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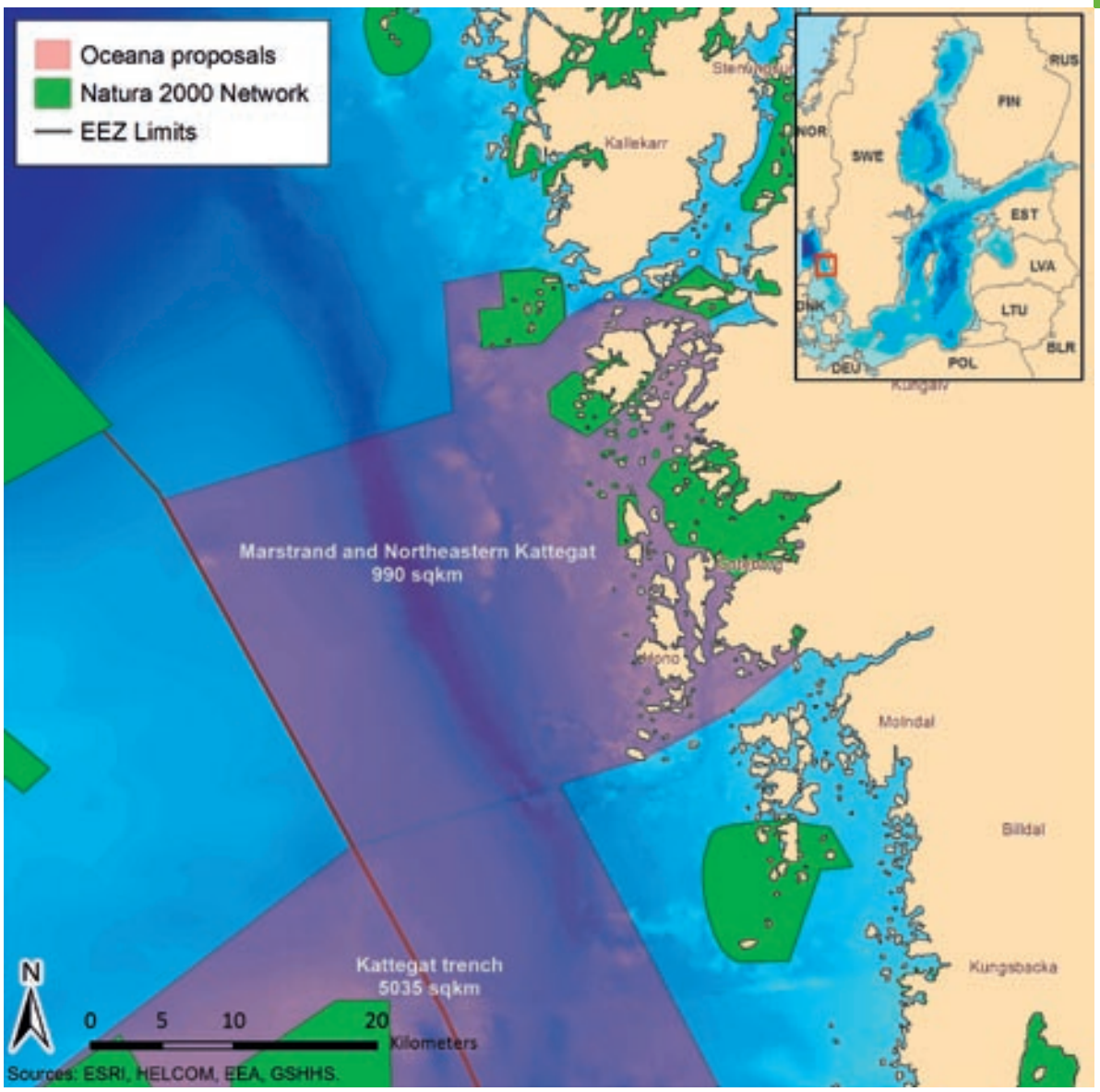
BALTIC SEA PROJECT



Oceana proposal for a Marine Protected Area

Marstrand and Northeastern Kattegat

INTRODUCTION

Marstrand, located in the southern Bohuslän Archipelago, is situated in the northeastern part of the Kattegat, on Sweden's west coast. The Kattegat and the neighboring Skagerrak form the transitional area between the salty North Sea and the brackish Baltic Sea. The Kattegat is fairly shallow with a mean depth of only 23 meters[1], but its deeper areas, including the Kattegat and Djupa Rännan trenches[2] can reach more than 150 meters[3]. The latter is connected to the former, which runs 45 km south through mainly Danish waters[4,5].

The surface salinity in northern Kattegat is relatively salty (30 psu) when compared to the southern part (15 psu)[6]. Water in deeper areas is even saltier, as the salty water from the North Sea and the Skagerrak flows towards the Baltic Sea via the lower layers of the water column. The upper layer transports water from the Baltic Sea to the Skagerrak and North Sea. As there are almost no tides in the Skagerrak and Kattegat, the major movements of water between the North Sea and the Baltic Sea occur through wind power[7].

Oceana conducted underwater studies with an underwater robot (ROV) and scuba divers in the area 2011, 2012 and 2013.

DESCRIPTION OF THE AREA

The deeper parts of the Kattegat, including the aforementioned trenches, boast muddy soft bottoms, and communities, like sea pens with burrowing megafauna, that are specialized to live in the particular physical conditions of the area. In shallower waters, the substrate is more diverse and includes bottoms with various stone covers and sand. Different benthic communities also reside there, including octocoral gardens. In the even shallower photic zone, macroalgae and eelgrass meadows occur.

Coral gardens are aggregations of one or more anthozoan species and can be found both on soft and hard seabeds. They are biodiverse; starfish, brittle stars, crustaceans, and molluscs are all associated with the community[8]. In the Kattegat, dead man's fingers (*Alcyonium digitatum*) form such gardens, which Oceana documented in several areas, including on the Dörjeskär offshore reef in 2013 (see Table 3). OSPAR has listed coral gardens as threatened and/or declining everywhere they occur[9].

Two different sea pen species, the phosphorescent (*Pennatula phosphorea*) and slender sea pens (*Virgularia mirabilis),* form, together with burrowing megafauna (Norway lobster, *Nephrops norvegicus*) a soft-bottom community in the Kattegat. Complex tunnels formed by lobsters in the mud allow oxygen to permeate the sediment. The habitat was documented at different depths in the deeper parts of the Djupa Rännan trench and this type of community is listed as threatened and/or declining in the Kattegat[10,11].

The shallow water off the Swedish west coast is mostly made up of soft bottoms, with zones bountiful in macroalgae (such as bladder wracks, *Fucus* spp.) and macrophytes (such as common eelgrass, *Zostera marina*)[12]. Eelgrass meadows are very productive and can form dense beds on sand or sandy mud[13]. In addition to providing shelter to fauna (such as bivalves, echinoderms, polychaet worms, amphipods etc.), and stabilizing the seabed, they also cement their importance to the local environment[14] by being an important nursery grounds for commercial fish, like cod and whiting (*Merlangius merlangus*)[15,16]. Furthermore, eelgrass meadows store large amounts of carbon, making them an important resource to consider in the quest to curb climate change[17]. Common eelgrass is broadly distributed across European seas, but has been declining throughout the last century, including along the Swedish west coast[18,19]. Oceana documented common eelgrass meadows in the shallow inner waters of the Gothenburg archipelago in 2013 (see Table 4). Due to their decline, seagrass is listed in the Rio Declaration[20] as a habitat to protect[21], while OSPAR and HELCOM list common eelgrass beds as threatened and/or declining wherever they occur[22], and as near threatened in the Baltic Sea[23] respectively.

Other interesting findings in the area include the *Suberites virgultosus* sponge, found in deep waters, and some cnidarians, including the Devonshire cup-coral (*Caryphyllia smithii*) and the red sea fan (*Swiftia rosea)* at 52 meters depth (see Table 2). The latter requires stable cold water to flourish, and therefore has a limited distribution. In the inner shallow waters of the archipelago a few common European oysters (*Ostrea edulis*) and horse mussels (*Modiolus modiolus*), categorized as vulnerable by HELCOM[24], were documented (see Table 4).

PROPOSAL

The proposed protected area is located in Swedish northeastern Kattegat and includes a small piece that extends into the Skagerrak. It ranges from the coastal waters of the southern Bohuslän Archipelago to the border of the Danish EEZ, covering both shallow and deep waters. The *Djupa rännan trench,* which Oceana recommended as a new protected area in 2011[25], is also included in this proposal.

The proposed area connects a number of smaller coastal N2000 sites[26], as well as the offshore and deeper waters in the Kattegat and Skagerrak, which are currently unprotected. Most of the benthic communities Oceana documented during all three expeditions, including sea pens with burrowing megafauna, are not getting any protection through the Habitats Directive, even though some have been defined as threatened and/or in decline by OSPAR. Little is known about many of the communities in the deeper areas, and the site should therefore be managed with precaution. What is known, is that the area harbors vulnerable species, including horse mussels, purple sunstars (*Solaster endeca*), sea anemones (*Stomphia coccinea*), whiting (*Merlangius merlangus*), and threatened species, such as the ling (*Molva molva*), and protection is therefore needed immediately.

POSSIBLE THREATS AND MANAGEMENT PROPOSALS

Bottom trawling poses a serious threat to the benthic species and communities[27] in the area, as well as to the species that depend on these habitats for food and shelter. This destructive fishing method targets mainly Norway lobster and flatfish, and frequently catches cod as bycatch[28,29]. In fact, the cod stock in the Kattegat has decreased dramatically since 1970,[30] with only a fraction of the historically abundant species remaining[31].

In 2011, Oceana documented bottom trawling tracks on a mud bottom that is located inside this proposed area. Since bottom trawling removes non-target species and is so destructive, Oceana recommends the prohibition of this type of fishery in all protected areas.

Eutrophication is one of the major reasons behind the decline of eelgrass in the Kattegat and the Baltic Sea. Physical disturbances, such as dredging, upland development and pollution also pose threats[32,33].

A management plan should address all of these human caused threats. The communities which are threatened and/or in decline, should particularly be addressed. EU management plans should be established for cod and flatfish.

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SPECIES LIST FOR MARSTRAND AND NORTHEASTERN KATTEGAT

Table 1: List of species recorded at Djupa Rännan trench in 2011. Possible threat category indicated in brackets.

Species
PORIFERA
Halichondria panicea
Haliclona urceolus
CNIDARIA
Alcyonium digitatum
Beroe cucumis
Bougainvillia ramosa
Cyanea lamarckii
Eudendrium rameum
Halecium halecinum
Metridium senile
Pennatula phosphorea
Sagartiogeton laceratus
Sagartia troglodytes
Stomphia coccinea (vulnerable, HELCOM)
Tubularia sp.
Urticina felina
Virgularia mirabilis
ANNELIDA
Anobothrus sp.
Polyphysia crassa
Sipunculus sp.
MOLLUSCA
Balanus crenatus
Balanus improvisus
Coryphella verrucosa
Cancer pagurus
Caprella linearis

Table 1: List of species recorded at Djupa Rännan trench in 2011. Possible threat category indicated in brackets.

Species
Liocarcinus depurator
Munida rugosa
Pagurus bernhardus
Pecten maximus
BRYOZOA
Crisia eburnea
Electra pilosa
ECHINODERMATA
Amphiura chiajei
Asterias rubens
Brissopsis lyrifera
Ophiocomina nigra
Spatangus purpureus
Thyone fusus
TUNICATA
Ascidiella scabra
Corella parallelogramma
Dendrodoa grossularia
FISH
Callionymus lyra
Hippoglossoides platessoides
Lesuerigobius friesii
Lumpenus lampretaeformis (least concern, HELCOM)
Micromesistius poutassou
Myxine glutinosa
Microstomus kitt
Platichthys flesus
Pleuronectes platessa
Pomatoschistus microps
Reinhardtius hippoglossoides
Trisopterus esmarkii
ALGAE
Corallina officinalis
Delesseria sanguinea
Dilsea carnosa
Fucus vesiculosus
Halidrys siliquosa
Laminaria digitata
Laminaria latissima
Lithothamnion glaciale
Pelvetia canaliculata
MAMMALIA
Phoca vitulina

Table 2: List of species at Marstrand and Northeastern Kattegat in 2012 by depth and their threat category.

Depth (m)	Species
80-102	**PORIFERA**
	Haliclona urceolus
	Suberites virgultosus
	CNIDARIA
	Abietinaria abietina
	Alcyonium digitatum
	Aurelia aurita
	Cancer pagurus
	Cerianthus lloydii
	Mnemiopsis leidyi
	Pachycerianthus multiplicatus
	Pennatula phosphorea
	Tubularia larynx
	Urticina felina
	Virgularia mirabilis
	ANNELIDA
	Arenicola cf. *marina*
	Filograna implexa
	Sabella pavonina (near threatened, HELCOM)
	CRUSTACEA
	Anapagurus laevis
	Balanus balanus
	Diastylis rathkei
	Liocarcinus depurator
	Meganyctiphanes norvegica
	Nephrops norvegicus
	Pagurus bernhardus
	ECHINODERMATA
	Amphiura chiajei
	Asterias rubens
	Echinocardium cordatum
	Luidia sarsi
	Ophiura affinis
	Ophiura sp.
	TUNICATA
	Synoicum pulmonaria
	FISH
	Callionymus lyra
	Eutrigla gurnardus
	Gadus morhua (critically endangered in Kattegat, HELCOM; threatened and declining, OSPAR)
	Limanda limanda
	Lumpenus lampretaeformis (least concern, HELCOM)

Table 2: List of species at Marstrand and Northeastern Kattegat in 2012 by depth and their threat category.

Depth (m)	Species
	Lycodes vahli
	Melanogrammus aeglefinus
	Merlangius merlangus (vulnerable, HELCOM)
	Molva molva (endangered, HELCOM)
	Myxine glutinosa
	Platichthys flesus
	Pleuronectes platessa
	Rhinonemus cimbrius
	Trisopterus esmarckii
26-60	**CNIDARIA**
	Abietinaria abietina
	Actinia equina
	Alcyonium digitatum
	Aurelia aurita
	Bolinopsis infundibulum
	Bougainvillia sp.
	Caryophyllia smithii
	Eutonina indicans
	Metridium senile
	Mnemiopsis leidyi
	Pennatula phosphorea
	Swiftia rosea
	Virgularia mirabilis
	MOLLUSCA
	Polycera faeroensis
	Solenidae sp.
	Turritella communis
	CRUSTACEA
	Balanus balanus
	Nephrops norvegicus
	Pagurus bernhardus
	BRYOZOA
	Flustra foliacea
	Securiflustra securifrons
	ECHINODERMATA
	Asterias rubens
	Marthasterias glacialis
	Ophiothrix fragilis
	Ophiura sp.
	Solaster endeca (vulnerable, HELCOM)
	TUNICATA
	Ascidia virginea

Table 2: List of species at Marstrand and Northeastern Kattegat in 2012 by depth and their threat category.

Depth (m)	Species
	FISH
	Callionymus lyra
	Ctenolabrus rupestris
	Eutrigla gurnardus
	Gadus morhua (critically endangered in Kattegat, HELCOM; threatened and declining, OSPAR)
	Labrus bergylta (least concern, HELCOM)
	Labrus mixtus (least concern, HELCOM)
	Melanogrammus aeglefinus
	Trisopterus esmarkii
	RHODOPHYCEAE
	Hildenbrandia rubra
16	**PORIFERA**
	Halichondria panicea
	Haliclona cf. *limbata*
	CNIDARIA
	Alcyonium digitatum
	Aurelia aurita
	Bolinopsis infundibulum
	Hydractinia sp.
	Metridium senile
	Mnemiopsis leidyi
	Obelia geniculata
	Obelia cf. *longissima*
	Protanthea simplex
	Sagartiogeton undatus
	Urticina felina
	MOLLUSCA
	Coryphella verrucosa
	Cuthona cf. *nana*
	Mytilus sp.
	CRUSTACEA
	Amphipoda sp.
	Balanus balanus
	Cancer pagurus
	Carcinus maenas
	Nucella lapillus
	Praunus flexuosus
	ECHINODERMATA
	Asterias rubens
	BRYOZOA
	Electra pilosa

Table 2: List of species at Marstrand and Northeastern Kattegat in 2012 by depth and their threat category.

Depth (m)	Species
	TUNICATA
	Ascidiella aspersa
	Ciona intestinalis
	Corella parallelogramma
	Dendrodoa grossularia
	FISH
	Ctenolabrus rupestris
	Entelurus aequoreus (least concern, HELCOM)
	RHODOPHYCEAE
	Delesseria sanguinea
	Dilsea carnosa
	Hildenbrandia rubra
	Pelvetia canaliculata
	Phymatolithon laevigatum
	Phymatolithon sp.
	PHAEOPHYCEAE
	Chorda filum
	Halidrys siliquosa
	Halosiphon tomentosus
	Laminaria digitata
	Laminaria latissima
	Sargassum muticum
	CHLORORPHYCEAE
	Cladophoraceae sp.
	MAMMALIA
	Phoca vitulina

Table 3: List of species at the offshore site Dörjeskär from 10 to 31 meters depth, 2013. Possible threat categories are given in brackets.

Species
PORIFERA
Halichondria cf. *panicea*
Haliclona oculata
CNIDARIA
Abietinaria abietina
Alcyonium digitatum
Caryophyllia smithii
Cyanea capillata
Cyanea lamarckii
Halecium halecinum
Kirchenpaueria pinnata

Table 3: List of species at the offshore site Dörjeskär from 10 to 31 meters depth, 2013. Possible threat categories are given in brackets.

Species
Metridium senile
Obelia geniculata
Tubularia sp.
Urticina felina
Virgularia mirabilis
ANNELIDA
Lanice conchilega
MOLLUSCA
Mytilus sp.
Nucella cf. *lapillus*
CRUSTACEA
Balanus balanus
Balanus sp.
Cancer pagurus
Carcinus maenas
Homarus gammarus
Hyas araneus
Liocarcinus depurator
Pagurus bernhardus
ECHINODERMATA
Asterias rubens
Astropecten irregularis
Crossaster papposus
Marthasterias glacialis
Ophiothrix fragilis
BRYOZOA
Electra pilosa
Membranipora membranacea
Securiflustra securifrons
TUNICATA
Ascidia sp.
Ascidiella aspersa
Ciona intestinalis
Clavelina lepadiformis
Corella parallelogramma
Dendrodoa grossularia
FISH
Callionymus lyra
Ctenolabrus rupestris
Gadidae sp.
Labrus bergylta (least concern, HELCOM)

Table 3: List of species at the offshore site Dörjeskär from 10 to 31 meters depth, 2013. Possible threat categories are given in brackets.

Species
Labrus mixtus
Labridae sp.
Microstomus kitt
Pleuronectes platessa
Pollachius pollachius
Pollachius virens
Pomatoschistus sp.
Symphodus melops (least concern, HELCOM)
RHODOPHYCEAE
Brongniartella byssoides
Delesseria sanguinea
Phymatolithon lenormandii
Phymatolithon sp.
Polyides rotundus
Polysiphonia cf. *fibrillosa*
PHAEOPHYCEAE
Fucus vesiculosus (least concern, HELCOM)
Laminaria digitata
Laminaria latissima

Table 4: List of species recorded south and east of the island Marstrand, in the inner waters of the southern Bohuslän archipelago, 2013. Possible threat categories are given in brackets.

Species
PORIFERA
Haliclona oculata
CNIDARIA
Cyanea capillata
Cyanea sp.
MOLLUSCA
Cerastoderma sp.
Coryphella verrucosa
Modiolus modiolus (vulnerable, HELCOM)
Ostrea edulis
Pecten maximus
CRUSTACEA
Balanus sp.
Carcinus maenas
Pagurus bernhardus
ECHINODERMATA
Asterias rubens

Table 4: List of species recorded south and east of the island Marstrand, in the inner waters of the southern Bohuslän archipelago, 2013. Possible threat categories are given in brackets.

Species
BRYOZOA
Electra crustulenta
FISH
Ctenolabrus rupestris
Gobiusculus flavescens
Pomatoschistus pictus
Pomatoschistus sp.
Spinachia spinachia (least concern, HELCOM)
Syngnathus typhle (least concern, HELCOM)
Zoarces viviparus
PHAEOPHYCEAE
Ascophyllum nodosum
Chorda filum
Fucus serratus (least concern, HELCOM)
Fucus sp.
Fucus vesiculosus (least concern, HELCOM)
Halosiphon tomentosus
Laminaria latissima
CHLOROPHYCEAE
Ulva lactuca
Ulva sp.
Urospora cf. *penicilliformis*
ANGIOSPERMAE
Potamogeton pectinatus
Zostera marina (near threatened, HELCOM)

Table 5: List of habitats and communities at Marstrand and Northeastern Kattegat in 2011, 2012 and 2013, and their threat category.

Habitats and communities	Red list category
Amphiura	
Coral garden	Threatened and/or declining (OSPAR)
Echinoderms	
Macrophyte meadow	
Sea pen with burrowing megafauna	Endangered (HELCOM) Threatened and/or declining (OSPAR)
Tube worm	
Pelagic, offshore (deep) waters	
Zostera marina meadow	Near threatened (HELCOM)

OCEANA

This report was made possible thanks to the generous support of the Arcadia Fund, Robertson Foundation, VELUX Foundations and Zennström Philanthropies.

Nyhavn 16, 4 sal · 1051 Copenhagen (Denmark) · Phone: +45 33151160 · baltic@oceana.org