

The Seafish Guide To Aquaculture



This is one of a series of guides in which Seafish explores topical issues affecting the UK seafood industry. Here we look at the UK and European aquaculture markets, the global picture, opportunities and challenges and how the sector is moving forward.

A Definition

The United Nations Food and Agriculture Organisation defines aquaculture as:

‘The farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants with some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators etc. Farming also implies individual or corporate ownership of the stock being cultivated¹.’

Farmed aquaculture species are either omnivores, herbivores or carnivores. Farmed species can also be categorised in three classes as: freshwater, marine and diadromous (i.e. those that live in both fresh and marine waters).

Generally fish and shellfish are farmed in ponds, in tanks, suspended on supporting structures or confined in nets or cages in lakes or coastal waters. The type and intensity of farming depends on the species and on market demand.

- Mussels and oysters, which feed on plankton and organic particles in the surrounding water, are grown on the bottom or on suspended ropes or racks.
- Warm water prawns are farmed in large ponds in coastal areas, predominantly in the Asia-Pacific region. When fed, artificial feeds come in the form of specially formulated, granulated feeds containing a range of ingredients including fishmeal and fish oil.
- Most marine fish are raised in net pens in coastal waters and are fed on pellets containing a range of ingredients including fishmeal and fish oil.

Aquaculture remains the fastest growing food supply sector in the world.

The intensity of farming method will depend on biology, economics and even the final consumer. In developing countries, where production is aimed at food for survival or to support the local economy, this can mean a family-owned operation where several species are cultured at the same time. In developed and developing countries market demand has led to increased intensification of aquaculture production methods to produce moderate to high-value species.

Key Facts

In the UK the total value of the shellfish produced in 2011 is estimated at about

£19.1 million

In the UK the total value of aquaculture finfish production in 2010 was

£484 million



The Global Picture

According to the UN Food and Agriculture Organisation *State of World Fisheries and Aquaculture 2012* (SOFIA)² report world aquaculture production attained another all-time high in 2010, at 60 million tonnes, with an estimated total value of US \$119 billion.

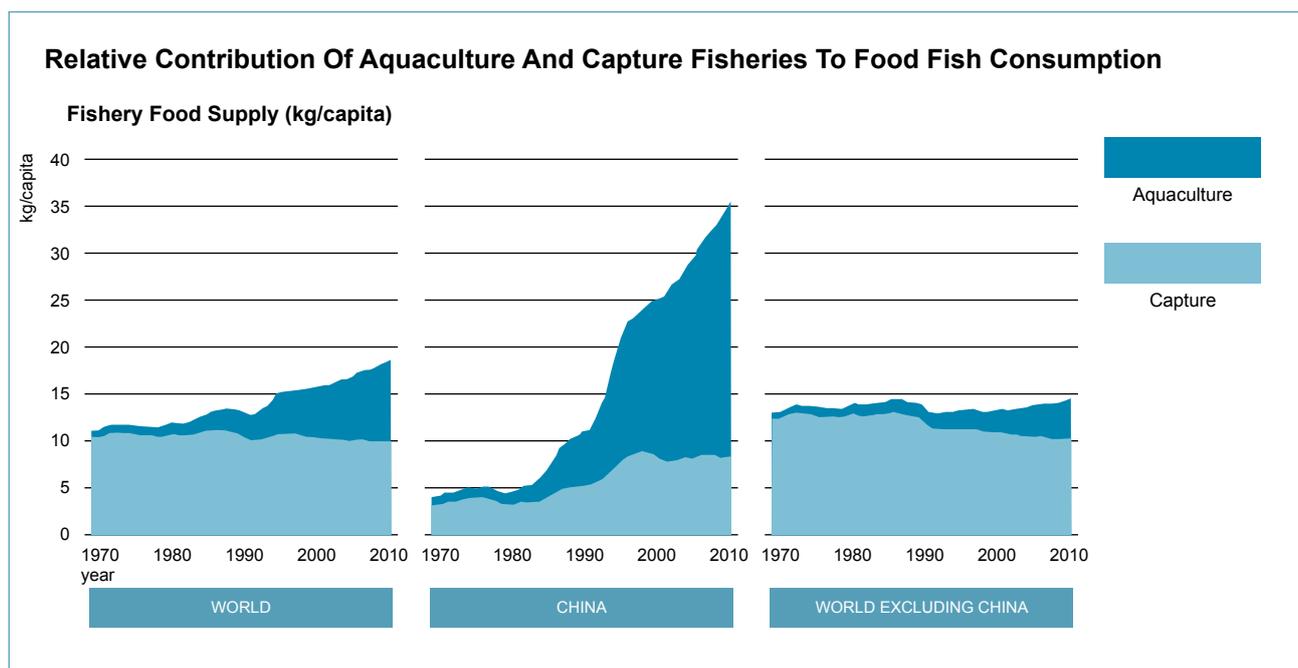
When farmed aquatic plants and non-food products are included, this figure increases to 79 million tonnes with a value of US \$125 billion.

In 2010, global production of farmed food fish was 59.9 million tonnes, up by 7.5% from 55.7 million tonnes in 2009 (32.4 million tonnes in 2000). New FAO data released in March 2013 shows an increase in production to 62.7 million tonnes in 2011 with an estimated total value of US \$130 billion, and a production estimate of 66.5 million tonnes in 2012^{2a}. Farmed food fish include finfishes, crustaceans, molluscs, amphibians (frogs), aquatic reptiles (except crocodiles) and other aquatic animals (such as sea cucumbers, sea urchins, sea squirts and jellyfishes), almost entirely destined for human consumption.

In the last three decades (1980-2010), world food fish production of aquaculture has expanded by almost 12 times, at an average annual rate of 8.8%. Aquaculture enjoyed high average annual growth rates of 10.8% and 9.5% respectively in the 1980s and 1990s, but has since slowed to an annual average of 6.3%. Its contribution to world total fish production climbed steadily from 20.9% in 1995 to 32.4% in 2005 and 40.3% in 2010. Its contribution to world food fish production for human consumption was 47% in 2010, compared with only 9% in 1980.

The growth rate in farmed food fish production from 1980 to 2010 far outpaced that of the world population (1.5%), resulting in average annual per capita consumption of farmed fish rising by almost seven times, from 1.1 kg in 1980 to 8.7 kg in 2010, at an average rate of 7.1% per year.

The global population is increasing and, in order to maintain at least the current level of per-capita consumption of aquatic foods, the world will require an additional 23 million tonnes by 2020.





The UK Aquaculture Sector

The majority of existing food finfish aquaculture activity is located in Scotland, although it is increasing in areas of Wales and England. Shellfish culture is spread more evenly throughout the UK.

Farmed UK shellfish production³

Production (tonnes) of farmed shellfish in the UK in 2011.

Tonnes	Scotland	England	Wales	Northern Ireland	UK Total (tonnes)	UK Total (£ value)
Pacific oyster	251	447	6	50	754	949,400
Native (flat) oyster	28	86	-	-	114	125,400
King scallops	9	-	-	1	10	31,000
Queen scallops	1	-	-	-	1	3,100
Mussels	6,996	3,127	8,370	7,665	26,158	17,966,590
Manila clams	-	5	-	-	5	16,120
Hard clams	-	10	-	-	10	31,000
Cockles	-	6	-	-	6	7,000
Total volume	7,285	3,681	8,376	7,716	27,058	19,130,000

Production of shellfish in the UK was down in 2011 compared to 2010. Total production dropped from 31,500 tonnes to 27,100 tonnes (14% down), with value dropping from £25.5 million to £19.1 million (25% down).

In England mussels are the main species although production decreased by 13% in 2011 compared with 2010. The 2010 total was already the lowest for 10 years. Production of native oysters decreased slightly having increased significantly (by 65%) in 2010 compared with preceding years. Pacific oyster production declined by 34% in 2011 due to the Oyster Herpes Virus, which causes mortality in the larvae and juveniles. Production in 2010 was the highest recorded annual total.

In Northern Ireland the main species cultivated is mussels, where production in 2011 of 7,613 tonnes, was a 29% decrease on 2010. Production of Pacific oysters in 2011 dropped to 50 tonnes, from 260 tonnes in 2010.

In Scotland in 2012⁴ production decreased by 10%, from 6,996 tonnes in 2011 to 6,277 tonnes in 2012. Production of Pacific oysters decreased by 14% from the 2011 total of 251 tonnes. Native oyster production decreased by 9% from the 2011 total of 28 tonnes. Queen and scallop production fell by 67% and 26% respectively since 2011. Overall the estimated industry value decreased to £8.7 million in 2012, from £9.8 million in 2011.

The UK is the third most important producer in Europe of both mussels and Pacific oysters. Overall in 2011 there were estimated to be 70 shellfish farms or sites in England, seven in Wales, 335 in Scotland and 39 in Northern Ireland.

Farmed UK finfish production⁵

The main production in the UK is focused on Atlantic salmon, which is grown mostly on the west coast of Scotland, in Orkney and in Shetland. In Scotland the total production of Atlantic salmon during 2012 was 162,223 tonnes, an increase of 2.7% on the 2011 production⁶. There is also a significant production of rainbow trout grown throughout the UK with concentrations in southern England, Yorkshire and Scotland. There are small quantities grown of carp, brown trout, arctic char, sea bass, cod, turbot and halibut, and more recently tilapia.

According to Cefas the total UK value of aquaculture finfish production in 2010 was £484 million, an increase from 2009 of £29 million.

Finfish	No. of sites	Volume (tonnes)	Employees (F/T)	Employees (P/T)	Employees (F/T equivalent)
England & Wales	292	9,194	844	361	1,006
Scotland	439	159,500	1,294	231	1,398
Northern Ireland	32	1,155	38	12	43
UK total	763	169,800	2,176	604	2,447

The European Aquaculture Sector

EU finfish production^{7,8,9}

In the UK and in other northern European countries (Denmark, Estonia, Ireland, Finland, Sweden and Norway) production is dominated by diadromous species. Marine species dominate in Greece, Cyprus, Malta and Portugal; and freshwater species dominate in Belgium, Czech Republic, Latvia, Lithuania, Hungary and Romania. Other countries show less specialisation, with a more diverse spread of target sectors.

- Diadromous species make up the bulk (81%) of finfish farmed in Europe. European production is focused on Atlantic salmon and rainbow trout. There is a minor contribution from eel, sturgeon, whitefish, brook trout and Arctic char.
- Marine species make up 12% of all finfish produced in Europe including gilthead seabream and bass, with cod, turbot and tuna making a small relative contribution. Other minor marine species farmed are meager, halibut, mullets, other seabreams and sole.
- The freshwater fish sector is the smallest, contributing 7% to total finfish production. It is dominated by common carp (68%), but also includes catfish (siluris, clarias, ictalurus), other carps (silver, bighead), tench, pike, pike-perch (zander), perch, striped bass, tilapia, largemouth bass and barramundi.
- It is notable that several tropical finfish species are being farmed, and the UK is the leading tilapia producer within Europe.

EU shellfish production³

European mollusc production of 0.63 million metric tonnes represents about 4.5% of the world total. Their value of US \$1.21 billion, is just over 8.5% of the world total for this group. Crustacean production in Europe is very small on a world scale and in 2010 was valued at US \$3.7 million, from 251 metric tonnes.

Mussels are the main group cultivated in Europe, with almost 477,000 tonnes (all species) produced in 2010. Pacific oysters are next in importance, with just over 105,000 tonnes produced in 2010, although this is 14% less than was produced in 2007.

Shellfish production in general in Europe is exhibiting a decreasing trend. Over the last five years production has fallen by 9% and 24% for molluscs and crustaceans, respectively.

EU imports

Imports represent a very significant percentage (64%) of European consumption. The EU imports a wide variety of aquaculture species and products, predominantly salmon from Norway, warm water prawns from South East Asia and South America, and fresh water fish such as pangasius and tilapia, primarily from South East Asia.

Key Facts

The total farmgate value of food fish production from aquaculture is estimated at US \$119.4 billion in 2010

In the EU, aquaculture at 1.3 million tonnes (€3.2 billion) accounts for one-quarter of EU production of fish, molluscs and crustaceans



Opportunities And Challenges

Aquaculture is an opportunity to produce consistently great tasting, high quality, healthy seafood in large volumes. It has the potential to match the shortfall between supply and demand whilst reducing the pressure on wild fisheries.

Health benefits

The opportunities are immense. Fish and shellfish are excellent sources of Omega-3 fatty acids and are recognised as important components of a healthy diet. The Food Standards Agency (FSA) recommends we all consume at least two portions of fish a week, including one oily. A recent FSA consultation suggests that, on average, UK per capita consumption is about 1.2 portions per week. If consumption levels are going to increase it is only through the sustainable development of aquaculture that demand will be met.

Economic benefits

Economically the industry is of vast importance. Take for example Scotland. Aquaculture is a nationally important industry for Scotland, particularly for coastal and island communities, where it is often a mainstay of the local economy. The worldwide retail value of Scottish farmed salmon is estimated to be over £1 billion.

Key Facts

To maintain at least the current level of per-capita consumption of aquatic foods for a growing population an additional 23 million tonnes of aquatic food is required by 2020

Scotland's salmon farmers injected £500 million into the Scottish economy in 2009¹⁰.

Environmental challenges

But there are challenges primarily with issues relating to the environment and animal welfare. The environmental pressures exerted by aquaculture are not uniform. The level of local impact will vary according to production scale, techniques and the species farmed. However aquaculture is a highly regulated industry and extensive measures are taken to manage these pressures and help reduce their impact.

Standards and certification

A series of certification and standard setting schemes are in place to demonstrate how the industry is regulated and controlled:

Setting standards	
Feed standards	IFFO Global Standard for Responsible Supply; organic standards such as Soil Association.
Farming standards	Global Aquaculture Alliance; GlobalGAP; Aquaculture Stewardship Council (ASC); Friend of the Sea; The Code of Good Practice for Scottish Fin Fish Aquaculture (CoGP); EU wide rules for organic aquaculture which sets legal minimum criteria.
Farmer and retailer schemes	Individual farming companies and most retailers have Codes of Practice and/or standards which mostly add specific criteria to those prescribed by the organisations above; UK supermarket quality schemes; the Label Rouge quality scheme in France.

Fish In: Fish Out

FIFO is a calculation of the weight of wild fish in kg needed to produce one kg of farmed fish.

The need to provide fish as feed for other fish has been seen as a challenge to the growth of the aquaculture sector, given that the amount of fish that can be produced annually from the world is finite. A lot of focus has also been put on replacement of fish oil and fishmeal by vegetable products and other sources. However today the use of fishmeal and fish oil in trout and salmon diets has decreased to below 20%, and is forecast to further lower to less than 10% by 2020. In addition one-third of the world's farmed food fish harvested in 2010 was achieved without the use of feed, through the production of bivalves and filter-feeding carps.

There has been a lot of research focused on finding replacements for fishmeal and fish oil in fish feeds in carnivorous diets and partial replacements have been identified. Aquafeeds have been seriously improved in terms of formulation, ingredient sourcing and technology, however fishmeal is an essential ingredient in almost all forms of finfish aquaculture requiring feed, even if it is only used early in the lifecycle.

A five to one ratio is often quoted for salmon and there is consensus that five metric tonnes of wild fish must be removed from the sea to produce sufficient oil to create one metric tonne of salmon at the end of the chain. But this fails to take into account the surplus fishmeal that is produced that can then be used for other species. According to the International Fishmeal and Fish Oil Organisation for every tonne of farmed product harvested, fed-aquaculture uses just 0.5 tonnes of wild, whole fish and the true ratio for salmon is around 1.7. The use of whole-fish is kept down as nearly 25% of the raw material for fishmeal comes from recycled fisheries by-products, much of which used to be dumped^{7,11}.

The Movement For Change

Given the strong likelihood that fish landings will remain stagnant in capture fisheries, aquaculture remains the only apparent means to expand world supplies and there is a strong movement for change to make this a reality.

Under the reform of the Common Fisheries Policy (CFP) the EU Commission wants to give new political impetus and leadership to the sustainable development of EU aquaculture by helping to make EU aquaculture more competitive; ensure sustainable growth and improve the sector's image and governance.

The Common Fisheries Policy and its related legislative instruments is currently under review and under the proposed reform aquaculture is seen as a priority area for development:

- The Common Fisheries Policy (CFP) is primarily concerned with the management of the stocks of wild fish in European waters.
- The Common Organisation of the Markets for Fisheries and Aquaculture Products (COM) looks to assist establishment of the best conditions for the markets in Europe.
- The European Maritime and Fisheries Fund (EMFF) is the financial instrument for supporting and implementing the CFP and the COM.

There is already an established aquaculture industry in Scotland; Wales has a robust aquaculture strategy and has invested in regionally distinct, sustainable aquaculture technologies with positive commercial outcomes; and in England, a strategy for sustainable aquaculture is emerging.

Key Facts

One-third of the world's farmed food fish harvested in 2010 was achieved without the use of feed, through the production of bivalves and filter-feeding carps

Other Seafish guides

There are a number of other Seafish Guides in this series, covering different aspects of responsible seafood sourcing, fisheries management and aquaculture. For more details and the most up to date information consult our website at www.seafish.org

There is also a series of Responsible Sourcing Guides¹² outlining the key characteristics of four of the main farmed species consumed in the UK.

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Key Facts

In 2010, global production of farmed food fish was 59.9m tonnes – an all-time high

For further information on the UK market and certification see:

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www.britishtrout.co.uk/
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About Seafish

Seafish was founded in 1981 by an Act of Parliament and aims to support all sectors of the seafood industry for a sustainable, profitable future. It is the only pan-industry body offering services to all parts of the industry, from the start of the supply chain at catching and aquaculture; through processing, importers, exporters and distributors of seafood right through to restaurants and retailers.

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