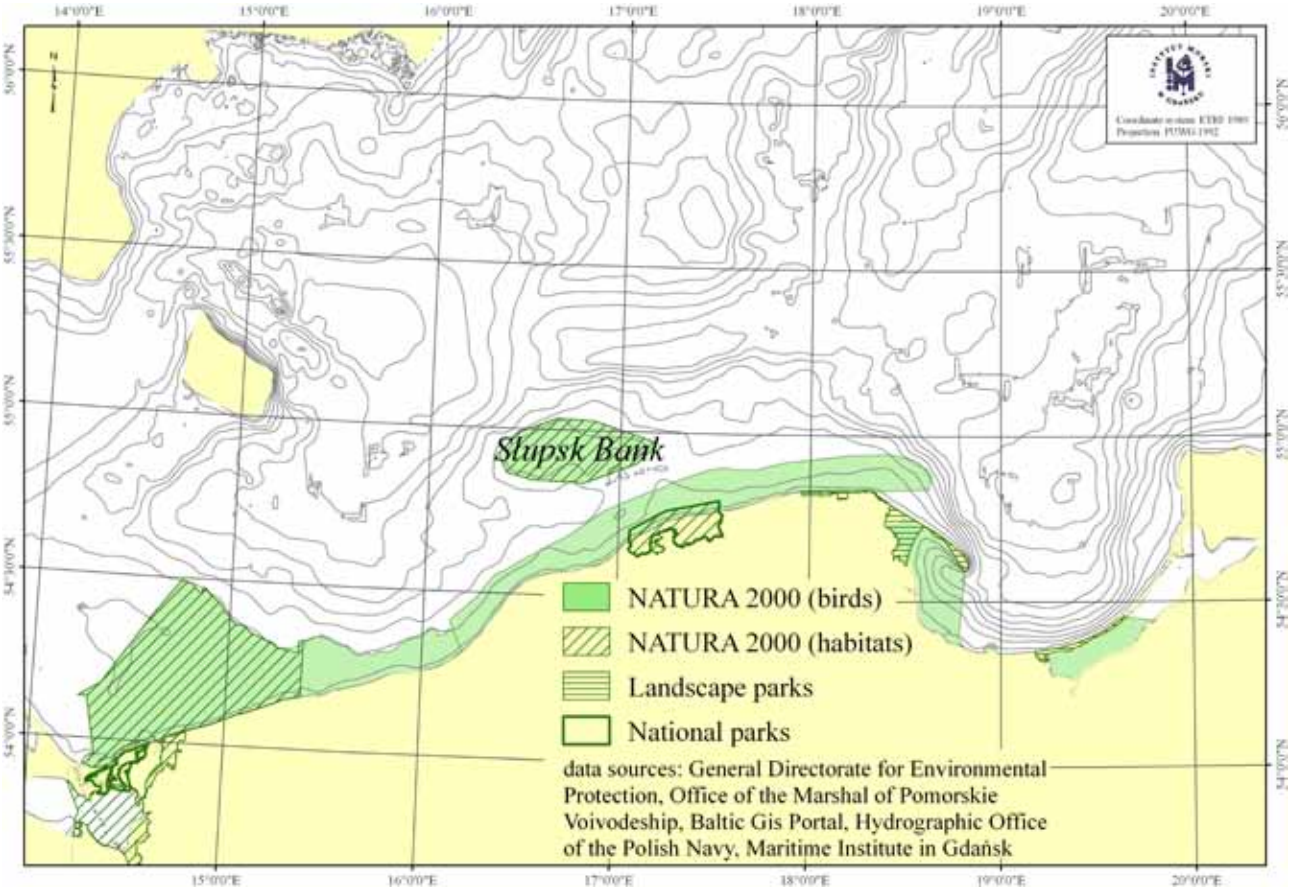
BalticMasterII

maritime safety across borders



The Influence of Associated Protective Measures on oil spill risk

JULIUSZ GAJEWSKI AND ANTONI STAŚKIEWICZ, MARITIME INSTITUTE IN GDAŃSK

www.balticmaster.org

THE BALTIC SEA - A PARTICULARLY SENSITIVE SEA AREA (PSSA)

The Baltic Sea was officially declared a Particularly Sensitive Sea Area in 2005, an area that needs special protection through action by the International Maritime Organisation (IMO) and is prone to damage by international maritime activities which may influence various socio-economic and environmental aspects of Baltic life.

PSSA is a tool which works effectively only when proper Associated Protected Measures (APMs) are introduced and implemented such as traffic separation schemes, areas to be avoided, discharge and emission restrictions, ship reporting and Vessel Traffic Services systems.

INTRODUCTION

There is a great need to evaluate the effect of Associated Protective Measures on oil spill risks in the Baltic Sea so the Maritime Institute in Gdańsk has carried this out for the Polish Marine Areas.

METHOD

The first step was to prepare a probability density function of oil spill. This required averaging detailed data on the courses of different ship types.

The Automatic Identification System (AIS), is a system for identifying and locating ships by radio-exchange of data, introduced in this century. It is an efficient tool for analyzing navigation intensity. The AIS navigation data can be used in a "snapshot" mode, when the current risk pattern has to be evaluated. The AIS data integrated for a certain time interval can be used, when the average risk for this interval is needed. In our case, the navigation density data were collected from different available sources in the Polish Marine Areas only.

Using integrated data on the courses of ships and data of past accidents, a probability density function of oil spill was calculated. As the navigation data were available only in the Polish Marine Areas, the function was prepared only for these areas.

The next step was to run multi-forecasts of oil spills, in the field of marine currents, based on particles released from each grid cell depending on the probability density function. The long-term forecast of sea currents was obtained from the HIROMB (High Resolution Operational Model for the Baltic Sea) executed by SMHI in Sweden.

After that, the multi-forecast oil spill trajectories have been integrated over time and space. This procedure has been repeated for tankers, ferries, fishing boats, and for all marine traffic. The results showed that tankers, ferries and fishing boats spill less oil than all other ship types together.

SEASONAL VARIATION

The results of the calculations also revealed strong seasonal variation in oil contamination risk which is caused by the seasonal character of winds over the southern Baltic. As wind is the main force generating currents in the Baltic, the contamination risk concentrates on leeward sea coasts for prevailing wind direction in any particular season. The seasonal effects are shown in Figs 1a and 1b. The first figure demonstrates the multi-year average oil spill risk in the Gulf of Gdańsk during the winter period, when westerly winds prevail strongly and the largest risk is concentrated along the eastern coast of the Gulf.

The second figure shows the appropriate situation for the summer period, when westerly winds do not prevail so strongly and the largest risk is more scattered along the coastline. The largest concentration can be found at both sides of the port of Gdańsk, as the traffic is most intensive in the area of ports of Gdynia and Gdańsk. In the open sea, larger risk concentration can be seen along the main route from the east of Hel Peninsula to both ports than it is during winter.

INFLUENCE OF APMS ON OIL SPILL RISK

The procedure of oil spill risk calculations can be repeated based on different density functions, e.g., the situation as it is now or after implementation of APMs as traffic separation schemes (TSS), navigation routes, areas to be avoided, etc.

The influence of an APM on the pattern of oil spill has been tested on the example of the new Słupsk Bank Traffic Separation Scheme. No new AIS analysis was carried out yet so a simple assumption of a 50% reduction in oil spill risk in close vicinity to the TSS was made.

Results of modelling TSS influence on oil spill risk are shown in Figures 2 and 3.

Seasonal variation figure 1a and 1b

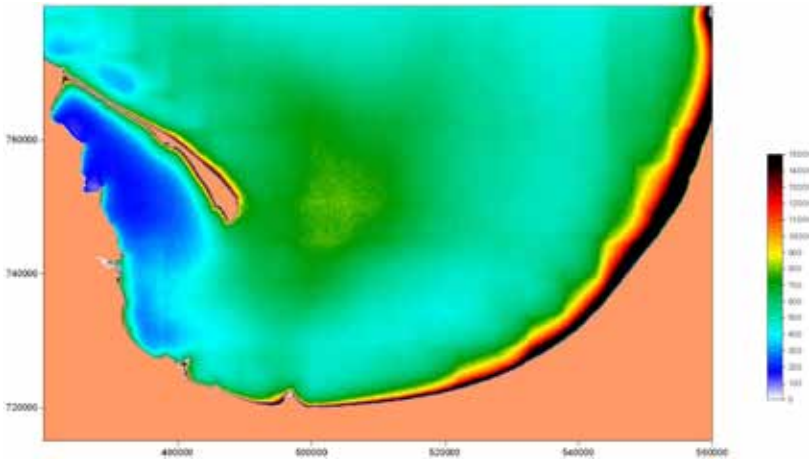


Figure 1a demonstrates the multi-year average oil spill risk in the Gulf of Gdańsk for the winter period. During this season, westerly winds prevail strongly and the largest risk is concentrated along the eastern coast of the Gulf.

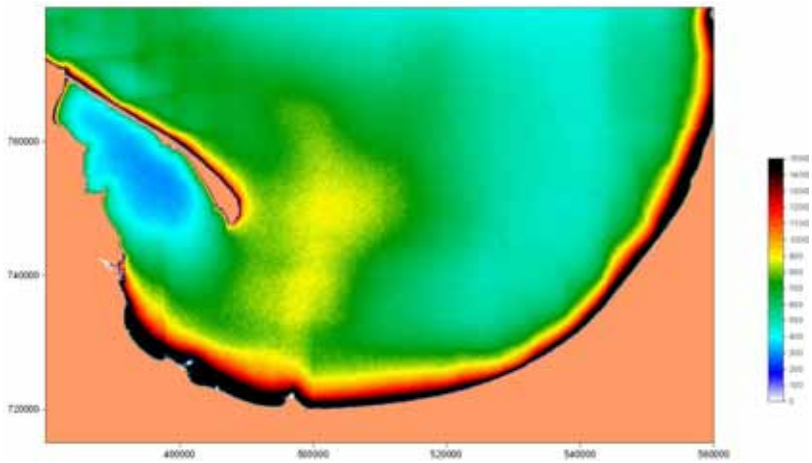


Figure 1b shows the appropriate situation for the summer period, when westerly winds do not prevail so strongly and the largest risk is more scattered along the coastline. The largest concentration can be found at both sides of the port of Gdańsk, as the traffic is most intensive in the area of ports of Gdynia and Gdańsk. In the open sea, larger risk concentration can be seen along the main route from the east of Hel Peninsula to both ports than it is during the winter.

CONTACT
Maritime Institute in Gdańsk
+48 58 301 16 41

Authors:
Juliusz Gajewski
Antoni Staśkiewicz, anstas@im.gda.pl

ID-no: BAMAIIWP4-002
Date: 2011-01-24

www.balticmaster.org

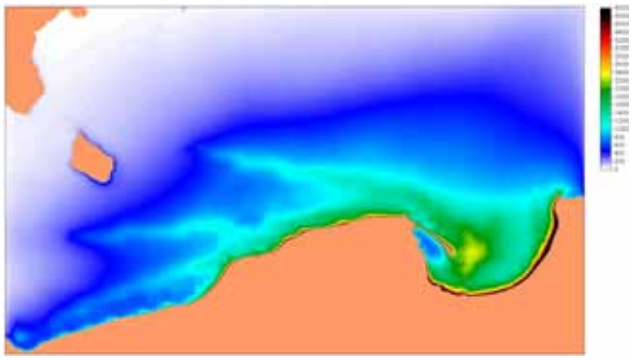


Figure 2 demonstrates annual-averaged oil spill risk with TSS "Słupsk Bank" covering all types of ships. Due to prevailing westerly winds, the westward-exposed coasts are mostly endangered by oil spills. In the open sea, higher risk related to the most frequent routes can be seen.

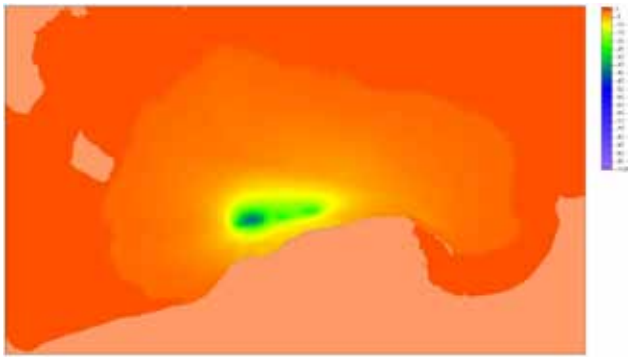


Figure 3. Relative (annual-averaged) difference in oil spill risk caused by the Słupsk Bank TSS. The influence of the particular TSS is clearly shown. The figure shows the difference in oil risk in the two scenarios with and without the Słupsk Bank TSS.

Conclusions from scenarios run so far

- There is a need to extend the work done so far from Polish Marine Areas to the southern Baltic, and the appropriate AIS data shall be available soon
- "Areas to be avoided" can hardly be efficient unless very wide buffer zones are used,
- Major improvements/reductions in oil spill risk can be provided by traffic routing and improvement of traffic quality,
- New potential uses of the sea are bringing new risks but at the same time may offer buffer zones around MPAs,
- There is a lot of Offshore Wind Farm potential activities – extra "areas to be avoided", but with extra risk,
- There is a need to test the effect of potential APMs on patterns of oil spill risk to get more reliability in finding optimal ones,
- There is a need to find simplified risk pattern mapping from actual AIS traffic density into probability of oil spills,
- For future use it is necessary to study the effect of APMs on real traffic patterns to better understand and forecast how particular types of APMs will influence oil spill risk pattern.

BalticMasterII
maritime safety across borders

Lead Partner
REGION BLEKINGE

Baltic Sea Region Programme 2007-2013

Part-financed by the European Union
(European Regional Develoment Fund)

Baltic Master II is a flagship project in the EU Strategy for the Baltic Sea region that brings together countries from around the whole Baltic Rim. Its aim is to improve maritime safety by integrating local and regional perspectives with cross-border co-operation. This involves increasing the land-based capacity to respond to maritime oil spills and working to prevent pollution from maritime transport. The project runs from. January 2009 to January 2012.