



Mussels general

The mussel is an important product in Dutch shellfish farming. The annual global mussel production amounts to approximately 1.94 million tonnes of mussels, of which approximately 57,000 tonnes are produced in the Netherlands. Most mussels are destined for the fresh market, and a large part is exported to Belgium and France. As production takes place in important nature areas, the farming process is governed by the strictest regulations. Mussel spat, the raw material for mussel farming, is becoming scarcer, and mussel farmers are looking for alternative sources of mussel spat. One of the options that could provide a solution is the installation of spat collectors. Experiments have demonstrated promising perspectives, and although the technology is still under development, spat collectors are likely to play a role in making Dutch mussel farming more sustainable.

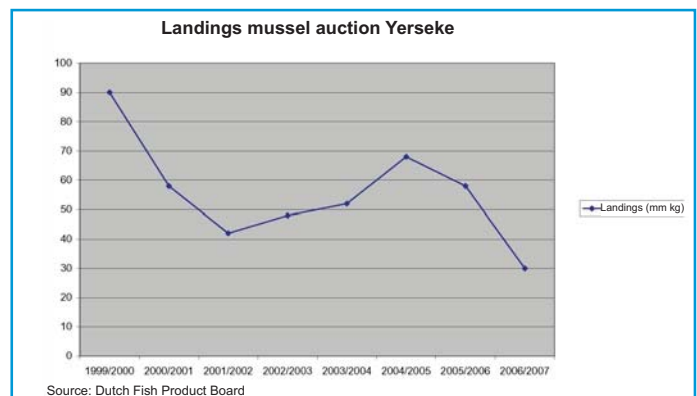
The mussel (*Mytilus edulis*) is a bivalve mollusc. Mussels occur in a range of habitats, such as drying sand flats and permanently covered sand flats. They also like to attach themselves to a hard substrate or to ropes in water. This range of habitats mainly produces differences in the construction of the shells - mussels that grow on sand flats that fall dry during low tide generally have a stronger shell than mussels that hang on ropes. Mussel fishing has taken place in Dutch waters for more than 150 years. The two farming areas are the Oosterschelde and the Wadden Sea - together approximately 6,000 hectares in size. The Wadden Sea has most mussel plots and with the strong influence of ebb and tide and the greater supply of food for mussels, it is the area that is most suitable for farming. However, the dynamic characteristics of this area make the yield of the Wadden Sea less consistent than that of the Oosterschelde. Storms and damage by crabs and starfish can have a significant influence on the quantities in the Wadden Sea, whilst the situation in the Oosterschelde has been strongly stabilised by the flood barrier. Apart from using seabed cultivation, mussels are also farmed with the suspended cultivation method in the Netherlands. The latter method places mussel spat in long mesh stockings that are hung from rafts in the water column in the Oosterschelde. There are a number of differences between the two farming methods. First of all, suspended-culture mussels grow quicker than mussels grown with the more traditional seabed culture. Suspended-culture mussels are processed differently, because their rapid growth means their shells are less strong. Finally, suspended-culture mussels do not require depuration, because they do not touch the seabed and are therefore free from grit.

Social debate

The nature organisations WWF and the North Sea Foundation have put mussels from a seabed culture in the orange column of their fish-purchase guide, the *Viswijzer*. This mussel is the 'second choice' according to this guide, because this method uses wild spat for farming. Their objection is that this possibly causes damage to the seabed and that it would leave less food for birds. However, importing mussel spat from abroad carries a small risk of importing parasites and diseases too. These factors do not play a role in mussels that are farmed with a suspended farming method, and therefore suspended-culture mussels are in the green column of the Fish Purchase Guide, and are an 'excellent choice'.

The facts in brief

- Seed mussels use 'byssus threads' to attach themselves to the seabed or onto objects, rocks, or each other. This enables mussels to cover large parts of the seabed, and produces the so-called mussel beds.
- Since the 1980s, the Wadden Sea can host fewer shellfish, because of the reduced growth of algae plankton - the food of shellfish. Their reduced growth is linked to falling amounts of phosphate and nitrogen compounds and to changes in the clarity of the water¹.
- However, there may still be large amounts of shellfish. The very large stocks that are sometimes formed are produced by one good spatfall, i.e. the number of larvae that grow into adult mussels. One good year class can ensure a succession of good shellfish years.





- By harvesting mussel spat in areas where it has a low chance of survival and by relaying it in protected areas, mussel spat fishery makes a positive contribution to the availability of mussels. It is estimated that this farming method means that 15% more mussels are permanently under water in the Wadden Sea than would be the case without farming².
- Until 2005, a food reservation system applied, which meant that a percentage of the mussel stock was reserved as food for overwintering oystercatchers and eider ducks. However, scientific research has shown that moving mussel spat to the productive areas only increases the production of shellfish in the system, and therefore food reservation was abolished.
- The Sustainable Shellfish Fishery Research Project, *Proodus*, consists of three phases. Phases 1 and 2 were completed in 2006. Phase 3 is the research for the 2007-2010 period and is focused on studying the effect of mussel-spat harvesting and managing mussels in the mussel stock of the sub-littoral of the Wadden Sea.

grower, the size of the mussels (shell size and meat weight), and the percentage of waste material, such as loose shells, barnacles, starfish, etc. in the batch. The result of the sampling is announced before the auction, following which traders can bid for the batches on offer. The trader then has the mussels taken to his 'wet warehouse'. The wet warehouses are plots off the coast of Yerseke, where the *Oosterschelde* has a hard seabed. Here the mussels can purify themselves (deuration), which means they are offered free from grit to the consumer. As a result of their deuration in the *Oosterschelde*, the mussels are given the label 'Zeeuwse mussel'. Mussels are sold alive in their shell, but also processed in sauces.

From mussel spat to market-size mussel

For the trade, the mussel season starts in the middle of July. The start of the season depends on the supply and the quality of the mussels. The season runs from the middle of July to the middle of April the following year. The adult mussels that are traded are also known as market-size mussels. These mussels are grown from mussel spat to seed mussels and finally to market-size mussels in the mussel plots in the farming areas. Traditionally, mussel spat was obtained by harvesting wild spat, particularly in the Wadden Sea and to a much lesser extent in the *Oosterschelde* and in the *Voordelta*. In the spring and in the autumn, an inventory is produced of the quantity of available wild mussel spat, following which a licence is requested for harvesting part of this wild spat. The mussel spat is then taken to lays. A small part of the mussel spat is put in the so-called stockings and hung in the water column. They are the suspended cultures.

Mussels then need 18 to 24 months to grow into a market-size mussel. In the meantime, the mussels are re-laid every so often to have the space to grow and to remove other predators, such as starfish and crabs. When they are large enough, the mussels are dredged up and taken to the mussel auction in Yerseke.

Here the batch is sampled by employees from the Dutch Fish Products Board, *Productschap Vis*. Sampling a batch means that a random sample is taken, which is used to determine the number of mussels offered by the

Farming methods:

- **Seabed culture:** The mussel spat is harvested in the Wadden Sea and then transplanted to lays, where it grows into seed mussels. These are dredged up again and are re-laid on plots with an optimum food supply. This is where mussels grow to market size.
- **Suspended culture:** This is where the spat is placed in long mesh stockings that are hung from rafts in the water column in the *Oosterschelde*.
- **Spat collectors:** Alternative method with under-water ropes and networks to harvest spat. This spat can then be farmed in the traditional manner.
- **Nurseries / hatcheries:** A completely artificial environment where the mussel is encouraged to reproduce artificially and where the spat is farmed into market-size mussels by feeding it algae.



Room for a salty harvest (*Ruimte voor een zilte oogst*)

Until the 1990s there were no restrictions on fishing shellfish in the Wadden Sea and the Oosterschelde. Drying mussel beds disappeared and this was followed by a period with low spatfall for mussels and barnacles, the resulting low shellfish stocks and major bird mortality ensured that shellfish fishery was brought into question. Areas were closed permanently for shellfish fishery. A food reservation system was also set up, whereby a percentage of the shellfish stocks was reserved for overwintering shellfish eaters, and part of the responsibilities of the government was delegated to the fishery industry (co-management). The efficacy of this shellfish policy was studied in the second phase of the evaluation of the shellfish fishery policy (EVAII). EVAII led to a policy decision for shellfish fishery 2005-2020: Room for a salty harvest. This policy decision strives for an economically viable business sector with production methods that value ecological features and possibly enhance them where possible.

This policy decision abolished the food reservation of mussels for birds. The policy decision recognised that by moving mussel spat from areas with a good spatfall but poor growth or little chance of survival to areas with little spatfall but good growth, the production of shellfish in the system increased. Autumn harvesting of mussel spat may only take place in so-called unstable stocks. These stocks are very likely to disappear due to storm or damage by starfish and crabs. In the spring, all open areas may be fished below the low-tide line that should always be under water. Both fisheries require a fishing plan. At the same time, approximately 85% of the mussels that are fished in the spring must overwinter in the Wadden Sea. Furthermore, the sector is working on a higher yield and alternative methods for obtaining mussel spat. The higher yield can be obtained by transplanting the spat to lays with a higher production capacity and with favourable characteristics for growing mussels.

Alternative methods for obtaining mussel spat are the spat collectors and the hatcheries/nurseries in particular. Spat collectors use under-water ropes and networks to catch mussel spat. This spat can then be farmed in the traditional manner to market-size mussels.

This year, the existing spat collectors were evaluated and it was decided to continue experimenting for one more year. For example, it must be studied as to whether it is possible to install the spat collectors completely under water.

Double use of the lays must also be studied, as the actual room required for the spat collectors is one of the sticking points. Double use means the lessor of the mussel lay is given the opportunity to place a spat collector in the water column above his lay. This could make a significant difference in terms of the room required.

In 2009, the policy for the spat collectors will take effect and the number of hectares where spat collectors may be placed will be scaled up gradually in order to work on alternative mussel-spat production. Hatcheries/nurseries work on farming mussel spat. Adult mussels are given a temperature shock to encourage them to reproduce. The mussel larvae that are produced are farmed into mussel spat and seed mussels. The problem in mussel farming is that mussels must be given the correct combination of algae to grow properly. Another issue is that mussels cannot stay in the nurseries for too long, because this would drive up the cost price of mussels. Therefore, the current experiments are on growing the mussels outside the nurseries.

By developing these alternative methods, mussel farmers must become less dependent upon wild mussel spat. This would enable the sector to comply with the objectives for the ecological features and value of the Wadden Sea and the Oosterschelde. Furthermore, the discussions with the nature conservation organisations could be reduced, and farmers and traders would have the additional benefit of a more stable supply of mussel spat.

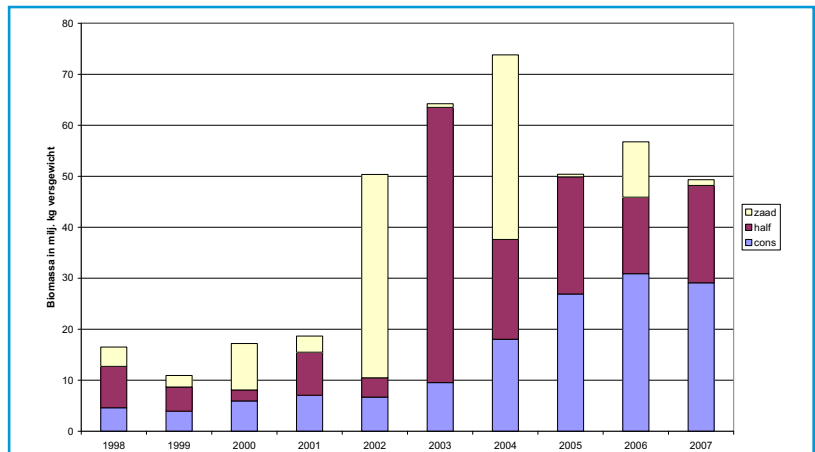
Making mussel production in Dutch coastal waters more sustainable is one of the key points in shellfish fishery policy. This mainly concerns harvesting mussel spat. Spat collectors are likely to play a role in making Dutch mussel farming more sustainable. According to the policy decision, the mussel industry has until 2020 to develop and experiment with alternative methods. In anticipation of the results of the Probus study in 2010, the fish industry believes it will no longer have to discuss the effects of mussel fishery.



Trade and processing

The annual global mussel production amounts to approximately 1.94 million tonnes of mussels, of which approximately 57,000 tonnes are produced in the Netherlands. The main markets are Belgium (65%) and France (23%). The Netherlands not only exports a large part of its mussels, it also imports a large part for the trade. Ireland is the most significant import nation.

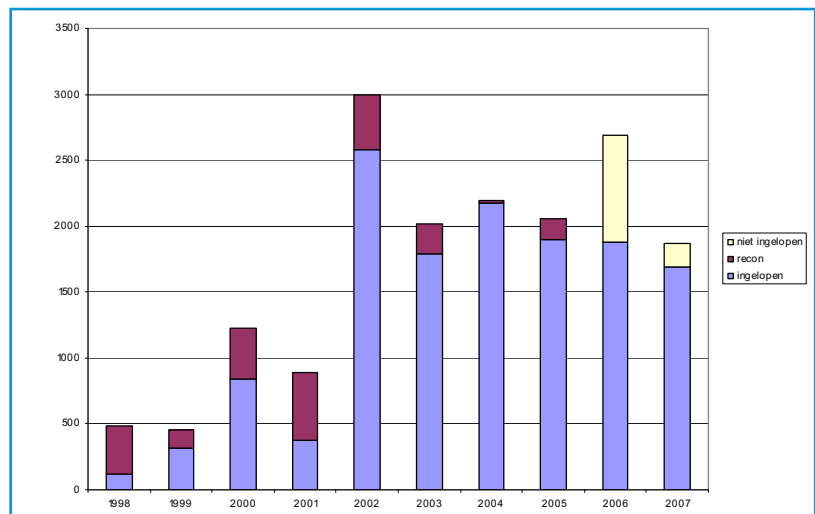
Most mussels are destined for the fresh market and are packaged in plastic bags or trays with different weights. Mussels are also processed into tinned and frozen products.



Top figure: Biomass and composition of the mussel stock in the littoral in the spring from 1998 to 2007.

Mussels are categorised in cohorts of spat (small), seed mussel (medium) and market size (large).

Bottom figure: Cultivated area of mussels in the littoral in the spring from 1998 to 2007. The uncharted cultivated area in 2006 and 2007 will be corrected by reconstruction on the basis of the upcoming survey.



WOULD YOU LIKE TO KNOW MORE?

If you would like to know more about mussels and/or the measures taken by the Dutch fishery sector, please visit www.pvis.nl where you will find more information.



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