

'Mini-mussels' - New Opportunities and Environmentally Friendly Production

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Editorial

An alternative solution to the problems with mussel dredging, overfishing and farming in eutrophicated and shallow Danish fjords may be the use of more open and deeper marine areas for cultivation of 'mini-mussels' during one season.

About half of the annual world-wide harvest of mussels comes from Europe, with main yields from Spain, France, The Netherlands, and Denmark. In Denmark, the mussel production mainly comes from fishery on wild stocks of blue mussels in Limfjorden. In this fjord-system the annual landings were about 100,000 tons in the 1990's resulting in overfishing and a subsequent reduction of the mussel stock, and in 2006-2008 the mussel fishery declined to about 30,000 tons per year which led to restrictions and a national policy that aims at developing a sustainable production of cultured mussels in balance with the extensive fishery of mussels.

In recent years, the total annual Danish mussel harvest has been around 35,000 tons, with 70% coming from Limfjorden. However, eutrophication and seasonal oxygen depletion cause high mortality of bottom-living wild mussels during late summer, and therefore, line-mussel farming has recently been introduced to increase the production of mussels and to mitigate the habit disturbance of mussel dredging. An alternative solution to the problems with mussel dredging in Limfjorden and other shallow Danish fjords may be the use of more open and deeper marine areas for cultivation of mussels.

The aim of a recent mussel-research project, MarBioShell was to evaluate the potential of the Great Belt region between the Kattegat and the Baltic Sea as a new line-mussel cultivation site to relieve some of the pressure on Limfjorden and to cover an increasing demand for blue mussels. Thus, the deeper water and faster current speeds in the Great Belt are likely to prevent the environmental problems encountered in Limfjorden. The wild blue mussels in the Great Belt have never been commercially exploited, but regarding future mussel farming the MarBioShell studies have shown that blue mussels (*Mytilus edulis*) can grow from settlement in spring to 30 mm in shell length in November. However, to reach the traditional consumer size of at least 45 mm it will take about 18 months because of the winter period with weight loss and subsequent re-growth during the next season. It has therefore been suggested to consider a new approach of line farming of 30 mm so-called 'mini-mussels' during one growth season, from early spring to November, recovering all equipment at the time of harvest and re-establishing it at the beginning of the next season for a new population and thus protecting the equipment from the often damaging weather of the Danish winter season.

The benefits of growing 'mini-mussels' in Great Belt and other comparable temperate waters seem to be many:

- Mussel larvae that settle on the cultivation lines (ropes) in May-June grow rapidly and attain a shell length of about 30-40 mm in one season so that they can be harvested in November as 'mini-mussels'.

- One mussel of 35 mm shell length grown in the Great Belt contains as much meat as a 45 mm mussel dredged in Limfjorden.

- There is no minimum size limit for line-mussels, and therefore the growth period can be reduced to one season (May to November). Small mussels harvested in November will not be plagued by epifauna such as ascidians, tubeworms and barnacles on the shells.

- Growth in the Great Belt can take place in the whole water column (i.e. at least to a depth of 8 m) and therefore approximately 30-40 kg per m², equivalent to 3-4000 tons per year within a normal production area of 250×750 m.

- The mussel-farm system can be packed together and placed on land during winter.

- Without the traditional thinning, sorting and transplantation the cultivation is less labor intensive (automation and robots might take over).

- 'Mini-mussels' are more delicate and taste better than large mussels (like: lamb versus sheep, calf versus cow, sucking pig versus adult pig, small chicken versus big hen), and mini-mussels may enter into new, exciting and tasty types of dishes after exotic model where small mussels and clams are traditionally used in many dishes. The suggested new, smaller-sized consumer product should be attractive in its own right - like the small French 40-mm 'bouchot' mussels for which there is a market.

- 'Mini-mussels' seem to contain more unsaturated fatty acids than large mussels.

- Harvested juvenile mussels that have not during the season grown up with the new minimum size (30 mm) for 'mini-mussels' may instead be used as for example chicken and fish feed, and the harvested mussels also help to remove nitrogen (N) and phosphorus (P) from the marine environment.

Although the above arguments may seem convincing no production of 'mini-mussels' has yet taken place because a number of problems must first be addressed: 1) The new product has to be developed and launched, i.e. 'mini-mussels' must come out to the consumers through distribution and effective marketing; 2) Investors should be made interested in producing 'mini-mussels', i.e. need for the establishment of large, rational mussel-cultivation farms; 3) It is an engineering task to design large mussel-farm systems for the Great Belt and similar more open temperate waters.