On the beach, intertidal area and estuaries (salt water). They are aquaculture facilities in which the cultivation is carried out with a minimum physical intervention on the environment. This is the case of the production of clams and oysters. It is carried out in beach areas or intertidal areas in which the animals are deposited directly on the substrate or in meshes on tables. It is also the type of farms located in ponds dug into the earth in old salt areas or marshes, being an example of this the estuaries for the production of fish such as sea bream, sea bass or meagre.

- In land (fresh water). They consist of facilities built on site on the banks of rivers, or their sources, which take advantage of the gravity circulation of water. It is the type of facility in which the production of rainbow trout or sturgeon is carried out.

5.3. Number of aquaculture facilities in Spain

In 2020 a total of 5.102 aquaculture facilities were producing in Spain, 160 facilities less than in 2019 with 5,262 according to MAPA data. Of these, 4,842 (138 less than in 2019) were mollusks in marine aquaculture, consisting of platforms and "long-lines" in which vertical cultures of mussels and other mollusks are carried out. In land aquaculture (in freshwater) had 150 active farms (18 fewer than in 2019), mainly for fish such as rainbow trout and sturgeon. The number of facilities on the coast, beaches, intertidal zones and estuaries was 67 (5 less than in 2019). And operating in pens at sea there were 43 (1 more than in 2019), for finfish farming.
It is key to note that in land aquaculture is key to the development of rural areas in Spain. In these areas, the facility of new companies is low and in land aquaculture represents an important focus of employment.

In 2020 has been a decrease in the number of facilities with production compared to the previous year, in total 160 facilities of which 18 correspond to in land aquaculture.

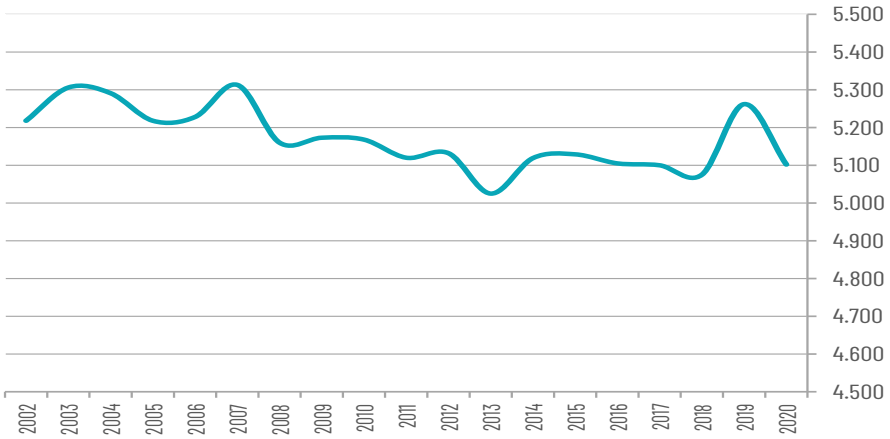


Figure 5-5. Evolution of the total number of aquaculture facilities in Spain with production between 2002 and 2020 (source MAPA/ APROMAR).

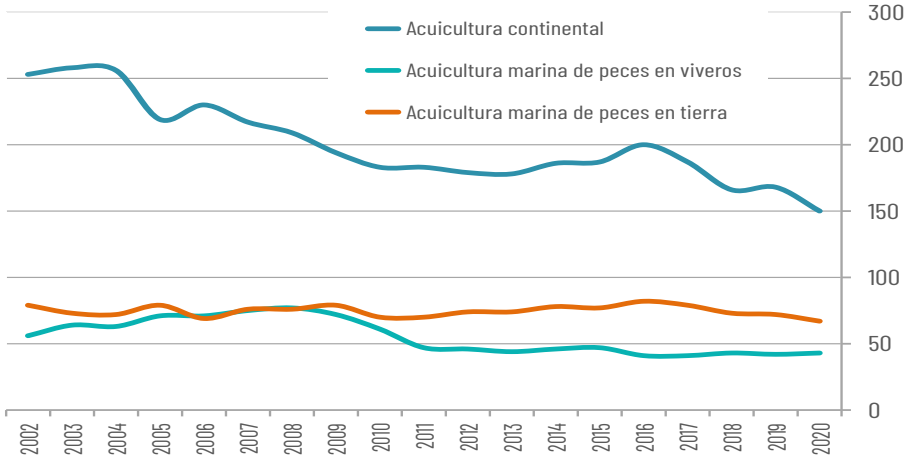


Figure 5-6. Evolution of the number of aquaculture facilities in Spain with production, dedicated to inland aquaculture, marine fish in nurseries and marine fish on land between 2002 and 2020 (source MAPA/ APROMAR).

5.4. Employment in aquaculture in Spain

The statistics prepared annually by the Ministry of Agriculture, Fisheries and Food (MAPA) indicate that the number of annual work units (UTA) in aquaculture in Spain in 2020 was 5,656, although this figure was distributed among 12,478 people. Most of these, 6,582, were non-salaried (self-employed), mainly from the mussel subsector. It was followed by 3,030 specialized operators, 1,846 non-specialized workers, 639 technicians with higher or intermediate degrees, 263 administrative workers and 118 people with other professional categories.

Since 2007 there has been an agreement in Spain between trade unions and employers to regulate minimum labour relations in marine aquaculture. On December 2 of 2021 was published in the BOE (Spanish Official Bulletin) the VI National Collective Agreement for Marine Aquaculture that applies for the period 2021-2022.

Employment in aquaculture continues to be dominated by men, and there are also notable differences in the distribution of jobs between genders. In 2020, the total number of women employed was 3,164 (18.8%) compared to 9,314 men (74.6%). In relation to the professional categories, the largest number of women occupy non-salaried (self-employed) positions with a total of 2.300 people, followed by non-specialized workers (265 women). Men occupy a higher percentage of the categories of non-salaried (self-employed) with 65.1% (4,283 people), and above 85% in specialized operating personnel (2.832 men) and non-specialized operators (1,581 men). In relation to the total of UTA, men agglutinate 81.2% and women 18.8% that in total add up to 5,656.

The evolution of employment in aquaculture in Spain shows over the years a decreasing trend in terms of the number of people employed, in 2020 the total number of employed people fell by -17.55% from 15,134 employees in 2019 to 12,478 in 2020, therefore, 2,656 people less. At the same time, the statistics measured in Annual Work Units (UTA) have decreased in 2020 by -15.84% from 6,720 to 5,656.

The estimate of indirect employment associated with the 12,478 people working in aquaculture was 31,195 people.

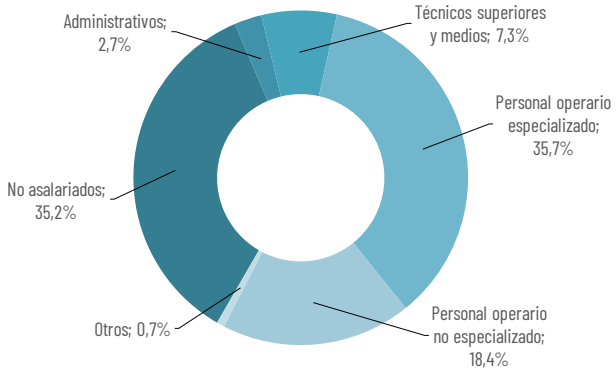


Figure 5-7. Distribution of employment in aquaculture in Spain, by professional category, in 2020 calculated on Annual Work Units (MAPA).

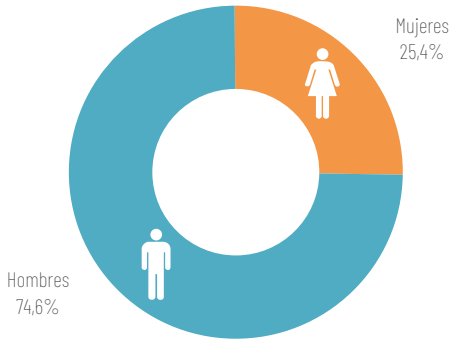


Figure 5-8. Distribution of employment by sex calculated on the number of people in aquaculture in Spain in 2020 (MAPA).

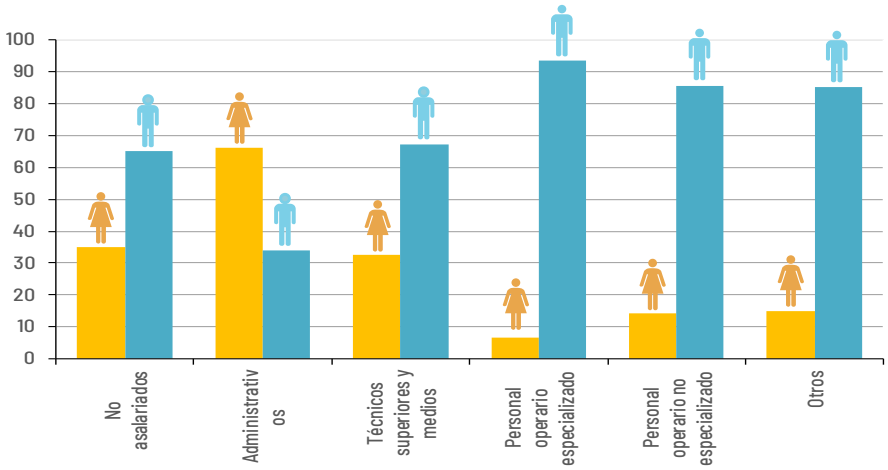


Figure 5-9. Employment by sex calculated on the number of people in aquaculture in Spain in 2020 (MAPA).

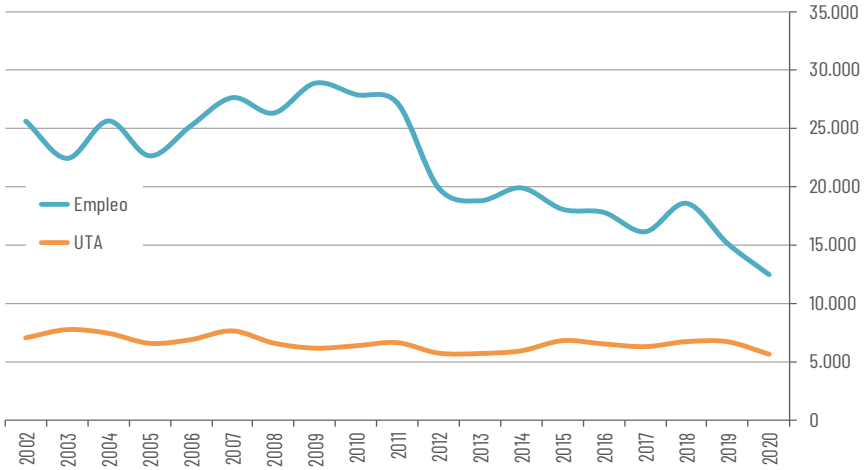


Figure 5-10. Evolution of employment in aquaculture in Spain during the period 2002-2020, showing the figures of people and Annual Work Units (MAPA).

5.5. Consumption of aquaculture feed in Spain

Feeding aquaculture animals, particularly fish, is a key element of their viability. The optimization of the use of raw materials, knowledge about nutrients, their digestibility and the correct handling of feed are essential for the responsible development of this activity. In 2021, 139,526 tonnes were used in Spain, a 48.6% more than the previous year with 93,881 tonnes. 85.3 % meaning 118,946 t of it was administered to marine fish: sea bass, meagre, turbot, sea bream, eel and sole, mainly. And the remaining 14.7%, 20,579 t to freshwater species such as rainbow trout and sturgeon. The amount of aquaculture feed used in Spain barely amounts to 1% of the total livestock feed consumed in this country.

The feed used in Spanish aquaculture farms is almost entirely extruded and has been produced mostly in the country itself, completed with imports from other EU Member States, mainly France and Portugal. The location in

Spain of feed mills facilitates the realization of an important research and innovation activity in the field of nutrition and feeding of fish. This innovation is promoted by the feed manufacturing companies themselves and by aquaculture companies, but public research centres and universities also play a crucial role.
In the cultivation of mollusks there is no consumption of feed because they filter the water to collect their nutrients. Its diet is based on the use of the natural productivity of the waters, whose nutrients favor the presence of plankton that is filtered and consumed by the mollusks. Galicia, which is the main mollusk producing region in Spain and Europe, stands out for the high natural productivity of its five estuaries.

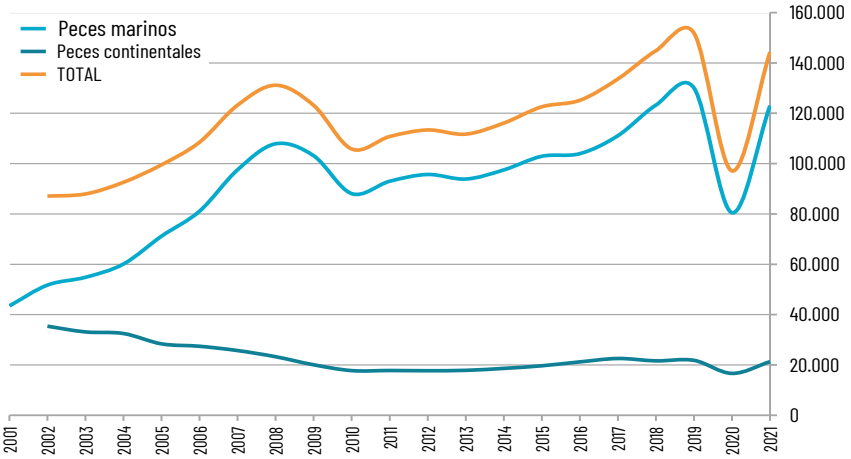


Figure 5-11.
Evolution of feed consumption (tonnes) for aquaculture in Spain broken down between marine and inland fish during the period 2001-2021 (Skretting and Biomar sources).

5.6. Marine aquaculture in Spain and Europe

The species produced by aquaculture in the Spanish marine waters, and covered in greater detail in this report, are sea bream, sea bass, turbot, meagre, sole, bluefin tuna, mussels, clams, oysters and abalones. Other species of interest such as eel, seriola, prawns, microalgae and macroalgae are also analyzed, but with a lesser degree of detail.

Marine finfish farming

The production of marine finfish species in Spain in 2021 was 58,761 tonnes, 13.7% more than in 2020 with 51,664 t. Fish farmers have made an important effort in 2020 and 2021 to recover the production that was affected by the previous climatic and epidemiological episodes.

Taking into account the total produced sea bream, sea bass, meagre, turbot, sole, eel and prawn, the Valencian Community is the one with the highest production of marine fish in Spain in 2021 with 14,575 tonnes, followed by Murcia with 11,368, Andalusia with 8,664, Galicia with 8,314, the Canary Islands with 5,676 tonnes and Catalonia with 95 tonnes.

The Region of Murcia has managed to recover its production in 2021 after being the most affected by epidemiological and climatic episodes, going from 4,777 t in 2020 to 11,368 t in 2021, a 138% more, thanks to the important effort of fish farmers. Andalusia has also managed to recover from the

past condition and goes from 5,195 tonnes in 2021 to 8,664 in 2021. It has been the Canary Islands that has experienced the greatest decrease, going from 7,489 tonnes in 2020 to 5,676 in 2021, that is, a -24% less. It is expected to reach approximately 54,500 tonnes in Spain by 2022.

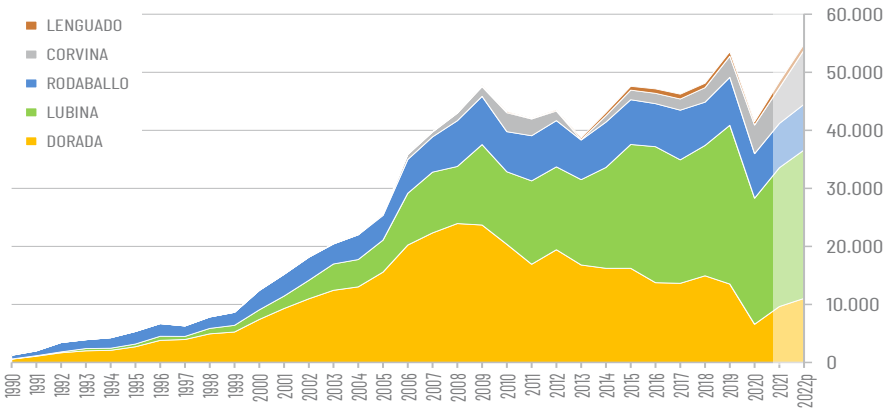


Figure 5-12. Evolution of the production (tonnes) of marine finfish in Spain in the period 1990-2022p

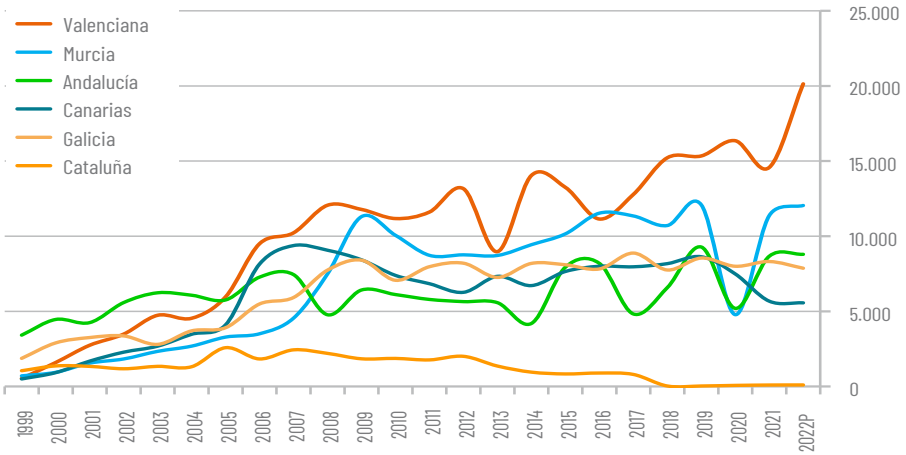


Figure 5-13. Evolution of the production (tonnes) of marine finfish in the different Autonomous Communities of Spain in the period 1999-2022p.

SEA BREAM production

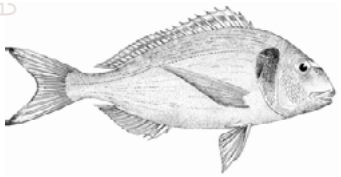
The total production of sea bream (*Sparus aurata*) in Europe and the rest of the Mediterranean in 2021 is estimated at 321,912 tonnes, according to data from APROMAR, FEAP and FAO. This quantity is a 12.6% higher than that of 2020 with 285,895 t. For 2022 it is estimated a growth of 1.8% to reach around 328,000 tonnes.

The total value at first sale of Mediterranean production sea bream harvested in 2021 is calculated at 1,448.6 million euros.

There is a production of sea bream in 20 countries, with the main producers being in Turkey with 135,000 tonnes (representing the 41.6% of total production), Greece with

especies

DORADA



Sparus aurata

SEA BREAM *(Sparus aurata)*

Class: Osteíctios Order: Perciformes · Family: Sparidae

Significant characters: High oval body and flattened laterally. Large head with arched profile. Silvery gray coloration with a dark spot at the beginning of the lateral line and a small scarlet band on the upper edge of the operculum. It shows a characteristic golden band between the eyes. Forked caudal fin. It reaches a size of up to 57 cm in length. It is a proterandric hermaphrodite animal, first matures as a male and from the second or third year becomes female. It can live more than 10 years.

Cultivation: Its breeding is carried out in almost all Mediterranean countries. Hatcheries produce eggs from breeding individuals under tightly controlled conditions. Each female lays 2 million eggs of 1 mm in diameter per kilo of weight. During their first month of life in production, the larvae feed on living organisms - rotifers and artemia. Then they start feeding with feed made from natural raw materials. Breeding facilities are varied: floating nurseries at sea, concrete tanks or ponds on land. Each sea bream takes between 18 and 24 months to reach 400g from the time it hatches from the egg. The commercial size ranges from 250 g to more than 2,000 g.

73,000 t (22.7 %), Egypt with 36,000 t (11.2 %), Tunisia with 16,000 t (5.0 %) and Spain with 9,632 t (3.0 %). Its cultivation is also carried out in Italy, Cyprus, Croatia and there are minor productions in: Malta, Israel, France, Portugal, Albania, Algeria, United Arab Emirates and Bosnia, among others.

The total production of juvenile sea bream in 2021 in Europe (including Turkey) is estimated to have been 709,417 million units, 8.9% more than in 2020. The main producing country is Turkey (250 million) followed by Greece (218 million). Further away are Italy (120 million), France (54.4 million) and Spain (27 million juveniles). In any case, the difficulty of contrasting these figures, especially in Greece and Turkey, should be pointed out again. It is estimated that the production of juvenile sea bream will increase by 3.9% in 2022, to 730 million units.

The unloading in fishing ports in the countries of the Mediterranean Sea and the Atlantic Ocean of sea bream from capture fishing totaled 8,646 tonnes in 2020, practically the same as in 2019 with 8,258 tonnes. This amount remains relatively constant in recent years, with an average of 8,000 tonnes per year in the last 10 years, while sea bream aquaculture accounts for 97% of the total supply of this species.

The production sea bream in Spain in 2021 has been 9,632 tonnes, 46.2% more than the previous year with 6,588 tonnes. By 2022 it is estimated to reach 11,000 tonnes. The highest annual Spanish production sea bream took place in 2008, with 23,930 t.

In 2021, the Valencian Community has led the production of production sea bream in Spain with 5,486 t (57 % of the total), followed by the Region of Murcia (2,461 t, 26 % of the total), Andalusia (960 t, 10 %) and Canary Islands (720 t, 8% of the total).

The production sea bream accounts for 97% of the total supply in the world compared to 3% of capture fisheries. In Spain, the aquaculture sea bream accounts for 83.8% of the supply, according to FAO data.

Although today a small amount of the sea bream caught by fishing vessels continues to arrive at Spanish fishing ports (1,246 tonnes in 2020), its volume between 800 and 1,200 tonnes in the last 10 years, while the sea bream from aquaculture represents the 83.8% of the total sea bream put on the market in 2020.

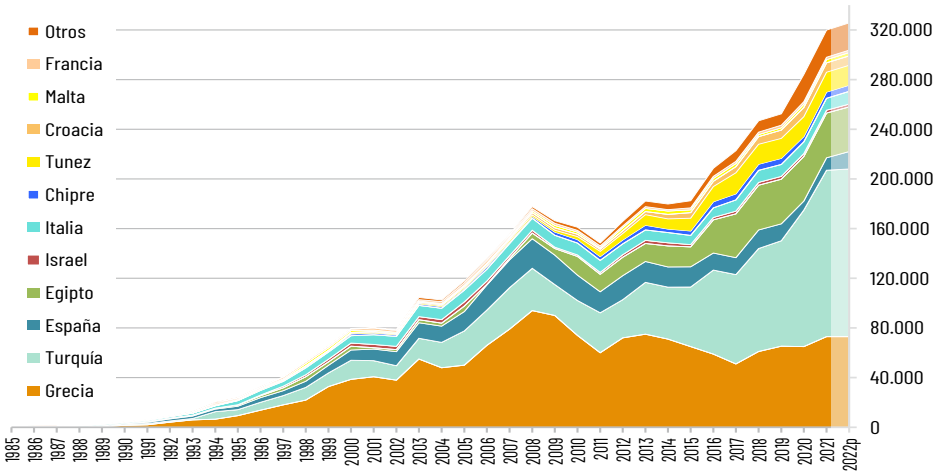


Figure 5-14. Evolution of the production (tonnes) of production sea bream in the Mediterranean area and the rest of the world in the period 1985-2022p (On FAO, FEAP and APROMAR data).

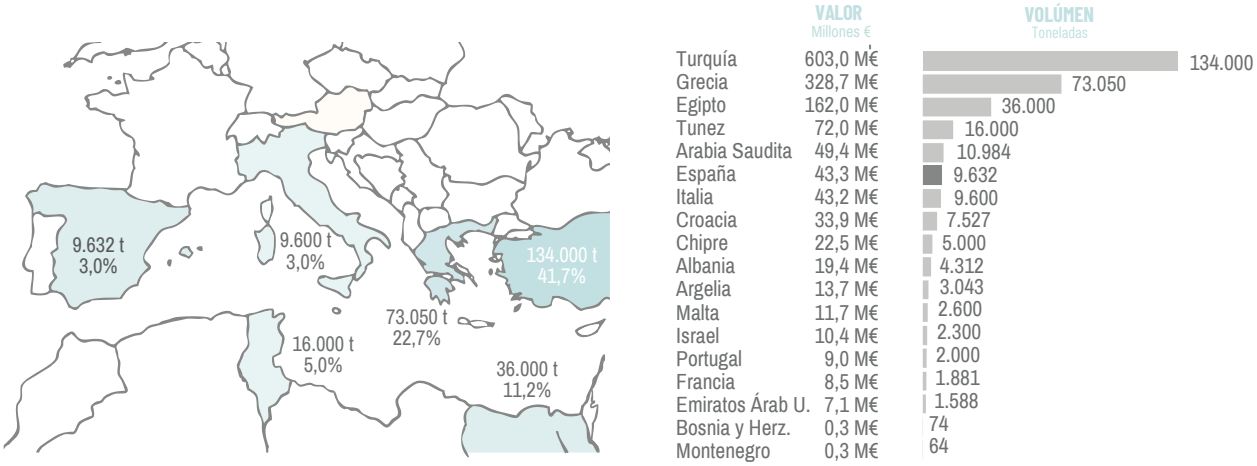


Figure 5-15. Distribution of production sea bream in the Mediterranean area by 2021 in volume (tonnes) and value (million euros), based on FAO, FEAP and APROMAR data.

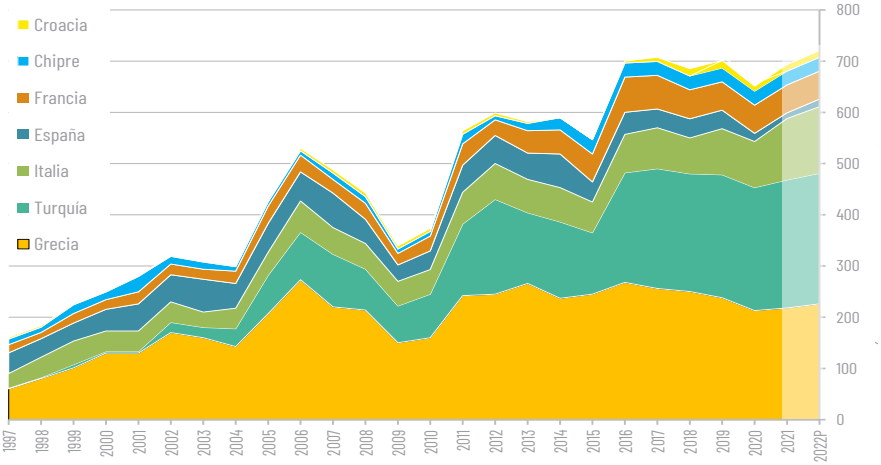


Figure 5-16. Evolution of the total production of juvenile sea bream (million units) in the Mediterranean area in the period 1997-2022p (on FEAP and APROMAR).

The production of juvenile sea bream in Spain in 2021 has been 27 million units. It is estimated that production in 2022 will decrease by around -9% and reach 24.5 million units. The production of juvenile sea bream was concentrated in 2021 in Andalusia (36%), the Region of Murcia (30%) and the Valencian Community (30%).

The average purchase price of young sea bream in Spain, at an equivalent weight of 2 g per unit, is estimated at 0.34 euros/unit.

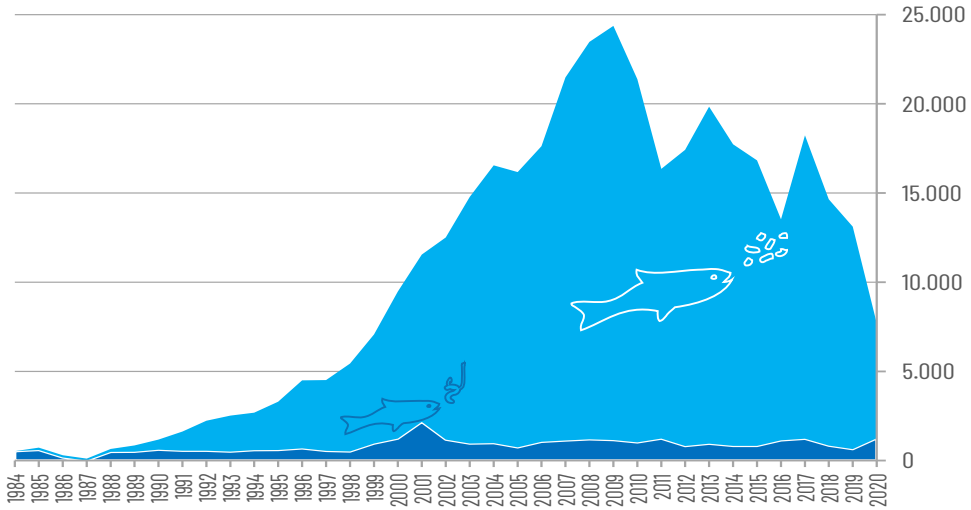


Figure 5-17. Evolution of world production (tonnes) of sea bream (Sparus aurata), through aquaculture and capture fisheries, in the period 1984-2020 (FAO).

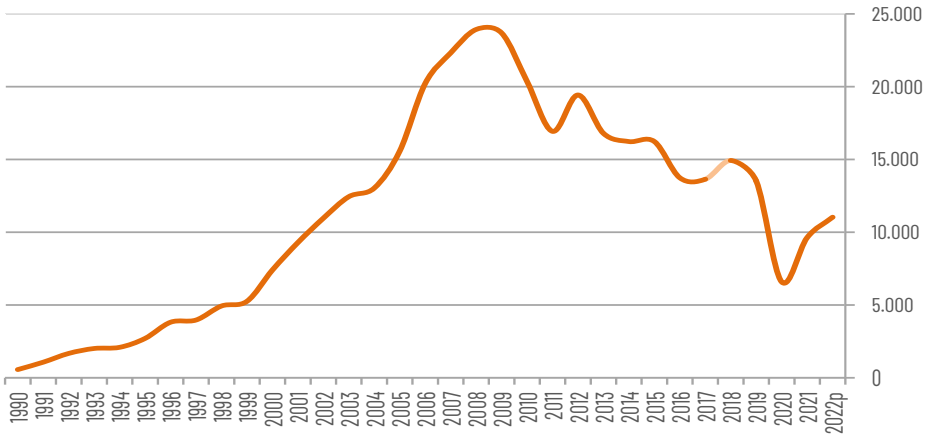


Figure 5-18. Evolution of production of sea bream (Sparus aurata) in Spain in tonnes (1990-2022p).

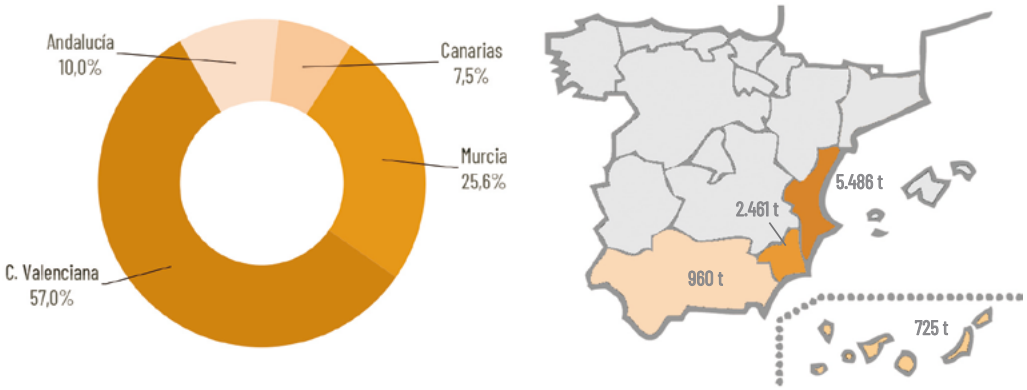


Figure 5-19. Percentage distribution of the productions (tonnes) of sea bream in Spain by Autonomous Communities in 2021

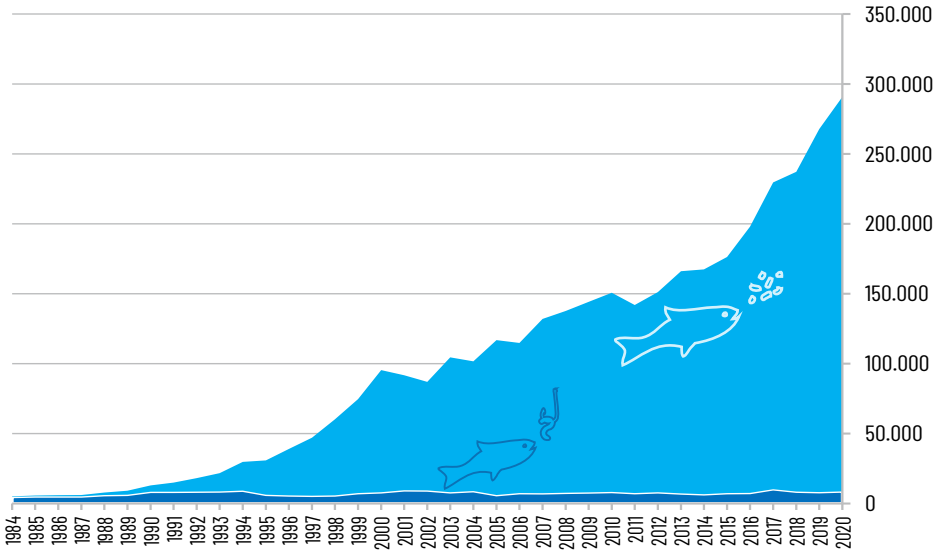


Figure 5-20. Evolution of the sources of sea bream (Sparus aurata) in Spain in tonnes: aquaculture and capture fisheries, in the period 1984-2020 (MAPA-FAO).

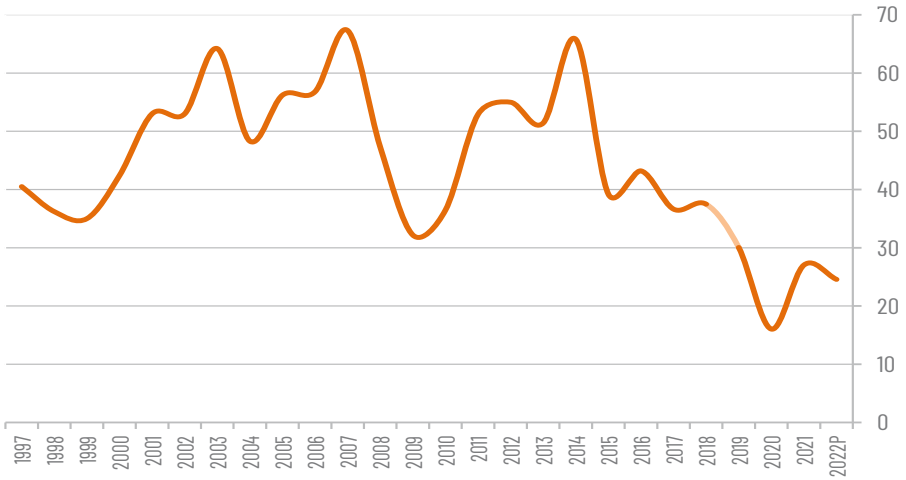


Figure 5-21. Evolution of the production of juvenile sea bream in Spain in millions of units (1997-2022p).

SEA BASS production

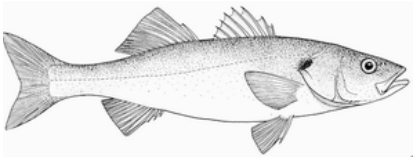
The total production of sea bass (*Dicentrarchus labrax*) in Europe and the rest of the Mediterranean arc in 2021 has been 298,083 tonnes, according to consolidated statistics from FAO, FEAP and APROMAR. This figure is 4.4% higher than the previous year with 228,506 t. For 2022 an increase of 3.7% is estimated to approximately 309,226 tonnes.

The total value in first sale of production sea bass in 2020 has been about 1,490.4 million euros.

The main sea bass producing countries are Turkey, with 156,000 tonnes (representing 52.3% of the total), Greece with 54,000 tonnes (17.6%), Egypt with 35,000 tonnes (11.4%) and Spain with 23,924 t (8.5 %). It is also produced sea bass in Italy, Egypt, Croatia, France, Tunisia, Portugal, Cyprus, Israel, United Kingdom, Bosnia, Algeria, Montenegro, Malta, Slovenia and Morocco.

The production of juvenile sea bass in 2021 in Europe (including Turkey) accounted to 598 million units, 8.8 % less than in 2020. The main producing country was Turkey with 240 million units, followed by Greece with 159.5 million and Italy with 100 million. While with minor productions are France (44.9 million) and Spain (58.3 million). By 2022 an estimated production of 614 million juvenile sea bass, i.e. 2.8 % more.

Although sea bass from capture fishing continues to be discharged in the fishing ports of several countries of the Mediterranean Sea and the Atlantic Ocean, in total 5,998 tonnes in 2020 (15.2% more than the previous year) according to FAO, while farmed sea bass accounts for 97.9% of the total of this species.
The production of sea bass in Spain in 2021 was 23,924 tonnes, a -10.2% less than in 2020. Andalusia has led the production with 7,365 tonnes (31% of the total), followed by the Region of Murcia (7,285 t, 30% of the total), the Canary Islands (4,951 t, 21%), Valencian Community (4,228 t, 18%) and Catalonia (90 t, 0.4%). For 2022 a growth of 6.9% is expected with a production in Spain of 25,576 t.



Dicentrarchus labrax

SEA BASS *(Dicentrarchus labrax)*

LUBINA

Class: Osteíctios Order: Perciformes · Family: Moronidae

Significant characters: Fusiform and vigorous body with large scales. Pointed head with small nasal openings, small eyes and large mouth. The lower jaw is somewhat prominent. Leaden gray coloration, darker on the dorsal part and silver sides. On the operculum has a black spot. Caudal fin slightly forked. It reaches a size of up to 70 cm in length. Tolerates wide variations in temperature and water salinity. The first sexual maturation usually occurs at 2-4 years. Its longevity is estimated at about 30 years.

Cultivation: Sea bass is a fish whose breeding is carried out in almost all Mediterranean countries. Hatcheries produce eggs from breeding individuals under tightly controlled conditions. Each female lays 250,000 eggs of 1 mm in diameter per kilo of weight. During their first month of life in production, the larvae feed on living organisms - rotifers and artemia. Then they start a diet based on feed made from natural raw materials. Breeding facilities are varied: floating nurseries at sea, concrete tanks or ponds on land. Each sea bass takes between 20 and 24 months to reach 400g from the time it hatches from the egg. The commercial size ranges from 250 g to more than 2,500 g.

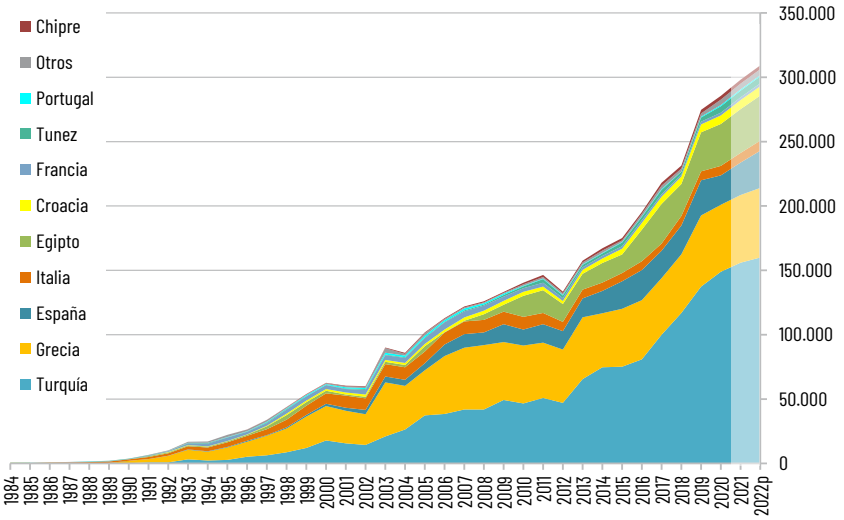
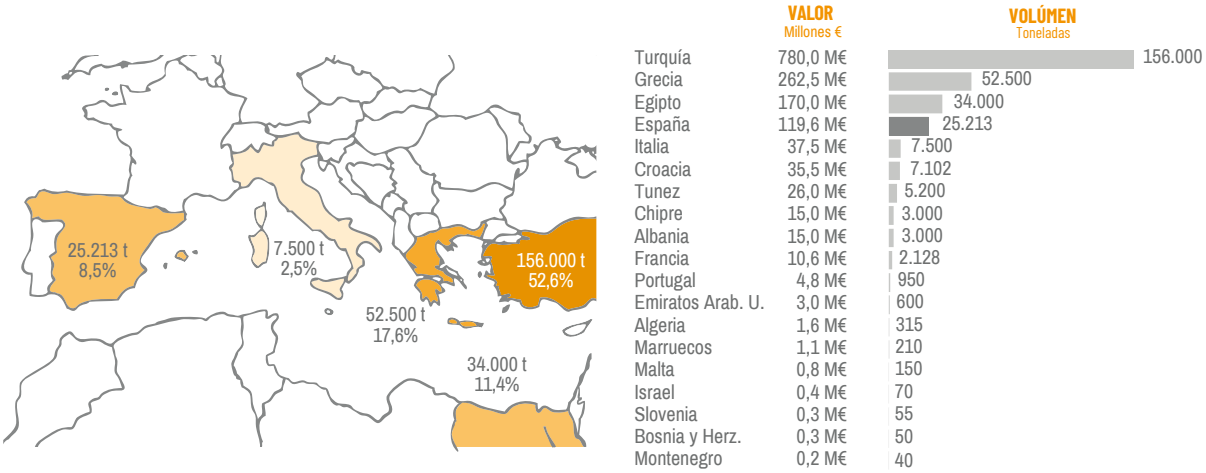


Figure 5-22. Evolution of the total production (tonnes) of sea bass in the Mediterranean area and the rest of the world in the period 1984-2022 p (FAO, FEAP and APROMAR data).



	VALOR Millones €	VOLÚMEN Toneladas
Turquía	780,0 M€	156.000
Grecia	262,5 M€	52.500
Egipto	170,0 M€	34.000
España	119,6 M€	25.213
Italia	37,5 M€	7.500
Croacia	35,5 M€	7.102
Tunez	26,0 M€	5.200
Chipre	15,0 M€	3.000
Albania	15,0 M€	3.000
Francia	10,6 M€	2.128
Portugal	4,8 M€	950
Emiratos Arab. U.	3,0 M€	600
Algeria	1,6 M€	315
Marruecos	1,1 M€	210
Malta	0,8 M€	150
Israel	0,4 M€	70
Slovenia	0,3 M€	55
Bosnia y Herz.	0,3 M€	50
Montenegro	0,2 M€	40

Figure 5-23. Distribution of sea bass production in the Mediterranean area by 2021 in volume (tonnes) and value (million euros), including FAO, FEAP and APROMAR data.

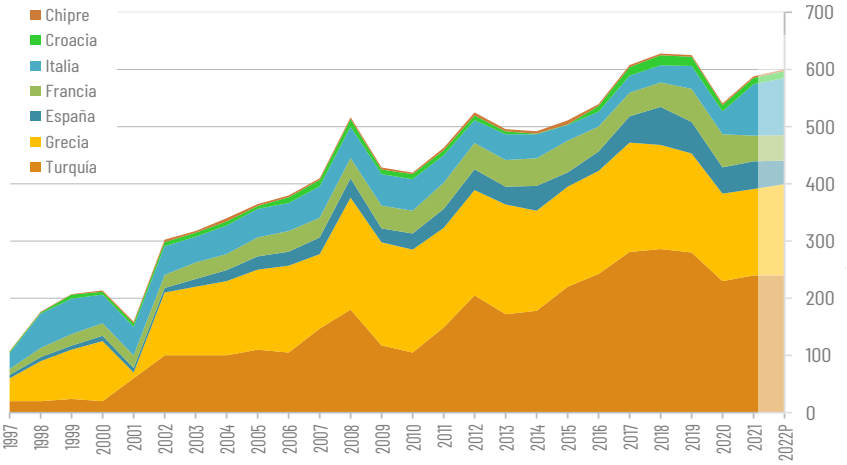


Figure 5-24. Evolution of the total production of juvenile sea bass in the Mediterranean area in the period 1997-2022p, in millions of units (on FEAP and APROMAR).

Although today a small amount of wild sea bass caught by fishing vessels continues to arrive at Spanish fishing ports (1,178 tonnes in 2020), its volume remains relatively constant around that amount, while farmed sea bass accounts for 93.5% of the total.

The production of juvenile sea bass in Spain in 2021 has been 58.3 million units, which represents an increase of 27.1% over the figure of 2020. The production of juvenile sea bass in Spain was carried out in the Balearic Islands (55%), the Valencian Community (14%) and Andalusia (31%). By 2022 it is estimated that the production of juvenile sea bass in Spain will fall slightly to 55.3 million units.

The average purchase price of juvenile sea bass in Spain, at an equivalent weight of 2 g per unit, is estimated at 0.33 euros/unit.

The Spanish production of sea bass of commercial size requires the import of juveniles additional to those of national production. The origin of these fish is, in order of importance, France, Italy and Greece. Although also from Spain juveniles are exported to other countries.

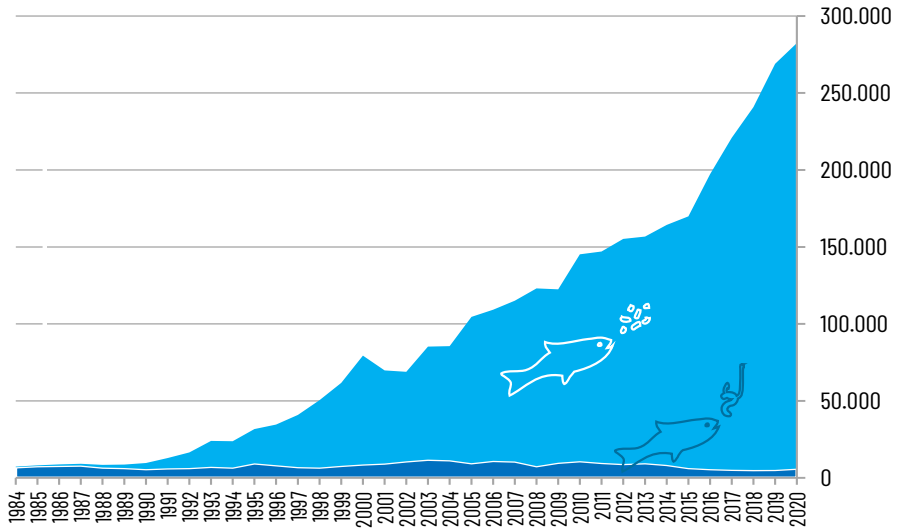


Figure 5-25. Evolution of total world production (tonnes) of sea bass (Dicentrarchus labrax) in aquaculture and capture fisheries, in the period 1984-2020 (FAO).

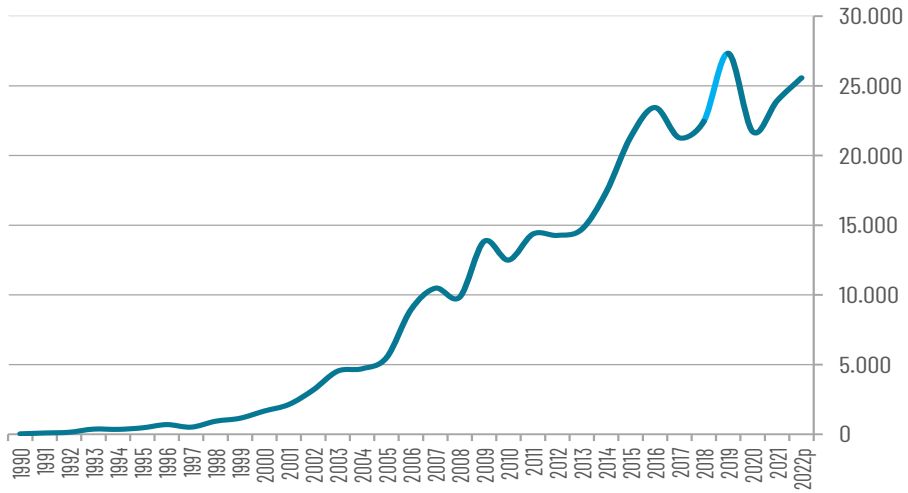


Figure 5-26. Evolution of the production of sea bass (Dicentrarchus labrax) in Spain in tonnes (1990-2022p).

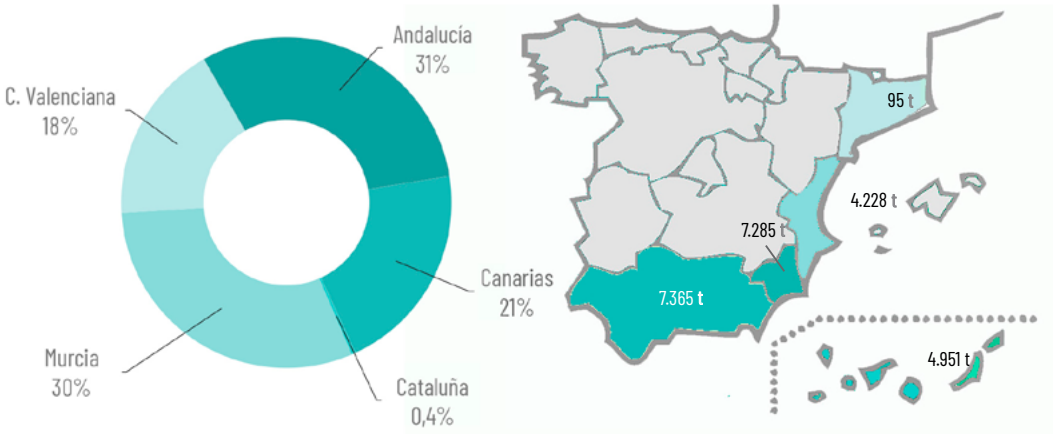


Figure 5-27. Percentage distribution of sea bass production (tonnes) in Spain by Autonomous Communities in 2021.

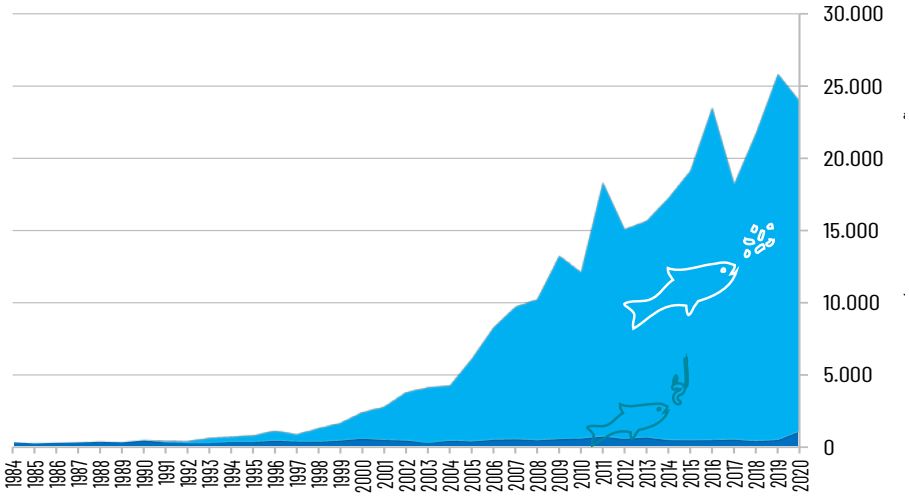


Figure 5-28. Evolution of the sources of obtaining sea bass (Dicentrarchus labrax) in Spain: aquaculture and capture fishing in tonnes, in the period 1984-2020 (MAPA-FAO).

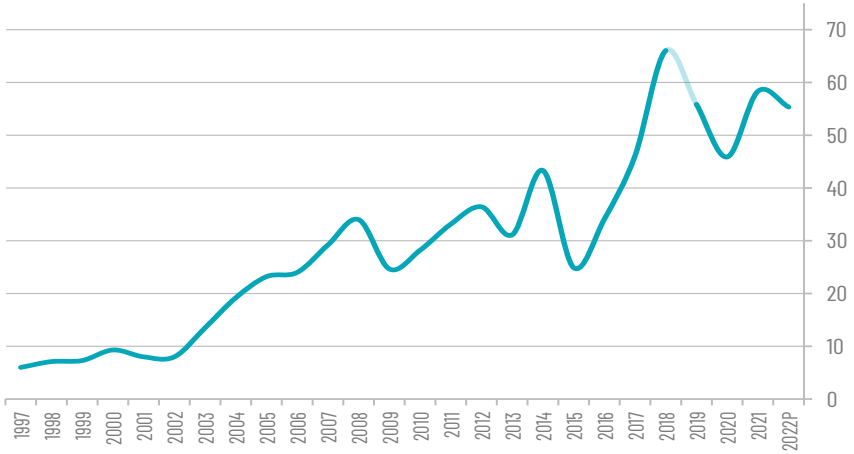


Figure 5-29. Evolution of the production of juvenile sea bass in Spain in millions of units (1997-2022p).

Joint figures of the production of SEA BREAM and SEA BASS

Given the very similar environmental and biological requirements of sea bream and sea bass, their forms of production are very similar. Therefore, on numerous occasions they are grown on the same farms and both are replaceable with each other. Even at the market level, the situation of sea bream affects that of sea bass, and vice versa. Therefore, it is interesting to show the joint analysis of the production of both species.

The total production of sea bream plus sea bass in Europe and the rest of the world in 2021 is estimated at 617,794, an 8.3% more than in 2020 with 570,638 tonnes, according to consolidated statistics from FEAP, APROMAR and FAO. For 2022 a growth of 2.5% is expected with an estimated production of 633,000 tonnes.

The combined production of juvenile sea bream plus sea bass in the Mediterranean area in 2021 (not including Egypt, nor Tunisia) has been 1,307 million units, which represents an increase of 9.7% over the previous year's figure. The main producing countries in order of importance are Turkey (490 million), Greece (369 million), Italy (210 million), France (99 million) and Spain (85 million). In 2021 production is expected to be approximately 3.1% more than the previous year assuming an approximate production of 1,344 million juveniles.

The total aquaculture production of sea bream plus sea bass in Spain in 2021 was 33,556 tonnes, 18.6% more than the previous year. The largest production took place in the Region of Murcia (29% of the total), Valencian Community (28.9% of the total), Andalusia (25%) and the Canary Islands (17%).

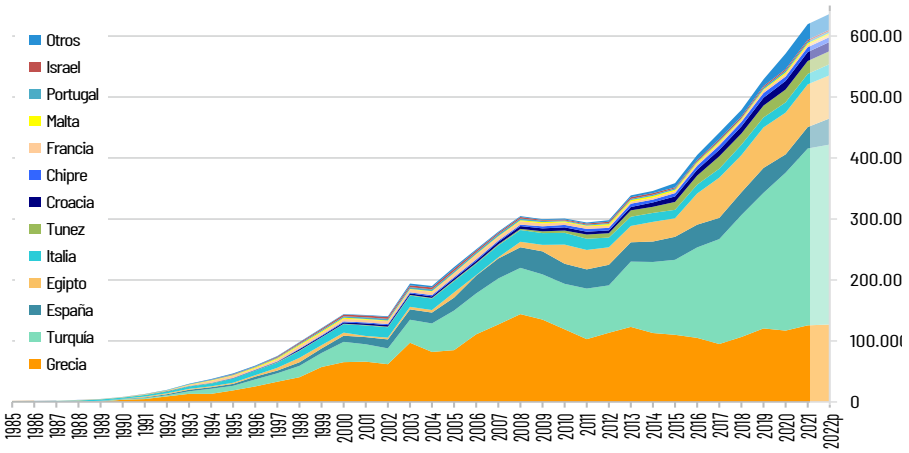


Figure 5-30. Evolution of the joint aquaculture production of sea bream and sea bass (tonnes) in the Mediterranean area and the rest of the world in the period 1985-2022p (On FAO, FEAP and APROMAR data).

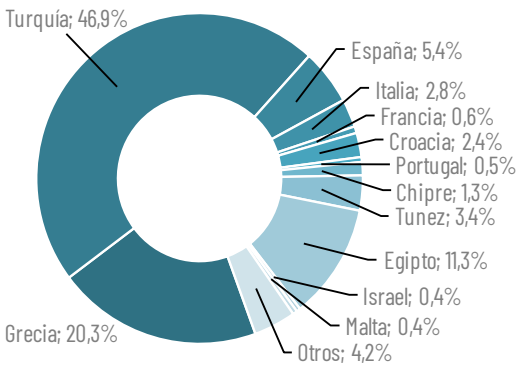


Figure 5-31. Distribution of aquaculture production of sea bream plus sea bass in the Mediterranean area by 2021 in volume (tonnes) and value (million euros), accordingto FAO, FEAP and APROMAR data.

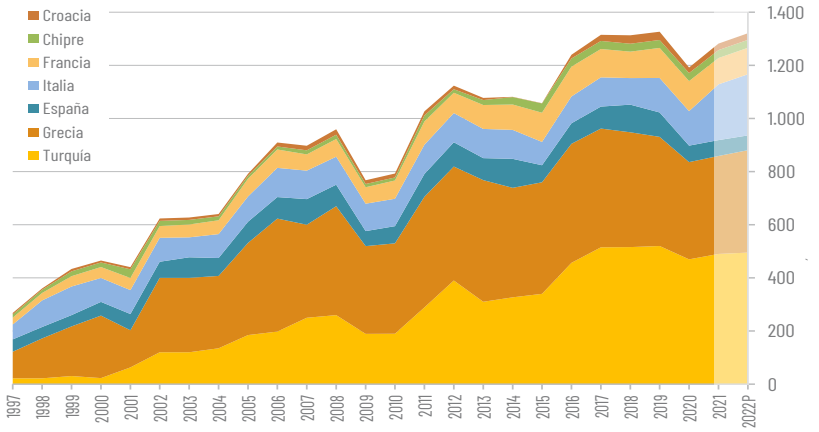


Figure 5-32. Evolution of the joint production of juvenile sea bream and sea bass in the Mediterranean area in the period 1997-2022p, in millions of units (on FEAP and APROMAR).

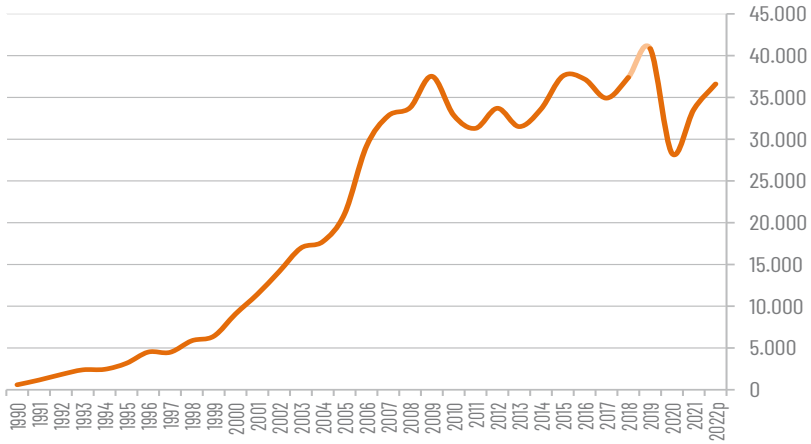


Figure 5-33. Evolution of aquaculture production of sea bream plus sea bass in Spain in tonnes (1990-2022p).

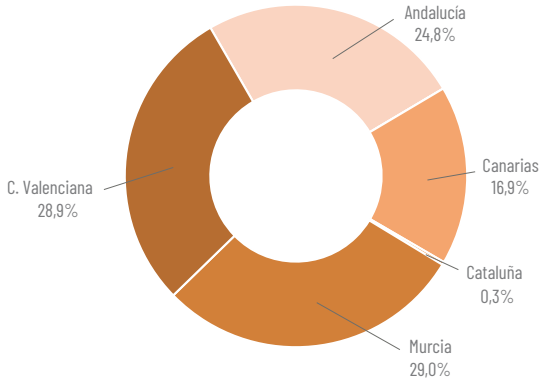


Figure 5-34. Percentage distribution of the productions (tonnes) of sea bream plus sea bass in Spain by Autonomous Communities in 2021.

TURBOT production

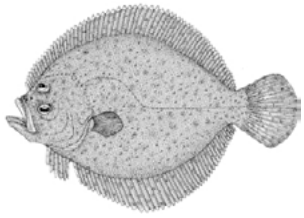
The total aquaculture production of turbot (*Scophthalmus maximus = Psetta maxima)* in the world in 2021 was 75,651 tonnes, -0.7 % more than the previous year. In China there is a very relevant aquaculture production of turbot of about 65,000 tonnes in 2021 according to FAO, although both the figures and the exact species are imprecise. In Europe the main producing country is Spain, which harvested 7,629 tonnes in 2021 (68.8 % of the total), -0.7 % less than in 2020. Portugal, with 3,300 tonnes is the second largest producer (29.8%) followed by France with 100 tonnes (0.9% of the total). By 2022 it is expected to remain similar at about 11,330 tonnes.

In the case of turbot, 92.4 % of the world is produced in aquaculture facilities (72,065 t in 2020) and the rest comes from capture fishing (6,963 tonnes).

The production of turbot in Spain in 2021 has been 7,629 tonnes, -0.7% more than the previous year. It is forecast to increase in 2022 to 7,800 tonnes. Galicia was the only autonomous community producing turbot in Spain.

As in the case of sea bream and sea bass, the amount of wild turbot caught by the Spanish fleet is increasingly scarce and testimonial for the markets (68 tonnes in 2019). The aquaculture production of turbot accounts for more than 99% of the production of this species in Spain. Although imports to Spain of capture fishing turbot from Europe, mainly from the Netherlands, are relevant.

The production of juvenile turbot in Spain in 2021 was 14 million units. In Galicia it was where all the juveniles of this species are produced. The average purchase price of turbot juveniles in Spain is estimated at 0.12 euros/unit.



Psetta maxima

RODABALLO

especies

TURBOT *(Psetta maxima)*

Kind: Osteíctios Order: Pleuronectiformes · Family: Scophthalmidae

Significant characters: **The body of the adult specimens does not present bilateral symmetry, being rounded and flattened. Bulging eyes, located on the left side. Large mouth with prominent jaw. Brownish upper color more or less dark, which varies according to the environment, presenting numerous spots that also cover the fins. The lower flank is depigmented. It can reach up to 100 cm in length. Reaches sexual maturity during the 4th or 5th year of life.**

Cultivation: **In production, reproduction takes place in hatcheries under very controlled conditions. The clutches are about 500,000 to 1,000,000 eggs per kilo of weight of the female. After an incubation period of 5 to 7 days the larvae hatch. During their first month of life in production they feed on living organisms: rotifers and artemia. Then they start a diet based on feed made with natural ingredients. Breeding facilities are usually circular concrete tanks in facilities on the coast.**

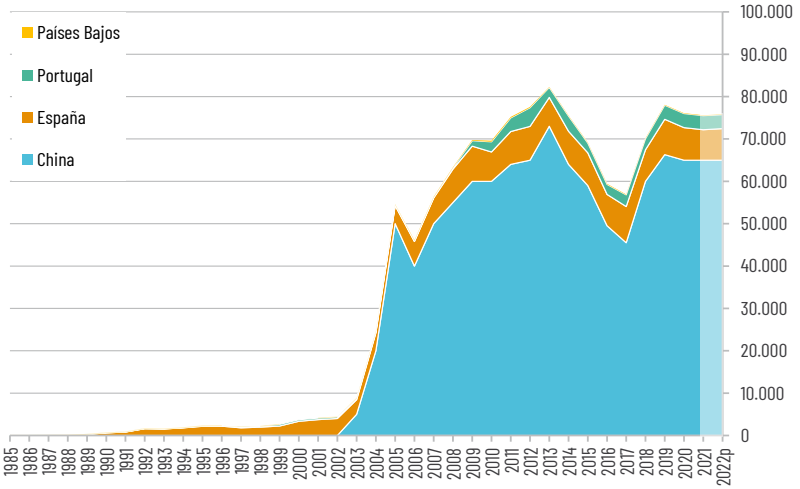


Figure 5-35. Evolution of the harvest (production) of turbot in Europe (tonnes) for the period 1985-2022p (On FAO, FEAP and APROMAR data).

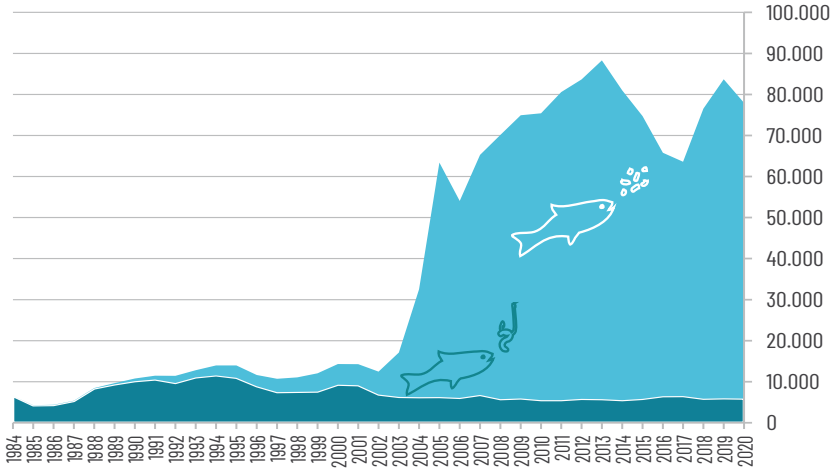


Figure 5-36. Evolution of world production (tonnes) of turbot (Psetta maxima), through aquaculture and capture fisheries, in the period 1985-2020 (FAO).

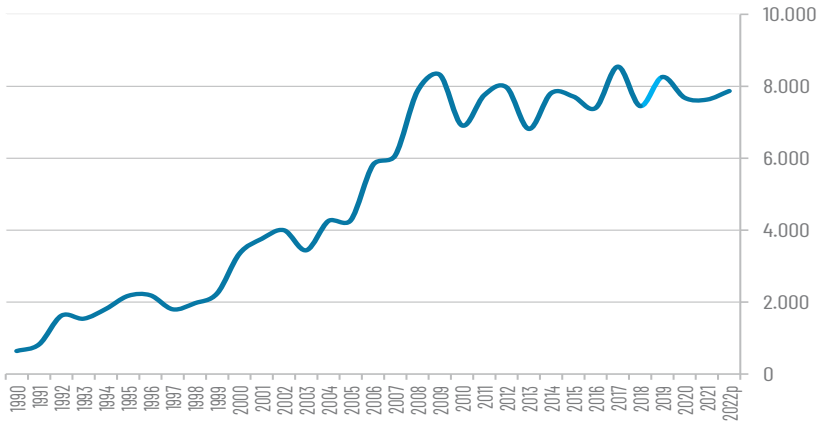


Figure 5-37. Evolution of the harvest (production) of turbot (Psetta maxima) in Spain in tonnes (2006-2022p).

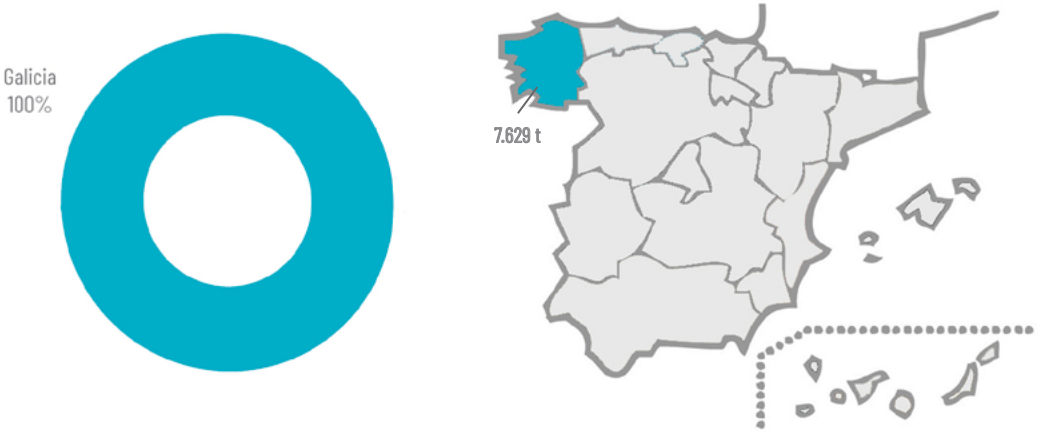


Figure 5-38. Distribution map of turbot production in Spain.

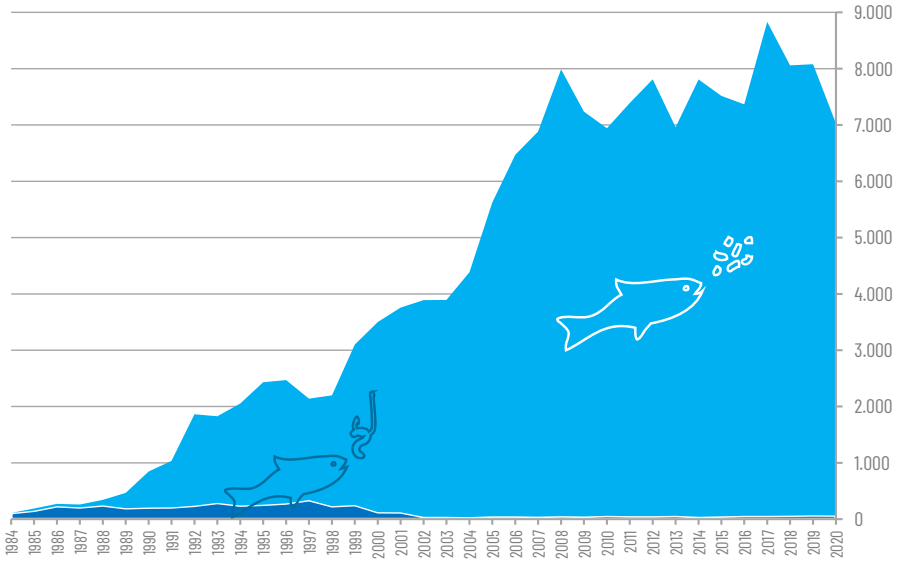


Figure 5-39. Evolution of the sources of turbot (Psetta maxima) in Spain: aquaculture and capture fisheries, for the period 1984-2020, in tonnes (MAPA-FAO).

Cultivation of CORVINA

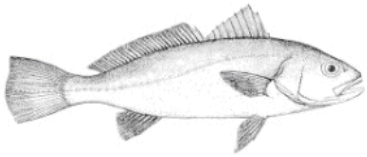
The aquaculture production of meagre (*Argyrosomus regius*) in the Mediterranean area in 2021 is estimated at 56,256 tonnes, representing a growth of 4.1% over the previous year. The main producing countries are Egypt (36,500 tonnes, 64.9 %), Spain (5,981 t, 10.6 %), Turkey (8,000 t, 14,2 %), and Greece (3,500 t, 6.2 %). For 2022 it is estimated a growth of 4.1% to exceed 56,256 tonnes.

Sea bass is a highly prized fish in those regions where it has traditionally been consumed. Recent increases in its production have begun to make it recognized in many new markets. In 2020 the world catches of this species were 7,414 tonnes, 9.1 % more than in 2019. Production farming therefore accounts for 87.8% of the world's meagre production.

The production of meagre by aquaculture in Spain in 2021 was 6,167 tonnes, 25.2% more than in 2020. This figure refers to fish placed on the market, and not to increases in live biomass. This nuance is important in a fish, such as sea bass, which is grown up to several kilograms of individual weight. The bulk of the Spanish meagre harvest comes from the Valencian Community, Murcia and Andalusia. For 2022 it is estimated a maximum production of 9,343 tonnes.

The total catch of meagre by fishing fleets in the world in 2020 was 7,414 tonnes. Of these, Spain captured 1,110 t.

In Spain, juveniles of this species are produced in Andalusia and the Region of Murcia. Some 7 million units were obtained in 2021 with an estimated value of 0.31 €.



Argyrosomus regius

CORVINA *(Argyrosomus regius)*

Class: Osteíctios Order: Perciformes · Family: Scienidae

Significant characters: Relatively large head and elongated body, gray-silver with a mixture of dark tones. The head is colored yellow with a rounded muzzle. Mouth in terminal position without chins, with conical and robust teeth. Small eyes. It reaches lengths of between 50 cm and up to 2m, and a weight of up to 40 kg kg.

Cultivation: The cultivation of meagre is carried out in various Mediterranean countries. Breeding centers produce eggs from breeding individuals under tightly controlled conditions. A female of 1 m in length produces more than 1 million eggs a year, which have a diameter of less than 1 mm. During their first month of life in production the larvae feed on living organisms: rotifers and artemia. They are then fed on feed made from natural raw materials. The breeding techniques are similar to those used for sea bass and sea bream, both in floating nurseries at sea and in earthen ponds. Meagres grow substantially faster than sea bream or sea bass, and can reach 1 kg in 12 months. The commercial size is between 1 and 4 kg.

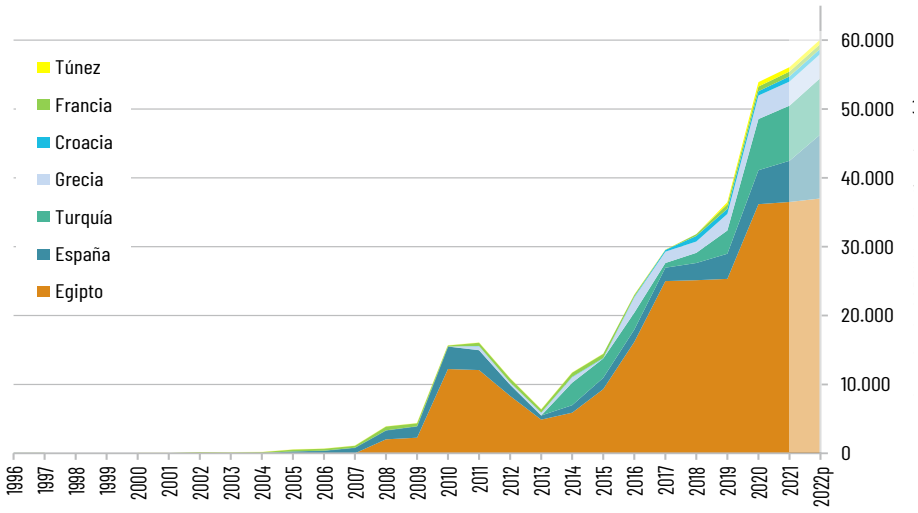


Figure 5-40.
Evolution of the harvest (production) of meagre (in tonnes) in the Mediterranean for the period 1996-2022p (On FAO, EAP and APROMAR data).

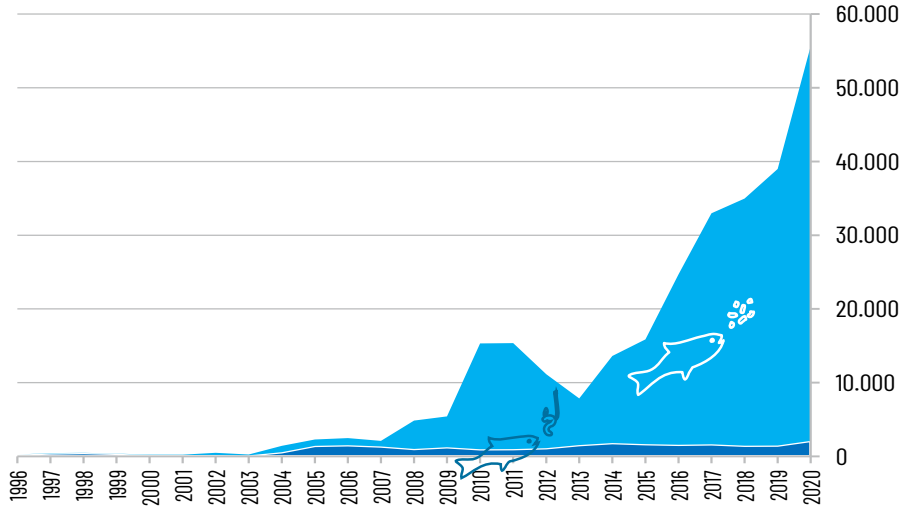


Figure 5-41.
Evolution of mediterranean production of meagre *(Argyrosomus regius)*, in tonnes, through aquaculture and capture fisheries, in the period 1996-2020 (FAO).

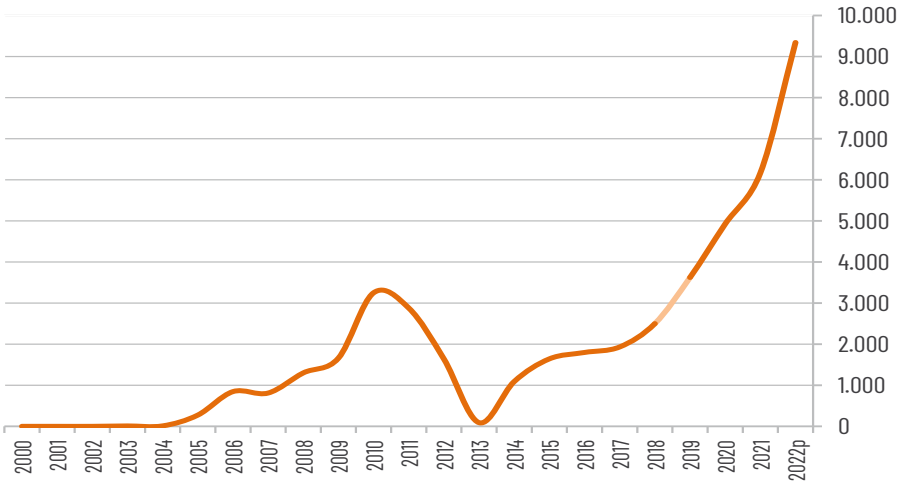
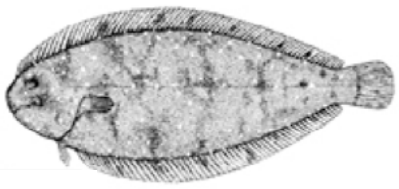


Figure 5-42.
Evolution of the harvest of meagre (Argyrosomus regius) in Spain in tonnes (2000-2021p).

SOLE production

In 2021 the world harvest of Senegalese sole (*Solea senegalensis*) from aquaculture was 1,480 tonnes, 37% more than the previous year. The same amount is foreseen for 2022. Senegalese sole capture by fishing landed 57 tonnes globally in 2020, of which 6 t in Spain, according to FAO.

In 2021, 1,020 tonnes of aquaculture sole were produced in Spain, 64.5 % more than in 2020. This production was located in Galicia (67%) and Andalusia 33%. The harvest of 2022 is estimated to be similar.



Solea senegalensis

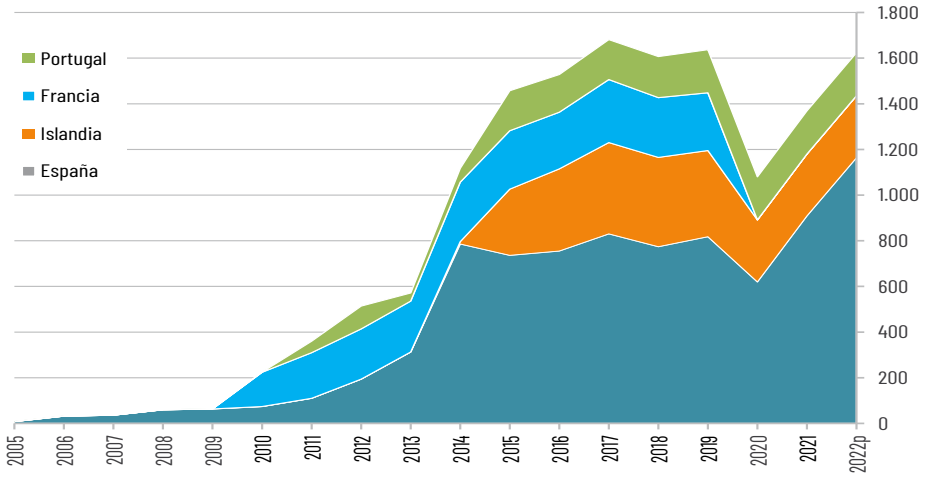


Figure 5-43. Evolution of the harvest (aquaculture production) of Senegalese sole (*Solea senegalensis*) in the world for the period 2005-2022p (on FAO, FEAP and APROMAR data).

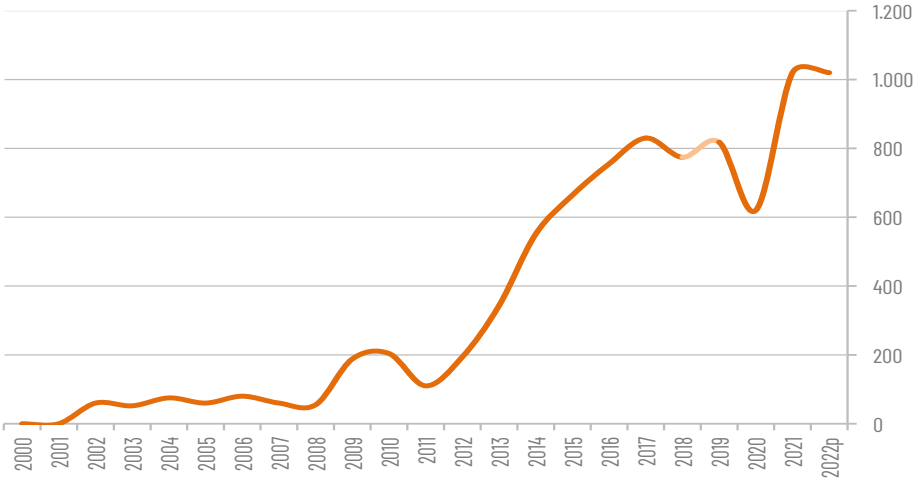
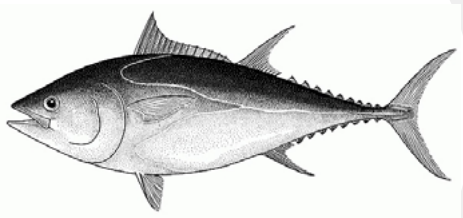


Figure 5-44. Evolution of the harvest (aquaculture production) of sole (*Solea senegalensis*) in Spain in tonnes (2000-2022p).

BLUEFIN TUNA Production

Almost all bluefin tuna (*Thunnus thynnus*) available on consumer markets originate from wild stocks. A part of them are put on the market immediately after their capture and are considered a product of capture fishing. But another part of the bluefin tuna, growing and now the majority, is caught alive by purse seine gear or traps and kept for months in production farms. In these farms, consisting of pens in the sea, bluefin tuna are fed to recover their optimal body condition after the breeding migration they will have made from the Atlantic Ocean to the interior of the Mediterranean Sea, and to regulate the market. But in addition to this partial production activity there is a remarkable scientific effort to close the production cycle and to breed bluefin tuna from egg to commercial size in captivity. Spain is a world leader in the research of the integral cultivation of bluefin tuna, especially through the Spanish Institute of Oceanography, and very satisfactory results have been achieved both in its reproduction and in the breeding up to commercial size.



Thunnus thynnus

World production of production bluefin tuna (Pacific, Atlantic and South) in 2020 was 70,086 tonnes, representing a notable increase

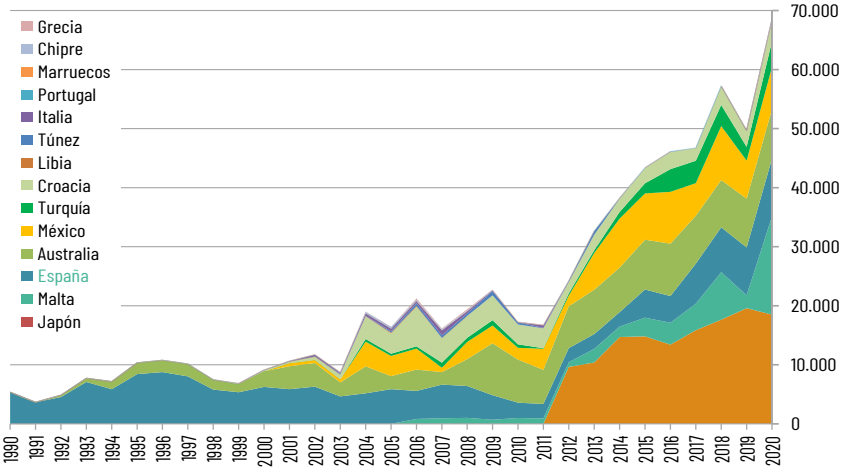


Figure 5-45. Evolution of aquaculture production (greasing) of bluefin tuna in the world for the period 1990-2019, in tonnes (on FAO data).

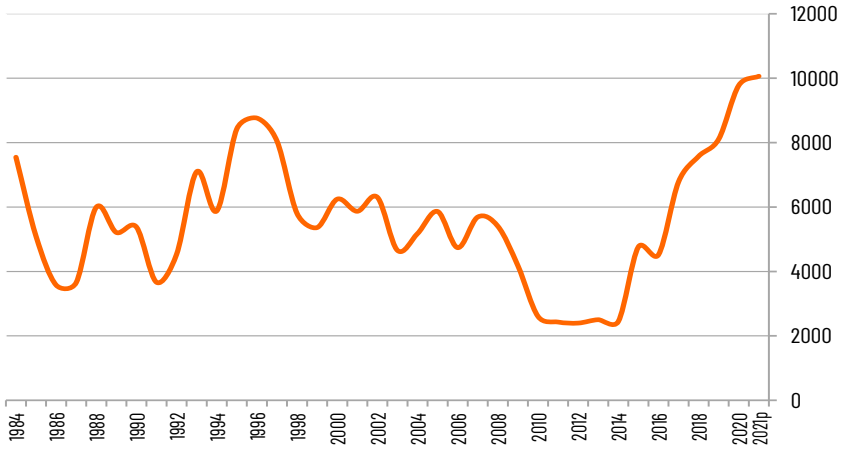


Figure 5-46. Evolution of the harvest (aquaculture production/ greasing) of bluefin tuna in Spain for the period 1984-2018 in tonnes (on MAPA-FAO data).

of 35.6% over the previous year. The main producing countries are Japan with 18,500 t that decreased its production by -6% and that represents 26.4% of the world total, Malta with 16,617 tonnes representing 23.7%, Spain with 9,776 tonnes (13.9% of the total), Australia with 8,345 tonnes (11.9% worldwide) and Mexico with 7,167 t (10.2%). Other countries are also producing as Turkey about 4,338 tonnes and Croatia 3,323 t. Bluefin tuna production is limited by internationally established catch quotas.

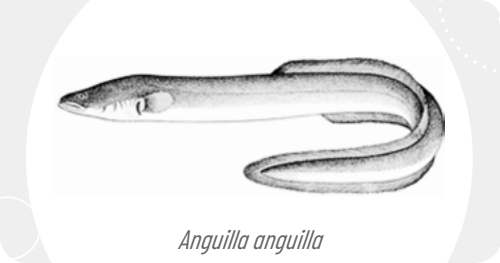
Aquaculture production of Bluefin Tuna (Pacific, Atlantic and South) in Spain in 2021 is estimated at about 10,062 tonnes. Of the specific production of bluefin tuna (*Thunnus thynnus*) about 4,500 tonnes were farmed in 2021. Much of the tuna was traded fresh and is considered a capture fishery product. It is estimated for 2022 a production of 5,548 t.

Production of other marine fish species

Production of EEL

The production of eel (*Anguilla anguilla*) is a traditional activity in Spain, with varying levels of intensification. Its production depends on the capture of wild eels since there is not enough scientific knowledge for their reproduction in captivity. That is why its future is very conditioned by the European Recovery Plan for this species.

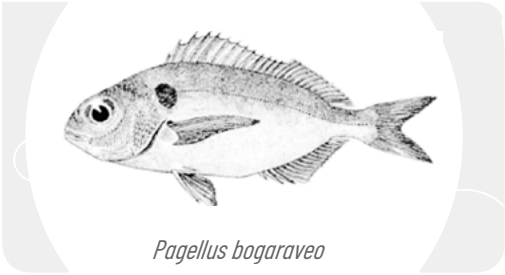
The Spanish production at commercial level of 2021, located mainly in the Valencian Community, was 320 tonnes. Its destination is both the repopulation of rivers and for consumption. At European level, 2020 were produced through cultivation 5,398 tonnes of European eel, -0.7% than in 2019 (5,435 t), with the Netherlands (2,150 t), Germany (1,207 t), Italy (700 t), Denmark (456 t) and Greece (404 t) standing out as producing countries.



Anguilla anguilla

Cultivation of BLACKSPOT SEABREAM

The cultivation of Blackspot seabream (*Pagellus bogaraveo*) in Europe was carried out only in Galicia but this cultivation ended in 2019. There are lines of research on its cultivation in several other Spanish autonomous communities that could reverse this situation.



Pagellus bogaraveo

Cultivation of GREATER AMBERJACK

Greater amberjack production of the species *Seriola dumerili*, also called Lemonfish, is currently being incorporated into aquaculture production on a commercial scale in Spain, although it is incipient. It is the culmination of many years of scientific research and technological development. With its cultivation, new business opportunities and job creation are opened, becoming one of the species with the greatest potential for Spanish production.

Seriola dumerili

It is a fish very well valued in its quality by people who know it. In 2020, 70 tonnes were produced in the United Arab Emirates, 21 tonnes in Greece and 18 tonnes in Spain. There are other species of Seriola more farmed in the world, such as *Seriola quinqueradiata*, with more than 138,900 tonnes harvested annually in Japan, although cultivated from wild juveniles.

In 2021, the aquaculture production of *Seriola dumerili* in Spain has increased reaching 123 tonnes and it is expected that in 2022, production will remain similar. In addition, juveniles of this species are produced in Spain in the Valencian Community.

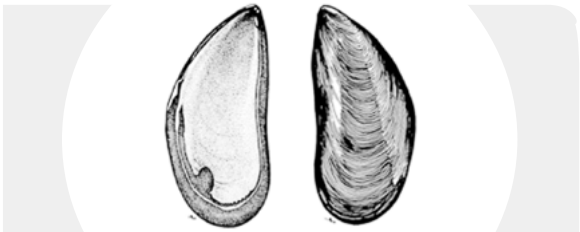
Mollusk production

Spanish production stands out as a reference at European and world level for the quantity and quality of its mollusk farming. In the year 2021 accounted for the harvest of 258,387 tonnes, 7.8 % more than in the previous year (236,900 (t) with a first sale value of EUR 135.1 million euros).

MUSSEL Cultivation

The mussel harvest in Spain was around 226,000 tonnes on average in the last 10 years. The year-on-year differences are not conditioned so much by the production capacity, which is stable, but by the greater or lesser incidence of red tide episodes that prevent the regular collection of the mollusk. The mussel harvest in Spain in 2021 is estimated at 255,303 tonnes, and a total value on first sale of 110.8 million euros.

Five are the Spanish autonomous communities in which mussels are grown, but it settles mainly in the Galician estuaries through its traditional cultivation in platforms. Galician production represents 97% of the total national mussel, but there are also productions in Catalonia, Andalusia, the Valencian Community and the Balearic Islands.



Mytilus edulis

The mussel seed (cheek) is usually collected from the natural environment, or collected using collecting ropes, for later stringing in platforms or long-lines.

A 62% of the mussel harvested in Spain is marketed by producers to the fresh market, that is, destined for sewage treatment plants; while the remaining 38% goes to the industry of the processing sector, that is, to cookers and canneries.

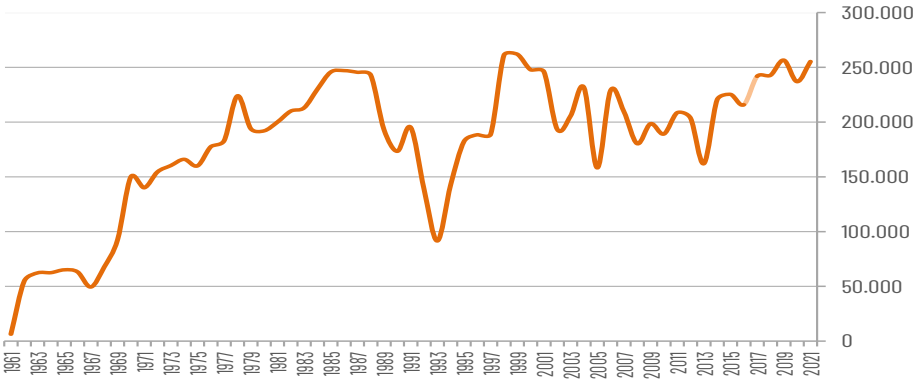


Figure 5-47. Evolution of mussel aquaculture production in Spain between 1961 and 2021 in tonnes (according to MAPA-APROMAR).

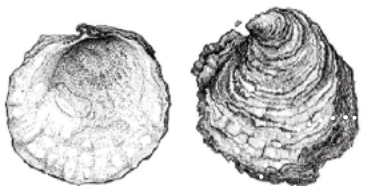
OYSTERS Production

Oysters are an important group of mollusks in economic terms in Spain. There are two cultivated species: the flat oyster (*Ostrea edulis*) and the Japanese oyster or Japanese oyster (*Crassostrea gigas*). The combined production in 2021 of both species was 1,331 tonnes, 21.8% more than the previous year with 1,093 t, and its economic value in first sale was 4.2 million euros.

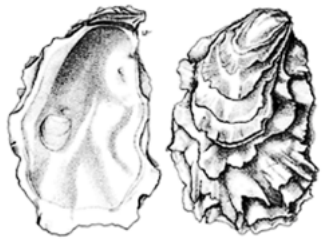
Of the Japanese oyster species, 1,074 tonnes were produced in 2021 in Spain, mainly in Galicia, Catalonia, Andalusia, Asturias, Cantabria and the Valencian Community. Its total value in the first sale was 2.8 million euros.

Galicia is the main autonomous community producing flat oysters, followed by the Valencian Community. In total, 257 tonnes of this species were produced in Spain in 2021, with a value of 1.4 million euros.

Oyster cultivation can be done through several techniques, but the usual ones in Spain are intertidal cultivation in coastal areas, or in vertical cultivation from platforms using baskets. Oyster seed is obtained from hatcheries, both domestic and imported.



Ostrea edulis



Crassostrea gigas

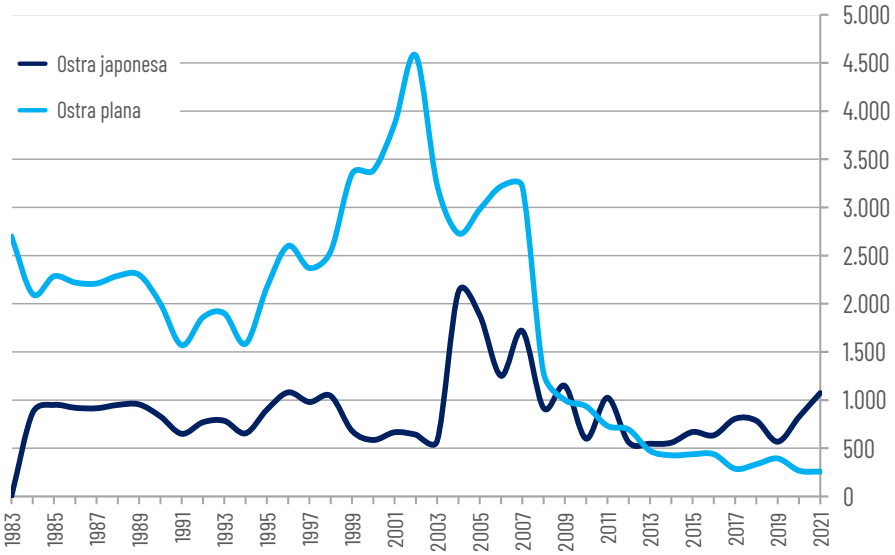


Figure 5-48. Evolution oyster production in Spain between 1983 and 2021 in tonnes (according to MAPA-APROMAR).

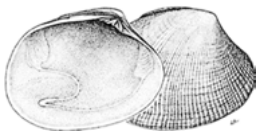
CLAM production

In Spain three species of clams are cultivated: fine, slug and Japanese, with a joint production in 2021 of 1,752 tonnes and an economic value in first sale of 20.1 million euros.

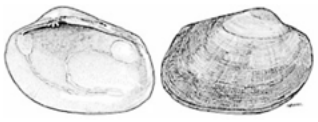
The Japanese clam *(Ruditapes philippinarum)* is the main species of clam grown in Spain. It has a shell whose color varies between brown, gray and black, with very marked stretch marks that form grids. It is known as Italian clam, because of the importance of its production in that country. In 2021 its production in Spain was 1,467 tonnes, with a first-sale value of 13.9 million euros.

The fine clam *(Ruditapes decussatus)* is also known as carril clam. Its color, between white and light brown, varies depending on the sand where it is raised. The inner face is bright white with yellowish tones, sometimes bluish in the area near the umbo that is located in the anterior part of the shell. In the year 2021, 145 tonnes of this species were produced in Spain, which reached an economic value in its first sale of 3.7 million euros.

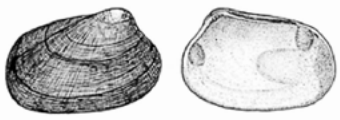
The slug clam *(Venerupis pullastra)* is gray or cream with brown spots. Its shell is oval and on its outer surface it has concentric lines that intersect with finer radial lines. In 2021, 140 tonnes were produced in Spain, with an economic value in first sale of 2.5 million euros.



Ruditapes philippinarum



Venerupis pullastra



Ruditapes decussatus

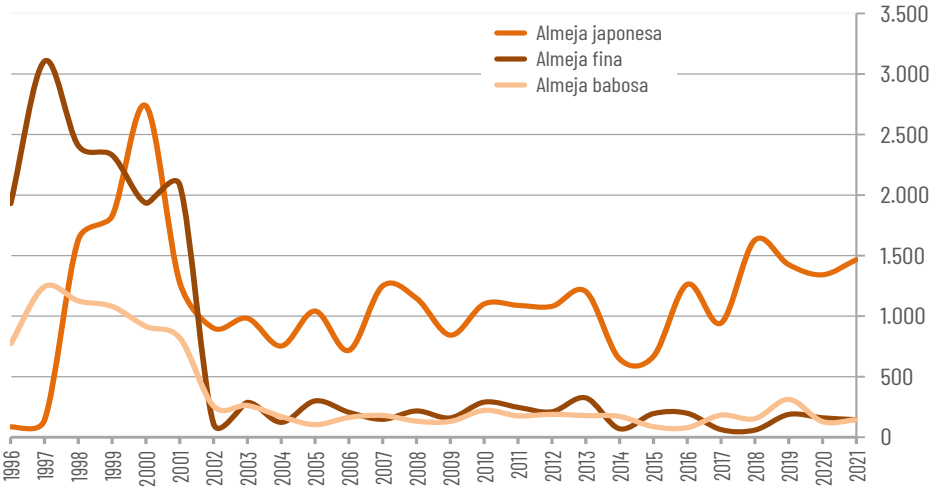


Figure 5-49. Evolution of production clam in Spain between 1996 and 2021 in tonnes (according to MAPA-APROMAR).

The seed for the production of clam comes from hatcheries and to a lesser extent from its collection in natural banks.

In Spain, clam cultivation is carried out in coastal areas or in natural banks with good water flow and at different depths depending on the species.

In all cases its cultivation is based on the care of the sandy bottoms, the elimination of algae, the control of predators, the oxygenation of the substrate, the rarity of the population when it is excessive and the planting of juvenile specimens.

Cultivation of other species

MICROALGAE production

In various regions of Spain are located companies dedicated to the commercial production of microalgae. Its facilities are sophisticated and develop important efforts in research, development and innovation. The destination of the microalgae produced is human nutrition, animal feed (including production), biofuels and cosmetics, among others. In Andalusia, some 0.8 t of microalgae were produced in 2020. The main cultivated species are *Nannochloropsis gaditana, Tetraselmis chuii, Isochrysis galbana* and *Phaeodactylum tricornutum*. In addition to its direct commercialization, the cultivation of microalgae is common in the hatcheries of fish, mollusks and crustaceans as food for the larval phases of cultivated animals.

Microalga

Microalgae have been incorporated in 2015 into the European Regulation on organic production, as well as their recognition as food products as a natural source of Omega-3 oils, which opens up new marketing possibilities.

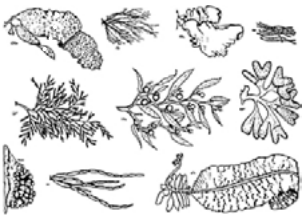
SHRIMP farming

Currently, a single shrimp farm is in operation in Spain, located in Medina del Campo (Valladolid), which has been demonstrating great dynamism and capacity for innovation. The species produced is white shrimp (*Litopenaeus vannamei*) and they stand out for the quality and freshness of their productions. In 2021, 7 tonnes of this species were produced in Spain.

Litopenaeus vannamei

Production of MACROALGAE

The use of macroalgae for uses such as obtaining different phycocolloids (alginates, agar and carrageenans) or as an agricultural fertilizer is traditional on the north coast of Spain. Most macroalgae are obtained from the natural environment without greater human intervention than the removal by hand or the collection of arribazones, but there are several initiatives underway for their cultivation. These macroalgae production initiatives produce species with superior added value because they are used for direct human food or as a source of bioactive compounds. The species currently cultivated are "sugar kombu" (*Saccharina latissima*), "sea lettuce" (*Ulva spp.*) and red algae known under the name "ogonori" (*Gracilaria spp., Gracilariopsis spp.*). In 2020, 5 tonnes were produced mainly in Galicia (83%) and Andalusia (17%).



Macroalgas

5.7. Freshwater aquaculture in Spain and Europe

Freshwater aquaculture is carried out in rivers, ponds and lakes. In Spain the main species produced by this aquaculture method are rainbow trout, several species of sturgeons and tench. There are also minor productions of common carp and Nile tilapia.

RAINBOW TROUT production

The world aquaculture production of rainbow trout (*Oncorhynchus mykiss*) in 2020 was 959,694 tonnes, representing an increase of 6.3% over the previous year with 902,570 tonnes.

The main producer countries are Iran with 197,370 tonnes (20.6 % of the world total), Turkey with 144,283 tonnes (15 %), Norway with 96,132 tonnes (10 %), Chile with 87,724 tonnes (9.1 %), and Peru with 54,188 tonnes (5.6 %). Other relevant countries are by production volume: China, Russia, Italy, Denmark, France, Colombia and the USA. It is a species produced in 79 countries distributed throughout the five continents, even if it is native to North America.

Most rainbow trout are produced in fresh water (70 %), but a significant part of their production ends their breeding in salt water, especially in Chile and Norway.

Commercial capture fisheries in freshwater for rainbow trout is very small and amounted to only 1,525 tons worldwide in 2020, in countries such as Uzbekistan, Mexico, Peru and the United Kingdom.

The production of rainbow trout in Spain in 2021 is estimated to have been 15,357 tonnes, -20.8 % more than in the previous year. For 2022 a slight increase is expected to reach 16,631 t, although both productions are far away from the peak of 35,384 tonnes in 2001. The main producing regions are Castilla y León, Galicia, Andalusia, Catalonia, La Rioja, Castilla la Mancha, Asturias and Aragon.

Rainbow trout production is changing in recent years to grow larger trout. This is due to the stagnation of the price of ration trout and the new opportunities offered by the HORECA market for fish weighing more than 1Kg.

Oncorhynchus mykiss

RAINBOW TROUT *(Oncorhynchus mykiss)*

Kind: Actinopterygii Order: Salmoniformes · Family: Salmonidae

Significant characters: Body of elongated shape, fusiform and adipose fin present. Blue to olive green coloration on a pink iridescent band along the lateral line and silver below it. Spine, sides, head and fins covered with small black dots. The coloration varies from intense dark to bright-silver.

Cultivation: Its upbringing takes place in half the world. Females are capable of producing up to 2,000 eggs per kg of body weight. The eggs are relatively large in size (3-7 mm in diameter). After hatching, the fry are nourished for a short period of time from the reserve food provided by the vitelline vesicle. Then they start a diet based on feed made with natural ingredients. Aquaculture farms are varied, with ponds on land, concrete or fiber facilities and even cages in fresh or salt water. Rainbow trout usually take 10 months from hatching to reach ration size (250-300 g), although commercial sizes reach several kilograms in weight.

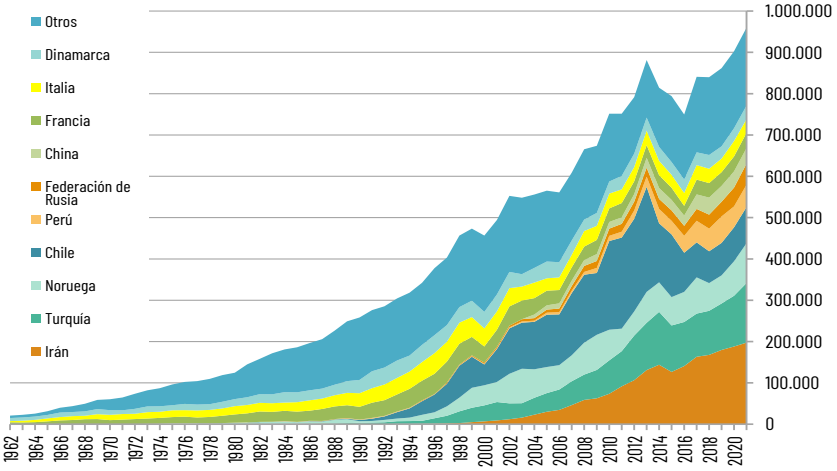


Figure 5-50. Evolution of rainbow trout aquaculture production in the world in the period 1962-2020 tonnes (on FAO data).

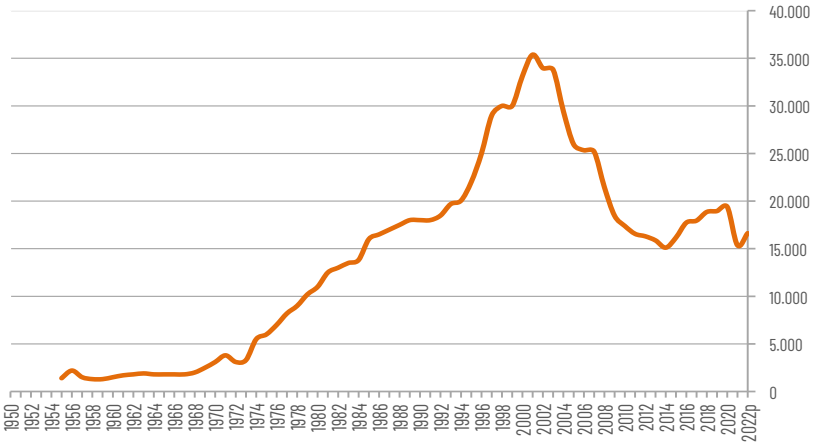


Figure 5-51. Evolution of aquaculture production of rainbow trout in Spain in tonnes (1950-2022 p). APROMAR data.

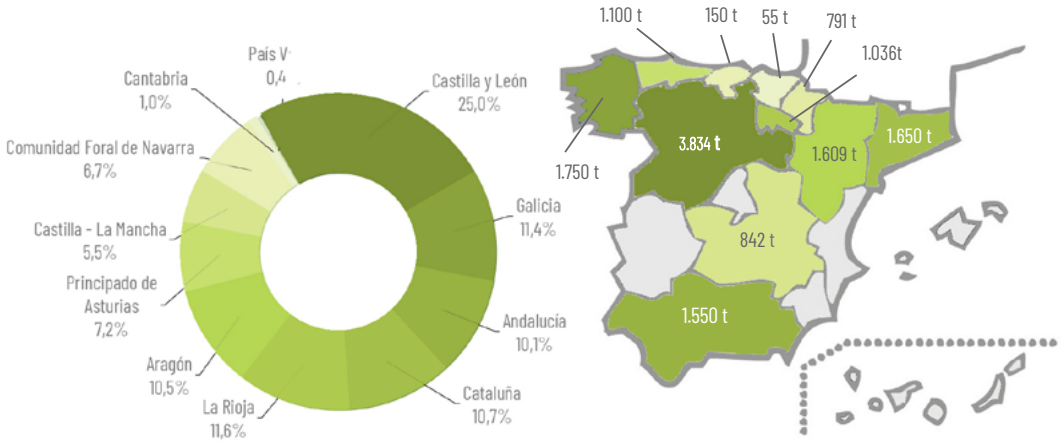


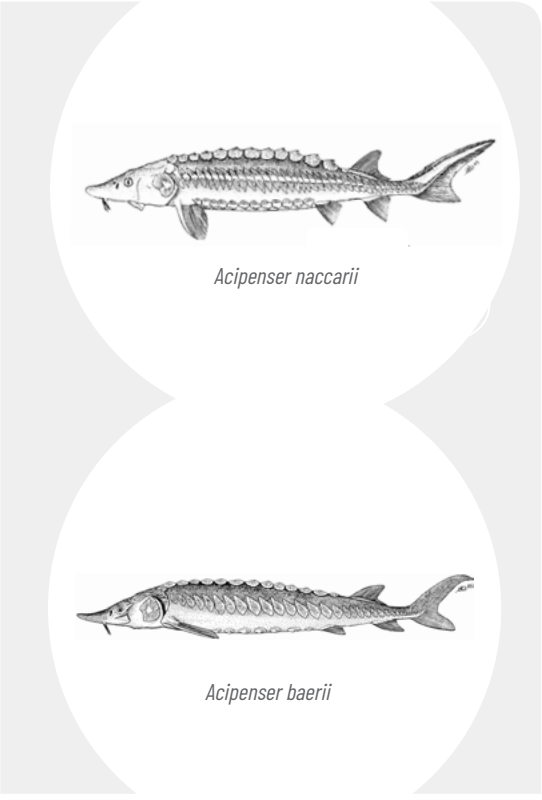
Figure 5-52. Distribution of the rainbow trout aquaculture among the autonomous communities in 2021 (MAPA data).

STURGEON production

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) agreed in 2006 to ban caviar exports in the face of severe declines in wild sturgeon populations. From that moment began the interest in the aquaculture of the various species of sturgeon for the production of farmed caviar, which is authorized to be traded internationally. Since then, the only caviar that can be purchased in international markets is the one obtained by growing these fish. There are several species of sturgeon cultivated in the world, all included within the family Acipenseridae: Siberian sturgeon (*Acipenser baerii baerii*), Russian or Danube sturgeon (*Acipenser gueldenstaedtii*), beluga sturgeon (*Huso huso*), barren sturgeon (*Acipenser ruthenus*), starry sturgeon or Sevruga (*Acipenser stellatus*), white sturgeon (*Acipenser transmontanus*) and Adriatic sturgeon (*Acipenser naccarii*).

The world production of caviar has been about 450 tonnes in 2020, of which 207 tons have been produced in Europe (46.0%). It is estimated that global caviar production will remain at 450 tons in 2021.

Although the main product of sturgeon aquaculture is the production of caviar, the meat of these fish is also valued and put on the market for consumption. In the world, it is estimated that some 123,476 tons of sturgeon meat were produced in 2020. Capture fisheries for sturgeon continues in some countries such as Canada, Russia, the United States and Iran, in 2020, 260 tons were obtained.



Acipenser naccarii

Acipenser baerii

In Spain, 4.3 tons of caviar were produced in 2021 and 131 tons of sturgeon meat. The two species produced are Adriatic sturgeon and to a lesser extent Siberian sturgeon.

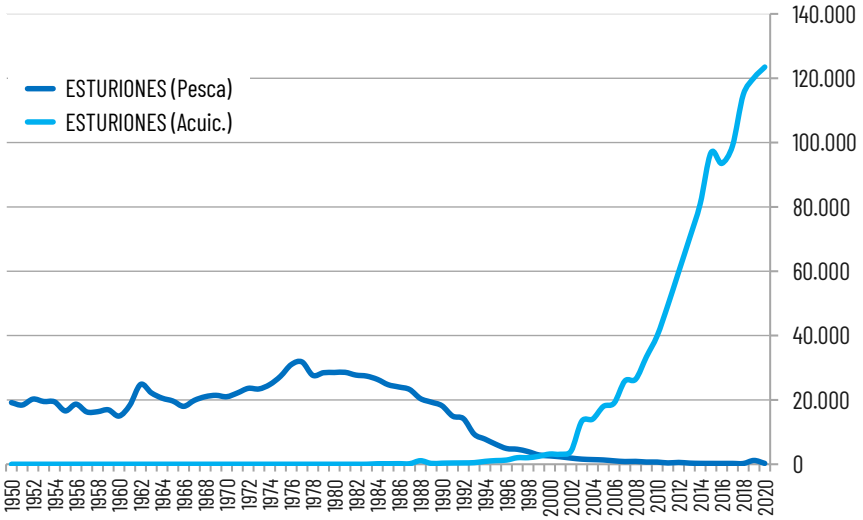


Figure 5-53. Evolution of world sturgeon production (fisheries and aquaculture) between 1950 and 2020 (FAO data).

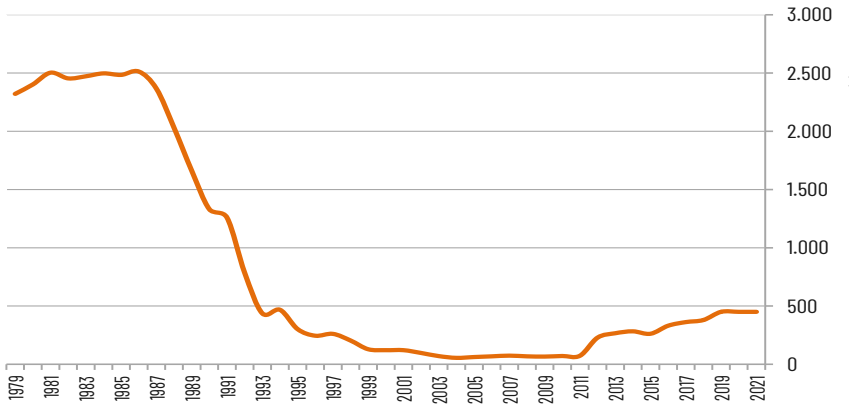


Figure 5-54. Evolution of world caviar production (originating from both capture fisheries and aquaculture) in tonnes, between 1979 and 2021 (FAO and FEAP data).

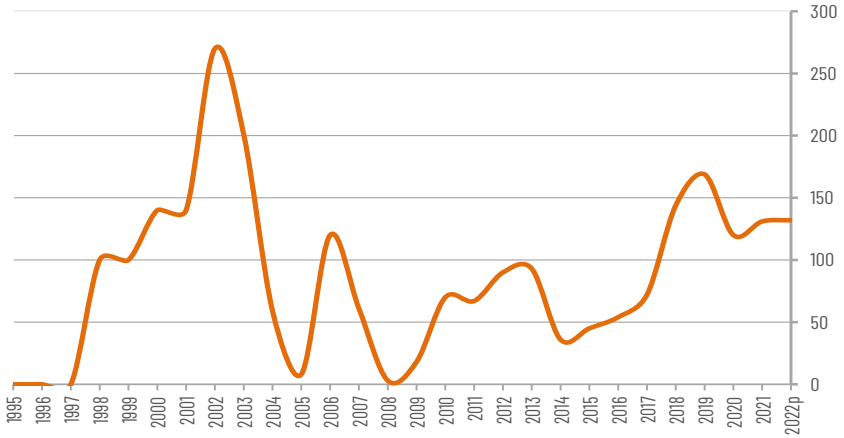
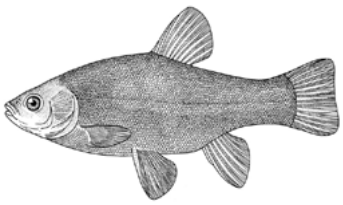


Figure 5-55. Evolution of aquaculture production of sturgeons (several species) in Spain in tonnes (1995-2022 p). Data APROMAR-MAPA-FAO.

TENCH production

The tench (*Tinca tinca*) is an exclusively European species. Its cultivation accounted for a total of 738 tons in 2020. France is the main producer (240 t), followed by Poland (160 t), the Czech Republic (135 t) and Germany (121 t). Tench is harvested in 20 countries.

In Spain, 17.5 tons were produced in 2021, grown in ponds, mainly in the autonomous community of Extremadura and less in Castilla y León. This figure is far from the maximums it reached at the end of the eighties around 450 tons. APROMAR is developing in 2022 a project to analyze the causes of this decline and promote the aquaculture of this species as a model of sustainable rural development together with the Association of Tech Farmers of Extremadura (Ibertenca).



Tinca tinca

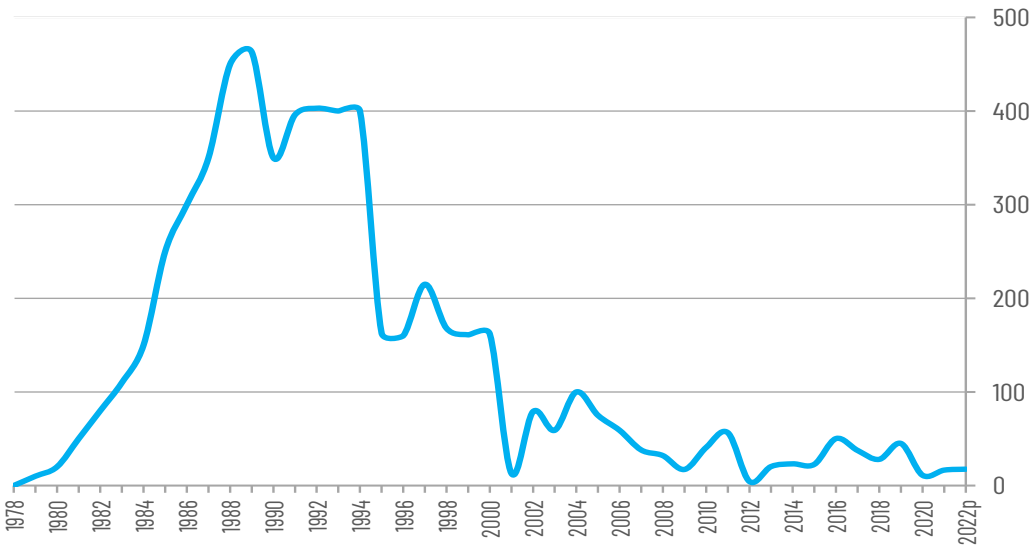


Figure 5-56. Evolution of the aquaculture production of tench (Tinca tinca) in Spain in tons (1978-2022 p). MAPA-FAO data.

Table 5-1. Data on production of farmed aquaculture species in Spain (tonnes).

DORADA	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022P
Andalucía	1.786	1.136	2.333	1.605	980	1.560	1.606	920	960	960
Baleares	0	0	0	0	0	0	0	0	0	0
Canarias	3.013	1.588	1.884	2.492	2.063	2.380	2.380	1.893	725	600
Cataluña	1.292	952	514	656	654	0	0	0	0	0
Murcia	3.730	3.892	4.103	3.368	4.356	3.184	2.906	1.107	2.461	1.715
Valenciana	6.974	8.662	7.397	5.619	5.590	7.806	6.629	2.668	5.486	7.760
TOTAL	**16.795**	**16.230**	**16.231**	**13.740**	**13.643**	**14.930**	**13.521**	**6.588**	**9.632**	**11.035**
Variación %	-13,6%	-3,4%	0,0%	-15,3%	-0,7%	9,4%	-9,4%	-51,3%	46,2%	14,6%
Precio €/Kg.	4,79	5,45	5,84	5,78	4,87	4,37	4,10	4,20	0,00	0,00
Valor (M€)	**80,4**	**88,5**	**94,8**	**79,4**	**66,4**	**65,2**	**55,4**	**27,7**	**0,0**	**0,0**

LUBINA	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022P
Andalucía	3.777	2.815	5.356	6.081	3.261	4.479	7.120	3.950	7.365	7.494
Canarias	4.286	5.097	5.767	5.507	5.900	5.793	6.253	5.596	4.951	4.964
Cataluña	66	0	318	236	146	30	30	70	95	100
Murcia	4.987	5.519	6.009	8.164	6.990	7.525	9.181	3.585	7.285	8.920
Valenciana	1.591	3.945	3.874	3.457	4.972	4.633	4.751	8.508	4.228	4.098
TOTAL	**14.707**	**17.376**	**21.324**	**23.445**	**21.269**	**22.460**	**27.335**	**21.709**	**23.924**	**25.576**
Variación %	3,1%	18,1%	22,7%	9,9%	-9,3%	5,6%	21,7%	-20,6%	10,2%	6,9%
Precio €/Kg.	5,35 €	5,79 €	5,64 €	5,67 €	5,18 €	4,64 €	3,80 €	4,30 €		
Valor (M€)	**78,7**	**100,6**	**120,3**	**132,93**	**110,17**	**104,21**	**103,87**	**93,35**		

RODABALLO	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022P
Asturias	0	0	0	0	0	0,00	0	0	0	0
Cantabria	75	75	108	50	105	100,00	0	0	0	0
Galicia	6.729	7.733	7.607	7.346	8.441	7.350,00	8.258	7.681	7.629	7.868
País Vasco	10	0	0	0	0	0,00	0	0	0	0
TOTAL	**6.814**	**7.808**	**7.715**	**7.396**	**8.546**	**7.450**	**8.258**	**7.681**	**7.629**	**7.868**

CORVINA	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022P
Andalucía	0	0	0	46	46	50	23	23	4	5
Canarias	0	0	0	0	0	0	0	0	0	0
Cataluña	0	0	0	0	0	0	0	0	0	0
Murcia	0	23	42	0	0	0	0	85	1.622	1.409
Valenciana	89	1.067	1.600	1.752	1.886	2.450	3.600	4.817	4.541	7.929
TOTAL	**89**	**1.090**	**1.642**	**1.798**	**1.932**	**2.500**	**3.623**	**4.925**	**6.167**	**9.343**

ANGUILA	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022P
TOTAL	**315**	**366**	**380**	**315**	**330**	**330**	**360**	**360**	**320**	**350**

BESUGO	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022P
TOTAL	**228**	**172**	**104**	**178**	**142**	**113**	**0**	**0**	**0**	**0**

LENGUADO	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022P
TOTAL	**343**	**551**	**664**	**755**	**830**	**774**	**818**	**620**	**1.020**	**1.020**

LANGOSTINO	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022P
TOTAL	**0**	**4**	**5**	**8**	**5**	**5**	**5**	**5**	**7**	**7**

TOTAL MARINOS	39.291	43.597	48.065	47.635	46.697	48.562	53.920	41.888	48.699	55.199

TRUCHA	2018	2019	2020	2021	2022P
Castilla y León	4.975	5.888	3.617	3.834	3.602
Galicia	2.689	1.840	1.363	1.750	2.541
Andalucía	1.380	1.448	1.587	1.550	1.600
Cataluña	1.630	1.921	1.652	1.650	1.750
La Rioja	1.728	1.912	1.728	1.781	1.745
Aragón	1.191	1.098	637	1.609	1.900
Principado de Asturias	704	922	1.160	1.100	1.150
Castilla - La Mancha	773	797	991	842	1.038
Comunidad Foral de Navarra	791	856	685	1.036	1.100
Cantabria	184	168	129	150	150
País Vasco	115	89	66	55	55
Comunidad Valenciana	0	0	6	0	0
Total	**16.160**	**16.939**	**13.620**	**15.357**	**16.631**

Marketing and consumption of aquaculture products in Europe and Spain

6. Marketing and consumption of aquaculture products in Europe and Spain

6.1. Consumption of aquatic products in the European Union

The European Union is the world's leading import and export market for aquatic products, i.e. the main market for food harvested by aquaculture or caught through fishing. The per capita consumption of aquatic products in the European Union in 2020 was 23.5 Kilograms (in whole fish equivalents) compared to 24.1 kilograms in 2019, -2.6% less. This consumption would be 29.1 Kg if the United Kingdom (EU 28) was considered.

The EU's internal supply integrates catches and aquaculture production. In 2020, 79 % was supplied by EU catches (27) (4.302 million tonnes) and the rest aquaculture (1.120 million tonnes). The share of catches destined for food use was 4.1 million tonnes in 2020.

Supply for consumption integrates European and imported production. In 2020 (capture fisheries + aquaculture) production in the EU amounted to 4.1 million tonnes and import 8.9 million tonnes, i.e. imports were more than double production. In addition, in 2020, the European Union exported some 2.5 million products. It has increased due to Brexit and therefore, the exit of the United Kingdom from the EU. This figure represents 62 % of the EU's total domestic consumption. In short, the net result of household supply was 10.5 million tonnes in 2020 (lower than previous years due to the absence of consumption in the United Kingdom).

Below are 2 comparative graphs, before and after Brexit, on the evolution of the origin of aquatic products consumed in the EU.

The apparent consumption in the EU (28) in 2019 of fishery and aquaculture products was 12,3 million tonnes of live weight equivalent (LWE). Of this figure, 76 % corresponded to capture fishery products (9.41 million tonnes) and 24 % to aquaculture products (2.89 million tonnes). Consumption decreased by -1% compared to 2018, about 187,000 tons, mainly due to the decrease in catches, especially those of herring.

In 2020, dependence on imported aquatic products was 68.7 %, which grew mainly due to a reduction in catches from capture fisheries and the United Kingdom's exit from the EU.

The apparent per capita consumption of aquatic products in the EU (28) was 24,0 Kg (live weight)/capita/year in 2019, representing an annual variation of -2 %, i.e. about 390 g, according to the EUMOFA 2021 report.
The countries with the highest per capita consumption are: Portugal with 59.9 Kg/capita/year with -2% compared to 2018, Spain with 46.0 Kg/capita/year remaining the same as in 2018 and Denmark with 42.6 Kg/capita/year (6% more). In the lowest positions of the ranking are: Bulgaria with 7.5 Kg/capita/year (6% more), Hungary with 6.3 Kg/capita/year (3% more) and Czech Republic with 6.0 Kg/capita/year (7% more).

The consumption of aquatic products in the Union is dominated by the supply of captured fish. Among the preferred aquatic species are, in order of highest to lowest, tuna (several species), cod, salmon, cod, shrimp and prawn, mussel, herring and hake. Within the apparent consumption of the most consumed aquatic products in 2019 in the EU (28), the proportional per capita consumption of these aquaculture products was led by salmon with 1,91 Kg (81 % of the total), followeb by mussel with 0,98 kg (79,6 % of the total), shrimp and prawn with 0,76 Kg (51,4 % of the total), trout with 0,40 Kg (98,3 % of the total) and tuna with 0,03 Kg (0,9 % of the total).

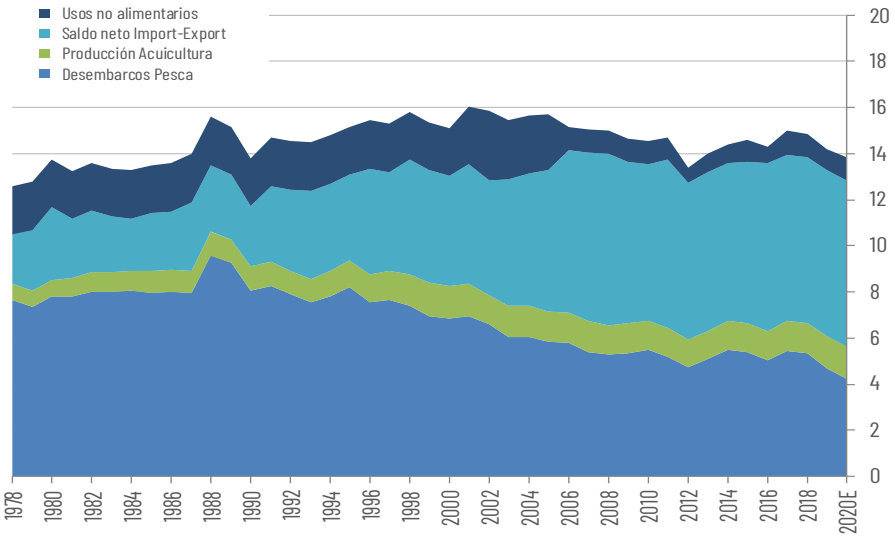


Figure 6-1a.
Evolution of the origin of aquatic products consumed in the European Union (28) between 1978 and 2020E, in tonnes of equivalent live weight. EU aquaculture and fisheries production is considered in addition to the net balance of imports and exports and non-food uses (AIPCE and FAO).

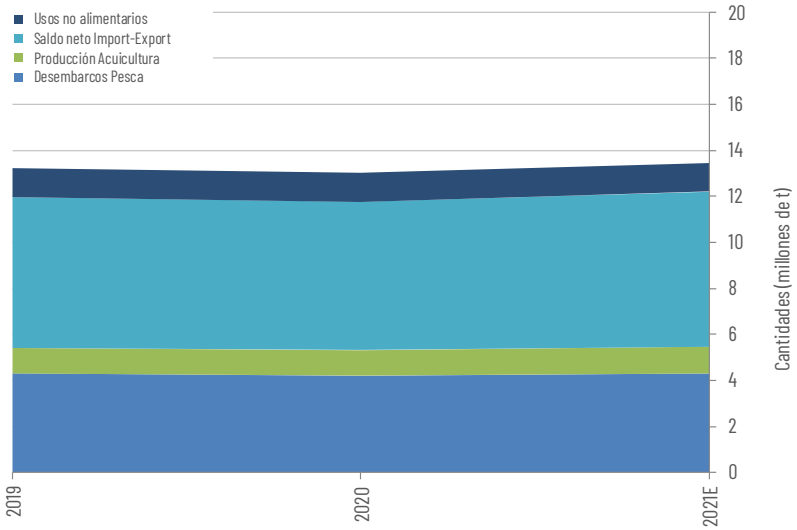


Figure 6-1b. E
volution of the origin of aquatic products consumed in the European Union (27) between 2019 and 2021E, in tonnes of equivalent live weight. EU aquaculture and fisheries production is considered in addition to the net balance of imports and exports and non-food uses (AIPCE and FAO).

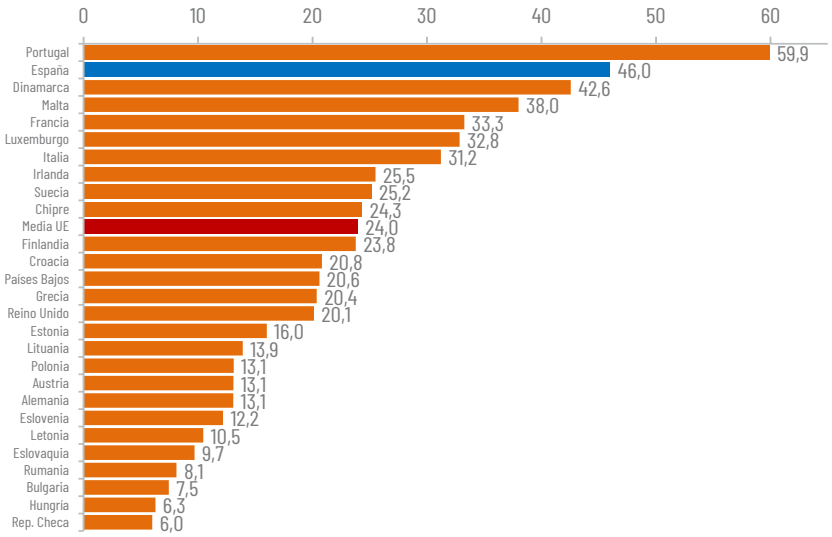


Figure 6-2. Per capita consumption of aquatic products in the member states of the European Union (European Commission. EUMOFA 2019).

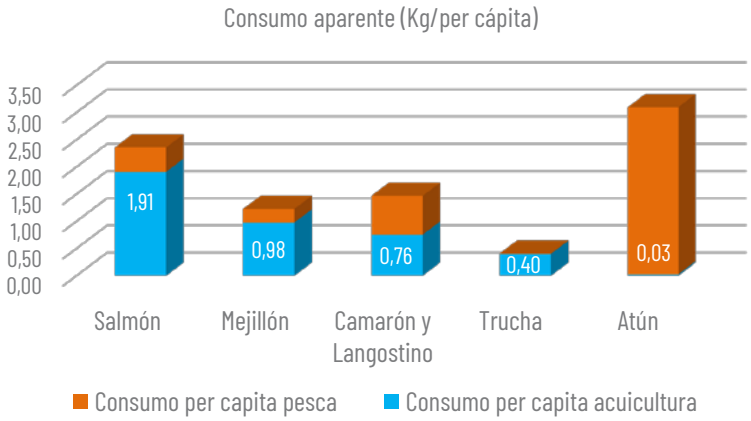


Figure 6-3. Per capita consumption of the main aquaculture products and their comparison with the consumption of the fishery product in the European Union (European Commission. EUMOFA 2019).

6.2. Food consumption in Spain

Having quality and timely information on markets and consumption is a relevant element for companies to make decisions. For more than a decade, the Spanish Ministry of Agriculture, Fisheries and Food (MAPA) has been publishing reports on the situation of food consumption in Spain. The most up-to-date information published by MAPA at the date of publication of this APROMAR report refers to 2021.

The Spanish population has remained stable compared to the previous year. It is in 47,432,805 million in January 2022, according to data from the INE. The most recent household number data is from 2020 with 129,100, a 0.7 % more than in 2019. The resident population in family homes increases by 0.5 % and the average size remains at 2.5 people / household. The number of single-person households increased by 2 %, those consisting of five or more people by 1.3 % and those formed by two people by 0.6 %. The one formed by three and four people decreases.

The positive evolution of the pandemic has meant a growth in consumption within the home and increased extra-domestic consumption. Adding both, each Spaniard ingested an average of 731.89 Kg-L of food and beverages in 2021. This resulted in a consumption in Spain of 102,552.1

million euros, a 0.5% more than in 2020 due to the increase in consumption outside the home. It is assumed an average expenditure per person per year of 2,425.3 euros, a 1.8% more than in the previous year. 90.3 % of the volume of food was consumed at home and 9.7 % outside.

In 2021, the total expenditure of Spanish households on food was 74,543.6 million euros, a decrease of a 6.1%. It equates to an average expense of about 1,610.3 per capita, about 106 million euros less than last year. On average, each person ingested 639.13 Kg-L inside the household, which is 50.4 Kg-L more than in 2020.

The main consumption food groups are did not vary (fruits>vegetables-potatoes >milk). There was adecrease in the purchase of these products by 9.1 % in 2021.

6.3. Consumption of aquatic products in Spain

This category of aquatic food includes fresh fish, frozen fish, molluscs, crustaceans and canned fish and molluscs.

In 2021 Spanish households allocated 13.1 % of the average budget to the purchase of aquatic products. Per capita expenditure was about 221.6 €/kg, which is -4.6 % less than in 2020. The sector in general loses consumption intensity in households in 2021 and despite the fact that prices are 4.3% higher than in 2020, it does not compensate for the decline in purchases.

On average, some 22.7 kg of fishery products were consumed, 8.5 % less than in 2020 due to the shorter time spent in households after the return to normality.

According to data from the Month-to-Month Fisheries Report of December 2021 of the MAPA, the year 2021 has a decrease in the intensity of purchase, -8.4 % in volume and 4.5 % in value. Consumption of fresh and frozen fish decreases by 8.9 % and 15.3 % respectively. The consumption of sole (-65.3 %) and turbot (-26.1 %) decreased and that of cod (20.3 %) and salmon (0.3 %) increased.

Fresh fish has the highest proportion of both volume and value with 42.2 % and 39.9 % respectively. Although it has experienced a reduction of -8.9 % in volume and -2.8 % in value compared to 2020.

Canned fish and molluscs are the next product in the presence of Spanish households with a volume of 19.9 % and a value of 22.6 %. But both values evolve in negative, -6.8 % and -4.7 %.

The third segment is fresh shellfish/molluscs with a volume share of 14.9 % and in value of 14.0 % and also decreases in 2021 (7.8 % volume and 4.5 % in value).

Frozen fish are the products that perform the worst in 2021 with 10.0 % by volume and 9.0 % in value.

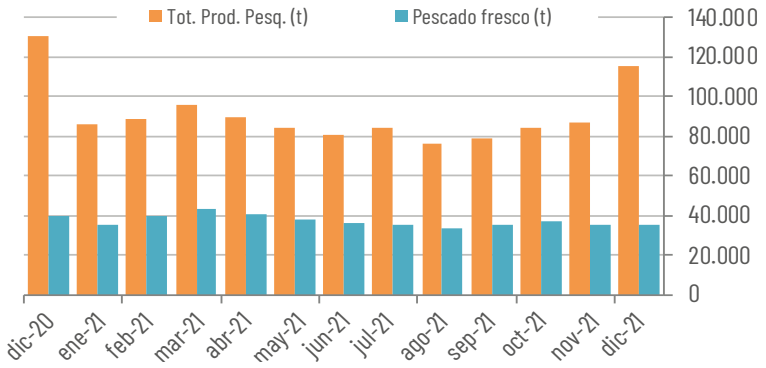


Figure 6-4.
Evolution of the consumption of fishery products (aquaculture plus fishing) in Spanish households from December 2020 to December 2021. The total of aquatic products (= fishery products) is shown and, within them, of the fresh ones (source: MAPA)

Table 6-1. Main statistical figures in the commercialization of fish in Spain for consumption in households in December 2020 and 2021. Data from the General Directorate of the Food Industry of the MAPA.

CONSUMO HOGARES EN EL MES

Productos	Cantidad consumida en el mes (miles de t)		Evolución	Valor (millones de €)		Evolución	PVP en el mes (€/Kg)
	2020	2021	%19/20	2020	202	%19/20	2021
TOT. PROD. PESQUEROS***	130,76	114,98	-12,1	1.344,35	1.216,41	-9,5	10,58
TOT. PESCADO FRESCO	39,72	35,37	-11,0	369,41	343,04	-7,1	9,70
TRUCHA fresca	0,90	0,70	-22,2	6,84	5,29	-22,7	7,57
LENGUADO	3,91	4,20	7,4	39,63	43,11	8,8	11,92
SALMÓN	7,52	6,98	-7,2	73,61	72,64	-1,3	9,86
LUBINA	3,39	2,84	-16,2	31,71	27,79	-12,4	9,80
DORADA	3,83	3,69	-3,7	30,57	29,07	-4,9	7,88
RODABALLO	1,24	0,77	-37,9	13,09	9,56	-27,0	12,37
TOTAL ALIMENTACIÓN	2.704,73	2.469,45	-8,7	8.028,37	7.485,25	-6,8	3,03

CONSUMO en HOGARES TAM* MES 2021 vs 2020

Productos	Cantidad consumida en el período (miles de t)		Evolución	Valor (millones de €)		Evolución	Kg per cápita
	TAM mes 2020	TAM mes 2021	%19/20	TAM mes 2019	TAM mes 2020	%19/20	TAM mes 2021
TOT. PROD. PESQUEROS***	1.148,20	1.051,50	-8,4	10.239,50	9.779,80	-4,5	22,70
TOT. PESCADO FRESCO	489,00	445,70	-8,9	4.011,10	3.898,40	-2,8	9,60
TRUCHA fresca	11,60	9,90	-14,7	79,80	70,90	-11,2	0,20
LENGUADO	29,50	10,20	-65,4	304,00	120,30	-60,4	0,20
SALMÓN	74,50	74,70	0,3	783,80	774,30	-1,2	1,60
LUBINA	34,30	30,30	-11,7	299,70	273,70	-8,7	0,70
DORADA	36,60	36,40	-0,5	287,50	285,10	-0,8	0,80
RODABALLO	6,90	5,10	-26,1	74,40	58,90	-20,8	0,10
TOTAL ALIMENTACIÓN	31.878,70	29.586,60	-7,2	79.348,30	74.543,60	-6,1	639,10

Notas: * TAM = Mes en curso + 11 meses anteriores.
** PARTICIPACIÓN del MERCADO en VALOR representa el % de gasto en cada producto comprado con el Gasto Total en Alimentación (= 100%)
Fuente: Subdir. Gral. de Estructura de la Cadena Alimentaria. Dirección Gral. de Industria y Mercados Alimentarios. MAPA.

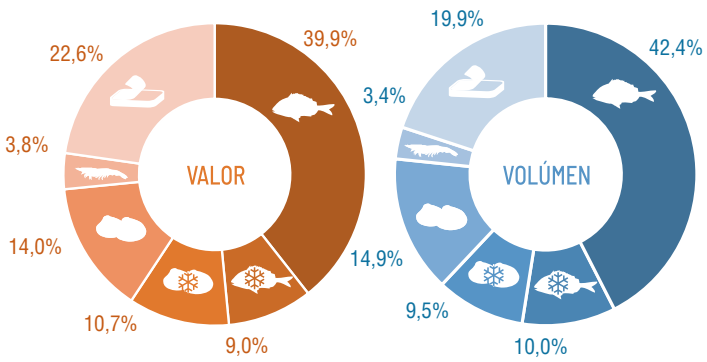


Figure 6-5. Importance of the different types of aquatic products in their consumption in households in Spain in 2021 (MAPA).

	%Variación mismo periodo año anterior	
	Valor	Volumen
Total Pesca	-4,5 %	-8,4 %
Pescados Frescos	-2,8 %	-8,9 %
Pescados Congelados	-11,8 %	-15,3 %
Marisco/Molusc Cong	-6,9 %	-7,3 %
Marisco/Molusc Fres	-4,5 %	-7,8 %
Marisco/Molusc Cocido	6,4 %	5,7 %
Cons.pescado/Molusco	-4,7 %	-6,8%

Figure 6-6. Percentage distribution of the purchase of aquatic products in 2021 by types of establishments and percentage variation over the previous year (MAPA Data).

6.4. The consumption of fresh aquatic products in Spain

The supermarket and self-service were the favorite channels for the purchase of seafood products in 2020, accounting for 49.8 % of the total volume. It increases by 6.5 % but does not reach the average growth of the market. On the other hand, the traditional store gains relevance with 12.6 % and a proportion of 23.7 % of purchases. E-commerce stands out with a growth of 93.9 % in volume.

The average price of aquatic products was 9.3 €/Kg, therefore, it increased by 4.3 % compared to 2020 (8.92 €/Kg). The increase occurs through all channels except e-commerce which experiences a slight decrease of 0.3%. The traditional store is the channel with the highest price on the market, 10.19 € /Kg and is also the channel that grew the most. On the other hand, the discount store has the most accessible prices with 8.63 € /kg.

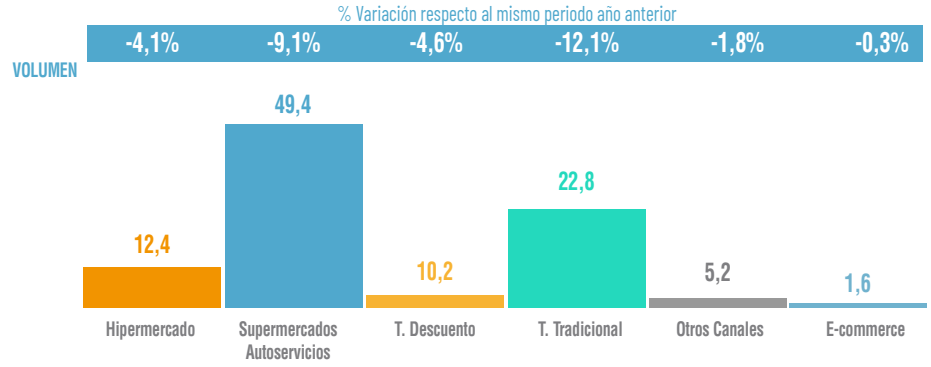


Figure 6-7. Percentage distribution of the purchase of fresh aquatic products in 2020 vs. 2021 by types of establishments and percentage variation over the previous year (MAPA Data).

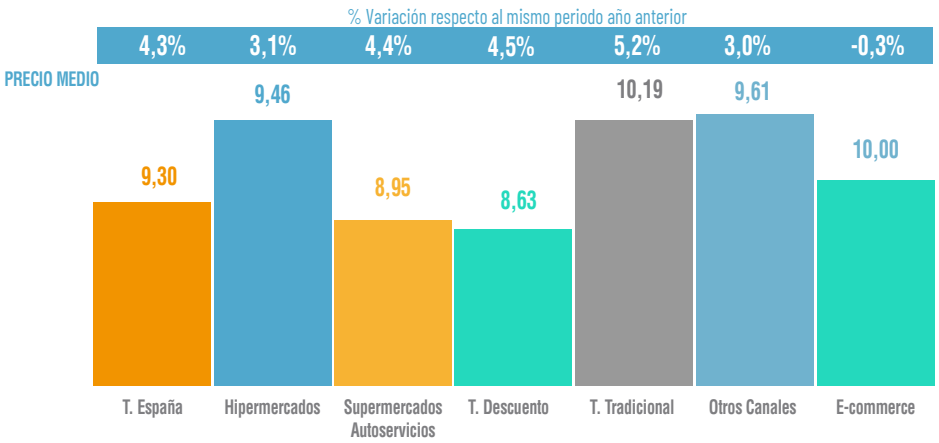


Figure 6-8. Percentage distribution of the average price of fresh aquatic products by sales channels in 2021 vs. 2020 and percentage variation over the previous year (MAPA Data).

NOTAS: 1. Esta ficha ha sido elaborada por APROMAR pa distribución restringuida a sus miembros.
2. Fuente: Subdir. Gral. de Estructura de la Cadena Allimentaria. Dir. Gral. Industria y Alimentaria. MAPA

Figure 6-9. Evolution of the consumption of fish from aquaculture and fishing in Spanish households betweenDecember 2020 and 2021. The quantity (t) and the retail price are indicated (source: MAPA).

6.5. Marketing of sea bream

The average price in first sale of aquaculture sea bream produced in Spain in 2021 was 4.18 euros/kg. This figure is -0.5 % lower than the average price of 2020 (4.2 €/kg). The total value of the 9,632 tons of Spanish sea bream marketed was 40.3 million euros.

The purchase of fresh sea bream fell in 2021 by 0.6 % in volume and 0.8 % in value compared to the previous year although with respect to 2019, the purchase intensified. This figure would mean household consumption of 0.79 Kg per person per year according to the MAPA, which implies a reduction of 0.7 %. The purchase of sea bream represents 0.12 % of the basket in households.

A total household consumption of 36.4 thousand kg in households is estimated in 2021. The total value of the sale to the public of these quantities of sea bream for consumption in households, reported in the statistics of the MAPA, has meant in 2021 an increase of 19.8 %, to add 285.1 million euros, with an average retail price (RRP) of 7.84 euros/kg, two cents more than the previous year. This average price represented an increase of 87.6% over the first sale price (€4.2/Kg), which in absolute values was 3.66 euros more paid by final consumers per kilogram than those charged by producers.

The marketing of aquaculture sea bream is mainly carried out through supermarkets and large commercial area. Traditional fishmongers (specialized trade) are the third way of sale. There is also marketing through the extra-domestic channel Horeca, but most of the consumption is made in homes (approximately 80 %). The COVID-19 crisis has favored that household consumption has exceeded this percentage in 2020.

At the Mediterranean level, the main market for sea bream remains Italy, where some 51,100 tons were consumed in 2021. The next markets are Spain (33,128 t), Turkey (57,584 t), Greece (22,116 t), France (14,252 t) and Portugal (11,122 t).

APROMAR estimates in those 33,128 tonnes consumption (production + imports - exports) of sea bream in 2021 in Spain, 20.3 % more than the previous year. The national harvest of this species was 9,632 t and from capture fishing 1,246 t, while 27,000 t were imported, and 4,750 t were exported. With this, only 29.1% of the sea bream consumed in Spain in 2021 were of national production (assuming that all the exports of sea bream from Spain were of Spanish productive origin). These data do not exactly coincide with the data of the Consumption Panel of the MAPA that refer only to consumption in households while those of APROMAR cover the total consumption in Spain, of this species.

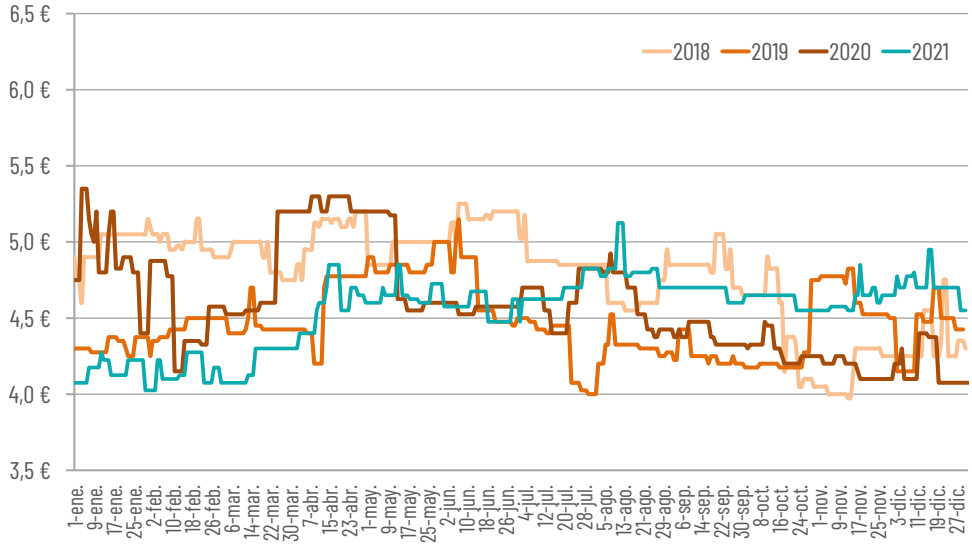


Figure 6-10. Evolution of the average prices (euros/kg) of marketing of sea bream (400/600 g) in MercaMadrid and MercaBarna (starting prices of Mercas) between 2018 and 2021 (data from the Ministry of Economy and Competitiveness). All price values are nominal and have not been adjusted for changes in the CPI.

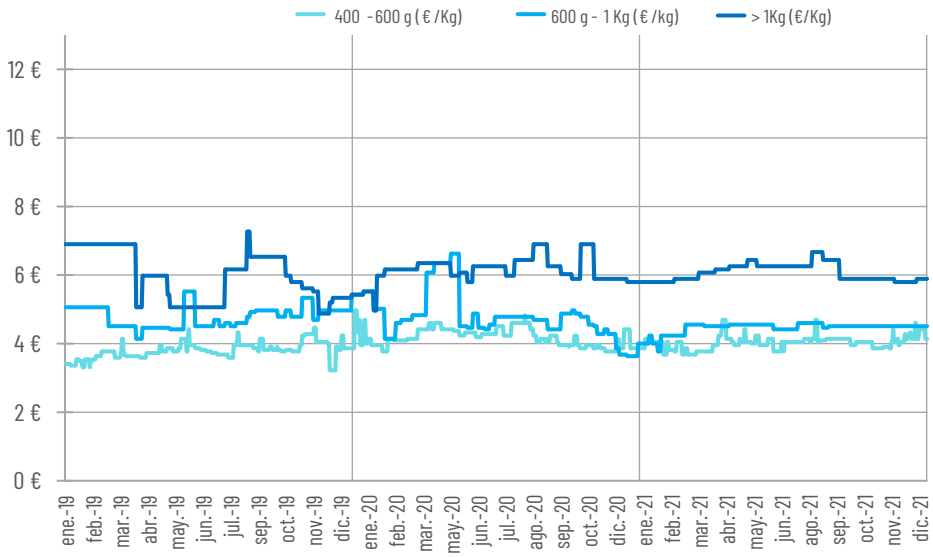


Figure 6-11. Evolution of the average prices (euros/kg) of first sale of sea bream in its three main commercial sizes between 2019 and 2021 (Mº of Economy and Competitiveness).

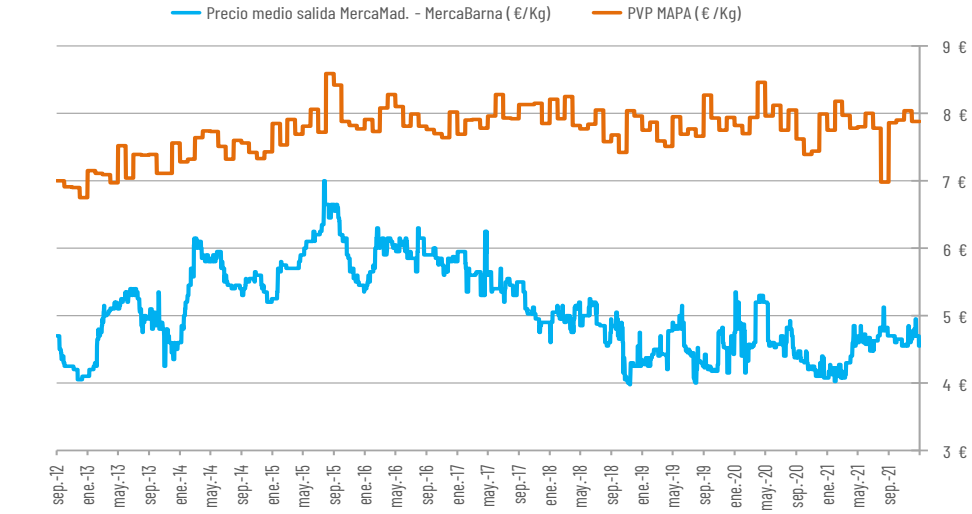


Figure 6-12. Evolution of the prices of mercas starting sea bream and the RRP between 2012 and 2021 (euros/kg). All price values are nominal and have not been adjusted for changes in the CPI.

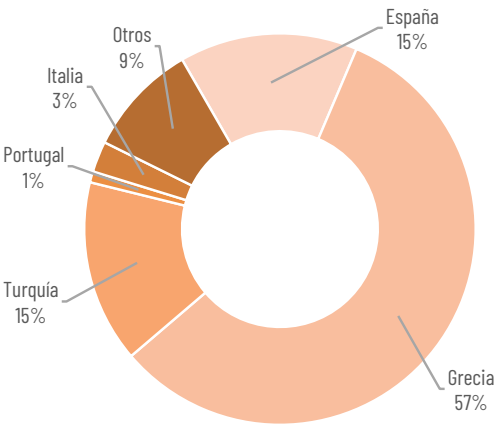
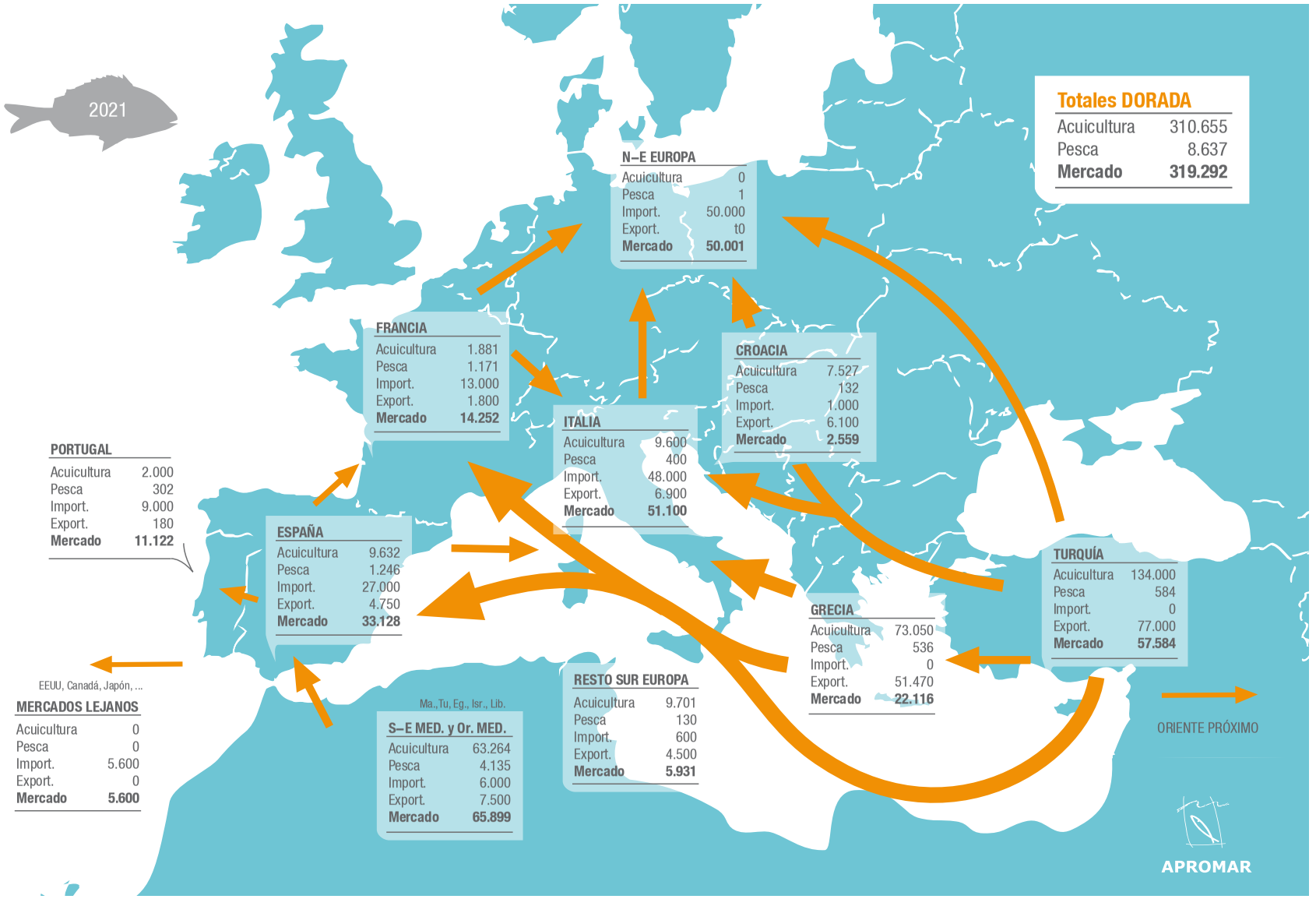


Figure 6-13. Percentage distribution of the country of origin of the sea bream marketed in Spain.

Figure 6-13. Diagram of productions, trade flows and apparent markets of sea bream in Europe in 2021. Based on data from FEAP, FAO and APROMAR.



6.6. Placing sea bass on the market

The average price in first sale of aquaculture sea bass produced in Spain in 2021 was 4.7 euros/kg. This figure is 8.5 % higher than the average price of the previous year, EUR 4.3/kg. The total value of the 23,924 tonnes of Spanish sea bass marketed has been 112.4 million euros.

In 2021, households bought -11.8% less than in 2020, remaining at 30,293 tonnes, according to the MAPA Consumption Panel. The expenditure on this species also decreased by 8.7 %. This figure would mean that each Spaniard consumed about 0.65 Kg in the year.

The total value of the sale to the public of these tonnes of sea bass for consumption in households in 2021 would have reached, according to the MAPA, 273.7 million euros, with an increase of 18.4 % compared to 2020. The average retail price (RRP) for sea bass in 2021 was 9.03 €/kg, an increase of 3.5 %. This RRP of the sea bass paid by consumers represented an increase of 110.0 % over the first sale price (4.3 €/Kg), which in absolute values were 4.73 euros per kilo more paid by consumers than those charged by producers in the first sale.

The marketing of aquaculture sea bass, like sea bream, is mainly carried out through supermarkets and supermarkets. The specialized channel (traditional fishmongers) are the third way of sale. There is also marketing through the Horeca channel but most of the consumption occurs in households (approximately 80 %).

The main international markets for sea bass are Italy and Spain, where approximately 51,649 and 42,319 tonnes are consumed annually respectively. The next markets are Turkey (47,060 t), Greece (11,825 t), France (14,323 t) and Portugal (7,000 t).

APROMAR estimates in these 42,319 tons the consumption (production + imports - exports) of sea bass in 2021 in Spain, 10.2 % more than the previous year. The national harvest of this species was 23,924 t and from capture fishing 1,178 t, while 24,000 t were imported, and 6,783 t were exported. With this, 40.5 % of the sea bass consumed in 2021 in Spain were of national harvest (assuming that all sea bass exports from Spain were of Spanish productive origin). These data do not exactly coincide with the data of the Consumption Panel of the MAPA that refer only to consumption in households while those of APROMAR cover the total consumption in Spain, of this species.

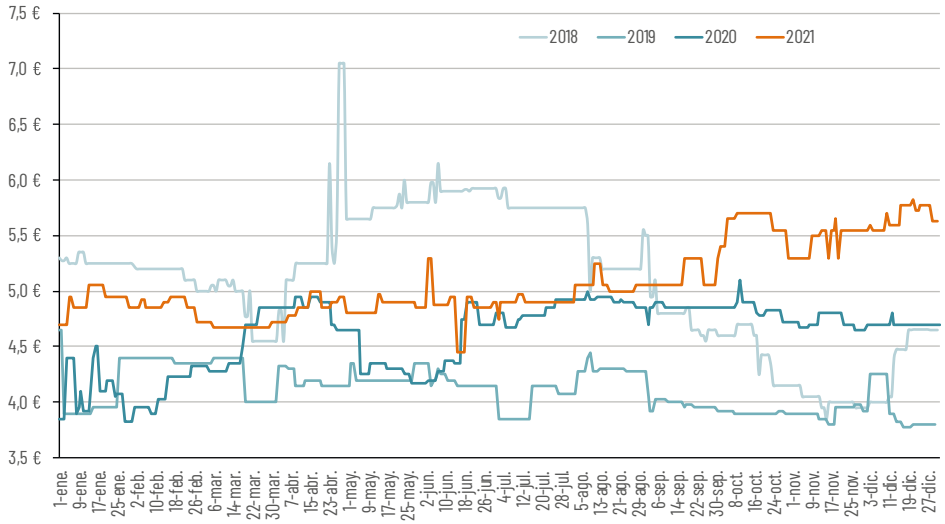


Figure 6-15. Evolution of the average prices (euros/kg) of sea bass marketing (400/600 g.) in MercaMadrid and MercaBarna (Starting prices of Mercas) between 2018 and 2021 (data from the Ministry of Economy and Competitiveness). All price values are nominal and have not been adjusted for changes in the CPI.

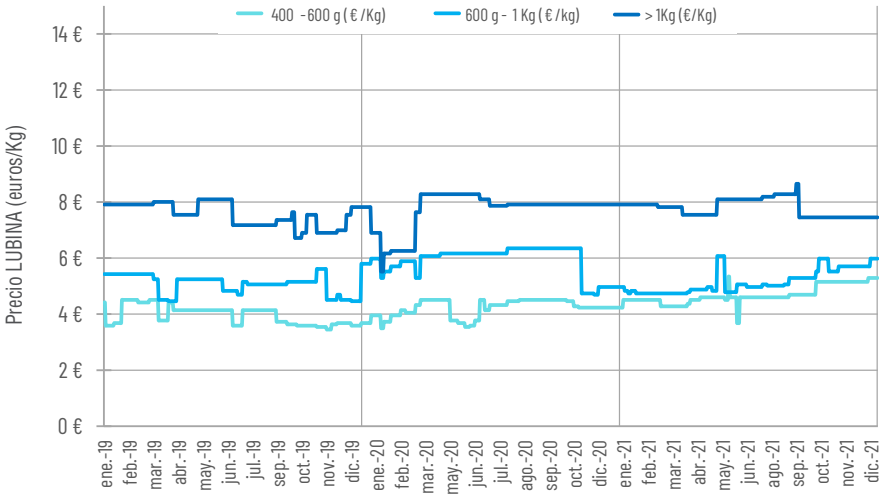


Figura 6-16. Evolución de los precios medios (euros/kg) de primera venta de lubina en sus tres principales tallas comerciales entre 2019 y 2021 (Mº de Economía y Competitividad).

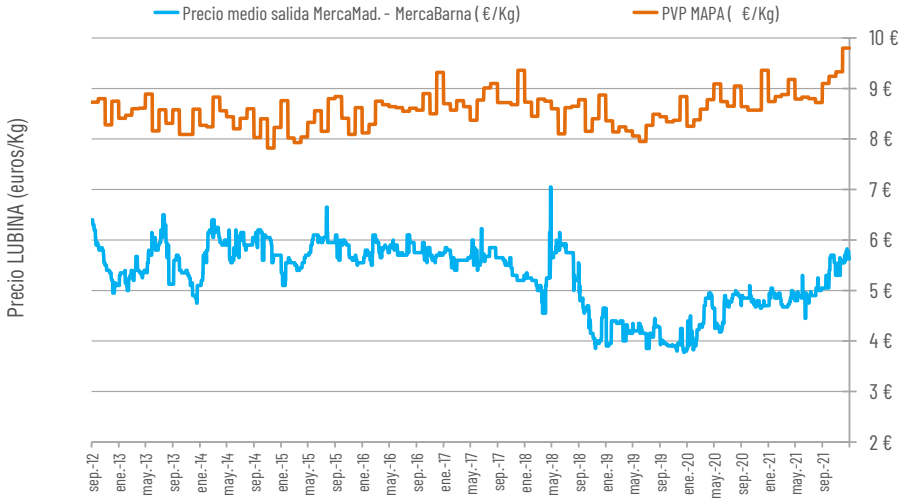


Figure 6-17. Evolution of the prices of Mercas starting sea bass and the RRP between 2012 and 2021 (Euros/kg). All price values are nominal

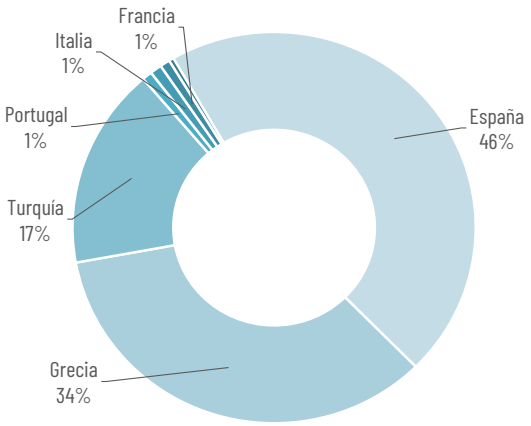
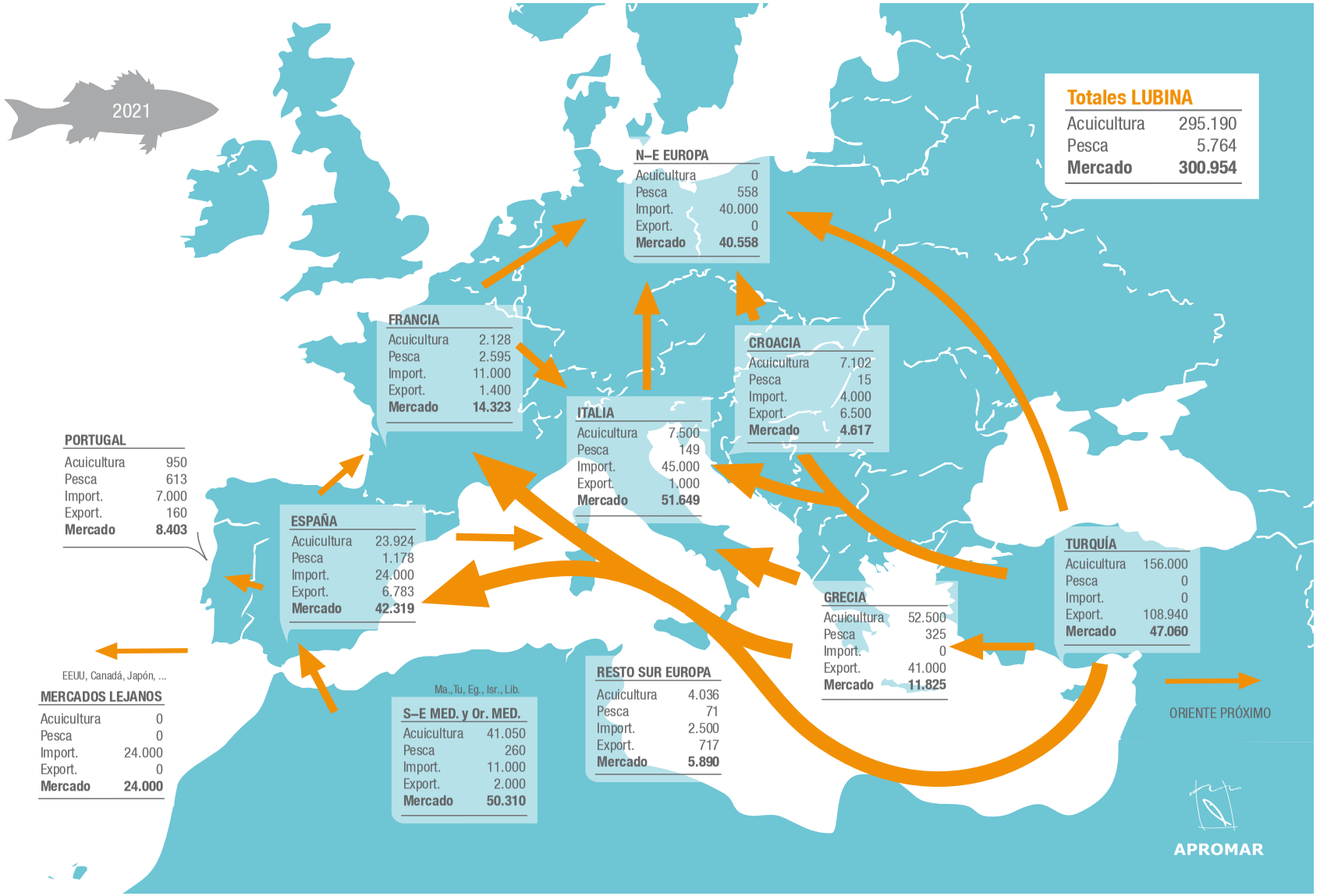


Figure 6-18. Percentage distribution of the country of origin of the sea bass marketed in Spain.

Figure 6-19. Diagram of productions, trade flows and apparent markets of sea bass in Europe in 2021. Based on data from FEAP, FAO and APROMAR.



6.7. Marketing of turbot

Turbot consumption in Spanish households fell by -26.1 % in 2021 with 5,122 tonnes, according to the MAPA Consumption Panel. This figure means a per capita consumption of 0.11 kg.

The average price in first sale of aquaculture turbot produced in Spain in 2021 was 9.5 euros/kg. This figure is 13.3 % higher than the previous year and represented a total amount of 48.5 million euros.

The total retail value of these tonnes of turbot represented an increase of 16.5 %, and amounted to a total of 58.9 million euros, with an average retail price (RRP) of EUR 11.49/kg. This average sale price represents a decrease of -9.5 %, on the first sale price, which in absolute values represent 1.99 euros more per kilo.

Spanish aquaculture turbot is marketed through various channels, but essentially through the Horeca, and to a lesser extent through traditional fishmongers, but also, and increasingly, in supermarkets and large commercial areas. Unlike in the case of sea bream or sea bass, a greater tendency to export stands out, due, among other things, to the fact that Spain produces 74 % of the aquaculture turbot throughout Europe. During the pandemic, the consumption of HORECA has been redirected to household consumption.

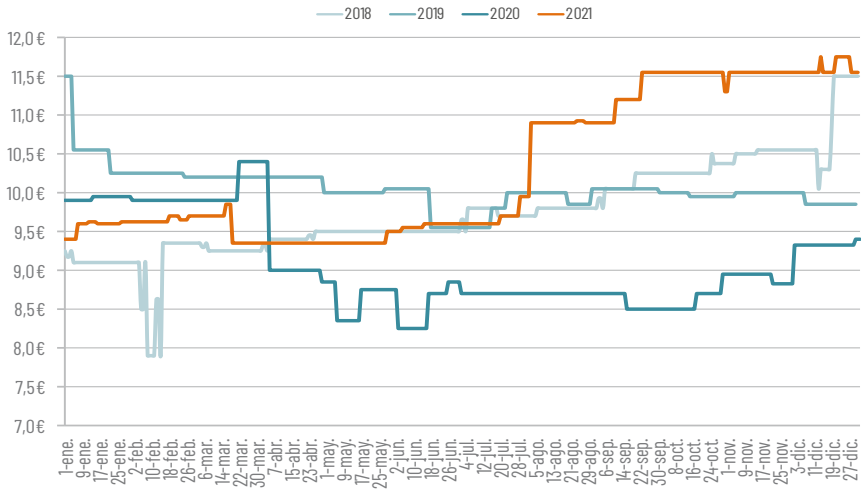


Figure 6-20.
Evolution of the average prices (euros/kg) of commercialization of turbot (1,000/2,500 g) in MercaMadrid and MercaBarna (starting prices of Mercas) between 2018 and 2021 (data of the Ministry of Economy and Competitiveness).

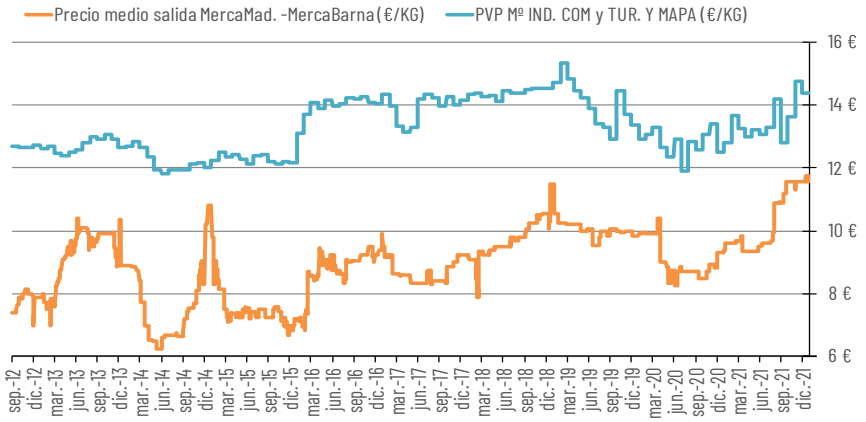


Figura 6-21.
Evolution of prices in the marketing of turbot (1,000/2,500 g) in MercaMadrid and the RRP between 2012 and 2021. All price values are nominal.

Challenges of aquaculture in Spain

7. Challenges of aquaculture in Spain

Aquaculture is an activity that has a remarkable tradition in Spain and is socially and economically relevant in many of its coasts and rivers. This primary sector, of which this country is the main producer in the European Union as can be read in the previous chapters of this report, is made up of micro, small and medium-sized enterprises, as well as some large companies. They are business-competitive entities, albeit limited in size by administrative reasons, but they are constantly innovating to optimize their work and put aquaculture at the forefront of sustainable food systems. Many of these companies are even at the forefront of European aquaculture and attract investors of multiple nationalities. And as for the commercialization of their productions, they do it both in Spain and in demanding international markets.
Aquaculture farms are usually located in remote rural, river or coastal areas, which are scarcely reached by other types of investment and where aquaculture is often the only business activity that generates stable and quality employment. In addition, it is an inclusive job, both in productive positions, as well as technicians and managers. Because of the inherent characteristics of this activity, that is, because it is the production of food and carried out in water, which in Spain is a public good, the legal framework in which aquaculture must operate is complicated. But, beyond that complexity, there are serious complications that are tremendously difficult to navigate. This adds administrative burdens, and their corresponding additional economic costs, to the income statements of companies, slowing down their competitiveness.

Complexity of current circumstances

Without falling into the folly that would mean considering that the years prior to 2020 were calm for Spanish aquaculture, because they never were, since that year the business landscape has been hard and uncertain, as well as in many other sectors. On the way back to the pandemic, there was an event that marked the recent development of Spanish marine aquaculture. At the end of January 2020, Gloria was primed on the western Mediterranean, causing very strong winds and wooded waves to numerous areas of southern western Europe and North Africa. The material damage to the aquaculture facilities was considerable and since then the way to carry out their occupation of the sea has been reconsidered. Just one month later, the Covid-19 coronavirus epidemic expanded, resulting in a two-year pandemic causing millions of deaths on the planet, and disrupting the lives of the entire world, trade, and transport. And in February 2022 there was the Russian invasion of Ukraine, shutting down the beginning of the post-covid economic recovery, in addition to enormous personal and political damages that have plunged the world into a level of extraordinarily complex uncertainty to manage for aquaculture companies.

The main cumulative impact of these events has been an unprecedented escalation in the cost of inputs that threatens the viability and development of aquaculture in Spain. At the end of 2021, the economic reactivation after the pandemic brought with it a notable increase in the costs of raw materials and services necessary for the development of most of the primary sectors, including aquaculture. The war in Ukraine has greatly worsened the situation. Spanish aquaculture has registered, in just one year, increases of 100 % in the price of oxygen and 30 % to 50 % in the price of feed, both essential elements for the activity. Energy costs, mainly electricity, have grown by 250 % compared to 2021. Diesel, which moves boats, vehicles, and trucks, is 20 % more expensive. The price of land and air freight is increasing by the day, increasing marketing costs. These general escalations coexist with those specific to aquaculture activity: packaging and transport materials (pallets, containers, labels, marches) are now 15 % more expensive than in 2021. The same goes for biosafety products (+30 %). As a corollary, the CPI has risen to levels not seen in decades and is stuck at around 10 %, impacting on all expenses. All this generalized increase in production costs, in magnitudes never seen so far, has come at a time

of very tight treasury in companies, after the productive stoppages due to Covid and contractions in the markets. It is true that there has been public aid to compensate for the loss of income in aquaculture companies, but its call has been generally uneven in the different autonomous communities and its insufficient impact.

Turning aquaculture into the benchmark for sustainable food systems

The landing on Spanish aquaculture farms in the European Green Deal is not being smooth. Unlike the rest of the world, aquaculture production in the European Union has remained stagnant since 2000. The reasons are multiple, but they can be summarized in one: the restrictive and inflexible implementation of European environmental regulations on an activity, aquaculture, which takes place in spaces of public domain, and, therefore, is especially sensitive to it. And this even though aquaculture itself needs waters of good environmental quality for its realization. This leads to the complexity of administrative procedures and the difficulty of obtaining permits for new farms or extensions of existing ones.

The Green Deal[1] aimed at transforming the European Union into a fair and prosperous society with a modern and competitive economy, while putting the Union on the path towards an ecological transition, with the goal of achieving climate neutrality by 2050. It is true that the Green Deal, and other previous EU policies, have led to valuable initiatives to protect and restore the natural environment, but has promoted very few initiatives supporting the livelihoods of working people. from the interior of ecosystems in coastal or fluvial areas producing food for society. The ultimate key is that the public administrations competent in the conservation of nature seek only to achieve their environmental goals and assume that other public administrations will develop promotion networks and support for primary producers. But the impacts of both are different by orders of magnitude, and overwhelmingly greater in the case of environmental protection, resulting in a blockage in the development of those productive activities. It is enlightening to analyze the different perspective on sustainable development promoted by FAO compared to the European Commission. The Commission's doctrine on nature conservation consists of setting standards for the recovery of biodiversity and nature in the Union's terrestrial and marine areas through the restoration of ecosystems while promoting an extensive aquaculture and ecological production model. On the contrary, FAO is pushing for what it has come to call the Blue Transformation[2] that recognizes the importance of aquatic food systems as drivers of employment, economic growth, social development and environmental recovery, underpinning the UN Sustainable Development Goals, that is, facing the dual challenge of I food assurance while environmental sustainability while promoting the sustainable expansion and intensification of aquaculture to meet the growing demand for aquatic feed and offer inclusive livelihoods. The differences are evident and substantial because FAO is more aware of the global challenge of ensuring the production of sufficient food in quantity, quality and price while protecting the natural environment. And also, that sustainable intensification of aquaculture is the best way to make use of limited natural resources. The reality is that the European Commission's strategy, sublimated at the level of the Member States and, above all, of the regions, has paralyzed the growth of aquaculture in the European Union, while the FAO formula continues to promote the fastest growing global food sector. Which is aquaculture. On the other hand, the European Union's food system still does not provide enough aquatic food to its population, requiring the continuous importation of more than 65 % of what is consumed, while in the rest of the world aquatic food is becoming an increasingly relevant part of diets. Finally, and although the European Union's environmental protection policy is likely to provide better quality ecosystems in Europe, with a population of 447 million, an ever-growing world population and a declining relative purchasing power of the European Union, the lack of food supply or food supply it could soon knock on the door of the Union.

In conclusion, the conservation of aquatic ecosystems in Europe should not be to the detriment of the sustainable production of the world's most nutritious animal feed, which are aquatic products, of which the European Union is very deficient. European fish farmers are in favour of the conservation and restoration of ecosystems, but not in the way that the European institutions are doing. The Union must continue to promote the protection and restoration of the natural environment, but in a manner compatible with those activities that take place within the coastal and river ecosystems themselves, and that provide food for the

1 The European Green Deal. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_es

2 FAO Blue Transformation. https://www.fao.org/3/cc0459en/cc0459en.pdf

European Union. On the other hand, extensive aquaculture has an important role to play in Europe, but sustainable intensification is the main way forward to, thanks to its unique efficiency, tackle limited natural resources by doing more with less. APROMAR proposes that the European Commission link Europe's environmental objectives also to socio-economic goals. This could be materialized by setting legally binding quantitative targets not only for environmental protection, but also for the performance of aquatic food production in those same areas. APROMAR fully identifies with the "Blue Transformation" advocated by FAO, but fears that European aquaculture will definitely be relegated to a minor role by the European Union's environmental policies.

An enabling Spanish administrative framework for aquaculture

Any stable business development needs to be built on a stable legal framework and clear and predictable administrative rules. And in the case of aquaculture, given its dependence on the occupation of the public domain and water, there must also be a strategic alignment of the administrations with competences over it so that the administrative procedures turn perfectly geared and do not hinder each other.

In the case of Spanish freshwater aquaculture, the Hydrological Plans for each of the river basins are the central element of the administrative framework that affects the sector. In these Plans there are several crucial issues for aquaculture: the methodology for the establishment of ecological stems must be correctly adapted to the reality of the natural flows of each of the sections of the rivers; the conditions for the use of water, covering the limits of discharges and the limits to the construction on the channel itself and the surrounding spaces; the physical delimitation of the restricted riparian areas; and the preference of the different concurrent uses of the water on the affected channel.

Meanwhile, in the case of marine aquaculture, the Coastal Act, the Marine Strategy Framework Directive and the Maritime Directive for the Organization of the Maritime Spatial Area, are the central elements of what affects it. In relation to the Coastal Law, the preliminary conclusions of the National Strategic Plan for the protection of the Spanish coast considering the effects of climate change are of concern. These impacts of climate change on aquaculture, both marine and continental, are a priority issue for this sector, although it is true that food production through aquaculture has one of the lowest carbon footprints of all vertebrate animal farms. In view of the radical structural impact of this Strategic Plan, and the possible modification of the Coastal Law on the survival of families and companies in Spanish coastal populations, any substantial revision of coastal regulations must be preceded by a thorough analysis. of all its economic, social, labour and interterritorial cohesion implications, by prestigious, independent expert groups with a deep perspective of the local and regional reality.

The European Commission recognises that aquaculture creates jobs and economic development opportunities in coastal and rural communities in the Union, and that it can contribute to decarbonising the economy, combating climate change and mitigating its impact, better conserving ecosystems and being part of more circular resource management. The challenges facing aquaculture in Spain are very similar to those that stand in the way of the sector in other Member States of the European Union. And the European Commission has accurately identified them in its new Strategic Guidelines for a more sustainable and competitive EU aquaculture for the period 2021-2030[3] , and proposes solutions. In this regard, the Ministry of Agriculture, Fisheries and Food is finalising the contribution of the strategic guidelines for a more sustainable and competitive EU aquaculture 2021-2030. It will establish as objectives, to develop resilience and competitiveness of the sector, participate in the ecological transition, guarantee social acceptance and consumer information and increase knowledge and innovation. APROMAR considers that this document, prepared by the General Secretariat of Fisheries (MAPA) in coordination with the Directorates-General in charge of aquaculture in the Autonomous Communities, is a very complete and well-worked document that could effectively contribute to advancing aquaculture in this country.

3 Strategic guidelines for a more sustainable and competitive EU aquaculture for the period 2021-2030. COM(2021) 236 final. https://eur-lex.europa.eu/legal-content/ES/TXT/HTML/?uri=CELEX:52021DC0236&from=FR

Spanish scientific production in the field of aquaculture

8. Spanish scientific production in the field of aquaculture

By Morris Villarroel Robinson, Polytechnic University of Madrid

In this section we will quantify the Spanish scientific production related to aquaculture research, counted in terms of scientific publications, usually called articles.

We will consider the evolution in recent years and highlight the production during the year 2021.

Material and methods

Next, we carry out a quantitative analysis of all the scientific articles in which at least one Spanish scientist has participated, in the journals of most relevance for aquaculture in the main collection of *Web of Science*, a database of scientific bibliographic information managed by Clarivate company. We have chosen this collection since it is the largest database of scientific publications in the world and allows us to evaluate and analyze the performance of research in an objective and contrasted way.

How much have Spanish scientists published on aquaculture in 2021?

To get a general idea about the number of "Spanish" scientific articles published in high-impact journals in 2021, we have used the PRISMA methodology (*Preferred Reporting Items for Systematic Reviews and Meta-Analyses*), which consists of the following four phases: (1) the identification of the articles, (2) the screening for errors, (3) a check of the eligibility of articles, and (4) the final decision on the articles to be included (see general outline in Figure 1).

First, and before the identification phase, all impact journals associated with the field of aquaculture were selected in the *Journal Citation Reports* (JCR 2019, https://jcr.clarivate.com/), a database within the *Web of Science*, which allows to have a complete list of journals in a category or field of study. Within the "Fisheries" category, which includes a large part of the journals specialized in aquaculture, there were 55 impact journals (in 2021), of which 25 have been chosen with an impact factor greater than 1.0 and that clearly publish works on aquaculture, thus avoiding more specialized journals in extractive fishing. The list of the 25 journals chosen and their abbreviations is summarized in Table 1, in order of impact. The impact of each journal is reflected in Figure 2.

For the identification phase, the first step of the PRISMA protocol, scientific articles were searched in the Main Collection of the *Web of Science* that me t the following four criteria:

"Address" field: Spain
"Publication name" field: Name of each of the 25 journals in Table 1
"Document Type" field: Article and Review
"Publish date" field: 2021

The result of this search yielded 208 publications. For the screening stage, all the publications obtained were analyzed, excluding those that were not published in 2021, since some journals publish works on-line in advance, accepted in 2021, but finally published in

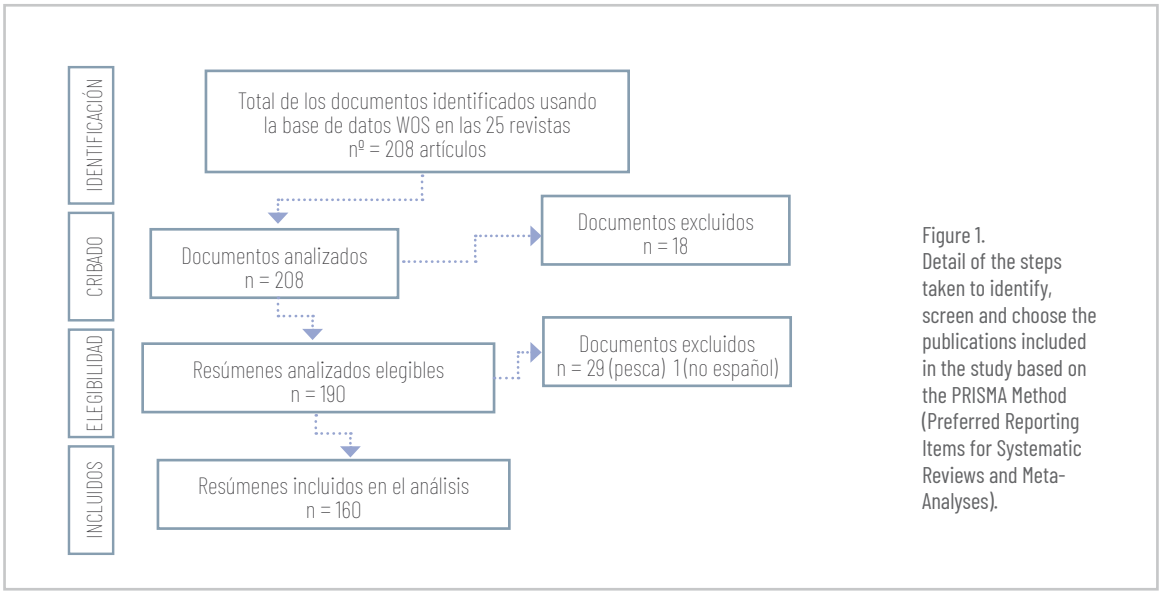


Figure 1.
Detail of the steps taken to identify, screen and choose the publications included in the study based on the PRISMA Method (Preferred Reporting Items for Systematic Reviews and Meta-Analyses).

Table 1. They summarize the journals (and their acronyms), in order of impact, in the field of aquaculture chosen to calculate the Spanish scientific production in the year 2021.

Full magazine name	Abbreviation
Reviews in Aquaculture	Rev Aquac
Reviews in Fisheries Science & Aquaculture	Rev Fish Sci Aquac
Aquaculture Economics & Management	Aquacult Econ Manag
Fish & Shellfish Immunology	Fish Shellfish Immunol
Aquaculture	Aquaculture
Aquaculture Nutrition	Aquac Nutr
Aquacultural Engineering	Aquac Eng
Aquaculture Reports	Aquacult Rep
Aquaculture Environment Interactions	Aquac Environ Interact
Fish Physiology and Biochemistry	Fish Physiol Biochem
Journal of Fish Diseases	J Fish Dis
Journal of The World Aquaculture Society	J World Aquac Soc
Aquaculture International	Aquac Int
Aquaculture Research	Aquac Res
Journal of Fish Biology	J Fish Biol
Aquatic Living Resources	Aquat Living Resour
Diseases of Aquatic Organisms	Dis Aquat Org
North American Journal of Aquaculture	N Am J Aquacult
Knowledge and Management of Aquatic Ecosystems	Knowl Manag Aquat Ec
Journal of Shellfish Research	J Shellfish Res
Turkish Journal of Fisheries and Aquatic Sciences	Turk J Fish Aquat Sc
Bulletin of the European Association of Fish Pathologists	B Eur Assoc Fish Pat
Latin American Journal of Aquatic Research	Lat Am J Aquat Res

2022. These 18 2022 posts were removed, reducing the total number of posts to 190.

At the eligibility stage, the titles and abstracts of all articles were analyzed to ensure that they corresponded to studies in the field of aquaculture, and not extractive fisheries. This is because some journals, such as *Fish & Shellfish Immunology, Journal of Fish Diseases, Journal of Fish Biology and Reviews in Fisheries Science & Aquaculture* publish works in both areas (aquaculture and extractive fisheries). As a result, 29 more jobs had to be eliminated. It was also verified if at least one author of the works was Spanish (that the address

associated with his institution was Spanish). One case was deleted since no author was Spanish. Thus, using these two criteria for eligibility, 30 jobs in total were discarded. Finally, there were 160 articles, representing the Spanish scientific production in 2021 in the field of aquaculture and in the 25 journals with the greatest impact.

Figure 2 shows the number of Spanish papers in 2021 for each journal, along with the impact factor of the journal in question. It can be seen that the most popular journal is *Aquaculture*, with 76 published works, followed by *Aquaculture Research* with 19 published articles.

Which species have been the targets of research in Spain in 2021?

Reviewing the 160 Spanish scientific publications published in 2021, we identified the species object of the study, which totaled 59 different species of fish, crustaceans, molluscs and algae, with some studies analyzing more than one species. A fifth of the Spanish studies (20.6%) in 2021 corresponded to works on sea bream (*Sparus aurata*), followed by trout (*Oncorhynchus mykiss*), sea bass (*Dicentrarchus labrax*), prawn (*Litopenaeus vannamei*) and tilapia (*Oreochromis niloticus*). Figure 3 shows the percentage of jobs for the 10 most popular species.

What were the most relevant topics?

The 160 Spanish articles published in 2021 were reviewed according to the theme of the study. The main themes were nutrition, physiology, health, production, sustainability, and genetics. Almost 35% of the studies that have been published fall within the field of nutrition, followed by physiology and health.

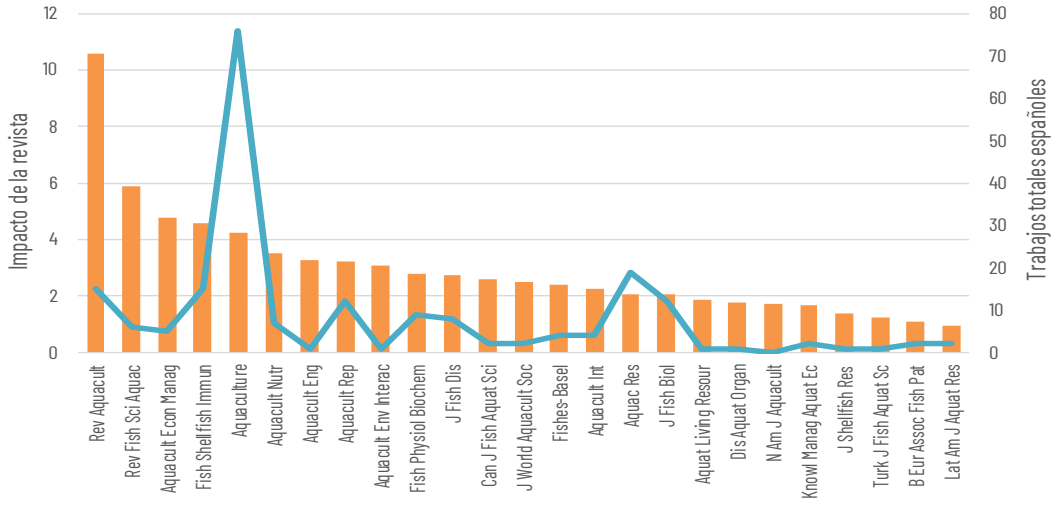


Figure 2. Summary of the impact (blue bars) of the 25 most important journals in the area of aquaculture at an international level and the total number of articles published (red line) in each journal, by Spanish scientists in 2021, according to the search criteria (see text).

What were the most relevant studies?

Similar to the positioning of pages by Google, the importance of each scientific publication can be estimated according to the number of citations it receives from other publications. Likewise, in Table 2 we summarize the works of 2021 that have received the most citations to date (May 2022), together with the authors and the theme. The work with the most citations is a review signed by 22 authors, including the

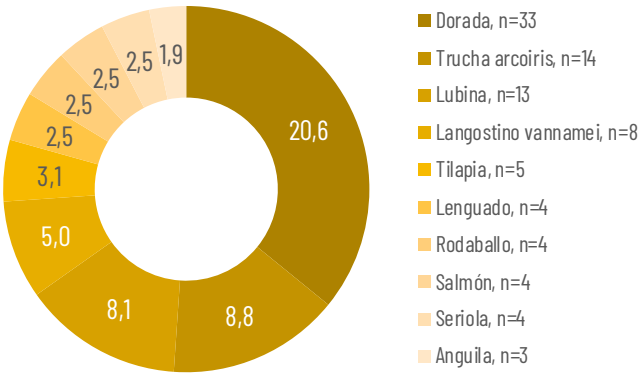


Figure 3.
Graph of the percentage of articles by species (blank number in the pie chart) on the total of the 160 publications selected in 2021. The number of articles per species appears to the right of each species name in the legend (n = number of publications).

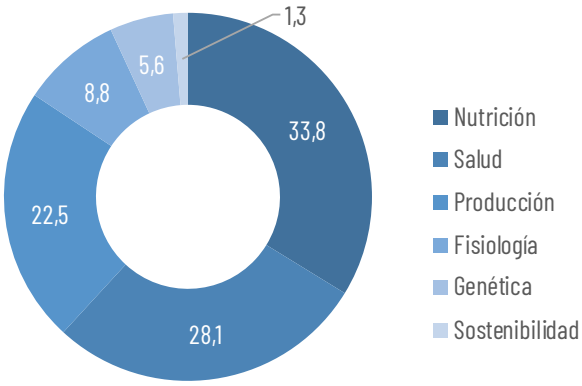


Figure 4.
Graph of the percentage of articles per topic (blank number in the pie chart) on the total of the 160 publications selected in 2021.

Table 2. Summary of the publications (with Spanish participation) of the year 2021 with more citations in the area of aquaculture, included in the 25 impact journals chosen.

Magazine	Authors	Dating	Title
Rev Aquac	Avdelas et al.	24	The decline of mussel aquaculture in the European Union: causes, economic impacts and opportunities
Rev Aquac	Haubrock et al.	17	The redclaw crayfish: A prominent aquaculture species with invasive potential in tropical and subtropical biodiversity hotspots
Rev Aquac	McKenzie et al.	12	Aerobic swimming in intensive finfish aquaculture: applications for production, mitigation and selection
Aquaculture	Gilannejad et al.	11	The digestive function of gilthead seabream juveniles in relation to feeding frequency
Aquacult Res	Gholamhosseiniet al.	11	Effect of dietary supplements of Artemisia dracunculus extract on the haemato-immunological and biochemical response, and growth performance of the rainbow trout (*Oncorhynchus mykiss*)

Spanish José Fernández Polanco of the University of Cantabria and Sebastián Villasante and Svjetlana Visnic of the University of Santiago de Compostela, which deals with the decline of mussel aquaculture in Europe.

How does Spain compare with other countries in terms of scientific production?

In order to compare our scientific production with that of other countries in the world, we can simplify the analysis and reduce it to an impact journal, the one called *Aquaculture*, and what has been, over the years, the most popular magazine. It is the oldest journal of the 25 mentioned in Table 1 and covers more topics and species than the other journals, being useful for making more cross-sectional comparisons at the international level.

Following the PRISMA methodology, all the articles of the journal were searched as follows in the Main Collection of the Web of Science, and then divided by countries:

"Publication name" field:	*Aquaculture*
"Document Type" field:	*Article and Review*
"Date published" field:	*1900-2020*

In Figure 5, you can see the evolution of the number of scientific articles published throughout the history of the journal, which total 18,330. Since 2000 there has been a clear increase in the number of articles published per year, reaching more than 1,000 articles per year in 2020.

Internationally, Spain is the fifth country with the most publications, in the journal Aquaculture, with more than a thousand in total (Table 3). Likewise, the Spanish National Research Council (CSIC) is among the 10 institutions worldwide that have the most publications in the same journal (Table 4).

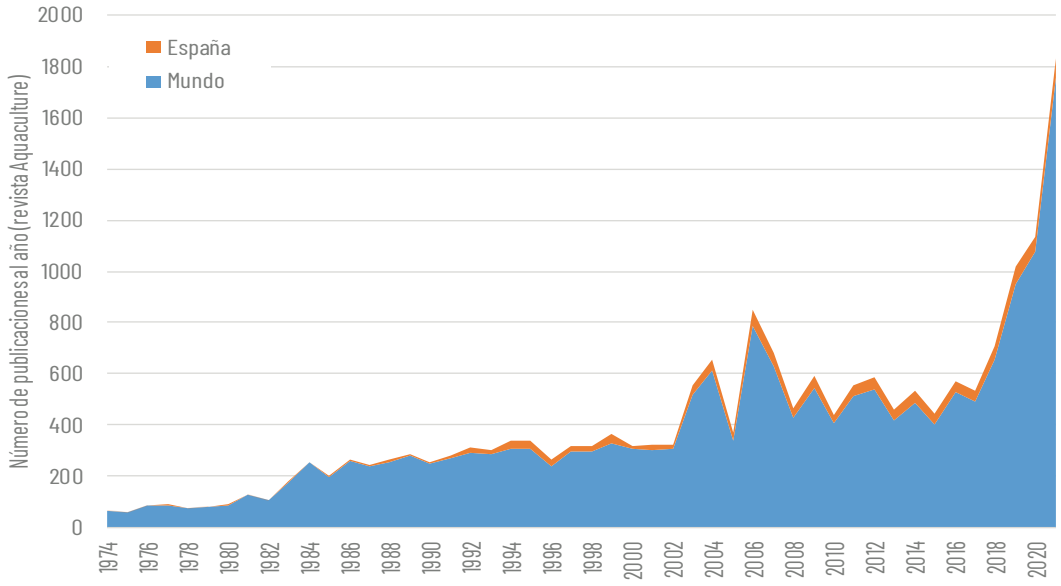


Figure 5. Evolution of the number of scientific articles published in the journal Aquaculture per year from 1974 to 2021, taking into account all the countries of the world (blue color) and the Spanish works (orange color), where at least one of the authors is Spanish.

Table 3. Summary of the countries with the highest number of scientific publications in the journal Aquaculture since 1974, including the percentage of total publications.

Country	Articles	%
PEOPLES R CHINA	2831	15.4
USA	2815	15.4
NORWAY	1603	8.7
AUSTRALIA	1335	7.3
SPAIN	1187	6.5
FRANCE	1118	6.1
CANADA	1024	5.6
JAPAN	938	5.1
SCOTLAND	729	4.0
BRAZIL	726	4.0

Table 4. Summary of the institutions with the most scientific articles in the journal Aquaculture since 1974, including the percentage of the total publications, which were 18,330..

Country	Articles	%
IFREMER	*567*	*3.1*
CHINESE ACADEMY OF SCIENCES	*484*	*2.6*
CHINESE ACADEMY OF FISHERY SCIENCES	*464*	*2.5*
INRAE	*444*	*2.4*
OCEAN UNIVERSITY OF CHINA	*417*	*2.3*
UNIVERSITY OF STIRLING	*399*	*2.2*
INSTITUTE OF MARINE RESEARCH NORWAY	*359*	*2.0*
FISHERIES OCEANS CANADA	*355*	*1.9*
LEAGUE OF EUROPEAN RESEARCH UNIVERSITIES LERU	*351*	*1.9*
INDIAN COUNCIL OF AGRICULTURAL RESEARCH ICAR	*332*	*1.8*
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS CSIC	*317*	*1.7*
NORWEGIAN UNIVERSITY OF LIFE SCIENCES	*297*	*1.6*

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