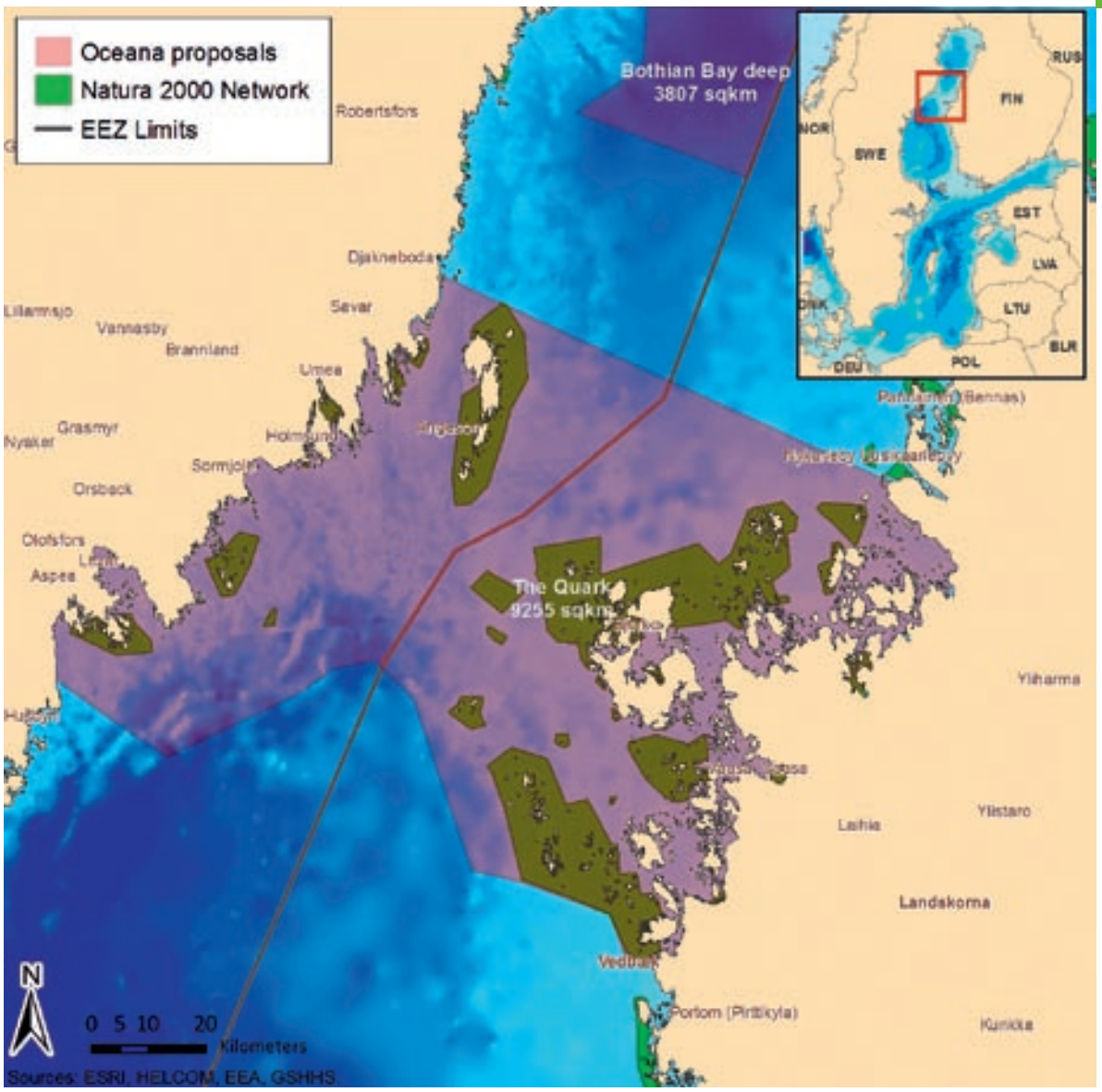

Oceana proposal for a Marine Protected Area

The Quark

INTRODUCTION

The Quark is a transnational area between Finland and Sweden, the majority of which lies in the former, that is dotted with 5600 islands. The Quark displays some unique biological conditions because of the rapid land uplift, a geological phenomenon caused by the last ice age. The annual uplift is one of the fastest in the world and greatly shapes the geology and biology of the area[1]. The Quark is included in the World Heritage List of UNESCO because of its unique geological features.

The Quark forms a shelf creating a transition zone between two sub-basins, the Bothnian Bay and the Bothnian Sea, and limiting water exchange. These conditions create differences in salinity in these sub-basins, which affect species composition in the Quark. Some marine species reach their northern distribution limit precisely at the Quark[2]. The sea bottom is characterized by bedrock and rocks ranging in size from pebbles to big boulders, but patches of sand do occur[3]. The Quark and the area south of it include a number of small marine protected areas, both in Finnish and Swedish waters.

As far north as it is, the ice season in Quark lasts from around 120 days from January to April in the outer coastal parts of the Quark, to around 150 days in the inshore areas. The Gulf of Bothnia is less exposed to nutrient leaching than the rest of the Baltic Sea, as fewer people are living in the catchment area[4,5].

Oceana conducted fieldwork in the southern part of the Quark in 2011 and 2013, with the use of an underwater robot (ROV), scuba divers and bottom samples.

DESCRIPTION OF THE AREA

Species composition and community structure varies from south to north in the Quark. The collection of organisms in the area is composed of a scientifically interesting mixture of marine, brackish and freshwater species. Some freshwater species have the Quark as their area of distribution south limit, including the vendace (*Coregonus albula*) a fish normally found in lakes in northern Europe and Russia, that lives in the Bothnian Bay[6]. The marine benthic species Baltic clam (*Macoma balthica*) reaches its northern distribution limit at the Quark, as the salinity in the Bothnian Bay gets too low for the clam to survive[7]. Other marine species, such as the bladder wrack (*Fucus vesiculosus*), are more abundant in the southern part of the Quark[8].

The Gulf of Bothnia is an important area for salmon (*Salmo salar*), which migrates via the Quark between the time when the ice has melted and the beginning of July to spawn in the northern rivers. The main migration route lies just outside the Quark archipelago. There are, however, variations in the migration route due to different sea-surface temperatures from year to year, so salmon may use both the Swedish and Finnish coastal areas for migration[9]. Grey seals (*Halichoerus grypus*) and ringed seals (*Phoca hispida*) are also present in the area, and conflicts between grey seals and salmon fishers in the past eventually led to a Finnish management plan for the two seal species in 2007[10].

In 2011, Oceana conducted surveys in both shallow and deeper water on the Swedish side of Southern Quark. The fourhorn sculpin (*Triglopsis quadricornis*), which was documented in both cases is a species found throughout the Arctic, but the population in the Baltic Sea derives from the last Ice Age, when it got isolated. Other species found in deeper water include the European eelpout (*Zoarces viviparus*) and mysids (*Mysidae* sp.), while in shallow waters, Oceana documented several species, both marine and freshwater, like the marine bladder wrack and the freshwater seamoss (*Fontinalis antipyretica*) (see Table 1 for the entire species list).

In 2013, Oceana surveyed the Finnish side of the Quark around an island called Norrskär, and the waters towards Storskäret and Rönnskären south of Norrskär. Several dives in the shallow waters showed sand bottoms with ripple marks and bottoms with stone-coverage, as well as several marine, brackish and freshwater species (for the list species see Table 2). Fishing nets were also present, some of which were seemingly abandoned, filled with holes and algae.

PROPOSAL

The Quark and its surroundings are made up of several ecologically important areas, such as spawning grounds, stony reefs, and shallow banks[11]. Oceana's proposal includes both the Quark itself, and the area just south of it. The proposal ties together a number of protected areas, including Natura 2000 sites and the world heritage site.

Many species reach their physiological tolerance limit of distribution exactly at the Quark, which makes the area even more important to protect from human activities. Moreover, the ongoing land uplift is constantly shaping the species composition. Oceana findings from the area revealed marine, brackish and freshwater species, with varying distribution ranges. Some species in the area are showing signs of improvement, the Baltic Sea fourhorn sculpin for example, was previously listed as vulnerable by HELCOM, and though it is doing better today[12], it is important that this trend continues. Therefore the area should be protected, and coupled with a proper management plan that takes these particular species into account.

POSSIBLE THREATS

Pollution from hazardous substances is considered to be one of the biggest threats to the Baltic Sea in general, affecting living organisms and bottom sediments[13]. For instance, herring in the Gulf of Bothnia have the highest level of dioxin compared to the rest of the Baltic Sea. This is because a large paper industry, having dioxin as a side product, existed in this part of the Baltic Sea for more than 30 years ago[14].

Climate change will also become a threat to the Baltic Sea, as the increase in temperature likely will result in lowered salinity, due to increased precipitation and freshwater runoff[15,16].

The Gulf of Bothnia is Finland's most important fishing area for Baltic herring[17,18]. Pelagic trawling, which occurs mostly in mid-water is the most commonly used type of gear for targeting this species, but trapnets, gillnets, and bottom trawls are also used. Bottom trawling disturbs the seabed and releases hazardous substances, such as dioxin into the water. Pelagic trawling however is not completely harmless, as high numbers of post-smolt salmon by-catch has been reported, probably affecting the overall population of the salmon in the Bothnian Sea[19]. Abandoned fishing nets also threaten fish and birds.

Many of the above-mentioned threats are shared with Finland and Sweden and should thus be addressed in one management plan to ensure that they are dealt with in a coherent manner. Natural sites on World Heritage List require management measures and administration in a special management plan. Fisheries activities in the area should also be managed, including proper measures for fisheries of safeguarded species, such as salmon.

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SPECIES LIST FOR THE QUARK

Table 1: List of species recorded at southern Quark, Sweden, in 2011. Possible threat category indicated in brackets.

Depth (m)	Species
45	**CRUSTACEA**
	Mysidae sp.
	FISH
	Triglopsis quadricornis (least concern, HELCOM)
	Zoarces viviparus
7	**PORIFERA**
	Ephydatia cf. *fluviatilis*
	ANNELIDA
	Piscicola geometra
	MOLLUSCA
	Macoma balthica
	Radix peregra
	CRUSTACEA
	Amphipoda sp.
	Balanus improvisus
	Mysidae sp.
	FISH
	Triglopsis quadricornis (least concern, HELCOM)
	BRYOZOA
	Electra crustulenta
	RHODOPHYCEAE
	Hildenbrandia rubra
	PHAEPHYCEAE
	Fucus vesiculosus (least concern, HELCOM)
	ANGIOSPERMAE
	Ruppia cirrhosa
	BRYOPHYTA
	Fontinalis antipyretica

Table 2: List of species recorded at Norrskär at depths varying depths from 6 to 37 meters, the Quark, Finland, 2013.

Species
CNIDARIA
Laomedea loveni
MOLLUSCA
Mytilus sp.
Radix peregra
CRUSTACEA
Balanus improvisus
Mysidae sp.
BRYOZOA
Electra crustulenta
FISH
Gasterosteus aculeatus
Pomatoschistus cf. *minutus*
Pomatoschistus sp.
Zoarces viviparus
RHODOPHYCEAE
Ceramium sp.
Polysiphonia fibrillosa
Polysiphonia fucoides

Table 3: Lists of habitats and communities at the Quark in 2011 and 2013. No threat categories are given for these communities.

Habitats and communities
Macrophyte
Mytilus bed
Water moss

OCEANA

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

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