



Pile and pontoon hulass

- *Type: uses biobuilders;*
- *Application: in salt, brackish, and fresh waters. Different varieties will move in depending on salinity levels.*
- *Contributes to:*
 - *Natura 2000 habitats⁷: 'Estuaries', 'Large shallow inlets and bays', 'Water courses of plain to montane levels with the Ranunculus fluitans and Callitriche-Batrachion vegetation', 'Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation';*
 - *Natura 2000 species⁸: fish, birds, snails, for example.*
 - *Water Framework Directive (WFD)⁹: transitional waters, coastal waters, rivers, lakes and canals.*

In working ports, the restoration of the original ecological values (ecotopes such as salt marshes, mud flats and shoals) is possible only to a very limited extent due to the amount of space required and the depth of the harbours. The natural function of a harbour basin can be enhanced using simple resources such as artificial hanging substrates of varying forms and materials: these are known as 'pile hulass' or 'pontoon hulass'.

- Pile hulass: freely suspended rope structures that can be attached around wooden and steel piles¹;
- Pontoon hulass: consist of square, floating frames made from PVC tubing. A nylon net is stretched on the inside of this frame and ropes are suspended on the mesh intersections¹.

Experiments in salt water can be described as successful. It is

suspected that mussels will colonise the hulass in fresh waters.

These structures are primarily intended for substrate-dependent (in other words, attached) organisms, as refuges for animals that crawl or swim in the locality, and as sources of food for birds, fish and macrofauna. Species such as mussels, sea squirts and sponges colonise the underwater structures and, because they filter the water, they can help to improve water quality. These are good habitats for fish, not least because this local increase in the food supply provides them with an excellent feeding ground.

In addition, it may be possible to use pontoon hulass to attenuate waves. However, this application has not yet been tested.

Specimen projects:

- Docks in Rotterdam (Scheurhaven and Pistoohlhaven), pile hulvas and pontoon hulvas ¹.



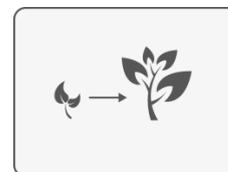
Spatial aspects



Pile hulvas with two-metre ropes



Pontoon hulvas with four-metre ropes



Growing time 3 months

Services^{10, 11}

Ecosystem services generate benefits if people can exploit the services and capitalise them.



Cleaning function²

Mussels filter their food from the water and, during the process, capture inorganic sludge particles as well. This removes sludge from the water, reducing turbidity. Calculations have shown that 35 pontoon hulases per harbour basin result in the entire water volume of the port of Rotterdam being filtered every month by mussels.



Biodiversity^{1,2,3}

The hulases provide a home for many species, including mussels. The hulases also serve as a source of food for fish and as refuges and breeding grounds. The Pacific oyster (an undesirable exotic variety) would not appear to bond well to rope structures and so hulases could be a way of improving the weakened position of the mussel with respect to the Pacific oyster in port areas. A pile hulase has between 8 and 20 times more biomass per m² than a pile without a hulase.



Water dynamic^{2,4}

Hulases could be used to attenuate reflected waves in harbours.

Benefits and cost savings^{10, 11}

The ecosystem services referred to above generate benefits if people can exploit the services and capitalise them.



More appealing habitats

Improvements to water quality help to prevent the growth of duckweed and algae (including cyanobacteria).



Aquaculture^{1,2,5}

Mussels make up at least 95% of the biomass on the ropes of the pontoon hulases. So it is not

at all surprising that all sorts of rope systems are being used worldwide to capture mussel seed and to cultivate mussels. Within a few months, no less than two to three kilograms of mussels have been cultivated on a hula rope with a length of 1.5 metres.

Natura 2000 and WFD measures

Hanging structures could be used for mitigation or compensation. The cost savings depend on the local objectives and the scale on which the pile and pontoon hulases are used.

Both costs and benefits are location-specific and difficult to extrapolate. Cost-benefit analyses will therefore have to be conducted for each individual location.

Costs

Construction costs more than traditional designs, which do not involve any three-dimensional structures. However, the material used is relatively cheap. Hulases still have to be made by hand.

Management and maintenance

Pile hulases

As long as the hulases are properly attached to piles, they do not require maintenance.

Pontoon hulases

As long as buoyancy is adequate, pontoon hulases do not require maintenance. Incidentally, pontoon hulases are so densely populated after a number of months that it becomes difficult to lift them out of the water for inspection and management purposes.

Physical boundary conditions

Water depth¹

Pile hulases have been developed for the area above the Average Low Water line with ropes that float; others with ropes that sink have been developed for the area below that. Organisms colonise ropes below the

Average Low Water line much faster than above it (in other words, the lower one goes, the more biomass one finds). The level of biomass production on the pile hulas above the Average Low Water line is limited but certainly not insignificant.

Dynamic¹

Water turbulence caused by ship thrusters led to ropes rubbing up against one another and a reduction in biomass.

Salinity^{1,6}

High levels of biomass production can be expected in salt and brackish waters as long as salinity remains relatively constant. Mussels grow less quickly for a period of approximately one month when they are exposed to lower salinity levels. If salinity remains low but stable, the rate of growth will return to more or less the original level. The same principles apply to freshwater variants.

Food supply¹

More food in the form of suspended organic particles results in more biomass.

Other boundary conditions

Low rope concentration

The horizontal input of food particles is important. Pontoon hulas with a lower rope concentration will produce more biomass because they allow for relatively high levels of water replenishment and food input. However, the distance from the inner ropes to the edge of the hula should not be too large.

Potential sites

The hulas can be used in city ports and rivers, but not in sections of the river where the flow is fast. The passage for boats should also be taken into account. There is most impact on water quality in waters where residence times are relatively long.

1. Deltares (2010) *Rijke Dijk in de Rotterdamse haven, Vrijhangende substraten en Ecobetonplaten*.
2. Rijkswaterstaat (2009) *Zachte werken met harde trekken, Toepassingen van eco-engineering in de waterbouw*.
3. Tydeman (1996) *Ecologische profiel van de wilde litorale mosselbank (Mytilus edulis L.)*. Watersysteemverkenningen 1996. Rijkswaterstaat, RIKZ. Rapport RIKZ-96.026. ISBN 90-369-0435-8.
4. van Steeg, P. and Wesenbeeck van, B.K. (2011) *Large-scale physical modelling of wave damping floating mussel structures*.
5. Kamermans & Smaal (2008) *Evaluatie van de mosselzaadinvang (MZI): proefperiode 2008. Rapport Co22/09*.
6. Almada-Villela P.C. (1984) *The effects of reduced salinity on the shell growth of small Mytilus edulis L.* *Journal of the Marine Biological Association of the UK*, 64: 171-182.
7. Janssen, J.A.M. and Schaminée, J.H.J. (2003) *Habitattypen. Europese Natuur in Nederland*. KNNV Uitgeverij, Utrecht.
8. Janssen, J.A.M. and Schaminée, J.H.J. (2004) *Soorten. Europese Natuur in Nederland*. KNNV Uitgeverij, Utrecht.
9. Siebelink, B. (2005) *Overzicht natuurlijke watertypen*. Foundation for Applied Water Management Research (STOWA). STOWA report no: 2005-08.
10. Witteveen+Bos (2012) *TEEB in de Stad, handleiding bij het rekeninstrument voor de baten van natuur en watermaatregelen. Rijkswaterstaat and 11 municipal authorities. Reference GD215-2-1/kiru/005*.
11. Ruijgrok E.C.M. *Kentallen waardering natuur, water, bodem en landschap; hulpmiddel bij MKBA's*. Ministry of Agriculture, Nature Management and Food Safety. GV706-1-1/ruie/1.



Europese Unie

Witteveen

Bos

Deltares

Enabling Delta Life



EcoShape

