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Background document to the policy brief *Raising Quality of Marine Protection – the next step in preserving common assets*.

Quality of marine protection in the Baltic Sea

Introduction

Marine protected areas (MPAs) are regarded as an important tool for halting biodiversity loss and habitat destruction in the sea. But even if the Baltic Sea was the first of the regional seas in EU to meet the UN target of protecting 10 % of the sea in MPAs (EEA 2015), many habitats and species are still threatened.

This document gives a short scientific overview of some aspects that are important for marine protection in the Baltic Sea and presents an analysis of human activities in Swedish Natura2000 areas in the Baltic Sea.

Marine species and habitats at risk, in Baltic Sea and elsewhere

Our use of the sea affects marine habitats and the plants and animals living there. Many things we do on land also have an impact on the marine system. In the long run, there is a risk that this will result in loss of species and fundamental changes to ecosystems (e.g. McCauley et al., 2015). For the Baltic Sea, HELCOM has assessed the situation for habitats and species, red-listing habitats and species that are at risk of collapse or disappearing. In this assessment, 30 % of the assessed habitats were red-listed, meaning that they had declined considerably in quality or quantity over the past 50 years (HELCOM 2013a). A large proportion of the red-listed habitats are found in coastal areas. For instance, estuaries and coastal lagoons belong to the most threatened habitats. Decline and degradation of habitats can have a large impact on the species that depend on them and habitat loss is one likely factor contributing to the decline of species in the Baltic Sea (HELCOM 2013b).

Marine habitats important for biodiversity – but also for us

Not only do marine habitats sustain biodiversity, they also provide important ecosystem services to us. One well studied example is seagrass meadows in shallow coastal areas (e.g. Rönnbäck et al. 2007; Waycott et al. 2009). Seagrass bind organic carbon which accumulates in seagrass beds, acting as natural carbon sinks. In addition, they take up nutrients and can act as a coastal filter for nutrients leaching from land. Their roots stabilise sediments and prevent

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resuspension, which leads to lower turbidity and less release of nutrients, as well as a lower risk for coastal erosion.

Apart from their large effect on biogeochemical cycles in the coastal zone, seagrass meadows act as an important habitat for many species, including fish species that are targeted by commercial and recreational fisheries (e.g. Jackson et al. 2001; Rönnbäck et al. 2007). Also other coastal habitats, such as seaweed beds and biogenic reefs, are important spawning, nursery and feeding areas for commercial fish (Beck et al. 2001; Seitz et al. 2013). It has been shown that availability of suitable habitat can be a bottleneck for fish populations (e.g. Fodrie and Levin 2008; Sundblad et al. 2014), which means that degradation of coastal habitats can result in decreased fishery catches.

MPAs differ in level of restrictions

MPAs are established for many different purposes and there are large differences in what restrictions are imposed on human activities. The strongest restrictions are applied in marine reserves, where fishing or other extraction of living or non-living resources is not permitted and where other types of human impact is kept to a minimum (Lubchenco et al. 2003). The aim of marine reserves is to allow the ecosystem to develop free of human influence and they are regarded as safety vaults for marine biodiversity and as potential reference areas showing an ecosystem free from human disturbance. Other MPAs are set up with the dual aim of delivering both ecological and social sustainability and allow cautious use of the marine resources by local communities. There are also MPAs which aim to protect particular species or habitats, where human activities are allowed as long as they do not pose a threat to these species or habitats.

Evaluations of the effect of marine protection have shown that the level of restrictions is one factor determining how effectively MPAs protect biodiversity (Lester and Halpern 2008; Sciberras et al. 2013; Edgar et al. 2014). Not surprisingly, MPAs where fishing is prohibited (marine reserves or “no-take zones”) provide the strongest protection, particularly for fish and other large animals.

Restrictions in Baltic Sea MPAs

The majority of the Baltic Sea MPAs are designated under the Bird and Habitat Directives (Natura2000 areas), which means they are set up to protect particular species or habitats rather than the entire ecosystem. This means that many activities are not prohibited. Few MPAs have specific fisheries restrictions and very few are no-take areas for fisheries (Fenberg et al. 2012).

As a consequence, Baltic Sea MPAs are often used for several different activities. For instance, a recent evaluation shows that intensive fishing occurs in 40 % of the Baltic Sea MPAs (HELCOM 2016). The Baltic Sea Centre has analysed the occurrence of commercial fishing, aquaculture, dredging, underwater constructions, shipping and military activities in Swedish Natura2000 areas in the Baltic Sea (Box 1). The results show that at least one of these activities occurred in 82 % of all areas. This was despite the fact that some activities that

we know occur extensively in the coastal zone, such as leisure boating and recreational fisheries, were not included in the analysis since they are not mapped at a national scale. This supports the picture that Baltic Sea MPAs are to a very little extent closed off entirely from human use.

Does the use of Baltic Sea MPAs conflict with conservation?

Studies show that MPAs can protect biodiversity also when all human activities are not prohibited (e.g. Sciberras et al. 2013). However, the high degree of human presence in Baltic Sea MPAs makes it important to evaluate if there are conflicts with conservation objectives.

There is no comprehensive evaluation of the effect of activities in Baltic Sea MPAs on the marine ecosystem. Fishing is pointed out as one of the main threats to vulnerable species and habitats in the Baltic Sea (HELCOM 2013a), so the frequent occurrence of fishing in MPAs may be in conflict with nature conservation. There is a growing scientific understanding of the direct and indirect effects of fishing on marine species and habitats (reviews in Jennings and Kaiser 1998; Pusch and Pedersen 2010), but the effects on the unique Baltic Sea ecosystem is to large extent understudied.

One area where evidence is accumulating is that overfishing of large predatory fish can have large effects on marine food webs, also in the Baltic Sea. For instance, experimental studies suggest that decline or loss of large predatory fish can cause extensive growth of ephemeral algae in shallow coastal areas through a trophic cascade where small fish are released from predation pressure and reduce the abundance of invertebrate grazers that normally control the abundance of ephemeral algae (e.g. Eriksson et al. 2009; Östman et al. 2016). This can result in a shift in coastal vegetation, where seagrass meadows and beds of large and long-lived seaweeds are replaced by ephemeral algae, with large effect on ecosystem function.

Blooms of ephemeral algae have previously been attributed to the increasing amount of nutrients from land that ends up in the sea, but a recent meta-analysis indicates that top-down effects from reduced stocks of predatory fish can have as large effect on ephemeral algae as that of increased nutrient concentrations (Östman et al. 2016). This means that declines in predatory fish that have been documented from coastal areas in the Baltic Sea (Ljunggren et al. 2010) may contribute to habitat degradation.

Monitoring and evaluation of MPA effectiveness

At present, the paucity of research on the effect of human activities in Baltic Sea MPAs makes it difficult to evaluate whether they provide an effective protection of marine biodiversity and ecosystem services or not. Well-designed monitoring of the effects of restricting human activities, with appropriate control areas where the activities occur, is the only way to evaluate which restrictions are effective and needed to reach the specific aims of MPAs.

Box 1. Analysing activities in Swedish Natura2000 areas in the Baltic Sea

We compiled spatial data on the occurrence of commercial fishing, aquaculture, dredging, underwater constructions, shipping and military activities from the entire Swedish marine area. To a large extent, we used spatial data on activities in Swedish marine waters from the national data portal “Miljöportalen” (Naturvårdsverket 2010). These include aquaculture (fish farms), harbours, underwater constructions, underwater cables and pipes/tubes, jetties and small marinas and shipping traffic based on AIS-data from 2009. The data also included a coastline exploitation indicator, based on the frequency of jetties, harbours and towns. In addition, we included occurrence of commercial fishing, using fishing positions from log books from the years 2011-2013 (Havs- och Vattenmyndigheten 2014). Occurrence of dredging was taken from an inventory of dredging from aerial photographs from 2006-2013. Military marine firing and training areas, blasting areas under water as well as danger zones above water were taken from the Swedish Armed Forces’ marine geographical biology calendar (Försvarsmakten 2012).

We analysed the occurrence of commercial fishing, aquaculture, dredging, physical constructions (underwater constructions and coastal exploitation; at least 3 jetties per 100 m shoreline) and frequent ship traffic (at least 1 ship passing per day) in all 257 Swedish Natura2000 areas with marine habitats in the Baltic Sea (including the Gulf of Bothnia). The results are shown in Table 1.

Table 1. Occurrence of activities and installations in Swedish Natura2000 areas in the Baltic Sea.

Activity/installation	Occurrence (% of N2000 areas)
Commercial fishing	35
Aquaculture	0.5
Dredging	33
Constructions	43
Frequent ship traffic	53
Military activities	17

At least one of the activities occurred in 82 % of all the Natura2000 areas. Commercial fishing occurred in 35 % of the areas. Most of the fishing used passive gears (gillnets and traps), demersal trawling only occurred in 5 % of the areas. Recreational fishing is not mapped in a way that allowed us to include it in the analyses, despite that it can have a considerable effect on coastal fish stocks. Aquaculture did not occur in Baltic Sea Natura2000 areas.

The aerial photographs showed that dredging had occurred in at least a third of the areas. This is likely an underestimation, since it only includes impacts that were visible in aerial photographs from one occasion. The estimated dredged areas were small across all Natura2000 areas, although more than 10 % of the MPAs were affected in a few sites. However, the effect of dredging can extend outside the area that is immediately affected.

Box 1. Continued

The only constructions documented from the Natura2000 areas were jetties and harbours. Almost half of the areas had a considerable amount of jetties (at least 3 in 100 m shoreline) along some part of the coastline. However, the part of the coastline that had jetties was overall small in the MPAs, only 1 % of the total coastline across all Natura2000 areas.

Ship traffic was the most common activity in the Natura2000 areas. Frequent traffic with ships carrying AIS occurred in more than half of the areas and often covered a large part of the area (in some MPAs the entire area is passed by ships).

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Who we are

Baltic Eye, part of the Baltic Sea Centre at Stockholm University, is made up of a team of scientists, policy and communication experts who analyse and synthesise scientific research on the Baltic Sea - and communicates it to stakeholders in the decision-making process. The realm of work is transdisciplinary and covers the broad areas of science important for Baltic Sea management. It focuses on four themes: eutrophication, sustainable fisheries, environmental pollutants and management of marine habitats and protected areas.