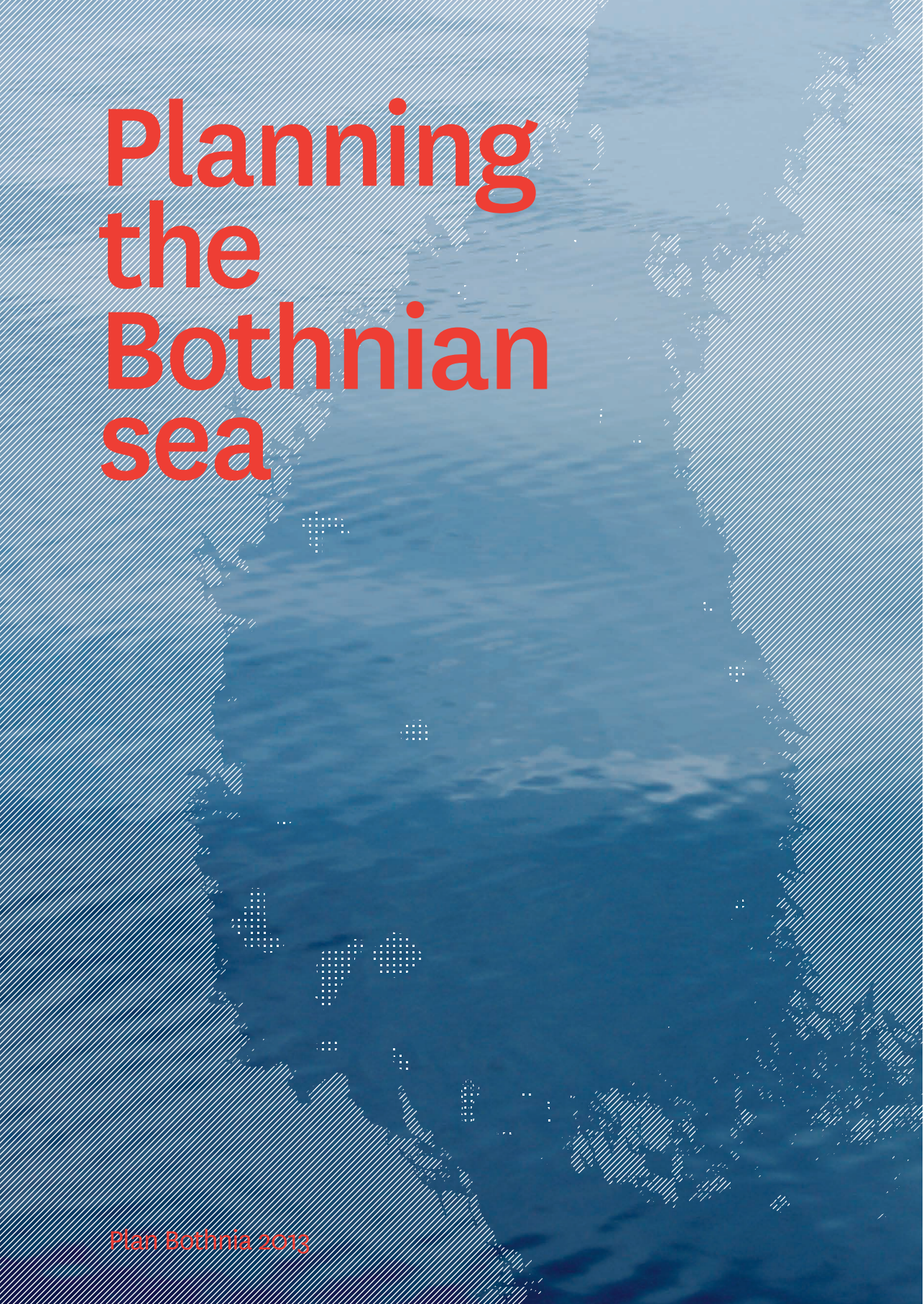
Planning the Bothnian sea



Plan Bothnia 2013

Planning the Bothnian sea

Outcome of Plan Bothnia - a transboundary Maritime Spatial Planning pilot in the Bothnian Sea *(Digital edition 2013)*

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Plan Bothnia 2013

This book co
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altic Sea.

It is the story of how two countries can work together to plan their neighbouring sea spaces.

Planning is the art of thinking ahead. But how can this be done for a whole sea basin?

This book is the summary outcome of the EU funded project Plan Bothnia (MARE 2009/16). The 0,5M euro initiative ran for 18 months between December 2010 and May 2012 under the co-ordination of the Helsinki Commission (HELCOM) secretariat. The initiative also provided a supporting geographical information system (GIS) map service, a blog diary and a library of process documents. These, and this book, are available from www.planbothnia.org until at least 2015

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Disclaimer
This book does not necessarily reflect the views of the organisations involved (either project partners, participants or the EU Commission)

Explore maps on the web:
Most of the maps in this book are also freely available through our website. There you can view, interact with and download the GIS data: www.planbothnia.org

Baltic wide MSP data is accessible through the HELCOM data and map service. www.maps.helcom.fi

Summer Night on the Bothnian Sea

Floating in light, the cooled-off Bothnian horizon
moves into the white nothingness of evening
where every star turns pale on the desolate fabric of the vaulted sky
and dawn takes over from the hidden sun.

Osaka Maru from far-away Nagasaki
heads north to the luminous lumberyards of Umeå,
towing, without lanterns, wondering bushido souls
into a shimmer spun by summer.
And like them, other sailors have always wondered;
and asked in a hundred foreign tongues: why
are the nights of June so white upon the Bothnian waves?

Harry Martinson 2009
The Procession of Memories- Selected poems 1929-1945,
new bilingual edition translated by Lars Nordström.
Wordcraft of Oregon, LLC. La Grande, Oregon, USA. 122 pp.
Originally published 1934 in *Natur* [Nature] as
Sommarnatt på Bottniska Havet
Published with consent of the translator.

Summary maps
These chapters include maps of features and interests important for planning.

The Plan
Based on this information, the book then sets out a pilot marine plan for the Bothnian Sea on the page 109. The Plan is also available as a separate file.


NORTHERN EUROPE
RUSSIA
FINLAND
SWEDEN
BOTHNIAN SEA
St. Petersburg
NORWAY
Helsinki
Oslo
Tallinn
Stockholm
ESTONIA
Riga
LATVIA
DENMARK
LITHUANIA
Copenhagen
Vilnius
RUSSIA
Gdansk
Rostock
GERMANY
POLAND
0
325 km

In all parts of the world the sea is a source of life, of energy, of food, of commerce, of fun. Its water, wind, and waves are all in demand – as a playground for pleasure-seekers and nature-lovers, as a highway for international commerce, as a home for unique communities of wildlife and people. All this is also true for the Bothnian Sea, a part of the northern European Baltic Sea between Finland and Sweden.

The Bothnian Sea is used by two neighbouring highly developed societies. There are many demands on its resources, and its open spaces are highly coveted areas for developments such as wind power farms. This relatively sparsely habitated corner of the world is also, at least at times, a place of wild seas and ancient heritage.

Like planning on land, maritime spatial planning is a process that has to incorporate ideals of the public good and the various politically-anchored ways to define this, taking in to account private development interests as well as the physical realities of limited natural resources and fragile ecosystems.

This book provides an introduction to the Bothnian Sea and the ideas around maritime spatial planning for its offshore areas.

We have tried to present a balance between the perspectives of competing interests. As this has been a pilot initiative, we have not aimed to give you ready answers, but instead try to provoke further debate.

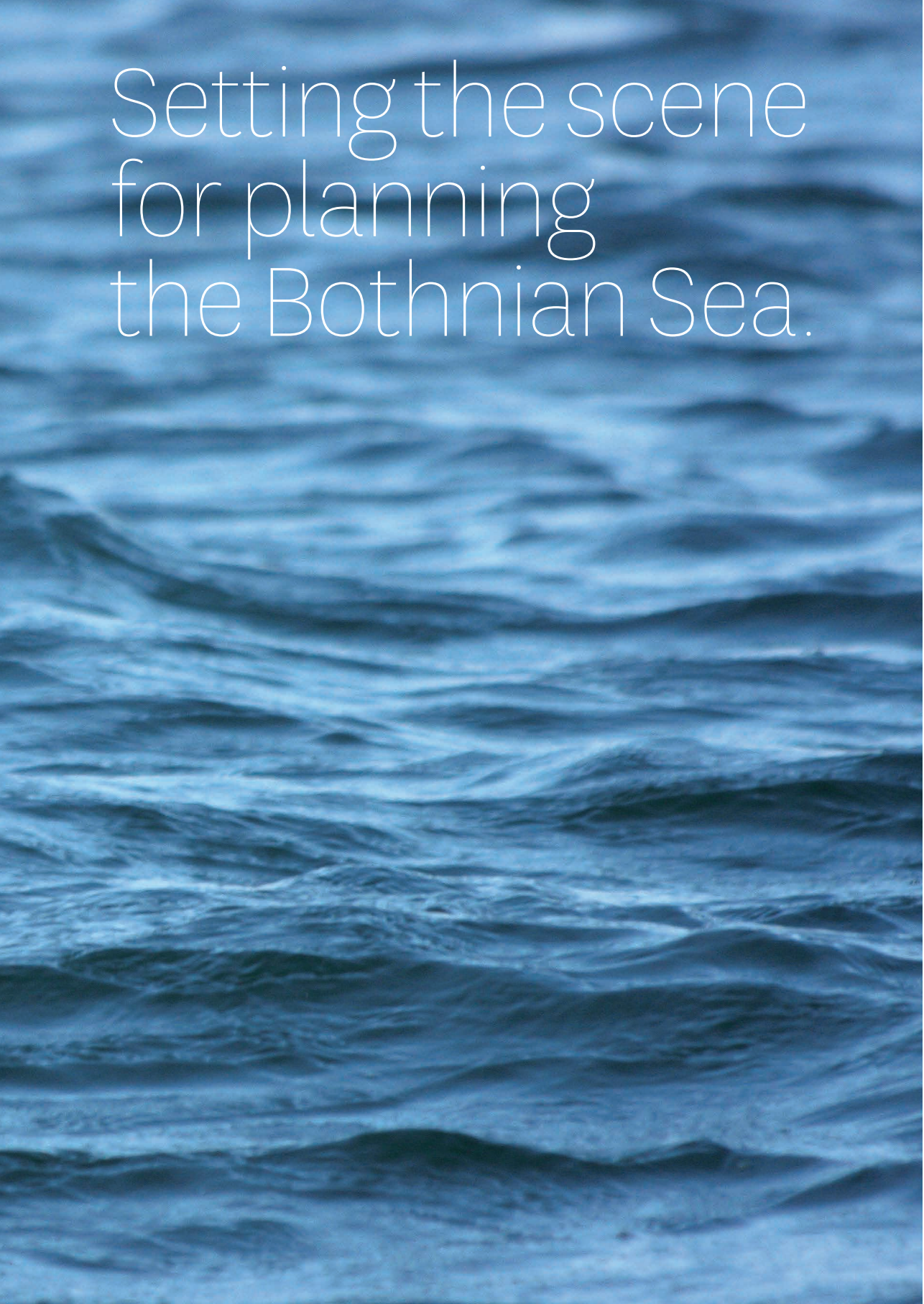
The Bothnian Sea and its future are in your hands.

The editors
Helsinki, February 2013

This digital 2013 edition includes corrections to the 2012 print version.

I: Stimulating thinking

Setting the scene for planning the Bothnian Sea.



Planning offshore spaces of the Bothnian Sea

MSP
Maritime, or marine, spatial planning is "the process of analyzing and allocating human activities to achieve environmental, social and economic objectives usually defined through a political process" (UNESCO).

UNCLOS
The 1982 United Nations Convention on the Law of the Sea (UNCLOS) is an international agreement, a kind of a constitution of the oceans, spelling out rights and duties of states.

Baseline
A baseline is the line from which the seaward limits of a state's territorial sea and certain other maritime zones are measured. A baseline follows the low-water line of the coast, or a straight baseline is drawn along the mouths of bays and outer islands.

Territorial sea (TS)
As defined by UNCLOS, the territorial sea is a belt of water extending 12 nautical miles (nm) from the baseline of a coastal state. The territorial sea, including the airspace above and seabed below, is regarded as the sovereign territory of the state.

Exclusive Economic Zone (EEZ)
According to UNCLOS, an EEZ is a sea area over which a state has special rights. It stretches from the seaward edge of the state's territorial sea out to a maximum of 200nm from its coastal baseline.

Planning area
Bothnian Sea waters offshore from 1nm from the baseline. This the same as in the proposed Swedish MSP legislation, as well as seaward limit of the EU Water Framework Directive.

This book explores the offshore areas of the Bothnian Sea through a pilot study on transboundary maritime spatial planning (MSP). It is one of only a few MSP excercises that has been carried out jointly by civil servants and researchers from different countries sharing a sea, in this case Sweden and Finland.

In precise legal terms, as defined by the UN Convention on the Law of the Seas (UNCLOS),[1] the focus area of this book covers the Bothnian Sea waters outside the baseline including the Swedish and Finnish terriorial seas and the Exclusive Economic Zone (see definitions).

Water does not respect boundaries, of course – an offshore area is connected to its surroundings. So this book also describes the Bothnian Sea's coasts, shorelines, its industry and commerce, the people who live by it and who work on its waters, the wildlife and natural features of its depths. Many of the chapters end with a map providing a summary of the identified features and interests.

By the end of the book, we try to synthesise this material for planning purposes. We also describe the planning systems of the two countries and how these countries deal, or aim to deal, with planning at sea.

Based on this information, the book then sets out a pilot marine plan for the Bothnian Sea. In terms of time it will look roughly fifteen years to the future. The planning area includes Bothnian Sea waters offshore from 1nm from the baseline.

We finalise with some remarks on our experiences along the way, as well as a number of comments from outside observers (see Annex).

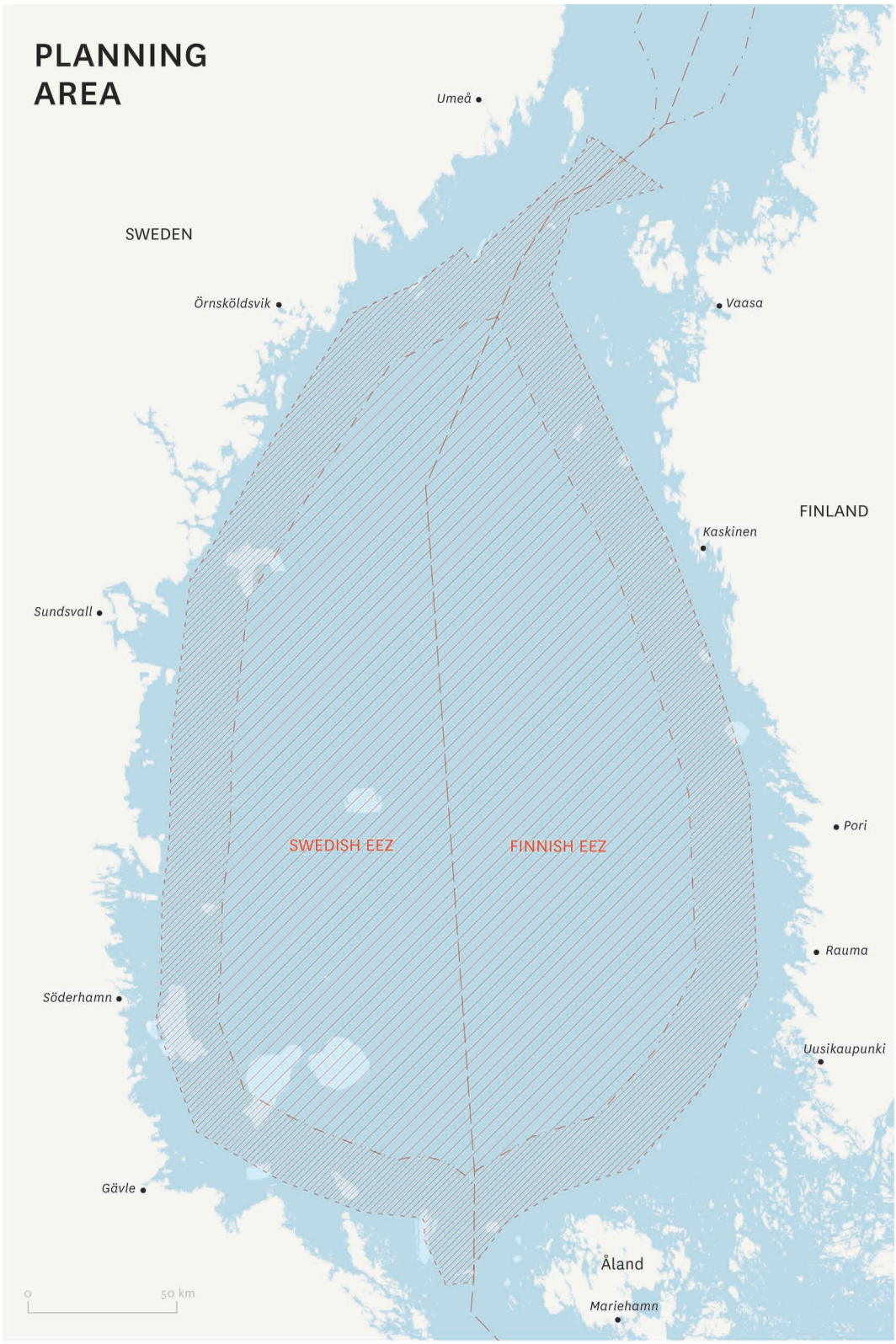
We hope the contents will generate more ideas on how the uses of the European sea areas and Baltic Sea, and the processes to steer them, could be organised so people can live harmoniously with the sea and its ecosystems, now and in the future.

Taking planning to an unknown territory

On land, spatial planning has a long history in property and civic development. At sea, especially in offshore areas far from public view, spatial planning has been less common. This, at least in Europe, is starting to change.

This is mainly due to the recent explosive interest in offshore areas for wind power developments, which are needed to provide sustainable energy and help address climate change. The drawback is that with present technology these will cover large sea areas with permanent fixed structures, dramatically changing European marine spaces. By occupying marine space they challenge other uses of the seas, commonly with similar growing trends. At the same time the European marine environment remains in a poor state, with risks of more degradation.

Maritime spatial planning (MSP) is increasingly carried out as a way to comprehensively address these developments.[2] As a result


PLANNING AREA
Umeå
SWEDEN
Örnsköldsvik
Vaasa
FINLAND
Kaskinen
Sundsvall
Pori
SWEDISH EEZ
FINNISH EEZ
Rauma
Söderhamn
Uusikaupunki
Gävle
Åland
Mariehamn
0
50 km
Exclusive Economic Zone within planning area
Territorial waters within planning area
Planning area boundary
Shallow banks

MSP plans have been drafted for both coastal and offshore sea areas of different countries around the continent, and the world.

However, in seas like the Baltic many marine issues such as shipping, fisheries, windpower developments and environmental protection have strong transboundary dimensions. A transboundary form of MSP, where neighbouring countries jointly plan the seas they share and jointly use, should enable such issues to be addressed more effectively than uncoordinated plans of single countries.

With this background, the European Commission launched in 2009 a call for a pilot project on transboundary planning in the Baltic Sea. This book is the summary outcome of the winning proposal "Plan Bothnia", a transboundary MSP project focusing on the Bothnian Sea (see Annex).

The Bothnian Sea is a clearly delineated sub-basin of the Baltic Sea shared by Sweden and Finland, two countries with similar administrative structures, practices and views on planning. Similar developments are taking place in the Bothnian Sea in both Swedish and Finnish parts, such as plans for major wind power installations. There is also significant interaction across the border – for example, the Finnish fishing fleet is active in the Swedish part of the EEZ and *vice versa*.

Unusually for central Europe, in these two countries, existing national legislation for spatial planning on land covers the entire territorial sea. However, no planning has been carried out in the EEZ in either country. The combined offshore and transboundary context of this book takes planning definitely to an unknown territory.

All these factors enabled a transboundary project where the two countries could participate on an equal footing, and the results would be of value to both. MSP should have potential especially in sea areas like the Bothnian Sea where user pressures are currently relatively low, but are expected to grow strongly in the future.

Conservation or exploitation?

In a democratic society, citizens but also all relevant interests and viewpoints should be included in a process of spatial planning.

Planning has a social dimension, playing a part in safeguarding the public good and civic well-being. Planning also has an economic dimension, aiming to boost growth and prosperity. There is also an environmental dimension of planning – even if this has often been in the shadow of other interests in practical applications.

At sea the environmental dimension is strenghtened by the ecosystem approach, which is often mentioned as a key characteristic of MSP.[3] Using this approach, the ecosystem of the planning area provides both the basis and limitations for planning. What practical implications this has on planning, without sacrificing its cross-sectorial nature, remains a question to be answered.

MSP, then, raises ideological questions. As with all planning, there are a variety of frameworks in which integration between different interests can take place.

A classic example of this are the arguments for and against the primacy of economy and employment, against the argument for

keeping landscapes and ecosystems intact – should we conserve or exploit? Another set of conflicts arises in the discussion around the benefits for local populations versus national, European or global interests.

Planning is never neutral, not even when best efforts are taken to ensure neutrality. It is always, in the end, a political process, anchored to some specific paradigm or mindset.

In 2011 the European Commission began a consultation on the need for new legislative measures on maritime spatial planning.[4] Since 2009, Sweden has been preparing national legislation on the subject and is set to embark on planning its sea areas in the near future. There is a growing demand for reflection around MSP.

The currently available examples of offshore MSP have mainly focused on rational dimensions of planning, such as easily measurable economic benefits. The immediate needs of the wind power industry has also been high on the agenda. The more poetic dimensions, the genius loci, or the very spirit of the seas under discussion, have been largely unexplored.

This is a pity, as planning at sea should not only be about pure rationality.[5] It should also be about cultural and maritime identity, personal connections to the surrounding marine environment, and our abstract dreams of a better future. In short, life in its full complexity. We hope the visual approach of this book will also awaken some ideas in this direction.[6]

II: The Bothnian sea


The sea and the
people that use it.

A sea of plenty: the ecology of the Bothnian Sea

The name Bothnian Sea is a latinisation of the Swedish name Bottenhavet, which comes from the old Swedish word *botten*, meaning bay and *hav* meaning sea. The Bothnian Sea, then, is the *bay-sea*.

The Finnish name for the Sea is *Selkämeri* from *selkä*, meaning an open stretch of water and also the back of the human body, and *meri* meaning sea. Its origins are more recent, as until the early 1900s, this area was called *Raumanmeri* like in the Finnish city of Rauma.

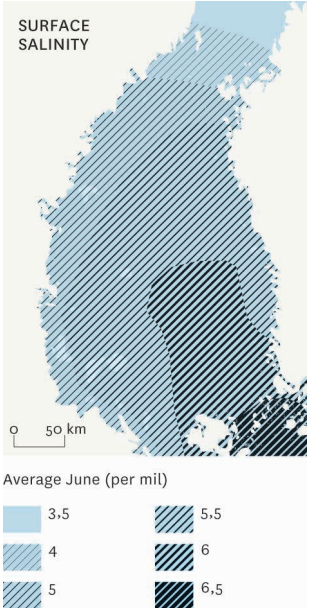
Geographically, the Bothnian Sea is a sub-basin of the Baltic Sea between Finland and Sweden. The autonomous region of Åland, a part of Finland, is situated at the southern end of the basin. The surface area of the Bothnian Sea is approximately 65,000 km², an area slightly smaller than Ireland and one third bigger than the Netherlands or Denmark.[7]

Major neighbouring bodies of water are Bothnian Bay, also called the Bay of Bothnia, to the north and the Baltic proper to the south, beyond the Åland islands. Together the Bothnian Sea and Bay, divided by the narrow Northern Quark passage, make up a larger geographical entity called the Gulf of Bothnia.

Planning at sea aims for a balanced approach, where long-term environmental aims are central planning goals alongside sustainable social and economic development. This follows the ecosystem approach promoted by the European Commission, the Baltic cooperation bodies of HELCOM and VASAB, as well as the Swedish marine policy.

This means we start our exploration of the Bothnian Sea by looking at its ecosystem, including its physical features, its different forms of life and the pollution risks that threaten it.

SALINITY COMPARISON	‰
Red sea	40
Eastern Mediterranean sea	39
Ocean seawater	33-37
Black sea mean	20
Baltic sea mean	7
Limit of Agriculture irrigation	2
Drinking water	0.1



Low salinity and months of ice

Salinity determines which forms of life are found in a sea. The waters of the Bothnian Sea have a very low salinity compared to most seas. Salinity is generally slightly higher in the south, closer to the Atlantic.

There are several larger rivers that bring fresh water to the Bothnian Sea, including the river Kokemäenjoki in Finland and the river Ångermannälven in Sweden. Climate change could potentially dramatically decrease the salinity of the Bothnian Sea, by up to 45 per cent, in the area.[8]

Wind and water currents affect the distribution of salinity and ice. As there is no tide in the Bothnian Sea, the mean conter-clockwise circulation is very weak, about a few centimetres per second. This is around 10 times slower than in most sea areas. Slightly stronger currents can be found along the Finnish coast (northward) and close to the Northern and Southern Quarks, where water exchange with the Baltic proper and Bay of Bothnia takes place.


BOTHNIAN SEA
WITH SURROUNDINGS
Bothnian Bay
GULF OF BOTHNIA
Umeå
SWEDEN
Northern Quark
Örnsköldsvik
Vaasa
FINLAND
Kaskinen
Sundsvall
Bothnian sea
Pori
Rauma
Söderhamn
Uusikaupunki
Gävle
Åland
Archipelago Sea
Mariehamn
Southern Quark
Baltic proper
0
100 km

Areas known as upwelling zones, where nutrient-rich water from the depths rises to the surface layer, are key areas where photosynthesis takes place and are hotspots for wildlife. The location of such zones in Bothnian Sea is determined by surface currents, caused by prevailing winds, the topography of the sea bottom and the exchange of water masses with different physical properties between the Baltic basins. A long upwelling front exists along the coast of Finland.[9]

Ice cover is an annual feature of the Bothnian Sea, blocking out wind and light from life below and creating difficulties for shipping and offshore constructions. The extent of the sea ice varies depending on the severity of the winter. Offshore waters freeze every year around mid-February, with an ice layer reaching a thickness of 40cm that lasts until mid-April.

Layered ridges of drift ice, or pack ice, often form in the northern parts of the Bothnian Sea. This kind of ice can be so thick it cannot even be broken by icebreaking vessels. At these times, ships have to take other routes or use alternative ports. The crushing force of moving pack ice makes the construction of any permanent installations, such as wind power units, a challenging task.

A rising land: the seabed and banks

The topography of the Bothnian Sea is characterised by a shallower area in the Swedish waters of the south-west, with several banks of around 20m depth, as well as a deeper depression running in a slight curve from the south to the north.

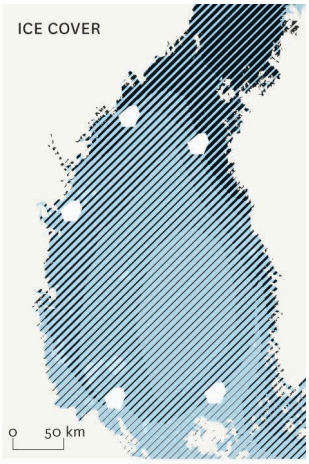
The deepest point, the Ulvö deep, is 293m and situated in an area with a highly variable seabed and steep underwayer cliffs, close to the High Coast (Höga kusten) region of the Swedish Bothnian Sea. The mean average depth of the Bothnian Sea is around 66m.

The Bothnian Sea is experiencing a rapid rising of the land beneath it, around 0.5 to 1m in the past 100 years, caused by the depression created by last ice age. Consequently, the surface area and the depth of the sea are slowly diminishing and more land is being created along the coast.

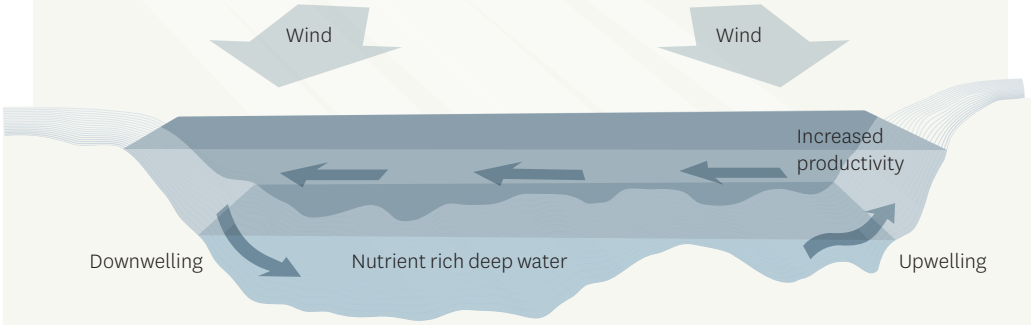
Of central concern for planning at sea are the shallow but permanently water covered areas in the Bothnian Sea, known as banks. These relatively unknown areas are the closest thing to land offshore and are attractive to wind power companies.

Initial studies have shown that banks have extremely high natural value, constituting important biodiversity hotspots and fish reproduction areas.

There are around 10 known larger banks in the Swedish areas of the Bothnian Sea, and seven on the Finnish side. The largest ones are situated in Swedish waters.



UPWELLING AND DOWNWELLING



Wind-induced coastal upwelling moves nutrient rich deep water to the surface. Coastal downwelling moves surface water downwards. Net movement of water is in a 90 angle to the direction of the wind due to a phenomenon called Ekman transportation.

PACK ICE

Drift ice, consisting of loose ice floes moved by wind, often aggregates to ridged ice (also called pack ice) in the Gulf of Bothnia. Such ice ridges have commonly a vertical thickness of 5-15 m, but up to 30m thick ridges have been observed. These can also touch the sea bed, especially in shallow areas, filling the whole water column with ice. The illustration is schematic only, icebreaker and ridge are not in the same scale.

Large banks in Swedish territorial sea and EEZ (north to south):

1 ***Sydostbrotten*** in the Northern Quark is an extensive chain of shoals 5nm long, covered by water in places.

2 ***Långrogrunden***, Northern and Southern. The northern (Norra) Långrogrundet is a bank with shallow ledges and rocks awash at its north end where a lighthouse stands. The southern (Södra) Långrogrundet is a rocky bank with a least depth of 4.9m, and lies 2 miles south of Norra Långrogrundet.

3 ***Vänta Litets grund***, lying 12.5nm east of Skarpudden Light (off Härnösand), consists of two shoals rising near vertically from the bottom, composed of stones and pointed rocks. The southwestern-most shoal has a least depth of 4.1m.

4 ***Eystrasaltbanken*** is an offshore shoal bank with a least depth of 12m, lying about 40nm offshore of Sweden.

5 ***Gretas Klackar*** is a group of three shoals off Hudiksvall with a least depth of 10.3m.

6 ***Sylen*** is an isolated shoal patch, lying about 16.5nm north-northwest of Finngrunden Light. It has a least depth of 9.4m and is marked by a lighted buoy.

7 ***Storgrundet***, off Söderhamn, is an extensive shoal consisting of gravel, sand and shingle. It has a least depth of 0.5m.

8 ***Finngrundet Västra banken*** and ***Östra banken*** are two extensive banks of sand and gravel. The Finngrundet Östra Banken (eastern bank), about 22nm from the coast, is approximately 20m deep and has an area of around 23,151 hectares. Sub-littoral sand banks make up 94 per cent of this area, the rest is a rocky sea bed. A shoal patch, with a least depth of 1.5m, lies near the southern end of the bank and other patches, with depths of 3.2 to 3.5m, are located in the northern part. The Finngrundet Västra Banken (western bank) lies about 6nm west of the eastern bank and consists of several shoal patches. A patch in the northeastern extremity is as shallow as 0.6m.

9 ***Campusgrund*** lies in the approach to Lövstabukten and has a least depth of 8m. Around 20nm to the east lie shoals named Argos outer and Argos inner. The name *Argos* comes from a schooner that ran aground in 1863.

10 ***Grundkallegrund*** is an extensive bank in the southern Quark that extends up to about 5.5nm south and 3nm southeast of a lighthouse with the same name. This bank is composed of numerous steep and shallow shoals, some covered by water. Eastward, around 8nm north of the Märket lighthouse, lie Märketskallen shoals.

Larger banks in Finnish territorial sea and EEZ (south to north):

11 ***Karlssoninmatala***, off Uusikaupunki, is the most northwesterly of a group of three shoals, with a depth of 9m. Other nearby shoals include Karlinmatala, with a depth of 5.3m, and Jonssoninmatala ,with a depth of 1m.

12 ***Storgrund***, off Kaskinen, has a least depth of 3.4m. A detached patch, with a least depth of 7.2m, lies about 1.6nm west-northwest of Storgrund.

13 ***Yttergrund***, off Kaskinen, is a rocky shoal with a least depth of 4.9m.

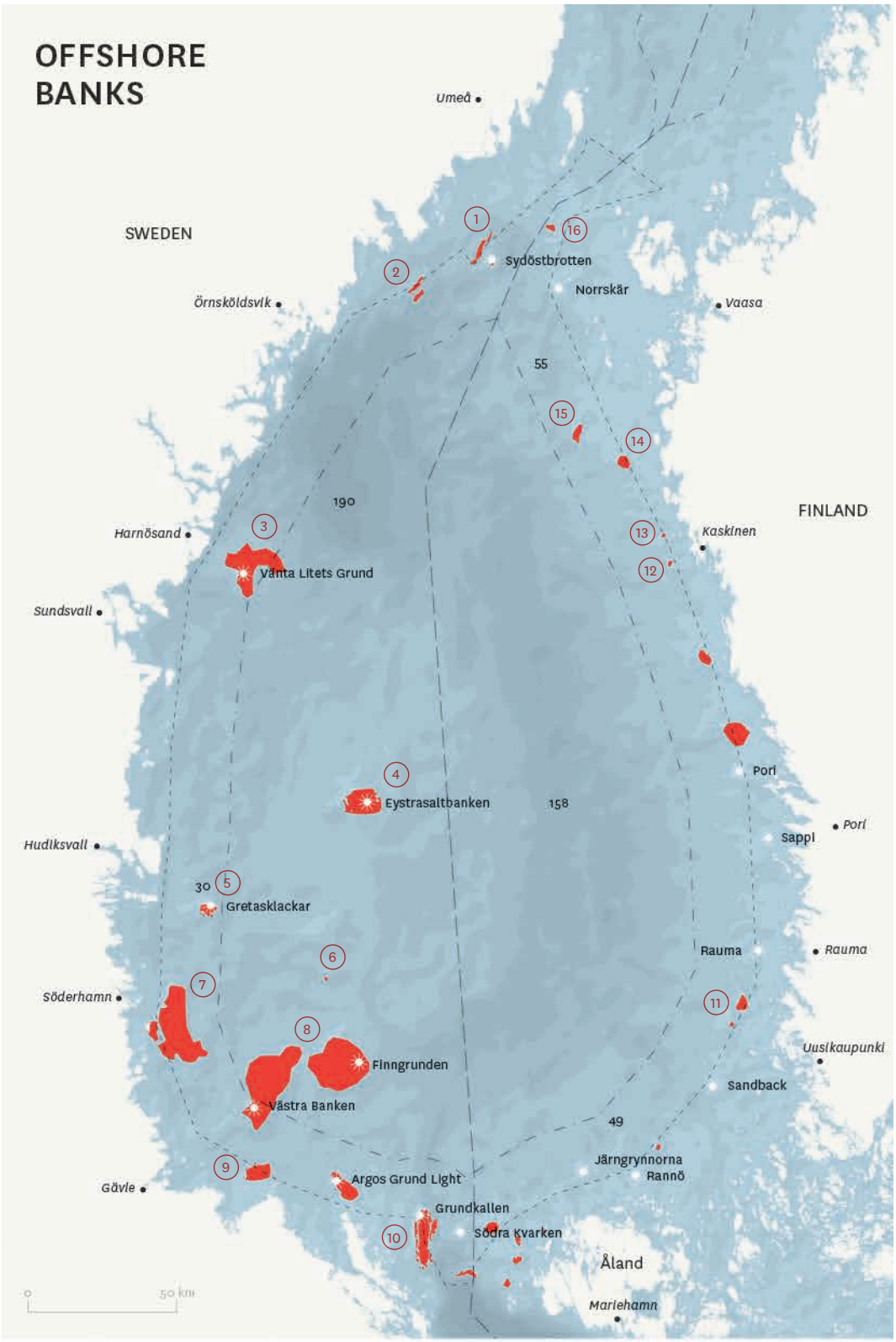
14 ***Storkallegrund***, an extensive shoal flat, lies about halfway between Sjogrund and the mainland.

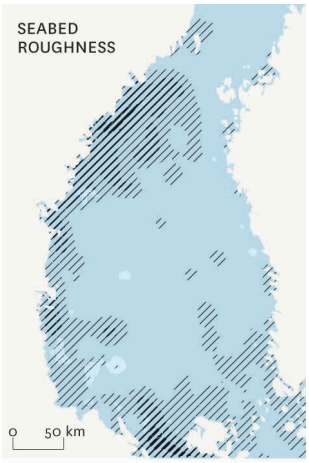
15 ***Sjögrund***, off Korsnäs, with a least depth of 8.2m, is located 16.5nm west of the mainland.

16 ***Gunvorsgrund***, a shoal in the northern Quark.

In addition, a number of smaller banks exist, including several to the north of the Åland islands.

Please note that there is little freely accessible information available on banks on the Finnish side.


OFFSHORE BANKS
Umeå
SWEDEN
1
16
Sydöstbrotten
2
Örnsköldsvik
Norrskär
Vaasa
55
15
14
190
FINLAND
3
Harnösand
13
Kaskinen
Vänta Litets Grund
12
Sundsvall
Pori
4
Eystrasaltbanken
158
Hudiksvall
Sappi
Pori
30
5
Gretasklackar
6
Rauma
Rauma
Söderhamn
7
11
8
Uusikaupunki
Finngrunden
Sandback
Västra Banken
49
9
Järngrynnorna
Rannö
Argos Grund Light
Gävle
Grundkallen
10
Södra Kvarken
Åland
0
50 km
Marlehamn
Banks
Lights
158
Depth in meters



Variable geology

Mineral deposits such as oil or gas are not present. Successive ice ages over the past 2.6 million years, during what is known as the Quaternary period, have scraped most of the older sediment layers off the seabed, and the remaining geological material is young, around 25,000 years old or younger.[10]

Major offshore underwater sand formations include the Yyteri ridge, off the coast of the city of Pori, as well as areas around the southwestern plateau.

Stone-littered bottoms line the Finnish side of the seabed, and also make up the elevations present in the southwestern parts, such as the shallows and banks in the Swedish EEZ.

A number of banks are made up of solid hard rock, such as the large area off Korsnäs, in the northeastern Finnish part of the Sea. The seabed in deeper areas is largely covered by mud or hard clay. Iron-manganese aggregations, or nodules, also cover some of the areas deeper than 30m.

The coastlines are largely flat landscapes with shallow waters peppered by boulders and larger stones that make the areas difficult to navigate by boat. An exception to this includes the High Coast area of Sweden (south of Örnsköldsvik), which has distinct steep cliffs and deep bays.

Life above and below the waters

The Baltic Sea is the world's largest body of brackish water, in which both saltwater and freshwater organisms are found side by side. The particularly harsh physical conditions in the Bothnian Sea – cold temperatures, long months of darkness and the very low salt content – make life challenging.

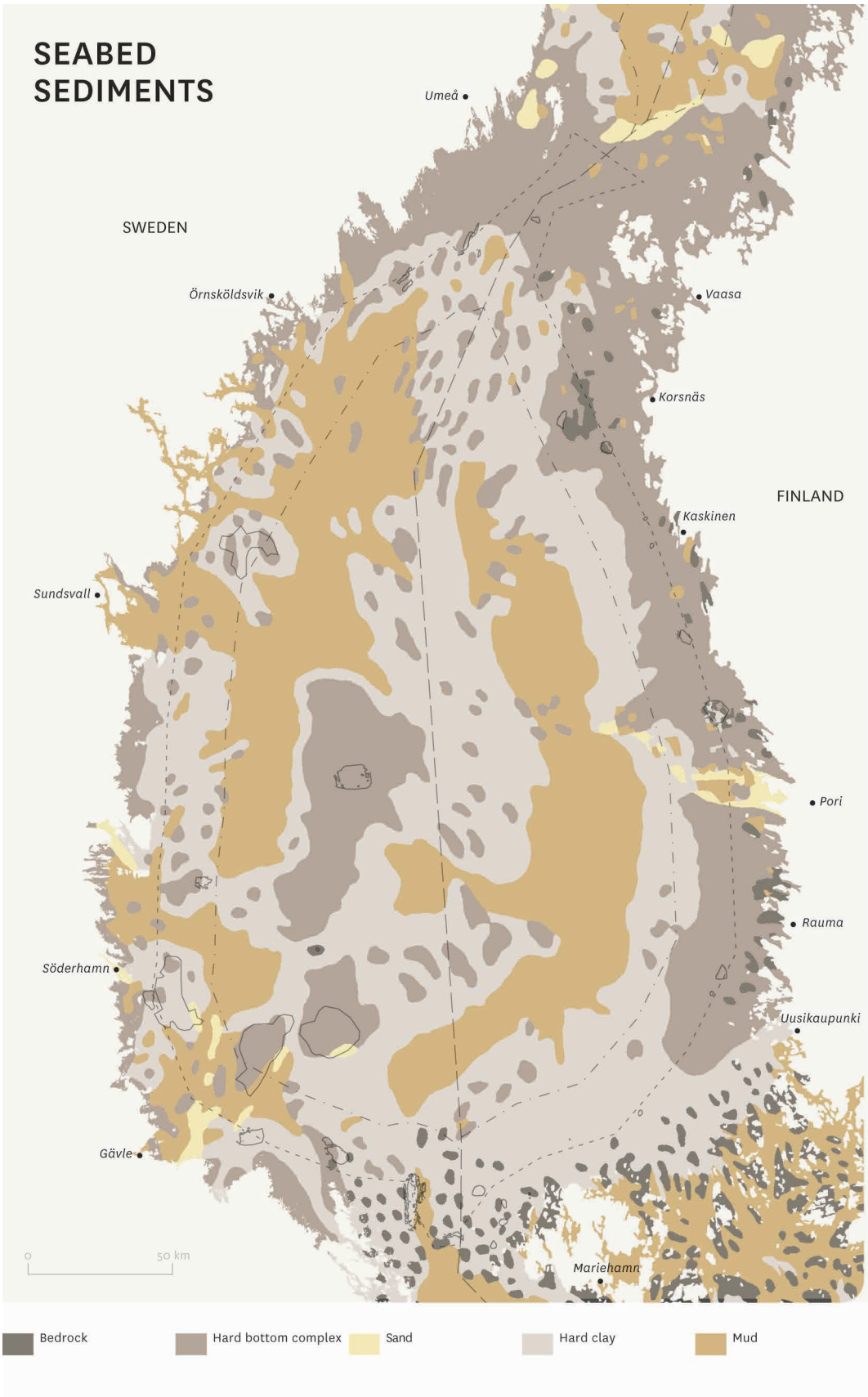
According to the preliminary results of the HELCOM Red list project to survey animal and plant life in the sea, the Bothnian Sea is home to approximately 420 macroscopic (larger) species. This breaks down to 157 plants and algae, 147 invertebrates, 73 fish, 42 birds, and two types of seal. The porpoise, a relative of the dolphin, is thought to be present in the waters.

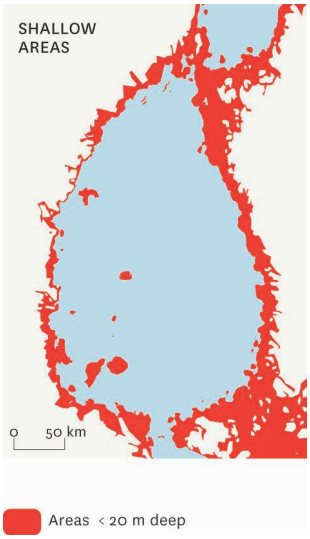
This is comparable to the rest of the Baltic Sea but is only a quarter of the number of species found in the Skagerrak between Denmark and Norway. The total number of species in the Baltic is low because the low salt content limits marine plant and animal species, but is still high enough to deter many freshwater species.

A peculiar feature of the fauna in the whole Gulf of Bothnia is the presence of a number of glacial relicts – isolated populations of arctic species that have remained in the Baltic Sea since the last glaciations. These include a seal, the Baltic Ringed Seal, and small crustaceans like *Saduria* and *Monoporeia*.

Microscopic organisms: Phyto- and zooplankton

As in all waters, the Bothnian Sea hosts a number of microscopic algae, or phytoplankton, which turn sunlight and nutrients to sugars and proteins. Phytoplankton are the base of the marine food chain.


SEABED SEDIMENTS
SWEDEN
FINLAND
Umeå
Örnsköldsvik
Vaasa
Korsnäs
Kaskinen
Sundsvall
Pori
Rauma
Söderhamn
Uusikaupunki
Gävle
Mariehamn
0
50 km
Bedrock
Hard bottom complex
Sand
Hard clay
Mud



Microscopic animals, zooplankton, eat the algae and are also, in turn, a source of food. Pelagic fish that live nearer the surface of the water, such as herring and whitefish, rely on this zooplankton as a food source.

Many smaller forms of marine life go into resting stages during the long period when the Sea is covered with ice. Microscopic algae and animals, however, continue to thrive in the pores and canals of the ice, creating unique micro-ecosystems.

Species from other parts of the world can be, and likely have been, unintentionally carried to the Bothnian Sea by shipping, an activity which can be influenced by maritime planning.

Many of these alien species are microscopic organisms and they can harm the local ecosystem. For example, the planktonic crustacean *Cercopagis pengoi*, native of the Black Sea and Caspian Sea, was first observed in the Bothnia Sea in 2002, and has rapidly spread and increased in biomass.

In the deeps: zoobenthos

The diverse forms of life that live on the seabed, known as benthos, are an important part of the biodiversity but also a source of food to larger fish.

Human activities, such as fisheries, can disturb the seabed and harm life here. Planning measures can limit this disturbance and its negative effects.

In typical samples from the muddy and sandy surfaces covering the dark deeps of the Bothnian Sea, fewer than 10 species of invertebrate animals can be found. Among the key species are the already mentioned glacial relicts *Saduria entomon* and the smaller shrimp-like *Monoporeia affinis*, as well as others like the Baltic clam (*Macoma balthica*). These are important food items for fish and even seals.

Organisms in the deeper parts of the Bothnian sea enjoy a relatively hospitable environment compared to those in the Baltic proper and the Gulf of Finland, where large areas of seabed lack oxygen.

In the sunlit shallows: phytobenthos

The shallow seabeds of the Bothnian Sea – especially offshore banks – are environments about which we still know relatively little. In these shallower areas, a few large species shelter a rich variety of other smaller animals and plants.

On hard surfaces, the seaweed-like bladder wrack (*Fucus*) is commonly found, as well as animals such as the blue mussel (*Mytilus*). Sandy and muddy seabeds host a number of vascular plants, such as freshwater pondweed (*Potamogeton*) and, in southern parts, even eelgrass (*Zostera*). *Fucus radicans* is a recently described seaweed and can only be found in the Gulf of Bothnia.

The shoreline communities of the Bothnian Sea are different from those of southern Baltic or Atlantic. Individuals are usually much smaller in size and the number of animals covering the seabed is not that high. This is partly because moving ice cleans the bottom every winter.

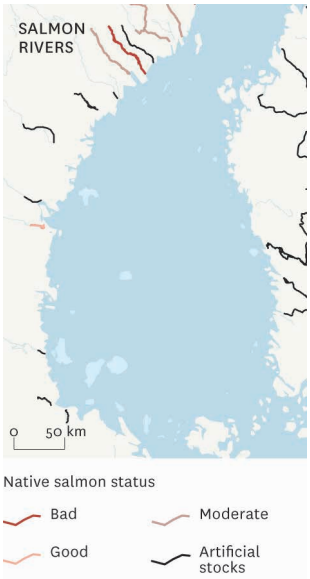
Fish

The spawning and nursery areas of several fish species in the Bothnian Sea have been mapped. These are very important for the fish populations but also the ecosystem at large, and should be taken into account when planning the sea.

In addition to herring and sprat, covered later in the chapter on fisheries, there are 71 other fish species in the Bothnian Sea. This includes freshwater species such as grayling, vendace and whitefish. These thrive together with saltwater species such as flounder.

A special delicacy in the Bothnian Sea region is the river lamprey (*Cyclostomata*), which is caught in sizeable numbers from the rivers.

During the last century, river dams and dredging in major salmon and trout hatching areas reduced the numbers of these species dramatically. Stocks of several formerly famous salmon rivers are now extinct.



Rich bird life

Birds are an important part of the ecosystem, especially when considering constructions such as offshore wind farms.

The bird life in the Bothnian Sea, especially around islands and the coast, is rich and diverse, including both marine and inland waterfowl. Among the main groups of birds are various species of terns, gulls, ducks, divers and waders.

Birds such as the Common Eider use offshore banks for feeding during the special molting period when they change feathers and can not fly well.

Large numbers of birds also use coastal waters and the open sea during their yearly migrations. Unfortunately, maps of these migrations or molting areas are not yet available for Bothnian Sea offshore areas.

Seals

The Grey Seal and the Baltic Ringed Seal are present in the Bothnian Sea. There are a number of colonies, as well as a few special protected areas, that are important to their populations.

The endagered Baltic variety of the Ringed Seal is a solitary animal that breeds on sea ice.

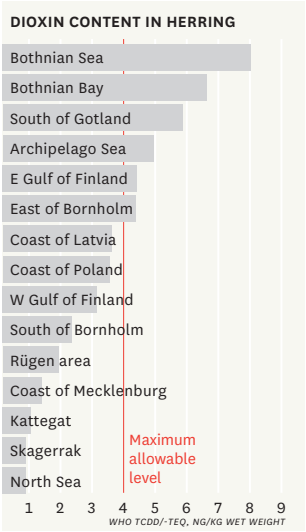
The Grey Seal has rapidly increased in numbers, much to the annoyance of fishermen who have greater competition for their catch. Grey Seals usually reside in dense colonies, but they also wander, hunting over very large areas.

The location of such seal colones should be taken into account when planning the sea, but information on sites are often classified to avoid intentional harm from illegal hunters.

Clean waters under threat

The main source of pollutants to the Bothnian Sea are inland, reaching the sea via rivers or the air.[11]

Spatial planning on the sea can not influence such pollution directly, except perhaps in the case of exhaust gases and sewage



from sea traffic. Pollution issues are important to take into account, however, as they affect uses of the sea. Certain substances are harmful for Bothnian sea life even after decades in the water.

At the moment, the Bothnian Sea remains relatively unaffected by nutrient pollution, but levels of nitrogen and phosphorus are rising. These nutrients cause eutrophication, where algae blooms become excessive, starving the sea of oxygen and light, harming life below.

Excessive nitrogen and phosphorus in the sea comes from sources such as coastal fish farming, fur farming, municipal waste waters and, in particular, agricultural fertilisers.

The problem of eutrophication is not as big in the Bothnian Sea as it is in the Baltic proper or the Gulf of Finland. Climate change, however, could increase the input of nutrients in the sea. River flows, especially in the northern Baltic basins,[12] are forecasted to increase, which could increase the nutrient run-off to Bothnian Sea.

Gas exhaust emissions from ships are also an important source of nitrogen oxides that end up in the Bothnian Sea. During harsh ice winters, this source of emissions can grow substantially due to the ice breaking activities needed to keep shipping lanes open.

Hazardous substances

In addition to nutrients, there are a number of directly hazardous chemicals that also pollute the Bothnian Sea.[13]

Dioxins were produced in large quantities as a side product of chlorine bleaching methods used by both the Finnish and Swedish paper pulp industry before the 1980s.

Northern Baltic herring can still contain large enough quantities of dioxins to be an issue for human health. Finland and Sweden have set recommendations for herring consumption to avoid health problems, and an export ban to the rest of the EU is in force.

TBTs, which derive mainly from paints used on ships and on maritime installations, were banned by EU from 2008 onwards.

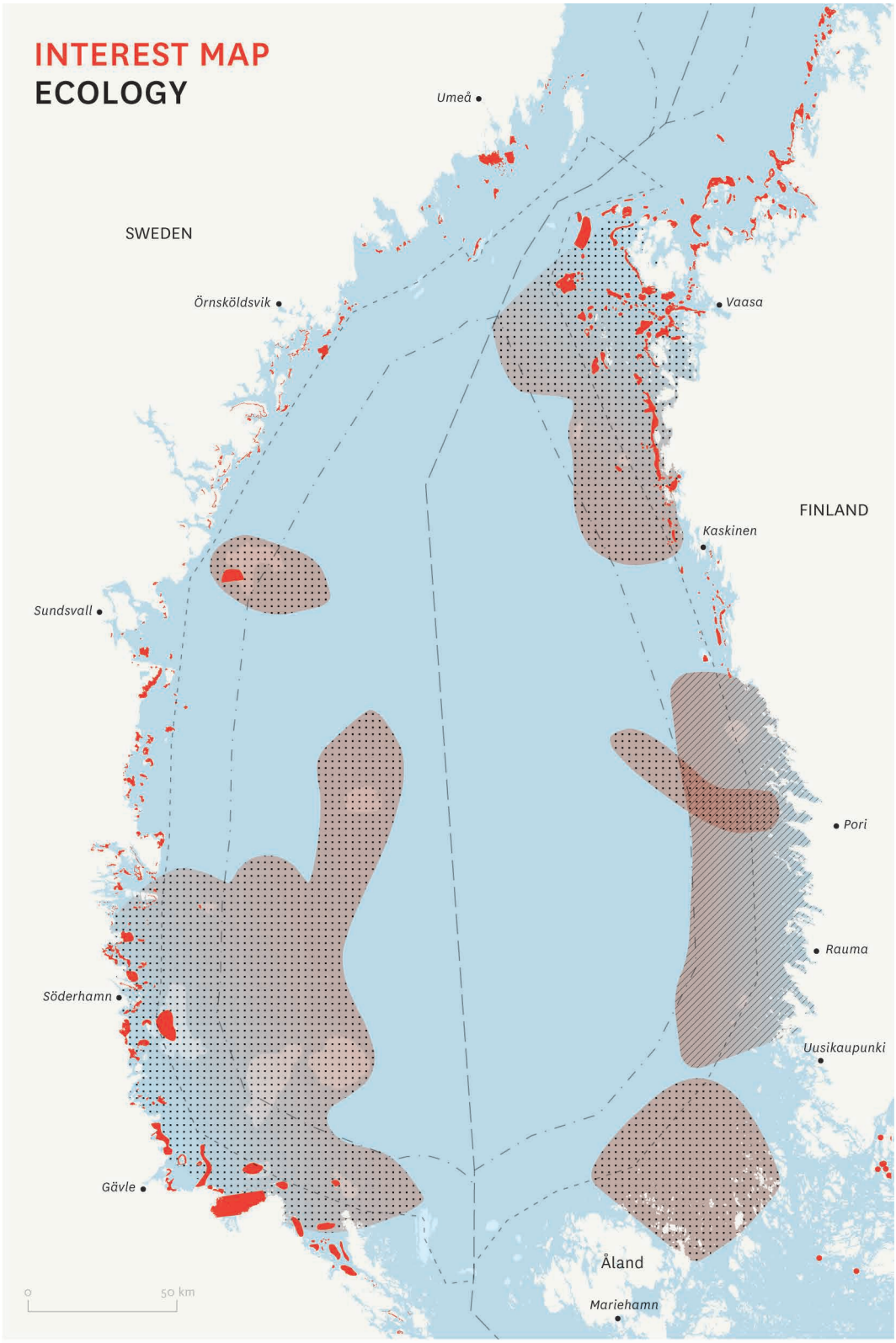
The Bothnian Sea is also the part of the Baltic with highest levels of radioactivity remaining from the Chernobyl accident of 1986.

The large number of chemical substances in use today constantly gives rise to new concerns over potential hazards.

Ecologically important areas

There is little information available on the Bothnian Sea's offshore environment, and the role valuable sub-areas like banks have in the Bothnian Sea ecosystem. Existing Swedish and Finnish reseach programmes aim to provide this kind of data in the near future.

The best available information at present tells us that places of high ecological value are usually connected to features such shallow areas, identified fish spawning areas, areas with high topographic complexity and certain geological features like sandbanks and stone reefs. By compiling such features, initial estimations on the location of ecological valuable areas can be made for spatial planning use.


INTEREST MAP
ECOLOGY
Umeå
SWEDEN
Örnsköldsvik
Vaasa
FINLAND
Kaskinen
Sundsvall
Pori
Rauma
Söderhamn
Uusikaupunki
Gävle
Åland
Mariehamn
0
50 km
Identified spawning areas
Areas with high upwelling
General areas of special ecological interest
Shallow banks, high ecological value

People and the Bothnian Sea

For the people living and working on its shores, the Bothnian Sea has always been both a natural resource and also the place they call home. Few of the relatively scarce population are employed by the maritime sector, but many use the area for recreation.

Centuries of civilisations

During the last ice age, the entire Bothnian Sea area was covered by thick sheets of ice. This glaciation period, known as the Weichsel, lasted for a 100,000 years between 110,000 and 8,000 BC.

After the melting of the ice sheets at around 8000 BC, people began to settle on the land areas around the coast. Here, there was a good supply of fish and seals and later, there was access to land suitable for cultivation and pasture. Waterways connected communities.

Remarkable archaeological remains have been found in the region from the Bronze and Iron Ages, including the Viking era.

In the first half of the last millennium, the coastal areas of the Bothnian Sea were a wilderness, outside the cultural and commercial centres of the south, such as Stockholm in Sweden and Åbo (Turku) in Finland. As commerce developed, trading posts along the coast grew in to towns and cities.

Finland was an integral part of Sweden for more than 600 years until 1809. The Bothnian Sea region, then, has a long tradition of cooperation that can be seen in the cultural similarities between the two shores of the Swedish Västerbotten, 'Western' bay, and the Finnish Österbotten, 'Eastern' bay.

These historical links between the two coasts are still visible today, particularly in the northern parts of the Finnish coast where there are monolingual Swedish-speaking communities.

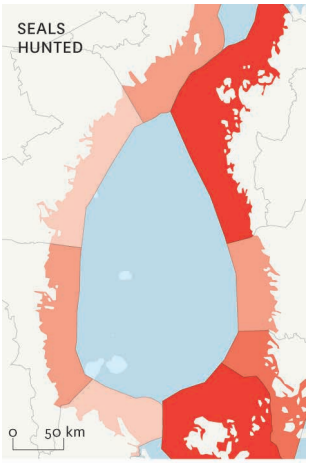
In 1809 Finland and Åland became autonomous parts of Russian empire, and the Bothnian Sea was divided between two states. In 1917 Finland became independent from Russia and at the same time Åland emerged as a self-governing area within Finland.

The Bothnian Sea and its coasts have for centuries been a source of resources for the communities on either side of the sea, and served as a transport route for commercial activities.

Early economic and trade activities were related to the natural resources of northern Scandinavia – at first, lumber, wood tar, fish and furs, and then later ores and related industrial activities. From the 17th century onwards, professional shipbuilding was common on many parts of the Bothnian Sea coasts.

The long history of shipping in the area, as well as the region's role in past conflicts, such as during the Crimean war, and the First and Second World Wars, gives the Bothnian Sea a unique marine archaeological heritage. Shipwrecks, ancient harbour constructions, fishing villages and ports can be found in and around the Sea, serving as a reminder of the coast's rich historical past.

Münster, Sebastian (Detail of a map printed in Basel, 1544)



The sea is still a dominant force in the culture and social traditions of the Bothnian region. A remarkable share of local traditions relate to the sea and to maritime activities, such as the autumn hunt of sea birds and traditional local foods, such as fermented herring on the Swedish coast. Some traditional small-scale seal hunting still exists in the region.

Modestly growing population

At the end of 2010, 1.3 million people lived in the municipalities that have a coastline on the Bothnia Sea. Of these, around 681,000 lived in continental Finland, 631,000 in Sweden and 10,000 in Åland.

Most people live in small towns and villages. Both Finland and Sweden have some 200 settlements along the Bothnian coast, but on the Finnish side, villages and towns are much smaller than their Swedish counterparts.

Many people in the region live on islands which do not have permanent road access to the mainland. A study from the Finnish Ministry of Employment and Economy[14] shows that almost 5,000 inhabitants on the Finnish Bothnian Sea are not connected by road to the mainland and use ferries to reach the shore.

During summer months, the number of people living in these areas increases as second-home owners and tourists come to enjoy holidays on the coast (see chapter on tourism and recreation). The total number of people around the Bothnian Sea has been modestly growing, at a rate of approximately 0.3 per cent per annum over the past five years, slower than the national averages of around 0.5 per cent in Finland and 0.7 per cent in Sweden.

Municipalities that have experienced a population increase were the regional centres of Mariehamn, Turku, Umeå and Vaasa and their commuter catchments regions, while rural populations have decreased. Almost all municipalities have recently gained from international migration.

GDP
Gross Domestic Product (GDP) is the total value of all goods and services bought and sold in a country (or region). It is one of the main indicators to estimate the status of the economy of a country.

Economy and employment

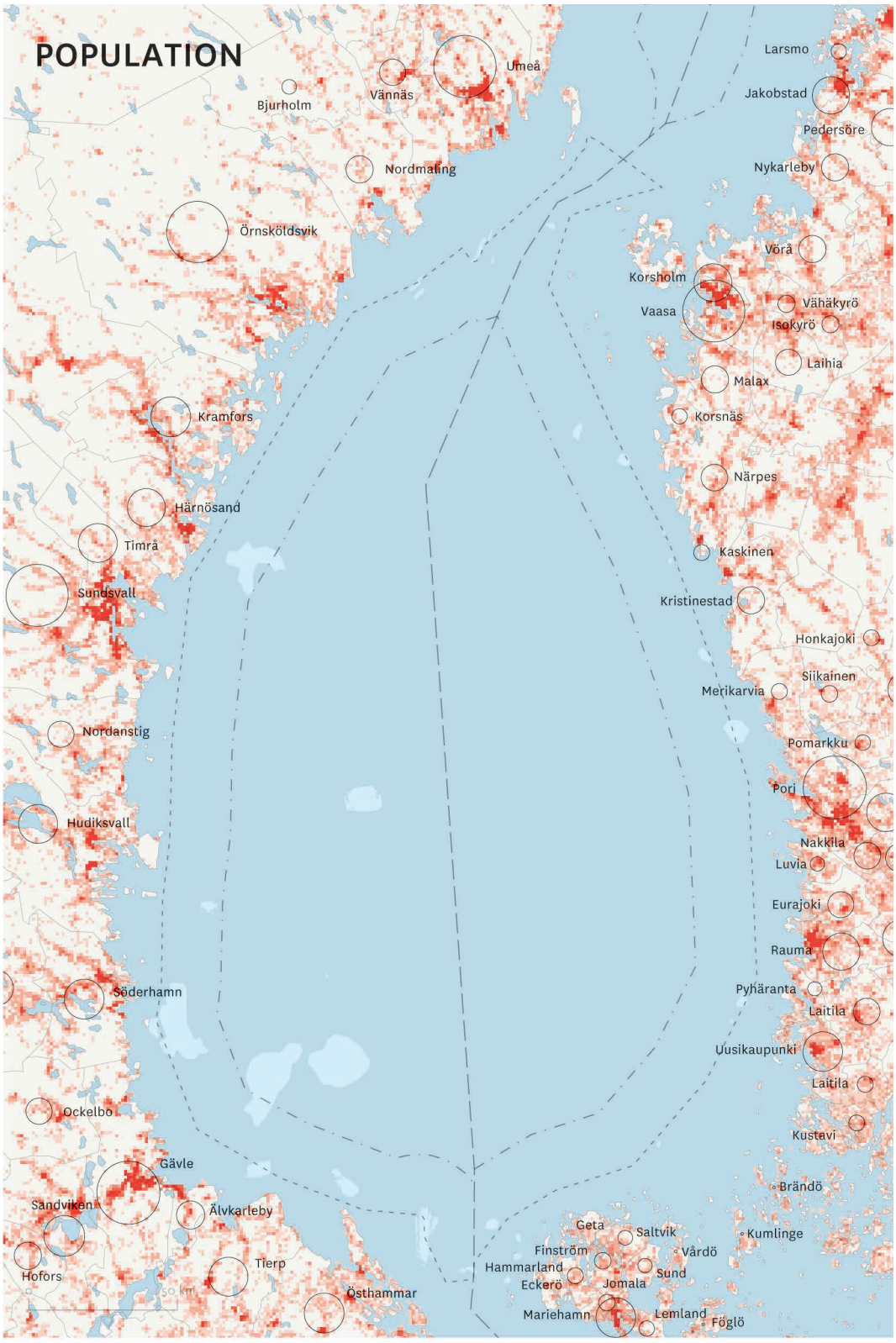
The Bothnian region amounts for 15 per cent of Finland's national gross domestic product (GDP). This is slightly higher than in Sweden, where the Bothnian region amounts to 10 per cent of GDP.

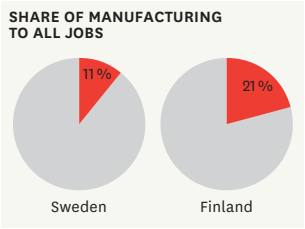
In the entire Bothnian region, GDP per capita, an indicator of living standards, is between 3 and 15 per cent lower than national averages. This figure does not include Åland, where GDP per capita is 23 per cent above the Finnish average and 47 per cent above the EU mean.

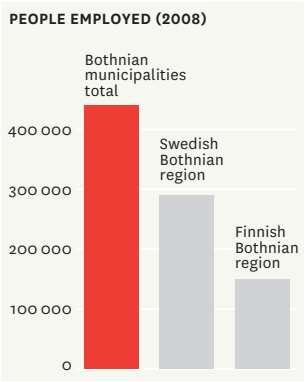
Important sectors

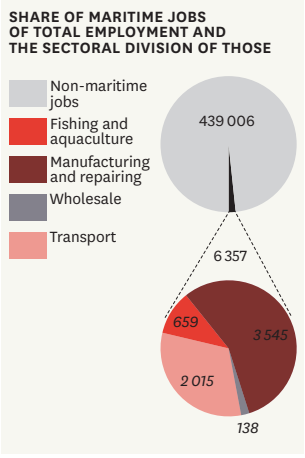
In 2008 jobs could be found mainly in services, manufacturing and the secondary sector. Within the services sector, public administration, education, health and social work are the most important types of jobs in the Swedish part of the Bothnian region.

Manufacturing jobs are most important in the Finnish side. They account for 21 per cent of the employment, compared to a national average of 16 per cent.


POPULATION
Umeå
Vännäs
Bjurholm
Nordmaling
Örnsköldsvik
Kramfors
Härnösand
Timrå
Sundsvall
Nordanstig
Hudiksvall
Söderhamn
Ockelbo
Gävle
Sandviken
Älvkarleby
Hofors
Tierp
Östhammar
Larsmo
Jakobstad
Pedersöre
Nykarleby
Vörå
Korsholm
Vaasa
Vähäkyrö
Isokyrö
Laihia
Malax
Korsnäs
Närpes
Kaskinen
Kristinestad
Honkajoki
Siikainen
Merikarvia
Pomarkku
Pori
Nakkila
Luvia
Eurajoki
Rauma
Pyhäranta
Laitila
Uusikaupunki
Laitila
Kustavi
Brändö
Kumlinge
Vårdö
Sund
Jomala
Lemland
Föglö
Geta
Saltvik
Finström
Hammarland
Eckerö
Mariehamn
0 50 km
Number of inhabitants per individual square kilometre 2010
1 – 10
11 – 50
51 – 100
101 – 250
> 251
Inhabitants per municipality 2010
< 1 000
1 001 – 5 000
5 001 – 10 000
10 001 – 50 000
> 50 001







Municipalities in the Bothnian Sea employed more people than the national averages in the secondary sector. This includes the fields of electricity, gas, water supply and construction.

A central activity in the Bothnian Sea region is manufacturing, which accounts for 22-34 per cent of total value added from all industries. It is slightly higher in Finland than it is in Sweden.

The exception is Åland, where value added by manufacturing is only 6 per cent and where most value creation is in transport and communication. The relative importance of agriculture, forestry and fishing is rather large, accounting for 16 per cent in Finland and 20 per cent in Sweden.

In Åland transport, wholesale, retail, hotels and restaurants account for 28 per cent of the total jobs. In addition, agriculture and fishing is more important in Åland compared to the rest of the Bothnian Sea.

In 2008, 445,000 people were employed in the Bothnian Sea region. Levels of employment in both countries was similar to national averages, with the exception of Åland, where there is less unemployment than in Finland.

To some extent, migration out of the region and an ageing population are reducing the available workforce in the Bothnian Sea region.

Few jobs in the maritime sector

Maritime activities like fisheries, energy production, transportation and tourism, can play an important role in the future of the Bothnian Sea as long as they take into account environmental values. These sectors constitute what the EU's Maritime Policy has recently called 'blue growth'.

At the moment, maritime activities in the area are diverse and mostly concentrated on the coast. There are also some offshore activities such as transport and commercial fishing.

Nowadays, only very few people derive their income from the sea. Only 6,400 people, or 1.4 per cent of the employed population, are employed by the four maritime sectors of building, transport, fishing and trade.

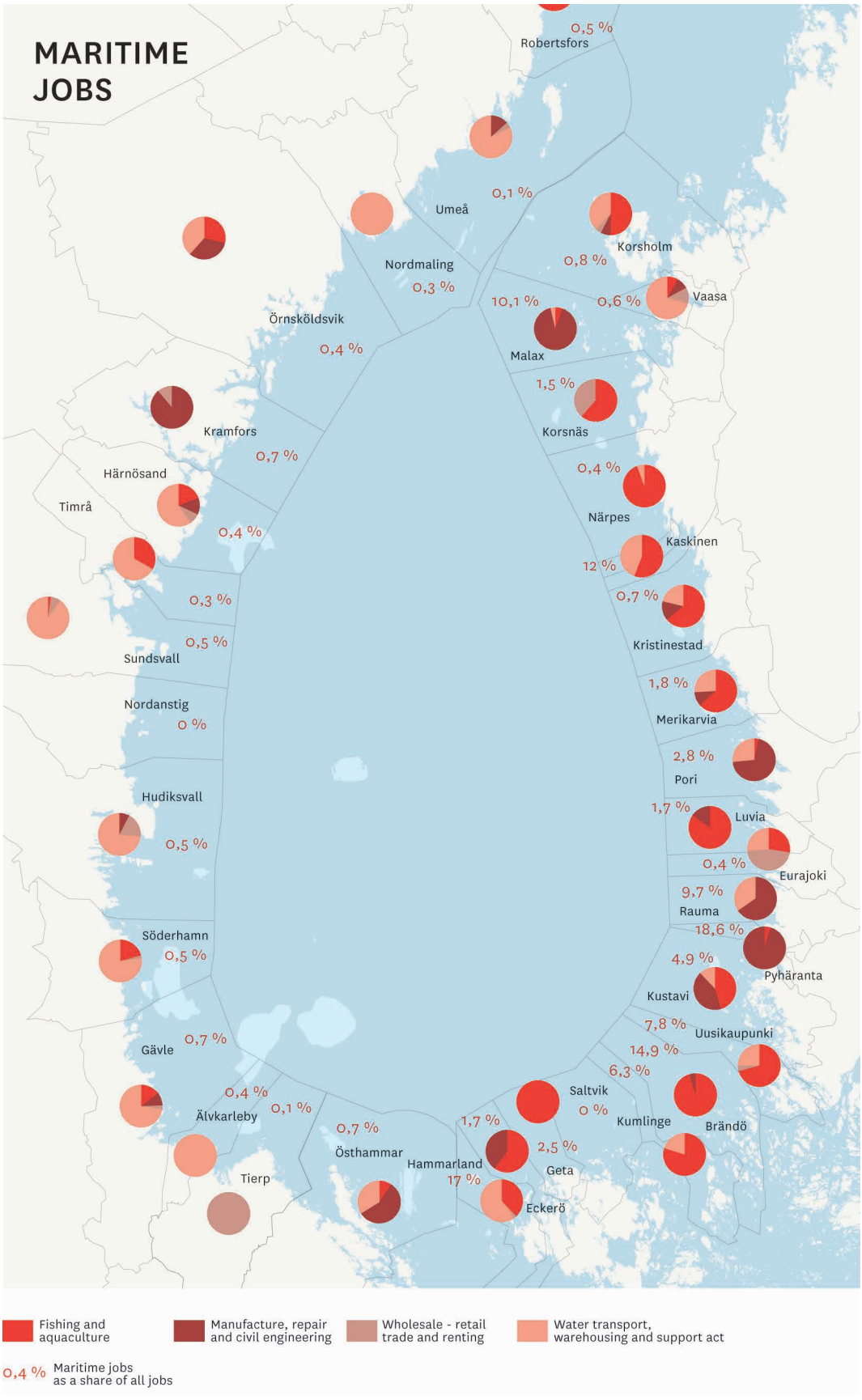
Shipbuilding and water projects

This maritime sector employs the most number of people – 3,500 jobs or 56 per cent of all maritime jobs. It includes activities such as building and repairing of boats and construction of water projects.

The highest share of these jobs is found in shipyards. The most important shipyards in Finland are those in Pori, Rauma, Uusikaupunki and Pyhäranta, with 60 per cent of maritime jobs.

Nearly a third of jobs in this sector, 30 per cent, are dedicated to the construction of recreational boats. This activity is mainly concentrated in a few municipalities of the Ostrobothnia region.

Pyhäranta has the highest percentage of jobs in this sector at 18,6 per cent.


MARITIME JOBS
0,5 %
Robertsfors
0,1 %
Umeå
Nordmaling
0,3 %
Korsholm
0,8 %
Vaasa
0,6 %
10,1 %
Malax
Örnsköldsvik
0,4 %
1,5 %
Korsnäs
Kramfors
0,7 %
Härnösand
Timrå
0,4 %
0,4 %
Närpes
Kaskinen
12 %
0,7 %
0,3 %
0,5 %
Sundsvall
Kristinestad
1,8 %
Nordanstig
0 %
Merikarvia
2,8 %
Pori
Hudiksvall
1,7 %
Luvia
0,5 %
0,4 %
Eurajoki
9,7 %
Rauma
Söderhamn
0,5 %
18,6 %
4,9 %
Pyhäranta
Kustavi
7,8 %
Uusikaupunki
Gävle
0,7 %
14,9 %
6,3 %
0,4 %
Saltvik
0 %
Älvkarleby
0,1 %
Kumlinge
Brändö
1,7 %
0,7 %
2,5 %
Östhammar
Hammarland
Geta
17 %
Tierp
Eckerö
Fishing and aquaculture
Manufacture, repair and civil engineering
Wholesale - retail trade and renting
Water transport, warehousing and support act
0,4 %
Maritime jobs as a share of all jobs

Maritime transport

Transportation is the second most important maritime sector, generating 2,000 jobs, or 30 per cent of all maritime jobs.

It includes water transport, warehousing and support activities, as well as passenger transport in archipelagos.

Rauma, Pori and Sundsvall are home to the highest number of maritime transport jobs. The cities where maritime transport is relatively the most important sector are Eckerö and Kaskinen.

Fishing

Fishing, including aquaculture and fish processing, accounts for only 660 jobs, or 10 per cent of all maritime jobs. The number of jobs in this sector has been decreasing for decades as larger vessels and more effective catch methods reduce the demand for labour.

There is a huge regional difference in terms of employment in the fishing industry. Some 80 per cent of fishermen and 70 per cent of people working in fish processing are located in Finland.

In aquaculture, both countries employ almost the same number of people, but in Finland this activity is concentrated on sea while in Sweden, aquaculture takes place mostly in rivers. Aquaculture is the most important fishery-related field in Åland.

The highest number of fish related jobs are in Uusikaupunki, Kaskinen and Gävle. The municipalities where this sector is relatively most important are Taivassalo, Kaskinen, Sund and Eckerö , with 6.5 per cent of all jobs.

Maritime trade

With only 140 jobs, only 2 per cent of all maritime jobs, trade is the maritime sector with relatively the smallest importance. This sector includes wholesale and retail trade and activities such as boat rentals. There is barely any difference in numbers between Finland and Sweden. Regional centres employ the highest number of jobs in the sector.

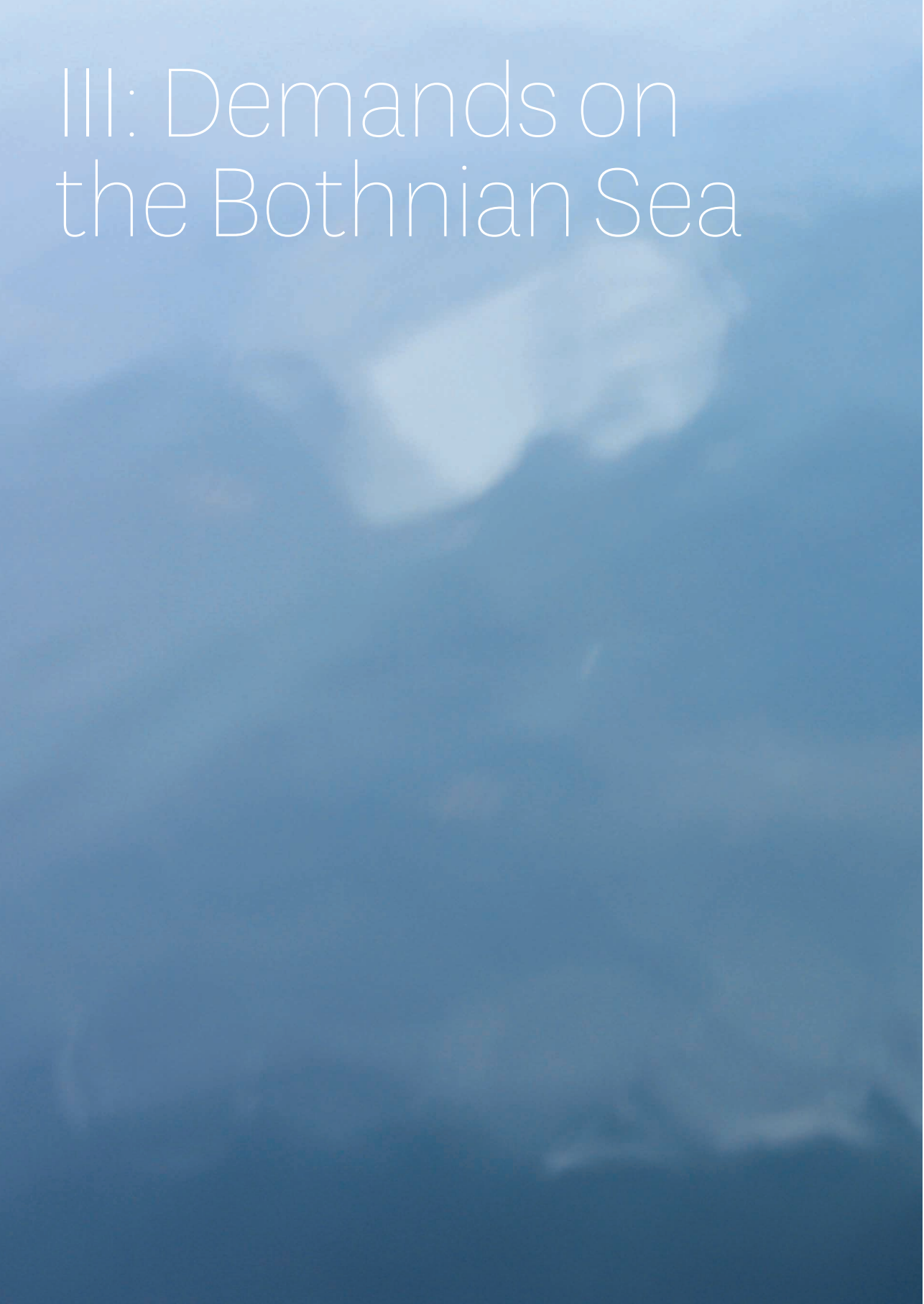
Tourism and energy production

There are a number of jobs that are related to the maritime environment of the Bothnian Sea, but these jobs are not directly available for analysis because in fields such as energey or tourism, for example, statistics do not show the division between sea and land.

The Bothnian Sea's coastal towns and natural parks do attract many visitors. The unspoiled natural environment and preserved regional culture is an asset to the tourism industry.

Renewable energy such as wind power has been proposed as an important field of future employment, but concrete estimates for this are not available. It is likely that contractors from abroad would be brought in to carry out installation works.

III: Demands on the Bothnian Sea




Demands on
the sea space,
both now and
in the future.

Maritime traffic

According to international law, outside the territorial sea of a country ships have the right to freely choose their routes. Within a territorial sea, foreign vessels have the right for what is known as innocent passage.

The only direct way for maritime planning to regulate offshore shipping in the EEZ is through so-called routing measures designated by the International Maritime Organisation. These recommend or oblige larger ships to take specific routes and are usually located in busy, confined waterways to reduce the risk of collisions and groundings.

One type of routing measure is the traffic separation scheme (TSS), which directs ships to specific lanes. Others include deep-water routes and Areas To Be Avoided (ATBA). Some require vessels to report to a coastal monitoring station or use local pilot services.

A TSS as well as a deep water route is in operation in the Southern Quark. A new routing measure in the Northern Quark was adopted in 2012.

Innocent passage
According to UNCLOS, passage is innocent as long as it is not prejudicial to peace, good order or security of the coastal state. Ships must conform with UNCLOS and other rules of international law.

International Maritime Organisation (IMO)
The IMO is a London-based international agency operating under the United Nations. Representatives from countries with shipping interests decide jointly on binding rules for international shipping.

Automatic Identification System (AIS)
Via AIS the position and name of a ship is broadcast via a high frequency transmitter. Other users are able to receive this information and display vessel information on a chart plotter or on a computer.

TEU
The twenty-foot equivalent unit (often TEU or teu) is an inexact unit of cargo capacity used by container ships and terminals, based on the volume of the standard-sized 20-foot-long (6.1m) metal box which can be easily transferred between different modes of transportation, such as ships, trains and trucks.

Less traffic than the Baltic Proper

Some 90 per cent of world trade is transported by sea. Most of the transport to and from Finland and Sweden is seaborne, which makes sea traffic of great economic importance to the region.

Traffic intensity in the Bothnian Sea and Bothnian Bay is low, however, compared to the rest of the Baltic Sea, based on Automatic Identification System (AIS) information.

In terms of containers, a total of 321,000 TEU is handled across ports in the Bothnian Sea per year. As a comparison, the Port of Helsinki, one of the biggest ports in Finland, handles a similar amount of container traffic alone.[15]

Shipping is still of great importance to the region. Around 5,000 vessels operated in the Bothnian Sea in 2010.

Total traffic in the Bothnian Sea ports amounts to around 28 million tonnes of cargo. An additional 35 million tonnes of cargo is shipped through the Bothnian Sea to the ports of Bothnian Bay to the north.

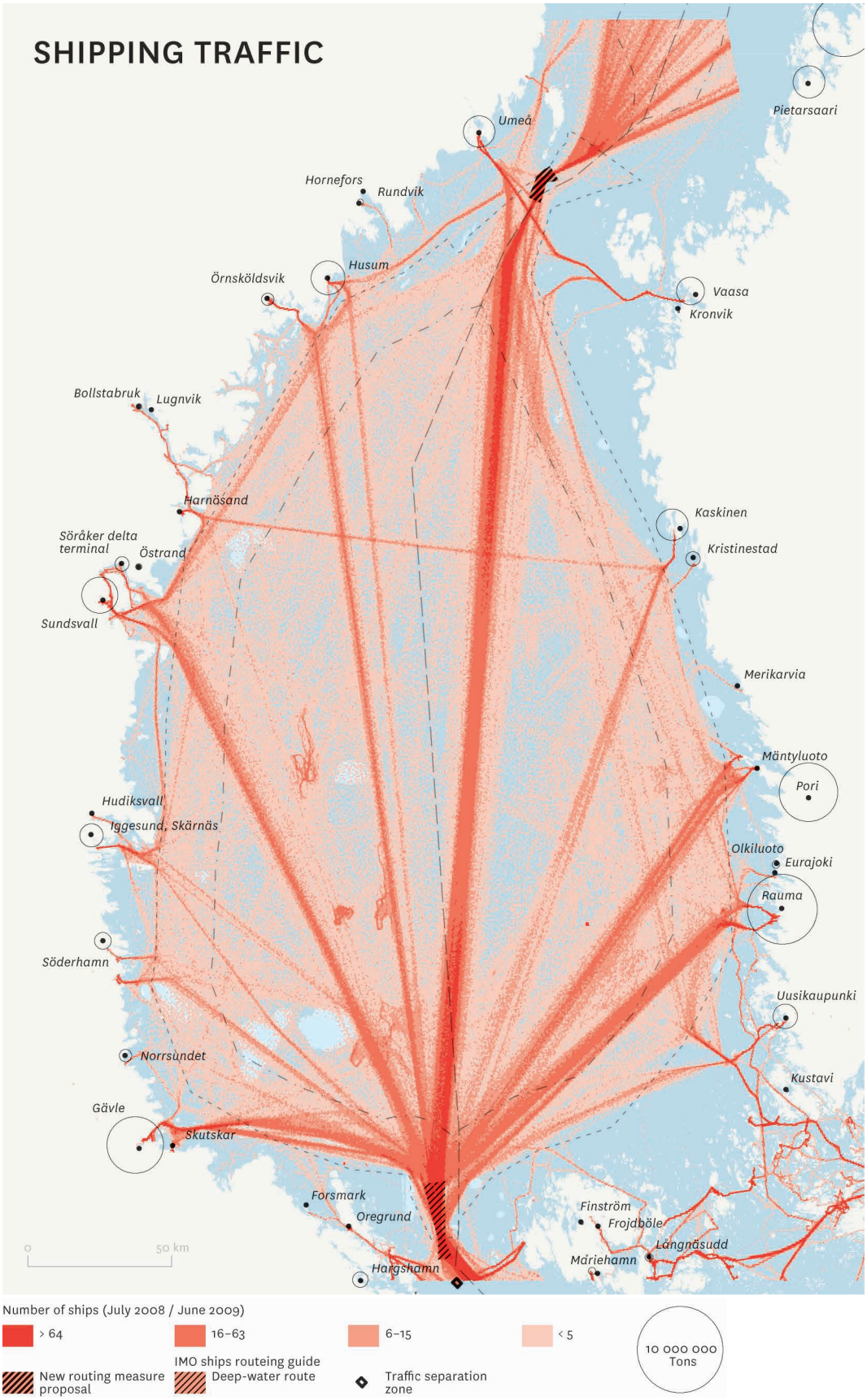
A constant flow of commodities

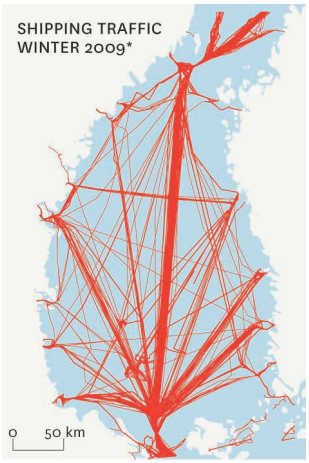
The main commodities handled by Bothnian ports are wood products, ores, minerals, oil, coal, chemicals (including hazardous substances) and steel.

Forest industry products such as paper, pulp and sawn wood are the largest commodity group transported to and from Bothnian Sea ports.

Sweden and Finland are among the world leaders in exports of wood and wooden products, and 70-80 per cent of their produce is exported within the EU.[16] Domestic demand for the import of raw materials as well as international demand for forest industry products is driving the market for forest industry transports.

As a special type of cargo in the Bothnian Sea is nuclear waste. There are two nuclear waste deposits in the region, Olkiluoto in


SHIPPING TRAFFIC
Umeå
Pietarsaari
Hornefors
Rundvik
Husum
Örnsköldsvik
Vaasa
Kronvik
Bollstabruk
Lugnvik
Harnösand
Kaskinen
Söråker delta terminal
Östrand
Kristinestad
Sundsvall
Merikarvia
Mäntyluoto
Pori
Hudiksvall
Iggesund, Skärnäs
Olkiluoto
Eurajoki
Rauma
Söderhamn
Uusikaupunki
Norrsundet
Kustavi
Gävle
Skutskar
Forsmark
Oregrund
Finström
Frojdböle
Långnäsudd
Mariehamn
Hargshamn
0
50 km
Number of ships (July 2008 / June 2009)
> 64
16–63
6–15
< 5
10 000 000 Tons
IMO ships routeing guide
New routing measure proposal
Deep-water route
Traffic separation zone



* Two first weeks of February
Normal ice condition

* Two first weeks of February
Heavy ice condition

Finland and Forsmark in Sweden (see Energy chapter). Nuclear waste is shipped from Sweden's other nuclear power plants to the central storage facility in Forsmark in the southwestern Bothnian Sea.

There is also one transport line taking also passengers, in the Northern Quark, between Vaasa and Umeå. The operating company is presently in financial difficulties, but the link has political support and representatives in both Finland, and Sweden are working on a long-term solution to keep the line operational.[17]

Navigating through ice

Ice cover in the Bothnian Sea lasts for several months every year (see page 22) with its peak from February to April. This presents particular challenges to marine traffic. Preferred shipping routes have to be deviated from as drifting ice sheets can fill the whole water-mass with solid ice that cannot be tackled by icebreakers.

The conditions make accidents more likely than in the ice-free season. It is not always possible for vessels to keep a safe distance from each other, especially when they are moving in a convoy through broken ice or getting ready for towing. For the same reasons, the TSS in the Southern Quark does not function properly in extreme ice conditions.

National agencies in Finland and Sweden set traffic restrictions for winter ports on a case-by-case basis. Vessels using winter ports are also required to meet specific requirements for coping with ice at a certain thickness and temperature conditions.

Extensive ice breaking services are required in the area. The Baltic Sea coastal countries, within HELCOM, have agreed a joint Baltic policy on winter navigation.[18]

Climate warming could shorten the ice season in Bothnian Sea, which would improve conditions for transportation.

New mines could increase cargo volumes

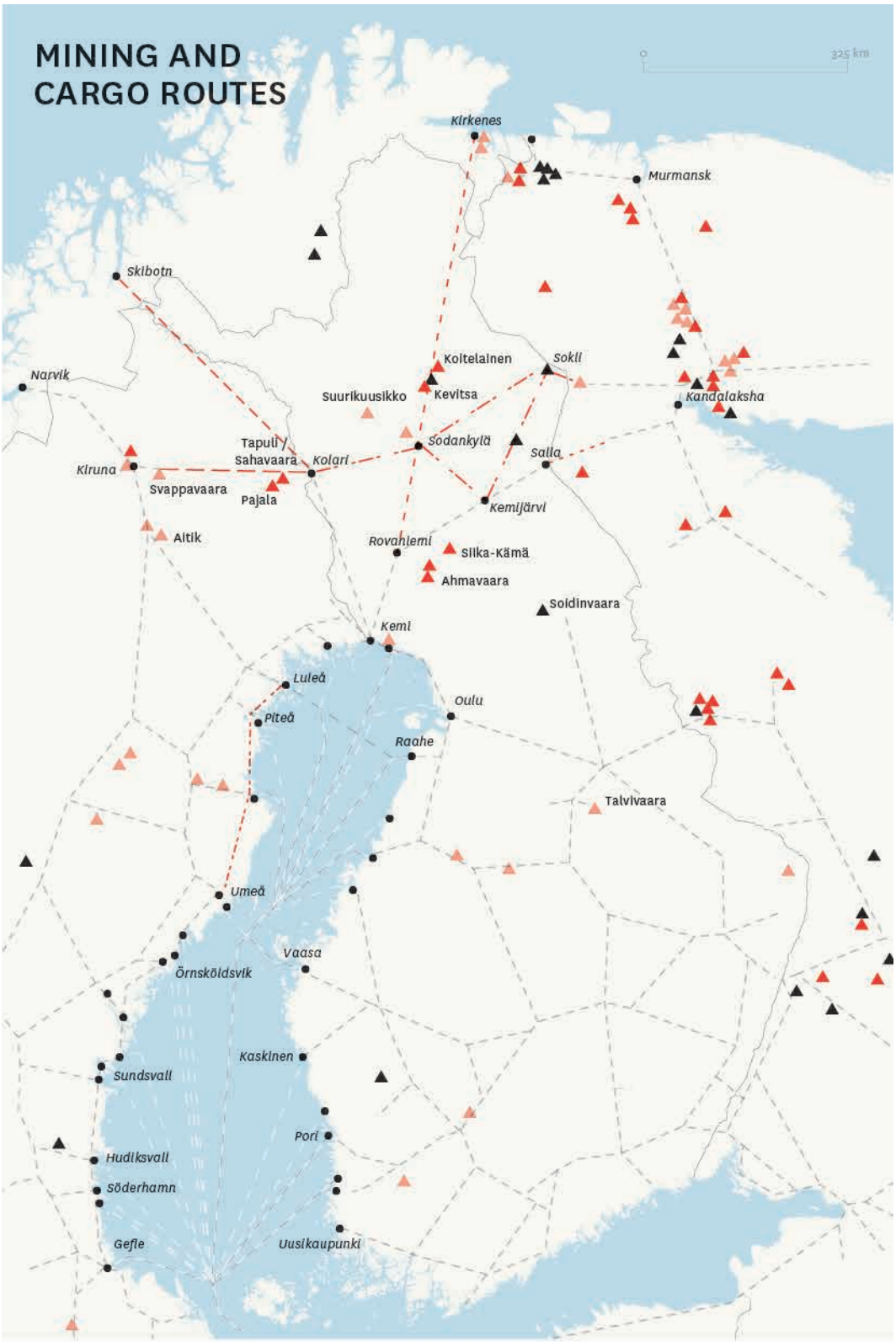
Ores and metal waste is the largest commodity group transported to and from Bay of Bothnia ports in the north of the Bothnian Sea, according to the Baltic port list of 2011.

Recent interest in the mineral resources of northern Sweden and Finland mean that transportation of such mining products could increase. Large investments in the mining and forest industries would require increased capacity in rail systems and in ports.

It is likely that some freight transport will go directly to Norwegian deep sea ports as the Gulf of Bothnia is not only shallower, but also frozen during winter. The related traffic would mainly pass the Bothnian Sea from north to south.

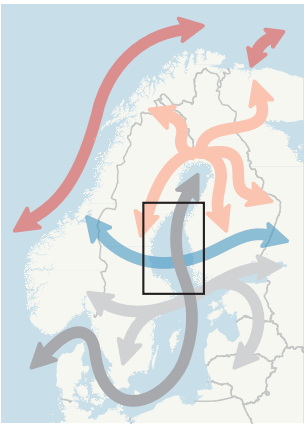
Mining projects and railroads

The development of new mining industries and how their transport needs will be solved are crucial for future maritime traffic volumes in the Bothnian Sea.


MINING AND
CARGO ROUTES
0
325 km
Kirkenes
Murmansk
Skibotn
Narvik
Koitelainen
Sokli
Suurikuusikko
Kevitsa
Kandalaksha
Tapuli
Sahavaara
Kolari
Sodankylä
Salla
Kiruna
Svappavaara
Pajala
Kemijärvi
Aitik
Rovaniemi
Siika-Kämä
Ahmavaara
Soidinvaara
Kemi
Luleå
Oulu
Piteå
Raahe
Talvivaara
Umeå
Vaasa
Örnsköldsvik
Kaskinen
Sundsvall
Pori
Hudiksvall
Söderhamn
Gefle
Uusikaupunki
Deposits
Active mining sites
Unexploited deposits
Potential deposits
Arctic Sea and Mid Lapland railways
Cross-Lapland railroad
Kolari-Svappavaara
Rovaniemi-Kirkkoniemi
Kolari-Skibotn
Salla-Kandalaksha
Norrbotniabanan
Sea transport routes
Forestry (wood, pulp, paper)
Ores and metal waste
Forestry, ores and metal waste

PRODUCTS AND PORT VOLUMES

In million tonnes



The Motorway of the Baltic Sea is a part of European TEN-T network, connecting priority ports.

The Bothnian corridor aims to improve connections in a north-south direction, between the Nordic Triangle and northern axis. Includes several Bothnian Sea ports. Railroads to the Barents Sea and Norwegian Sea coast (Murmansk and Narvik links) are based on a projected increase in mining. Deep-sea ports in the Barents Sea and North Atlantic would enable larger ships to dock, and a link to the Northern Sea route.

The Mid-Nordic Green Corridor running across the Bothnian Sea would enhance east-west connections. The corridor would continue from North Atlantic ports to Russia and Asia.

The Northern Sea route depends on global warming and milder ice conditions. It would offer time and distance savings for traffic between the Atlantic and Pacific Oceans.

The Nordic triangle connects the Nordic capitals with St. Petersburg. The connection runs from Nordland and Västerbotten through Finland, Estonia and using the Via Baltica road to Poland and beyond.

Environmental goals could boost shipping volumes

In terms of energy efficiency, shipping is a relatively environmentally friendly mode of transport and there are moves to increase waterborne transport for this reason.

The European Commission, for example, has set a goal that by 2050, 50 per cent of intercity passenger and freight journeys over a medium distance (300km and over) should move from road to rail and waterborne transport, facilitated by efficient and green freight corridors. Similar goals have been set by Finland (Traffic 2020), Sweden (Hållbar mobilitet 2030/Transport 2030). These goals will set both challenges and opportunities for transport in the Bothnian Sea. EU-wide networks such as shipping promotion centres of the European Shortsea Network are facilitating the process.

Green corridors
Green corridors are a European concept for long-distance freight transport corridors where advanced technology and combinations of rail, road and sea transportation are used to achieve energy efficiency and reduce environmental harm.

In order to achieve the goals sustainably, the environmental record of shipping must be improved by technology, better fuels and safer operating methods. Eventual growth will likely be concentrated in ports with good container facilities and connections to rail transport networks.

Cleaner air

Despite its green credentials, shipping is also the leading source of pollutants like sulphur dioxide in the EU. This pollutant is present in heavy fuel oil traditionally used in ships. It damages the environment but above all human health, causing respiratory and cardiovascular diseases, and reduces life expectancy in the EU by up to two years.

Global regulations (MARPOL), as well as a related EU directive, require that the sulphur content in fuel used in the Baltic Sea should be decreased significantly, from 1.5 to 0.1 per cent by 2015.

MARPOL
MARPOL 73/78 is one of the most important international agreements on pollution from ships. It includes six regularly updated annexes with specific regulations on oil, hazardous liquid substances, hazardous packaged substances, sewage, garbage and airborne emissions.

This means that at least to some extent, heavy fuel oil will have to be replaced by more expensive diesel. Alternatively, sulphur can be removed from exhaust fumes before emission.

The most important industries in the Bothnian Sea are forestry, metal and chemical industries, which are highly dependent on international exports. There is a risk that increased transport costs will lead these industries to shift away from sea transport to rail or road.

If infrastructure for the distribution of Liquefied Natural Gas (LNG) is developed further, it could become an alternative sulphur-free fuel for shipping. LNG use could also increase traffic within the Bothnian Sea, as gas products could be transported from the Barents Sea to Europe. The potential of LNG has been highlighted in recent regional discussions, for example within the HELCOM MARITIME group.

Some ports might get bigger

While the number of ports is predicted to remain the same over the coming years, they may expand in size. The size of vessels using the ports is also forecasted to grow. This means the ports will need deeper and wider channels, as well as new cargo handling equipment.[19]

The Baltic Transport Outlook report for 2011 has identified ports in the Bothnian Sea that form part of a 'strategic port network'.[20]

These are the Rauma, Pori and Vaasa ports in Finland, and Umeå, Husum, Sundsvall and Gävle in Sweden. Several ports were considered important because of their connections with strategic railway and road networks, even though they did not qualify according to the original criteria. Sundsvall and Gävle, for example, are especially mentioned as terminals that connect with other modes of transport such as rail and road.

Ports of national interest to Sweden include the Forsmark nuclear power plant, Söderhamn and Örnsköldsvik.

In Finland, similarly important ports are ones that form part of the TEN-T network, a trans-European transport project. This includes Rauma and Pori in the Bothnian Sea. Vaasa is not part of the grouping, as its cargo volume is too small for TEN-T-status.

TEN-T
The Trans-European Transport Networks are a planned set of road, rail, air and water transport networks designed to serve the entire continent of Europe. The objective is to improve primary roads, railways, ports and airports to provide integrated and intermodal long-distance high-speed routes for the movement of people and freight throughout Europe.

Compatibility with other activities

Shipping traffic is fully or partly compatible with most of other uses in the Bothnian Sea. There are only two activities which cannot be in the same place – wind farms and aquaculture.

Wind farms: Ships must keep a distance of 500m from wind parks and anchoring is usually forbidden within a safety zone of 500m from cables connected to wind power parks. In areas such as the Finngrunden banks some shipping takes presently place where wind power developments have been proposed.

Aquaculture: Offshore aquaculture installations cannot be established within main shipping routes as they create an obstacle for shipping and can interfere with safe navigation.

Large-scale fishing: Fishing activities where the fishing vessel has limited ability to maneouvre can be dangerous on main shipping routes, especially in narrow navigation areas or when visibility is reduced.

Sand and gravel extraction: Large-scale commercial extraction of sediments by stationary vessels creates an obstacle for shipping. Moving extraction vessels that have restricted ability to maneouvre operating on main shipping routes can be dangerous in narrow navigation areas or during reduced visibility.

Defence and military practice: Temporary restrictions are enforced for shipping where military training takes place.

Dredging activities: Dredging is in some cases a requirement for safe shipping, as the post-glacial uplift of land in the Bothnian Sea region means fairways in to ports have to be regularly deepened to allow ships to pass through. Temporary restrictions are possible.

Cables and pipelines: Marking routes on navigational charts so that ships know where they lie can ensure safe co-existence of shipping with cables and pipelines. Cables and pipelines can also be covered with rocks, for example, to ensure that anchors will not damage them. Safety zones of 500m can also be established.

Small scale and leisure fishing: Small-scale and leisure fishing on main shipping routes can be dangerous, especially in narrow navigation areas and during reduced visibility.

Tourism and leisure boating: Tourism and leisure boating can

cause dangerous situations within narrow navigational routes or when visibility is reduced.

Research: Shipping traffic does not significantly interfere with research activities.

Nature protection: Shipping and nature protection are compatible activities, provided that ships comply with laws and regulations for the Baltic Sea area, and take precautions to avoid harm in protected areas.

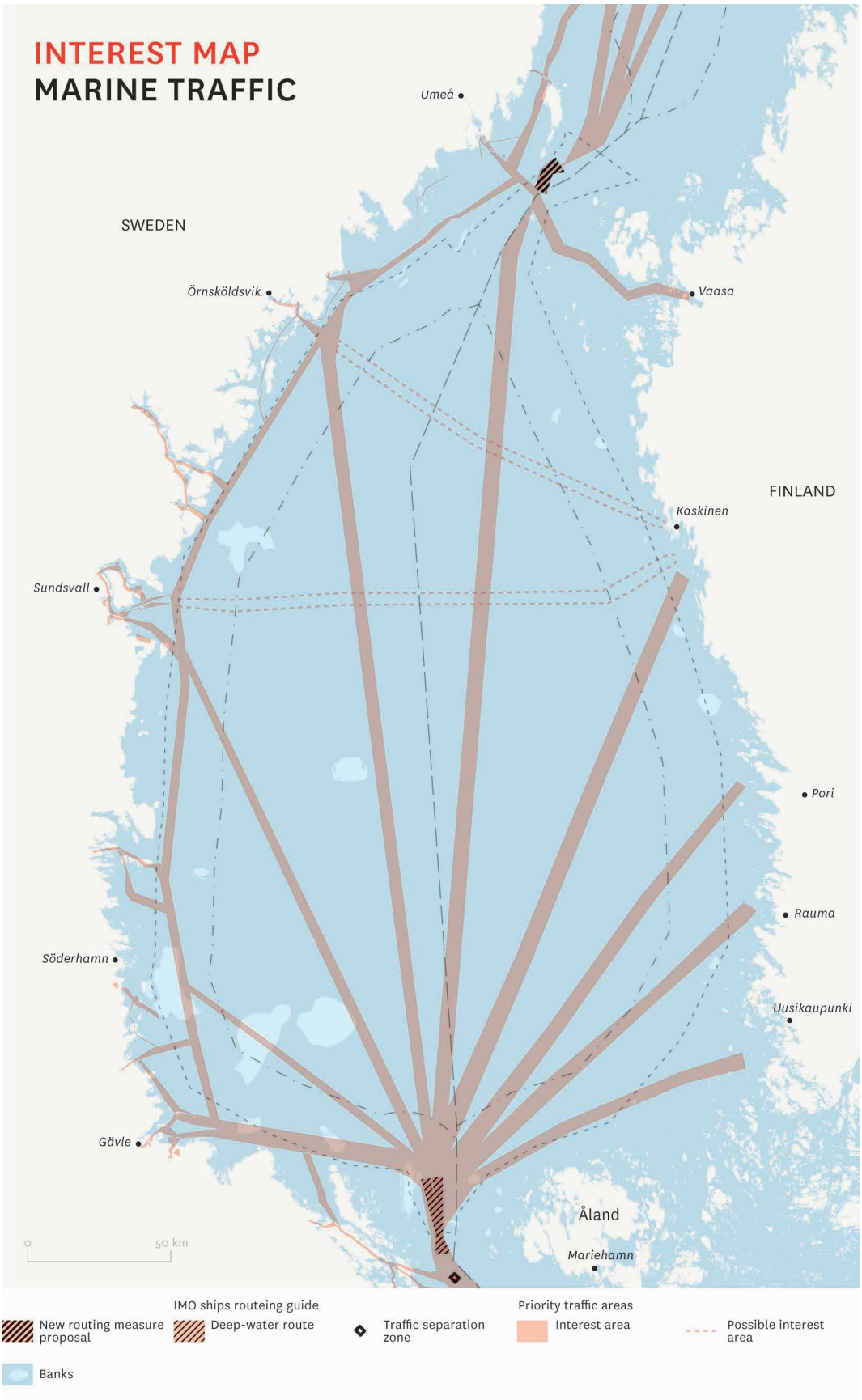
Important areas for shipping traffic

The most important areas for present and future maritime traffic to be considered when planning the Bothnian Sea include routes to important ports, connections through and across, as well as coastal routes.

Important ports are defined as national interest ports, as well as to ports with good railway connections/other prospects for development.

The Quarks and the direct route between them is an area of interest for shipping to and from the Bay of Bothnia. Cross-Bothnian connections are marked as possible interest areas since the use of these routes is dependent on the establishment of a Mid-Nordic Green Corridor and the investment in land-based infrastructure needed for this route.

Coastal routes can have great importance for winter transportation as well as domestic cargo. During difficult ice conditions, ice breaking services might be restricted to coastal fairways only, where ships must comply with speed limits and have a pilot on board.


INTEREST MAP
MARINE TRAFFIC
Umeå
SWEDEN
Örnsköldsvik
Vaasa
FINLAND
Kaskinen
Sundsvall
Pori
Rauma
Söderhamn
Uusikaupunki
Gävle
Åland
Mariehamn
0
50 km
IMO ships routeing guide
New routing measure proposal
Deep-water route
Traffic separation zone
Priority traffic areas
Interest area
Possible interest area
Banks

Fishing

In the Bothnian Sea's EEZ, all European countries are theoretically allowed to fish. In practice, however, only Swedish and Finnish vessels fish in the Bothnian Sea, as Sweden and Finland alone share the total allowable catch (TAC) of herring.

According to the EU common fisheries policy, it is not possible within the EEZ to institute new regulations on a national basis. Since fishing in the Bothnian Sea is conducted by Sweden and Finland, the most convenient way to institute new regulations is to reach bilateral agreements and request a decision within the EU.

In the territorial sea, national and foreign vessels from countries that have reached a bilateral agreement are allowed to fish. In the case of the Bothnian Sea, this concerns only Swedish and Finnish vessels, which are allowed to fish 4nm from the other country's baseline.

Within this 4-12 nm zone, either country is to some extent free to regulate fishing nationally. However, in order to include foreign vessels in the regulations, both countries need to have the same regulations in their national legislation.

In general, the Finnish fleet uses more or less the whole Bothnian Sea as fishing ground, while the Swedish fleet mainly operates in the southern parts, closer to its own baseline.

Total allowable catch (TAC)
The TAC is a catch limit set for a particular fishery, generally for a year or for a fishing season. TACs are usually expressed in tonnes of live-weight equivalent, but are sometimes set in terms of numbers of fish. The coastal state determines the allowable catch of the living resources in its EEZ in cooperation with other states to avoid over-fishing (see also UNCLOS Articles 61 and 62).

Active Fishing vessels 2007–2009

Finnish Swedish

Vessel Monitoring System (VMS)
VMS is a satellite-based system that automatically sends the position and speed of fishing vessels to national authorities. In both Finland and Sweden the information is transmitted every hour. In EU waters, all fishing vessels of more than 15m in length must have VMS installed.

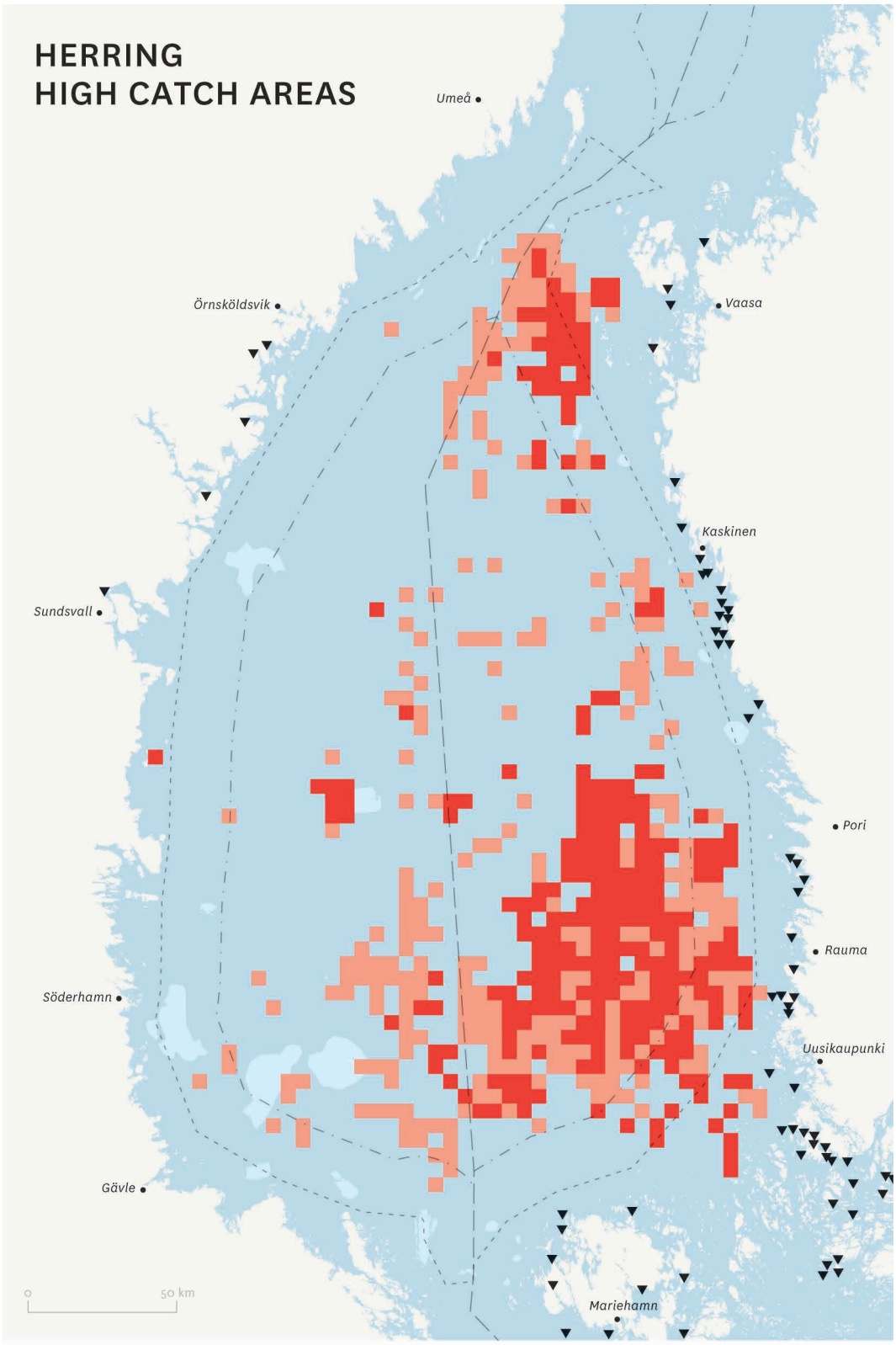
A sea of herrings

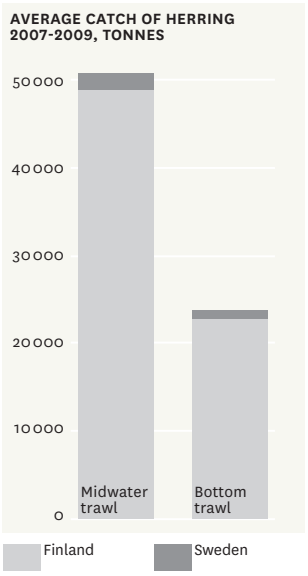
Commercial fishing activity in offshore areas of the Bothnian Sea is almost exclusively directed towards Baltic herring (*Clupea harengus membras*), and to some extent, sprat (*Sprattus sprattus*).

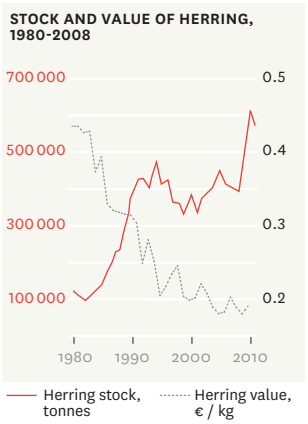
The Bothnian Sea is the most important area for herring fishing in the Baltic Sea, providing 30 per cent of total catches from the Southern Baltic Bornhom basin and northwards, according to data from 2009.[21] The sprat catch, of 4,000 tonnes in 2009, constitutes only 1 per cent of the total caught in the Baltic.[22] Other species are scarce in the offshore waters of the Bothnian Sea. In coastal fishing, herring is also the most important species, although whitefish, salmon (*Salmo salar*) and perch (*Perca fluviatilis*) are also caught, mainly by gillnets.[23]

Only Finnish and Swedish vessels fish commercially in the Bothnian Sea. Finland operates 45 vessels above 15m, while Sweden operates 10 vessels of the same size. Both countries fish in the waters of the other, so, like shipping, it is an activity with a clear transboundary dimension. Nearly all of the herring catches, 96.5 per cent, are taken by vessels under the Finnish flag. The fishing is almost exclusively done by mid-water and bottom trawls.

According to Vessel Monitoring System (VMS) and fishing logbook data from 2007 to 2009, the largest herring catches were mostly made within the Finnish EEZ. There are two major areas that could be regarded as being of main importance for fishing: one large area in the southeast part of the study area and one in the northeast (see Annex for methods).


HERRING
HIGH CATCH AREAS
Umeå
Örnsköldsvik
Vaasa
Kaskinen
Sundsvall
Pori
Rauma
Söderhamn
Uusikaupunki
Gävle
Mariehamn
0
50 km
Total Fishery Herring 2007–2009
75–100 %
50–75 %
Banks
Aquaculture installations





Seasonal trends

Fishing is most intense from January to June, when more than 70 per cent of catches are taken. The biggest catches in the southeast area were made during this period, while the biggest catches in the northern area were made during July to September.

Future in exports

During the past 30 years the estimated biomass of herring in the Bothnian Sea has increased from 100,000 tonnes to the current size of 400-500,000 tonnes. Commercial catches have increased from 20,000 tonnes a year to 70,000 tonnes.

This long-term increase is mainly due to an increase in zooplankton, the main food for herring. The increase in zooplankton, in turn, is related to changes in the physical environment including salinity and temperature.

More recently, however the population growth and the proportion of larger herring have decreased. These adverse effects might be explained by stronger competition for food and increasing consumption by seals, combined with the effects of fishing.[24]

While the catch has been good in recent years, there are indications that the consumption of Baltic herring is in decline and that it is increasingly a fish for industrial uses and export.

For example, most of the catches are exported to Russia and Estonia where it is used mainly in the canning industry and as animal feed in industries such as fur farms. It is also now being used as a raw material in fish meal factories in Sweden and Denmark.

Due to high levels of dioxins in Bothnian Sea herring, Finland and Sweden have set recommendations for herring consumption to avoid health problems, and an export ban to the rest of the EU is in force.[13]

Overall, the Bothnian Sea herring stock is strong and yield is expected to remain high for the foreseeable future. However, growing populations of Grey Seals, combined with increasing fishing activity, may reduce the availability of large herring for human consumption.

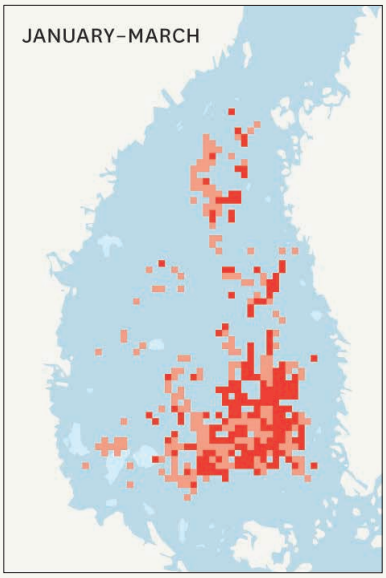
The problems of trawling

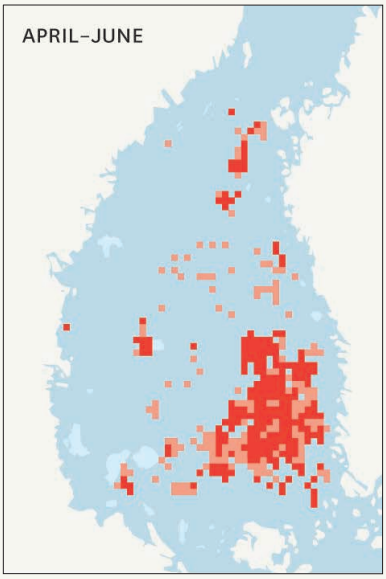
Fisheries are generally compatible with other activities. The use of bottom trawling, however, could conflict with other interests, such as offshore wind farms. Bottom trawling may also have potentially negative effects on nature conservation values, by damaging the integrity of the sea floor.

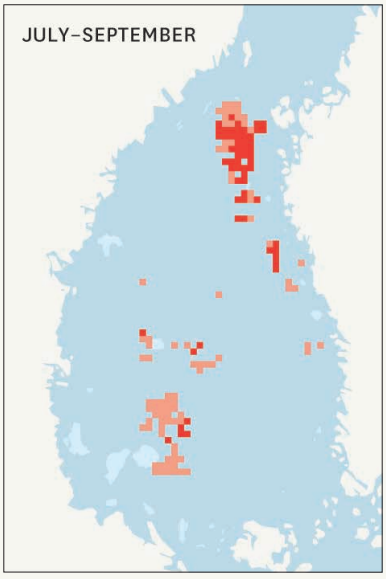
Large catches of herring by bottom trawl fishing is mainly conducted where the seabed has a soft bottom. In the Bothnian Sea, this area is not home to large numbers of sensitive species. Bottom trawling, however, disturbs sediment, which may lead to release of nutrients and hazardous substances such as dioxins.[25]

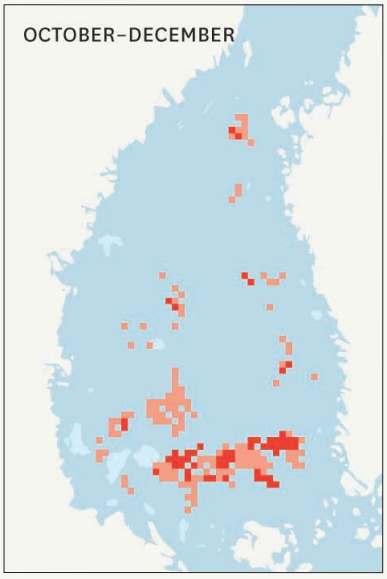
Although generally considered more environmentally sound, pelagic trawling in mid-water may also have some negative effects. According to recent studies, by-catches of post-smolt salmon (*Salmo salar*) during pelagic trawling can be significant and can have an effect on the overall post-smolt survival in the Bothnian Sea.[26]

HERRING HIGH CATCH AREAS, SEASONAL





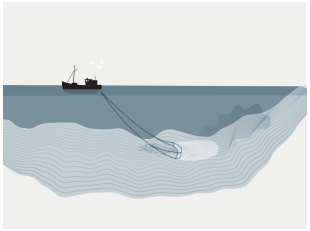




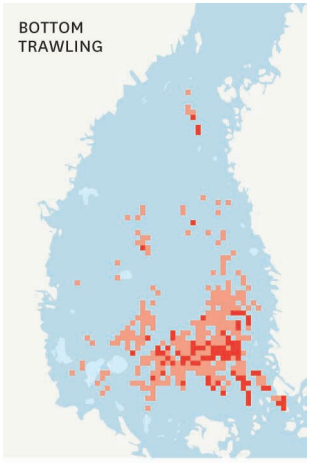
Areas with highest catches

75–100 %

50–75 %



Bottom trawl



Herring catches with bottom trawl, areas with highest catches

75–100 % 50–75 %

The magnitude of this potential problem is not yet known, but given the poor situation of Baltic salmon stocks, deserves further attention.

Compatibility with other activities

Trawl fishing in the Bothnian Sea has the potential to conflict with shipping, wind farms, electrical cables and marine protected areas.

Existing protected areas and wind farms, however, are mainly located in shallow waters, where trawling vessels generally do not operate.

Wind power technology is moving towards construction at deeper areas, with turbines based on floating platforms. This could lead to conflict with fishing in the future. Trawling could potentially interfere with shipping and plans for cables or pipelines.

Protecting larger herring areas and spawning grounds

In order to maintain a viable stock of herring it is critical ensure areas for larger herring and spawning grounds thrive. To identify important areas for larger herring, maps were produced by interpolating data from scientific hydroacoustic surveys from 2007-2009.[27]

Even if the distribution was studied only during a limited part of the year, the result shows that coastal areas are of importance for larger herring.

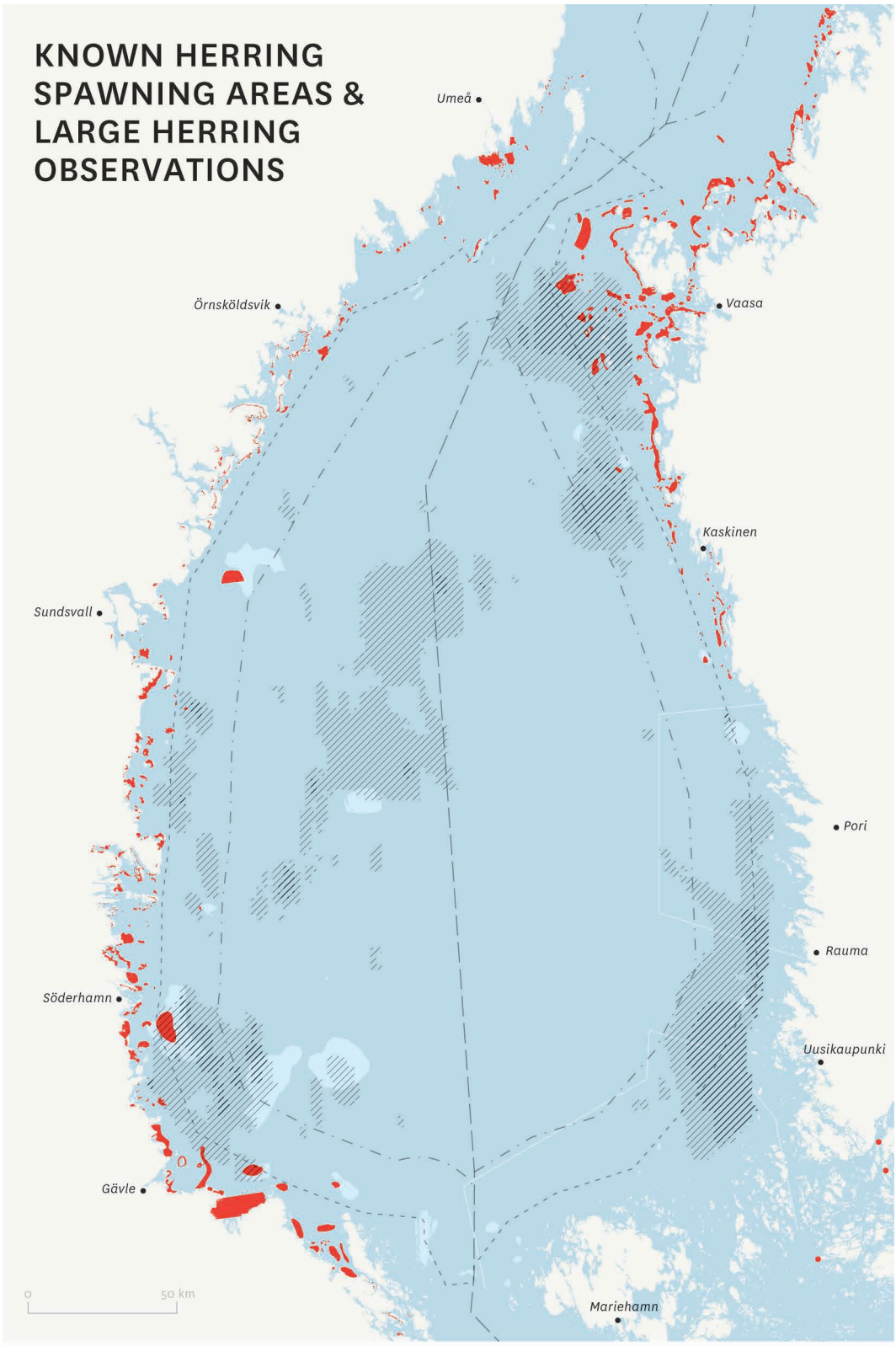
Three major areas can be identified – the coasts in the southwestern, southeastern and northeastern parts of the Bothnian Sea. Adult herring migrate to the coast for spawning in spring/summer and then back to the open sea. The location of important areas may therefore differ during the year.

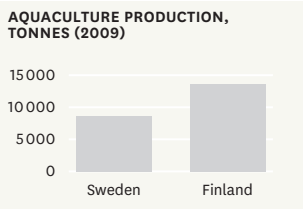
In addition, many spawning grounds for herring have been identified by interviewing local fishermen. For herring, two major areas are clear – one in the southwest and one in the northeast. It is also known that the vast archipelago area in the southeast is a very important spawning area for herring.

A majority of the important spawning and nursery grounds for herring are also located in shallow coastal areas. These lie mostly outside the focus area of this book. It is, therefore, important to remember that what happens outside the planning area can affect the situation inside the area.

Shallow areas near the coastline are important spawning and nursery grounds not just for herring, but for many species of fish. So despite the fact that most spawning grounds are located outside the planning area, they are included in this project due to their vital importance to fish stocks.

When comparing areas where large herring are in abundance with spawning areas, an interesting pattern emerges. Large herring seem to be mostly found in the vicinity of the three major spawning areas, indicating that these three “corners” of the Bothnian Sea are of special importance for the herring stock.


KNOWN HERRING SPAWNING AREAS & LARGE HERRING OBSERVATIONS
Umeå
Örnsköldsvik
Vaasa
Kaskinen
Sundsvall
Pori
Rauma
Söderhamn
Uusikaupunki
Gävle
Mariehamn
0
50 km
Spawning areas
Identified herring spawning areas
No data
Density of large herring, >20 cm (acoustic surveys 2007–2009)
90–100 %
80–90 %



Aquaculture

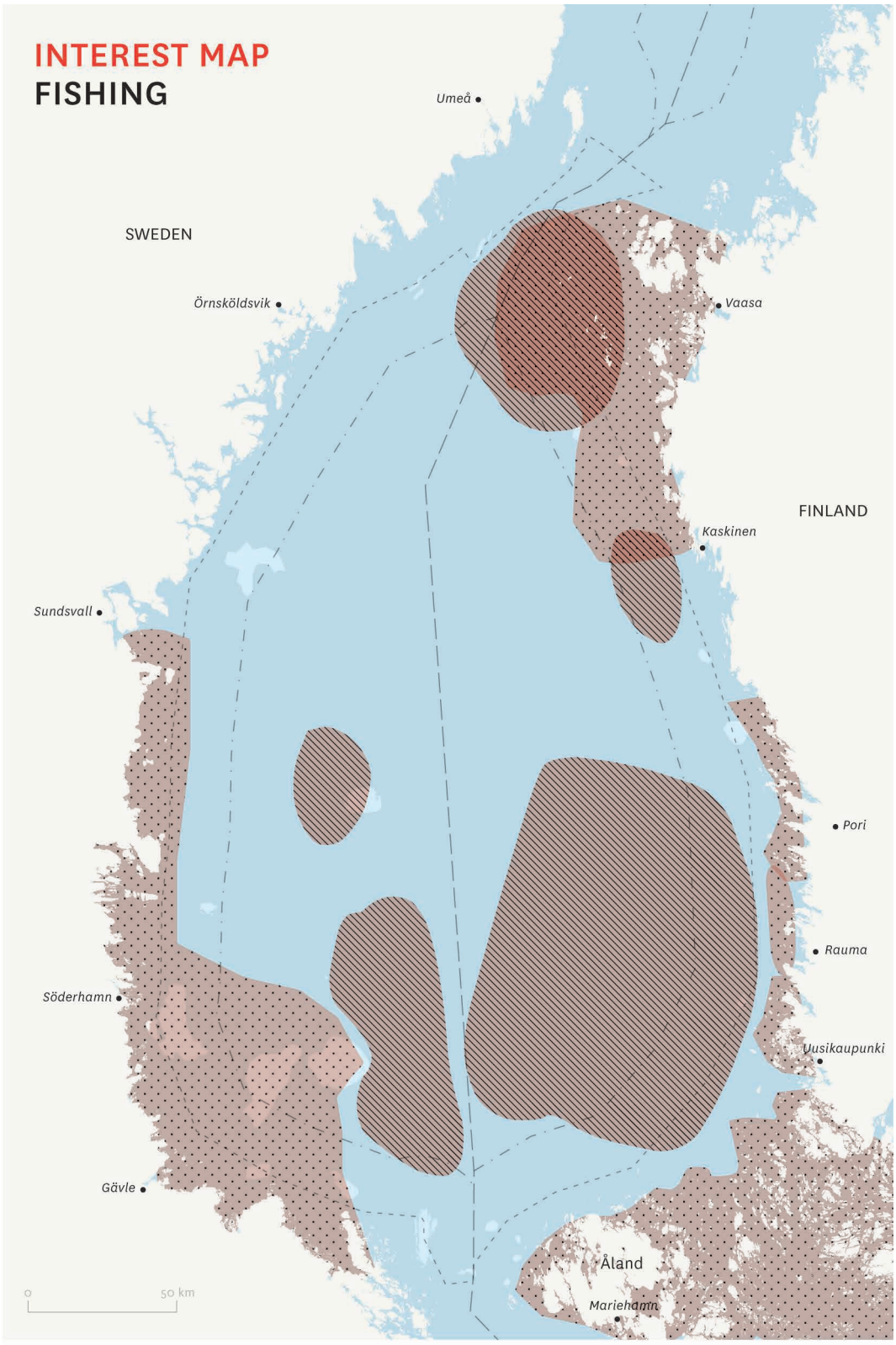
Aquaculture is the farming of aquatic organisms such as fish, crustaceans, molluscs and aquatic plants. In the Bothnian Sea, only fish is cultivated in aquaculture installations, rainbow trout being the main species.

In Finland aquaculture is proportionally a bigger industry than in Sweden and in European countries in general. There are long-term plans for large-scale offshore aquaculture installations in Finland, but these will require development of new technology able to withstand the harsh ice conditions of the Bothnian Sea. At the moment, offshore wind power farms are also the most likely location for offshore aquaculture.

Sweden seems to be less restrictive than Finland in granting aquaculture permits. As a result, aquaculture production may shift from Finland to Sweden. Other forms of aquaculture might become relevant in the future.

Important areas for fisheries

The most important areas for present and future fisheries to be considered when planning the Bothnian Sea include important fishing and spawning areas of herring. In many cases the spawning areas coincide with areas were high densities of large herring have been observed.


INTEREST MAP
FISHING
Umeå
SWEDEN
Örnsköldsvik
Vaasa
FINLAND
Kaskinen
Sundsvall
Pori
Rauma
Söderhamn
Uusikaupunki
Gävle
Åland
Mariehamn
0
50 km
Main potential spawning areas
Herring largest catches
Banks

Energy

Energy-related installations, both in the EEZ as well as in the territorial sea, are permitted at the discretion of the coastal state.

Present status: a nuclear sea

Despite several future plans for renewables such as wind power, the Bothnian Sea is presently mainly a nuclear sea. There are two nuclear power facilities located directly on the shore in the southern part of the Bothnian Sea.

The Olkiluoto facility in Finland has two active reactors producing 14.5TWh a year, which accounts for 16 per cent of Finland's total energy production. A third reactor is under construction and a fourth is waiting permission from the authorities. The Forsmark facility in Sweden has three reactors producing 22.3TWh, also 16 per cent of Sweden's total energy production.

Both Olkiluoto (Onkalo) and Forsmark are designated storage facilities for nuclear waste. All nuclear waste from the two countries will be transported to, and stored on, the shores of the Bothnian Sea if permits are given for these repositories.

The future: renewables

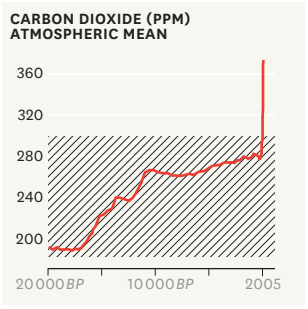
In order to meet energy needs in the coming decades, targets for energy infrastructure are in the process of being set.

In December 2011, the European Commission adopted the Energy Roadmap 2050,[28] which sets out to reduce greenhouse gas emissions to 80-95 per cent below 1990 levels by 2050.

The challenge is to deliver the EU's decarbonisation objectives while at the same secure Europe's energy supply when industries, struggling to remain competitive against other global players, are increasing their energy demands. The mid-term goal is to increase the share of renewable energies in final energy consumption to 20 per cent by 2020.

Renewable technologies need further investment and development to bring down their costs, increase efficiency, and research new potential resources. Marine-based resources, such as wind, wave and algae production, offer significant potential to contribute to low-carbon energy supplies.[29]

In the following sections we look at the energy uses of the Bothnian Sea, and its potential to meet energy needs.



Wave power

Wave power technology is now at the same stage of development as the wind power industry was in the 1970s.[30] There are high hopes, however, that waves could become an important energy source in the future. As the Baltic Sea has practically no tides, tidal energy is not possible.

It is believed electricity from waves will become cheaper to produce than from the wind. Compared to wind power, wave power produces a pure alternating current and has more production hours

per annum. It needs only 75 per cent of the area a wind power farm needs to produce the same amount of energy. The potential for wave power in the Baltic proper has been calculated to be at least 24 TWh per annum.

The environmental impact of wave power is in many respects similar to that of wind power. There are, however, no tall rotating blades that can harm birds and bats.

Unlike wind power, however, wave power is not suitable in shallow waters. It needs at least 20m deep, and can even be constructed where the deep is 200m or more.

Wave power plants are incompatible with most other uses. Shipping vessels and other activities would be have to be prohibited in an area containing a wave power facility. They could, however, be potentially compatible with wind power farms, where these are constructed in areas where the deep is more than 20m. Wind power generates a different kind of current to wave power, however, so dealing with the difference in currents would increase production costs.

Wave-powered electricity cannot be produced when the water surface is covered by ice. This hampers its potential in the Bothnian Sea, given its frozen winters. A research plant to test solutions to the ice problems is due for construction close to Åland.

Due to the lack of knowledge regarding the suitability for wave power plants in areas usually covered with ice during the winter, more research has to be done.

Floating wave / windpower plant

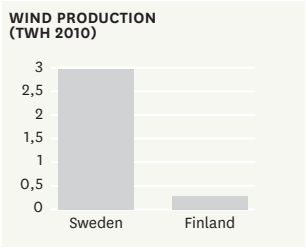
Wind: the most important renewable

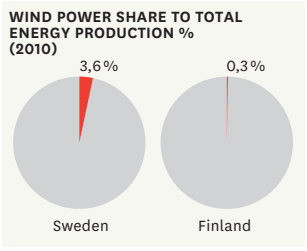
Wind power is one of the fastest growing energy industries. Over the past 10 years wind power capacity has increased by almost 30 per cent per year worldwide. At present, the majority of wind farms are onshore, but when costs and technical challenges are resolved, there is potential that offshore farms could be more successful, given stronger wind resources.

The EU has set targets for wind electricity by the year 2020, when it wants 12 per cent of all renewable energy to come from wind power. A significant share of this has to come from offshore sources due to opposition to developments on or near land. The Swedish government has adopted a goal of 30TWh and the Finnish parliament has adopted a total of 6TWh.

To meet these targets, many new wind farms are needed. From January to September 2011, wind energy production in Sweden was 5.2TWh, only 3.6 per cent of total electricity production. A year earlier, total annual wind power production was lower, at 2.98TWh.[31]

In Finland the total capacity of the 130 existing wind turbines is 197MW, as of May 2011. A year earlier, production was 0.29TWh, 0.3 per cent of the total electricity consumption.

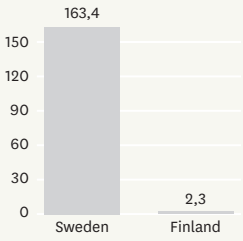




Ongoing projects

Currently, there is only one offshore wind turbine in the Bothnian Sea, the *Pori Offshore I*, a test turbine in Finland with a capacity of 2.3MW. There are six active windfarm projects in the area.

OFFSHORE WINDFARMS CAPACITY CURRENTLY INSTALLED (MW)



On the Swedish side, one project has been approved for construction: *Storgrundet* by WPD Sweden Ltd. It will have 53 turbines, produce 265MW/0.8 TWh a year, and is close to the town of Söderhamn.

Another project application has been submitted, *Finngrundet*, by WPD Sweden Ltd for 500-800 turbines, producing 1500MW, 5.5TWh/year. The Finngrunden project consists of two farms, one on each of the two shallow areas, the east bank and west bank.

On the Finnish side, four projects are planned. *Pori Offshore II* by Hyötytuuli Ltd, plans for 20-30 turbines with a capacity of 90-160MW. Construction work is due to start in 2012.

Two farms near Kristiinankaupunki, called *Närpes* and *Siipyy*, have been approved. *Kristiinankaupunki-Närpes*, by Pohjolan Voima Ltd, will house 73 turbines with a total capacity of 230-400MW. *Kristiinankaupunki-Siipyy*, by Suomen Merituuli Ltd, plans for 80 turbines with 240-400MW. Both are due to start construction in 2013.

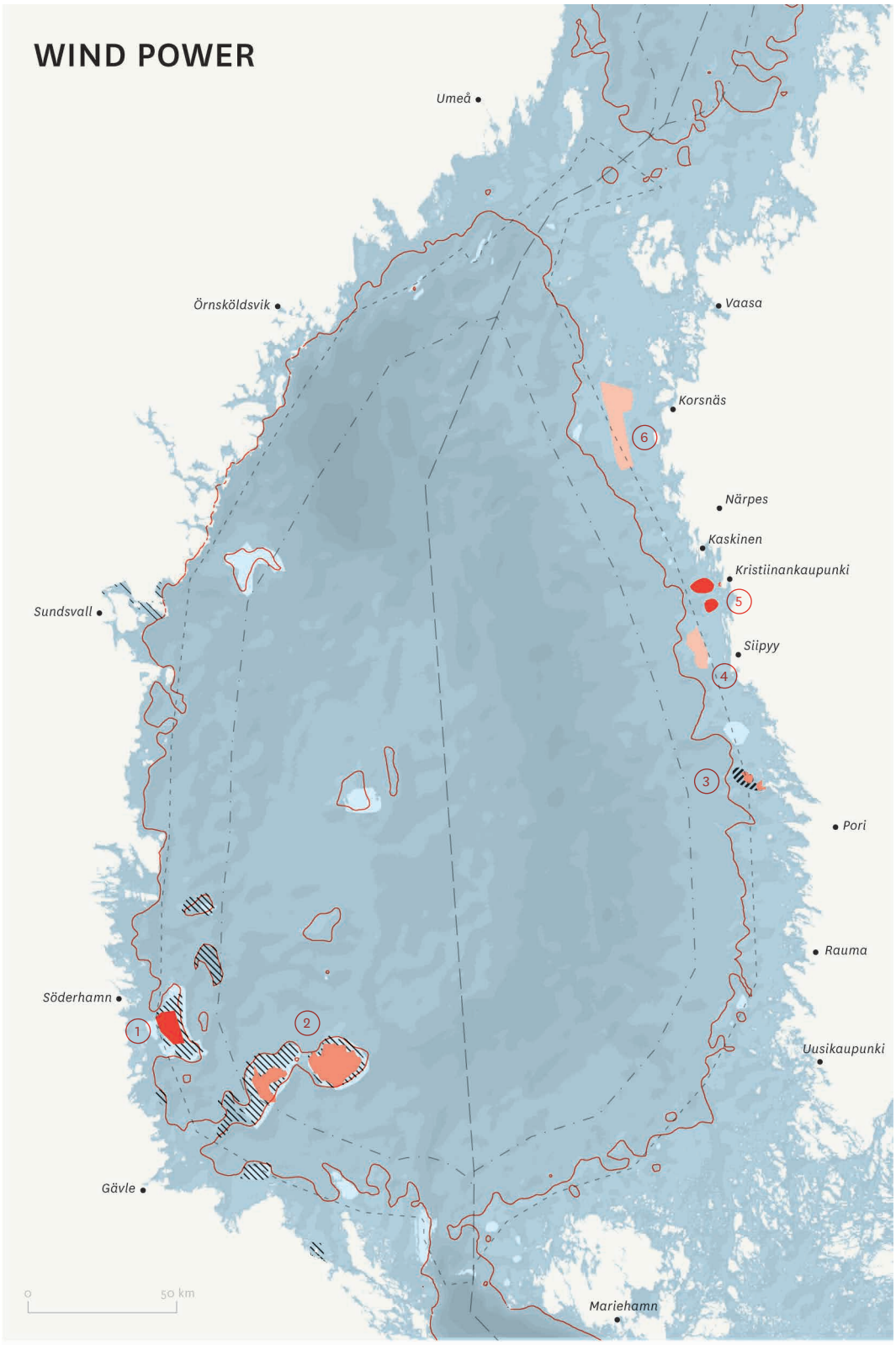
An environmental impact assessment (EIA) has begun for a wind farm in Korsnäs. The farm, by WPD Finland Ltd, plans to have 120-160 turbines with capacity for 600-800MW. Construction is due to start in 2016.

Offshore wind plans

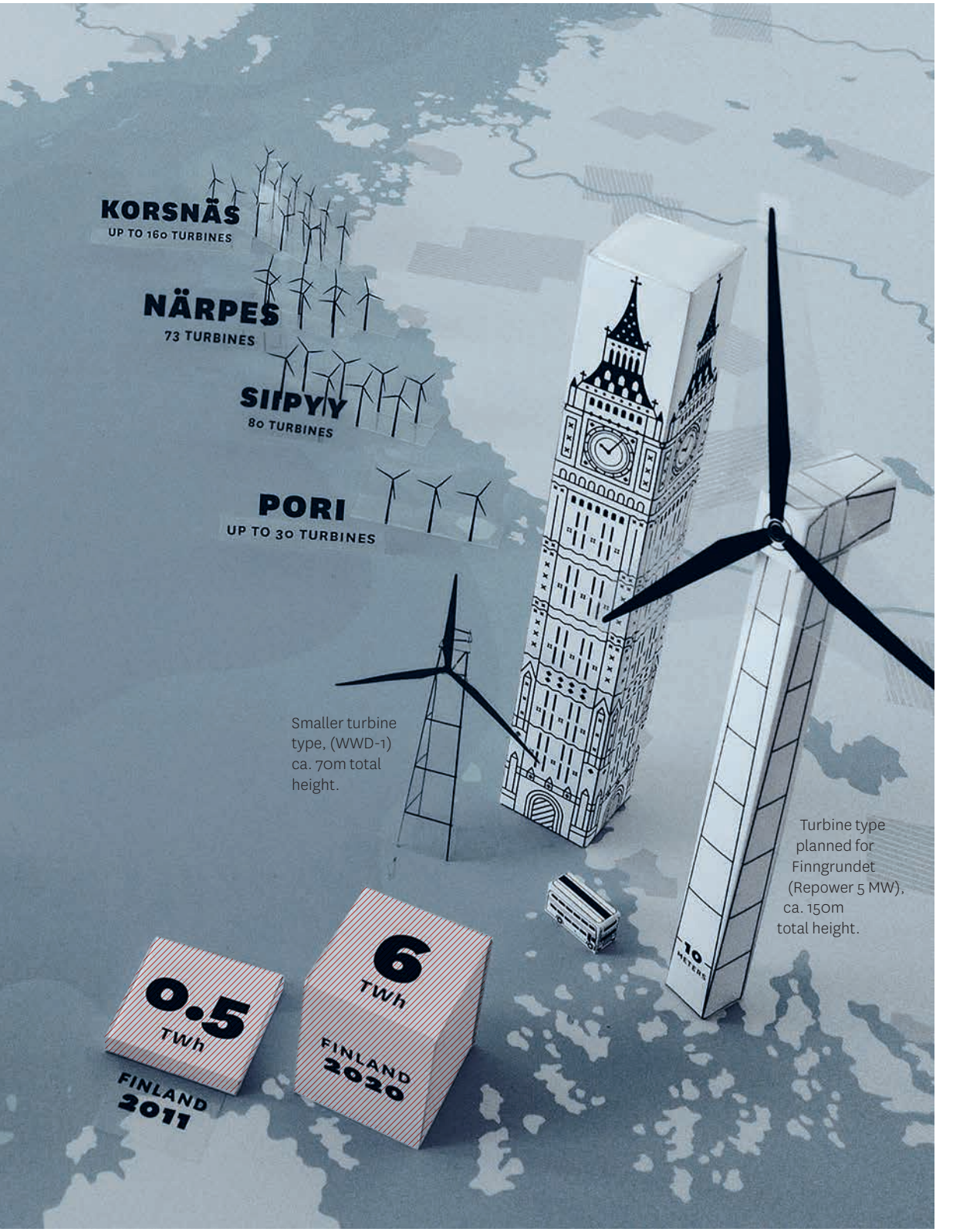
Production capacity is 10 to 30 per cent higher in coastal and offshore areas than on land, due to better and more stable wind conditions. At the moment, however, the cost of offshore wind power plants is 1.5-2 times more than on land. Larger wind farms, then, are more economically viable.

Although progress is being made in deeper waters, for the moment, wind power interests are concentrated in areas close to the coast or on banks. A depth of 30m is presently considered to be

	Wind park	Country	Status	Turbines	Capacity	Company
1	Storgrundet	Sweden	Approved	53	265MW/0.8TWh year	WPD
2	Finngrundet	Sweden	Submitted	500-800	1500MW/5,5TWh year	WPD
3	Pori Offshore II	Finland	Submitted	20-30	90-160MW	Hyötytuuli
4	Kristiinakaupunki-Siippyy	Finland	Planned	80	240-400MW	Merituuli
5	Kristiinakaupunki-Närpes	Finland	Approved	73	230-400MW	Pohjola
6	Korsnäs	Finland	Environmental Impact Assessment started	120-160	600-800MW	WPD


WIND POWER
Umeå
Örnsköldsvik
Vaasa
Korsnäs
Närpes
Kaskinen
Kristiinankaupunki
Sundsvall
Siipyy
Pori
Rauma
Söderhamn
Uusikaupunki
Gävle
Mariehamn
1
2
3
4
5
6
0
50 km
Consent authorised
Consent application submitted
Concept / early planning
Banks
30 m depth contour
Regional plans (FIN)
Municipal comprehensive plans (SWE)
Areas of national interest for wind power (SWE)

WIND POWER: PLANS AND PRODUCTION


KORSNÄS
UP TO 160 TURBINES
NÄRPES
73 TURBINES
SIIPYY
80 TURBINES
PORI
UP TO 30 TURBINES
Smaller turbine type, (WWD-1) ca. 70m total height.
Turbine type planned for Finngrundet (Repower 5 MW), ca. 150m total height.
10 METERS
0.5 TWh
FINLAND 2011
6 TWh
FINLAND 2020

the technical and economical limit for the construction of offshore wind turbines, meaning existing and planned offshore wind farms are mainly based on fixed installations in shallow water. Today, research in to constructions in considerably deeper areas is being carried out, as well the development of floating platforms. The first wind power park to use floating platforms is planned in the "Venotec Ost 2" project in the German economic zone of the southern Baltic. It will have 80 turbines in its first phase.

Sweden aims to produce 10TWh of offshore wind electricity per year by 2020. In January-September 2011, only 0.5TWh of wind electricity was produced offshore. There are currently 71 offshore wind turbines in southern Sweden, which together produce 163.4MW. The biggest wind farm is *Lillgrund*, southwest of Malmö, which consists of 48 turbines capable of producing 110MW. Applications already underway to construct offshore wind farms in Swedish maritime areas have potential to produce 17TWh.

A number of Swedish municipalities have recently adopted comprehensive plans targeting wind power, or are in the process of preparing such plans. So far, however, none of these plans include areas for offshore wind farms. The Swedish Energy Agency has, however, pointed out eight offshore areas they regard as of national interest for wind power production in the Bothnian Sea. All of them are in the southern part, off the coast of Gävleborg County. The current areas are under review, in which new wind speed data is being used.

In Finland, there are 16 offshore wind power projects in various planning phases, with a total capacity of approximately 3,000MW. The Satakunta region in Finland has suggested an area suitable for wind power production in its land use plan and similar plans exist in other regions.

Cables and pipelines

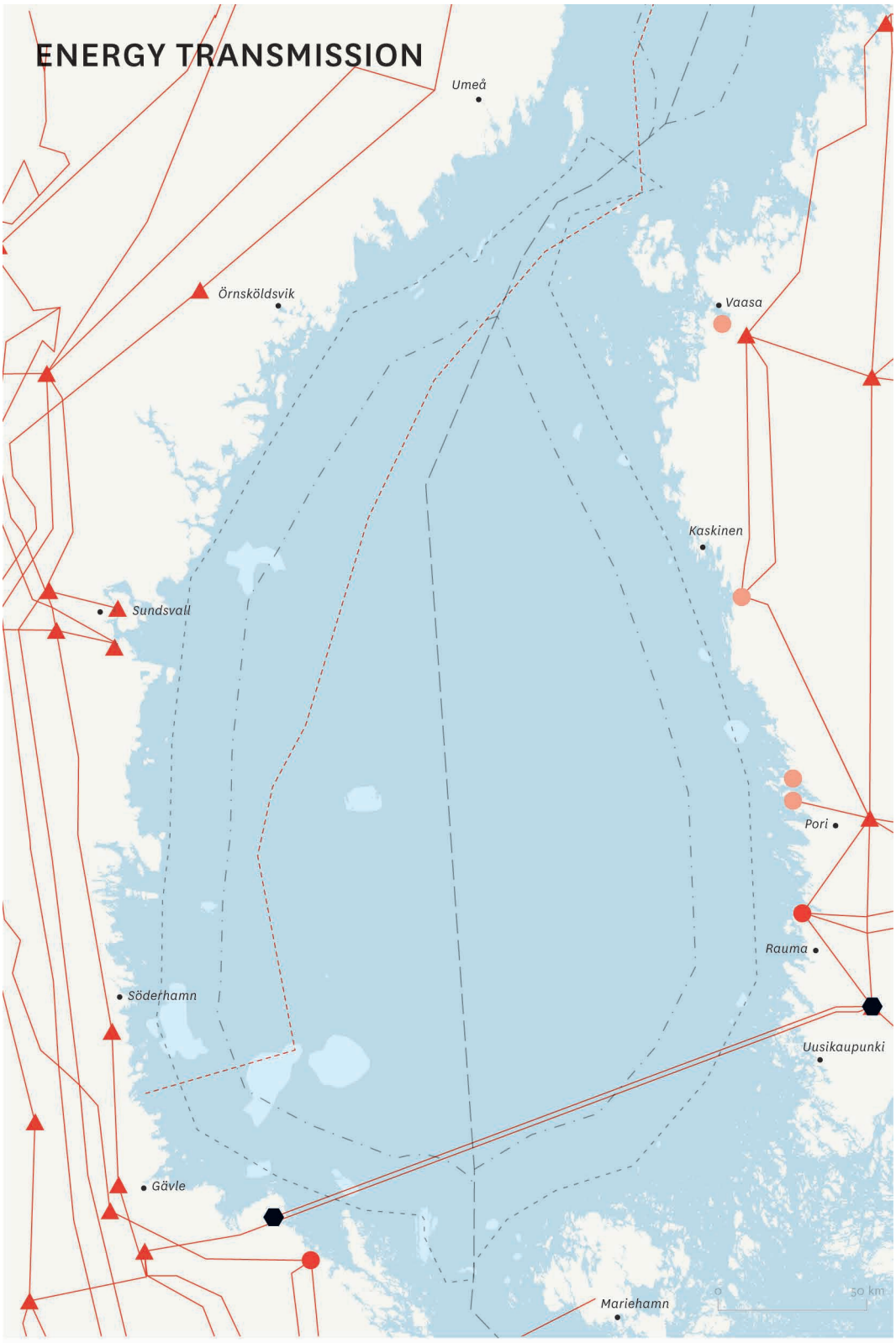
In both Finland and Sweden energy transmission capacity has to be increased if the planned offshore power plants are realised. Besides possible connections to offshore wind energy, there is also limited capacity to transmit additional power between the northern and southern parts of both countries.

Some years ago a modern type of electricity cable, using High Voltage Direct Current (HVDC) technology, was proposed in a north-south direction through the whole Gulf of Bothnia. This would have solved the north-south transmission shortages and made it possible to connect new offshore wind farms to the grid.

This would have been considerably more expensive than the present plans to strengthen capacity in land-based power lines, however, and the HVDC plans have now been withdrawn.

There are two submarine electricity cables crossing the Bothnian Sea between Finland and Sweden. Both connect to the two national power grids close to the two nuclear power plants Olkiluoto in Finland and Forsmark in Sweden.

The cable *Fenno-Skan 1* became operational in 1989. It has a


ENERGY TRANSMISSION
Umeå
Örnsköldsvik
Vaasa
Kaskinen
Sundsvall
Pori
Rauma
Söderhamn
Uusikaupunki
Gävle
Mariehamn
0
50 km
Conversion station
Nuclear power plants
Thermal power plants
Substation
Lines
Proposed but abandoned HVDC cable

voltage of 400kV and a transmission capacity of 500MW. *Fenno-Skan 2* is a new 500kV cable with a capacity of 800MW. Fenno-Skan 2 became operational in 2011. There are no plans for more electric cables across the Bothnian Sea.

There are no pipelines in the planning area, and no plans to construct new ones. Early plans for a natural gas pipeline running from Russia to Germany involved a pipeline through the Bothnian Sea, but the plans for the final Nord Stream pipeline from Vyborg in Russia to Lubmin in Germany were later altered.

Environmental impact of wind installations

Regarding the usage phase there are very little Baltic-specific knowledge on the effects of wind farms to marine life, particularly the impact of several different wind farms operating at the same time. However, some generalisations can be made based on studies conducted elsewhere.

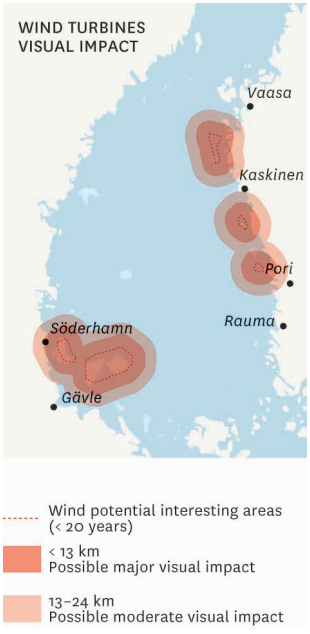
The construction phase is usually more directly damaging to wildlife than the operating phase. The noise from driving piles can frighten fish and other animals. Sediments often have to be removed from the site during installation, which involves dredging. This creates turbidity, nutrient release from the sediment, and destroys fish spawning areas. The construction, assembly, transportation and maintenance of wind power installation cause carbon dioxide emissions.

There are indications that bats and birds collide with wind turbines. Often there are one or a few turbines that tend to cause the majority of fatalities in a wind power farm.[32] The sound of a turbine can also disturb birds when they are feeding. With the exception of birds, the sound and vibrations from wind turbines seem to have a limited impact on marine fauna. A turbine may provide a new living habitat for some fish, with the foundations functioning as artificial reefs. Good planning and positioning of the turbines may reduce negative effects.

Lowering cables to the seabed creates turbidity and can damage fishing tackles. The area occupied by foundations and cables is, though, a small percentage of the total area covered by the farm. After the construction phase is complete, the situation quickly normalises, and similar benthos spreads to the area. The magnetic field from a cable is greater than the natural geomagnetic field, but only to a radius of 1m, and does not seem to have a substantial effect on the environment.

Overall, there is limited research in to the long-term impact of wind power plants. Not enough is known about the differences between solitary mills, large wind parks, and the combined effects of many parks in a basin like the Bothnian Sea to draw solid conclusions on their environmental impact.

However, wind power turbines certainly affect how the landscape looks. In a British study from 2003,[33] based on a turbine height of 100 to 150m to the tip of the blade, the visual impact was divided into



three zones. At a distance of less than 13km, the visual affects are major. At 13-24km away, possible visual effects are moderate, and at a distance of more than 24km possible visual effects are minor. In the Netherlands and Germany wind power is usually pushed offshore, where they are invisible from the coast.

Compatibility with other activities

The main interactions of windpower developments with other uses come from the fact that they alter the landscape as well as prevent trawling, military practice and sand extraction. They are also obstacles for maritime traffic.

Due to the risk of collision, shipping must be forbidden in and around a wind power farm. A safety zone of 500m around a wind farm is usually applied. Anchoring vessels is also usually prohibited within 500m of a wind farm's cables. A large-scale farm with several hundred turbines therefore becomes an obstacle for sea transport.

Extraction of sand and gravel, as well as dredging, could affect the stability of the seabed, which could damage the foundations of wind power turbines.

Turbines can obviously not be constructed in areas where military shooting practices take place. They can also disturb radar and other military installations.

Wind farms may offer new offshore aquaculture possibilities. However, this might increase the environmental impact of wind power developments in the future.

Turbines in a wind park are placed several hundred metres from each other. Small vessels can therefore navigate inside the farm without difficulty. Wind farms could act as a destination for tourism and leisure boating, particularly if there is a possibility to berth or even sleep over.

Wave power and wind power could be located together, provided the water is deep is enough for wave power production (20 m or more). It is not, however, an ideal pairing as the current produced by each are of different quality (see text on wave energy above).

Due to the limited knowledge about the long-term environmental impact of offshore wind farms, areas of high natural value should be kept free from permanent wind power developments.

Areas of potential interest for energy

The most important areas for present and future energy activities include windpower areas of municipal or regional plans, Swedish national interest areas for wind power, as well as those areas that the wind power industry has started to prepare the application process for.

Considering national goals, an appropriate level for offshore wind power production in the planning area could be around 5-10TWh in total for the next 15-20 years. Floating platforms and new methods of building turbines in deeper areas could make it possible to produce wind electricity in areas where other interests are minimal.

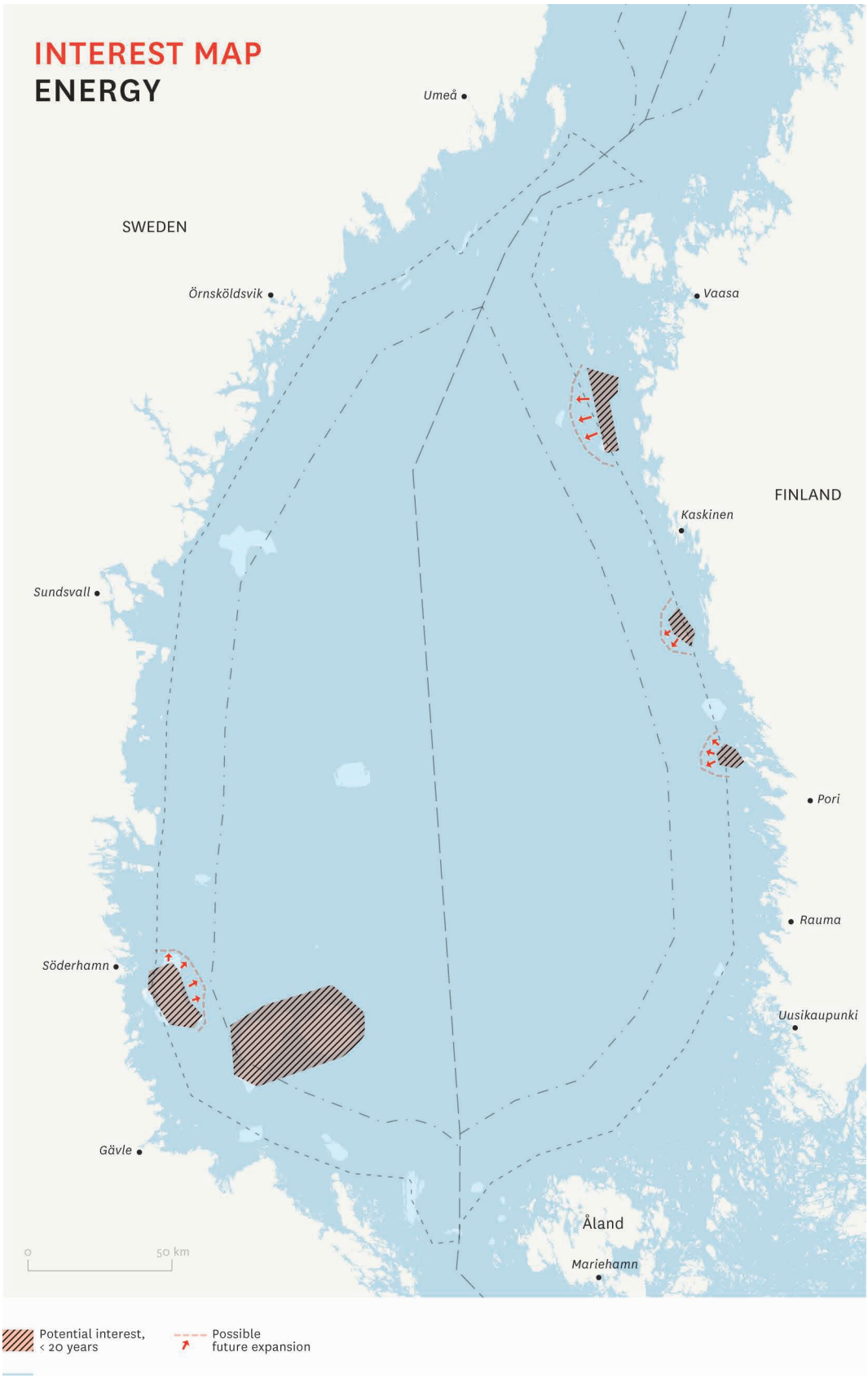
As there are few offshore areas less than 30m deep in the Bothnian Sea and that most of these are of high natural value, the ambition

should be to concentrate wind power production in just a few areas, favouring large wind parks above small ones.

This would also minimise the visual impact on coastal areas, which have high cultural value and great importance for tourism and recreation, as well as sea-side properties, whose value to a certain extent depends on an uninterrupted horizon.

Given the increasing importance of seaborne transport, wind farms and other energy constructions should not be located in, or in the close vicinity to, important shipping routes unless it is possible to alter fairways at a limited cost.

Due to limited capacity in present power grids, areas for power plants should be located as close as possible to connection sites where the transmission capacity is sufficient, or is planned to be strengthened. In this respect, the Finngrunden banks on the Swedish side of the Bothnian Sea could be suitable site for wind power.


INTEREST MAP
ENERGY
Umeå
SWEDEN
Örnsköldsvik
Vaasa
FINLAND
Kaskinen
Sundsvall
Pori
Rauma
Söderhamn
Uusikaupunki
Gävle
Åland
Mariehamn
0
50 km
Potential interest, < 20 years
Possible future expansion

Nature protection areas

Protected areas are legally designated areas aiming to protect specific ecosystem features within their boundaries.

MSP should, however, take as its starting point the ecological features of the whole planning area, which means addressing environmental issues beyond protected areas to ensure the long-term integrity of the entire planning area.

Nevertheless protected areas are, as spatially defined legal entities, important components of MSP.

In marine areas protection can be based on national laws, international agreements, or EU directives such as the Natura 2000 sites, a pan-European network for nature reserves.

Planning on land is based on building and planning acts, and protected areas have been viewed through the restrictions that they pose to human activities such as building. This means new protected areas have rarely been proposed through planning.

Restrictions within protected areas

The consequences of designating protected areas vary depending on their legal basis, specific management plans and site designation documents.

In many cases designations carry only limited restrictions regarding usage, beyond other applicable laws and spatial plans.

No restrictions apply for shipping or commercial fisheries, for example, within Bothnian Sea protected areas. In principle it would be possible to apply restrictions or recommendations through the IMO, national fishery regulation or EU common fisheries policy. EU guidelines have been drafted for fishing within Natura 2000 areas.

Wind power developments are planned within a Natura 2000 site in Kattegatt. Wind power is also planned in the Finngrundet area of the Bothnian Sea.

Present situation: Existing protected areas

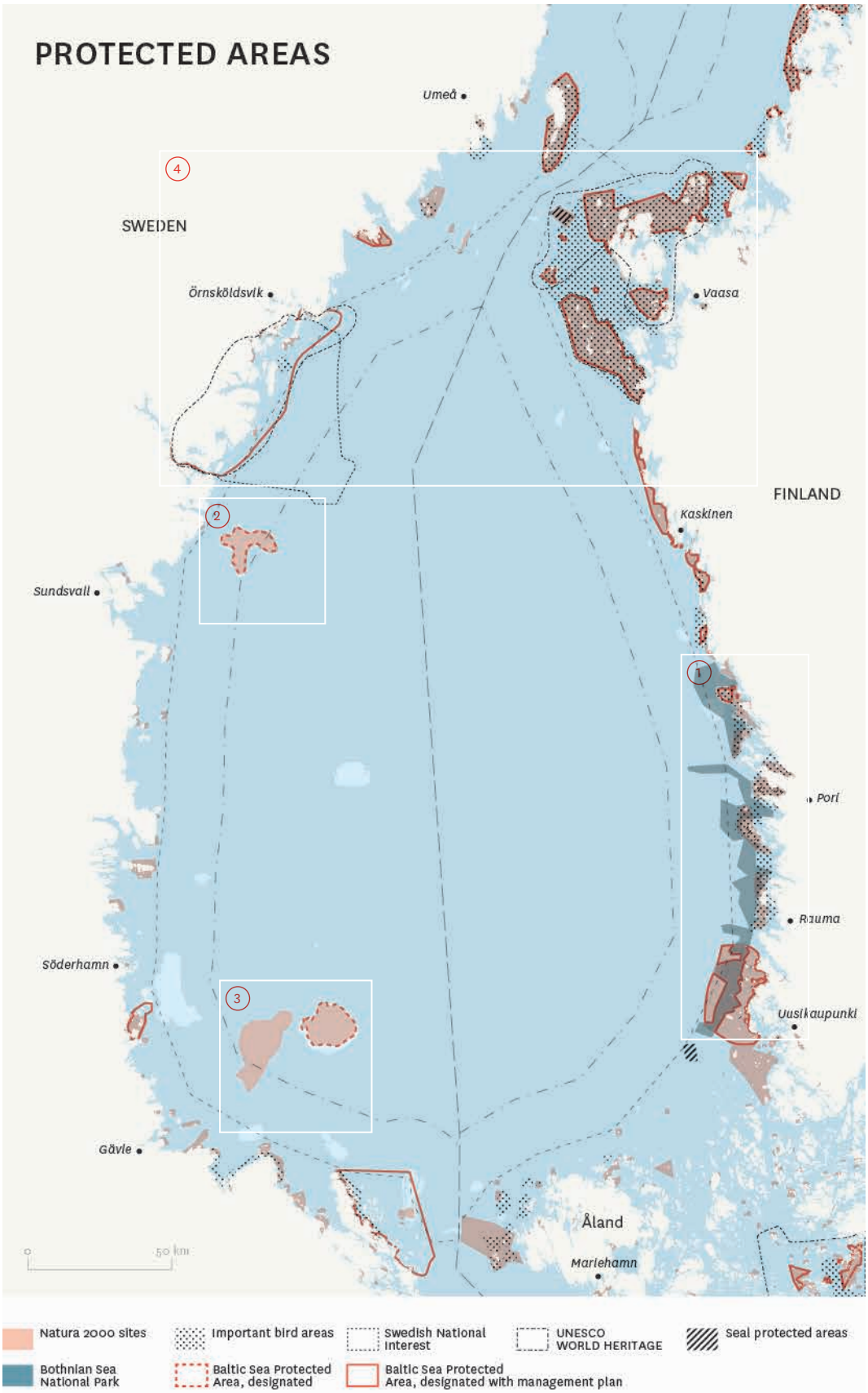
A number of sites in the Bothnian Sea have been designated as protected areas. They can be divided into three main groups: national or EU designations, international designations and other areas.

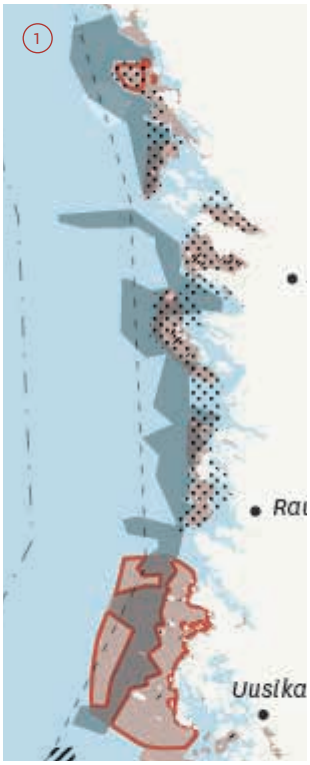
National parks, and other national designations such as seal protection areas and national reserves, are based on national laws. The Natura 2000 network are based on EU Habitats and Birds Directives.

International protected area designations are based on international treaties and are usually less directly enforceable by national courts. These include the Quark and the High Coast World Heritage Site, based on the UNESCO World Heritage Convention. The HELCOM Baltic Sea Protected Areas are established on the basis of the Helsinki Convention.[34]

It is important to note that there is a large degree of overlap. Many areas are listed both under the Natura 2000 as well as BSPA networks.

There are also other areas without formal protected status, but


PROTECTED AREAS
Umeå
4
SWEDEN
Örnsköldsvik
Vaasa
FINLAND
2
Kaskinen
Sundsvall
1
Pori
Rauma
Söderhamn
3
Uusikaupunki
Gävle
Åland
Mariehamn
0
50 km
Natura 2000 sites
Important bird areas
Swedish National Interest
UNESCO WORLD HERITAGE
Seal protected areas
Bothnian Sea National Park
Baltic Sea Protected Area, designated
Baltic Sea Protected Area, designated with management plan



Bothnian Sea National Park

The Bothnian Sea National Park is the first and only marine national park in the Bothnian Sea, with an area of 90,000ha. It was established in early 2011 and consists of marine waters dotted with outlying islands and rocks along a 130km-long section of Finland's west coast.

The park includes a number of smaller Natura 2000 areas within its boundaries, as well as the geologically and ecologically important Yyteri sand formation.

Wind power installations, gravel extraction and aquaculture are not allowed, based on Finnish nature protection laws. Fishing and seal hunting is possible within the whole park area. Bird hunting is allowed during the autumn in specifically designated sites. Military activities take place in a specific sector of the park.

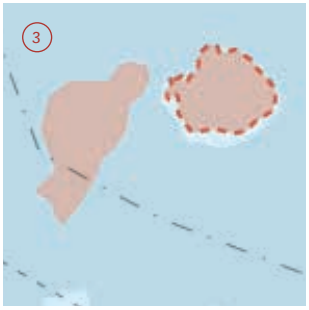
Vänta Litets Grund (A BSPA and Natura 2000 site)

Vänta Litets is a shallow bank about 17km off the Bothnian Sea coast of Sweden close to Härnösand (Västernorrland). The origins of its name lie in its short distance to the shore – fishermen used to leave their nets on the bank, return to the shore and after waiting a while ('vänta lite' in Swedish), would come back to get the fish.

In 2009 the Swedish government decided to protect the site due to its importance for fish spawning and the presence of rich underwater fauna. It was also included in the Natura 2000 network.

Vänta Litets Grund has an area of 15,131ha, comparable to the city centre of Brussels. A small portion, only 1.39 per cent, is made up of stony reefs, with the rest sublittoral sand banks. The seabed topography is varied, with numerous small banks steeply rising from the surrounding seabed.

Several potential threats to Vänta Lites Grund have been identified: dredging, blasting, damage to the seabed caused by trawling, wind turbine developments, eutrophication, sand extraction and oil and chemical spills.



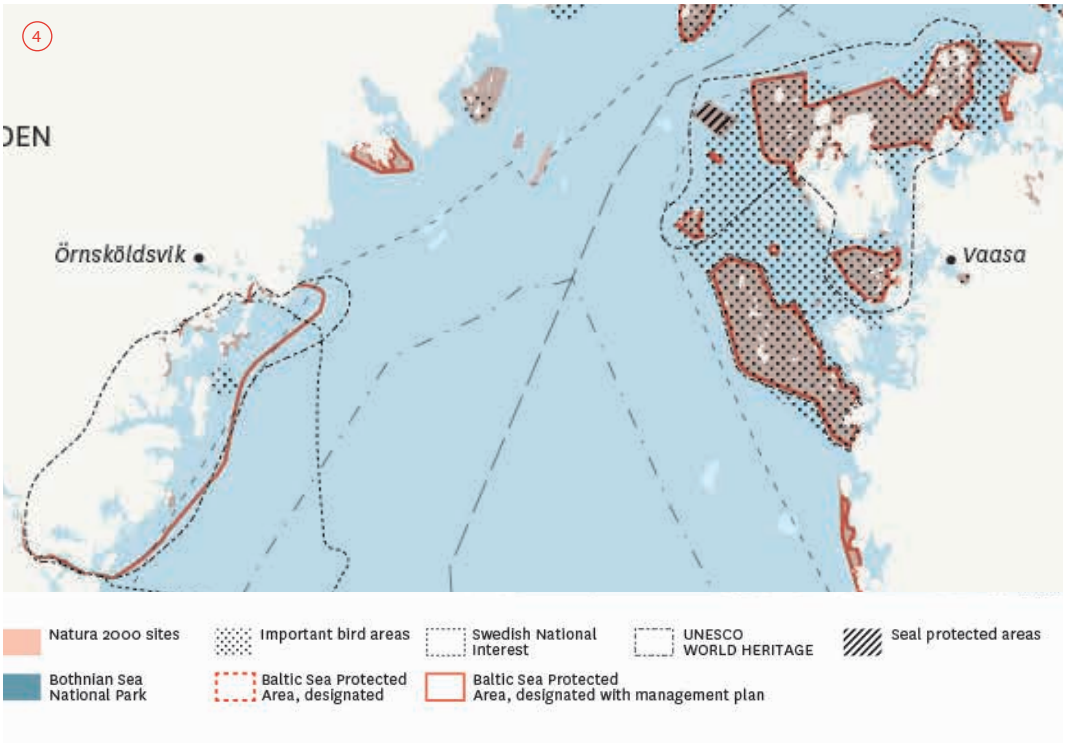
The Finngrunden banks (A BSPA and Natura 2000 site)

This site consists of three banks important for the wildlife of the Bothnian Sea that were designated as Natura 2000 areas in 2012.

Finngrunden banks are feeding areas for Grey Seals and a spawning place for Baltic herring. The eastern Finngrundet is also considered a sanctuary for species under pressure from human activities near the coastline.

The eastern Finngrundet bank is 23,151ha and is situated 40km from the coast. Sublittoral sandbanks cover most of the area and around 5 per cent is made up of stony reefs. The bank suffers from strong erosion by currents and waves, as well as ice abrasion during winter.

A major wind power development initiative by WPD Ltd is presently in EIA phase, aiming to build 500-800 turbines within this protected area.



which can be regarded as 'priority areas' for further conservation action, such as Important Bird Areas (IBAs) and parts of the Swedish national interest areas.

The future

Highly valuable areas offshore should be clearly protected from degrading human activities.

Designating protected areas, however, depends on the discovery and description of such highly valuable areas. The offshore areas of the Bothnian Sea are still practically uncharted in terms of natural values, especially regarding flora and fauna.

Some individual spots are visited as part of scientific monitoring cruises but such information can not be used to map larger areas.

For example the EIAs of wind power developments are often the first studies carried out in offshore banks. This is especially the case in Finland. Sweden carried out an inventory of offshore banks in 2004-2005.[35]

However, features such as shallow waters with sand and hardrock seabed, fish spawning grounds and seabed complexity can indicate areas with high natural values. These features can be used as a first step towards recommending future protected areas.

Important areas for nature protection

In addition to existing designations, the ecologically highly valuable areas offshore, discussed in part II, are potential protected areas.

The UNESCO World Heritage Site

The High Coast was designated as a UNESCO World Heritage Site in 2000 and was expanded in 2006 to include two areas in the Quark (Kvarken) archipelago. The combined area covers 194,000ha.

The basis for the status of the area is the 1972 UNESCO convention concerning the protection of world cultural and natural heritage.

The site does not have strong conservation protection directly as a result of this designation, but it is taken into account in regional and municipal planning. The UNESCO World Heritage designation attracts tourists to the northern Bothnian Sea.

Defence and scientific research

Military activities and scientific research are two less frequent but important uses of the Bothnian Sea.

Defence

Planning measures could discuss the appropriate location and type of military activities. There are presently two large marine military practice areas in the Bothnian Sea, one in each country.

The Finnish area is situated outside the city of Rauma. It consists of two sections called Reila and Isokaari. In these areas, the army and the navy are allowed to arrange practices with hard ammunitions and explosives. It overlaps an area of the Bothnian Sea National Park, which is closed when military practices are carried out.

On the Swedish side, there is a large marine practice and shooting area near Sundsvall, Härnösand, and the southern part of the High Coast. This area covers the entire Vänta Litets Grund.

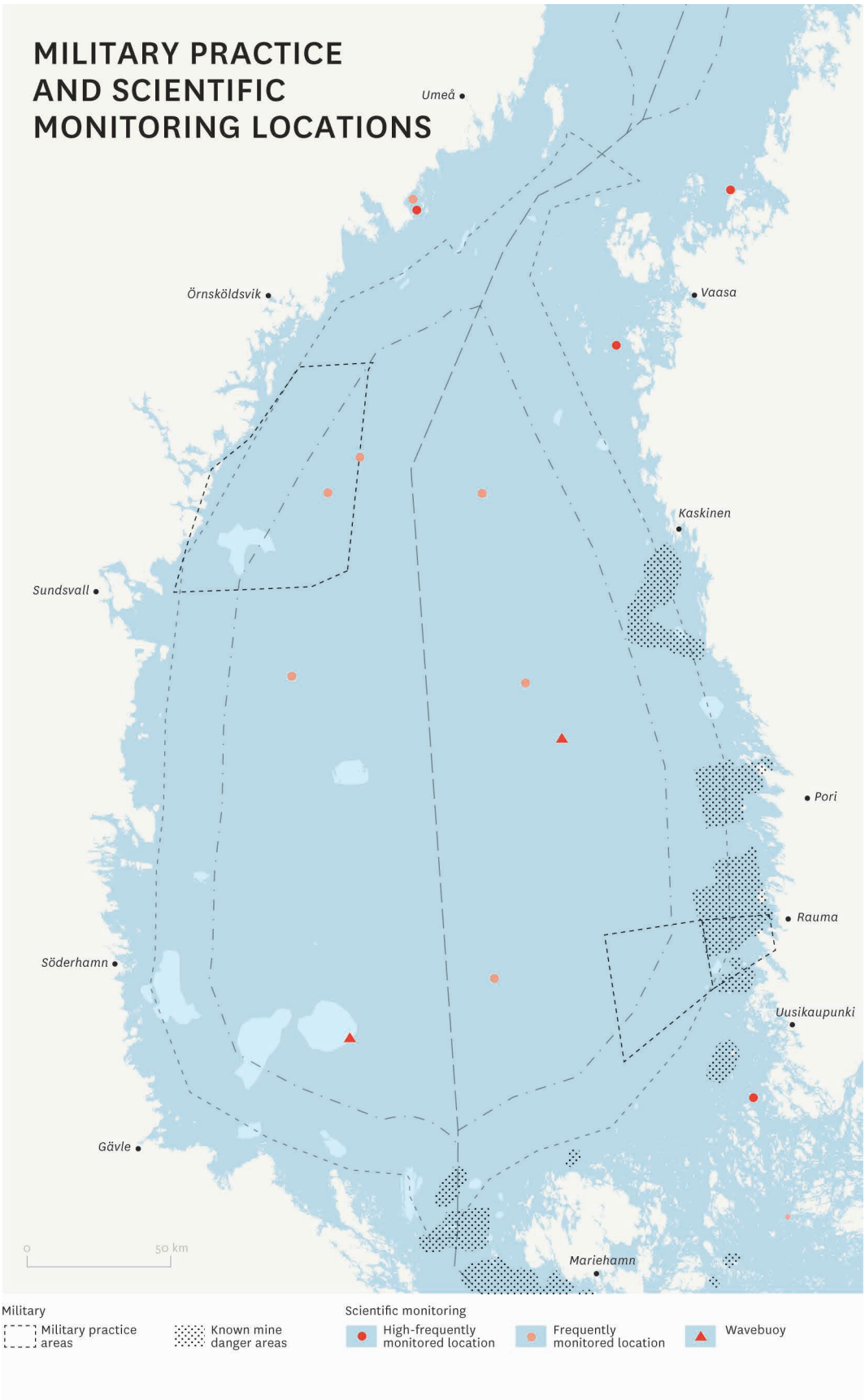
Due to their specific use, the areas require large amounts of space. They are open to the public when military practices are not being carried out. The whole Bothnian Sea on the Finnish and Swedish side can be used for military practices if live ammunition is not used. There are also a number of smaller military shooting zones along the coasts. These are not, however, inside the planning area.

Military use has environmental impacts in the form of noise pollution and perhaps also discharges of ammunition waste. The military is obligated to inform the regional environmental authority about a practice. Military use may also conflict with wind power installations as wind turbines may disturb radar signals even outside the areas designated for military use. Many coastal military areas, especially islands, have, however, proved to be a form of nature protection, due to restrictions on access and building. Privatisation of these areas would lead to more intensive use that could damage biodiversity values.In addition, historic mine fields exist in the Bothnian Sea and are possible hazards for fisheries, shipping and the laying of pipelines and cables.

Scientific research

Planning should also ensure that existing and future research activities are not be disturbed unnecessarily. Observing changes in the marine environment requires scientific measurements over a long period of time.

Traditionally, such measurements are conducted from research ships visiting specific locations called scientific monitoring stations. In the offshore areas of the Bothnian Sea there are six such locations belonging to the regional Baltic HELCOM COMBINE programme. In addition, automatic instruments are used, like wave buoys moored to the seabed at Finngrundet (SMHI), and off Pori (FMI).


MILITARY PRACTICE AND SCIENTIFIC MONITORING LOCATIONS
Umeå
Örnsköldsvik
Vaasa
Kaskinen
Sundsvall
Pori
Rauma
Söderhamn
Uusikaupunki
Gävle
Mariehamn
0
50 km
Military
Military practice areas
Known mine danger areas
Scientific monitoring
High-frequently monitored location
Frequently monitored location
Wavebuoy

Sand and gravel extraction

Planning should ensure that eventual sand and gravel extraction in the Bothnian Sea does not harm the environment, or interfere with other activities with priority in an area.

The present

Marine sand extraction is common in the southern Baltic Sea and in the North Sea continental shelf, but so far, it is limited in Swedish and Finnish waters.

Natural deposits of sand and gravel are non-renewable resources valuable to the construction industry. These natural materials have unique properties, and for many infrastructure works, cannot be cost-efficiently replaced with other materials such as processed or crushed bedrock.

On land, drinkable groundwater can be extracted from intact sand and gravel deposits. Removal of deposits makes this important source of groundwater disappear or reduce in quality. This limits the extraction of sand and gravel on land.

As a result, demand for sand and gravel extraction from the sea is likely to increase.

The future

In Sweden, the availability of sand and gravel is generally good on land in the Bothnian Sea region. The exception is an area south of the city of Gävle and an area between the cities of Sundsvall and Härnösand, where there is little sand compared to demand.[36]

Ten potential areas for marine aggregate extraction have been identified in Sweden, of which one is located in the Bothnian Sea – the Finngrundet eastern bank. This is a shallow area with mostly a hard seabed of limestone (sedimentary bedrock) and till (diamicton).

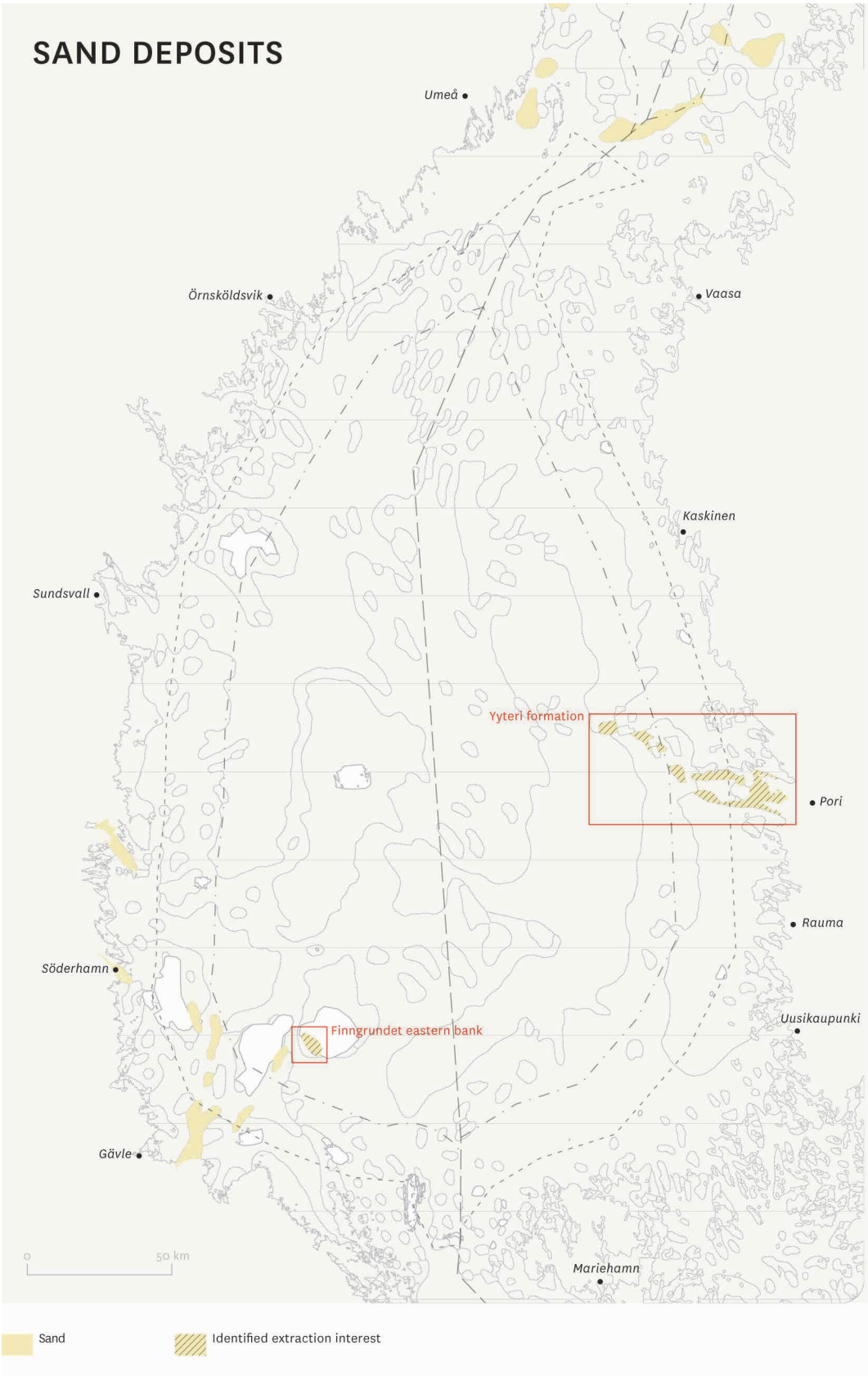
The potential sand and gravel extraction area is located along the southern slope of the bank. The thickness of the deposit is around 15m and the total volume is around 35 million cubic metres, comparable to 14 Great Pyramids of Giza.

Finngrundet eastern bank is a dynamic environment, with regular movement of sand, mainly towards the southwest. In addition, sand suitable for extraction continuously accumulates in several areas.

Finngrunden banks are designated Natura 2000 and BSPA areas. Consequently, there are major environmental concerns regarding marine sand extraction here.

On the Finnish coast of the Bothnian Sea there are a few known potential aggregate sites. Demand is currently low but is likely to increase.

A long winding ridge of sand and gravel, called an esker, submerges in Yyteri, near the city of Pori, and continues on the sea bottom towards northwest. Another smaller underwater esker can be found close to the Oura archipelago, some 20km north of Yyteri.


SAND DEPOSITS
Umeå
Örnsköldsvik
Vaasa
Kaskinen
Sundsvall
Yyteri formation
Pori
Rauma
Söderhamn
Finngrundet eastern bank
Uusikaupunki
Gävle
0
50 km
Mariehamn
Sand
Identified extraction interest

The Yyteri formation is very large. It is estimated to contain about 200 million cubic metres of mainly sandy material. Close to the shoreline, it erodes and is hardly distinguishable from the surrounding sea bottom. Further out in deeper water, it stands out as a distinct formation.

It has recently been studied for possible aggregate extraction. An application to extract 3.5 million cubic metres was sent to Environment Permit Authority in 2009, but the application was rejected due to the high natural values of the area.

The area close to the Oura archipelago, also known as the underwater continuation of the Reveli esker island, is much smaller, and stops and starts in places. It contains an estimated 5-10 million cubic metres of sand and gravel.

No applications on extraction of the Oura formation have been presented so far. It is situated in the National Park, making future applications very unlikely.

Environmental impact of extraction

The most significant potential damage comes from the direct removal of the substrate and the associated fauna and flora that make their home there. Alteration of the seabed and increased turbidity can lead to short or long-term changes in the composition and abundance of species in both benthic and fish communities. This, in turn, could have negative impacts on the bird and fish populations that feed on these resources.

Fish require a stable seabed in which to lay their eggs, so extraction can disrupt spawning.

After extraction, the time it takes for benthic fauna and flora to recover is rapid in unstable dynamic environments with mobile sands, but can range from a few months to 2-4 years.

The considerable variation how long it takes benthos to recover suggests that a meaningful assessment can only be done site by site.

Tourism and recreation

Tourism is one of the fastest growing industries in the region and although recreation activities mainly take place close to the coast, this sector should be considered by maritime planning.

Tourism in the Baltic Sea region as a whole brings in €90bn a year and employs around 2 million people. In the Bothnian Sea region most visitors come during the short summer.

Developing tourism services such as cruises, boat trips, hotels, restaurants, and travel excursions could boost local economies. Although development would put a strain on coastal environments,[37] it could also act to safeguard its natural features, as unspoiled lands and seascapes are what draw visitors to the region.

Bothnian Sea beauty spots

The Bothnian Sea area is full of beautiful places. The Finnish side hosts the attractive marine areas of the northern Quark with nearby cities like Vaasa, Korsnäs and Närpes, as well as the Åland Sea and the Archipelago Sea.

There are also picturesque towns such as Rauma, whose centre contains the largest intact medieval wooden town area in the Nordic region and is included among UNESCO's World Heritage Sites. There is also the famous 6km long Yyteri beach.

On the Swedish side there are the attractive cities of Sundsvall and Gävle, although marine activities are less developed here. The High Coast, a BSPA and UNESCO World Heritage Site, attracts many visitors who come to enjoy activities such as hiking, diving, sea kayaking, bird watching, fishing and camping. Around 250,000 visitors every year take in the views from High Coast Bridge, the third longest in Europe, crossing the mouth of the Ångermanälven river.[38]

Leisure boating

Leisure boating is an important maritime form of tourism. In Finland and Sweden leisure boating is a very popular and relatively inexpensive activity accessible to all social classes.

People have a strong connections to the sea, shown in the fact there is a leisure boat for every seven people. This is 10 times higher than boat ownership in the rest of the EU, excluding Denmark and Norway. It is an activity that can be good for promoting environmental awareness, due to the close personal contact it gives people with the sea.

Organised fishing excursions and leisure boating are on the increase, the latter growing at 5 to 6 per cent a year. These activities can bring tourists to sparsely populated areas and the need to provide for tourists drives better services for locals too, such as better grocery supplies and waste management.

On the other hand, maintaining leisure harbours and boating routes requires extensive dredging because of the strong land uplift around the coasts of the Bothnian Sea. Disturbing the sea bottom through dredging can harm wildlife and increase nutrient levels.

Cruising ships

Another recent trend is the boom in cruise tourism, which increased by 12 per cent per year between 2000 and 2010 in the Baltic Sea region.

In the Baltic at large, cruising has been one of the fastest growing forms of tourism in recent years. But so far, there is little in the way of commercial cruising activities by larger passenger ships on the Bothnian Sea coasts. This is a potential area for development in the Bothnian Sea, with its natural parks and archipelagos.

Holiday homes by the sea

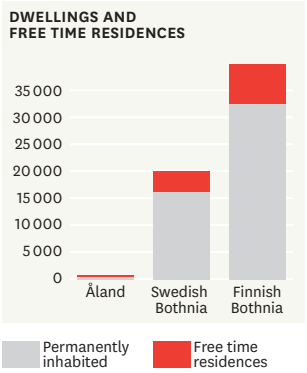
The Bothnian coasts attract a remarkable number of holiday homeowners. These seashore properties have considerable monetary and sentimental value to a large number of people. Wind power, and other similar developments that impact the landscape, will affect these values.

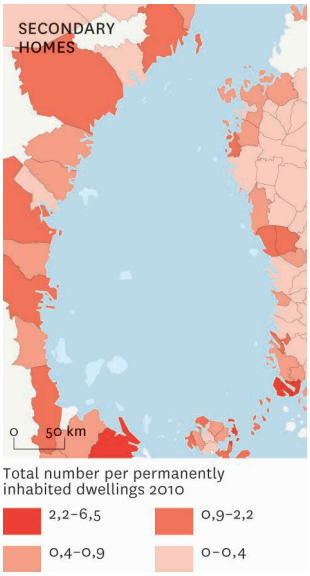
On the Finnish side of the Bothnian Sea, there are 72,000 holiday homes in coastal municipalities. Half of these are in southwest Finland – the area with most holiday homes. In Bothnian Sweden, there are 38,000 holiday homes.

On average, for every 10 permanently inhabited properties there are two holiday homes on both sides of the Bothnian Sea coasts. In Åland half of properties are holiday homes.

Nine municipalities on the Finnish Bothnian coast have more holiday homes than properties lived in all year round – Taivassalo municipality has 2.3 holiday homes per inhabited property.

On the Swedish Bothnian coast, however, numbers of holiday homes across most of its municipalities are around the regional average of two per 10.





Cultural heritage

Underwater remains should be thoroughly investigated before constructions such as wind farms are allowed to take place. Shipwrecks, harbours and fishing villages give the present generations a link to the region's maritime past and should be protected.

Underwater cultural heritage

The absence of shipworm means there are potentially many well-preserved shipwrecks in the Bothnian Sea, giving it a unique marine archaeological heritage.

Only very small parts of the Bothnian Sea have so far been investigated for wrecks. Searching for them offshore is expensive and there are less than 20 known shipwrecks in the offshore areas. All of them are in the southern Bothnian Sea. There are, however, several areas where ships are known to have been lost but the exact position of the wreck has not been located.

It is highly likely that there are several undiscovered wrecks in the offshore areas of the Bothnian Sea. Being navigational hazards, offshore banks are potential hotspots for wrecks. Due to this, developments such as wind power installations in these areas can potentially conflict with requirements to preserve underwater heritage.

In territorial seas, fairly strict national regimes for archaeology and cultural heritage apply. Sweden is currently considering introducing a contiguous zone beyond its territorial sea where a similar regime would also apply for cultural heritage.

Contiguous zone
A contiguous zone, under UNCLOS, is an extension from the outward edge of the Territorial Sea border where certain national laws apply. One purpose would be to protect the cultural heritage of coastal seas by national laws. These zones are also sometimes designated to prevent customs or immigration infringments as is the case in the US. Neither Sweden or Finland currently have such zones in force.

National laws do not apply in the EEZ

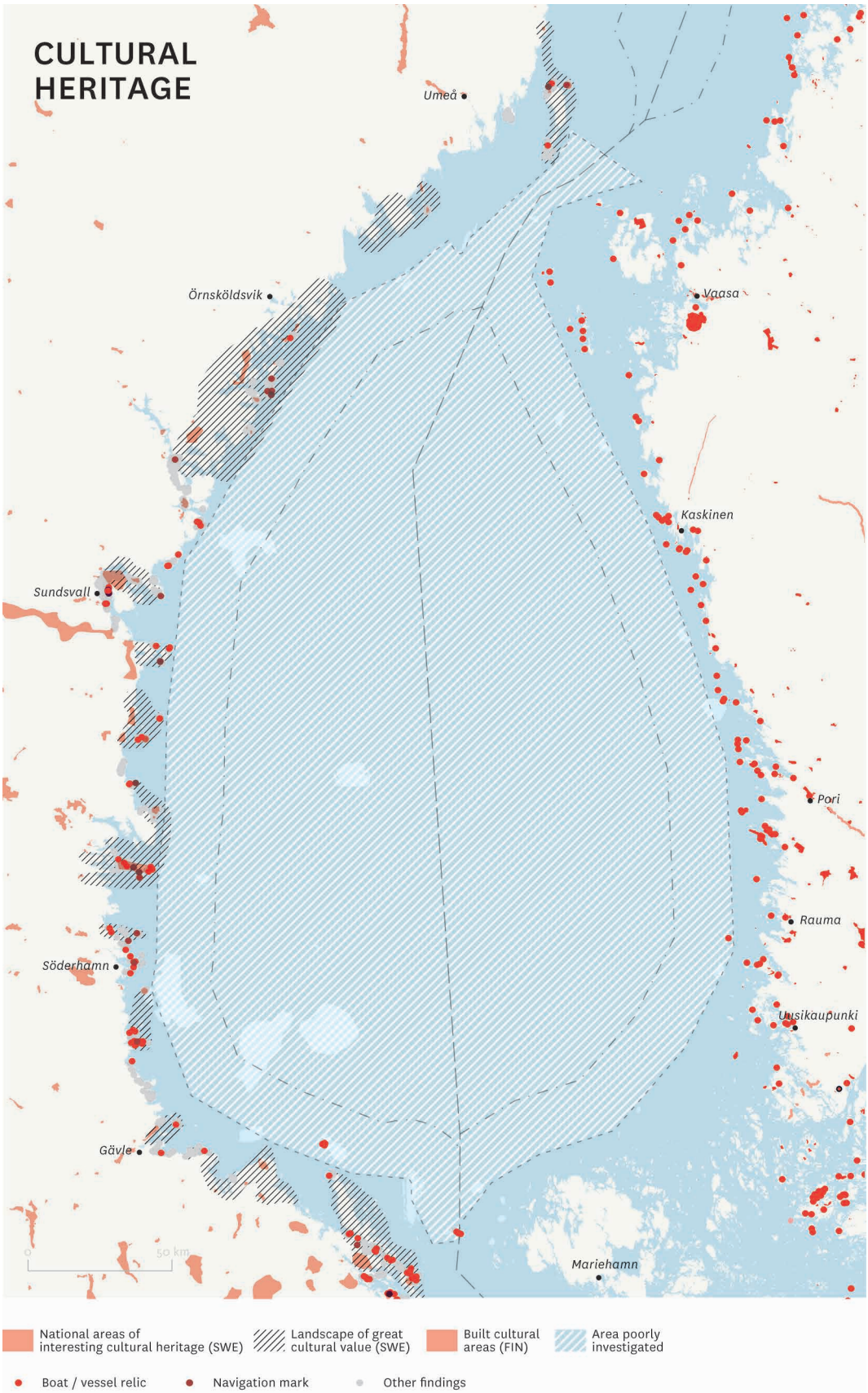
The international legal framework, articles 303 and 149 of UNCLOS, as well as the 1992 UNECE Valletta convention, include only a general duty to protect underwater cultural heritage.

In international waters, the ancient maritime customary laws of the Law of Salvage and Law of Finds entitle the finder of a wreck to partial or complete ownership of the valuables found in it, depending on whether or not the original owner has been identified. These customary rights were rejected in the 2001 UNESCO convention on the protection of the underwater cultural heritage. Neither Sweden nor Finland, however, have ratified this convention.

Coastal cultural heritage

People have shaped the coastal landscape over centuries. In many coastal areas on the Swedish and Finnish side large parts of the historic landscape are intact and archaeological remains and ruins are relatively common. These areas are particularly sensitive to new buildings and developments.

To protect their cultural value, new constructions and other activities should be designed to respect the landscape and its historical qualities. This should also be the case in offshore areas. Large-scale and tall constructions even quite far away can be detrimental to cultural and historical landscapes.


CULTURAL HERITAGE
Umeå
Örnsköldsvik
Vaasa
Kaskinen
Sundsvall
Pori
Rauma
Söderhamn
Uusikaupunki
Gävle
Mariehamn
0
50 km
National areas of interesting cultural heritage (SWE)
Landscape of great cultural value (SWE)
Built cultural areas (FIN)
Area poorly investigated
Boat / vessel relic
Navigation mark
Other findings

IV: Prospects for MSP

Synthesis and description of existing planning systems.

Bringing it all together

From the material presented so far, we can draw the conclusion that according the available information, the most important future uses of the offshore areas of the Bothnian Sea are wind power, shipping and fisheries. Concerns for nature protection, both within and outside protected areas, grow as pressures from different users increase.

Activities such as recreational boating, military, scientific research, cultural heritage and sand and gravel extraction interests can be identified, but they are less acute in the studied offshore areas. Special precautions are needed with regard to cultural heritage and archaeology, as there are likely to be many unknown remains in the offshore seabed.

In most parts of the Bothnian Sea, identified uses appear to be largely compatible with each other. Definite conflicts are concentrated in relatively few areas. It seems that of the various uses, only wind power installations, due to their permanent nature, need to be discouraged from specific areas or designated to alternative sites in an MSP plan.

It is also clear that detailed analysis of the risks to the Sea's natural values is hampered by knowledge gaps. While the position of shipping, fisheries and wind power facilities are easily mappable, it is not so easy to find information on the wildlife and living organisms of the Bothnian Sea's offshore areas.

The available measurements are restricted to station-based sampling of plankton, fish and seabed fauna and do not provide a reliable/mappable overview of the distribution of ecologically important areas.

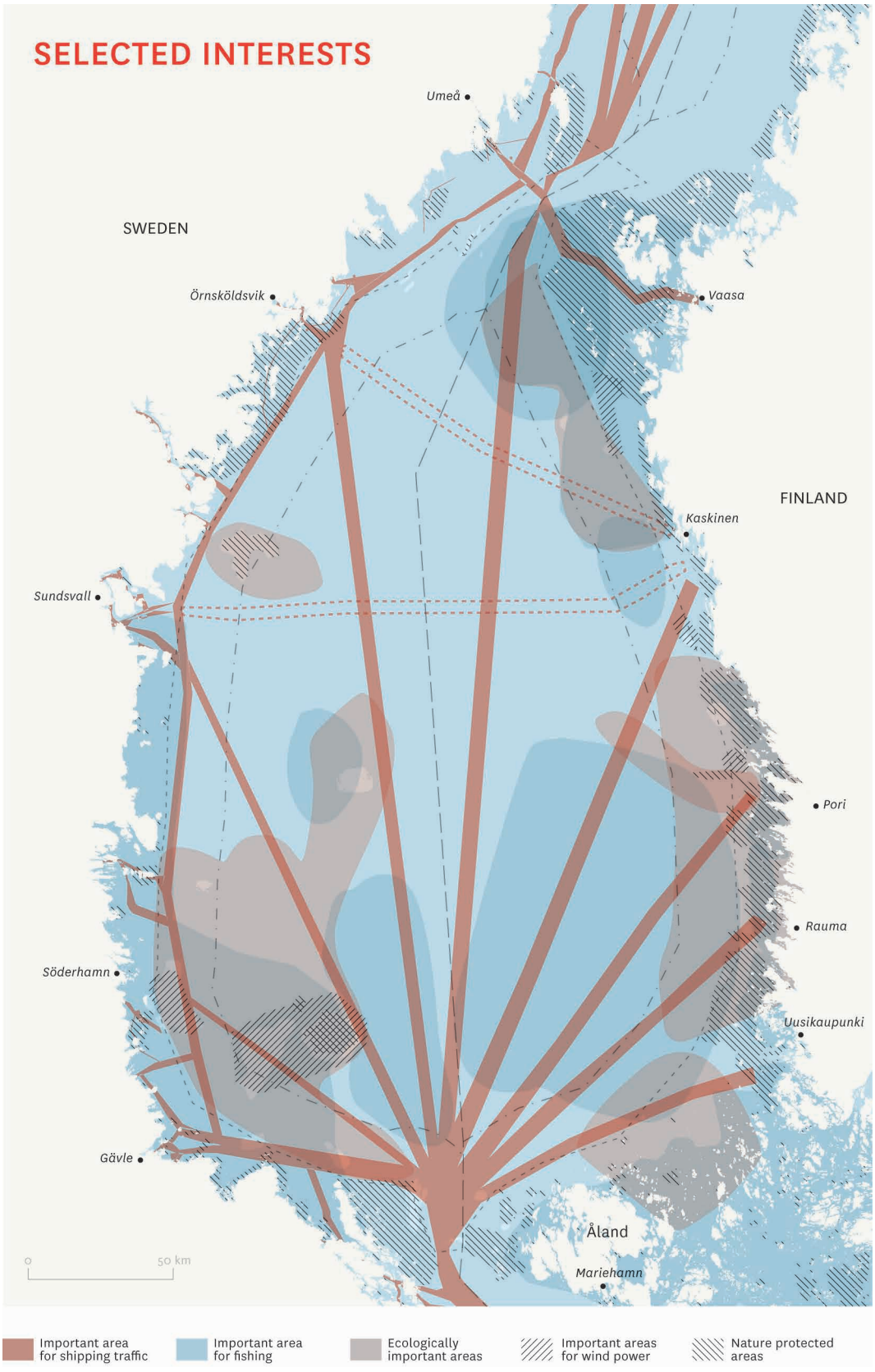
As an example, in Finland, offshore banks and other shallow areas of the Bothnian Sea that are of high interest to wind power developers, are uncharted in terms of their underwater biological value.

Little is known about life above the sea surface close to offshore banks, such as bird communities and their migration, due to a lack of research and the high cost of studies in such remote places. A recent study of most of the shallow banks on the Swedish side, however, has produced fairly good knowledge about their nature values.

Mining in the northern parts of Sweden and Finland is likely to increase due to elevated prices of minerals worldwide and demand for cheaper materials. This will possibly result in increased shipping volumes in the Bothnian Sea, depending on whether plans for new railway connections to ports in the Arctic Ocean will be implemented.

During recent years, wind power has emerged as a major user of offshore areas in Europe. In Sweden, the industry has applied for installations that would, if realised, meet the ambitious 2020 renewable targets.

Partly due to recent decisions on major nuclear power investments, such as in Olkiluoto on the Bothnian Sea coast, Finland has less ambitious renewables targets. However, even here there has been interest to develop offshore wind projects in several areas including the Bothnian Sea.


SELECTED INTERESTS
Umeå
SWEDEN
Örnsköldsvik
Vaasa
FINLAND
Kaskinen
Sundsvall
Pori
Rauma
Söderhamn
Uusikaupunki
Gävle
Åland
Mariehamn
0
50 km
Important area for shipping traffic
Important area for fishing
Ecologically important areas
Important areas for wind power
Nature protected areas

Key areas

There are four areas in the offshore Bothnian Sea that stand out as particularly interesting for planning.

These include the shallow bank area around Finngrundet (Swedish TS & EEZ), the Southern Quark (Swedish & Finnish TS), the Northern Quark (Swedish & Finnish TS) as well as the area off the Rauma-Pori coast extending south to the north Åland sea (Finnish TS & EEZ).

There are a number of other areas of interest. These include a shallow area with unusually high level of rocky seabed and wind power interests situated south of the Northern Quark on the Finnish coast (Korsnäs, Finnish TS). Another is the offshore Eystrasaltsbanken in the middle of the Bothnian Sea (Swedish EEZ) with fisheries and high biodiversity values. The third is an area off the High Coast, a UNESCO site (Swedish TS) with a highly complex seabed, scenic landscapes and military activities. Conflicts here, however, are less evident.

We will here take a closer look at the four key areas and describe the interactions between different uses.

Bank area around Finngrundet

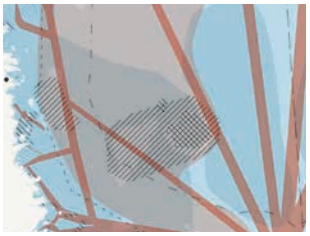
The southwestern Swedish part of the Bothnian Sea includes a number of shallow banks around which a high level of traditional maritime activities, as well as wind power development interests, are concentrated. Within the area there are two groups of shallows, Finngrundet and Storgrundet, where wind power development are on the agenda.

In the case of Finngrundet, an application for a very large wind farm has been submitted to the Swedish government. So far no decision has been taken. The project covers both main parts, the eastern bank and the western bank.

At least three factors makes Finngrundet attractive for wind power production: 1) the relatively short distance to the Stockholm-Uppsala metropolitan region, 2) the vastness of the shallow area which makes it possible to develop a wind farm with a capacity similar to a nuclear reactor, and 3) the location largely out of sight from the coast.

However, both banks are Natura 2000 sites on the basis of their high natural values. There is also some shipping over the western bank, and herring trawling around the western part. The eastern bank is also a site for scientific monitoring, hosting a wave buoy deployed by SMHI.

A part of Finngrundet eastern bank has also been identified as a potential resource for sand and gravel extraction. The thickness of the deposit is 15m and the total volume 35 million cubic metres. Sand and gravel extraction is not compatible with wind power plants, and will probably be detrimental to the natural environment.



The same company, WPD Ltd, also wants to develop a wind farm at Storgundet, although considerably smaller than the Finngrundet project.

The Storgrundet bank has been identified as an important spawning ground for fish.

Southern Quark: Safety of navigation/risk of oil spills

The Southern Quark, part of the Åland Sea located between Sweden and Åland Islands, is a narrow strait with heavy traffic, causing challenging navigation conditions.

Ships navigating between the North Baltic and Bothnian Sea must pass through the strait and the narrow passage of Märket. The possible increase of shipping in the Bay of Bothnia would increase pressure on the area by adding to the volume of traffic and increasing the risk of accidents.

Many of the ships passing through the strait carry oil. The port in the Gulf of Bothnia imported about 2.4 million tonnes of oil products in 2010, mostly through the strait.

The deep water route in the Åland sea was established in 1987 and guarantees a depth of 18m for navigation. A TSS was set up in 2008 to help direct traffic and reduce the risk of collisions.[39]

Ships must follow the TSS rules, except during difficult ice conditions when transport agencies can suspend them.

The adjacent sea areas have rocky, complicated bottom structures and the depths vary greatly between 4 and 150m.

There are several nature protection interest areas, including Natura 2000, BSPA areas, as well as IBAs and a site belonging to the Ramsar network, an international convention on the protection of wetlands. An oil accident in the strait would have serious consequences.

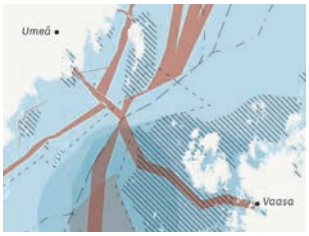
In summertime leisure boats and small fishing vessels put additional pressure on the strait. Salmon fishing is currently restricted from the beginning of May to the end of June, and mainly takes place when the fish return to their spawning rivers between June and September.

New Swedish regulations for salmon fishing could change the situation by 2013. According to the Swedish proposal,salmon fishing will be moved away from open sea areas, where the wild and cultivated populations are mixed, to the coast.[40] Here, it is easier to target the cultivated salmon populations. Recreational salmon fishing out at sea will also be revised.

There are currently no wind power interest areas within the strait area. However, there is an ongoing pilot initiative to test wave power in Åland, close to Hammarudd, south of the Quark area.

TSS areas should be prioritised for shipping and no other activities that can interfere with shipping should be planned here or in adjacent sea areas where they could compromise the safety of navigation in the strait.

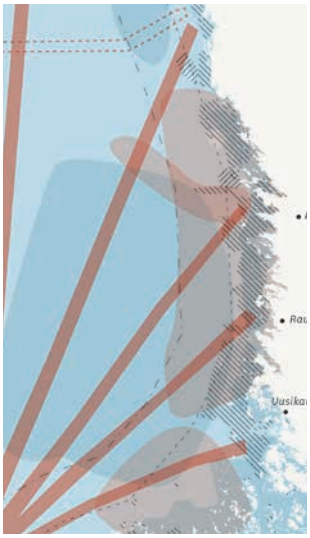
The Northern Quark: many uses and interests



The Northern Quark is the name for the narrow, shallow strait in the northern extremity of the Bothnian Sea, beyond which lies the Bay of Bothnia.

It holds a range of issues typical for MSP: intensive maritime traffic, fishing activities, wind power interests, as well as UNESCO world heritage and environmental values.

There have been proposals for a bridge over the Northern



Quark – but so far these have been rejected as too expensive and environmentally damaging.

Safety concerns for the increasingly intensive traffic through the narrow international strait has made Finland propose a TSS to the IMO. In addition to passing traffic, there is also some crossing traffic between Umeå in Sweden and Vasa in Finland, as well as leisure boating during summer.

The area has very a special natural make-up due to rising of the land. In 2006, the Finnish part of the Quark Archipelago was added as an extension to the UNESCO World Heritage Site of the High Coast in Sweden, which is located on the western shore of the Gulf of Bothnia.

The Finnish part is also made up of a BSPA, a Natura 2000 area and seal protected areas in addition to the UNESCO designation.

The Holmöarna archipelago in Sweden has been identified as an area of interest for wind power development. It is also a Natura 2000 site and a BSPA site for similar reasons as the World Heritage Site on the Finnish side.

There are herring fishing activities in the southern part of the area and many shallow areas have been identified as important spawning grounds. There are important fishing harbours close to Korsholm.

Area off the Rauma-Pori coast – an ecologically important area with many uses and interests

The offshore area between the waters north of the Åland archipelago and west of Pori is a hub of activity on the Finnish side, comparable to the bank area on the Swedish side.

The area is a route for intensive traffic to and from the important port Rauma and Pori. It also has commercial fishing, nature protection aims and wind power interests closer to the coast.

The new Bothnian Sea National Park, covering a 913km stretch of the pristine Satakunta outer archipelago, was established in 2011. Large-scale aquaculture installations have been mooted for areas outside the National Park.

An ecologically important feature in this part of the Bothnian Sea is upwelling, where wind circulation forces nutrient-rich water from lower down the water column towards the surface. This stimulates algae and may contribute to the high fish catches in the area.

Partly due to pressure from holiday home owners in the northern Archipelago Sea, offshore wind power has difficulty in gaining acceptance in the area. Dangerous dumped munitions and mines are known to litter the Satakunta coast.

Planning in Finland and Sweden

This chapter describes the present spatial planning regime in the two countries both at sea and on land. It considers relevant strategies and discusses possibilities for joint planning of the Bothnian Sea.

Introduction

Both Finland and Sweden have a planning regime in force for their territorial seas, but not for the EEZ.

For its territorial sea, Finland has a regime with both regional plans created by regional councils, and more detailed plans created by individual municipalities. In Sweden, planning of the coastal waters is carried out only at a municipal level.

In Sweden a government-appointed committee for MSP proposed a new law for national maritime spatial planning covering both the territorial sea and the EEZ. The newly-created Swedish Agency for Marine and Water Management (SwAM) in Gothenburg will have this planning responsibility, in close co-operation with county administrative boards and municipal authorities.

In Finland no concrete initiatives currently exist regarding spatial planning of EEZ areas. Decisions are made on a case-by-case basis using national laws implementing the UNCLOS. In addition to spatial planning laws and regulations, emerging MSP systems in both countries are also being shaped by national and regional strategies as well as EU directives.

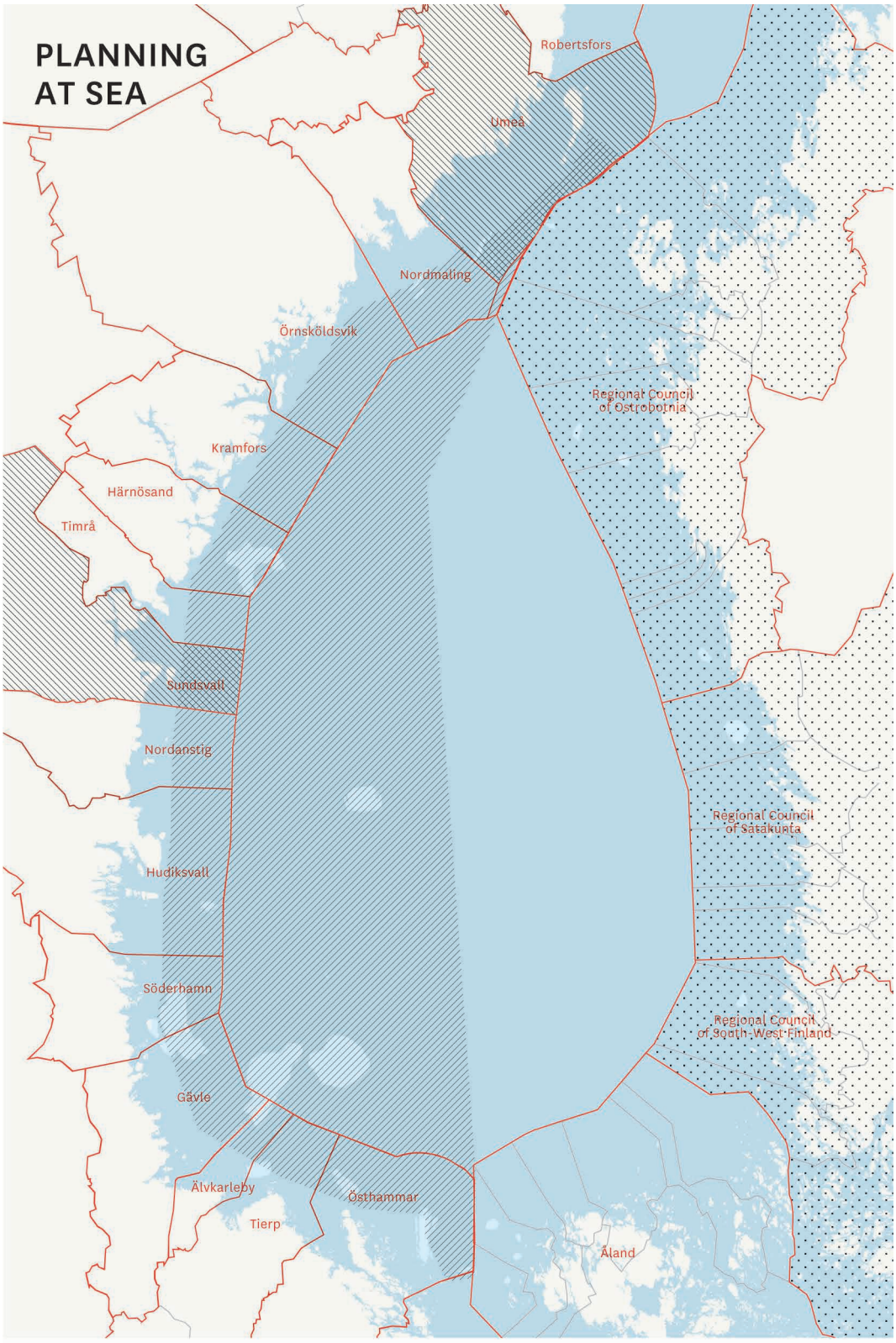
Existing maritime planning in Finland

Planning on land and on waters in Finland is based on the Land Use and Building Act. Municipalities and regional councils have the planning mandate for their adjacent marine waters up to the border of the territorial sea.

Regional councils have two main functions laid down by law: regional development and regional land use planning. There are 18 regions in mainland Finland, and the autonomous Åland Islands. Eight of the regions are coastal ones, made up of 70 municipalities in total.

Regional plans cover larger areas than municipal plans and are more strategic in character. In addition to regional priorities, they must also promote national interests. At the moment, nine coastal regional plans are under preparation, 15 coastal regional plans have already been ratified, and three coastal regional plans are awaiting ratification by the Ministry of the Environment. Municipal authorities draft more detailed and exact plans. No municipal plans have so far been drafted exclusively for marine areas but some plans have markings at sea.

In Finland, no form of planning legislation is in force in the EEZ and UNCLOS is implemented through Finland's national legislation. Decisions on construction and installations in the EEZ are made by the government.


PLANNING
AT SEA
Robertsfors
Umeå
Nordmaling
Örnsköldsvik
Regional Council
of Ostrobotnia
Kramfors
Härnösand
Timrå
Sundsvall
Nordanstig
Regional Council
of Satakunta
Hudiksvall
Söderhamn
Regional Council
of South-West Finland
Gävle
Älvkarleby
Östhammar
Tierp
Åland
Anticipated national
MSP planning (SWE)
Municipal plans with
MSP components (SWE)
Regional plans
(FIN)

Finland's land use planning system

The Finnish Land Use planning system

The Land Use and Building Act aims to: organise land use and building to create the basis for high quality living environments; promote ecologically, economically, socially and culturally sustainable developments; ensure that everyone has the chance to participate in open planning processes; guarantee the quality of openly publicised planning decisions and participatory processes, and finally to ensure that a wide range of planning expertise is available.

These objectives have been designed to help make living environments healthy, safe, attractive and socially functional, with the needs of different groups fully considered.

The land use planning system has three levels: the regional land use plan, the local master plan and the local detailed plan. In addition, the government defines national land use guidelines, which should be taken into account in all land use decisions.

The system is hierarchical, with higher level plans steering lower plans. Regional and local plans are drawn up through participatory planning procedures, which give local residents the chance to get involved in developments that affect them.

National land use guidelines

The national land use guidelines are a government tool to steer policy on land use issues that are important for the whole country.[41] They relate to regional and urban structure, the quality of the living environment, communication networks, energy supply, natural and cultural heritage and the use of natural resources.

The national guidelines ensure that issues of national importance are taken into consideration in regional and municipal planning and in the work of the state authorities; promote ecologically, economically, socially and culturally sustainable development and create conditions for a favourable living environment; act as a tool in local planning in issues of national importance and promote the consistency and uniformity of advance guidance all over Finland; promote the implementation of international agreements in Finland; and create a basis in terms of land use for the implementation of national projects.

Regional plans

Each of Finland's 18 regions is covered by a regional land use plan. These general plans set out medium-term and long-term objectives to guide regional development. The regional land use plan brings national land use goals to the local level.

Regional land use plans are drafted and approved by regional councils, whose members are representatives from municipalities. Individual citizens and non-governmental organisations are fully entitled to participate in the planning process. These plans are then submitted to the Ministry of the Environment, where the legality of the plans is assessed before final ratification.

When a regional plan is being drawn up, special attention is given to the following: regional and community structure of the

region; ecological sustainability of land use; environmentally and economically sustainable arrangement of transport and technical services; sustainable use of water and extractable land resources; operating conditions for businesses; protection of landscape, natural values, and cultural heritage; as well as sufficient availability of areas for recreation.

Regional land use plans are legally binding, but also leave scope for municipalities to resolve local issues. To ensure that regional land use plans provide suitable guidelines for the local level, they are reassessed and updated regularly.

Concerning land use planning in marine areas, a number of regional plans cover the marine territories of the Baltic Sea basin. Within the Plan Bothnia area, regional land use plans in Satakunta, Ostrobotnia and South West Finland extend into Bothnian Sea.

However, land use plans mainly cover areas close to the coast and include tourism development zones, strategic transport plans and potential wind power development areas.

Municipal land use plans

Finland's municipalities draft their own local land use plans – local master plans and local detailed plans.

Local master plans define land use patterns in general terms, allocating different areas for different uses such as housing, traffic, services and recreation. They may also control land use and developments in specific areas, such as along shores.

Local detailed plans determine the characteristics of local neighbourhoods, with locations and sizes of buildings, streets and parks defined in detail. Plans may cover whole residential districts or sometimes just a single property. Developments along shorelines may also be controlled under separate detailed shore plans.

Planning in Sweden

Like in Finland, Swedish municipalities cover the territorial sea out to the border with the EEZ.

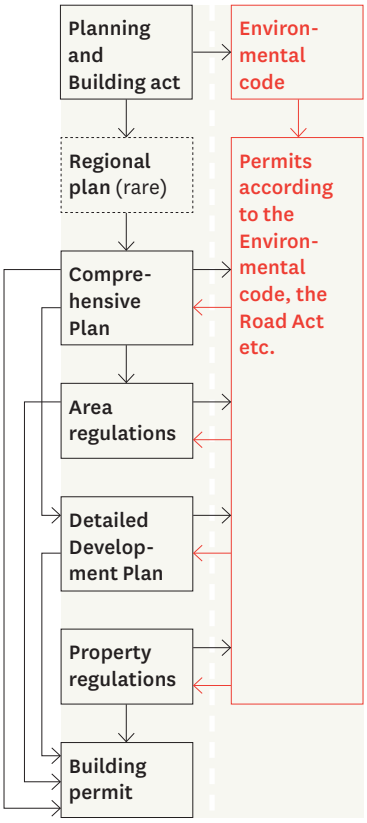
In addition to municipalities Sweden is divided to counties, where County Administrative Boards represent the central government. This system was abolished in Finland in 2009. Control of the Swedish territorial sea is divided between 14 counties and 80 municipalities.

Spatial planning is almost exclusively a municipal responsibility in Sweden. Legislation makes no difference between marine and land areas. Municipalities must have an obligatory comprehensive plan, which covers the whole municipal area, including its part of the territorial sea, but in practice, most plans leave sea areas blank. Only coastal waters are normally of interest for planning initiatives.

Plans covering several municipalities may be possible under certain conditions. So far, however, only the Stockholm region has been active in adopting regional plans that include marine areas.

Many areas along the Swedish coast, including areas at sea, are declared areas of regional or national interest and are given a special kind of protection.

Sweden's land use planning system



Like in Finland, no form of comprehensive planning legislation is in force in the EEZ and decisions on construction and installations in the EEZ are made by the government case by case.

A new MSP system to include the EEZ, however, has been proposed by a commission established by the Swedish government and could be in place by the end of 2012. SwAM will be responsible for MSP in both territorial sea and the economic zone.

Land use planning in Sweden

Spatial planning is the responsibility of local municipalities in Sweden. Planning is regulated by the Planning and Building Act from 1987, which was updated in 2011.

The main instruments are the comprehensive plan and the detailed development plan.

According to the Planning and Building Act, every municipality must have an up-to-date comprehensive plan covering the entire area of the municipality. For coastal municipalities, this plan covers automatically sea areas.

The comprehensive plan is not binding but should give guidance on the use of land and water areas. It should give direction for the long-term development of the physical environment, indicating how the municipality will take account of interests for use of land and water especially in areas of national interest, and follow the environmental quality standards set by the government.

Swedish municipalities are presently preparing their third successive comprehensive plans since 1987. Increasingly, these plans are evolving to become municipal development programmes that deal with housing supply, the development of business and industry, and with environmental considerations.

Only four municipalities have so far made scomprehensive planning efforts in their marine areas, but there is a growing interest in the sea. In the Bothnian Sea area, only the municipalities of Umeå and Sundsvall have coastal development plans extending into to the sea.

A detailed development plan is necessary for new buildings or constructions, if the building has a significant impact on its surroundings, and if it is the first building in an area that is under pressure to be developed.

If there is no detailed development plan, the municipality will assess the application using regulations in the Planning and Building Act and the intentions in the comprehensive plan.

A detailed development plan shows which areas are to be used for buildings, streets, roads, public places for parks, as well as protected areas. For buildings, the permitted use and extent of the use have to be stated.

The detailed development plan has an implementation period of a minimum of 5 years and a maximum of 15 years. During the implementation period, economic rights granted in the plans, such as the right to build on your land, are protected. A detailed development plan can be adopted for constructions in small areas at sea.

In order to secure the aim of the comprehensive plan or provide for

a national interest, one-off regulations may be adopted for areas not covered by a detailed development plan. Such regulations can also be used for areas at sea.

Areas of national interest

National guidelines for the management of land and water areas were codified in the Natural Resources Act of 1987. The regulations of that act were included in the Environmental Code, which was adopted in 1998 and amalgamated 15 environmental acts in to one system.

The Environmental Code aims to promote sustainable development and acts as overarching legislation for different laws on the use of land and water. The Code has provisions on managing areas of public and national interest, which have to be taken account of in planning decisions.

There are, then, strong links between the Planning and Building Act and the Environmental Code and these laws form the legal basis for spatial planning in Sweden.

Chapter 3 of the Code covers requirements for nature protection, cultural heritage, transport such as shipping, mining, and national defence. These areas are defined following a consultation process between state authorities, county administrative boards and municipalities.

Chapter 4 of the Code has requirements for large geographically-specified areas of national interest with high natural values, cultural heritage and recreation. These areas have been specifically decided on by parliament. They include large parts of the Swedish coastline as well as vast mountain areas in northern Sweden.

These requirements can be seen as national guidelines for municipal planning for land and sea. Municipal detailed development plans can be overruled by the state if they do not respect these areas of national interests.

Areas of national interest
Sweden has a special system of national interest areas. These areas, defined through administrational consultation (Chapter 3 areas) or by parliamentary decisions (Chapter 4 areas) highlight issues of national importance for municipal planners.

Proposal for a new Swedish MSP system

The Commission on Marine Spatial Planning proposed a new system for national planning of Sweden's sea areas and an MSP Act in its report *Planering på djupet*.[42]

The proposed act states that plans should cover each of the following three areas – the Gulf of Bothnia, the Baltic Sea main basin and the western seas area consisting of Skagerrak and the Kattegat. This covers all Swedish waters seawards from a line 1nm outside the baseline including the Swedish EEZ.[43]

Fundamental to the proposed system is using an ecosystem planning approach. This means the structure and functioning of ecosystems and their ability to provide societies with goods and services must be maintained, or restored where necessary. The entire ecosystem in a regional sea must be considered, so co-operation with bordering states is essential.

MSPs will mostly target national and municipal authorities, and should be applied when examining applications for licenses and permits, or deciding on any measures concerning the sea. The MSPs

will also set the framework for planning in sea areas.

Detailed specifications for certain areas will be an integral part of each plan. This means that there will be a single plan for each planning area, and all amendments will be made in this context. SwAM will become responsible for the planning process with the assistance of government offices in all the counties along the coast. There will be one designated regionally co-ordinating county for each planning area.

All agencies and municipalities will have a responsibility to provide basic planning data, and be involved in ongoing consultations with all interested parties while the plan is being drawn up.

When the consultation process has been concluded, a final proposal for a marine spatial plan will be made available for public scrutiny. SwAM will then submit the proposal for government adoption. SwAM is responsible for following up the plans, keeping them updated and, at least every four years, deciding whether they need to be replaced.

The commission also proposed that Sweden should make use of the powers provided by the UNCLOS to introduce a so-called contiguous zone within the EEZ. A contiguous zone is a band of water out as far as 24nm from the baseline, within which a state can exert limited control.

The Government appointed a commission in 2011 to review its marine boundaries and to explore the possibility of a contiguous zone. New legislation based on the proposals from the MSP commission is expected in 2012.

Swedish regional strategies and programmes

In comparison with Finland, regional planning in Sweden is relatively weak. County administrative boards, county councils or regional development councils are responsible for regional plans and strategies, but these focus on mainly on strategic development, rather than land use.

The regional plans are not legally binding and do not have any formal mandate to control land use development. They guide and co-ordinate comprehensive planning between municipalities.

In Plan Bothnia area, the regional development councils of Uppsala, Gävleborg and Västerbotten are responsible for co-ordination of regional development. In the region of Västernorrland, the county council is main co-ordinator of regional development planning.

Regional development plans address the goals, priorities and challenges of the region and outline strategic policies, such as economic development, sustainable development and infrastructure development.

There is strong focus on infrastructure investments and the tourism industry, as can be seen in the Gävleborg region, where there is emphasis on the development of Gävle as a logistical centre. Maritime development is only covered briefly.

There are also a number of sectoral plans at a regional level but none are focused on maritime development.

National environmental strategies in the Bothnian Sea

Besides the national guidelines for the land use system in Finland and Sweden, there are a number of other important national objectives to take into consideration in a MSP planning process.

From a Swedish perspective, environmental objectives adopted by the Swedish parliament are an important framework for ensuring sustainable development and a clean environment, both on land and at sea.

There are 16 environmental objectives to be achieved by 2020, including emphasising biological diversity and that recreational and industrial uses of the Baltic Sea must be developed sustainably alongside its natural and cultural assets.

Another of the objectives key for maritime use is to ensure nutrient levels in soil and water do not adversely affect human health, and the conditions for biological diversity or the possibility of varied use of land and water are not harmed.[44]

Finland adopted a programme for protecting the Baltic Sea in 2002. Six action areas were defined, including combating eutrophication, reducing the risk of dangerous substances, curbing damaging use of the Baltic Sea, preserving biological diversity, and increasing environmental awareness.

County / Region	Regional Plans and strategies (examples only)	Targeted marine related regional strategies and municipal plans (examples only)	Sectoral regional plans and strategies (examples only)
Southwest Finland	SW Finland Regional Land Use Plan 2030 Regional Programme 2011-2014	Archipelago Programme 2011	Tourism strategy Plan for Southwest Finland Traffic system - Traffic Strategy 2030
Satakunta	Satakunta Regional Land Use Plan Regional Programme 2011-2014		
Ostrobothnia	Ostrobothnia Regional Land Use Plan Regional Programme 2011-2014	River Basin Management Plan for Kokemäenjoki – Archipelago Sea-Bothnian Sea	Ostrobothnia regional phase plan for renewable energy Österbotten Turism
Åland	(no regional planning)		Program of actions for Åland's coastal, surface- and groundwaters 2009-2015 Traffic Plan for Lanscape of Åland 2003-2010
Uppsala	(no regional planning) Regional Development Programme for Uppsala County 2008		Tourism strategy under development County Plan for Regional Infrastructure 2010-2021
Gävleborg	(no regional planning) Regional Development Programme for Gävleborg County 2009-2013.		Development project for tourism industry in Gävleborg County 2011-2013 County Plan for Regional Infrastructure 2010-2021
Västernorrland	(no regional planning) Regional Development Strategy – County Council Västernorrland 2008-2013	BSPA Höga kusten Coastal Plan Sundsvall	Sustainable tourism in Västernorrland 2008-2015 (project) Regional Transportation Plan Västernorrlands County 2010-2021
Västerbotten	(no regional planning) Regional Development Programme for Västerbotten County 2007-2013	Strategy for protection and of marine and coastal environmenta in Västerbotten County 2008; Bottenvikens Archipelago Strategy; Umeå coastal plan	County Strategy For travel and tourism for Västerbotten County Regional Transportation Plan for Västerbotten County 2010-2021

European and regional initiatives

The European Maritime Policy is an overarching EU document on marine issues.[45] It highlights MSP as a tool for both the restoration and environmentally sustainable development of European seas, as does the EU MSP roadmap.[46] The EU Strategy for the Baltic Sea Region (EU 2009) includes MSP as a so called 'Horizontal Action', which means it targets all fields of policy.[47]

The EU Marine Strategy Framework Directive, which aims to achieve the good environmental status of European seas by 2020, names spatial and temporal distribution controls among measures to be considered in its Annex VI.[48]

Regional dialogue on MSP among the nine Baltic countries and the EU has recently taken place within HELCOM, the implementing body of the Convention on the Protection of the Marine Environment of the Baltic Sea Area[49] and VASAB, the regional co-operation body of spatial planning ministries. In 2010 these two organisations merged their activities and established a joint HELCOM VASAB MSP working group. As a starting point the group members adopted a joint set of principles on MSP (see Annex).[50] The Plan Bothnia project is a test of these Baltic and EU-wide principles on MSP.

Beyond HELCOM and VASAB, the Nordic Council of Ministers, the organisation for governmental cooperation between Nordic countries, has carried out work on MSP and has established a working group for MSP.

Prospects for joint MSP in the Bothnian Sea

Concludingly, how to include the sea in spatial planning is still being discussed in both Finland and Sweden. It is nevertheless possible to outline how a maritime plan for a joint sea area like the Bothnian Sea could become a reality.

In both Finland and Sweden, the territorial sea is not simply an undivided area controlled by the state at a national level as it is in most other European states. When it comes to spatial planning, the territorial sea belongs to coastal regions and municipalities. Both Finland and Sweden have a planning regime that applies to the territorial sea.

Both Finland and Sweden lack a comprehensive spatial planning regime for the EEZ. Permits for activities in the EEZ are granted based on acts on the EEZ and in Sweden, also on an act for the Continental Shelf. Sectoral ministries or agencies are responsible for planning of individual issues such as maritime traffic, fisheries and military activities.

Both countries have their own systems for safeguarding national interests in municipal planning and in Finland, this also occurs in regional planning. In Finland, regional planning covering large areas of the territorial sea is already possible.

Although both Finnish and Swedish coastal municipalities are obliged to have plans covering their stretch of the territorial sea, most plans lack specific marine regulations.

Forthcoming Swedish MSP legislation will introduce national

maritime plans that cover the territorial sea as well as the EEZ for three parts of the Swedish sea area. The Swedish part of the Bothnian Sea will be included in the national plan for the Gulf of Bothnia. Sweden will then have one national plan covering the whole territorial sea and also the 14 municipal comprehensive plans. The territorial waters of Finland will be covered by three regional plans and also the plans of Åland.

The Finnish regions must co-operate closely if their respective regional plans are to form a coherent plan for all of Finland's territorial waters in the Bothnian Sea and match up to the future Swedish plan. Finnish regional planners do have practical expertise in planning large areas that could be valuable when developing the Swedish national plan for the Gulf of Bothnia.

The proposed Swedish MSP legislation envisages a national maritime plan that is comprehensive across the territorial waters and the EEZ, and does not single out a particular area. This planning system for the EEZ could also be a point of reference for developments of MSP for the Finnish EEZ.

A common transboundary maritime plan for the Bothnian Sea could have the same kind of recommendations and regulations for both the Swedish and Finnish parts that can be interpreted according to each nation's legal system.

V: Plan Bothnia

A pilot maritime plan for the Bothnian Sea.

The plan

Having assessed present activities and future scenarios in previous chapters, this section provides a draft plan of the Bothnian Sea. It was developed and discussed jointly by a group of Finnish and Swedish participants (see Annex). The map is followed by draft recommendations for certain designated issues.

This is not meant to be a definitive plan, nor even an authorative proposal. It aims simply to stimulate discussion around what a transboundary plan of the Bothnia Sea could look like and which elements it could include.

Planning area and timescale

The planning area includes offshore Bothnian Sea waters 1nm from the baseline. As appropriate, the plan also includes information on activities in nearby coastal waters.

By focusing on offshore areas, the plan offers a new dimension to both Finnish and Swedish planning systems. The area includes both Finnish and Swedish territorial sea and the EEZ.

Timewise, the planning horizon is around 15 years.

Vision

The Bothnian Sea lacks long-term comprehensive planning across the Finland-Sweden border. As a result, there is a danger that offshore developments within this shared sea basin will be carried out in an unco-ordinated way.

The plan aims that as a result of long-term transboundary co-operation, the Bothnian Sea remains a place of unique natural beauty where human activities take place without damaging the Sea's ecological status, contribute to combating global climate change and enable communities in the region to prosper.

This vision should be implemented by six objectives covering ecosystem integrity, protected areas, maritime traffic, renewable energy, fisheries as well as regional development.

Creating a framework for a healthy ecosystem

Although industrial needs are important, the overall objective is to obtain the healthy status of the entire Bothnian Sea ecosystem and to preserve and strengthen its ecosystem services.

Safeguarding maritime traffic

The volume of goods transported by shipping in the Bothnian Sea is expected to increase in the coming decades. Sustainable transport systems demand a large part of land transports move to the sea. Possibilities for increased shipping should be secured, including the development of ports. Where ever possible ships should be allowed to travel the shortest possible route.

Designating areas for sea-based energy

Without compromising the ecosystem and taking in to account the affect on the visual landscape, the potential for sea-based energy production should be utilised. So far, this mainly involves wind power. The ambition is to reach a Bothnian Sea production capacity of 5-10TWh before 2020, developed in an ecologically and aesthetically-responsible way. To preserve the natural values of untouched banks and other areas, and to avoid harm to wildlife such as migrating birds, building on offshore banks should be minimised, by clustering wind farms into larger units and directing them to deeper waters. The environmental harm of cables and their laying should be minimised.

Maintaining spawning, nursery and fishing areas

The ecological sustainability of commercial fishing should be promoted. Management actions should be taken to ensure the preservation of viable herring stocks and other fish species of commercial value. Actions should also be taken to avoid negative effects to the ecosystem, including the destruction of habitats, and the release of toxins and nutrients from seabed. Important fish spawning and nursery areas should be protected.

Ensuring a network of offshore nature protected areas

Offshore areas in the Bothnian Sea identified as especially ecologically valuable should be designated as protected areas with efficient management measures, including Natura 2000.

The sea and coastal communities

In the areas close to the shore and also in offshore areas, importance should be given to uses and activities that benefit coastal communities -such as local small-scale fishing and aquaculture, tourism and recreation.

Guidelines for areas referred to on the plan map

Nature protection, Natura 2000
Area with high natural value. The entire area or a large part of it belongs to the EU Natura 2000 network. Areas off the Finnish coast also to a maritime national park. **RECOMMENDATION:** *Natura 2000 values should be protected and activities harmful to these values should not be allowed. The National Park regulations must be followed.*

Nature protection and wind power
Shallow banks of high ecological value and conditions for wind power. Part of Finngrundet has sand and gravel extraction interests, but this would be harmful to its natural/ecological values and wind power interests. **RECOMMENDATION:** *Natural values should be protected. Shipping and fishing harmful to these values should not be allowed. New activities that could significantly harm the possibilities for wind power in the area should not be permitted.*

Nature protection, other
Area with high natural and ecological value that should be protected. **RECOMMENDATION:** *The biological and ecological conditions that create its high natural values should be protected. Activities harmful to these values should be made to avoid the area.*

Important fishing area
Area identified as of particular importance for commercial fishing. **RECOMMENDATION:** *The possibilities of sustainable fishing should be ensured. The conditions that are fundamental to its natural values and rich fish stocks should not be harmed.*

Potentially high natural value, spawning and nursery area
Area of particular significance for spawning or nursery of fish. Due to the shallowness and varied seabed, the area is expected to be of higher natural/ecological value than most of the Bothnian Sea. **RECOMMENDATION:** *The area's qualities for spawning of fish should be preserved. The effects of new activities on the area's values should be assessed, harmful activities should be avoided. Existing activities such as fishing should be performed in a way that does not harm.*

Potentially high natural value
Due to the relatively shallowness and varied seabed conditions the area, particularly the banks, could be expected to be of higher natural value and biodiversity than most of the Bothnian Sea. **RECOMMENDATION:** *The natural and ecological values in the area should be preserved. New activities should not be allowed unless their environmental effects have been assessed. Existing activities such as fishing should be performed in a way that is not harmful.*

Valuable geology and landscape view from land
An important part of UNESCO High Coast World Heritage is that the views from the high coastal cliffs are free of visible constructions. **RECOMMENDATION:** *Permanent constructions that could be visible from land and harm cultural values should be avoided.*

Military practice area
Area used for live ammunition practice by the military. **RECOMMENDATION:** *The area should be protected against uses that can significantly harm its use for military purposes.*

Shipping route
Recommended route for commercial shipping. **RECOMMENDATION:** *Constructions, activities and other measures that would hinder passage should only be allowed if the measures are of great importance for society and if no other acceptable place can be found.*

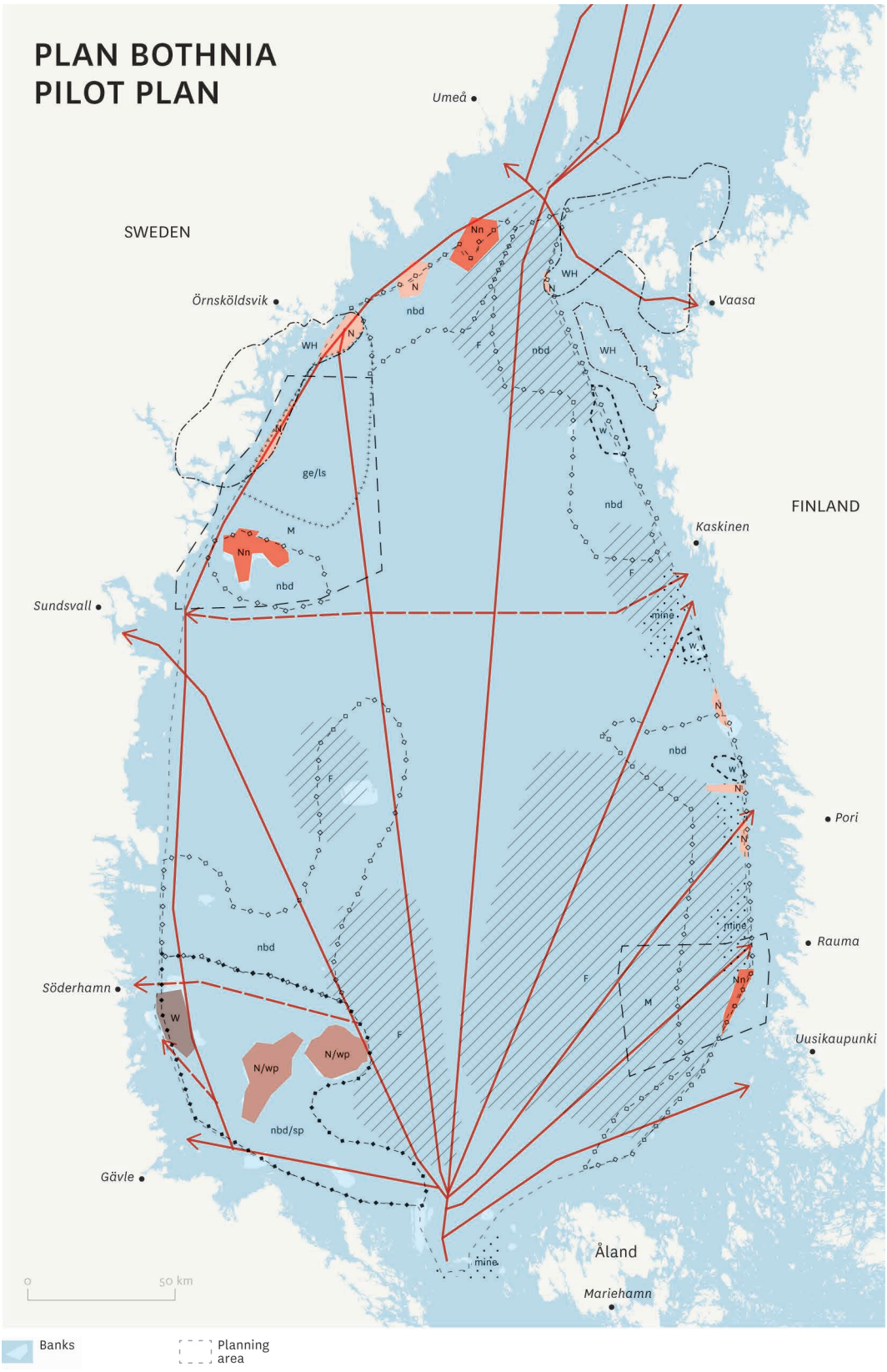
Future shipping route
Future potential fairway for cross-Bothnian shipping. **RECOMMENDATION:** *Measures that could prevent the establishment of the route should be avoided.*

Mine/dumped ammunition risk
Site where mines or other kinds of ammunitions have, or are supposed to have, been dumped. **RECOMMENDATION:** *Activities that could lead to risks of explosions should be avoided, or carried out with great caution.*

World heritage
Area in the UNESCO World Heritage list, mainly coastal. **RECOMMENDATION:** *When granting permission for new activities and measures, within or close the area, the impact on world heritage values should be assessed. Activities and measures that could harm world heritage values should not be allowed.*

Wind power
Area for wind power production. The area is also of relatively high natural value. **RECOMMENDATION:** *Activities and measures that could harm wind power production should not be allowed. Natural values should be preserved as far as possible.*

Good wind power conditions
Area with good wind power production conditions. **RECOMMENDATION:** *Activities and measures that could harm the potential to use the area for wind power production should not be allowed.*


PLAN BOTHNIA
PILOT PLAN
Umeå
SWEDEN
Örnsköldsvik
Vaasa
FINLAND
Kaskinen
Sundsvall
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Planning area

Reflection on impact assessment

According to the EU's so-called Strategic Environmental Assessment (SEA) directive (2001/42/EC),[51] an environmental assessment should be carried out for plans and programmes that are likely to have significant environmental effects. The SEA protocol of UNECE's EIA convention, also called the Espoo convention, has the same requirements. Both Sweden and Finland have implemented the directive and ratified the protocol.

The SEA directive only concerns plans that meet certain criteria, such as those being prepared or adopted by an authority and being required by law or administrative provisions. Both existing Finnish regional and municipal plans and Swedish municipal plans fall under these criteria, as do Sweden's proposed new national MSP plans.

SEAs must also be prepared for certain sectors such as fisheries, town and country planning, or land use. They must also set the framework for the consent of future development projects listed in the annexes to the EIA directive (85/337/EEC).[52]

Even though maritime planning or maritime uses are not specifically mentioned in the directive, it is likely that any maritime plan will fall under this stricter criteria. A maritime plan will certainly set the framework for the consent of future development projects such as those mentioned above. In addition, environmental effects also include positive effects, which makes it even more likely that an environmental assessment will be deemed necessary for a maritime plan.

The SEA directive has for many years been implemented in Swedish and Finnish legislation and its application has become an accustomed procedure for planners. Performing an environmental assessment for a maritime plan covering new areas and dimensions for planning will be a challenge, however. New concepts and methods will be needed.

Carrying out an environmental assessment means preparing an environmental report and performing consultations, including with other states. The results of the report and the consultations then inform the adoption of the plan. In comparison to a traditional land use plan, a maritime plan should not pose any particular problems in these respects, save for the environmental report.

Due to time limitations and because this project was only tentative in its nature, it was not possible to carry out a proper environmental assessment. Some vital elements, however, were considered, which we explain further below.

Significant environmental effects

The environmental report should include a description of the likely significant environmental effects of implementing the plan and reasonable alternatives. These effects should concern broad issues such as biodiversity, population, human health, and climatic factors, but also material assets and cultural heritage.

Applying the ecosystem approach, as has been tentatively done in this project, should mean that the conditions for biodiversity, flora and fauna and the effects of various uses on these factors have been considered, depending on the level of knowledge concerning each issue. The earlier chapters comprise such assessments, which would have been more substantial if this project had been a real planning initiative.

The recommendations on wind power probably comprise the most significant environmental effects, not only in terms of the transformation of the marine landscape but also on marine habitats. If there had been better knowledge of the effects of wind power on migratory birds, more detailed recommendations for different areas would have been possible.

Assessing effects on the human population generates a special difficulty in MSP, as the planning area is uninhabited. Social impacts – largely meaning economic factors and job creation – could be envisaged for people working in the fishing, shipping, wind power, aggregate extraction and tourism industries. It would not be easy to assessing the effects of the plan on these areas. Furthermore, the directive does not require an economic impact assessment.

On the other hand, the effects from wind power installations near the coast on second-home owners would be easier to assess.

We should describe the relevant aspects of the environment and its future if the plan is not implemented, the so-called 'zero alternative'. With this plan, the most likely effect would be that the ad hoc and unco-ordinated granting of permits for offshore wind power developments would continue and could result in too many installations in shallow and environmentally sensitive sea areas.

Possible alternatives to the plan could either be a more restrictive approach in designating areas of potential natural value, concentrating on the most sensitive areas. It could alternatively take a more extensive approach and assess all the area of the Bothnian Sea, designating it for various uses. Other alternatives could be to have a more restrictive attitude to wind power, or to pose more restrictions on shipping in environmentally sensitive areas.

On consultation

Proper consultations as per the requirements in the EU's SEA directive were understandably not possible given the limited time available and the pilot nature of this initiative. Immediate and open access to all meeting and process documentation, including document drafts, has, however been ensured for all interested parties.

The active participation of representatives from Sweden and Finland, including the Swedish County Administrative Boards and the Finnish Regional Councils, in this process grounded it in the day-to-day work of the national administrations. Swedish municipalities were also explicitly requested to directly comment on a sketch of the draft plan, even if the timetable allowed only a two-week commenting period. The other Baltic Sea states have also been informed on several occasions within the regional HELCOM-VASAB working group.

A transboundary maritime planning exercise such as this will automatically include consultations between the two countries directly involved. According to the directive and the protocol, transboundary consultations should also be performed with other EU member states or parties to the protocol if they are likely to be significantly environmentally effected by the plan, or if they request such consultations.

There are established procedures for these consultations and Sweden and Finland have developed an efficient system of co-operation. In a real transboundary planning exercise for the Bothnian Sea, both countries would have approached the other Baltic Sea states in the very early stages and kept them informed during the entire process. At the end of the process, they would have engaged in formal consultation on the draft plan at the same time as formal national consultation had taken place.

Conclusions

All in all, although a maritime plan using an ecosystem approach in itself would require a systematic inquiry into the environment and the ecology of the maritime planning area, a separate description of the different steps and choices made in the planning process is necessary in order to produce a satisfying environmental report.

Proper involvement of relevant stakeholders and the public at an early stage in the planning process would be helpful for adequate and effective consultations. The challenge will be to raise interest in marine issues and to consolidate the vision and aim of the plan.

VI: Lessons learnt

Time to reflect

The Bothnian Sea pilot planning initiative described in this book illustrates how two countries, in a joint planning effort for their shared sea, can assess planning conditions, formulate a vision and draft a common plan that could, in theory, be legally operational in both countries.

The function of planning as a tool for identifying and solving acute conflicts between various maritime uses has often been highlighted. However, its strategic role as an activity where the public sector lays down guidelines for the future use of larger sea areas is perhaps more crucial for the long-term sustainable development of the sea. This is especially important for areas like the Bothnian Sea where the pressure from different uses is currently low, but is expected to intensify in the future. Some indications on likely developments can be seen in the material presented in this book.

This most acute issue in the Bothnian Sea is, as in many other seas of the world, wind power installations. The scale of these developments and their fixed nature makes them different from most other uses of the sea.

All large, shallow offshore areas can expect to be the subject of interest from wind power installations in the near future. These are used by other interests and at the same time have high ecological values as near-pristine underwater environments.

The possible expansion of wind power is a good example of an issue that should be considered on the scale of the whole basin. The combined effect of all such developments in the basin might influence the whole ecosystem, beyond the perspective of individual permit applications.

As the book tries to demonstrate, an important starting point is to describe and visualise important issues taking place offshore in transboundary sea areas such as the Bothnian Sea. Without such information, the general public or even civil servants have little chance to reflect on, and form opinions about, offshore planning issues.

Based on our experiences, transboundary planning seems possible and also serves an important purpose, through awakening interest in, and forming joint goals on, the future of shared sea basins like the Bothnian Sea.

Transboundary planning

The planning excersise described in this book was an EU-funded pilot and did not aim for a politically adopted plan. It was carried out to provide a test case of transboundary MSP that would inform European processes, as well as test a set of regional principles developed through Baltic Sea intergovernmental co-operation on MSP (under HELCOM&VASAB).

However, in the case of a transboundary plan that is aiming for political adoption, it is naturally crucial to establish which authority is responsible for this kind of joint transboundary plan, and who will adopt it. As an example, if a joint maritime plan is decided upon by

both governments, it could potentially be a strong document giving directions to respective national authorities.

In this kind of scenario, a common transboundary plan must be based on the governance structure of both countries and formulated in such a way that it is possible to either directly, or via corresponding plans in either country, lay down legally effective recommendations or regulations.

Each country may find they have to transpose common recommendations for certain sea areas into more detailed regulations in their own national plans covering the sea area. Regulations forbidding wind power installations or sand or gravel extraction in certain sensitive areas are relevant examples.

Issues such as the management of fisheries and shipping are highly dependent on regulations based in EU or international legislation. Depending on the governance structure of the plans involved, however, it might be possible for an MSP to influence such policies.

Discussion on why a joint plan is needed and what issues should be treated in the plan would be helped considerably if there is a clear notion of the conceivable function of the final plan. To have a shared understanding of this will prove very useful, saving time and resources when embarking on a joint MSP exercise

In practical terms, the differences in planning traditions and practices also play a role. In our Bothnian Sea case this was visible in, for example, the different ways professionals from the two countries used planning markings. Due to the central role of municipal planning in Sweden, Swedish planners are perhaps more accustomed to exact definitions. The larger geographic areas covered by Finnish regional planning, and the need to leave some flexibility for interpretation at a municipal level, seemed to foster a more general, strategic approach. Still, participants from Sweden and Finland agreed on planning regulation and markings as included in Part V.

It could also be discussed as to whether an approach like the Finnish land use guidelines, which are in written form rather than map based, would in some cases be more suitable than a map-based plan for some offshore MSP initiatives. Another option would be to start with an overview of the facts, followed by a joint strategy, and after this reconsider the need for a full joint MSP approach.

Another important topic is the full implications of implementing the ecosystem approach, or the role of nature conservation issues in general. The limitations of this particular Bothnian Sea initiative, in terms of available time and resources, left many questions open for further national and international initiatives. However, in-depth consideration of these issues are fundamental for a meaningful discussion on the needs and effects of MSP.

Information

All planning tasks start by gathering information on the planning area as it is necessary to identify, describe and visualise issues that might be essential for planning. With such information it is possible to start formulating objectives, and recommendations for reaching these.

Information on many maritime issues is often scarce, meaning maritime planning needs a long preparatory phase where accurate information on offshore areas is gathered and processed into an understandable format. In terms of the substantial working phase, this pilot planning process was completed during a one year period (March 2011-March 2012), which limited the possibilities for detailed analysis. A real planning process would naturally have required a more comprehensive approach.

There is an obvious danger that only those issues where information is ready, abundant and of good quality are highlighted in the planning process. These include human activities such as wind power, fisheries and shipping. Information on ecological features and many other topics is generally much less comprehensive, requiring a precautionary approach.

Openly accessible public data on transboundary maritime issues is a prerequisite for a participatory offshore planning initiative. In terms of basic regional data sets, this initiative started off with material available from HELCOM's GIS service. This open transboundary data infrastructure greatly helped our pilot Bothnian Sea process, as national datasets remain closed, or are limited by national borders.

Direct involvement of interest groups and NGOs, not only the authorities concerned, may be especially vital for guaranteeing a solid and comprehensive assessment of important maritime issues. All efforts must also be made to stimulate interest and involvement by the citizens, general public. Even if formal public consultations were not held, the project engaged the public with a website, www.planbothnia.org, containing a sourcebank of all materials and a blog of the project's progress. Updates were also posted on the social networking site, Twitter.

MSP principles and the Bothnian Sea pilot plan

One of the aims of the initiative was to test two sets of MSP principles in a practical case study. One set, of general European applicability, was released by the EU in 2008.

Another set, more detailed and Baltic Sea specific, was developed within the Baltic Sea intergovernmental co-operation on MSP (HELCOM&VASAB). The previous chapters should cover most of the issues highlighted in these principles. Nevertheless, some summary notes of the application of these principles are highlighted in the table below. Finally, some suggestions for monitoring and evaluation are provided in an Annex to this book.

Epilogue and acknowledgements

We hope that this book is only the starting point for a wider dialogue on maritime spatial planning of the Bothnian Sea offshore areas. With the material collected here, future initiatives should have an easier time taking planning to another level.

Many people have helped the initiative along the way. We are especially grateful to our contacts at the Swedish and Finnish Ministries -Tiina Tihlman (Ministry of the Environment, Finland) and Sten Jerdenius (Ministry of the Environment, Sweden). Without your

contribution from the beginning to the end we would not be here today.

Many people have also helped with crucial details: Martti Hario, Leif Nilsson, Jannica Haldin, Michael Haldin, Jari Setälä, Timo Halonen, Orian Bondestam, Linda de Hertogh, Jouni Leinikki, Raimo Parmanne, Jukka Puro, Ali Lindahl, Markku Nousiainen, Participants of the Plan Bothnia Stakeholder events (Helsinki 27. Sep 2011 & Riga 6. Feb 2012) and participants of our session during HELCOM/OSPAR/ICES MSP workhop, Lisbon Nov 2011. Kaj Myrberg, Jouni Vainio, Martin Isaeus, Jouni Hiltunen, Anne Christine Brusendorff, Juha-Markku Leppänen, Lars Nordström, Lars Backer, Berit Ahlbäck. Christer Bengs, Kaisa Schmidt-Thomé, Jan Ekebom, Hanna Paulomäki and all the people we have not remembered at this moment.

The Editors

EU 10 MSP principles. See COM (2008) 791 Final	**Baltic MSP principles (HELCOM-VASAB). See minutes of HELCOM HOD 34/2010**	**Implementation in the Bothnian Sea MSP trial (Plan Bothnia)**
	1. Sustainable management	The aim and purpose of the plan is to create a base for the sustainable management of the Bothnian Sea.
Ecosystem approach	2. Ecosystem approach	The aim of the plan is to ensure good status of the ecosystems. The plan has recommendations for protection of large areas of high ecological value.
Precautionary principle	4. Precautionary principle	Several recommendations express precaution concerning areas with ecological and natural values.
1. Using MSP according to area and type of activity	9. Planning adapted to characteristics and special conditions at different scales	The plan addresses the whole Bothnian Sea with targeted information and planning. Specific sub-areas are highlighted where more detailed planning is needed.
2. Defining objectives to guide MSP	3. Long-term perspective and objectives	Long-term aims including a vision and six implementing measures were formulated and guided the drafting of the plan.
3. Developing MSP in a transparent manner	5. Participation and transparency	Concerned national and regional authorities were active in the planning process, the documentation of which has been openly accessible through a constantly updated targeted website. Two public international stakeholder meetings have been held.
4. Stakeholder participation	5. Participation and transparency	See above
5. Co-ordination within member states – simplifying decision processes	Transboundary issues only	The aim of the plan is to prepare for coherent transboundary public sector views of developments in offshore areas.
6. Ensuring the legal effect of national MSP	Transboundary issues only	The draft plan is not meant to be adopted but is based on existing and forthcoming legal frameworks.
7. Cross-border co-operation and consultation	7. Transnational co-ordination and consultation	This planning exercise has been a successful test of transboundary co-operation in maritime planning.
8. Incorporation monitoring and evaluation in the planning process	10. Continuous planning	This pilot plan gives valuable input for ongoing municipal and regional planning in both countries, as well as future MSP developments.
9. Achieving coherence between terrestrial and maritime spatial planning – relation with ICZM	8. Coherent terrestrial and maritime spatial planning	The pilot plan is based on conditions and developments in coastal areas (e.g. regional plans) and correlated with these.
10. A strong data and knowledge base	6. High quality data and information basis	Releveant and up-to-date information on the Bothnian Sea and surrounding region has been created, collected and used.

VII: Annexes

Kick off
Stockholm
13 participants
Plan Bothnia partners meet for the first time
Dec 2010

→

1st meeting
Pori
23 participants
Status quo and prospects for planning
March 2011

→

2nd meeting
Uppsala
24 participants
Background information and central topics
June 2011

Annex 1: The Plan Bothnia project process

This book and the material it relies on were produced by the Plan Bothnia project, which tested transboundary planning between two participating countries, Finland and Sweden, during the period December 2010 to June 2012.

The lead partner, responsible for overall co-ordination and implementation, was the HELCOM secretariat. Six partners provided expertise and background material within their specific fields: Nordregio on the socio-economic dimensions, the Swedish University of Agricultural Sciences on fishing, the Finnish Environment Agency, SYKE, on environment, the Turku University Centre for Maritime Studies on sea traffic, and the Swedish Board of housing, building and planning on spatial planning. The VASAB secretariat provided its own expertise on regional development in the Baltic Sea.

During the period from December 2010 to March 2012, the project held five working meetings, in which around 20 groups from Finland and Sweden participated. These included a number of regional authorities from Sweden (County Administrative Boards) and Finland (Regional Councils but also Centres for Economic Development, Transport and the Environment).

In addition, national agencies and ministries responsible for matters such as shipping, energy, defence and fisheries, also actively attended the

3rd meeting
Helsinki
29 participants
Areas of special interest
October 2011

4th meeting
Stockholm
18 participants
Draft plan
January 2012

5th meeting
Vaasa
20 participants
Plan, publication and follow-up
March 2012

meetings (see inner cover pages for a list of participants). All those involved were chosen with support from Finnish and Swedish national ministries responsible for planning.

MSP meetings

The first meeting (March 2011, Pori, Finland) looked at the situation and prospects for planning marine areas in Finland and Sweden, as well the existing features of the Bothnian Sea.

The second meeting (June 2011, Uppsala, Sweden) discussed background information suggested by the first meeting. Maritime traffic, wind power developments, environmental protection and fisheries emerged as central topics.

The third meeting (October 2011, Helsinki, Finland) reassessed the background material and identified areas of special interest for specific fields.

The fourth meeting (January 2012, Stockholm, Sweden) focused on plan drafts developed by the project participants.

The fifth meeting (March 2012, Vasa, Finland) finalised the draft plan and this publication, proposed monitoring, follow-up procedures, and discussed conclusions and lessons learned.

Public interaction

The project also organised three events for the public. The first was a mid-project information event in Helsinki, Finland, in September 2011. The second was a Baltic Sea regional discussion event in Riga, Latvia, in February 2012.

The final conference was held on 23 May 2012 in Gothenburg, Sweden. In addition, on 22 May, a joint session with Plan Bothnia's sister project in the North Sea, MASPNOSE, was arranged at the European Maritime Day conference in Gothenburg.

The project also engaged the public on an ongoing basis, with a website, www.planbothnia.org, containing a sourcebank of materials and a blog of the project's progress. Updates were also posted on the social networking site, Twitter.

Annex 2: Processing of fisheries data used in this project

For the analyses and maps in this book, Swedish and Finnish VMS records and logbook data from 2007-2009 were used. Since vessels shorter than 15m in length do not have VMS equipment installed, they were not included in this analysis. Fishing activity by smaller vessels is negligible in the offshore areas included in the Plan Bothnia area.

In total, 45 Finnish vessels, with an average engine power of 540kw, and 10 Swedish boats, with an average engine power of 1,050kw, were included in the analysis. Several steps were taken to obtain the fishing data.

Clean VMS data

Only signals when fishing occurs are included. Signals when vessels were in port or steaming were removed. The maximum fishing speed was defined as 4 knots, based on speed-frequency histograms. VMS positions near ports and close to land were classified as non-fishing activity. In total, 110,117 VMS positions from Finnish vessels and 6,824 VMS positions from Swedish vessels were identified.

Link VMS and catch data

Information from logbooks was linked to corresponding VMS signals obtained by assigning a unique identification number to each vessel and fishing day in both the VMS- and logbook dataset. The resulting dataset contained both the spatial information from the VMS-dataset and the information of gear-type used and catches made from the logbook. The catches of each species were then distributed among the VMS signals, after adjusting for the fishing time, i.e., the elapsed time from the previous signal, in order to attain an estimate of catches at each position.

Convert to raster

the combined VMS and logbook dataset was converted from a point dataset to a number of raster layers. In raster form a two dimensional square gets a value derived from one dimensional points. This makes the data more conveniently mappable. The end results show the spatial patterns of fishing separated into different gear types and species. The raster layers had a resolution of 5x5km to match the precision of the one-hour interval of the VMS signals.

Annex 3: Monitoring and evaluation

There are often many potential causes for changes in the planning area over time. Due to this, the monitoring and assessment of a plan, especially a strategic plan covering a long time period, is very difficult. However, the following topics could be monitored to follow up a Bothnian Sea MSP plan:

Issue	Indicator proposals (examples only)
Fishing activities:	1. Changes in spatial distribution of fisheries (VMS) 2. Fisheries catch 3. Status of fish stocks
Wind power:	1. Status of wind projects 2. Emerging new projects
Nature protection:	1. Conservation status within existing protected area designations 2. Potential new designations based on emerging information
Ecosystem Status:	1. Progress toward reaching GES (sensu EU MSFD, HELCOM BSAP). 2. Status of spawning grounds/habitats
Shipping:	1. Changes in spatial distribution of shipping (AIS) 2. Location of accidents 3. Location of spills 4. Alien species introductions
New uses:	1. Spatial distribution of new uses
Maritime related economy in the region:	1. Number of regional jobs/GDP creation in maritime sectors 2. Increase in tourism activites

Annex 4: External Review commentaries

Summary by Dr Stephen Jay
University of Liverpool,
United Kingdom (April 2012)

The Plan Bothnia project has the aim of advancing transboundary maritime spatial planning (MSP), in line with the principle of overcoming the artificial borders imposed on ecosystems by administrative and political units. The project relates to other initiatives in areas where human pressures upon the sea are increasing and the need for cooperation between maritime nations is greatest. Plan Bothnia is welcomed as a further study in this respect, and demonstrates the feasibility of cross-border cooperation, with Swedish and Finnish bodies working closely together on the project, carrying out data-sharing, stakeholder engagement, mapping and formulation of proposals on an equal footing.

A wide range of information has been gathered together for the chosen plan area, covering both natural characteristics and human uses and impacts. This includes interesting perspectives on the human history of the sea, socio-economic topics, and current and growing demands, especially for offshore wind energy, shipping, nature protection and fishing. Information on some topics is inevitably partial, but this is counterbalanced by the breadth of material presented when compared to some other MSP exercises. The interaction of interests is also well portrayed, especially by the online Map Service that accompanies the report.

However, Plan Bothnia has not been a simple data-gathering exercise. In keeping with terrestrial planning practice, information has, to a large extent, been geared towards the needs of planning and used in the formation of proposals for the future use of the Bothnian Sea. These proposals are presented in the form of the draft maritime plan for the area, which includes overarching aims, policy targets, a plan map for the sea as a whole, and more specific proposals for four specially selected areas. This latter innovation illustrates the potential of a 'nested approach', whereby planning effort is concentrated into areas of most need, and more general guidance is provided for more extensive areas.

This is carried out with the recognition that planning is not simply a rational process of allocating resources, but also expresses social and cultural aspirations. This is an important insight, and suggests that there is the potential for exercises of this kind to be more clearly focused on specific planning aims from the outset. In the case of this project, it would have been possible to begin by stating overriding goals, such as environmental protection or the support of maritime development and trade, with a view to achieving certain benefits. However, Plan Bothnia does recognise the principle maritime drivers in the area, especially for offshore wind energy, shipping, fisheries and tourism, and responds to many of these issues.

Similarly, a further elaboration of the planning process would be to undertake a more thorough analysis of the policy frameworks relevant to marine activities, at international, EU, national and sub-national levels. This would allow planning efforts to be more clearly directed to the achievement of stated priorities, in recognition of the specific purposes that planning inevitably serves, which are determined socially and expressed politically. However, the transboundary nature of

areas such as the Bothnian Sea demands great sensitivity to potential differences in national priorities when seeking to address policy demands.

This leads to the issue of establishing a statutory status for transboundary MSP exercises, which would be necessary in order to for plans of this kind to achieve their intended aims. Relevant international agreements and EU and national legislation can be a starting point here, though political will is needed at all levels, as well as stakeholder engagement and institution building. For the Bothnian Sea, recent Swedish legislation is a promising start in this regard.

Plan Bothnia has also set a helpful tone for cooperation between nations engaging in MSP by the open-ended approach taken to the planning process. From the outset, the plan invites the participation of all concerned in envisaging possible desirable futures for the Bothnian Sea, presenting this not just as a technical exercise of efficient resource use, but as a creative social process of building attractive identities for the sea; this is well-illustrated by the evocative titles and rich imagery used throughout the report, and by the draft plan map. This project has thus begun a collaborative process of shaping the sea in question and acts as an example of imaginative planning for others to take forward.

Commentary of Dr Stephen Jay
University of Liverpool,
United Kingdom.

Marine / maritime spatial planning (MSP) is taking on increasing international importance as coastal nations exert greater control over their marine territories, in the interests of reversing the environmental degradation of the seas and facilitating the sustainable use of marine resources (Douvere, 2008; Kidd et al, 2011; Schaefer & Barale, 2011). Following the example of longer-standing initiatives in Australia, North America and elsewhere, the European Union is supporting the uptake of MSP, and HELCOM and OSPAR have also encouraged its implementation in European waters (CEC, 2008; De Santo, 2011; Ehler & Douvere, 2007; HELCOM & OSPAR, 2003). The recent BaltSeaPlan project illustrates the growing interest in MSP for the Baltic Sea (Gee, Kannen & Heinrichs, 2011), building on longer-standing, intense environmental research in the Baltic region. It is in this context that DG Mare's initiative in setting up the Plan Bothnia project is to be welcomed, as a further initiative in taking forward the MSP agenda.

Plan Bothnia has a stated aim of taking a novel transboundary approach. This reflects the key principle of cross-border cooperation laid down in the EU MSP roadmap, and wider concern within MSP thinking for integrating efforts across jurisdictional boundaries (CEC, 2008, 5.7; Gilliland & Laffoley, 2008). The importance of this issue is highlighted by the national / sub-national character of most MSP efforts to date and the political and institutional barriers to cross-border cooperation (Backer, 2011; Douvere, 2008). Plan Bothnia has furthered a process of inter-jurisdictional working by taking a fully bilateral approach to planning for the sea area in question. Hence data-gathering and mapping has been carried out as consistently as possible across the Finland-Sweden border, and there has been some sharing of aims in deciding on possible planning scenarios, especially affecting areas that straddle the EEZ border, such as the Northern Quark. However, the relatively limited scope of planning measures undertaken means that debate on transboundary topics has perhaps been less advanced than expected. More difficult issues, such as navigation and associated risks throughout the sea as a whole, would have to be addressed in a fuller, perhaps statutory, marine planning exercise.

Another innovation of the project is suggested on the opening pages where the future of the Bothnian Sea is presented as something to contemplate, as illustrated by the poem Summer Night on the Bothnian Sea, and the foreword, where readers are invited to join in the planning exercise. This implies that scope is being given to conceiving of different possible futures in line with a variety of social aspirations. Potentially, this marks a welcome advance from the scientifically rationalist approach that is generally being taken to MSP, whereby MSP is conceptualised as a matter of organising sea activities into as efficient a pattern as possible, typically with the functional zoning of different uses as its end point (Agardy, 2010; Kenchington & Day, 2011). Although this approach is in line with the prevailing marine management ethos of MSP, it falls short of wider spatial planning practice developing for the terrestrial environment (Jay, 2010; Jay et al, forthcoming; Kidd & Ellis, 2012); this involves, for example, the creation of distinctive and attractive identities for places. Plan Bothnia has taken significant steps in the direction of a more creative approach to MSP, allowing more open-ended and

imaginary possibilities for the sea to emerge, which are not simply based on the efficient allocation of resources. This follows, to some extent, the example of the Belgian North Sea project, A Flood of Space (Maes et al, 2005). Visual language and plentiful images, the involvement of participants in mapping important areas, the development of an overall vision as set out in the final maps, and the recommendations for the four key areas are a promising start. These represent a worthwhile attempt to integrate different pressures with the environment and each other, whilst minimising potential conflicts. Also, having amassed a great deal of information on the sea and human interests within it, the project has begun to develop more comprehensive, well-informed visions of the desired state of the Bothnian Sea as a whole and of identifiable places within it.

Turning to the main content of the draft report, the project has succeeded in drawing together a wealth of data on the Bothnian Sea, covering most of the relevant aspects, including natural conditions and human interests. The inclusion of socio-economic data is particularly welcome, as this demonstrates a more comprehensive approach to MSP as has been the case in some other MSP exercises, where the emphasis has been on accumulating baseline information on natural conditions and sea uses. An impressive amount of information has been assembled, and the online Map Service provides an excellent (if rather static) representation of the available information. However, the omission from the plan of the inner coastal waters zone warrants explanation.

Plan Bothnia is in keeping with the environmental bias of MSP to date in other countries, with a good emphasis on the needs of environmental quality and nature conservation (Foley et al, 2010). At the same time, the inherent tensions between environmental and socio-economic needs, typically represented by different stakeholder groups, are presented as a challenge for planning the Bothnian Sea.

One tendency of MSP to date has been that the concern to understand the marine environment, especially by drawing on natural science perspectives, has overridden the actual needs of spatial planning, and insufficient attention has been given to other elements, such as policy objectives. The Plan Bothnia project has attempted to address this shortcoming by drawing out the policy relevance of the information presented. This demonstrates an awareness of established terrestrial planning practice, and suggests that MSP needs to engage more closely with spatial planning more widely (Smith et al, 2011). Having said this, there is scope for developing the planning dimension of the project further. In particular, the relevant policy frameworks for the two countries could be integrated more fully into the sections covering different demands, describing, for example, the respective national policy objectives for tourism, nature conservation, fishing, aggregates extraction, etc. Nonetheless, the plan concludes with a series of well-focused policy targets.

In summary, Plan Bothnia has made significant strides forward within the limits of the time and resources available. Firstly, it has drawn together a good range of existing data for the sea area, and organised this into meaningful categories. Secondly, it has engaged participants in a provisional process of identifying priority areas for key interests and creating an overall, integrated vision for the sea. Third, it has moved MSP towards a broader spatial planning approach with specific consideration of the planning relevance of data. There is considerable scope for developing MSP further in this direction, with, for example, more specific attention being given to policy frameworks and continuing to apply creative and imaginary thought to possible futures of sea spaces like the Bothnian Sea. Finally, attention could be given to planning theories that are seeking to steer strategic planning towards more open and visionary approaches (eg. Hillier, 2010).

Agardy, T. (2010) Ocean Zoning: Making Marine Management More Effective, Earthscan, London

Backer, H. (2011) Transboundary maritime spatial planning: a Baltic Sea perspective, Journal of Coastal Conservation, 15, 279–289

Commission of the European Communities (CEC) (2008) Roadmap for Maritime Spatial Planning: Achieving Common Principles in the EU, COM 791, CEC, Brussels

De Santo, E. (2011) Environmental justice implications of Maritime Spatial Planning in the European Union, Marine Policy 35, 34–38

Douvere, F. (2008) The importance of marine spatial planning in advancing ecosystem-based sea use management, Marine Policy 32 (5) 762– 771

Ehler, C. & Douvere, F. (2007) Visions for a Sea Change, Report of the first international workshop on marine spatial planning, UNESCO, Paris

Foley, M., Halpen, B., Micheli, F. et al (2010) Guiding ecological principles for marine spatial

planning, Marine Policy, 34, 955–966
Gee, K., Kannen, A. & Heinrichs, B. (2011) BaltSeaPlan Vision 2030: Towards the Sustainable Planning of Baltic Sea Space, BaltSeaPlan, Hamburg
Gilliland, P. & Laffoley, D. (2008) Key elements and steps in the process of developing ecosystem-based marine spatial planning, Marine Policy 32 (5) 787-796
HELCOM & OSPAR (2003) Towards an Ecosystem Approach to the Management of Human Activities, unpublished document
Hillier, J. (2010) Strategic navigation in an ocean of theoretical and practice complexity, in Hillier, J. & Healey, P. (eds) The Ashgate Research Companion to Planning Theory, Ashgate, Aldershot, 447-480
Jay, S. (2010) Built at Sea: Marine management and the construction of marine spatial planning, Town Planning Review, 81 (2), 173-191
Jay, S., Klenke, T., Ahlhorn, F. & Ritchie, H. (forthcoming) Early European experience in marine spatial planning: planning the German exclusive economic zone, European Planning Studies
Kenchington, R. & Day, J. (2011) Zoning, a fundamental cornerstone of effective Marine Spatial Planning: lessons learnt from the Great Barrier Reef, Australia, Journal of Coastal Conservation, 15, 271–278
Kidd, S., & Ellis, G. (2012) From the land to sea and back again? Using terrestrial planning to understand the process of marine spatial planning, Journal of Environmental Policy and Planning
Kidd, S., Plater, A. & Frid, C (eds) (2011) The Ecosystem Approach to Marine Planning and Management, Easrthscan, London
Maes, F., Schrijvers, J. & Vanhulle, A., (2005) A Flood of Space: Toward a Spatial Structure Plan for Sustainable Management of the North Sea, Belgian Science Policy, Brussels
Schaefer, N. & Barale, V. (2011) Maritime spatial planning: opportunities & challenges in the framework of the EU integrated maritime policy, Journal of Coastal Conservation, 15, 237–245
Smith, H., Maes, F., Stojanovic, T. & Ballinger R. (2011) The integration of land and marine spatial planning, Journal of Coastal Conservation, 15, 291–303

Commentary of
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There have been no maritime area transboundary management experiences in Spain equivalent to the Plan Bothnia. Nevertheless, the development of Directive 2008/56/EC (and Law 41/2010 which transposes it into national legislation) must envisage this.

Due to its relative position and geographical features, Spain is a country which generates maritime boundaries with seven countries and has seaboards that give on to three of the ten sub-regions set out in Directive 2008/56/EC. The situation that is closest to the Plan Bothnia occurs in the Alboran Sea, the westernmost sub-basin in the Mediterranean Sea. With a similar surface area (some 65,000 km2) and similarly shared by two countries (Spain and Morocco), this transboundary area is, nonetheless, one of the outer boundaries of the EU where striking contrasts exist in terms of economic and socio-political development.

Management of these waters is done through the respective national legislations and the international instruments subscribed by the two States. Spain and Morocco form part of one of the longest-standing regional agreements (the Mediterranean Action Plan, 1975) although this treaty barely covers all of the joint marine waters; only the Protocol on Integrated Coastal Zone Management (in force since March 2011) would be able to extend the area being managed. The uses and activities that generate the greatest areas of conflict (navigation, fisheries, and the environment) do not therefore count on any common planning instrument, even though they are included in the various international regulatory frameworks or are the responsibility of European institutions (fisheries). The Spain-Morocco Mediterranean Intercontinental Biosphere Reserve (2006) can be cited as an approach to shared management, with a surface area of a million hectares (3,861 sq.ml.) on both sides of the Straits of Gibraltar, but without including the maritime area.

No marine planning transboundary instruments exist with the other countries with which Spain shares maritime borders, either. Indeed, there is still no definitive delimitation agreement regarding the borders with Portugal. To date, cooperation with Portugal in the transboundary areas has focused on the joint use of information for delimiting the outer edge of the continental shelf beyond 200 miles on the northern Miño river border. Delimitation agreements only exist with Italy (continental shelf, 1978) and France (territorial sea, contiguous zone and continental shelf in the Bay of Biscay, 1975). An area of joint exploitation was set out

according to this agreement although no activity has been undertaken there to date. Action for the joint protection and management of the marine environment in the Gulf of Lion with the creation of a marine park is in the development stage (2011 French Decree).

What features of the experience in the south of Europe can be highlighted? What we could call the Mediterranean model is characterised by less intense marine environment use and exploitation, although this does not mean that there are no conflicts, especially with respect to the environment. Environmental impacts are less linked to the strong industrial and port development found in the northern European marine basins. There are greater contrasts and a greater variety in the Mediterranean model from the economic and socio-political points-of-view, which also makes joint actions difficult. Planning instruments are also less developed in general and, therefore, this is also true with respect to specific instruments for the maritime area, and this is combined with a land planning system which has no competences for jurisdictional waters on the regional and municipal levels.

On a positive note, the Mediterranean model of (transboundary) cooperation for marine management is characterised by its being based on the use of international instruments (some 65 of these can be applied in this basin), although only a very small number of these have been subscribed by all the States. In this context, the international organisations linked to some of these agreements allow greater transboundary integration, albeit with the typical restrictions of international law as there is no supranational executive capacity, with the exception of the EU system regarding certain matters, such as fisheries. It is precisely within the sphere of the EU that transboundary cooperation can be developed in the medium term, with the implementation of Directive 2008/56/EC and the respective national laws that have already been passed in Spain, France, Portugal and Italy.

Commentary of Nicole Schaefer
Sustainable Ocean Solutions Inc., Calgary, Canada

Planning – whether on land or at sea – always serves particular purposes, such as to protect environmental goods and services, balance diverging interests on the same area, support development or assist international trade and transport. Therefore, any kind of planning serves political needs and demands and reflects the particular context and priorities of its era.

While terrestrial planning in most countries has a long and rich tradition, comprehensive planning of marine space is still a fairly new process. Despite existing planning activities for single uses or a limited set of sectorial objectives, experience with all-embracing marine spatial planning (MSP) processes is only about to be gathered. However, countries around the world are increasingly using MSP to manage marine resources in a sustainable way that is in line with healthy marine ecosystems.

MSP is characterized by its procedural, incremental set-up. It is a tool that encompasses political as well as spatial and scientific components. MSP is integrated and aims to involve all marine sectors and uses equally. It is forward-looking and as such reaches beyond the management of existing, on-going uses. MSP provides an appropriate framework for arbitrating between competing human activities and managing their impact on the marine environment. Applying the ecosystem-based approach is the prerequisite of any MSP implementation.

Internationally, two main reasons can be identified that led to the increasing application of MSP: economic development (particularly with regard to new marine uses such as offshore wind and renewable ocean energy) and marine conservation and protection (mainly through environmental law or commitments to environmental conventions that require the establishment of marine protected areas – MPAs).

The same reasons have been identified for the Bothnian Sea. Particularly the future prospects of offshore wind-power development along with already on-going traditional uses, such as fisheries and marine transport, and in combination with increasing tourism in the region require a smart management of marine resources and marine space.

The situation in Canada's oceans differs from e.g. the European one. In general Canadian waters are much larger and in many areas not as densely used as the European seas. This provides Canada with the unique opportunity of a pro-active approach towards the management of marine resources and securing the integrity of the country's marine ecosystems.

Canada positioned itself as an international leader for comprehensive ocean policy development with the adoption of its Oceans Act in 1997. The Act establishes a general foundation for integrated policy making across government departments,

and is supported by the Oceans Strategy (2002). The strategy provides more explicit guidance for integrated planning and management of the oceans, their natural resources and ecosystems. It is undisputed, that both the Oceans Act and the Oceans Strategy provide a solid framework for the development and implementation of MSP in Canadian waters.

However, despite Canada's designation of five Large Ocean Management Areas (LOMAs) under the Oceans Act and two Integrated Management Plans (IMPs) by today it is fair to say that comprehensive MSP has not been implemented in Canada. For more information on LOMAS please visit http://www.dfo-mpo.gc.ca/oceans/marineareas-zonesmarines/loma-zego/index-eng.htm.

Policies that have an impact on the development of the seas and oceans (e.g. marine transport, industry, offshore energy, fisheries, tourism etc.) have for decades been treated sector-by-sector. This led to a fragmentation of policy and decision-making which in turn can result in the adoption of conflicting measures. A systematic examination of how policies could be combined to reinforce each other as well as an appropriate assessment of the potential impact of one set of activities upon another are both currently lacking. These results in two main types of conflicts: user-user and user-environment conflicts.

For the Bothnian Sea the report states that the identified uses are largely compatible with each other and that conflicts tend to be concentrated in relatively few areas. This is similar to large parts of the Canadian oceans where user-user conflicts currently occur only in small numbers and mainly between two sectors.

Canada's Oceans Strategy has highlighted the fact that failure to implement forward-looking planning and management of ocean space will likely result in costs such as increased conflicts and competition for ocean space, lost economic opportunities and continued environmental degradation.

Canadian marine stakeholders stated that sufficient "bi-sectorial" processes are in place to solve these types of conflicts. This poses challenges for MSP: if user-user conflicts can be solved through bilateral or inter-sectorial processes that are already established what is the benefit of a fully developed MSP regime? What does MSP add over and above processes that have been used by marine stakeholders until today?

MSP would be misunderstood if it would be seen as only a conflict solving tool. MSP is not a tool to manage the oceans or marine ecosystems. Instead, it is a future-oriented process that offers a framework to develop and select appropriate strategies and hence provides a framework to manage human activities at sea and their impact on the environment.

With regard to the comparison of the costs of a newly to be established planning framework with its added benefits, however, the arguments of pro-actively managing resources and securing ecosystem integrity seem to lack politically convincing power. This is particularly true in difficult financial times.

The economic effects of MSP, which are likely to include legal certainty for all stakeholders in the marine arena, coherence with other planning systems, enhanced cross-sector and cross-departmental coordination, simplified application procedures for projects, streamlined decision-making, or eased environmental impact assessments for single projects (due to a comprehensive plan being in place) have to be communicated and quantified by reliable numbers. Without the provision of clear and transparent information regarding these benefits marine sectors – at least in Canada – seem to be difficult to convince to buy into and support the development and implementation of MSP.

The Plan Bothnia project report lacks information about the motives of Finland and Sweden to embark on cross-border MSP. It would have been beneficial for other countries if some insights would have been shared by the project regarding the interests of, and anticipated benefits for both countries. Why is it worthwhile to coordinate national efforts concerning the development of MSP regimes? And what do both countries gain through cross-border coordination besides making a complex process even more complex by coordinating stakeholder involvement from both countries.

It is important to recognize that transparency and stakeholder engagement is at the very heart of any MSP process. The report does not elaborate on how involved stakeholders have been chosen and how it was ensured that all relevant bodies and parties from both sides of the border were involved.

As the Plan Bothnia project is a pilot project with no legal implications it provides the ideal framework to test stakeholder engagement in a cross-border approach. Other countries that share marine borders with neighbouring states, such as Canada, could have profited from insights that were gained in this regard by the Plan Bothnia project.

Another interesting question

that presents itself with regard to cross-border cooperation is the legal framework in which it occurs. The proposal for a new Swedish planning system foresees the use of an ecosystem planning approach. More concretely, the structure and functioning of ecosystems and their ability to provide societies with goods and services must be maintained or restored, where necessary. Therefore, the entire ecosystem in a regional sea must be considered which makes cross-border cooperation between neighbouring states a prerequisite. This proposal has its roots within the EU Marine Strategy Framework Directive (MSFD) which requires EU Member States to ensure good environmental status of their seas by 2020.

From a Canadian point of view it would be interesting to know whether the benefits that countries gain through improved coordination across borders are significant enough to make cross-border coordination worthwhile, or if a legal requirement such as the MSFD is a condition sine qua non? Does some sort of legal pressure have to be in place for cross-border cooperation to work?

MSP is not applied in a political vacuum. Rather, it reflects the particular political circumstances and environment in which it occurs. This leads to an interesting difference that can currently be observed between Canada and Europe. While in Europe MSP has sometimes been criticized as being too development driven, taking environmental concerns only half-heartedly into account, the contrary argument is frequently used in Canada. In Canada MSP is perceived as too environmentally friendly, in some areas even being considered as high-jacked by environmental groups and non-governmental organizations (NGOs) to further pursue environmental protection, conservation and the ban of economic development from certain areas. While this is an extreme position put forward by marine industries that lack evidence it is important to take these arguments seriously and tackle them in a transparent, open manner. If certain stakeholder groups fear MSP could be just another term for marine environmental protection and therefore being anti-development it is important to stress that MSP does not seek to halter development. In the contrary it seeks to enable development with a mid- to long-term perspective that ensures sustainability and functions within the capacity of marine ecosystems.

The development of a MSP process, its implementation, enforcement and subsequent monitoring is costly and time consuming. To embark on this process can only be successful if the purpose and the envisaged outcome is clearly communicated right from the start. It seems therefore less significant if a MSP process is driven by ecological or economic objectives. What is rather important is the clear and transparent communication of these objectives and their support by all parties involved.

The reasoning behind applying MSP has to be understood and shared by all stakeholders concerned. Common values have to be identified and agreed upon, and common challenges and competing demands, which MSP will either be able to solve or to balance, have to be determined at the very beginning. As this is a future oriented process it would be interesting to assess future development goals and objectives not only of the marine sectors operating in a certain marine area but also of the different government levels involved. Such an assessment could lead to a "future demands" map

The Plan Bothnia project has identified four areas of outstanding interest for marine planning purposes, both for ecological and economic reasons (in particular wind-power development and marine safety). Despite the moderate size of the Bothnian Sea – at least compared to the Canadian oceans – and although a draft marine plan has been developed for the entire water body these areas have caught the special attention of the stakeholders and experts involved in the project. This poses the question whether a fully developed, descriptive plan is always needed for an entire ecosystem or if for some areas a "lighter" rather general planning regime, e.g. based on guiding principles would suffice.

None of the global seas and oceans is homogenous. Successful MSP requires management that accounts for the oceans' dynamics in space and time. In the Canadian context stakeholders and experts are of the opinion that a Canadian-specific approach to MSP is needed due to the shire size and heterogeneity of each designated LOMA, which cover several marine ecosystems each. This approach has been called "nested" approach. Nesting would imply at least two different meanings with regard to both scale and scope.

Firstly different scales have to be considered. Heterogeneity occurs at different scales. As far as MSP implementation in Canada in concerned experts were of the opinion that MSP should incorporate all levels from the largest scale (ocean basin), through eco-regions (the LOMAs) to specific habitats. "Using a nested hierarchy of spatial patterns and conducting

a gap analyses will allow governance and management to set priorities that reflect oceanographic, ecological, and human use patterns as well as the process that underlie them [...]" (Crowder& Norse 2008, p. 774).

Secondly scope is important in terms of geographical area that needs to be managed. Due to limited financial and human resources and considering the degree of planning effort and detail required, MSP focus could initially start in "priority areas" such as densely used areas or areas with high vulnerability or risk potential. This way of thinking is to some extend reflected by the identified "areas of special interest" in the Bothnian Sea. Focussing on priority areas would provide the opportunity to learn from implementation and closely monitor the benefits of MSP; thereby learning by tangible results. In the Canadian context it is felt that this approach could promote the needed buy-in from marine industries by allowing administration to move relatively quickly with implementation and lead to tangible outcomes. Determination of "priority sites" should be based on a sound assessment of cumulative effects of the number, occurrence and intensity of human activities. The experience gathered with these "first priority planning sites" could then be transferred to "second" or "third" priority areas.

It would be interesting to discuss this issue further in detail. The question about scale and scope might not just be an issue of size and complexity but also of enforcement and the creation of tangible management results which in turn could boost the support for MSP among all stakeholders involved.

Despite the obvious benefits of MSP the following challenges have also been identified by Canadian stakeholders and experts with regard to MSP implementation in Canadian waters:

I. The need to ensure political will and leadership. MSP is a cross-departmental and intergovernmental approach that integrates all concerned marine sectors and users. Related support throughout a government (both regarding financial and human resources allocated to the process) is a conditio sine qua non in this regard.

II. The involvement of all marine sectors. It has been found that certain stakeholders are easier to involve than other. How can a "coalition of the willing" be avoided for the greater sake of a truly integrated MSP approach?

III. The necessity to create an ownership of the process among all stakeholders. Intensive and active stakeholder involvement is essential and requires an investment of time.

IV. Accountability and enforcement of MSP. In order to avoid the "toothless tiger" MSP had to have some regulatory power.

V. The need of trust-building both between different marine sectors and between these sectors and scientific advice.

These challenges and the consequent requirements may offer some interesting food for thought to take the Plan Bothnia project results a step further.

Agardy, T. (2010) Ocean Zoning: Making Marine Management More Effective, Earthscan, London

Backer, H. (2011) Transboundary maritime spatial planning: a Baltic Sea perspective, Journal of Coastal Conservation, 15, 279–289

Commission of the European Communities (CEC) (2008) Roadmap for Maritime Spatial Planning: Achieving Common Principles in the EU, COM 791, CEC, Brussels

Crowder, Larry and Norse, Elliot (2008) Essential ecological insights for marine ecosystem-based management and marine spatial planning, Marine Policy 32 (5) 772-778

Douvere, F. (2008) The importance of marine spatial planning in advancing ecosystem-based sea use management, Marine Policy 32 (5) 762– 771

Ehler, C. & Douvere, F. (2007) Visions for a Sea Change, Report of the first international workshop on marine spatial planning, UNESCO, Paris

Government of Canada (2002) Canada's Oceans Strategy. Our Oceans, Our Future, Department of Fisheries and Oceans (DFO), Ottawa

Government of Canada (1996) Oceans Act, Canada Communication Group - Publishing, Public Works and Government Services Canada, Ottawa

Maes, F., Schrijvers, J. & Vanhulle, A., (2005) A Flood of Space: Toward a Spatial Structure Plan for Sustainable Management of the North Sea, Belgian Science Policy, Brussels

Mann Borgese, Elisabeth. "The Oceanic Circle. Governing the Seas as a Global Resource." The United Nations University, Tokyo, 1998

Schaefer, N. & Barale, V. (2011) Maritime spatial planning: opportunities & challenges in the framework of the EU integrated maritime policy, Journal of Coastal Conservation, 15, 237–245

Smith, H., Maes, F., Stojanovic, T. & Ballinger R. (2011) The integration of land and marine spatial planning, Journal of Coastal Conservation, 15, 291–303

Commentary of Fanny Douvere, Ph.D.

The boundaries of marine ecosystems rarely coincide with the political and administrative boundaries of individual nations. While the management measures of maritime spatial plans are inevitably implemented by national governments, planning and analysis of ecosystem-based maritime spatial plans are often necessary across national boundaries. Projects such as Plan Bothnia can demonstrate the benefits of maritime spatial planning across national boundaries, in this case, between Sweden and Finland. Results of this project will be useful in any marine area shared by more than one country, e.g., the North Sea, the Mediterranean Sea, the Black Sea, but also in much larger marine areas such as the Arctic or the High Seas. While the area for maritime spatial planning can vary widely, the process of how to deliver it remains the same, including the essential questions it can address.

The Plan Bothnia project is complicated because of the lack a national authority responsible for planning the exclusive economic zone in both countries (Finnish Regional Councils and Swedish municipalities currently have planning authority for their respective territorial seas only). The new Agency for Marine and Water Management will ultimately have that authority for Swedish marine waters; new maritime spatial planning legislation is expected in 2012. No similar management authority exists or is planned in Finland.

The report first describes the existing spatial planning systems at the regional and municipal level for Finland and Sweden and suggests that a transboundary plan for the Bothnia Sea is necessary, possible, and beneficial to both countries.

Much of the report describes and provides maps of the oceanographic and ecological characteristics of the Bothnian Sea, as well as the species that inhabit it, and the impact of human activities on elements of the marine ecosystem. Existing information is used to identify, describe and map ecologically important areas. A history of human use of the Bothnian Sea and existing marine uses are identified, with a focus on maritime transport, port development, and fisheries. Offshore wind energy, marine transport, nature protection, and fishing are identified as most important. Future trends for each of the major human activities are also included where information was available. Environmental impacts and risks are briefly described. Compatibilities and conflicts across activities are described, but a compatibility/conflict matrix would have been useful for seeing interactions and patterns more clearly. Only four areas of the Bothnian Sea appear to have real conflicts among existing uses. Data sources are well documented in this section.

The need for transboundary MSP is obvious in areas where different countries share the goods and services of the marine ecosystem. Shared fisheries can be better managed, marine protected areas can be better identified and managed, marine transport and offshore renewable energy can be more efficiently planned and managed, and water quality management can be more effectively sustained. Stakeholder interests in these sectors also often cut across national boundaries and can be better identified and considered through a transboundary stakeholder process. Research and information collection can be better directed toward management needs at the regional ecosystem level.

While the need might be obvious, the reality of implementing transboundary MSP proves to be difficult to achieve, especially in areas where national governments have little or no experience in managing marine areas, such as, for example, Sweden and Finland. To date, transboundary MSP remains an experiment. Germany has just completed a research project, the 'BaltSeaPlan', which tried to stimulate MSP in countries of the Baltic Sea—including two trans-national projects. One of the principal outputs of that research, 'Vision 2030: toward the sustainable planning of Baltic Sea space', suggests looking at the entire Baltic Sea as one "planning space". The Bothnian Sea project also moves in that direction.

A problem with transboundary MSP is its lack of specificity of why MSP needs to be done across borders or, in other words, what is the added value to both countries and indicate what will be gained concretely that cannot be obtained when carrying out MSP on an individual country basis. Too frequently, the added value remains only very vague specified and politicians and decision-makers do not see the benefit. As a result, projects remain in their initial, research-oriented phase.

While the current project in the Bothnia Sea has good intentions, it tends to go a similar route. The project aims at providing a basis for a transboundary MSP approach between two nations but concretely indicating what this can achieve and what benefits both countries have by cooperating with one another. While it indicates that maritime transport, fisheries and MPA's

are common areas of concern in the area that is jointly managed, it does not specifically draw attention to the added value of cooperating -- at least not in very specific terms. Why should MSP be transboundary if it doesn't serve a particular purpose? Being proactive is one thing, indicating why you should be proactive jointly is still another. It is crucial for successful transboundary MSP to articulate the needs (current, future, or both) and indicate the benefit to both countries.

Interesting remarks on benefits of cooperation on MSP have been made in the past for the North Sea area, albeit only for specific sectors, not for MSP as a whole. For example, experts pointed out that multiple small wind farms of approximately 100 turbines each are very cost intensive and not necessarily efficient. Small farms come at a high cost to producers that each need their own network to deliver power to land, to governments who need to evaluate every EIA individually, and to the environment because of huge fragmentation of habitats often close to shore and in important biodiversity areas). It was pointed out in the past that a much more efficient approach would be to construct joint farms with many turbines attached to a transboundary power delivery network that would deliver power to multiple countries simultaneously from a plant far from land, and hence not in areas that need special protection. This type of thinking could make a better case on why MSP should be transboundary and provide concrete arguments to both countries on how to act proactively and to joint benefit. Similar arguments could be made for other sectors, such as maritime transport, port facilities, and MPAs.

A crucial benefit of PlanBothnia in moving transboundary MSP further could be to look more closely into these benefits for cooperation, ideally for each of the specific sectors of concern for the future and indicate concretely a roadmap for efficient, joint use of the Bothnia Sea. PlanBothnia has made a good effort to describe the legal arrangements in both countries for MSP, describe environmental features and current and future use of the area, but lacks a clear and specific argument of why a transboundary approach is indispensible (apart from the general idea that it is a good thing to do). Building such arguments would require looking into the overall national policies of the two countries with regard to environmental conservation (what are the priorities of the respective nations?) and economic development (what are the priorities of the respective nations for future economic development and how do they translate to the Bothnia sea?).

Finally, the text indicates that a key reason for MSP in the Bothnia Sea is the prospect of increasing pressures primarily of shipping and wind energy. Consequently, the necessary information to embark on MSP in this region should concentrate on expectations and innovations in those two sectors, their (potential) interaction with already existing users of the area and knowledge about exceptional natural/ecosystem features. Questions such as 'expected port expansions', 'expected increase in shipping and ship routes and its correlation to the natural environment of the area and/or exceptional marine relevance to iconic species', 'increased likelihood of shipping accidents in correlation to potentially hazardous cargo. For example, oil is often focused on, but chemicals are much more difficult to trace but would be equally hazardous when they would enter the marine environment in the case of collision or other types of accidents. What are the regulatory prospects in each country the sector anticipate and how will they accelerate or halt the development of the offshore uses. How is technological development for the respective sectors stimulating the increase of the uses? What are the economic prospects for each of the sectors? This type of information is crucial for the design of a proactive plan for the Bothnia Sea and is currently lacking in almost all MSP initiatives around the world. Still far too frequently, MSP too often concentrates on maintaining the status quo, is based on descriptions of historic and current use of the area and lacks information on the prospects for the future. MSP is not meant to plan for today -- it is meant to build a better future. Therefore, information on what potentially might jeopardize a desired future is what is needed to provide the basis for any MSP.

Commentary of Dr. Daud Hassan

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The conflicts between human use and interest and the marine environment are growing and will continue to accelerate in the future. All ocean uses are not compatible to each other and they are competing for ocean space or have adverse effects on marine environment (Douvere 2008). Various global and regional assessments of the marine and coastal environment indicates that the biodiversity in marine and coastal areas are declining continuously.

According to one of the leading academic publication- Science the loss of marine biodiversity is increasingly impairing the ocean's ability to produce seafood, resists diseases, filter pollutants and maintain water quality (Worm et al. 2006).

The Bothnian Sea ecosystem is a unique marine nature in the region. There is an inherent need to protect and preserve the marine and coastal environment of the Bothnian Sea region in an integrated and sustainable manner. The EU is committed to ecosystem based management (EBM) as an effective implementation of EBM could pave the way to achieve this. For the management of sea use purposes the OSPAR and HELCOM defined the ecosystem management as follows:

The comprehensive integrated management of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of goods and services and maintenance of ecosystem integrity (HELCOM & OSPAR 2003, ICES 2003).

This ecosystem approach relates to improved planning and management system that emphasis a balance between economic development and marine environmental conservation, not just conservation and prevention.

The aim of transboundary maritime spatial planning (MSP) is 'to create and establish a more rational use of marine space and the interactions between its uses, to balance demands for development with the need to protect the environment and to achieve social and economic objectives in an open and planned way' (UNESCO-IOC 2012). This planning system 'allows both high level of environmental protection and a wide range of human activities (Day 2008). It emphasis coordinated networks of national, regional and global institutions. Since MSP includes integrated, adaptive, strategic, area-based and participatory measures (UNESCO-IOC 2012) the application of EBM through the use of MSP has been considered as a way forward for the effective ocean governance.

As a useful measure to marine and coastal management in an integrated and sustainable manner MSP has been used at national and regional levels. The management of Australia's Great Barrier Reef (GBRMP) is a well-known example in this respect. Although GBRMP 'has specifically been regulated by the Great Barrier Reef Marine Park Authority (GBRMPA) in accordance with the Great Barrier Reef Marine Park Act 1975 (Cth) (Rosswell & Jessup 2008), various management approaches in the GBRMP have evolved and changed since 1975 (Day 2002). At present a comprehensive and adaptable spatial planning and zoning system exists to manage and protect the GBRMP.

As part of its integrated maritime policy a number of instruments have been adopted by the European Union (EU), incorporating various strategies and programs for sustainable management of marine and coastal resources which include the EU Integrated Maritime Policy (IMP) 2007, the EU Marine (Strategy Framework) Directive (MSFD) 2008, a Roadmap for Maritime Spatial Planning: Achieving Common Principles in the EU 2008, an EU Strategy for the Baltic Sea Region with special preparatory action on maritime spatial planning in the Baltic Sea Region 2009, and Helsinki Commission Baltic Sea Action Plan for maritime spatial planning 2009. Although the legal and policy measures and requirement for MSP is yet to be fully developed in Europe, these has been some success in developing and implementing MSP in certain parts of Europe, particularly in North Sea region. The Belgian MSP covering its territorial sea (TS) and exclusive economic zone (EEZ) could be noted in this respect. The Netherlands MSP and German initiatives with respect to MSP are also important development in this respect.

The 2010 Spanish Marine Environment Protection Law has provided a legal basis for integrated panning. It has trans-posited the MSFD into national law. It has application to all Spanish jurisdictional waters which include TS, EEZ, continental shelf and fisheries protection zone in the Mediterranean Sea (Suarez et al 2012). The Spanish approach to marine spatial planning demonstrates how the maritime economy model and geographical factors explain the planning options for the marine environment and the role of MSFD and IMP for MSP as to the connection between them as well as their administering bodies (Suarez et al 2012, at p.18).

Transboundary dimension of MSP emerged due to various human activities and uses in offshore areas. HELCOM and OSPAR serves as an important platform to encourage and facilitate transboundary MSP due to the importance of cross border collaboration as well as the transboundary nature of marine resources and activities. Increased cooperation between states in various aspects of joint assessment and monitoring such as maritime surveillance and maritime data systems have been encouraged. The transboundary initiative between

Denmark, Germany and the Netherlands (Wadden Sea Plan) are good examples in this respect.

The Plan Bothnia project study creates an excellent scope to understand the concept of MSP and examine the opportunities and obstacle to develop a transboundary MSP in the Bothnian Sea region.

Providing a very good overview of the current regimes of the Bothnian Sea the study has highlighted the strategic importance for a transboundary MSP. Focusing on ecosystem based approach a transboundary dimension of MSP that comprise of a joint efforts of planning process and procedures has been advocated in the study. With a view to protect and preserve common interests of the countries in the region the study has highlighted the importance of the uses of the ocean spaces in an integrated and sustainable manner.

In order to ensure an effective management of various ocean uses across the boundaries of Finland and Sweden this study has significant potential. Track record of good cooperation across the border in Sweden and Finland, current regional infrastructure, various joint meetings, joint public events, joint consultant studies on MSP are good signs towards the success of transboundary MSP in the Bothnian Sea region.

Certainly these opportunities are notable. However someone has to be mindful that planning strategies is one thing and their implementation is another. Implementation of transboundary MSP in an effective manner is a challenging task as it involves political, economic, social and environmental concerns across the borders. It represents complex technical, administrative and economic challenges. These challenges could encounter development plans and affect implementation.

Joint Governance, balancing of powers, Institution building, training and capacity building, sufficient stakeholders participation, open and transparent dialogue in planning and development process of a transboundary MSP are significant to translate strategic plans in to action. Development of a common vision of regional actors in assessing, evaluating and monitoring plans are also important in this respect. A strengthened cooperative regime in the Bothnian Sea region could be a way forward in enhancing integration and effective transboundary cooperation at a cross broader ecosystem issues such as shipping, commercial fishing and cultural heritage.

Day J, Marine Park Management and Monitoring: Lessons for Adaptive Management from Great Barrier Reef' in Bondrup-Nielsen S et al (eds) Managing Protected Areas in a Changing World (2002) 1258.

Day J, 'The Need and Practice of Monitoring, Evaluating and Adapting Marine Panning and Management' (2008) 32 Marine Policy 823.

Douvere F, 'The Importance of Marine Spatial Planning in Advancing Ecosystem-Based Sea Use Management' (2008) 32 Marine Policy 763

HELCOM& OSPAR, Statement on the Ecosystem Approach to the Management of Human Activities, First Joint Ministerial Meeting of the Helsinki and OSPAR Commissions, Bremen, Germany, 25-26 June, 2003

ICES, Advisory Committee on Ecosystems, Report of the Regional Ecosystem Study Group for the North Sea (2003).

Rothwell DR and Jessup B, The Limits of the Great Barrier Reef Marine Park: Defining Bays and Redefining Regulatory Control (2009) 37 Federal Law Review 73.

Suarez JL et al, The Spanish Approach to Marine Spatial Planning. Marine Strategy Framework Directive Vs EU Integrated Maritime Policy (2012) 36 Marine Policy 24

UNESCO-IOC. 2012. Global overview of Maritime Spatial Planning Initiatives: http://www.unesco-ioc-marinesp.be/marine_spatial_planning__msp.

Worm B et al, 'Impacts of Biodiversity loss on Ocean Ecosystem Services' (2006) 314(3) Science 787

Additional Commentary by Prof. Jacek Zaucha

Dr hab. Jacek Zaucha, professor of University of Gdansk, and Maritime Institute in Gdansk (May 2012)

The research supporting maritime spatial planning (MSP) has started to flourish just recently. Numerous studies and analysis have been published in professional marine management periodicals during the recent three years, mainly in Marine Policy. Less frequently the subject has also been touched in periodicals and monographs dealing with spatial planning (e.g. Duhr et al.). This indicates that MSP has been approached mainly from marine sciences, whereas it is still a comparatively new subject in the spatial planning domain. The different type of research related to MSP can be classified in following way in regard to its scope and focus:

a) Analysis justifying the need for MSP based mainly on some heuristics, deductive speculations, extrapolation of current trends and usually fuelled by normative considerations, (frequently

such research is limited to pure description of the intention of policy makers or description of the policies paving way towards MSP),

b) Descriptive and comparative analysis of MSP systems, their performance, legal aspects, results achieved, lessons learned and directions of further development,

c) Analysis focusing on methodological aspects of MSP usually based on comparative analysis, deduction and induction sometimes also experiments and falsification,

d) Multidisciplinary analysis researching in depth MSP inputs i.e. bridging MSP and some other field of research (usually paving way from perception or examination of a concrete problem towards adjustment of policy response necessary to solve the problem or a challenge).

The Plan Bothnia has adopted different approach. The document and the working process has been holistic in it its nature as postulated by e.g. Ehler and Douvere 2009. It tries to bridge research and policy making in a similar way as the recent BaltSeaPlan Project. It fills an important gap of putting spatial planners to the sea and makes them sea oriented. The project created a forum for day to day work between spatial planners, oceanographers, marine biologists, specialists in data processing and management and many other disciplines, starting, one can hope, their permanent cooperation in the area covered- the Bothnian Sea.

The Plan Bothnia Project aimed at testing cross-border maritime spatial planning covering two countries and different type of water areas; territorial waters and exclusive economic zones, but also shallow banks, deep waters and the land-sea interface. The choice of the planned area proves that maritime spatial planning is important not only when the conflicts and intensive use pressure call for some kind of coordination of sea activities but mainly as a preventive measure in order to actively influence the future sea space development. In this context the Plan Bothnia project becomes one of the first attempts to contribute to the joint Baltic sea space vision (Gee, Kannen & Heinrichs, 2011) to become a reality. It provides a nice complement to the other cross-border plans developed in the Baltic Sea region in the same time (Zaucha & Matczak, 2011; Gee et al, 2011) for more intensively used sea areas.

Maritime spatial planning has become an important part of the public choice domain. It aggregates preferences over the present and future use of the sea space. The reason is a typical market failure in regulating activities at sea. This is due to the lack of clearly defined property rights, and lack of the exclusion principle. Sea space as a resource might seem plentiful and abundant, but this is not the case. Sea space is a scarce resource requiring careful management. The inter-temporal character of MSP requires particular attention. The sea processes are difficult to reverse and often of catastrophic character. Small incremental changes can lead to substantial changes in future quality, and quantity, of ecosystem services. Therefore MSP coupled with properly designed research should become key measures in order to safeguard the possibility of future generations to enjoy the current rich variety of ecosystem services.

The methodology of the Plan Bothnia pilot plan, based on some key principles, shows the right way of coping with the inter-temporal challenges. However, it could be recommended that the current very general formulations would be made even more detailed and operable in the future e.g. covering also rules of coexistence between different uses and their temporal sequences. This would imply prioritizations like favouring research over commercial exploitation or laying cables together with pipelines. Also, even more attention could be paid to some future oriented uses fulfilling different goals of the plan e.g. aquaculture for protection of maritime environment (plants, mussels) or identification of areas important for fish-fauna well-being.

One of the key assets of the Plan Bothnia pilot plan is that the project bridges also important gaps between research and planning reality by collecting, interpreting and displaying information. It makes use of immense HELCOM information resources illustrating importance of the properly gathered, interpreted and displayed to the public (easily accessible) data and information for initiating planning discussions. Therefore the project should be treated as evidence supporting the need to continue common work in the Baltic Sea region on joint collection, standardization, and exchange of data. Such approach would create solid bases to successfully cope with the MSP information gaps recently described in the literature (Zauch,a 2010).

The project has been also testing co-operation between pan-Baltic organizations in the field of MSP. This is the only Baltic maritime spatial plan prepared with such intensive involvement of VASAB and HELCOM. Therefore it provides useful insight into possibility of vertical co-

ordination in MSP creating a first world-wide example of such an approach. It seems that the co-operation between VASAB and HELCOM has appeared to be fruitful and rewarding. The question, that requires more thoughts in the future, is how to safeguard such a co-operation when MSP will become more intensive and popular. Should we create a VASAB-HELCOM help desk for MSP? Or perhaps the existing VASAB-HELCOM Working Group on the MSP should be engaged in benchmarking of different cross-border planning initiatives and provide Baltic planning community with periodical reflection paper on the MSP development in the region. Definitely the Baltic Sea region needs a kind of depository for the very rich, and growing, knowledge on the MSP in the region -in order not to lose the existing expertise, knowledge and experience.

But the key finding of the Plan Bothnia project is the importance of fostering a MSP planning culture, needed in order to turn into a reality the Baltic and the EU Commission wish to have a harmonized cross-border MSP covering the entire sea basin, including an appropriate land-sea interface. This problem has been properly highlighted in the report but one can suggest even much more far reaching conclusions. If we want to enhance cross-border MSP in the Baltic Sea region it would not be sufficient to create appropriate legal structures (focal points) and strive to fulfil the EU legislation on the SEA consultation.

In the Plan Bothnia case the planning process was likely much easier than those foreseen for many other Baltic cases. There was less problems with language barriers and the system of values is largely shared by Swedish and Finnish societies. But still the different planning experience in these countries resulted in allocation of the lion share of the planning time to discussions between stakeholders on the current situation, clarification of the planning goals, ambitions and intentions. Involvement of the general public to the planning process was equally challenging.

Therefore if we want to continue cross-border MSP in the future we should invest in creation of the foundations for a Baltic MSP planning culture. Perhaps the starting point should be in a symbolic language (joint legend of maritime spatial maps), creation of software (e.g. transboundary GIS) for cross-border communication on MSP alleviating language barriers, or agreeing on a common structure of the SEA reports to make them more easily readable for the other Baltic nations. Joint university courses for the Baltic maritime spatial planners would be of equal importance. They can be used not only for dissemination of knowledge, but also for integration of the Baltic maritime spatial planning community.

Dühr, S,. Colomb, C.. & Nadin V. (2010). European Spatial Planning and Territorial Cooperation Routlege, Milton Park-New York.

Ehler, Ch. & Douvere, F. (2009) Marine Spatial Planning: a step-by-step approach toward ecosystem-based management. Intergovernmental Oceanographic Commission and Man and the Biosphere Programme. IOC Manual and Guides No. 53, ICAM Dossier No. 6. Paris: UNESCO.

Gee, K., Kannen, A. & Heinrichs, B. (2011) BaltSeaPlan Vision 2030: Towards the Sustainable Planning of Baltic Sea Space, BaltSeaPlan, Hamburg

Gee, K, (2011) Developing a Pilot Maritime Spatial Plan for the Pomerania Bight and Arkona Basin. BaltSeaPlan Report no 9 available at http://www.baltseaplan.eu/index.php/Reports-and-Publications;809/1 access 1st of May 2012

Zaucha, J. Matcza,k M. (2011) Developing a Pilot Maritime Spatial Plan for the Southern Middle Bank. Maritime Institute, BaltSeaPlan Report no 9 available at http://www.baltseaplan.eu/index.php/Reports-and-Publications;809/1 access 1st of May 2012

Zaucha, J. (2012) Offshore Spatial Information – Maritime Spatial Planning in Poland. Regional Studies 46(4), pp.459-473

Annex 5: Baltic Sea MSP principles

The HELCOM-VASAB Baltic Sea Broad–scale Maritime Spatial Planning Principles were adopted by HELCOM and VASAB CSPD in the end of 2010, fulfilling the commitment set out in the HELCOM Baltic Sea Action Plan (BSAP, 2007) on creating MSP principles.

Baltic Sea broad-scale Maritime Spatial Planning (MSP) principles

HELCOM and VASAB,

RECALLING the HELCOM Baltic Sea Action Plan commitment to jointly develop by 2010, as well as test, apply and evaluate by 2012, in co-operation with other relevant international bodies, broad-scale, cross-sectoral, marine spatial planning principles based on the Ecosystem Approach: whereby all Contracting Parties and relevant HELCOM bodies shall co-operatively participate; thereby giving guidance for the planning and ensuring the protection of the marine environment and nature, including habitats and seafloor integrity; securing sustainable use of marine resources by reducing user conflicts and adverse impacts of human activities,

RECALLING the "HELCOM Recommendation 28E/9 on development of broad-scale marine spatial planning principles in the Baltic Sea area" adopted to facilitate the protection and sustainable use of the Baltic Sea.

RECALLING that Maritime Spatial Planning is promoted and called for by the VASAB Long Term Perspective, Nordic Council of Ministers, the European Union Strategy for the Baltic Sea Region and its objectives, The European Union Marine Strategy Framework Directive, the Integrated Maritime Policy for the European Union, including its roadmap with Maritime Spatial Planning Principles, and the work of UNESCO.

AWARE that while management and regulation of human activities is divided into sectoral frameworks, the Baltic Sea ecosystem hosting these activities and enabling economic and social prosperity, is a single entity which has limits in terms of ecological integrity and available space, and is inherently connected to activities and processes on land.

AWARE that there is an increasing need and competition for marine space of the Baltic Sea which requires an integrated, cross-sectoral approach of managing human activities.

AWARE that Maritime Spatial Planning is an instrument for analysing, coordinating and allocating the spatial and temporal distribution of human activities in marine areas to achieve a balance between economic, environmental, social and any other interests in line with internationally and nationally agreed objectives.

AWARE that the Baltic Sea is in great need of a developed, well adapted and coherent Maritime Spatial Planning to accomplish long term trade-offs between different and sometimes competing human activities, thereby providing a predictable framework for maritime economic investment and activities, for creating job opportunities and at the same time ensuring compatibility with good environmental status, thus promoting sustainable development of the marine areas and the Baltic Sea Region.

AWARE that according to sustainable development the needs of the present generation should be met without compromising the ability of future generations to meet their own needs.

ACKNOWLEDGE that although substantial work has already

been carried out in the Baltic Sea Region as regards Maritime Spatial Planning and Management, still great differences exist between the Baltic Sea Region countries in terms of Maritime Spatial Planning systems.

AGREE that this document, including the following ten principles, will provide valuable guidance

for achieving better coherence in the development of Maritime Spatial Planning systems in the Baltic Sea Region:

1. Sustainable management

Maritime Spatial Planning is a key tool for sustainable management by balancing between economic, environmental, social and other interests in spatial allocations, by managing specific uses and coherently integrating sectoral planning, and by applying the ecosystem approach.

When balancing interests and allocating uses in space and time, long-term and sustainable

management should have priority.

2. Ecosystem approach

The ecosystem approach, calling for a cross-sectoral and sustainable management of human activities, is an overarching principle for Maritime Spatial Planning which aims at achieving a Baltic Sea ecosystem in good status -a healthy, productive and resilient condition so that it can provide the services humans want and need. The entire regional Baltic Sea ecosystem as well as sub-regional systems and all human activities taking place within it should be considered in this context. Maritime Spatial Planning must seek to protect and enhance the marine environment and thus should contribute to achieving Good Environmental Status according to the EU Marine Strategy Framework Directive and HELCOM Baltic Sea Action Plan.

3. Long term perspective and objectives

Maritime Spatial Planning should have a long term perspective in relation to the goals it seeks to attain and to its environmental, social, economic and territorial effects. It should aim for longterm sustainable uses that are not compromised by short term benefits and be based on long term visions strategies and action plans. Clear and effective objectives of Maritime Spatial

Planning should be formulated based on these principles and national commitments. The establishment of a legal basis for Maritime Spatial Planning in the Baltic Sea countries should be investigated including vertically and horizontally well-coordinated decision making processes concerning sea space uses to ensure efficient implementation of maritime spatial plans and to provide for an integrated sea space allocation process when such plans do not yet exist.

4. Precautionary Principle

Maritime Spatial Planning should be based on the Precautionary Principle. This implies planning has an obligation to anticipate potential adverse effects to the environment before they occur, taking into account Article 3 of the Helsinki Convention, and take all precautionary measures so that an activity will not result in significant harm.

A similar, but distinct, forward looking perspective should be applied with respect to the economic and social dimensions.

5. Participation and Transparency

All relevant authorities and stakeholders in the Baltic Sea Region, including coastal municipalities as well as national and regional bodies, should be involved in maritime spatial planning initiatives at the earliest possible stage and public participation should be secured.

Planning processes should be open and transparent and in accordance with international legislation.

6. High quality data and information basis

Maritime Spatial Planning should be based on best available and up to date comprehensive information of high quality that to the largest extent possible should be shared by all. This calls for close cooperation of relevant GIS and geo-statistical databases, including the HELCOM GIS, monitoring and research in order to facilitate a trans-boundary data exchange process that could lead to a harmonised pan-Baltic data and information base for planning. This base should cover historical baselines, present status as well as future projections of both environmental aspects and human activities. It should be as comprehensive, openly accessible and constantly updated as possible and compatibility with European and Global initiatives should be ensured.

7. Transnational coordination and consultation

Maritime spatial planning should be developed in a joint pan-Baltic dialogue with coordination and consultation between the Baltic Sea states, bearing in mind the need to apply international legislation and agreements and, for the HELCOM and VASAB EU member states, the EU acquis communitaire. Such dialogue should be conducted in a cross-sectoral context between all coastal countries, interested and competent organizations and stakeholders. Whenever possible

maritime spatial plans should be developed and amended with the Baltic Sea Region perspective in mind.

8. Coherent terrestrial and maritime spatial planning
Spatial planning for land and for the sea should be tightly interlinked, consistent and supportive to each other. To the extent possible legal systems governing spatial planning on land and sea should be harmonised to achieve governance systems equally open to handle land and sea spatial challenges, problems and opportunities and to create synergies. Synergies with Integrated Coastal Zone Management should be strengthened in all BSR countries and in a cross-border setting.

9. Planning adapted to characteristics and special conditions at different areas
Maritime spatial planning should acknowledge the characteristics and special conditions of the different sub-basins of the Baltic Sea and their catchments. Consideration should be taken of the need for separate sub-regional planning adapted to such areas including sub-regional objectives supplementing regional objectives specified in principle 3. In general maritime spatial plans should seek coherence across ecosystems.

10. Continuous planning
Maritime spatial planning should reflect the fact that planning is a continuous process that will need to adapt to changing conditions and new knowledge. Monitoring and evaluation of the implementation of maritime plans and its environmental, as well as socio-economic, effects should be carried out with a view to identify unforeseen impacts and to improve planning data and methods. This monitoring and evaluation should, particularly in its trans-boundary dimensions and in addition to national and transboundary monitoring schemes, build on, and if possible be part of, regional monitoring and assessments carried out by regional organisations.

Annex 6: Endnotes

1. UN. 1982. United Nations Convention on the Law of the Sea. Signed December 10. 1982 in Montego Bay, Jamaica. (available on the web). As also highlighted by others, the preambula of UNCLOS notes that the ratifying states are "Conscious that the problems of ocean space are closely interrelated and need to be considered as a whole".
2. A widely cited reference is Ehler, Charles, and Fanny Douvere. 2009. Marine Spatial Planning: a step-by-step approach toward ecosystem-based management. Intergovernmental Oceanographic Commission and Man and the Biosphere Programme. IOC Manual and Guides No. 53, ICAM Dossier No. 6. Paris: UNESCO.(in English). A number of special issues of academic journals have focused on MSP including issue 32 (2008) of Marine Policy (guest editors F. Douvere & C. Ehler) as well as volume 15, number 2 (June 2011) of Journal of Coastal Conservation -planning and management (guest editors V. Barale and N. Schaefer). See also Jay, S. 2010. Built at Sea: Marine management and the construction of marine spatial planning, Town Planning Review, 81 (2), 173-191 for an account on the origins of MSP and the relationship with planning on land.
3. Commission of the European Communities (CEC) (2008) Roadmap for Maritime Spatial Planning: Achieving Common Principles in the EU, COM 791, CEC, Brussels; For a Baltic Sea regional policy document see: HELCOM & VASAB. 2010. The Baltic Sea broad-scale maritime spatial planning (MSP) principles. Adopted by member countries of HELCOM and VASAB and the EU Commission in December 2010 (Annex 3, Minutes of HELCOM HOD 34/2010).

   Academic accounts of MSP and the ecosystem approach are provided by e.g. Kidd, S., Plater, A. & Frid, C (eds) The Ecosystem Approach to Marine Planning and Management, Earthscan, London. 231 pp.; Douvere F. 2008. The importance of marine spatial planning in advancing ecosystem-based sea use management. Marine Policy 32:762–771; Foley, M., Halpern, B., Micheli, F. et al. 2010. Guiding ecological principles for marine spatial planning, Marine Policy, 34, 955–966; and Gilliland, P. & Laffoley, D. (2008) Key elements and steps in the process of developing ecosystem-based marine spatial planning, Marine Policy 32 (5) 787-796. A classic reference with a similar ethos is McHarg I. 1969. Design with Nature (reprinted as 25th anniversary edition 1994). Wiley. 198 pp.
4. EU (2011b) IP/11/353: Commission seeks views on how to reduce pressure on Europe's coastal and marine areas (press release 24 March 2011).
5. A parallel could be drawn to 20th century rational urban planning -where rational idealism led unfortunately to rather dystopian results. It was often conducted by technical expert master planners with little or no sensitivity for public views, historical values or the virtues of smaller scales. Typical examples of this genre of planning include e.g. the "Plan Voisin" proposal of Le Corbusier, aiming for complete renewal of the Paris old town, various plans of totally rational industrial cities like those by Ernst May for the Soviet city of Magnitogorsk as well as the work of planners like Robert Moses, the master builder of mid-20th century New York. Such plans might be very rational- but are they desirable?
6. We were ourselves inspired by Maes, F., Schrijvers, J. & Vanhulle, A., (2005) A Flood of Space: Toward a Spatial Structure Plan for Sustainable Management of the North Sea, Belgian Science Policy, Brussels.

http://193.191.208.76/belspo/home/publ/rappma_en.stm
7. For physical details see e.g. Leppäranta M. & Myrberg. 2009. Physical Oceanography of the Baltic Sea. Springer & Praxis. 378 pp.
8. HELCOM. 2007. Climate Change in the Baltic Sea Area - HELCOM Thematic Assessment in 2007. Baltic Sea Environment Proceedings 111. 49 pp.
9. Myrberg K. & Andreev O. 2003. Main upwelling regions in the Baltic Sea - a statistical analysis based on three-dimensional modelling. Boreal Environment Research 8: 97-112. and Leppäranta M. & Myrberg. 2009. Physical Oceanography of the Baltic Sea. Springer & Praxis. 378 pp. (at p.281)
10. This part on geology is largely based on Kotilainen J. & Kohonen T. 2005. 2. Selkämeren pohjan sedimentit: kerrostumishistoria ja sedimentaatiodynamiikka p.14-19 in Sarvala M. & Sarvala J. (eds): Miten voit, Selkämeri ? Merialueen tila Satakunnan ja Vakka-Suomen rannikolla. Southwest Finland Regional Environment Centre. (in Finnish) 144 pp.
11. HELCOM. 2011. The Fifth Baltic Sea Pollution Load Compilation (PLC-5). Baltic Sea Environment Proceedings 128. 217 pp.
12. Graham LP. 2004. Climate change effects on river flow to the Baltic Sea. Ambio 33:235–241
13. HELCOM. 2010. Hazardous substances in the Baltic Sea – An integrated thematic assessment of hazardous substances in the Baltic Sea. Baltic Sea Environmental Proceedings 120B. 116 pp. ;HELCOM. 2004. Dioxins in the Baltic Sea. www.helcom.fi
14. Anon. 2010. Ilman kiinteää tieyhteyttä olevat pysyvästi asutut saaret. Finnish Ministry of employment and the economy publications 26/2010. http://www.tem.fi/files/27537/26_2010_web.pdf
15. Holma, E., Heikkilä, A., Helminen, R. & Kajander, S. 2011. Baltic Port List 2011: Annual cargo statistics of ports in the Baltic Sea Region. University of Turku, Centre for Maritime Studies.
16. Erik Gløersen. 2009. Strong, Specific and Promising. Towards a Vision for the Northern Sparsely Populated Areas in 2020. Nordregio Working Paper 2009:4. Stockholm, 2009
17. Ministry of Transport and Communication 2011. Press release: Working group to solve the securing of marine transport in the Northern Quark (in Finnish). Retrieved from: www.lvm.fi/web/fi/tiedote/-/view/1278090 (25.11.2011).
18. HELCOM Recommendation 25/7 "Safety of winter navigation in the Baltic Sea Area". Perhaps surprising to many, HELCOM has since 1970s been the forum for intergovernmental cooperation also on regional maritime issues, some of which have dimensions beyond the marine environment as such. These include e.g. safety of navigation issues, hydrographic re-surveys, AIS data exchange and an operational system of regional oil pollution response reporting, POLREP, backed up by annual HELCOM BALEX response exercises.
19. WWF 2010. Future Trends in the Baltic Sea. WWF Baltic Ecoregion Programme 2010. Retrieved from: http://wwf.panda.org/what_we_do/where_we_work/baltic/?uNewsID=194764 (22.4.2011).
20. Baltic Transport Outlook (2011) Report on main task 1: Strategic Network Methodology. Retrieved from http://www.baltictransportoutlook.eu/index.php?main=about-rapporter.html .
21. ICES. 2010. Report of the Baltic International Fish Survey Working Group (WGBIFS), 22–26 March 2010, Klaipeda, Lithuania. ICES CM 2010/SSGESST:07. 461 pp.
22. ICES. 2010. Report of the Baltic fisheries assessment working group (WGBFAS), 15-22 April 2010. ICES Headquarters, Copenhagen, Denmark.
23. Fiskeriverket. 2011. Fiskbestånd och miljö i hav och sötvatten – Resurs- och miljööversikt.
24. Lindgren, M., Östman, Ö., Gårdmark, A. 2011. Interacting trophic forcing and the population dynamics of herrring. Ecology, 92(7), 2011, pp. 1407-1413.
25. Thrush, S.F., Dayton, P.K. 2002. Disturbance to marine benthic habitats by trawling and dredging: Implications for marine biodiversity. Annual Review of Ecology and Systematics, Vol. 33, (2002), pp. 449-473.
26. ICES. 2011. Report of the Baltic Fisheries Assessment Working Group (WGBFAS), 12 -19 April, ICES Headquarters, Copenhagen. ICES CM 2011/ACOM:10. 824pp.
27. ICES WGBIFS reports from 2008-2010: ICES. 2008. Report of the Baltic International Fish Survey Working Group (WGBIFS). 31 March4 April 2008, Gdynia, Poland. ICES CM 2008/LRC:08. 584 pp.; ICES. 2009. Report of the Working Group on Baltic International Fish Survey (WGBIFS), 30 March- 3 April 2009, Lysekil, Sweden. ICES CM 2009/LRC:05. 742 pp.; and ICES. 2010. Report of the Baltic International Fish Survey Working Group (WGBIFS), 22–26 March 2010, Klaipeda, Lithuania. ICES CM 2010/SSGESST:07. 461 pp.
28. European Commission (2011). Energy Roadmap 2050. COM(2011) 885/2 http://ec.europa.eu/energy/energy2020/roadmap/doc/com_2011_8852_en.pdf
29. UNEP (2012). Green economy in a Blue World. Synthesis report. http://www.unep.org/pdf/green_economy_blue.pdf
30. YLE. 2011. Interview of Peter Lund, professor in Renewables technology, Aalto University in Finnish tv program Min Morgon (FST5 9.12.2011) http://goo.gl/mM2D9

31. Svensk Energi 2012. Kraftläget i Sverige v 37. Online statistics of Swedish energy (in swedish). http://www.svenskenergi.se/upload/Statistik/Kraftläget/vrapp.pdf
32. Vindval. 2011. Syntesrapport Fåglar och fladdermöss.Vindval release 31/10 2011. (in swedish)
33. Environmental Report: Offshore Wind SEA (BMT Cordah for DTI, July 2003)
34. HELCOM.2010. Towards an ecologically coherent network of well-managed Marine Protected Areas– Implementation report on the status and ecological coherence of the HELCOM BSPA network. Baltic Sea Environment Proceedings. 124B. 143 pp.
35. Naturvårdsverket.2008. Utbredning av arter och naturtyper på utsjögrund i Östersjön -En modelleringsstudie. Rapport 5817. 63 pp. http://www.naturvardsverket.se/Documents/publikationer/620-5817-3.pdf
36. Mattias Göransson. 2011. Ersättningsmaterial för naturgrus – kunskapssammanställning och rekommendationer för användningen av naturgrus (in Swedish). SGU-report 2011:10. http://www.sgu.se/dokument/service_sgu_publ/SGU-rapport_2011-10.pdf
37. WWF 2010. Future Trends in the Baltic Sea. WWF Baltic Ecoregion Programme 2010. Retrieved from: http://wwf.panda.org/what_we_do/where_we_work/baltic/?uNewsID=194764 (22.4.2011).
38. Mitt Sverige Turism - Data from Regional Tourism organization Västernorrland http://www.visitvasternorrland.nu/
39. IMO. 2008. New traffic separation scheme and deep-water route "Åland Sea" Submitted by Finland and Sweden. NAV 54/3/7. Sub-Committee on the safety of Navigation. 54th session. Agenda item 3. Retrieved from http://www.shipadm.com/pages/14913/54-3-7.pdf
40. Havs och Vattensmyndigheten (2011) Förslag till ändring av Fiskeriverkets föreskrifter (FIFS 2004:25) om resurstillträde och kontroll på fiskets område och Fiskeriverkets föreskrifter (FIFS 2004:36) om fisket i Skagerrak, Kattegatt och Östersjön. Retrieved from http://www.havochvatten.se/download/18.77581c8213364cf66b380005013/Remisslaxkvot2011slutlig.pdf
41. Anon. (2002) Finland´s National land Use Guidelines. Issued by the Council of State on November 30/2000 Environment Guide 92: 38 (not valid for certain chapters, revised 31st March 2009)
42. Anon. 2010. Planering på djupet –Betänkande av havsplaneringsutredningen. Stockholm. SOU 2010:91. 535 pp. (in Swedish). This is a study of possibilities, and proposal for MSP legislation in Sweden (unofficial translation of title 'Planning at depth').
43. Just as a note this delineation, baseline +1 nm, is the same as the outer boundary of the EU Water Framework Directive (2000/60/EC) application area. Anon.2000. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 Establishing a Framework for Community Action in the Field of Water Policy.
44. Swedish Environmental Objectives (2008) published by the Swedish Environmental Objectives Council. www.miljomal.se.
45. Main Policy Document: Anon. 2007. An Integrated Maritime Policy for the European Union COM(2007)575. See also the maritime policy work program: Anon.2007. Accompanying document to COM (2007)575. SEC (2007)1278. More up to date information available from the DG MARE website.
46. Anon. 2008. Roadmap for Maritime Spatial planning: achieving common principles in the EU COM(2008)791.
47. Anon. 2009. COM(2009) 248: European Union Strategy for the Baltic Sea Region.
48. Anon. 2008. Directive 2008/56/EC of the European Parliament and the Council of 17 June 2008. Establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). Official Journal of the European Union. L164/19.
49. Anon. 1992. Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992 (entered into force on 17 January 2000). This revised Convention replaced the original which was signed in 1974, and entered into force in 1980. A wide cooperation on Baltic Sea issues- including topics like shipping, oil response, land-based pollution, scientific monitoring and assessment, protected areas and environmental effects of fishing -has formed around the implementing body, Helsinki Commission (HELCOM) since 1974.
50. HELCOM & VASAB. 2010. The Baltic Sea broad-scale maritime spatial planning (MSP) principles. Adopted by member countries of HELCOM and VASAB and the EU Commission in December 2010 (Annex 3, Minutes of HELCOM HOD 34/2010).
51. Anon. 2001. Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment. Official Journal of the European Communities L 197/30.
52. Anon. 1985. Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment (85/337/EEC). Official Journal of the European Communities L 175/40.

Annex 7: Map and figure sources

(Numbers referring to pages)

p.10 & p.15 TS and EEZ borders based on information available through HELCOM GIS.
p. 20 (top) Red Sea, Black Sea and Baltic Sea means from Leppäranta M. & Myrberg. 2009. Physical Oceanography of the Baltic Sea. Springer & Praxis. 378 pp. (at p. 3). Ocean seawater and Eastern Mediterranean values from Pickard G. & Emery W. 1990. Descriptive Physical Oceanography 5th ed. Pergamon Press. 320 pp. (at p.51).
p.20 (bottom) redrawn from Myrberg K., Leppäranta M. & Kuosa H. 2006. Itämeren fysiikka, tila ja tulevaisuus (p.72, referring to Bock 1971). Helsinki University Press, Helsinki. 202 pp. (in Finnish)
p.21 Based on public domain information available through e.g. HELCOM GIS.
p.22 (top) Upwelling area redrawn from information to be included in: Myrberg, K., Lehmann, A and Höflich, K (in preparation) -based on 443 SST maps (derived from NOAA satellite data) 1990-2009, May-September with a temperature gradient threshold of 2°C. Circulation redrawn based on Witting (1936), reproduced in Myrberg K. & Andrejev O.2006. Modelling of the circulation, water exchange and water age properties of the Gulf of Bothnia. Oceanologia. 48 (S), pp. 55–74.
p.22 (bottom) Sea ice average cover redrawn based on the results of the Swedish Meteorological and Hydrological Institute (SMHI) project SWECLIM (1996-2003). Pack/Ridged ice locations from: SMHI& FIMR.1982. Climatological ice atlas for the Baltic Sea, Kattegat, Skagerrak and Lake Vänern (1963-1979). Swedish meteorological and hydrological Institute (SMHI) and the Finnish Institute of Marine Research. Norrköping. 220 pp.
p.23 (top) Redrawn based on Garrison T. 1999. Oceanography- an invitation to marine science. Wadsworth publishing company 552 pp. (at p. 218)
p. 23 (bottom) Schematic picture (not to scale) based on various illustrations including those in Kankaanpää P. 1991. Morphology of sea-ice pressure ridges in the Baltic Sea. Helsinki University (PhD thesis). Jouni Vainio helped in locating the reference.
p.24 Banks on Swedish side from Swedish Environmental Protection Agency (Naturvårdsverket) 2011. Banks on Finnish side produced by Plan Bothnia from IOW depth relief from HELCOM GIS and US NGA digital nautical chart available from Oceanografix web site (2011). Lights produced by Plan Bothnia from: NGA. 2011. Sailing directions (Enroute) 195-Gulf of Finland and Gulf of Bothnia. 2011, Eleventh edition. National Geospatial Intelligenge Agency, Bethesda, Maryland. 169 pp.
p. 26 Created by the Plan Bothnia project (Marco Nurmi, SYKE) based on bathymetric data from the Baltic Sea Research Institute Warnemünde, IOW (data available through HELCOM GIS). Method used has been published by Ardron J. & Sointula B.C.2002. A GIS recipe for determining benthic complexity: an indicator of species richness. In: Breman J (ed) Marine geography: GIS for the oceans and seas. Environmental Systems Research Institute, Redlands, CA, p 169–175.
p. 27 Redrawn based on a Baltic –wide map on the distribution of Quaternary deposits in the Baltic Sea is a result of INTERREG III B project “Balance”. The data is available through HELCOM GIS. The material was originally published in: Al-Hamdani Z. & Reker J (eds) 2007. Towards marine landscapes in the Baltic Sea. BALANCE Interim Report 10. 115 p. (electronic publication)
p. 28 Contours based on bathymetric data from the Baltic Sea Research Institute Warnemünde, IOW (data available through HELCOM GIS).

p.29 Salmon data based on HELCOM. 2011. Salmon and sea trout populations and rivers in the Baltic Sea . Baltic Sea Environment Proceedings 126A. 79 pp.
p.30 Redrawn from HELCOM. 2004. Dioxins in the Baltic Sea. www.helcom.fi
p.31 Spawning grounds for whitefish based on results from Gunnarz et al. 2011. Spawning grounds for herring based on two interview studies: Gunnartz U, Lif M, Lindberg P , Ljunggren L, Sandström A & Sundblad G 2011. Kartläggning av lekområden för kommersiella fiskarter längs svenska ostkusten - en intervjustudie. FINFO 2011:3, Swedish Board of Fisheries, Sweden and another from the surroundings of Vasa, Finland, in 1984 performed by Regionplaneförbundet för Vasa län (on file at SLU/Bergström). General areas of special ecology interest: defined on Plan Bothnia meetings with partners and participating experts.
p. 33 Münster, Sebastian. 1544. Gemaine Beschreibung aller Mittnächtigen Länder Schweden, Gothen, Norwegien, Denmarck, Basel 1544. (Reproduced in Anon. 1967. Vanhoja Suomen Karttoja, Old Maps of Finland. Suomen Kirjallisuuden Kirjapaino Oy. Helsinki. 111 pp.)
p. 34 (top) Finnish data from RiistaWeb. Finnish Wildlife Agency & Finnish Game and Fisheries Research Institute (riistaweb.riista.fi/?lang=en). Swedish data from Swedish Hunters Association (Svenska Jägareförbundet www.jagareforbundet.se/Hunting-in-Sweden/). Redrawn based on HELCOM. 2010. Ecosystem Health of the Baltic Sea - HELCOM Initial Holistic Assessment . Baltic Sea Environment Proceedings 122. 63 pp.
p. 34 (bottom) Based on official national statistics for 2008, from Sweden (Statistics Sweden) and Finland (Statistics Finland). Filed at Nordregio.
p.35 Redrawn based on official national statistics for 2010, from Sweden (Statistics Sweden) and Finland (Statistics Finland). Filed at Nordregio. Europe-wide gridded population data is available through the European Forum for Geostatistics, EFGS (www.efgs.info).
p.36 (top, middle and bottom) Based on official national statistics for 2008, from Sweden (Statistics Sweden) and Finland (Statistics Finland). Filed at Nordregio.
p.37 Based on official national statistics for 2008, from Sweden (Statistics Sweden) and Finland (Statistics Finland). Filed at Nordregio. Swedish municipalities borders from Nordisk Kartdatabas/Nordic Cartographic Database (1996). Finnish municipalities border from National Land Survey of Finland (2012).
p. 43 Redrawn from a Baltic-wide AIS dataset compiled by the INTERREG project “Sub-regional risk of spill of oil and hazardous substances in the Baltic Sea (BRISK)” (www.brisk.helcom.fi). Data originally retrieved from the regional Baltic Sea HELCOM AIS database. Port volumes from: Holma, E., Heikkilä, A., Helminen, R. & Kajander, S. 2011. Baltic Port List 2011: Annual cargo statistics of ports in the Baltic Sea Region. University of Turku, Centre for Maritime Studies.
p. 44 (middle and bottom) Data retrieved from the regional Baltic Sea HELCOM AIS database.
p. 45 Redrawn based on Pekkarinen (2012) Maritime Transport in the Gulf of Bothnia 2010-2030: Future scenarios for Maritime Spatial Planning Purposes. Master thesis. University of Akureyri, University Centre of the Westfjords, Iceland.
p. 46 & 47 Transport corridors (p.47 top) redrawn based on: Meriläinen, A, Mäenpää, M., Kunnas, J., Lundberg, A., Ramstedt, L., Quistgaard, K, Isberg, L., (2010) Transport potential and development needs in Bothnian Corridor transport network. This is the final report of a study commissioned by the Swedish Transport Administration and the Finnish Transport Agency. Large illustration by Jukka Pylväs based on various sources from this chapter.
p. 51 Based on the outcomes Plan Bothnia meetings with partners and other participating experts on status and future of traffic in the Bothnian Sea. Material used include Swedish national interest areas for shipping, Baltic regional HELCOM AIS data, HELCOM resurvey areas, priority ports and various suggested transport corridors.
pp. 52, 53, 54 (top), 55 & 56 (middle) Fisheries maps in this report were created by Plan Bothnia project by Swedish Agricultural University (SLU), U. Bergström and R. Fredriksson, using raw VMS and fisheries logbook data of 2007 to 2009 (from Swedish and Finnish fisheries authorities). Important areas are visualised by showing the 50 per cent proportion of the area that had the highest catches of herring. See Annex of this book for details on methodology used, based on Bastardie, F., Nielsen, J.R., Ulrich, C., Egekvist, J., Degel, H. 2010. Detailed mapping of fishing effort and landings by coupling fishing logbooks with satellite-recorded vessel geolocation. Fisheries Research. 106 (2010). 41-53. Proper reference to these figures should be Bergström U. & Fredriksson R. 2012. Fishing and aquaculture (chapter) in Backer H. & Frias M. (eds) 2012. Planning the Bothnian Sea. HELCOM.
p. 54 (middle) Herring stock based on ICES. 2011. Report of the Baltic Fisheries Assessment Working Group (WGBFAS), 12 -19 April, ICES Headquarters, Copenhagen. ICES CM 2011/ACOM:10. 824pp.; Value of fisheries based on data from the website of the Finnish Game and Fisher-

ies Research Institute (RTKL) www.rktl.fi/tilastot/aihealueet/ammattikalastus_merella/(in Finnish). Herring value corrected with 2010 cost of life index, from Statistics Finland.
p.55 Important areas for large herring, identified by analysing densities of herring larger than 20 cm from a number of scientific hydro acoustic surveys performed in October 2007-2009. The important areas for herring larger than 20 cm are visualized by showing the 20 per cent proportion of the area that had the highest densities of herring. Spawning grounds for herring identified by interviewing local fishermen. See note 18 above. Jouni Leinikki and Raimo Parmanne helped identifying South West spawning areas. Spawning grounds: see map reference for page 31.
p. 58 2009 aquaculture production figures from Eurostat (Fishery Statistics).
p. 59 Areas with largest Herring catches based on VMS and logbook data from Swedish and Finnish Fisheries authorities produced by Plan Bothnia. Spawning grounds see map reference for page 31. Jouni Leinikki and Raimo Parmanne helped to identify potential South West Finland spawning areas. Other areas identified by partners and experts in Plan Bothnia meetings.
p. 60 (top) Data from HELCOM GIS
p. 60 (bottom) Drawn based on Figure TS.2 of IPCC 2007. TS.2.1.1 Changes in Atmospheric Carbon Dioxide, Methane and Nitrous Oxide, in Solomon et al (eds): Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 996 pp. www.ipcc.ch
pp. 61, 62 (top), 63 Wind production data, project locations, Swedish national interest areas and wind power areas in regional plans are from different national and industry sources checked with project participants. The 30m depth curve is based on bathymetric data from the Baltic Sea Research Institute Warnemünde, IOW (data available through HELCOM GIS).
pp. 64 & 65 Large illustration by Jukka Pylväs based on various sources from this chapter.
p. 67 Energy transmission lines and powerplants data from Nordel 2009 / Nordregio
p. 68 Visual disturbance map calculated by project from project locations using distances (see text) in Environmental Report: Offshore Wind SEA (BMT Cordah for DTI, July 2003).
p. 69 Energy interest areas identified by partners and experts in Plan Bothnia meetings.
pp. 73 & 74 Protected areas based on data available through HELCOM GIS. Potential ecological interest areas are same as on page 31. Other areas identified by partners and experts in Plan Bothnia meetings.
p. 77 Swedish military practice areas based on data from FOI-the Swedish Defence Research Agency. Finnish areas based on: Ministry of Defence.2006. Puolustusvoimien harjoitusalueiden käyttö kansainväliseen ja kaupalliseen toimintaan Harjoitusaluetyöryhmän loppuraportti (in Finnish- "The Defence Forces practice areas use of international and commercial activities"). Practice area working group final report 2006. 41pp. http://www.defmin.fi/files/866/PLM-Harjoitusalueraportti-nettiin.pdf. ; Mine danger areas redrawn based on: Gunnar Möller.2011. From a DC-3 to BOSB: The road to a breakthrough in military safety measures against the risks of historic explosive ordnance. Marine Technology Society Journal 45(6) p. 26-34(9).
p. 79 Redrawn based on sand areas in the Baltic –wide map on the distribution of Quaternary deposits in the Baltic Sea, a result of INTERREG III B project "Balance". See map reference for page 27.
p.83 (top, middle) Finnish data from: Statistics Finland.2011. Official Statistics of Finland (OSF): Buildings and free-time residences. ISSN=1798-6796. www.stat.fi/til/rakke/index_en.html. (viewed 6.4.2011). Swedish data from SCB.2011. Taxeringsenheter efter region, typkod och tid - 221 småhusenhet, fritidsbostad för 1-2 familjer; Statistiska centralbyrån (Statistics Sweden). www.scb.se
p. 85 Finnish data on remains and built cultural heritage are from the National Board of Antiquities, Finland (Museovirasto) 2011. Swedish data on national interest areas and remains are from the Swedish counterpart, Riksantikvarämbetet (via Boverket).
p. 89-92 This is a compilation of selected interest information included in other maps of this book.
p.95 Swedish municipality and county borders: Nordisk Kartdatabas/Nordic Cartographic Database (1996). Finnish municipalities and region borders: National Land Survey of Finland (2012). Swedish offshore MSP redrawn based on Anon. 2010. Planering på djupet. SOU 2010:91. The latter is a study of possibilities, and includes a proposal for MSP legislation in Sweden (unofficial translation of title 'Planning at depth').
p. 109 Work carried out during Plan Bothnia meetings 2011-2012, see Annex. An archive of meeting documents on process is available through the project website until 2015, later through HELCOM web archives.

Annex 8: Index and Glossary

Plans are nothing.
Planning is everything.

– Dwight D. Eisenhower,
general and president
(1890 – 1961)

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This book contemplates the future of the Bothnian Sea, part of the Baltic Sea.

It is the summary outcome of Plan Bothnia, a pilot project on transboundary maritime spatial planning. The work was carried out between December 2010 and May 2012 by a partnership of seven institutions.

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