Pilot area Great Belt
Mapping and modelling for MSP

Aim

Actual maritime spatial planning was not part of the expected outcome from the Danish straits. The area was meant to serve more as a workshop area for investigating how ecological data / information can be better used in MSP

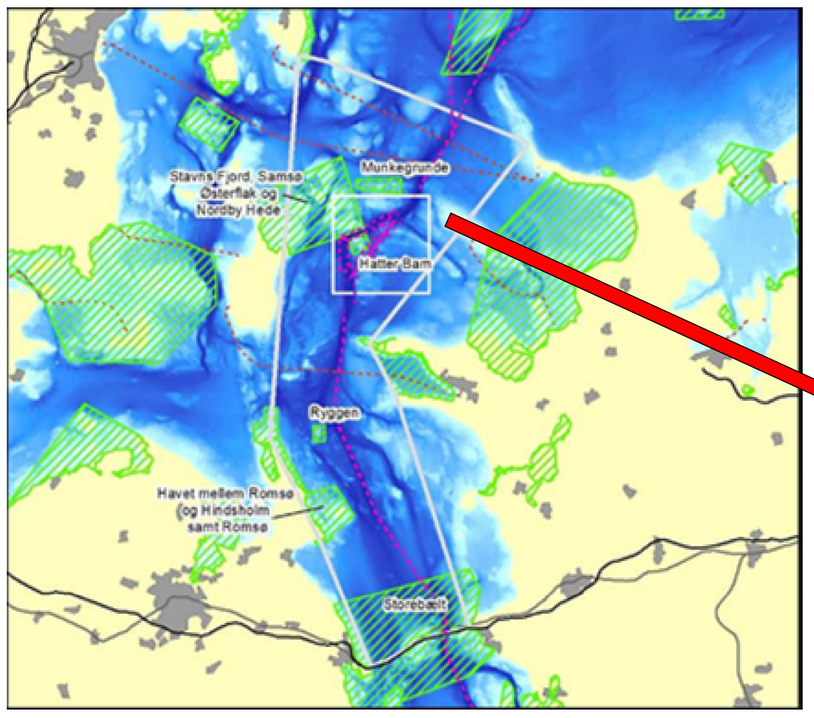
> Developing new mapping and modelling tools and testing their applicability for maritime spatial planning in general.

> Investigate the effect of ship noise on harbour porpoises

Stocktaking

NATURE PROTECTION AND SHIPPING

Pilot area in the Danish Strait. It hosts a large number of NATURA-2000 areas (green hatching) and is a key area for harbour porpoises. Major shipping routes are indicated by purple dots Based on data from Senstius (2009), the number of ship passages around Hatter Barn is estimated to be approximately 25,000 per year with a size exceeding 300 gross tons.

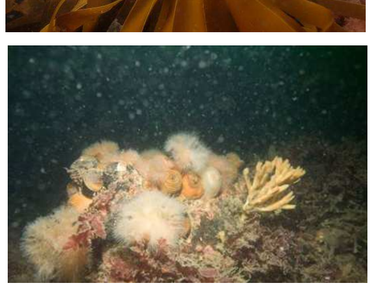


ECOLOGICAL VALUES

The biological communities inhabiting the pilot area are shaped by the substrate, the presence of light and the salinity.

Shallow stone reefs
Very productive sea-weed forests inhabit the reef areas in shallow waters where light is sufficient.

Deep stone reefs
Different fauna species dominate the boulders in deep waters below 18m depth



Biogenic reef on gravely seabeds
Dense populations of the horse mussel below 15-16m depth act as a sub-strate for a rich biological community.

Occurrence of harbour porpoises
One of the most important areas in European waters

Main Conflicts

The area around Hatter Barn in the Danish Great Belt area was chosen as a pilot area for the BaltSeaPlan project for several reasons. It is known as a notorious risk area for grounding and collision of ships passing the Danish straits to and from the Baltic.

The pilot area hosts a high number of different habitats, large areas designated as NATURA-2000 areas and it is a key area for marine mammals like harbour porpoises and harbour seals.

A risk analysis for shipping in Danish waters in 2001 concluded that the Hatter Barn area at that time had the second highest risk of accidents in Danish waters (Anon. 2002). The reason was a combination of the necessary crossover of ships in the separation zones between the deep and shallow water route, the sharp turns in the deep water route combined with the lack of possible traffic separation due to the narrow passage and relatively strong and shifting current pattern in the area. One suggestion to minimize the risk was a deepening of the shallow water route from 15 to 19 m.

POTENTIAL FUTURE DILEMMA:

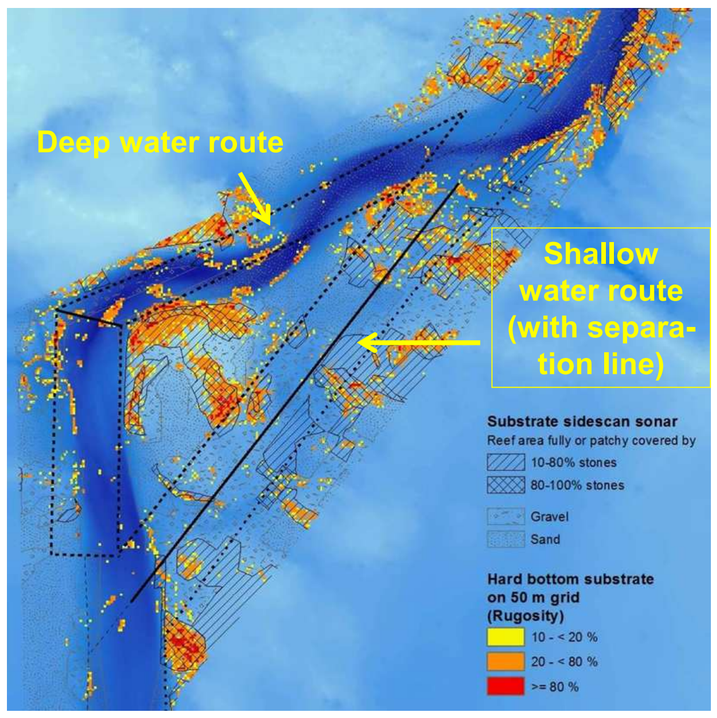
Shipping accidents in the area could cause severe effects on valuable ecosystems and protected areas and accidents affecting the ship traffic passing this bottleneck could have severe economic influence in the Baltic as well as other regions. On the other hand dredging the seabed could result in loss of valuable habitats.

Findings

MAPPING HARD BOTTOM HABITATS

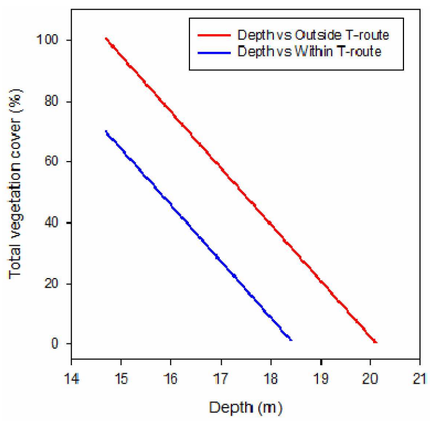
Mapping reef areas was a major activity within the Hatter Barn area. Two different methods were used:

1. Visual Interpretation of sidescan sonar images (common methodology).
2. Identification of reefs using index values of seabed rugosity on basis of high resolution multibeam bathymetry data (new method developed as part of the project)

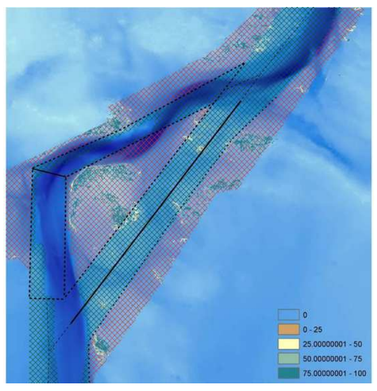


HABITAT MODELLING AND EFFECT OF SHIP TRAFFIC

A statistically significant model describing the macroalgal vegetation cover as function of depth, cover of sea urchin and location was established based on data from the area.
We found that the seaweed forest was significantly effected by depth, sea-urchin grassing and the presence inside or outside the shipping route.
The vegetation model was used to produce a habitat map. The map describes the vegetation cover on the identified reef parts taking depth and presence (inside-outside the sailing route) into account assuming a moderate grassing pressure from sea urchins.

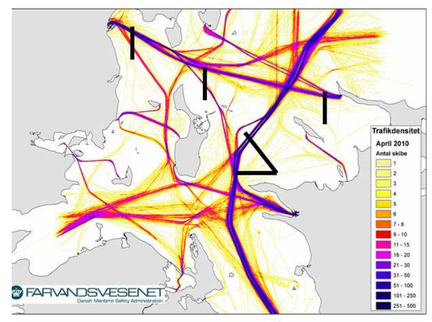


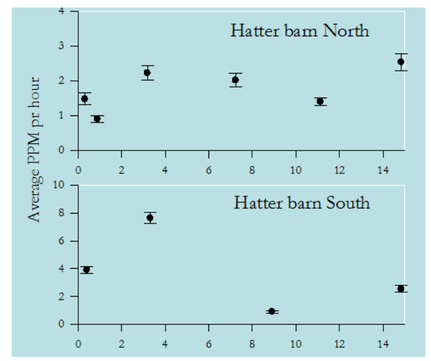
The seaweed vegetation was reduced by 30% inside the T-route on the reef areas.



RELATION BETWEEN SHIP NOISE AND PORPOISE ECHOLOCATION

The presence and activity of harbour porpoises was monitored by means of stationary acoustic monitors specially designed for detection of porpoise signals (T-PODs). Stations were placed along transect lines perpendicular to fast ferry routes (Hatter Barn north) and the main deep water route (T-Route) through the Great Belt (Hatter Barn south). Black bars indicate the measuring transects. At the same time under-water noise was monitored by noise recorders.
Porpoises were detected at all stations, despite variable and often high levels of ship noise. No correlation between ship noise and porpoise activity was observed and it is thus concluded that any avoidance to the ship noise occurs close to the ships. Further studies are required with finer spatial resolution closer to the noise source.





Conclusions

The new method identifying hard bottom using a calculated rugosity index was proven to be an effective, reproducible and cost effective method, given that high resolution bathymetry data are available.

Deepening the present shallow water route would result in a loss of 15% reef areas within the investigation area. The relative effect would be most severe on the deeper reef parts were app. 1/3 would be lost.

Ship traffic significantly affect the benthic seaweed forest within the shipping routes. The reduction in this case was approximately 30%.

Although high levels of noise were recorded within the shipping lanes, no evidence of lower abundance of porpoises within shipping lanes could be documented with the present measuring setup.

References:

Anon. 2002: Risikovurdering af sejladssikkerheden i de danske farvande. Søfartsstyrelsen og Farvandsvæsenet. Dokument nr. P-054380.
Senstius, J. 2009: AIS i Passagestatistikker - Nye metoder til Farvandsstatistik i danske farvande. Danish Maritime Safety Administration

Who was involved?

> Department of Bioscience, Aarhus University (former National Environmental Research Institute - NERI)
> Geological Survey of Denmark and Greenland (GEUS)
> Danish Maritime Safety Administration

Part-financed by the European Union (European Regional Development Fund)
Baltic Sea Region Programme 2007-2013