

General advice

- Draw up a business plan and consult independent financial advisors.
- Identify your market(s) at the outset.
- How likely are you to receive planning permission from the competent agency (eg Local Council, Crown Estate)? Consult local aquaculture development plans, where they exist, and speak to the staff involved in granting licenses.
- Is the local infrastructure (roads, piers etc) adequate to support your proposal, or will you have to construct them?
- Can a Crown Estate lease be secured? Consult them.
- What conservation value/interest does the site have? What about the surrounding area? Consult the nature conservation agencies, statutory (English Nature, Countryside Council for Wales, Scottish Natural Heritage, Environment and Heritage (Northern Ireland) and voluntary, for the area.
- Is there likely to be any hazard to navigation or transport? Consult the Maritime & Coastguard Agency and the Department of Transport.
- Are local inhabitants or other user groups of the marine environment likely to object? Can objections be overcome through dialogue or design modifications? Consult them early on.
- Does the proposition require grant aid or other assistance and how likely is it to be awarded? Consult the agencies administering grant and other business assistance in the area from the start.
- Generally, avoid areas close to boatyards, marinas, industrial developments or large urban areas. This minimises the risks from pollutants or other anthropogenic inputs. Potential inputs from within the wider water catchment area (eg land-based farming activity, both arable and livestock, forestry, horticulture, chemical industry etc) should be investigated.
- Evaluate the potential risk (disease, nutrient input, therapeutic use, predator displacement, controls on stock movement/sales following from disease events on other sites etc) from other marine aquaculture activity in the vicinity.
- How secure is the site? What is the risk from interference or other unwanted human activity? Can the site be secured if required?
- Try and establish whether the area has a shellfish cultivation or harvesting waters classification from the local Environmental Health office or equivalent.
- Try and establish whether the site has a history of algal biotoxin (PSP, DSP, ASP etc) accumulation or harmful algal blooms ('red tides'), although past track record is a poor predictor of future performance.
- What potential predators, competitors or fouling organisms are likely to be encountered?
- Once the business is operational, the site must be registered. Consult the Centre for Environment, Fisheries and Aquaculture Sciences (CEFAS), Scottish Executive Environment and Rural Affairs Department (SEERAD) or Department for Agriculture and Rural Development (DARD) in Northern Ireland as appropriate.

Further advice

■ For further advice on any aspect of rope-grown mussel cultivation please contact the aquaculture advisor for your area.

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Alternatively, please visit our website at www.seafish.org/sea for more information. The website also contains details of the CD-ROM based resources produced by Seafish. There is a specific Hyperbook, which combines in-depth information regarding the culture of this species together with an economic modelling tool for business planning purposes. In addition, there is a more general Guide to commercial bivalve molluscs with information on aspects of cultivation, harvesting, the fishery, depuration and distribution for all species.



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INVESTOR IN PEOPLE

ROPE-GROWN MUSSEL CULTIVATION

This leaflet is intended to offer a summary of the methods used to cultivate rope-grown mussels in the UK. More detailed information about specific aspects of the business may be found in Seafish publications, technical publications from other agencies and books. Prospective cultivators are advised to consult these in addition to this sheet. Preliminary business planning assistance can be found in the associated Seafish economic model and 'Hyperbook' publications.



Rope-grown mussels



Site selection

- Seawater temperatures above 8 – 9°C for much of the year are preferable for fastest growth.
- Salinity generally above 20 ‰.
- Shelter from extreme wave action or strong tidal flows is preferable.
- Tidal flow of 1 – 2 knots (50 - 100 cm sec⁻¹) is acceptable, although less is also acceptable.
- Water depths in excess of 12 m at extreme low water on spring tides are preferable, although shallower sites can also be utilised.



Mussel longlines



Droppers and floats attached to longline



Mussel rafts

Cultivation techniques

- Rope-grown mussels are usually grown on ropes suspended from either surface longlines or rafts.
- A typical longline in the UK would consist of either a single or double headrope supported by grey plastic floats at regular intervals. The line is anchored to the seabed or shore at either end. The specification of the anchor system is tailored to the local conditions. The length of the line can be varied to suit the location, but it is generally between 200 – 400 m. The spacing of the plastic floats (buoys) depends upon their buoyancy and the expected load upon the line. Generally, they are spaced at up to 3 m apart. Rope of between 20 – 32 mm diameter is commonly used for the headlines. The separation between longlines is largely dependent upon the size of the servicing vessel; sufficient clearance should be allowed to enable the vessel to work and manoeuvre safely. In some locations, the longlines may be kept slightly submerged in order to avoid disturbance from wave action.
- A typical UK raft would be approximately 10 m square and consist of two floatation pontoons or float arrays, one either side, overlaid with a wooden framework, with supports approximately 0.5 m apart. Each raft may be anchored separately or it may form part of a larger array.
- The rope 'droppers', on which the mussels are grown, are usually 12 mm in diameter although there are a wide variety of bespoke 'mussel line' designs available on the market. Plastic pegs or discs may be inserted through the twist of the rope to provide additional support for the mussels. 'Droppers' are generally between 6 – 10 m in length, depending on the depth of the water.
- 'Droppers' may be tied to the headlines or raft cross pieces at between 0.45 – 1 m apart, depending upon local tidal conditions.
- Most rope-grown mussel cultivators collect their own stock from the wild spat-fall. The rope droppers are coiled so that they remain in the top 2 – 3 m of the water column and they are placed on the line or raft in time to collect the natural spat. The exact timing of settlement varies around the country, but the main spat-fall is generally in early summer, although later and earlier settlements also take place. Mussels can spawn several times during the year.



Mussel seed on dropper ropes

- The spat settle from the water column on to the ropes and attach using their byssus threads.
- Once the spat are firmly attached, the ropes can be carefully uncoiled and lowered to their full length.
- For growers in areas of poor spat settlement, it may be possible to purchase spatted ropes from growers in areas of denser settlement.
- The stock should be assessed regularly in order to check growth and to remove any predators which may also settle from the plankton on to the droppers (eg starfish and crabs).
- As the stock grows or fouling increases, it may be necessary to add additional buoyancy to the longline in order to prevent the droppers touching the seabed. If this occurs large starfish often gain access to the droppers and decimate the growing stock.
- Other marine organisms that have planktonic larval stages, such as barnacles, tubeworms and sea squirts, may also settle on to the mussel ropes or on to the mussel shells themselves. They can compete with the mussels for feeding and if settlement is particularly dense they can, especially in the case of the hard-shelled varieties like barnacles or tubeworms, cover the stock to the extent that it becomes unsaleable.
- 'Soft fouling', such as sea squirts and macro-algae or predators like starfish, can be controlled by raising the droppers from the water and allowing them to dry in shady conditions before they are resubmerged.
- 'Hard fouling', such as barnacles and tubeworm, are more difficult to control and the best method seems to be one of settlement avoidance. This may take the form of raising the droppers from the water when settlement of



Mussel dropper lines underwater

- these organisms is expected, although this is hard to predict accurately since it varies from year to year and between locations. An alternative is to move stock to an area where settlement is usually light or absent. Experimentation is often required to find such locations and even so the pattern may vary from year to year.
- Avian predators, such as eider and golden-eye ducks, can present the grower with problems in some areas. Both are protected species and it is illegal to kill them without a licence. One of the most effective methods of deterring their presence around the mussel lines is to harass them by boat whenever they are seen. Other control or predation prevention measures are used and they are outlined in guidelines produced jointly by the Association of Scottish Shellfish Growers (ASSG) and the conservation bodies. Consult them for the latest guidance.

- As the stock grows, the density of mussels on a dropper may be such that growth falls below optimal levels due to overcrowding. Some growers take action to remedy this by raising the droppers, removing the mussels, decreasing their density and then re-attaching them to a fresh dropper enclosed in a supportive mesh stocking. This process is called 'resocking' or 'retubing'. Alternatively, other growers think that the time and effort expended in 'resocking' is not justified by the returns and they allow 'natural thinning' to occur as stock falls from the droppers under its own weight.

- Mussels are generally retubed at densities between 1.5 – 2 kg per metre of dropper. This can be accomplished either manually or using automated machinery. The choice of method is largely determined by the level of production.

Harvest

- Depending upon the location and size at harvest, the first 'crop' of rope-grown mussels can be obtained in between 2 – 3 years.
- Depending on the size of the business, harvesting may be by hand or fully automated.
- Each dropper is raised from the water and the mussels removed either by hand or by machine.

- They may then be transferred to a shore-based facility or the next stages may take place on-board the harvesting vessel.

- The mussels are separated or 'declumped', washed and graded, again by hand or automated line.
- Each dropper may yield between 5 – 7 kg of marketable mussels.

- Small mussels may be retubed and returned to the sea for further growth, although not every grower will do this.
- It is now common for the marketable mussels to be passed through a shore-based depuration plant before they go to market, even when this is not required by law. The grower may operate the depuration plant themselves or contract the service from a third party.



Depurating mussels

- After depuration, the mussels may be shipped to a wholesale packing and dispatch centre in bulk or they may be packed in to bags or other display containers by the grower.

- Mussels should be transferred to market or wholesaler in chilled transport conditions in order to preserve quality.

Mussel declumping, washing and grading line



Rope-grown mussels bagged ready for sale

Markets

- Rope-grown mussels may be retailed direct from the grower or via a wholesaler.
- The markets, both home and export, for rope-grown mussels are strong and premium prices are commanded in the market place.
- Individual growers or wholesale co-operatives are developing processed or value-added product lines to further enhance the value of their crop.



Mussels loaded into chilled transport

Equipment

- At greater production volumes increasing mechanisation will be needed.
- Additional equipment may include storage and dispatch facilities, a depuration facility, larger declumping and grading machines, retubing equipment, packing system, stock handling system.
- A mussel farmer will also need an assortment of smaller pieces of equipment and safety clothing in addition to the more specialised items. Examples of the equipment required include First Aid kit, lifejackets/ buoyancy aids, signal flares other boat safety equipment – see the workboat code of practice for guidance, pressure washer, gloves, knives, communication equipment (mobile phone or VHF radio).