Coalition Clean Baltic

PROTECTING THE BALTIC SEA ENVIRONMENT - WWW.CCB.SE

MANAGEMENT BRIEFING:
Baltic blue mussel beds, *Mytilus* spp.

Mussels (Mytilus sp.) and barnacles © Oceana, Carlos Minguell

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Coalition Clean Baltic
Researched and written by Susan Gubbay for Coalition Clean Baltic
E-mail: secretariat@ccb.se
Address: Östra Ågatan 53, 753 22 Uppsala, Sweden
www.ccb.se

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SUMMARY OF KEY MANAGEMENT MEASURES

Blue mussels (*Mytilus edulis trossulus* complex) are a keystone species in the marine environment of the southern Baltic Sea. They can form extensive biogenic reefs and provide habitats for a wide range of both sessile and mobile species.

The main threat to this habitat is probably climate change as changes in salinity and temperature are predicted to affect growth rates and reproduction of the blue mussel. The extent and condition of mussel beds are also affected by nutrient enrichment, which can enhance mussel growth, but can also disrupt feeding particularly when there is a high sedimentation rate following plankton blooms. Increase siltation can also be caused by dredging and run-off from the land. Dredging of wild mussel beds is known to change the composition of mussel beds as well as altering the topography of the seabed.

Management measures can usefully focus on reducing nutrient inputs, and protecting areas where this habitat is present within the framework of Marine Protected Areas using tools such as fisheries regulations and zoning schemes to ensure damaging activities do not take place in the vicinity of mussel beds. Marine Spatial Planning is also helpful in this regard. A longer-term management focus should be working with partners on reducing and mitigating the effects of climate change. Mussels are already used as an indicator species for reporting on the environmental status of in the Baltic Sea and can have a similar role in relation to climate change.

Eelpout on Mytilus bed, Lillgrund © OCEANA Carlos Suarez
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THE HABITAT AND ASSOCIATED SPECIES

Habitat description

Baltic blue mussels are a hybrid species of *Mytilus trossulus* and *Mytilus edulis*[1] that grow in clumps forming extensive biogenic reefs. They are smaller and have a lower growth rate and thinner shells than *Mytilus edulis* mussels from the North Sea[2]. Nevertheless, they dominate the animal biomass in the Baltic[3], colonizing a zone from the algal beds down to depths of around 40m. The shells provide a hard surface for attachment by other species, and there are also sheltered microhabitats within mussel beds, including 'mussel mud' - accumulations of sediment, waste products and shell fragments –colonized by infaunal species such as polychaetes and nemerteans. Shells of dead mussels accumulating on the seabed also create a habitat which is colonized by many species.

Blue mussels are farmed in the western Baltic in the Skagerrak and also in the Kiel Fjord, using a system of rope culture.

Mussels are a key species in the Baltic Sea, linking benthic and pelagic systems through filtration of the water column and deposition in the benthos, and speeding up the cycle of production and breakdown of organic matter through the ecosystem[4]. They are the staple food of common eiders and flounder while mussel larvae form a very important part of the diet of herring larvae and other carnivorous zooplankton[5]. Where there is a reduced abundance of invertebrate predators (e.g. the starfish *Asterias rubens* and the shore crab *Carcinus maenas*) in parts of the Baltic Sea with low salinity, blue mussel beds dominate areas of hard substrate, especially in shallow waters where they can make up more than 90% of the animal biomass[6].

The HELCOM HUB classification[7] lists 14 biotopes characterized by the Mytilidae. These are present on rock and boulders, hard clay, shell gravel, muddy sediments, coarse sediments, sand, and mixed substrates in both the photic and aphotic zone.

Distribution in the Baltic Sea

Beds of the Baltic blue mussel are present in many parts of the Baltic Sea but as their growth rate and reproduction is affected by salinity, the limit being around 4.5ppt, their northern distribution limit is in the Quark sub-basin. The formation of pack ice also affects their survivability in the northern regions[8].

In the Baltic Sea, mussel beds generally develop on rocks and boulders at depths of between 3-12m, although extending in deeper waters where conditions are suitable[9]. Wave exposure influences depth distribution, with mussel beds at more exposed sites being found in greater depths[10].

1 Väinölä et. al., 2011
2 Larsson et al., 2017
3 Kautsky, 1981
4 Dankers et al., 2001; HELCOM 2013; Larsson et al., 2017; Kautsky & Evans, 1987
5 Öst & Kilpi, 1997
6 Kautsky& Kautsky 1995
7 HELCOM 2013 – HELCOM HUB
8 Westerbom, 2006
9 Vuorinen et al., 2002
10 Westerbom & Jattu, 2006

Associated species

The species richness in mussel patches is similar to that of other highly diverse habitats in the Baltic Sea[1]. They provide a hard surface for attachment, sheltered interstices and soft sediment/shell debris which is a microhabitat for infauna.

A study of blue mussel beds in the northern Baltic Sea (Gulf of Finland) recorded 39 species or species groups (excluding fish species) associated with Mytilid beds[2]. In the Kattegat, 45 species of macrofauna, 23 species of macroalgae and 33 meiofaunal species were found associated with mussel beds[3]. The majority are generalist species found elsewhere in the Baltic Sea and include bryozoans, hydroids, crustaceans, bivalves, gastropods, polychaetes and nemerteans.

Blue mussels are an important source of food for a number of fish species including flounder and plaice, and for diving ducks, especially the common eider *Somateria mollissima* and long-tailed duck *Clangula hyemalis*[4].

Conservation status

Reefs are on Annex I of the EU Habitats Directive (code 1170). This biotope complex, which includes biogenic reefs such as mussel beds, have been assessed by HELCOM as being Vulnerable in the Baltic Sea.

All Baltic Sea habitats characterized by Mytilidae have been assessed as Least Concern by HELCOM[5].

Rockpool prawn (Palaemon elegans) on top of blue mussels (Mytilus edulis) © OCEANA Carlos Minguell
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1 Norling & Kautsky, 2008
2 Koivisto et al., 2011
3 Norling & Kautsky, 2007
4 Koivisto, 2011
5 HELCOM, 2013

PRESSURES AND THREATS

Climate change is probably the main threat to Baltic blue mussel beds as this is predicated to reduce salinity and increase temperatures in the Baltic Sea. Episodes of warmer sea temperatures may have already been the cause of mortality of large mussels and the predicated changes in both temperature and salinity are considered likely to affect their distribution, growth rates and reproduction[1].

Nutrient enrichment, leading to plankton blooms, can enhance the growth of mussels, but it can also disrupt filter feeding by clogging up gills. High sedimentation rates of organic matter when the blooms die can also have a detrimental effect on the ability of mussels to filter feed. Increased siltation and organic matter associated with dredging and run-off from agricultural lands can have a similar negative effect[2].

In the southern Baltic the salinity is high enough for cultivation of mussels and, in some locations, to support commercial harvesting of wild beds.
Dredging for mussels is known to affect both the epibenthos and the topography of the seabed. A study in Limfjorden (Denmark) for example, revealed significant differences in species composition and density between fished and closed areas as well as significant reductions in the amount of shell debris and gravel, and changes in the topography of the seabed in areas subject to mussel fisheries[3].

MANAGEMENT MEASURES

Management measures need to be linked to conservation objectives and to address the main pressures and threats to the habitat. Although not considered below, monitoring the effects of management measures is also essential to review progress, and to modify actions in light of the findings.

Conservation objectives

The conservation objectives for blue mussel beds need to be concerned with maintaining and potentially improving the status of existing beds as expressed by extent, quality, structure and function. This is consistent with the objectives HELCOM MPAs and Natura 2000 sites established under the EU Habitats and Birds Directives.

Management objectives

The principle management objective for this habitat type should be to prevent degradation and loss of existing beds, although recognizing that there may be periods of depletion, associated with, for example, high predation pressures or poor recruitment years in particular locations.

1 Kautsky, 1982
2 Darr et al., 2013; Westerbom, 2006
3 Dolmer, 2002

Practical measures

Reducing nutrient inputs

The main source of nitrates and phosphates entering the Baltic Sea is a runoff from agricultural land. This has long been recognized as an issue because of the resulting risk of eutrophication. Tackling eutrophication is one of the four goals of the HELCOM Baltic Sea Action Plan with the first Nutrient Reduction Scheme, promoting a regional approach to achieving this goal, being agreed by HELCOM in 2007. The scheme established Maximum Allowable Inputs and Country-Allocation Reduction Targets compared to a reference period of 1997-2003. Reducing inputs of nitrogen and phosphorus at source is seen as key to achieving good environmental status for the Baltic Sea. Unfortunately, due to both a lack of ambition in the implementation of measures and the time-lag until the effect of a measure can be measured, the Baltic Sea is still highly eutrophic decades after the problem has been recognized.

For managers working at a local level, tackling diffuse sources of pollution will require participating in and supporting schemes outside their immediate area of operation. They should, for example, involve encouraging measures on the surrounding land or entire watersheds, joint targets with other management authorities and participation in national as well as transnational and Baltic wide initiatives. Practical actions at a local level such as modifying farming practices, establishing buffer zones along water bodies, the creation of reed beds to retain and filter nutrients and other agri-environment schemes will also help reduce nutrient inputs[1].

Blue mussel is farmed in parts of the western Baltic Sea on ropes. An expansion of cultivation has been suggested as a cost-effective way of reducing eutrophication in coastal areas but there are both environmental issues related to these proposals as well as uncertainty about their economic viability[2]. Schemes such as these should, in any case, not be a first option as they do not address the root of the problem. Even then, they should only be considered following detailed examination including Environmental Impact Assessments as they can be seriously disruptive with environmental implications in their own right.

Regulatory measures

Protected Areas

Baltic blue mussel beds are present in Natura 2000 sites in the Baltic Sea. There are also examples in protected areas designated through national conservation programmes and those which are recognized as Baltic Sea MPAs, as well as some Baltic Sea Ecologically or Biologically Significant Marine Areas (EBSAs) (e.g. in the Åland Sea). Designation provides a regulatory framework for action. In the case of the Habitat Directive this includes a requirement to achieve favourable conservation status and to prevent damage and deterioration of the habitat and its typical species. MPA management planning should include the scope for emergency measures to protect the habitats and species for which the MPA has been designated. Consideration should also be given to adopting interim measures for protection whilst formal designation is pending.

1 Baltic COMPASS project. http://www.helcom.fi/helcom-at-work/projects/completed-projects/baltic-compass/

2 Hedberg et al., 2018

Fisheries regulations

Fisheries regulations can be used to manage both wild and cultivated mussel fisheries. Where wild beds are exploited the harvesting methods as well as the scale and frequency of operation will determine the potential impact. Effort control, gear types, rotation of areas open to fishing, and mechanisms for emergency closures are important tools for operating a sustainable fishery at the same time as protecting the biodiversity interest of these habitats. Licensing and regulation of mussel cultivation, including spatial planning and zoning to ensure it does not take place over particularly sensitive habitats and establishing buffer zones around mussel beds to prevent silting from activities such as dredging or demersal fishing in adjacent areas will be important.

Blue mussels (Mytilus sp.) © OCEANA Carlos Minguel
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Supporting measures

Planning frameworks

Planning frameworks can set direction, bring together key players and involve the public in decision making for particular geographical areas. There is a long history of land use planning in Baltic States with responsibility typically falling to local and regional authorities. Maritime Spatial Planning is a more recent idea and is the marine equivalent. UNESCO describe it as "a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that usually have been specified through a political process"[1]. It is essentially a practical way to create and establish a more rational organization of the use of marine species and the interactions between its uses, to balance demands for development with the need to protect marine ecosystems and to achieve social and economic objectives in a planned way[2]. The management of mussel beds cannot be undertaken in isolation of activities, demands and influences taking place around them hence there is the need of incorporating the biodiversity objectives and associated management measures for mussel beds, such as Marine Protected Areas and protective buffer zones around this habitat into Maritime Spatial Plans. This in turn requires knowledge and mapping of the extent of mussel beds in the Baltic Sea.

Management plans

Management plans should provide a framework in which to develop, promote, monitor and report on actions for the conservation of mussel beds. They typically set out the objectives, consultation processes, actions, key players, timescales, and organizational structures. Specific mussel beds may be the main focus but management plans for these features cannot be developed in isolation as the surrounding habitats, environmental conditions and regional or even international issues are likely to have an influence on the success of any planned measures.

HELCOM Baltic Sea Action Plan

The goals and objectives of the Baltic Sea Action plan (BSAP), and most especially those relating to eutrophication and biodiversity, are directly relevant to the management of this habitat. The BSAP provides a framework for joint actions across Baltic states as well as added incentive for national initiatives aimed at reaching good environmental status for the Baltic Sea. Mitigating eutrophication and developing Maritime Spatial Plans are some of the agreements promoted through the BSAP that can benefit habitats characterized by blue mussels and need to be maintained and potentially strengthened in the revised BSAP[3]. BaltSeaPlan and Baltic SCOPE have supported the development of MSP in the Baltic and there is a deadline of 2021 for Baltic Member States to establish Marine Spatial Plans under the EU Directive establishing a framework for MSP (EU 2014/89/EU).

Climate change

Measures to reduce and mitigate the effects of climate change are essential and whilst nothing specific can be done at the level of mussel beds, their sensitivity to changes in temperature and salinity may be useful as an indicator species. This is the case within the Marine Strategy Framework Directive (MSFD) with the Baltic blue mussel being used as an indicator of good environmental status.

1 Ehler & Douvere, 2009

2 Defra, 2009

3 E.g. http://www.helcom.fi/baltic-sea-action-plan; BMEPC, 2018

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