



More than 20 species of mussels (1) make up the 2.9 million tonnes (t) (2) world production (natural and cultivated) every year. Of this, the UK produces around 26,000 t per annum of blue mussels (*Mytilus edulis*) (3). UK consumption in 2010 was around 4,000 t (4).

Mytilus edulis IMAGE © Scandinavian Fishing Year Book

Mussels are usually purchased 'live in the shell' or pre-cooked in a range of mussels in sauce, shucked meats and marinated forms. Mussels are extremely popular in many other European countries, such as France, Belgium, the Netherlands, Spain and Italy, where demand is buoyant for a good quality product that is handled and delivered to market correctly.

Mussels can be harvested from wild or cultivated stocks. They can be cultivated either on the seabed or on ropes. Mussels grown in different environments have different characteristics in terms of meat content, shell strength, shelf life and biofouling (barnacles and algae on the shells).

During spawning, mussels are weak and unfit for trade. It is important to ensure purchases are from mussels in season and fully recovered from spawning. Shells should be closed or should close tightly when subjected to a light tap. For fresh, live sales, produce must be alive and healthy.

Due to their filter feeding habit mussels are at risk of picking up contaminants, so it is essential that measures are taken to reduce the risk to consumers. These measures are part of the legal framework within which mussel farmers, processors and retailers work.

The purpose of this guide is to give buyers the necessary background information on the responsible sourcing and safe handling of mussels.

BUYERS' TOP TIPS

Know the food safety law

Under certain circumstances mussels can become contaminated with micro-organisms. To ensure food safety, there is a legal framework which strictly regulates the commercial harvesting, processing and retailing of mussels and other live bivalve molluscs. Mussels must be harvested from areas classified under European Food Hygiene Regulations (5, 6). The classification dictates post-harvest processing, which requires mussels to pass through an approved dispatch centre.

Be aware of biotoxins

Mussels can accumulate marine biotoxins (see page 4). This is a natural process, but can result in the mussels being unfit for human consumption. Appropriate sampling will ensure toxin levels are monitored. Waters are closed if toxins levels exceed predefined limits (7).

Traceability

Traceability of mussels is a legal obligation from harvesting to retail. The minimum requirement is for each batch to have a number and a dispatch centre approval number. There are also labelling requirements.

Seafish Responsible Sourcing Service

This is one of a series of Responsible Sourcing Guides which can be found on the Seafish website.

For further guides and information see:

<http://tinyurl.com/seafishrsg>

Mussel growing conditions



Image 1. Mussel beds at Conwy



Image 2. Loch Etive

Biology

Mussels are a type of bivalve mollusc; they have two shells which hinge together. Mussels living in different habitats have different characteristics. Those living intertidally have thicker shells and may exhibit a longer shelf-life than those which are submerged continuously. There are local regulations governing minimum landing size for wild harvest fisheries (Table 2) but, in general, cultivated mussels are not regulated in this way. Mussels are sourced from both wild and farmed origin although the juveniles or 'seed' used for farming are collected from natural settlement.

Wild harvest

Mussels grow naturally in large beds either subtidally or between the tides. Wild harvest of mussels occurs in many areas by towed dredge or hand-raking at low tide. For all scales of operations there is a requirement to meet water quality and food safety regulations.

Seabed and suspended culture

Mussel farming can be carried out by cultivation on the seabed or using suspended culture. This involves locating and fishing seed mussel of around 10mm shell length from offshore beds and then relaying in a more productive and protected location, termed a 'lay', set aside for this purpose (8). In Wales, Northern Ireland, The Wash, North Norfolk and Poole Harbour, the production is mostly derived from sea bed culture within restricted Several Order fisheries (9). In these fisheries a person or company is granted legal ownership of the mussels in a given area of seabed in order to enable mussel cultivation. In suspended culture (10), the mussels are cultivated on a system of ropes and floats (Images 1 and 2) where they grow until harvest 18-24 months later. About 4000 t of rope grown mussels are produced in the UK, predominantly in Scotland, but also in Cornwall. Mussels are also produced in many other European countries. In France they are grown on posts (11) and in Spain they are predominantly cultivated on ropes suspended from rafts.

Organisation key

FSA: The UK Food Standards Agency is an independent Government department set up to protect the public health and consumer interests..

EU: The European Union manages fisheries within European Economic Zones in cooperation with Norway for certain stocks.

FAO: The Food and Agriculture Organisation of the United Nations acts as a neutral forum where all nations meet as equals to negotiate agreements and debate policy.

Inshore Fisheries and Conservation Authorities (IFCAs). IFCAs were created in April 2011. They are either committees or joint committees of local authorities. They are tasked with the sustainable management of inshore sea fisheries resources in their local area (12).

ASSG: Association of Scottish Shellfish Growers is a trade association for producers of mussels, scallops and oysters in Scotland (13).

SAGB: The Shellfish Association of Great Britain is a trade association for harvesters and processors of shellfish in Great Britain (14).

Harvesting and processing

Production requires certain procedures relevant to harvesting areas A, B, C or prohibited.

Cultivated mussels – On ropes or seabed		Wild grown mussels – Dredged or hand raked	
↓ No harvesting permitted in prohibited areas.			
Harvesting Raking, dredging or harvesting from ropes		Relaying For a minimum of 2 months in either A or B category waters	 <p>Image 3. Harvesting cultivated mussels from ropes</p>
↓		↑	
Declumping and grading Mussels are clumped together when growing in their natural habitat. In this mechanical process the mussels are separated and selected by size.		↑ ↑ ↑	
↓	↓	Category C	 <p>Image 4. Harvesting cultivated Mussels. Image 5. David Attwood inspecting the crop at Loch Fyne.</p>
Category A No treatment required	Category B	→ Approved heat treatment	
↓	↓ Purification (deuration) for 42 hours ↓	↓	
Packing and dispatch as live product		Packing and dispatch as a processed product	

Water quality and safety

Biology

Some species of algae that are filtered by mussels and other bivalve molluscs can contain naturally occurring toxins, called biotoxins, found throughout the world. These can become concentrated inside mussels through the process of normal filter feeding. If present in sufficient quantity, they can cause illness in the consumer.

Numerous factors can influence levels, including seasonality, and monitoring is needed to ensure mussels are safe to eat.

In the UK, the Food Standards Agency (7) coordinates the national testing programme for the occurrence of harmful algae, bacteria, viruses and toxins. Mussel samples from

each growing region are tested for the presence of biotoxins, using highly sensitive and accurate procedures. Areas may be closed if threshold levels of biotoxins are reached – this information is kept up to date on the FSA website (7). This high level of surveillance gives food safety assurance to the industry and confidence to the customers.

Microbiological contamination

Microbiological contamination can occur from two main sources – bacteria and viruses. *Escherichia coli* (E.coli) is used as an indicator of general microbial contamination. Bacteria usually have a short residence time in the mussel, and low

levels can be removed by a process termed purification or depuration. Viruses can have a longer residence time in the mussel. Both bacteria and viruses are deactivated by approved heat processing.

Surveys of bacterial levels in mussels are undertaken and it is the results of these surveys which determine classification, either Grade A, B or C categories, under European Food Hygiene Regulations (5). The correct and safe handling of mussels (and other bivalve molluscs) is dependant upon the classification of these waters. The levels of contamination found in the mussels and their required subsequent treatment are shown below and described in the flow chart on page 3.

Table 1: Classification and safe handling requirements under EU Regulations (15)

Classification	Maximum concentration <i>E.coli</i> in mussel flesh	Restriction	Other conditions
Grade A	< 230 cfu of <i>E.coli</i> /100g	Can be sold for direct human consumption	Fresh sales: must be alive and healthy at point of consumer purchase
Grade B	<4,600 cfu of <i>E.coli</i> /100g in 90% of the samples	Cannot be sold direct for human consumption; must be purified (depurated), relayed or heat treated	Approved purification (depuration) for fresh sales or approved heat treatment
Grade C	<46,000 cfu of <i>E.coli</i> /100g	Cannot be sold direct for human consumption; must be relayed (for a minimum of two months) or heat treated to remove microbiological contamination	Re-laying in higher grade water classification for a prolonged period (two months) or approved heat treatment
Prohibited – unclassified	Levels undetermined or greater than 46,000 cfu of <i>E.coli</i> /100g	Cannot be harvested for human consumption	

Seed mussels taken from unclassified areas and relayed for on-growing cannot be harvested for at least six months.

Management and conservation

Mussel growth is dependent on natural plankton being present – no additional food is added to the water. Mussels are also dependent on a stable natural habitat to settle and grow into adult stock. Well managed mussel production can be regarded as a sustainable, low impact operation. Mussel cultivation frequently occurs in valuable wildlife habitats, with many areas protected by nature conservation designations.

The coastal waters, sea lochs and estuaries in which mussels live are often areas where many other activities take place, such as fisheries, leisure and shipping, and other fish farms. Mussel cultivation and wild harvest activities have to fit in with these activities - this can be achieved by good planning and management, with specific issues considered on a site-by-site basis.

To set up a mussel cultivation operation in the UK you must follow a structured process, involving all interested parties including the Crown Estate and local and, in some cases, national Government (9, 16, 17). There is an obligation for those managing fisheries to protect nature conservation from the effects of fisheries and fish farming, under the European Habitats Directive

(18) and Wild Birds Directives (19). The ASSG has designed a Code of Practice (13) which helps to ensure well planned and managed shellfish growing operations. Some shellfish harvesting waters are protected by the EU Shellfish Waters Directive (20) (21).

Legal requirements

Product standard for live bivalve shellfish

Producers of live bivalve molluscs have a legal obligation to supply a safe product. Primarily, they must meet the EU's End Product Standard (5). This states that mussels should be alive, fresh and in good condition, contain inter-valvular fluid, respond to a sharp tap and meet specified bacterial and toxin standards.

Registration document

The registration document is a legal requirement to maintain traceability throughout the food chain so any subsequent handlers, including retailers, can ensure that the mussels have passed through an approved dispatch centre and are marked with an approval number.

The document provides critical information about the quality of the mussels and of how the mussels have been handled before presenting for sale to

the consumer (3). Information on the document includes the supplier (harvester or shellfish producer), the date of harvest, the harvest area classification (Grade A, B or C) under European Legislation (6), its status (open and therefore not subject to a closure due to the presence of marine bio-toxins) and whether the consignment has been re-laid or purified (depurated) at an approved location and handled by an approved dispatch facility.

In addition, waterproof labelling on the mussels must contain a health mark or approval number, state the species, (common and scientific names), date of packaging, a use-by date or state that the animals must be alive when sold (5). Retailers must keep labels for any live mussels which are split from bulk bags for 60 days.

Table 2 Minimum legal landing sizes in England and Wales	
Sea Fisheries Committee	MLS mm shell length
North West and North Wales	45
South Wales	51
Southern	50
Eastern	Wash = 45 Elsewhere = 50
Cumbria	45
For more details contact the Inshore Fisheries and Conservation Authorities (IFCAs) (12).	

Product characteristics

Mussels are sold either as a live, fresh product or processed into a variety of chilled or frozen products, such as cooked mussels in sauce, canned, marinated or breaded mussel meats. Live mussels are generally sold from the chilled cabinet or wet fish counter, priced by the kilo in various pack sizes. Different markets can be demanding on the quality of mussels, including meat content, number of pieces per kilo (weight) and level of biofouling, so it is important that the buyer understands the intended use of the product by the customer. For example, heavily biofouled mussels may be more suitable for shucking and further processing.

Suspended cultivation

Mussels that are produced in suspended cultivation – not on the sea bed – may have certain characteristics. Their shells may be thinner, depending on age and rate of growth and, consequently, the meat-to-shell weight ratio is usually high. Shells may also be less prone to certain biofouling organisms.

Wild harvest and seabed cultivation

Mussels sourced from the sea bed can have as good quality meats as rope grown mussels. Since shell thickness is normally greater, the percentage of meat content is often lower. Thicker shells may give extra durability advantages during handling, particularly in certain mechanical washing, grading and packing processes. In certain situations, bottom grown mussels may also contain particles of grit. This can be removed through washing and purification

Supply chain standards

Responsible practice in the chilled and frozen supply chain depends on correct catching, gutting, washing, chilling or freezing, processing and handling practices throughout the chain. There are standards which cover these aspects from capture to retailer:

- **Seafish Responsible Fishing Scheme.** Sets best practice standards for fishing vessels, based on British Standards Institution specifications (BSi: PAS 72:2006);
- **British Retail Consortium (BRC) Global Standard & Safe & Local Supplier Approval (SALSA) certification.** Designed to raise standards in the seafood processing and wholesaling sectors.

REFERENCES

1. www.food.gov.uk/foodindustry/guidancenotes/labelregsguidance/fishlabellingregs2010eng Mussels are defined as species within the Mytilidae family.
2. <http://www.fao.org/fishery/species/2688/en>
3. <http://www.seafish.org/media/Publications/EnglishAquacultureOverviewFEB2011FINAL.pdf>
4. Seafish statistics.
5. *Council Regulation (EC) 853/2004.
6. *Council Regulation (EC) 854/2004.
7. www.food.gov.uk/foodindustry/farmingfood/shellfish
8. Seafish Seabed Cultivated Mussel Hyperbook, <http://www.seafish.org/aquaculture/information-for-culturists/species-and-sites/species-selection>
9. UK Shellfish Act 1967.
10. Seafish Suspended Cultivated Mussel Hyperbook, <http://www.seafish.org/aquaculture/information-for-culturists/species-and-sites/species-selection>
11. www.fautaweb.com
12. <http://www.marinemanagement.org.uk/fisheries/ifcas/>
13. www.assg.co.uk
14. www.shellfish.org.uk
15. <http://food.gov.uk/foodindustry/farmingfood/shellfish/shellharvestareas/>
16. <http://www.scotland.gov.uk/Topics/marine/Fish-Shellfish/18716>
17. <http://www.defra.gov.uk/environment/marine/shellfish/>
18. *EU Habitats Directive 1992/43.
19. *EU Wild Birds Directive 1979/409.
20. EU Shellfish Waters Directive 2006/113.
21. <http://www.defra.gov.uk/environment/quality/water/water-quality/shellfish-directive/>
*European Legislation available on www.europa.eu

For further information contact:

Bill Lart **T:** 01472 252323 or **E:** w_lart@seafish.co.uk

Karen Green **E:** k_green@seafish.co.uk

Origin Way, Europarc, Grimsby DN37 9TZ

t: 01472 252300 f: 01472 268792

e: seafish@seafish.co.uk w: www.seafish.org SIN: <http://sin.seafish.org>

supporting the seafood industry for a sustainable, profitable future