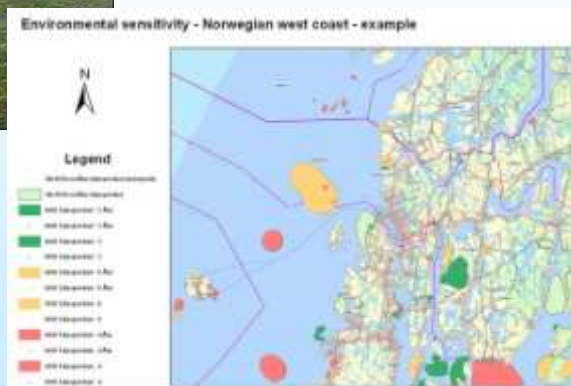


Introduction

I. Ecosystem & human uses in BA area

II. 'State of the Art' on sensitivity mapping



Ronny Schallier
MUMM/RBINS (BE)



'Task F' in Brief

- ***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 a Workshop (early 2013) to agree on approach***
- ***Result: Preliminary report on joint environmental & socio-economic sensitivity mapping***



I. Ecosystems & human uses in BA area

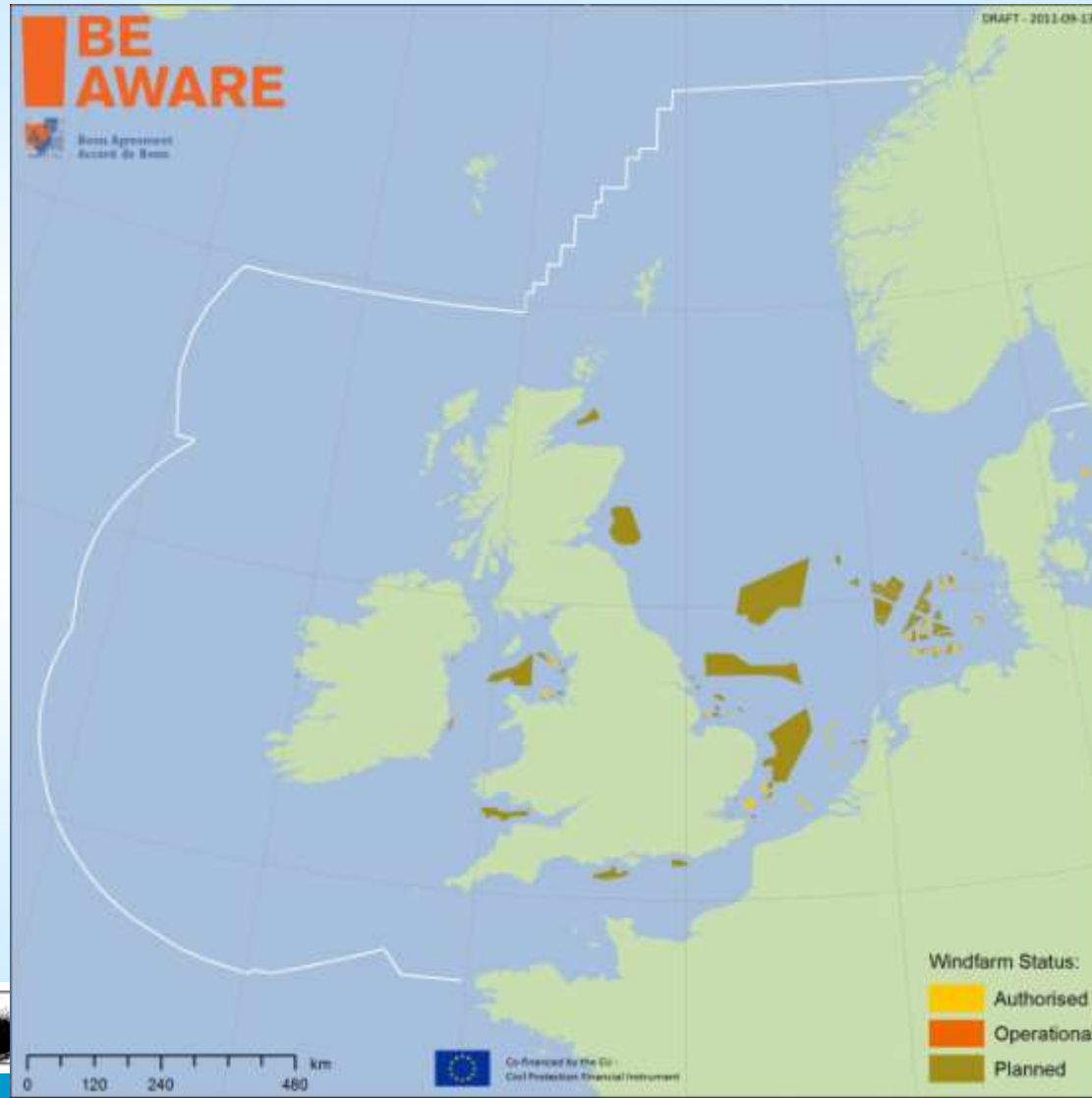
Introduction to:

- Environment & ecosystems
- Human uses (socio-economic charact.)





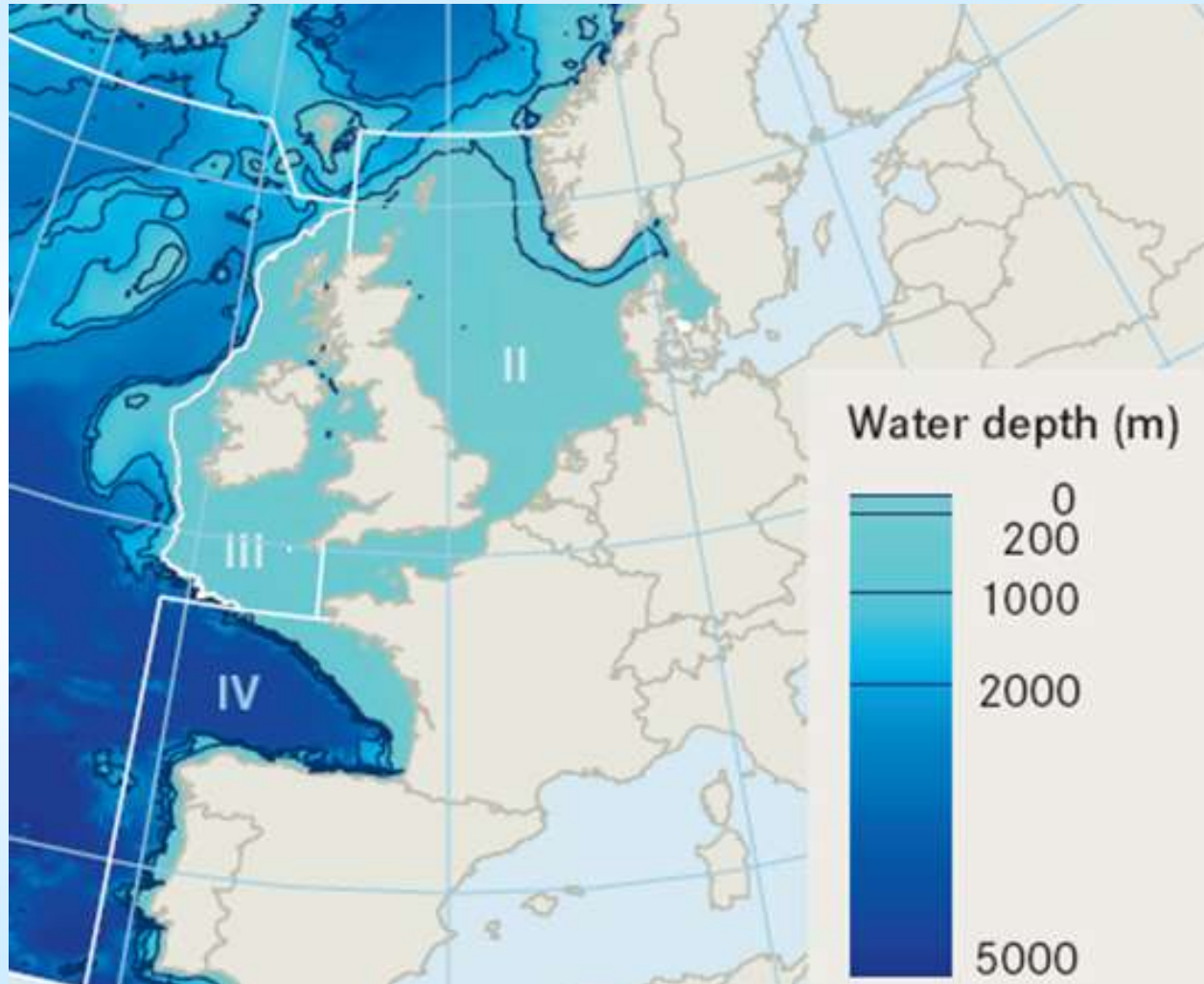
The BA area: 'Greater North Sea and its wider Approaches'



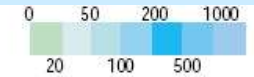
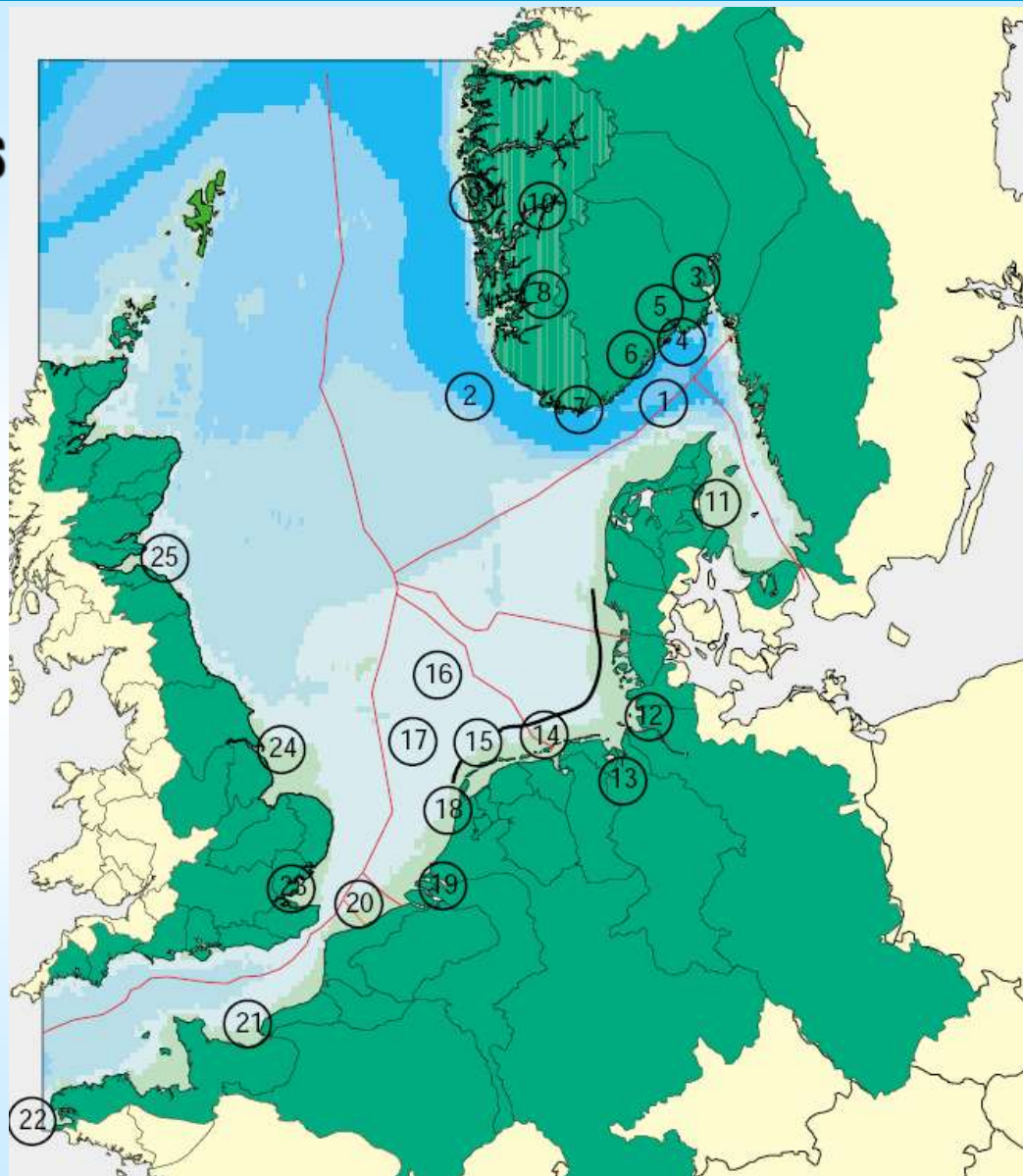
~OSPAR Regions
II, III & (part of) V



Wide variety of depths in BA area



Bathymetry & catchment areas (Region II)



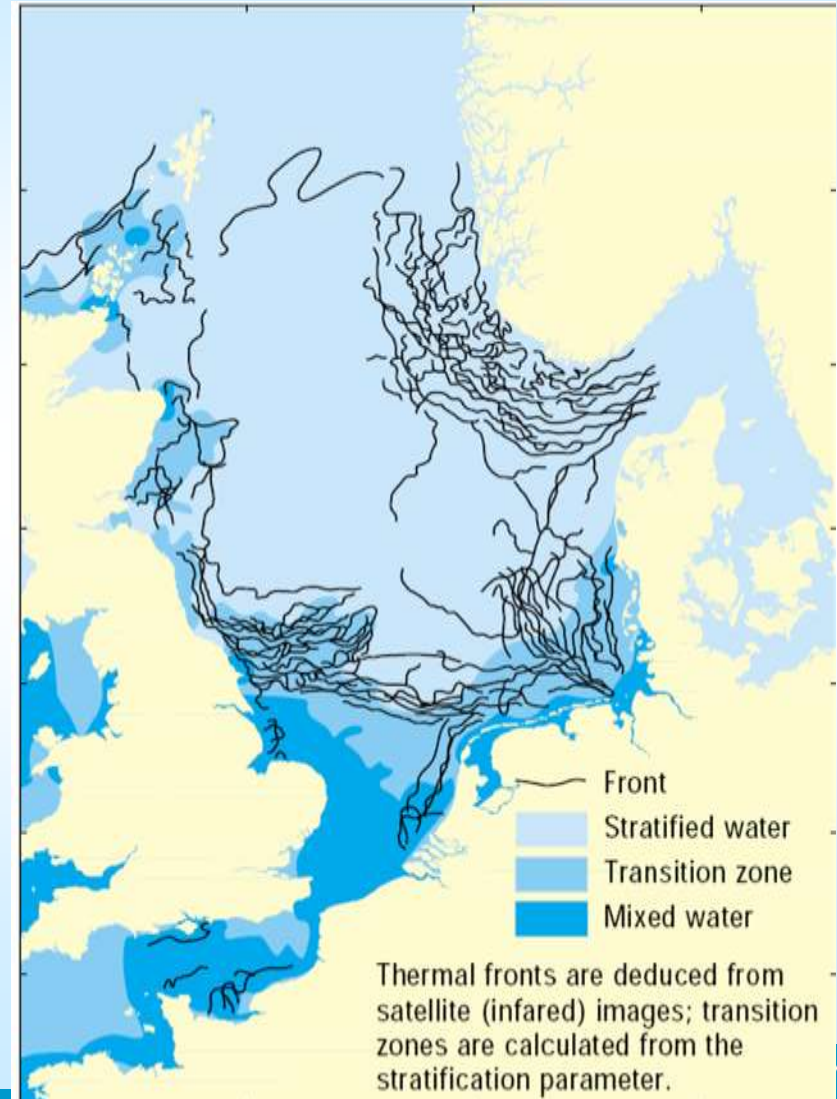
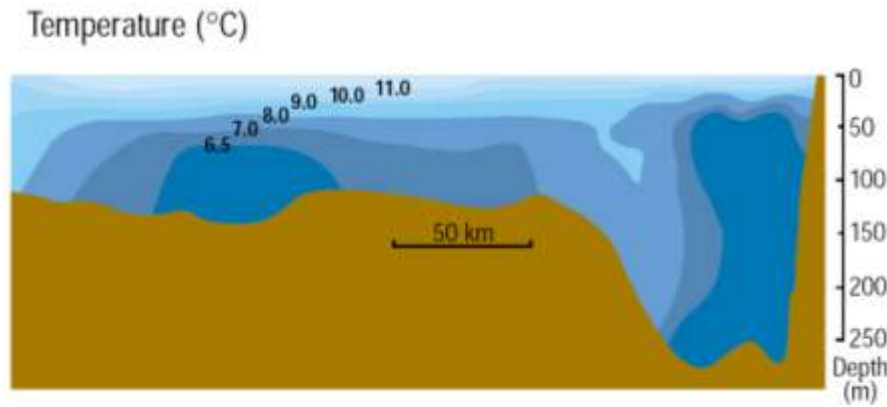
1. Skagerrak
2. Norwegian Trench
3. Inner Oslofjord
4. Sandefjord
5. Drammensfjord
6. Grenlandsfjord
7. Kristiansandsfjord
8. Saudafjord
9. Bergensfjord
10. Sørfjord/Hardangerfjord
11. Kattegat
12. Elbe
13. Weser
14. Jade
15. Wadden Sea
16. Oyster Ground
17. Frisian Front
18. Dutch coastal zone
19. Scheldt estuary
20. Flemish Banks
21. Seine estuary
22. Rade de Brest
23. Thames estuary
24. Humber estuary
25. Firth of Forth





Mixed & stratified water / Fronts – Region II

Figure 2.9 Mean summer vertical temperature, salinity and density sections between Norway and Scotland along 57° 17' N.

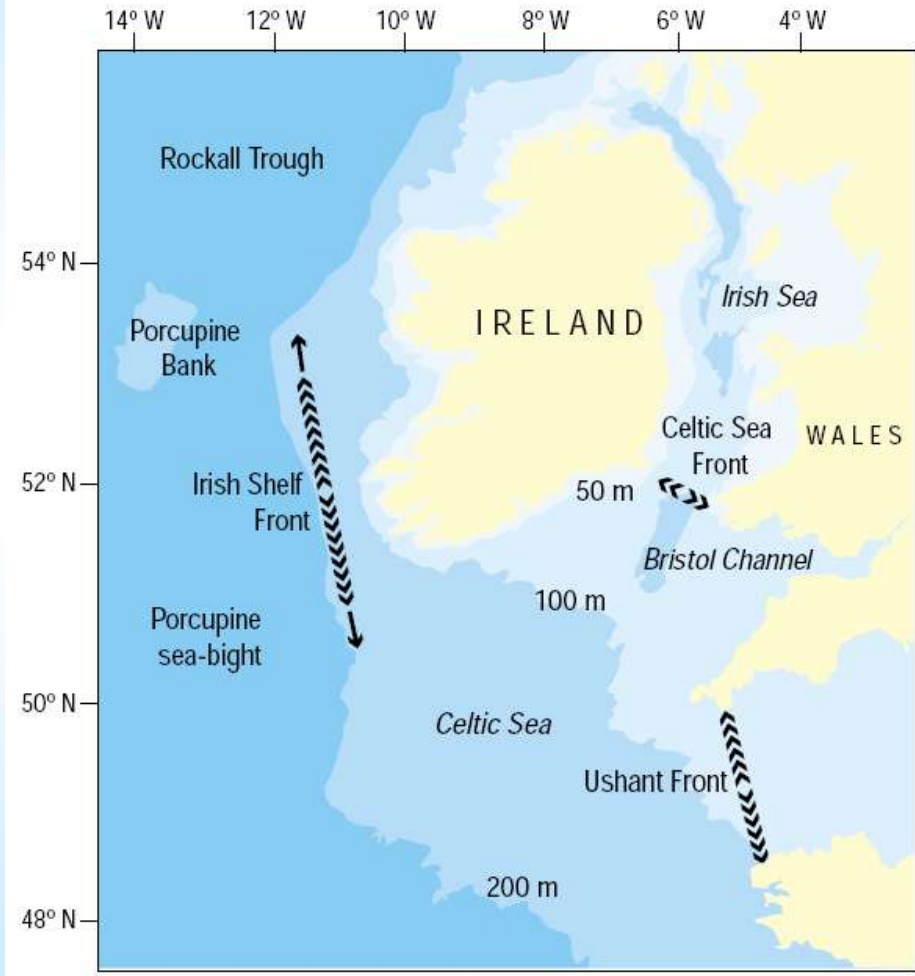




Water masses & Fronts

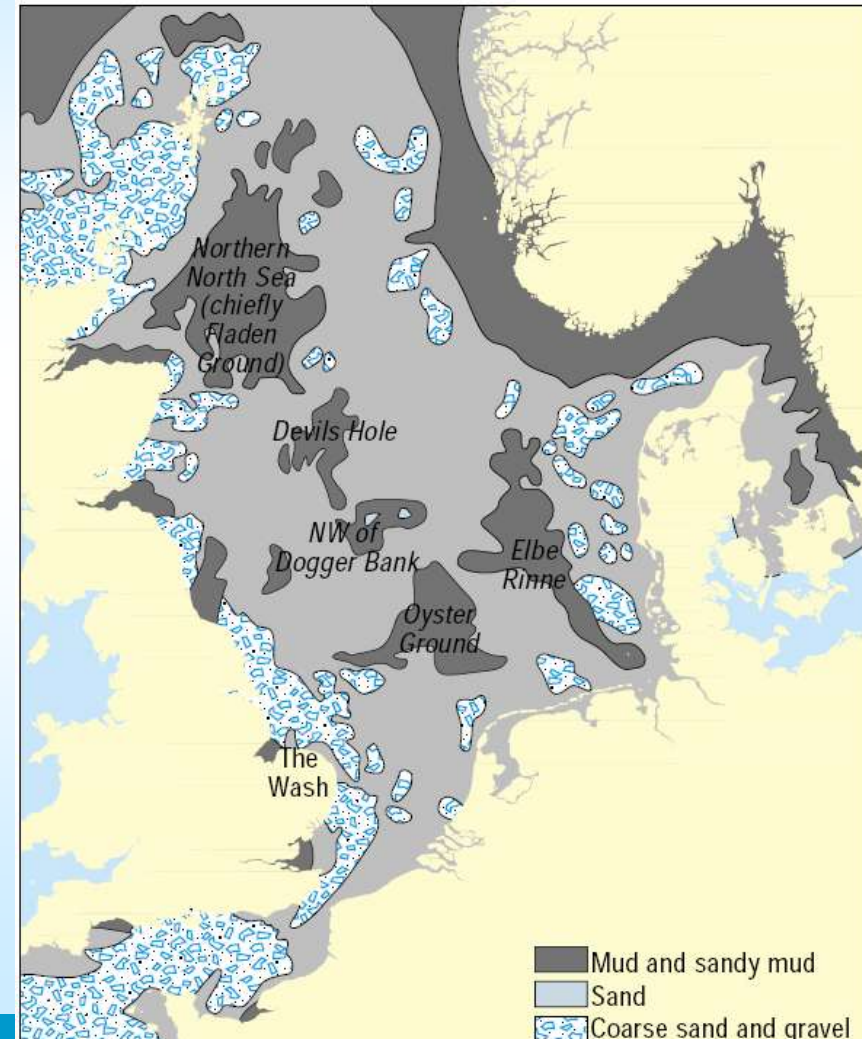
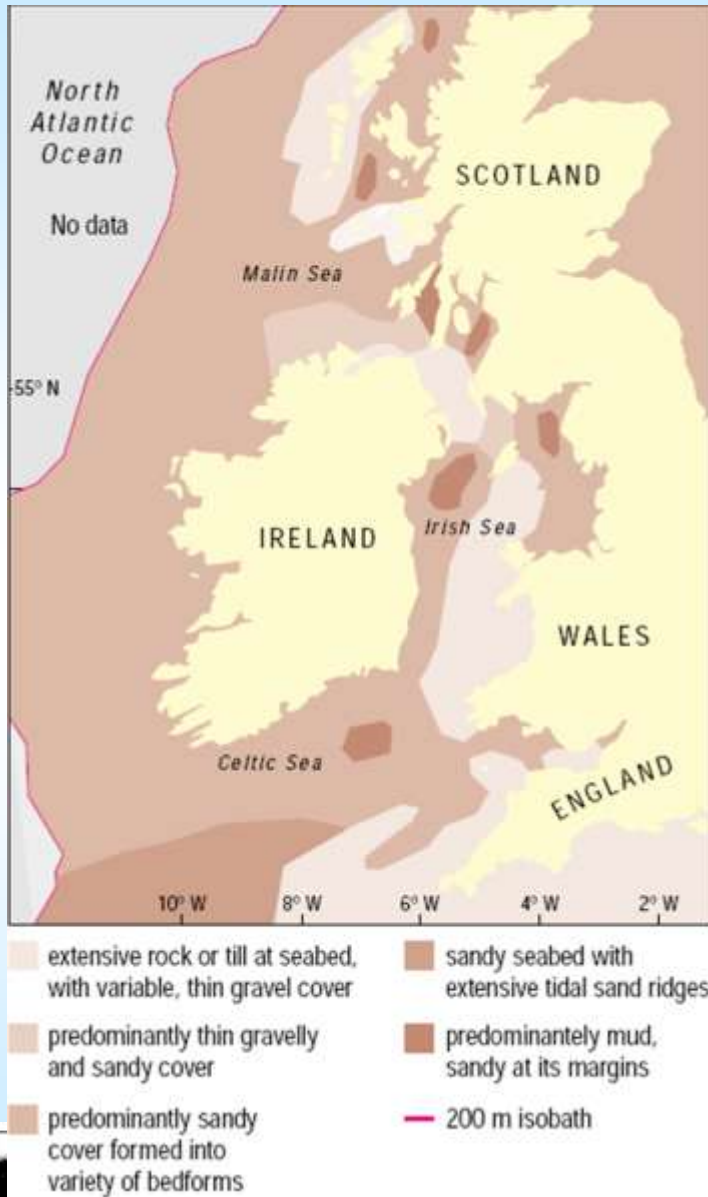
– Region III & V

Figure 2.3 Frontal systems of the Celtic Sea and Atlantic seaboard.



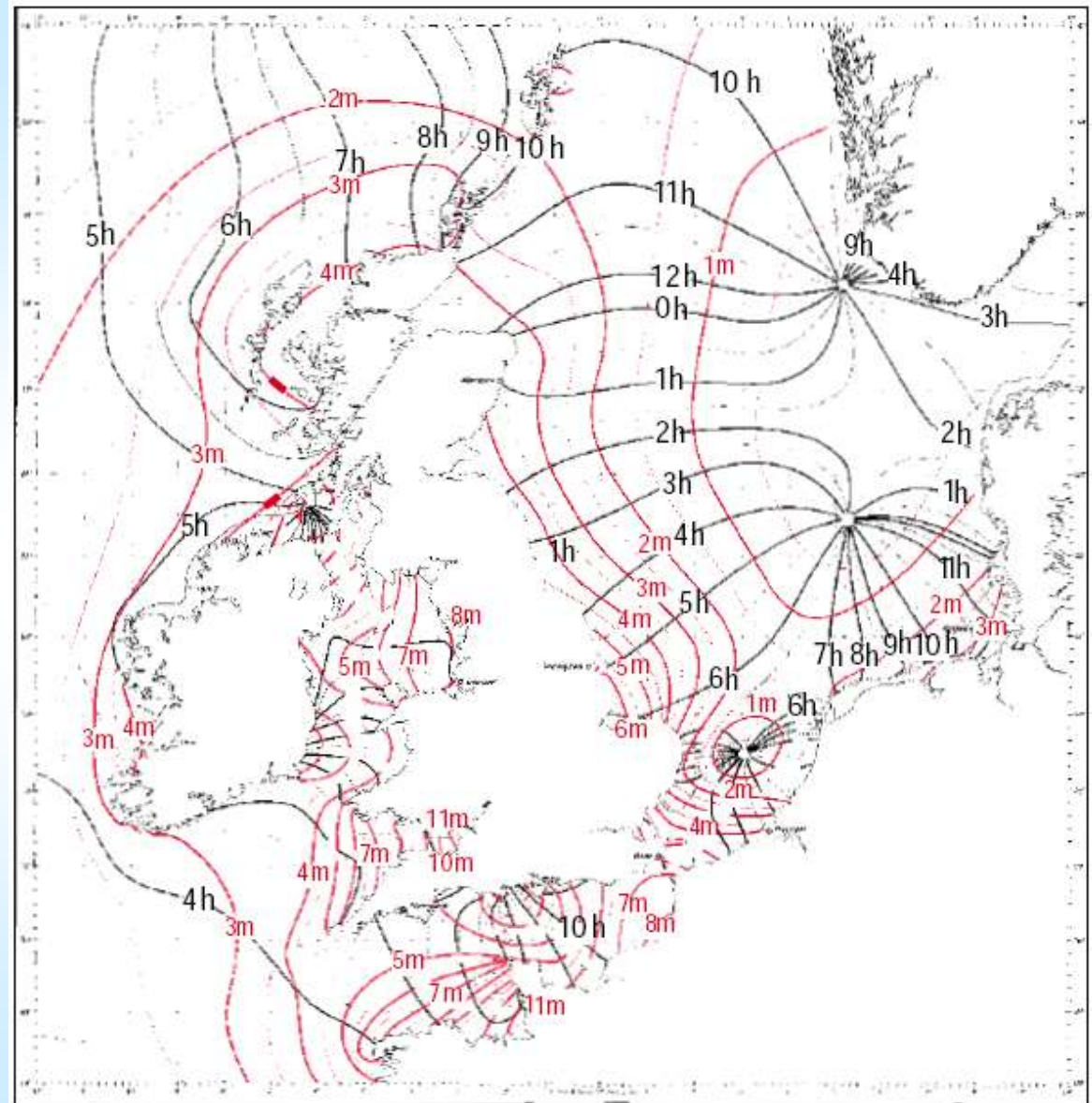


Variety of seabed sediment types - Region II & III



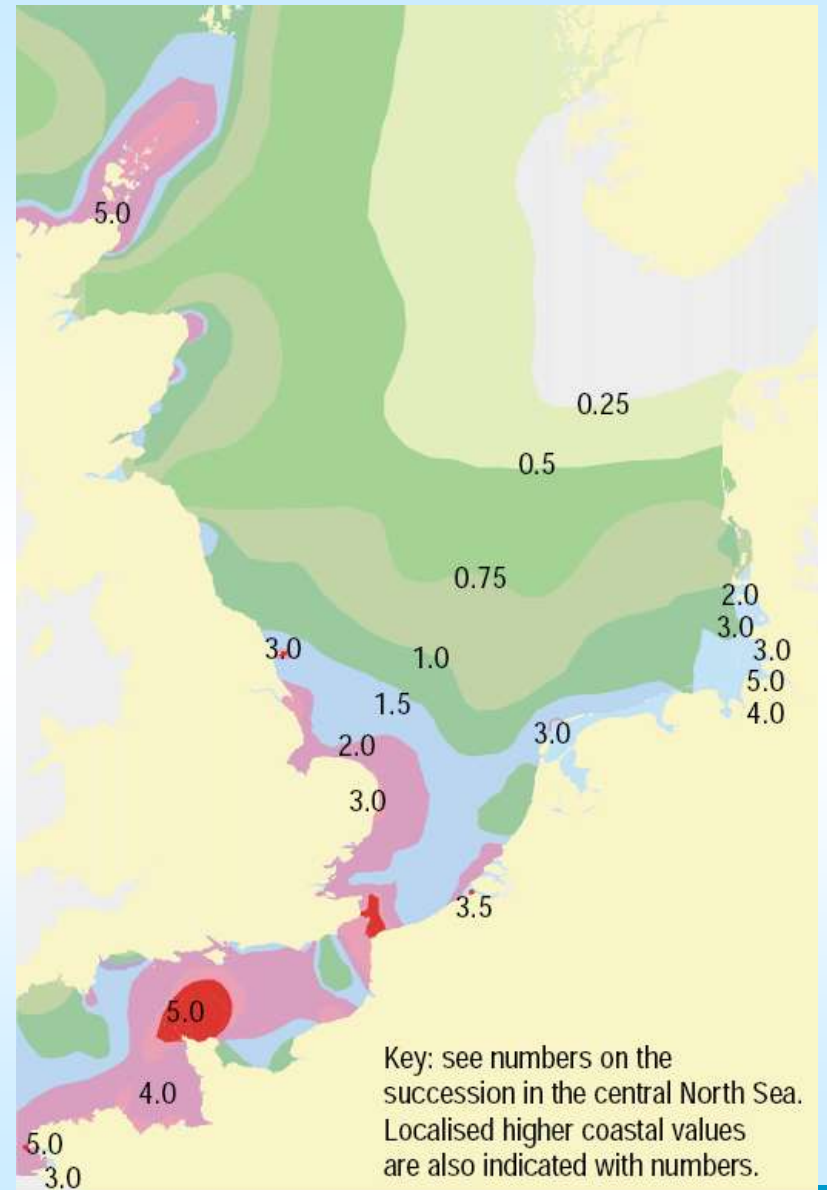


Tidal ranges





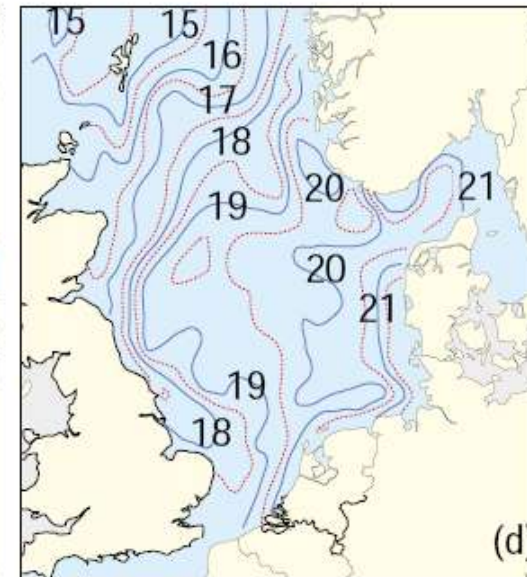
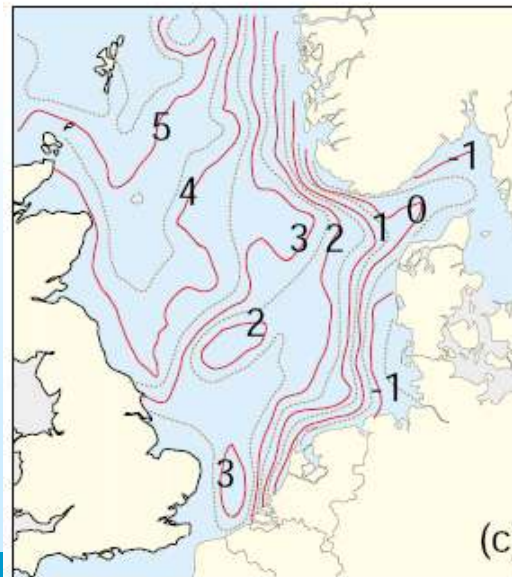
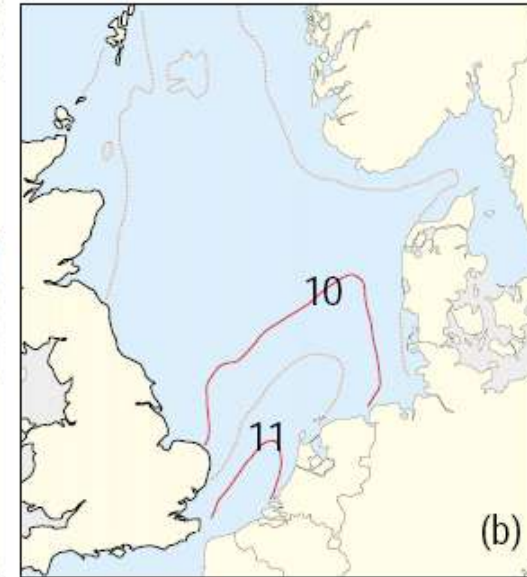
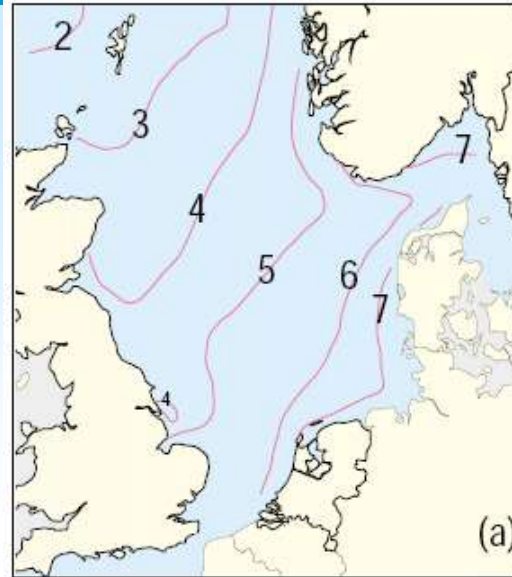
Max. tidal stream amplitudes (knots)



Seasonal variability in North Sea – Region II

Sea-surface T distribution (°C)

- (a) yearly cycle amplitude
- (b) Mean
- (c) Minima
- (d) Maxima





BA area → Wide variety of shorelines & coastal habitats - being reflection of strongly varying dynamics -



Diverse marine habitats/ecosystems and large variety of (often sensitive) organisms





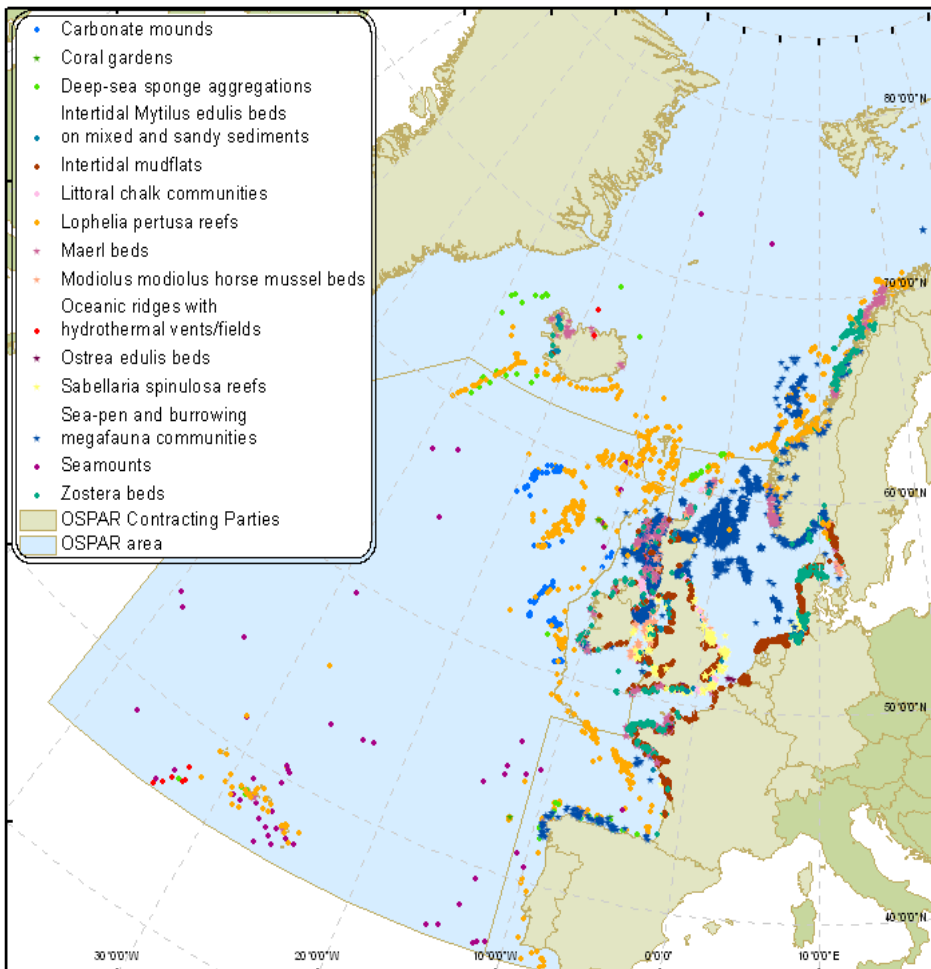
With wide variety of human uses ... and appreciation High socio-economic importance of seas and shores !



OSPAR list of threatened/declining Species & Habitats

→ Several marine/deep-sea habitats:

- *Lophelia pertusa* coldwater coral reefs
- Coral gardens
- Carbonate mounds
- Deep-sea Sponge aggregations
- Seapen and burrowing megafauna
- Maerl beds
- Oyster grounds





II. 'State of the Art' in sensitivity mapping

- **BONN AGREEMENT** (national systems / BA Workshop 2008)
- **BRISK (HELCOM)**
- **BE-AWARE project** → Adaptation of BRISK?



Bonn Agreement

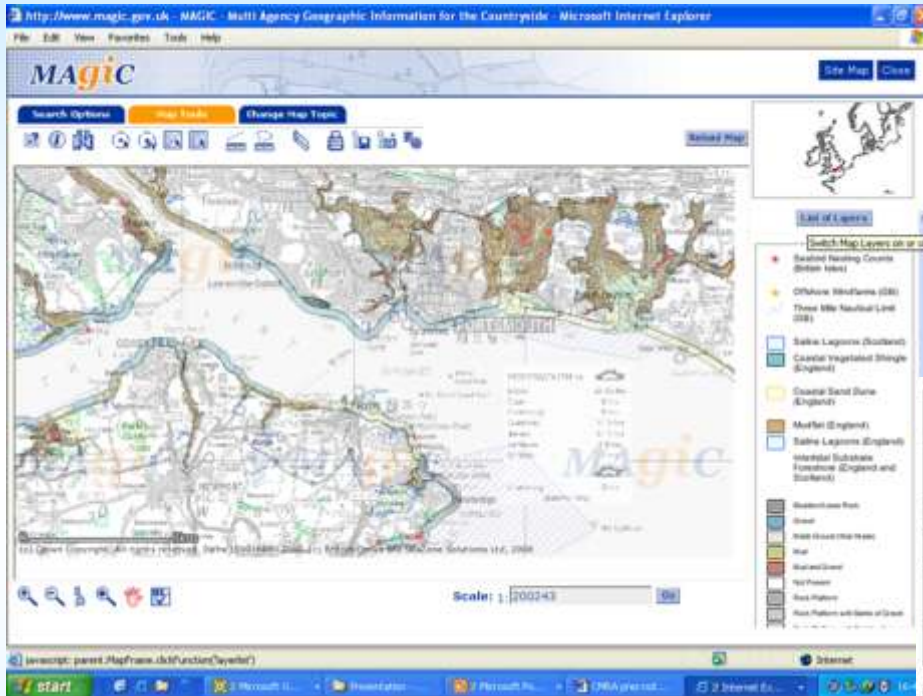
National systems of sensitivity mapping
+ BA Workshop (GE, 2008) conclusions

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

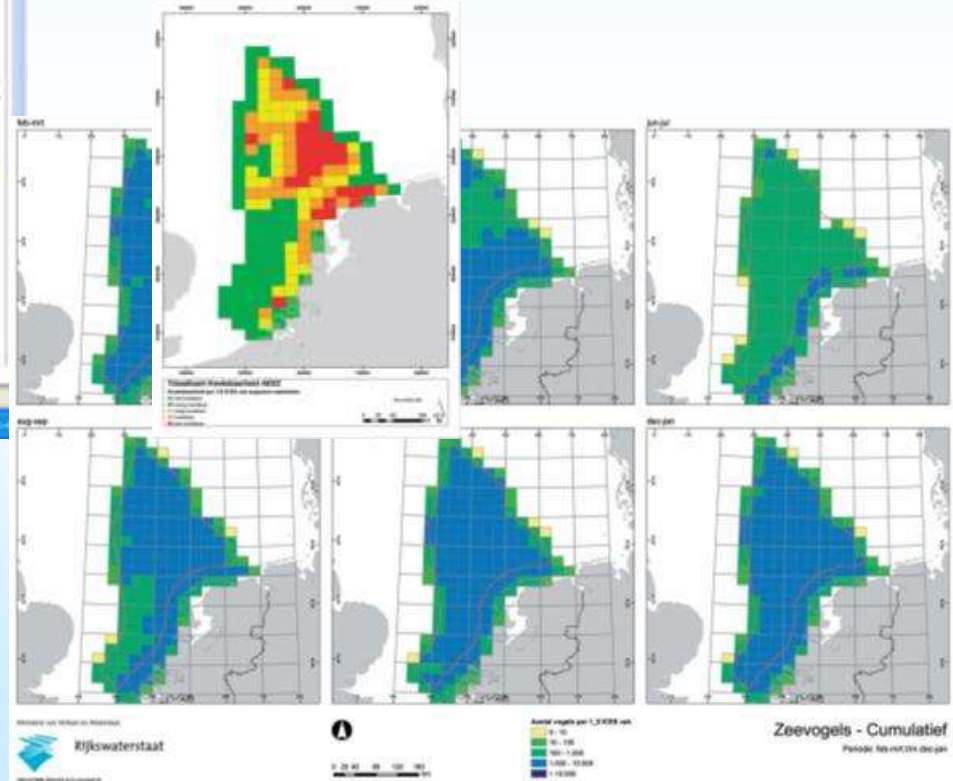


National systems of sensitivity mapping

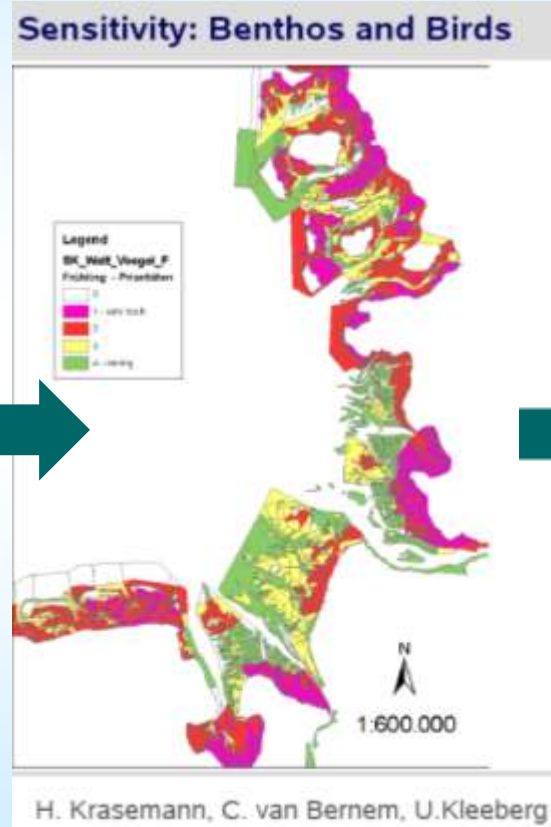
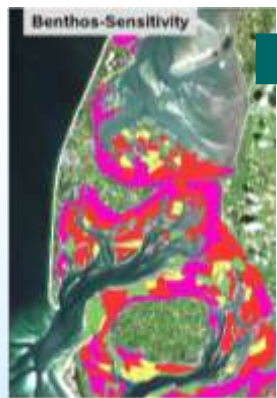
NL – monthly seabird maps
seasonal EEZ maps



UK - coastal maps
(Magic/Defra)



GE – detailed, *quantitative* maps (Waddensea !)





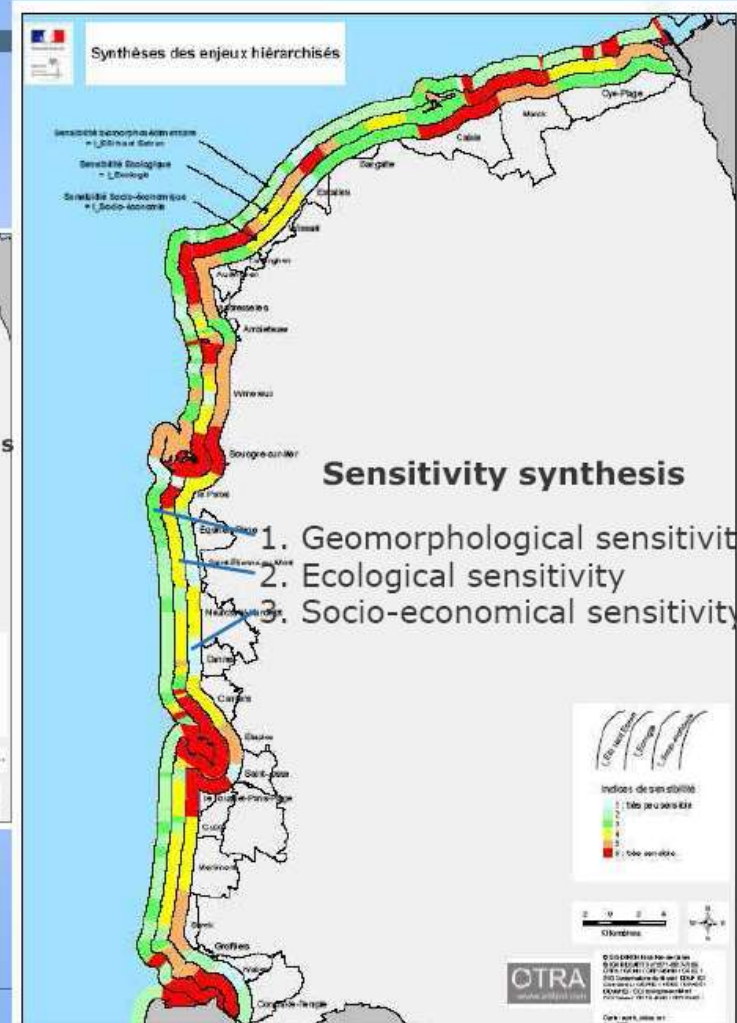
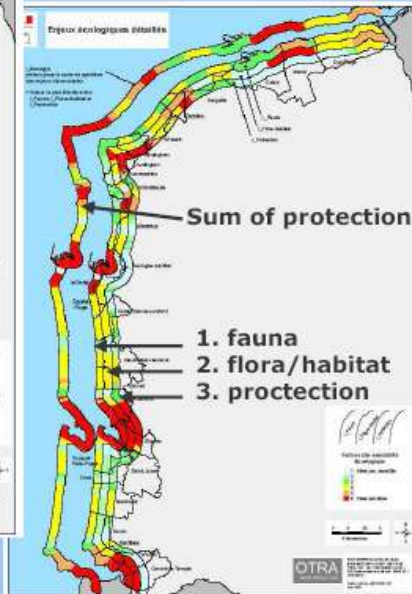
FR – Coastal maps based on 3 indices (geomorphological, ecological, socio-economic)

Department of Pas-de-Calais

Geomorphological sensitivity



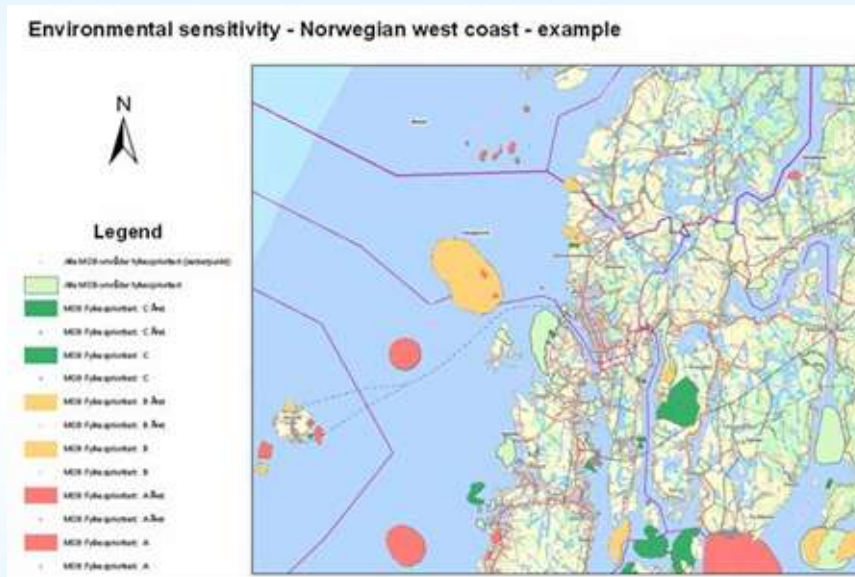
Ecological sensitivity



OTRA consultant

OTRA
www.antipol.com

NO (MOB-model) - Sensitivity maps, used as support tool in response, but also for strategic studies (risk assessments)



- Recommended in 'Safety@Sea'
- Used by DNV in ERAs for offshore industry and shipping



National systems of sensitivity mapping

- Level of detail and development varies significantly
- But several STRIKING SIMILARITIES in basic approach!

EXAMPLES → →



National Systems

Ex.1:

Some CPs: only ‘mapping’ of sensitive sites

- UK, IRL -

Most CPs: **RANKING** of sensitivity based on pre-defined criteria

- NO, SE, GE, NL, FR, BE, DK -

~UK: MEHRAs studies

- Qualitative: ‘Low’ → ‘Medium’ → ‘High’
- Quantitative: using classification scales (e.g. 0-9)



National Systems

Ex.2:

Most, if not all CPs take into account:

- **SHORELINE TYPE** sensitivity based on geomorphology
(cf. ESI (G.&H.) - with local adaptations in FR,GE)
- **CONSERVATION VALUE** of a resource
(Protected Areas)





ESI	Shoreline type
1	<u>Exposed</u> rocky shore, solid structures, rocky cliffs
2	<u>Exposed</u> wave-cut platforms in bedrock, mud or clay; exposed scarps and steep slopes in clay
3	Fine- to medium-grained sand <u>beaches</u> Scarps and steep slopes in sand
4	Coarse-grained sand beaches
5	Mixed sand and gravel beaches
6	Gravel beaches (granules & pebbles) Riprap structures and gravel beaches (cobbles & boulders)
7	<u>Exposed</u> tidal flats
8	<u>Sheltered</u> rocky shore and scarps in bedrock, mud or clay; Sheltered solid structures, riprap, rocky rubble shores, peat shorelines
9	<u>Sheltered</u> tidal flats, vegetated low banks
10	Salt & brackish water <u>marshes</u> , freshwater marshes, swamps, mangroves





National Systems

Ex.3:

Many CPs focus on **COASTAL** sensitivity

- UK, SE, IRL, FR, (GE-North Sea) -

Many other CPs however also consider **OFFSHORE** sensitivity

- BE, NL, NO, DK, (GE-Baltic), (UK for seabird vuln.index) -

e.g. also sensitive marine habitats, seabird areas, fisheries resources, ...



National Systems

Ex.4:

Some CPs focus on **ECOLOGICAL** sensitivity (ENV. S. in 'strict' sense)
(BE, NL, GE)

Most CPs: also **SOCIO-ECONOMIC** sensitivity (ENV. S. in 'broad' sense)
(UK, NO, FR, IRL, SE, DK)

Socio-economic criteria vary considerably, but interesting approaches used (FR, NO)



BA Workshop on Sensitivity Mapping (Cuxhaven/GE, 2008)

- **General conclusions (1):**

Level of detail/development of CP maps varies significantly

→ Hesitation towards BA-wide harmonization

→ However, there was perceived benefit to produce a generic, simplified sensitivity map in the BA area



BA Workshop on Sensitivity Mapping (2008)

- General conclusions (2):

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

→ It should be clear which environmental info is needed, as a
MINIMUM STANDARD, to support response



Workshop on Sensitivity Mapping (2008)

- General conclusions (3):

→ To be taken into account:

- Geomorphologic characteristics – Shoreline type
- Sensitive natural and socio-economic resources (ENV in broad sense)
- Protected Areas or other areas of ecological importance



BRISK

(DK/ HELCOM)

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





BRISK – Environmental Vulnerability work

- According to MUMM, the BRISK method & work is:
 - Simple and effective
 - Systematic (step-by-step) approach
 - Well-documented & underpinned by literature, + expert input
 - Principles in line with previous BA findings & conclusions

= Example of '**BEST PRACTICE**'

WHY/HOW ?? → →





BRISK Methodology

- **RANKING** performed (**strategic Risk Assessments**)
$$\text{Risk of damage} = \text{probability} \times \text{vulnerability}$$
- **QUALITATIVE** ranking
- **COASTAL & MARINE** vulnerability
- **SHORELINE TYPE** considered
- **PROTECTED AREAS** considered
- Ranking of **ECOLOGICAL** & (some) **HUMAN USE** features





'Vulnerability vs. 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, ..

(Schematically)

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





BRISK Methodology

Ranking & mapping process in 3 steps:

- **STEP 1**: Identification of sensitive features
- **STEP 2**: Vulnerability ranking of identified features
- **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 : BRISK Vulnerability Ranking

■ Vulnerability scores:

- Score 4 = **VERY HIGH**
- Score 3 = **HIGH**
- Score 2 = **MODERATE**
- Score 1 = **LOW**

■ Seasons:

- Winter: Dec., Jan., Feb.
- Spring: Mar., Apr., May
- Summer: Jun., Jul., Aug.
- Autumn: Sept., Oct., Nov.





Step 2 – Ranking process for each feature

- 1. Ecol. characteristics, significance & location**
- 2. (Qualitative) assessment of vulnerability**
 - Based on 2 criteria:**
 - 1. FATE OF OIL**
 - 2. IMPACT OF OIL on organisms**
- 3. Assign vulnerability ranking (per season)**





Step 2 – Criteria considered when ranking each feature

(1) FATE of oil

- In terms of 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)



BRISK – Assigned Vulnerability Ranking of selected features

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

- After having mapped & ranked all features
- Total vulnerability of an area = SUM of all individual Scores
of features in that area
- With reclassification of 'area' Score in
5 'total' Vulnerability Classes

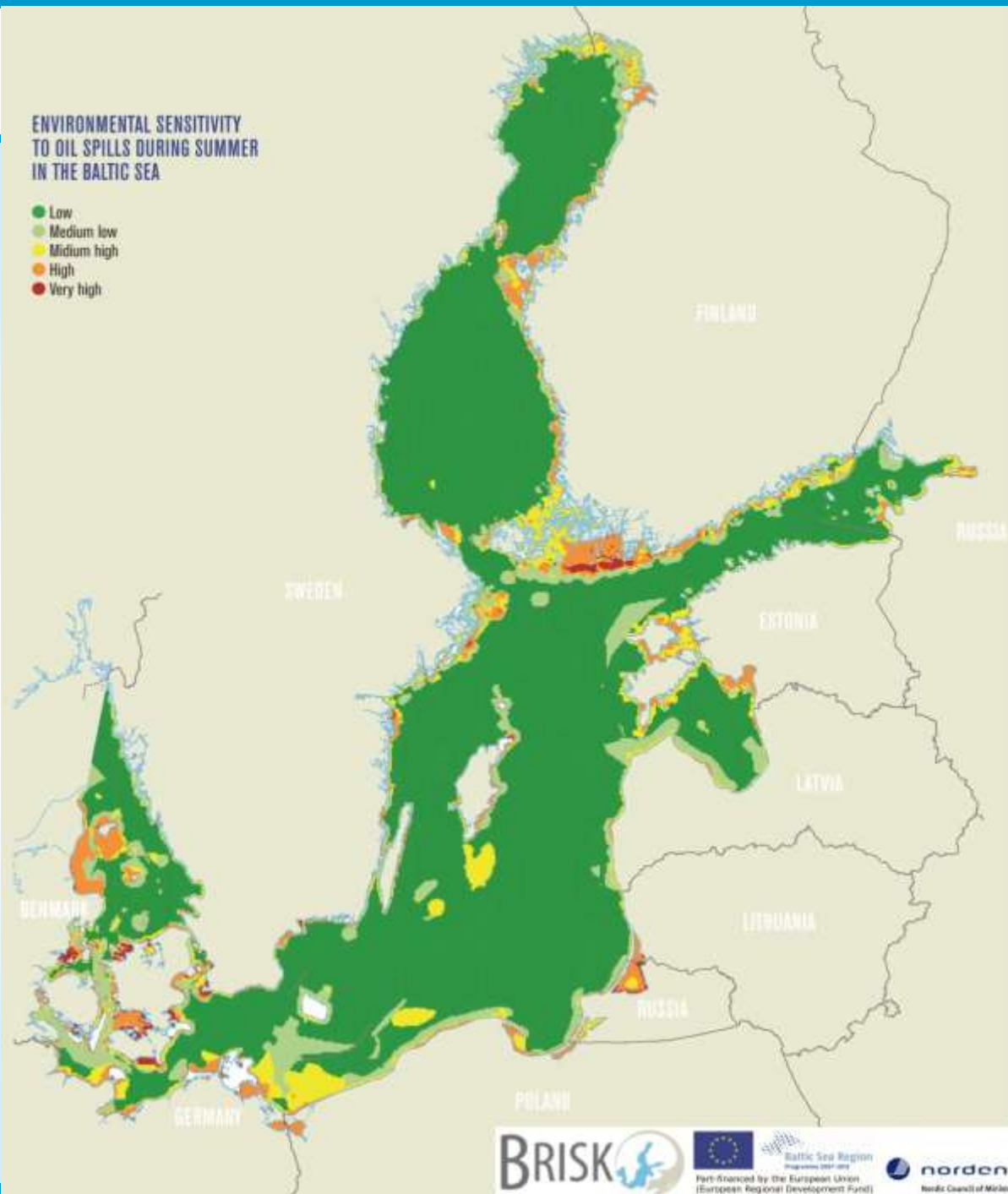




BRISK End Result – 4 vulnerability maps (1 per season)

ENVIRONMENTAL SENSITIVITY TO OIL SPILLS DURING SUMMER IN THE BALTIC SEA

- Low
- Medium low
- Medium high
- High
- Very high





BRISK as basis for BE-AWARE approach

BRISK approach ('best practice') is applicable in BE-AWARE if adapted to 'North Sea' / 'BONN' context

How?

- 1. ≠ Region → ≠ List of SENSITIVE FEATURES**
- 2. Higher risk of "3D" impact**
 - Severe storms
 - Dispersants important response option in BA
 - Option of subsurface dispersant use (blowout-scenarios)
- 3. Expand SOCIO-ECONOMIC PART - Incl. ranking & mapping approach**





Workshop Agenda: “Stepwise” approach

AIM of Workshop ~

To agree upon an ‘*adapted*’ *BRISK* approach
with adapted features & steps

MUMM drafted Working Documents taking also into account:

- BA CPs ‘Best Practice’
- International ‘Best Practice’ & key Ref.documents (OSPAR, IMO, EC..)

→ Step-by-step presentations, for discussion & agreement





Workshop Agenda: “Stepwise” approach

- **STEP 1** - Proposed selection of sensitive features
(Ecological & socio-economic)
- **STEP 2** - Proposal for a BE-AWARE ranking method
- **STEP 3** - Suggestions for Total Vulnerability Mapping

