Maritime spatial planning and ship routeing systems

The high and rapidly increasing demand for maritime space for different purposes, as well as the multiple pressures on coastal resources, requires an integrated planning and management approach. Rerouteing of shipping lanes and the introduction of new routing systems may be needed to ensure high maritime safety and sustainable co-existence of various marine activities. SSPA's toolbox and experience assist planning and maritime authorities to prepare sustainable and efficient plans.

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Project Manager

Björn has an MSc in Mechanical Engineering and joined SSPA in 1980. He has been active in areas related to the marine environment, oil spill prevention and clean-up as well as the reduction of ship emissions and alternative fuels. Maritime safety and risk analysis are currently the main fields of expertise in his projects and in the research projects that he is engaged in. He has also been the programme manager for a number of advanced international training programmes.

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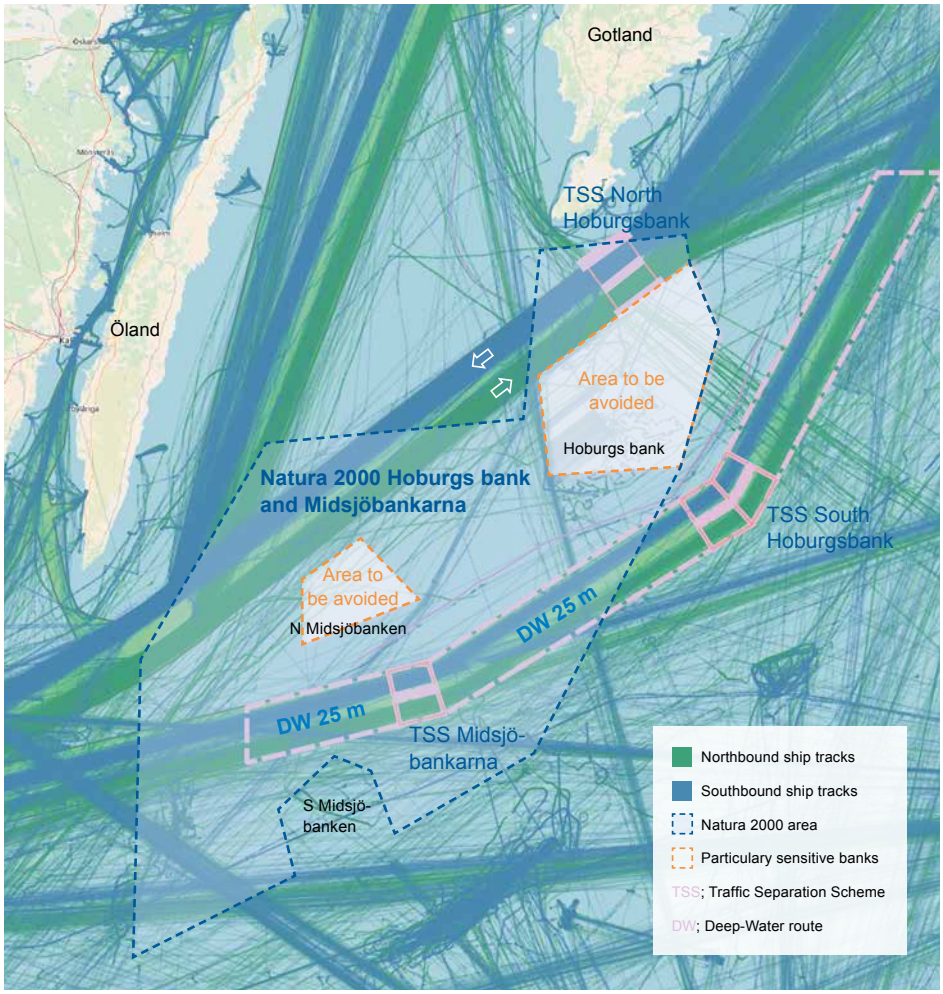
Sweden implements the Maritime Spatial Planning Directive

European Union Directive 2014/89/EU requires all coastal member states to present an integrated plan by 2021 on how to prioritise the use of sea areas within their economic zone and territorial waters, e.g. how to locate an offshore wind farm in areas with intense sea traffic. In Sweden, it is the Swedish Agency for Marine and Water Management (SwAM) that is responsible for the planning process and the Agency is also coordinating the planning process with neighbouring states. SSPA has been engaged by SwAM to conduct consequence analyses of the possible relocation of maritime sea traffic lanes in order to improve the protection of particularly environmentally sensitive areas.

Consequences of potential rerouting of ship traffic south of Gotland

The area south and southwest of the Swedish island of Gotland includes the Midsjöbankarna and Hoburgs bank, which constitute the most important wintering habitat for European long-tailed duck and it is also one of very few areas used for reproduction by harbour porpoise (the smallest species of toothed whales). The bird population is severely decimated every winter when thousands of oiled long-tailed ducks are stranded on the shores of Gotland and porpoise reproduction is believed to be disturbed by ship noise from vessels traversing the bank areas. Although no oil spills are observed by air surveillance in the bank areas, researchers assume that the oiling of the diving sea birds must be caused by invisible operational oil discharges from ships passing the main transit lane south of Gotland. SSPA's consequence analysis shows that the probability of any such potential operational oil discharges reaching the bank areas would be significantly reduced if the current main transit route through the Baltic Sea were redirected to the designated Deep-Water (DW) route located south of the Hoburgs bank.



The figure shows todays´ AIS traffic pattern, with the main flow north of the banks and the deep draught ship flow south of the banks. The protected banks with their "Areas to be avoided" have recently been included in one common enlarged Natura 2000 area, as indicated in the map.

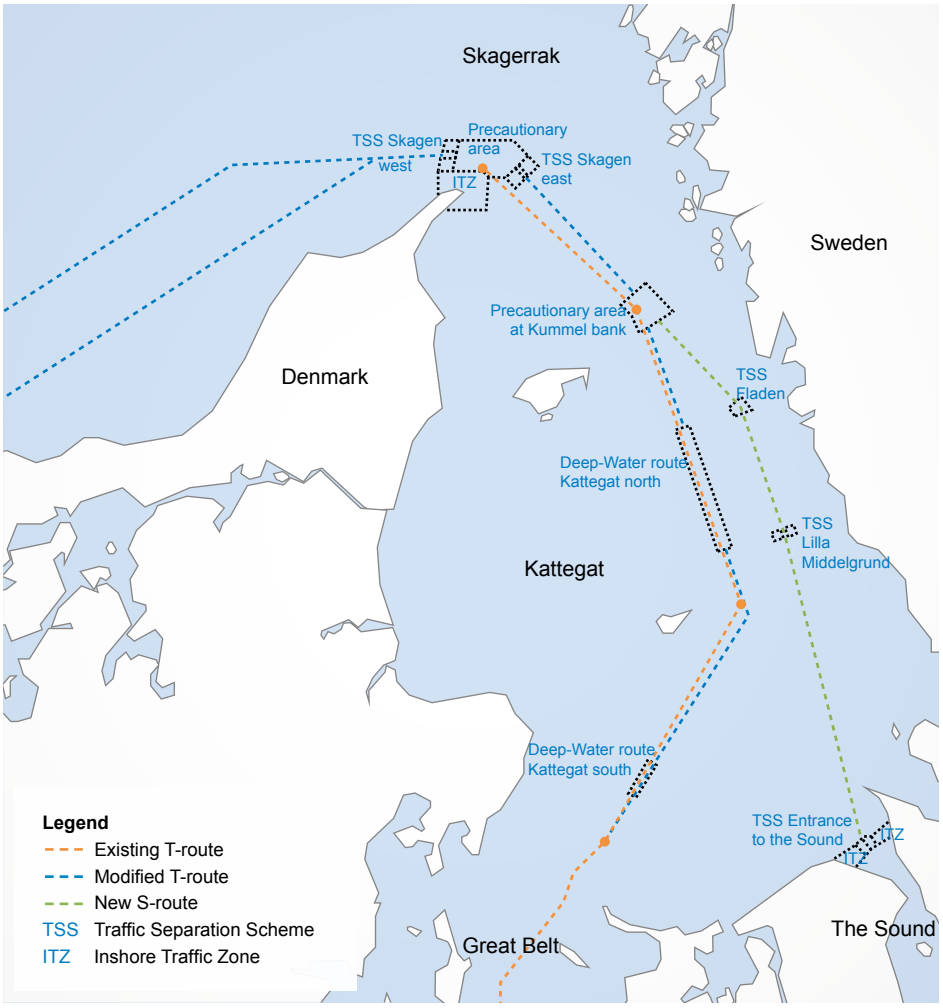
"SSPA provided qualified input on rerouting consequences in terms of fuel consumption, emissions and safety risks." – Dr Jonas Pålsson, SwAM.

Increased route distance may be balanced by reduced shallow water resistance

SSPA's consequence analyses also predicted and compared the total fuel consumption and exhaust emissions from the route currently in use and two optional alternatives for rerouting of the traffic. Though the options west of Gotland and south of the Hoburgs bank are longer, it was found that fuel consumption would not increase in proportion to the lengthening of the distance. This was because the shallow water induced additional resistance, was reduced for many ships when they choose the designated Deep-Water route (DW) 25 m, instead. Modelling of shallow water effects in the resistance and fuel prediction algorithms is based on empirical model and full-scale test results gained in SSPA's joint industry project SWABE, and demonstrates that it is important to carefully model and take into account the shallow water effects when assessing and comparing possible options for new and modified routeing systems. The mathematical models used to calculate added resistance caused by shallow water are also being further refined by being combined with Computational Fluid Dynamics (CFD) calculations, in order to allow estimation of ship-generated bottom erosion effects.

New routing system in the Kattegat and Skagerrak

SSPA has conducted comparative consequence analyses for the Swedish Transport Agency and for the Swedish National Road and Transport Research Institute; one study specifically addressed a proposed new routing system for the Kattegat and Skagerrak between Sweden and Denmark. The proposal was jointly submitted by the Swedish Transport Agency and Danish Maritime Authority to the International Maritime Organization (IMO), NCSR 5th session (19 – 23 February). The proposal includes a number of new Traffic Separation Schemes (TSS), a new Deep-Water route, and a separate route for ships in transit to the Sound. Separating traffic to the Sound from traffic to the Great Belt into different routes and separation of north- and southbound traffic by TSS will contribute to improved navigational safety. As a result of the proposed changes to the transit traffic in Route T, the total fuel consumption will increase by 3%, between the Skaw and the Great Belt. Considering the total transit traffic through Kattegat, including both the Great Belt and the Sound directions, the calculated fuel consumption and associated emissions are estimated to be about 0.9% lower than today provided that transit speed is kept unchanged. The calculated total saving percentage is small but converted into monetary terms it corresponds to a SEK 4.5 million reduction in fuel costs. The external costs related to greenhouse gases and air pollution together represent a reduction of SEK 7.4 million per year.



Proposed new roueting system between Sweden and Denmark to be implemented by July 2020.

IWRAP – tool for maritime risk assessment

The IWRAP software from Gatehouse Maritime was used by the Danish Maritime Authority (DMA) for design and validation of the new proposed routeing system in Kattegat. SSPA also regularly uses the IWRAP Mk2 version 5.3.0 as a tool for estimating collision and grounding probability in various waterways. The use of IWRAP is recommended by IALA (a non-profit, international technical association for marine aids to navigation authorities and other stakeholders), and SSPA provides IWRAP calculation services e.g. to SwAM for comparative analyses of different rerouting options in the marine spatial planning process and for offshore wind farm localisation studies.

Development of maritime safety and marine spatial planning requires expert cooperation

It is well known that development towards more sustainable cargo transportation systems includes modal shift from road to seaborne solutions. The predicted future increase in sea traffic and the ongoing process of preparing marine spatial plans highlight the need for creative cooperation efforts between qualified mariners, naval architects, risk analysts, environmentalists and planning experts. SSPA has the expertise, experience and tools – let us be your maritime solution partner.

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