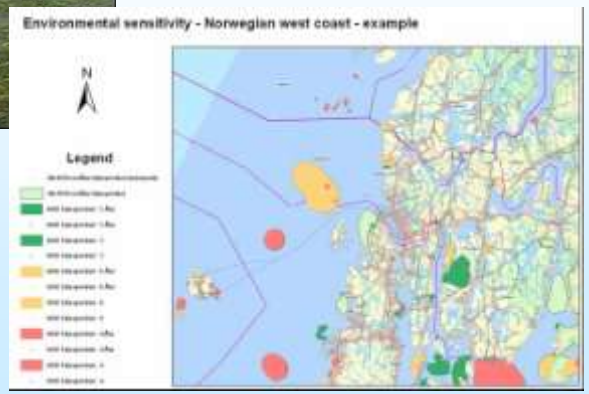
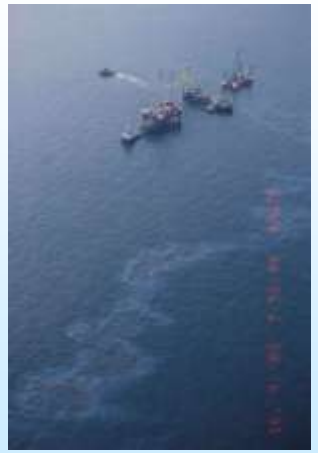
Introduction

BE-AWARE TASK F – 'Sensitivity Analysis'



Ronny Schallier
(MUMM)



Contents

1. The BE-AWARE project
2. BE-AWARE Task F – 'Sensitivity analysis'
3. Ecosystem & Human uses in BA Area
4. 'State of the Art' in Sensitivity Mapping
   - Bonn Agreement
   - BRISK
5. BE-AWARE Sensitivity Mapping Workshop(s)
   - Outcome 1st Workshop
   - Agenda 2nd Workshop

1. BE-AWARE Project

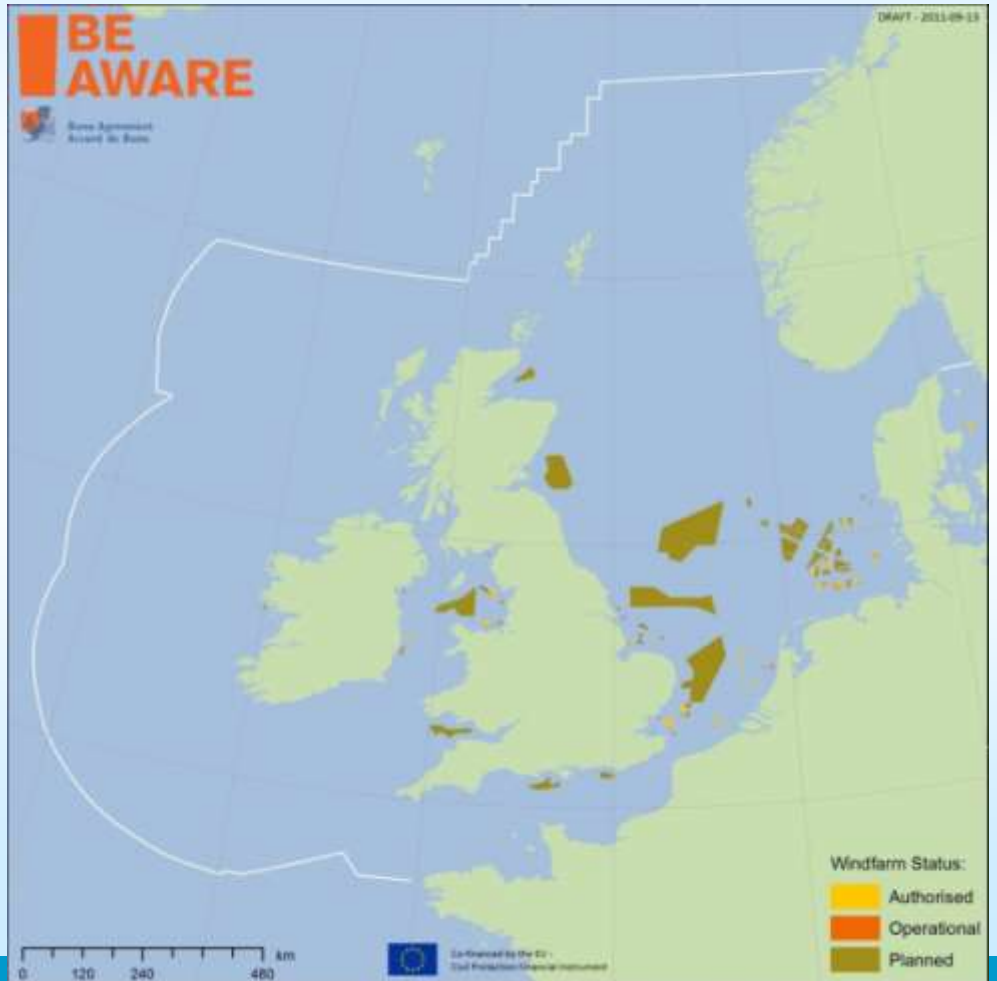
- BA Area-wide Risk Assessment study
- Key priority action BAAP
- Co-funded by EU

- BE AWARE work packages:
  - Study of current and future maritime activity levels
  - Study of risk for accidental (oil) spills
  - Study of area-wide environmental vulnerability (1st phase: method)
  - **All parts combined: RISK for ENVIRONMENTAL DAMAGE**

2. 'Task F – Sensitivity analysis'

- ***Towards a common approach on sensitivity mapping***
  - *Establish common criteria & qualitative descriptions*
  - *Main focus on potential coastal impact (incl. seasonal variability)*
  - *Build on work already done → **BA, BRISK (!)***
  - *Draw on a major socio-economic analysis in **OSPAR***
- ***Undertake Workshop(s) to agree on common approach***
- ***Result: Preliminary Report on joint environmental & socio-economic sensitivity mapping***

3. Ecosystem & human uses in BA area



The BA area:

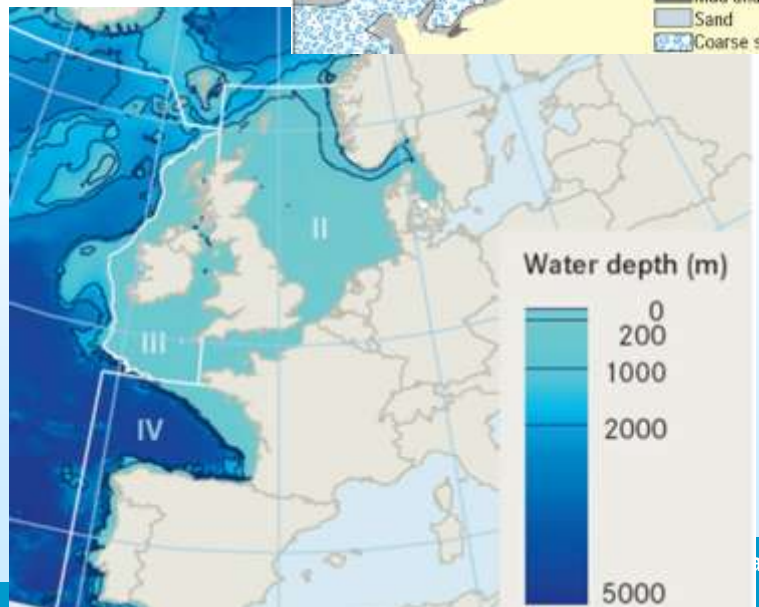
'Greater North Sea and its wider Approaches'

~OSPAR Regions
II, III & (part of) V

BA Area

Varying geographical & hydrographical characteristics

- Wide variety of:
  - Depths
  - Seabed sediment types
  - Tidal ranges & amplitudes
  - Marine fronts
- Mixed & stratified waters
- Variable sea temperature



Wide variety of shorelines & coastal habitats

…being a reflection of strongly varying dynamics

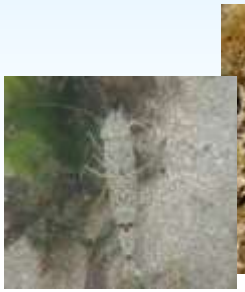




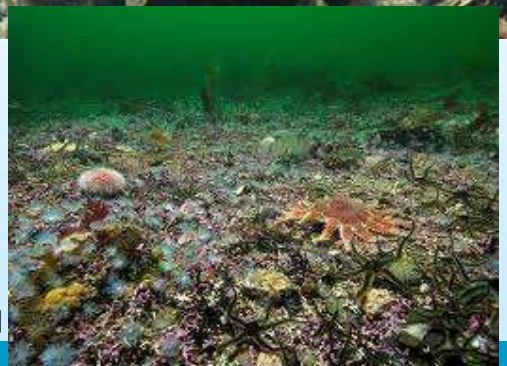

Large variety of marine habitats/ecosystems

… and of (often sensitive) organisms







With wide variety of human uses

High socio-economic importance of seas and shores











4. 'State of the Art' in sensitivity mapping

- BONN AGREEMENT (national systems / BA Workshop 2008)
- BRISK (HELCOM)

Bonn Agreement

- National systems of sensitivity mapping
- BA Workshop (GE, 2008) conclusions

source: BA Compilation, 2005/08
BA Workshop PPTs , 2008

National Systems of sensitivity mapping

Level of detail varies significantly, but several striking similarities (!)

Most CPs:

- Consider SHORELINE TYPE sensitivity based on geomorphology
  - *Cf. ESI Shoreline Type (G.&H.)*
- Consider CONSERVATION VALUE of a resource
- Consider OFFSHORE SENSITIVITY (besides coastal sens.)
- Consider SOCIO-ECONOMIC SENSITIVITY (besides ecological sens.)
- Perform RANKING of sensitivity based on pre-defined criteria
  - *Qualitative or quantitative*

BA Workshop on Sensitivity Mapping (2008)

- **General conclusions**:

The sensitivity info was, in some cases, seen as too detailed
("*Keep it simple*")

Environmental info that is needed, as a **MINIMUM STANDARD**:

- Geomorphologic characteristics – Shoreline type
- Sensitive natural **and** socio-economic resources
- Protected Areas or other areas of ecological importance

BRISK

(HELCOM)

Source: BRISK Environm. Vulnerability Report, COWI, Jan.'12

Background

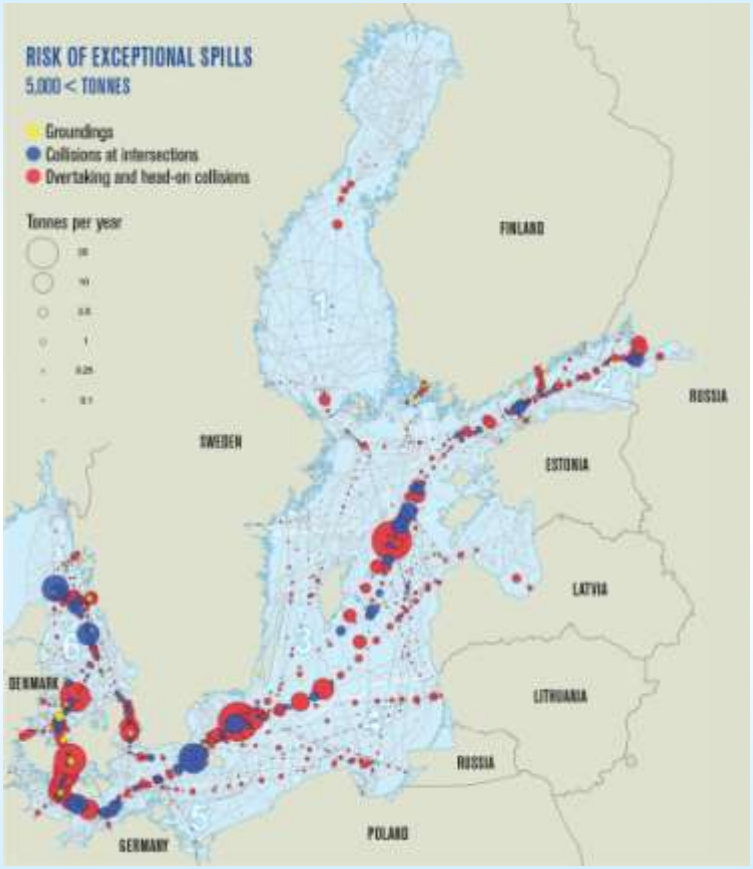
BRISK:

- Assessed spill probability in Baltic sea
- Ranked & mapped environmental vulnerability
- Combined probability and vulnerability, in order to assess risk of environmental damage

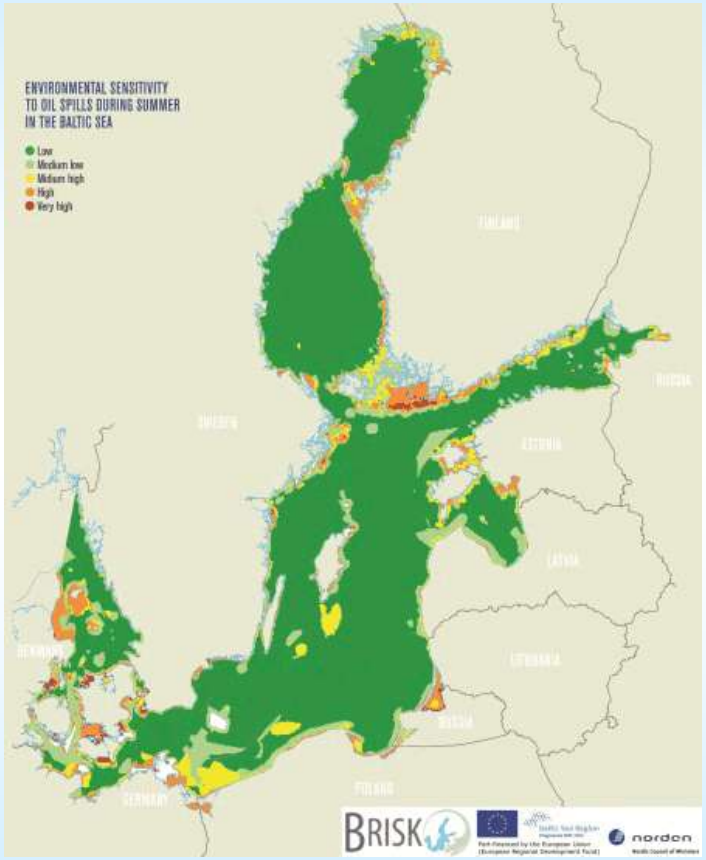
RISK OF DAMAGE = Probability x Vulnerability

*(incl. **oil types**)*

SPILL PROBABILITY X ENV. VULNERABILITY



~drift simulations



= Risk for ENVIRONMENTAL DAMAGE

BRISK Method for Environmental Vulnerability

(~aim of this workshop!)

- According to MUMM, the BRISK method used is:
  - Simple and effective
  - Systematic (step-by-step) approach
  - Well-documented & underpinned by literature + expert input
  - Principles in line with BA conclusions/standards
    - *Qualitative ranking; shoreline type; protected areas; coastal & marine features; ecological + (some) human use features; seasonal variability…*

= Example of '**BEST PRACTICE**'

'Vulnerability' *versus* 'sensitivity'

- Vulnerability of organism, community, habitat or area is determined by:
  - **Exposure to oil**
  - **Intrinsic sensitivity to oil** (impact of oil on organisms & habitats)
  - **Recovery potential** of habitat, population, ..

$$\text{VULNERABILITY} = \frac{\text{EXPOSURE} \times \text{SENSITIVITY}}{\text{RECOVERY}}$$

BRISK Methodology

Ranking & mapping process in 3 steps:

- **STEP 1**: Identification of sensitive features
- **STEP 2**: Ranking of each identified feature
- **STEP 3**: Total (seasonal) vulnerability mapping

STEP 1 – Selection of sensitive Features (BRISK)

- **Open waters**
- **Coastal habitats**
  - Rocky shores & stone reefs
  - Sandy beaches
  - Underwater sandbanks
  - Shallow inlets & bays
  - Coastal lagoons
  - Estuaries
- **Flora**
  - Seagrass meadows (*Zostera*)
- **Fish**
  - Spawning areas in shallow water (demersal eggs)
  - Offshore spawning areas (pelagic eggs)
  - Nursery areas in shallow water
- **Birds**
  - Wintering areas (sea & shore birds)
  - Staging areas (migrating sea & shore birds)
  - Breeding areas (sea & shore birds)
  - Moulting areas (sea birds)
- **Marine mammals**
  - Breeding, moulting and haul-out sites for seals
- **Protected Areas**
- **Fish farms**

Step 2 – Ranking of features based on pre-defined criteria

(1) FATE of oil

- oil degradation and removal
- Varies considerably
- Main factors:
  - Wave/tidal energy exposure
  - Shoreline slope
  - Substrate type

~ Exposure & *chemical* recovery

(2) IMPACT of oil on organisms/habitats

- Effects of oil on organisms
  - Smothering, toxicity, tainting
- Population & life-cycle considerations
  - Densely populated (small) areas
  - Spawning & nursery areas (~fish)
  - Sensitive stages/locations (~birds)
  - Threatened species & habitats, …

~ oil-sensitivity & *biological* recovery

Assigned Vulnerability Ranking of selected features (BRISK)

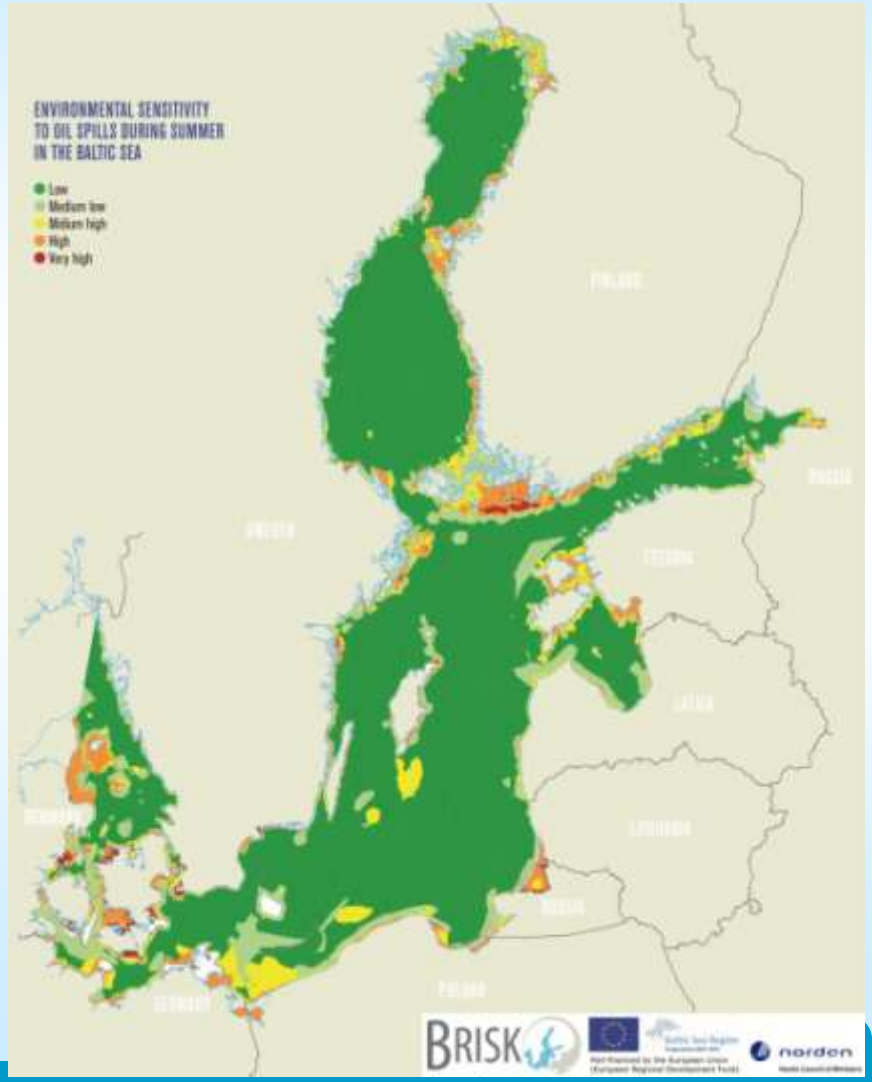
Environmental feature	WI	SP	SU	AU
Rocky shores and stone reefs (sheltered)	4	4	4	4
Sandy beaches	1	1	2	1
Underwater sand banks (water < 10 m)	2	3	3	3
Estuaries	2	4	4	3
Coastal lagoons	2	4	4	3
Shallow inlets and bays	2	4	4	3
Seagrass meadows	3	4	4	3
Fish – shallow spawning areas	3	4	4	3
Fish – shallow nursery areas	3	4	4	3
Fish – offshore spawning areas	0	1	2	1
Protected areas	4	4	4	4
Aquaculture facilities	4	4	4	4
(Birds, marine mammals, etc.)	...	...	...	...

Step 3 – Total (seasonal) vulnerability mapping

Total vulnerability of area

= SUM of all individual feature scores

RESULT: 4 vulnerability maps



BRISK as basis for BE-AWARE approach ?

Yes, IF adapted to 'North Sea' / 'BONN' context

- Different Region → Different list of sensitive features (Done)
- Higher risk of "3D" impact

  ~storms, (sub-)surface use of dispersants
- Expand SOCIO-ECONOMIC PART

  Incl. ranking & mapping approach

5. BE-AWARE Sensitivity Mapping Workshop(s)

- Outcome of 1st Workshop (Apr.13)
- Agenda of 2nd Workshop (Oct.13)

Outcome 1st Workshop

- **STEP 1** (selection of sensitive ecological and socio-econ. features) finalized
  - 3D element considered
  - Socio-economic features extended

STEP 1 – Selected sensitive ecological Features (BE-AWARE)

Shoreline & Coastal habitats

- Exposed rocky shores & stone reefs
- Sheltered rocky shores & stone reefs
- Littoral chalk communities
- Sandy beaches
- Shingle beaches
- Muddy beaches
- Tidal sand & mud flats
- Salt marshes
- Estuaries
- Large shallow inlets & bays
- Coastal lagoons open to sea
- Underwater sandbanks (<20m/>20m)
- Biogenic reefs (<20/>20m)
- Maerl beds
- Eelgrass meadows

Open Sea habitats

- Open water
- Deeper sea floor (>20m)
- Deeper water column (>20m)
- Seamounts
- Coral gardens & sponge aggregations
- Carbonate mounds & *Lophelia pertusa* reefs
- Sea-pen & burrowing megafauna
- *[Artificial reefs/windmill farms]*

Higher trophic level species

- Birds - Wintering areas
- Birds - Staging areas
- Birds - Breeding areas
- Birds - Moulting areas
- Fish - spawning areas
- Fish - nursery areas
- Otters
- Seals

Protected Areas

- Protected areas

STEP 1 – Selected sensitive socio-economic Features (BE-AWARE)

Fisheries
- Offshore fisheries
- Coastal fisheries
- Shellfish/seaweed harvesting

Aquaculture
- Fish farms
- Shellfish cultures
- Algacultures

Tourism
- Amenity beaches
- Marinas
- *[? hot spots for tourism and leasure ?]*
- Densely populated towns and communes
- Other specific touristic& recreational activities (surfing hot spots/main recreational fish.locations/cruiseliner stops)

Coastal communities/ heritage sites
- Heritage sites

Coastal facilities with sea water inlet
- Energy plants
- Onshore fish farms
- Industrial activities (incl. oil & chem.industry)

Ports
- Ports

Mineral extraction
- Extraction zones

Renewable energy
- Renewable energy

Agenda 2nd Workshop

- **STEP 1** (feature selection): DONE – except
  - 'Tourism hot spots' feature *(cf. working doc.)*
  - Clarification on oil types

Aim 2nd Workshop: To agree upon an 'adapted' BRISK approach for Steps 2+3:

- **STEP 2** - RANKING of features
- **STEP 3** - Total Vulnerability MAPPING