

Mapping of marine habitats in shallow coastal areas in Denmark

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GEUS

Mapping marine habitats. Overview & examples from shallow coastal areas in Denmark

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Contents

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- What's habitat, and why mapping habitats. EU classifications, EU initiatives.
- Mapping coastal habitats. Downscaling.
- Examples.
- Concluding remarks.

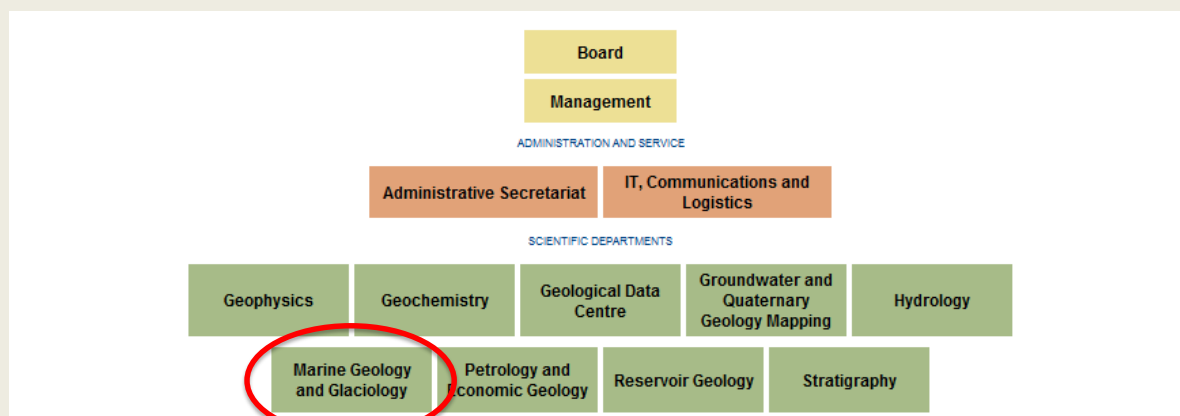
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The organization

- The Geological Survey of Denmark and Greenland, GEUS, is a research and advisory institute in the Ministry of Climate, Energy & Building. The survey also operates in the private sector.
- The staff numbers a total of about 350 full time specialists, technicians and administrative staff. Approximately 200 hold PhD or MSc degrees.
- The activities are organised within five programme areas:
 1. Data banks, information technology, and information to the general public
 2. Water resources
 3. Energy resources
 4. Mineral resources and Greenland mapping
 5. Nature and climate

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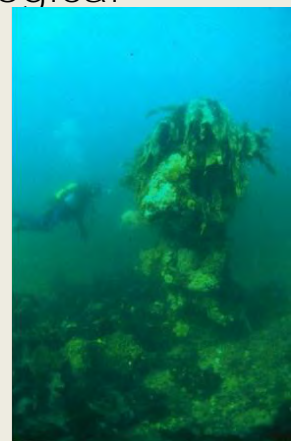


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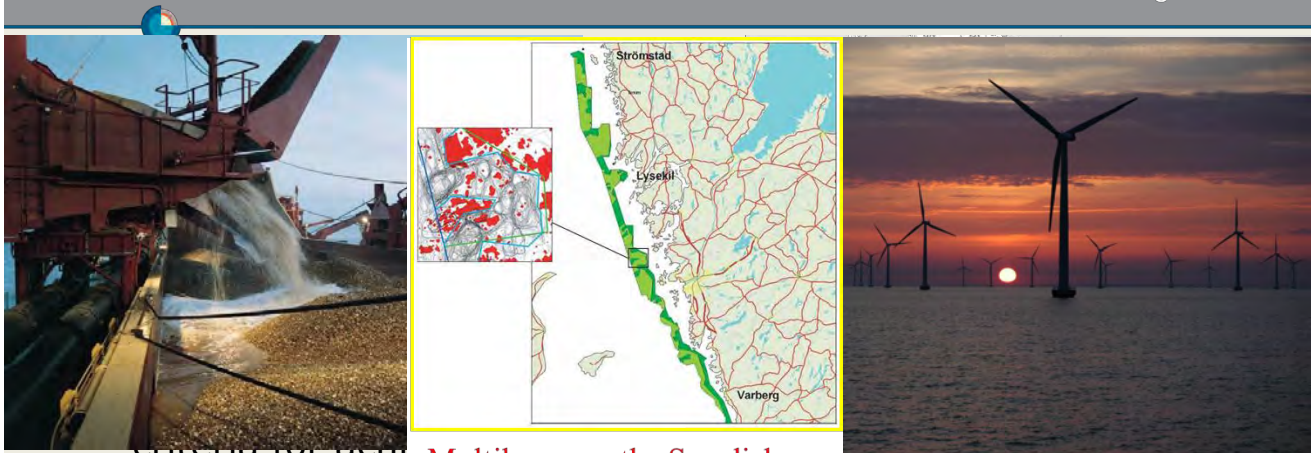
What are habitats?

- Originally, it meant the location where a single plant or animal lives. (Darwin 1859)
- But the definition was extended to include the physical and environmental conditions that influencing the spatial distribution of biological community or assemblages.
- **A "fuzzy" rather than "sharp" boundary** exist between these parameters.





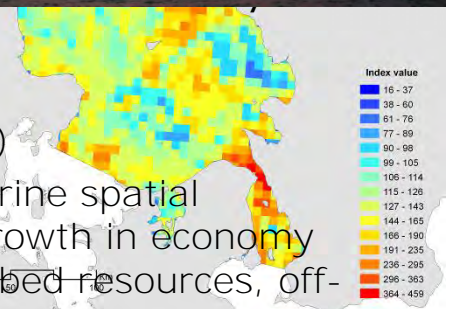
- A Benthic habitat in the marine realm can be described in terms of its sediment type (such as rocks, sand or biogenic reef), its topographic condition (sand bank, reefs), wave exposure (energy), salinity, tidal currents, oxygen, turbidity, etc.. (Connors *et al.* 2004).



Criteria for dem...
2020. (MSFD).

Multibeam on the Swedish west coast & trawl effort.
Fiskeriverket

- Assessing cumulative impacts on the marine environment. (HELCOM/HOLAS 2010)
- Provide fundamental information for marine spatial planning, thus supporting sustainable growth in economy on different aspects such as fishing, seabed resources, off-shore constructing, and leisure activities.





International policy instruments

- 1992 EC Habitats Directive
- 1996 North Sea Ministerial Declaration
- 2000 EC Water Framework Directive
- 2001 EC Strategic Environmental Assessment Directive
- 2003 OSPAR Biodiversity Strategy
- 2007 EC Maritime Strategy
- 2010 EC Marine Strategy Framework Directive.
- 2013 EC Framework for maritime spatial planning and integrated coastal management (Proposed).

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Why all these initiatives

- Harmonisation.
- No more one nation one solution.
- Insure coherent & ecosystem-based management of the sea.
- Cross-sectoral integration. And establishing a coherent network of MPAs.
- "The ecosystem approach is the comprehensive integrated management of human activities, based on best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of the marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity (Anon 2004)".

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Pan Europe Habitat classification The EUNIS classification

The EUNIS (European Nature Information System) habitat classification is a comprehensive system covering the terrestrial and marine habitat types of the European land mass and its surrounding seas.

- **Relationships between EUNIS habitats and other habitat classifications are an important component of the classification.** These **enable users of national classifications to relate their data to the international level**, and provide linkages to habitat systems in use in legislation.
- In the context of the European Environment Agency the most important of these is **Annex I of the EU Habitats Directive**, and all habitats in that Annex are cross-referenced to EUNIS habitats.
- It is vital that the user understands the distinction between Annex I, a selective list of habitats of conservation interest adopted for legislative purposes, and the EUNIS habitat classification, a comprehensive system designed to cover all habitat types occurring in Europe.



EUNIS

The screenshot shows the EUNIS habitat type hierarchical view on the European Environment Agency website. The page is titled "EUNIS habitat type hierarchical view" and displays a tree structure of habitat types. The main content area shows a list of habitat types under the heading "EUNIS habitat type hierarchical view". The list is organized into levels, with the top level being "A: Littoral habitats". The list includes:

- A: Littoral habitats
 - A1: Littoral rock and other hard substrata
 - A2: Littoral sediment
 - A3: Infralittoral rock and other hard substrata
 - A4: Circumlittoral rock and other hard substrata
 - A5: Sublittoral sediment
 - A6: Deep-sea bed
 - A7: Infralag water column
 - A8: Ice-associated marine habitats
- B: Coastal habitats
- C: Inland surface waters
- D: Mires, bogs and fens
- E: Grasslands and lands dominated by herbs, mosses or lichens
- F: Heathland, scrub and tundra
- G: Woodland, forest and other wooded land
- H: Inland unvegetated or sparsely vegetated habitats
- I: Regularly or recently cultivated agricultural, horticultural and domestic habitats
- J: Concreted, industrial and other artificial habitats
- K: Habitat complexes

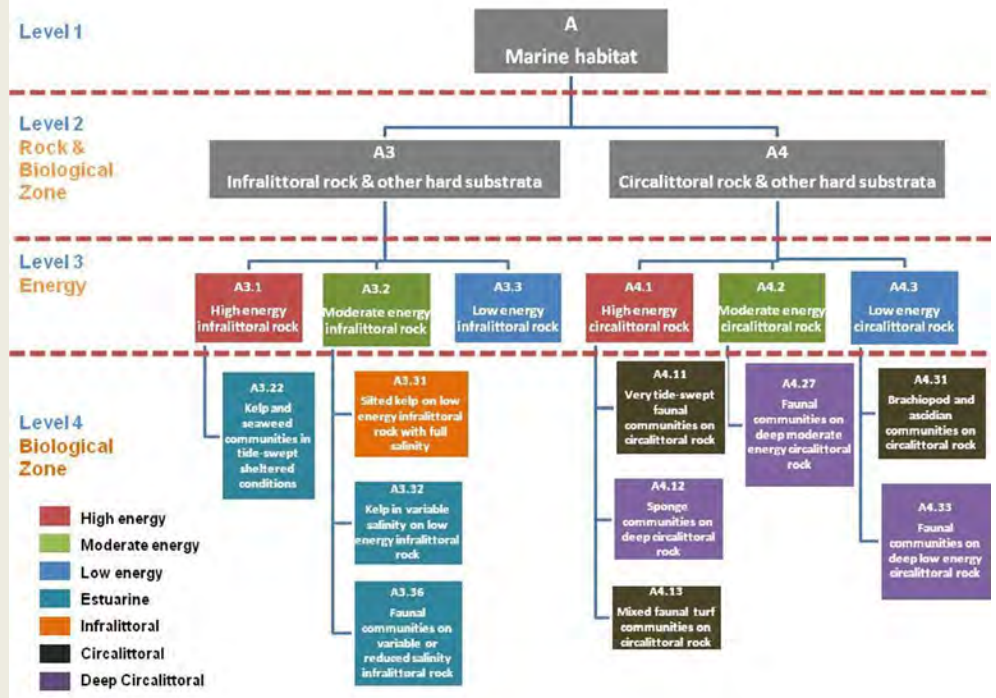
The screenshot shows the EUNIS habitat type description for "Littoral rock and other hard substrata". The page is titled "Littoral rock and other hard substrata" and provides detailed information about the habitat type. The main content area shows the description of the habitat type, including its English name, EUNIS habitat code, and a description in English. The description states: "Littoral rock includes habitats of bedrock, boulders and cobbles which occur in the intertidal zone (the area of the shore between high and low tides) and the splash zone. The upper limit is marked by the top of the splash zone and the lower limit by the top of the lamination table zone. There are many physical variables affecting rocky shore communities: wave exposure, salinity, temperature and the degree of erosion and deposition of the shore. Ice exposure is most commonly associated to the splash zone, from extremely exposed on the open coast to relatively sheltered in enclosed coves. Exposed shores tend to support faunal communities of barnacles and mussels and some robust seaweeds. Sheltered shores are most notable for their dense cover of fucoid seaweeds, with distinctive zones according from the shore. In between these extremes of wave exposure, on moderately exposed shores, rocks of seaweeds and barnacles are more typical."

The page also includes a table of "Relationships with other classifications" and a list of "External links".

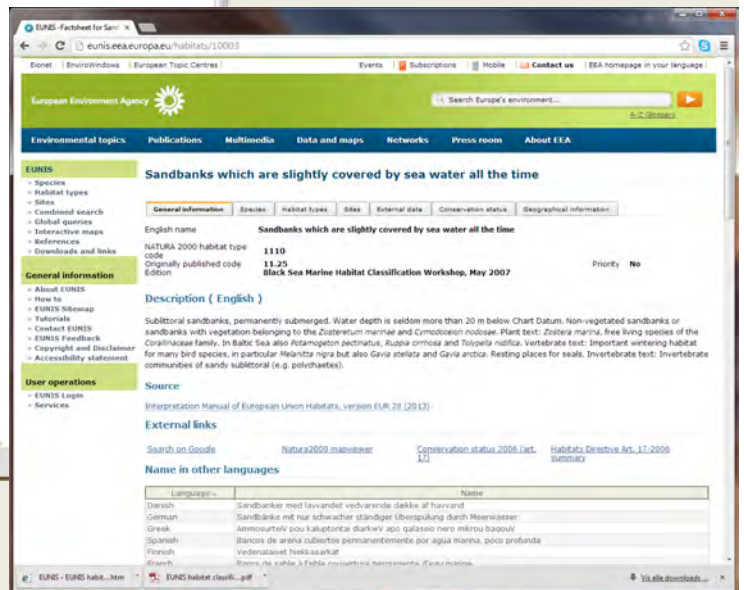
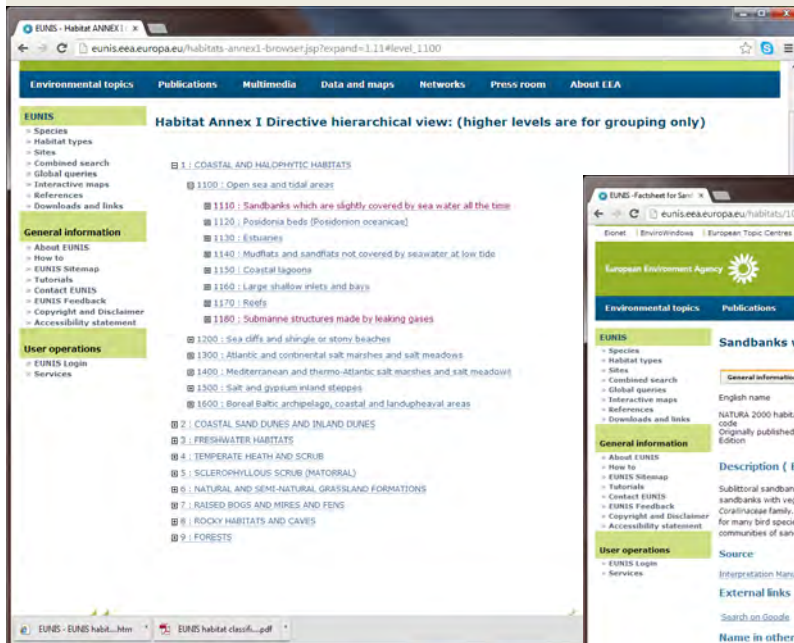
Classification	Code	Title	Relation type
EUNIS Habitat Classification 2008A2	A1	Littoral rock and other hard substrata	same
EUNIS Habitat Classification 2008B2	A2	Littoral rock and other hard substrata	same
EUNIS Habitat Classification 2008C2	A3	Littoral rock and other hard substrata	same
EUNIS Habitat Classification 2008D2	A4	Littoral rock and other hard substrata	same
EUNIS Habitat Classification 2008E2	A5	Littoral rock and other hard substrata	same
EUNIS Habitat Classification 2008F2	A6	Littoral rock	subset
EUNIS Habitat Classification 2008G2	A7, A8	Littoral rock	subset
EUNIS Habitat Classification 2008H2	A1, A2, A3, A4, A5, A6, A7, A8	Coastal rocky habitats	subset



EUNIS habitats are arranged in a hierarchy, starting at level 1. They provide a comprehensive typology for the habitats of Europe and its adjoining seas.



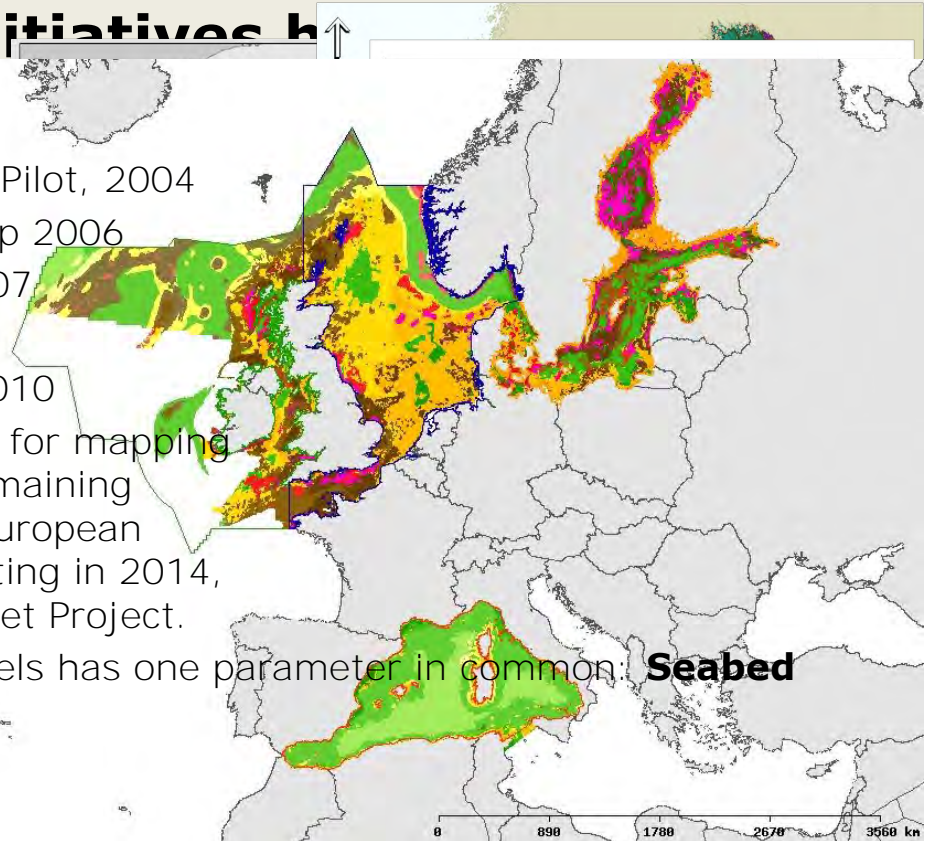
Annex I Habitat Directive





EU Initiatives h

- The Irish Sea Pilot, 2004
- The UKSeaMap 2006
- BALANCE, 2007
- MESH, 2008
- EUSeaMap, 2010
- New Initiative for mapping habitats in remaining parts of the European waters is starting in 2014, Under EMODnet Project.
- All these models has one parameter in common: **Seabed sediment.**



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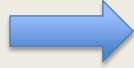
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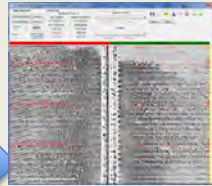
Downscaling



Satellite & Orthophotos,
Or LIDAR !



Geophysical Survey



Ground truth



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Using satellite and Orthophoto images was essential in delineating and interpreting areas with shallow water depth where the survey ship can not reach.



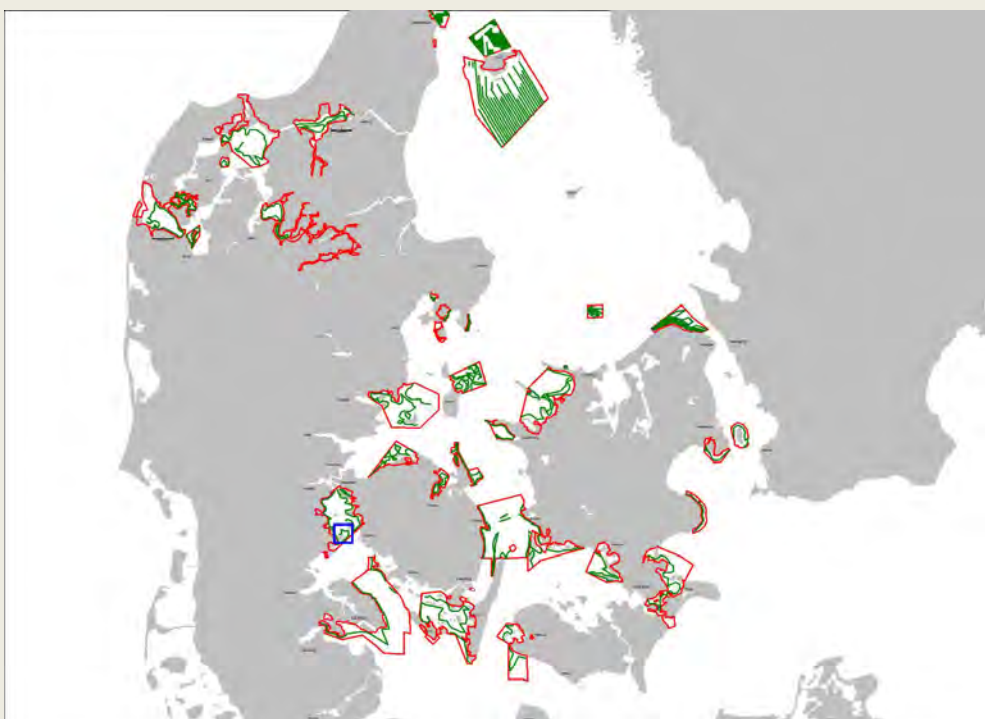
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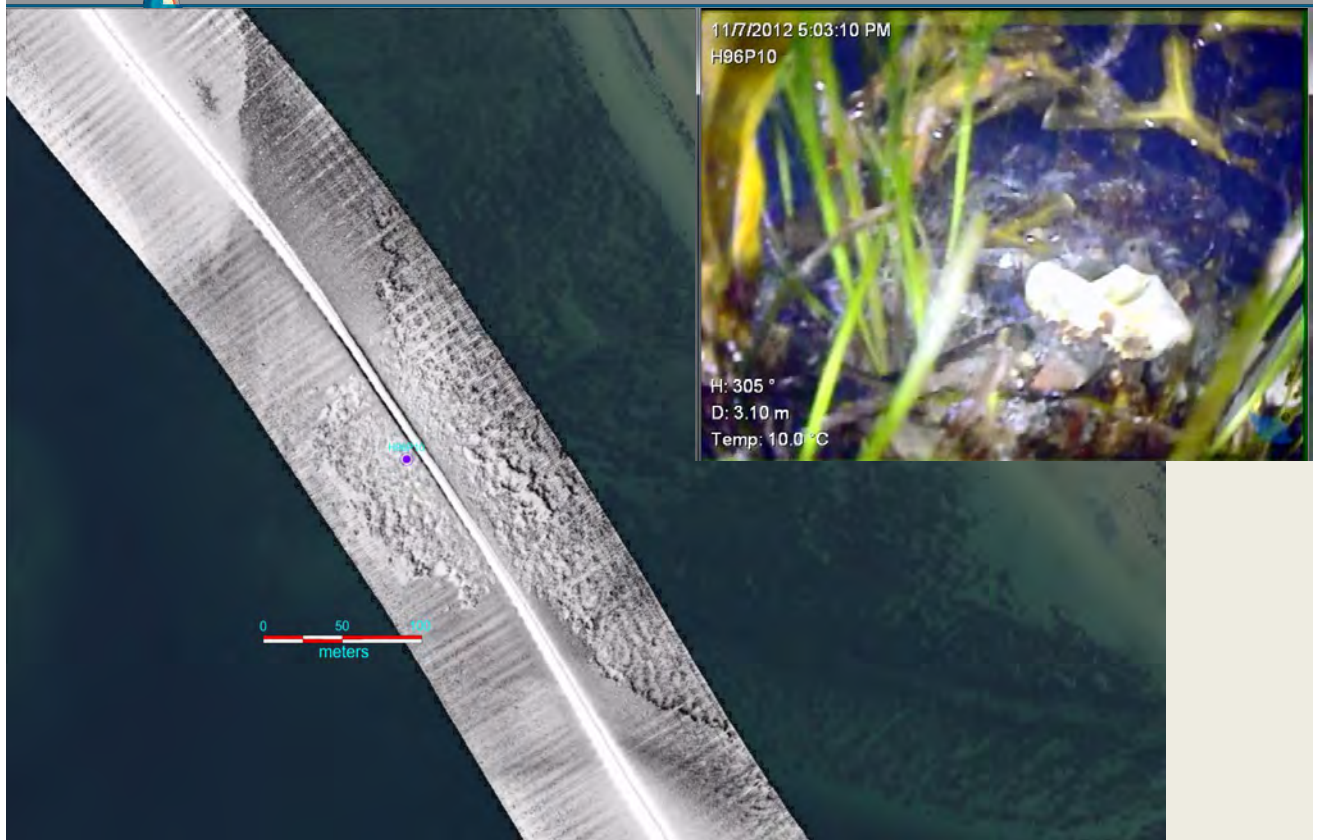


recent example from Little Belt / DK





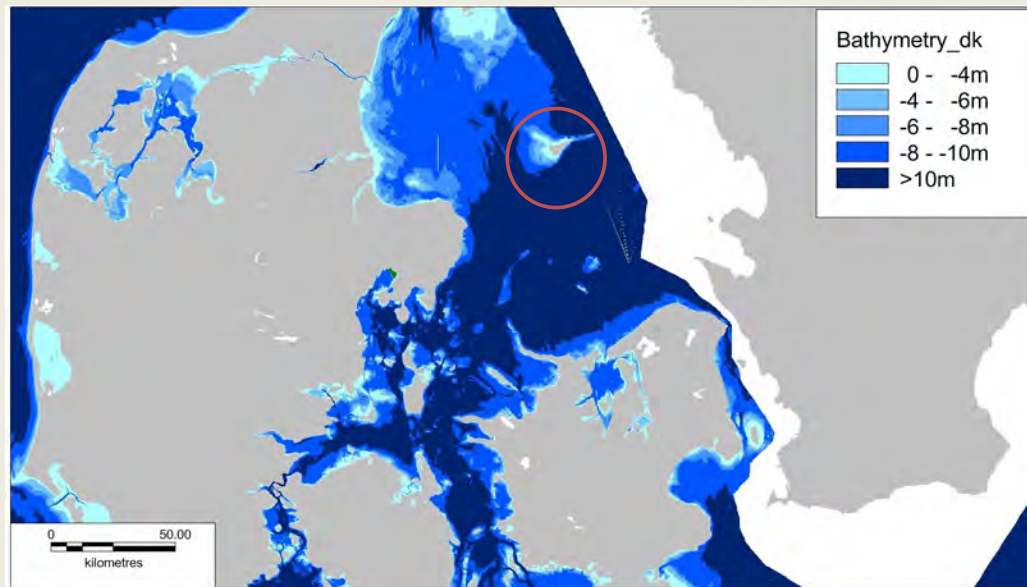
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If we look at this example



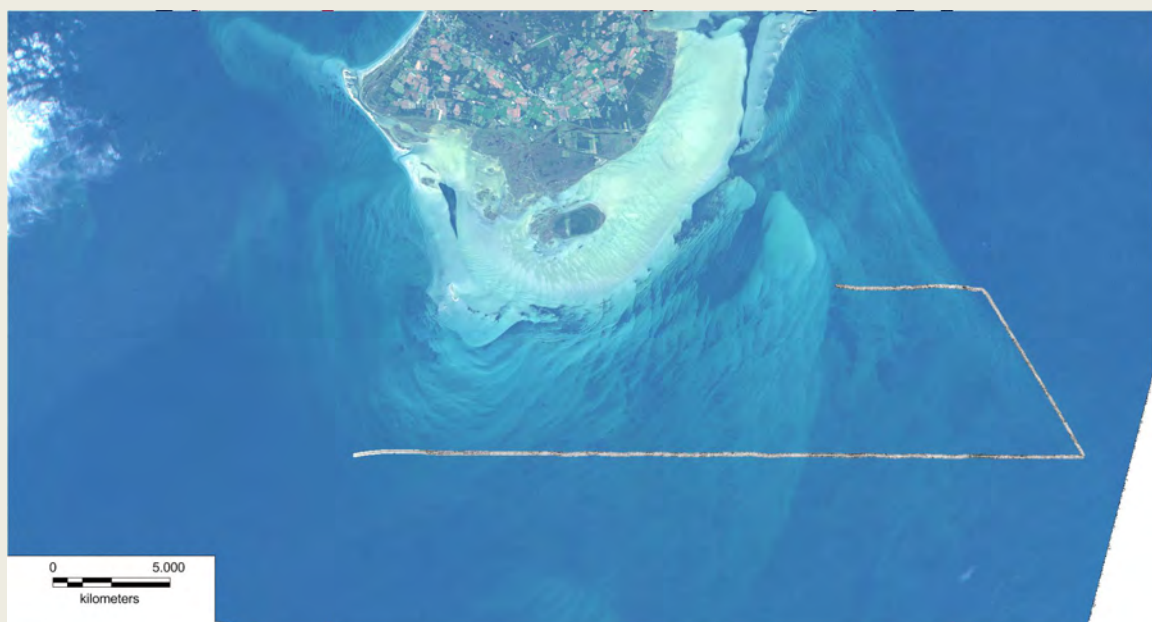
21/11/2013

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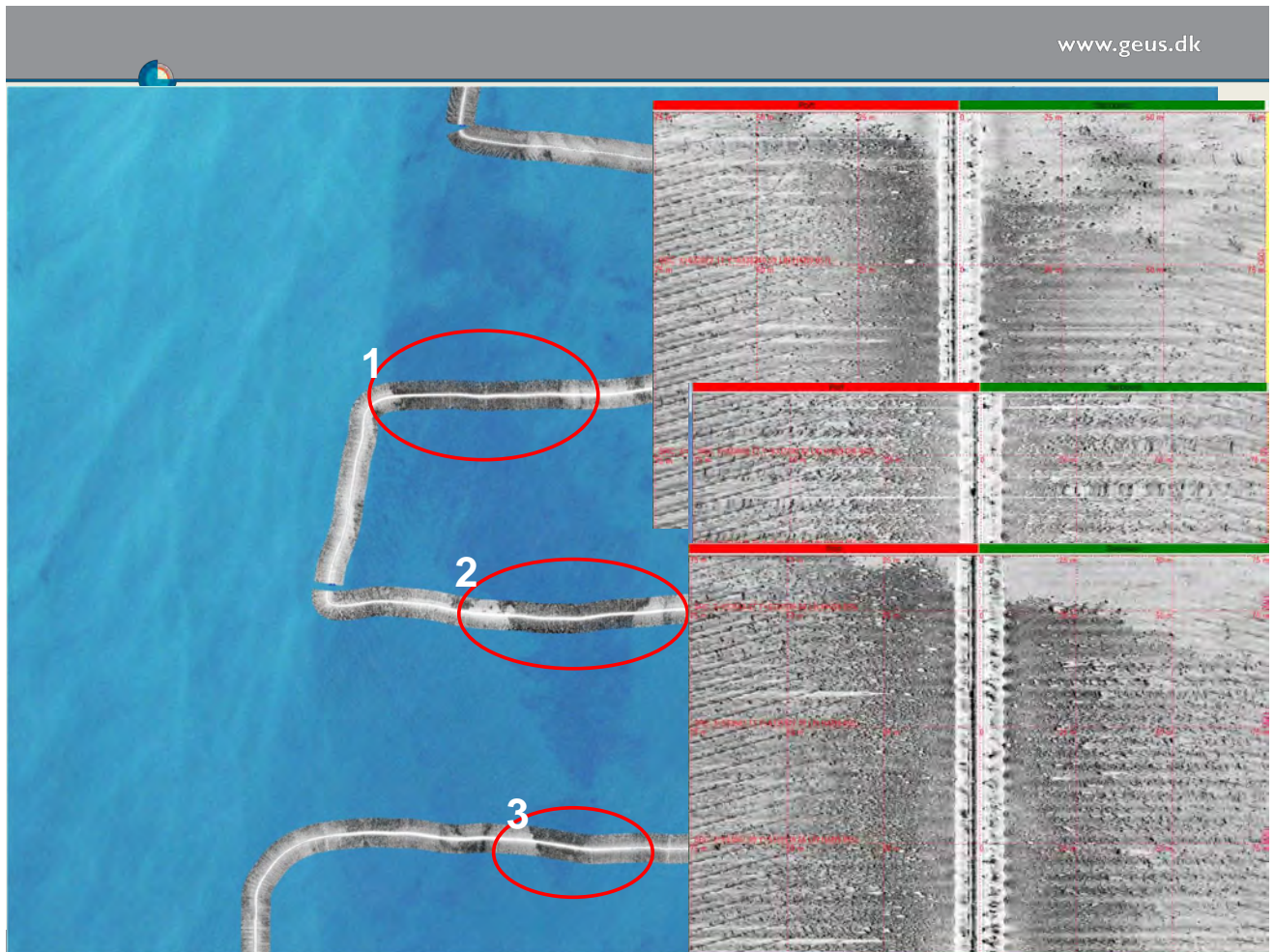
Here we surveyed the area at large line-spacing



21/11/2013

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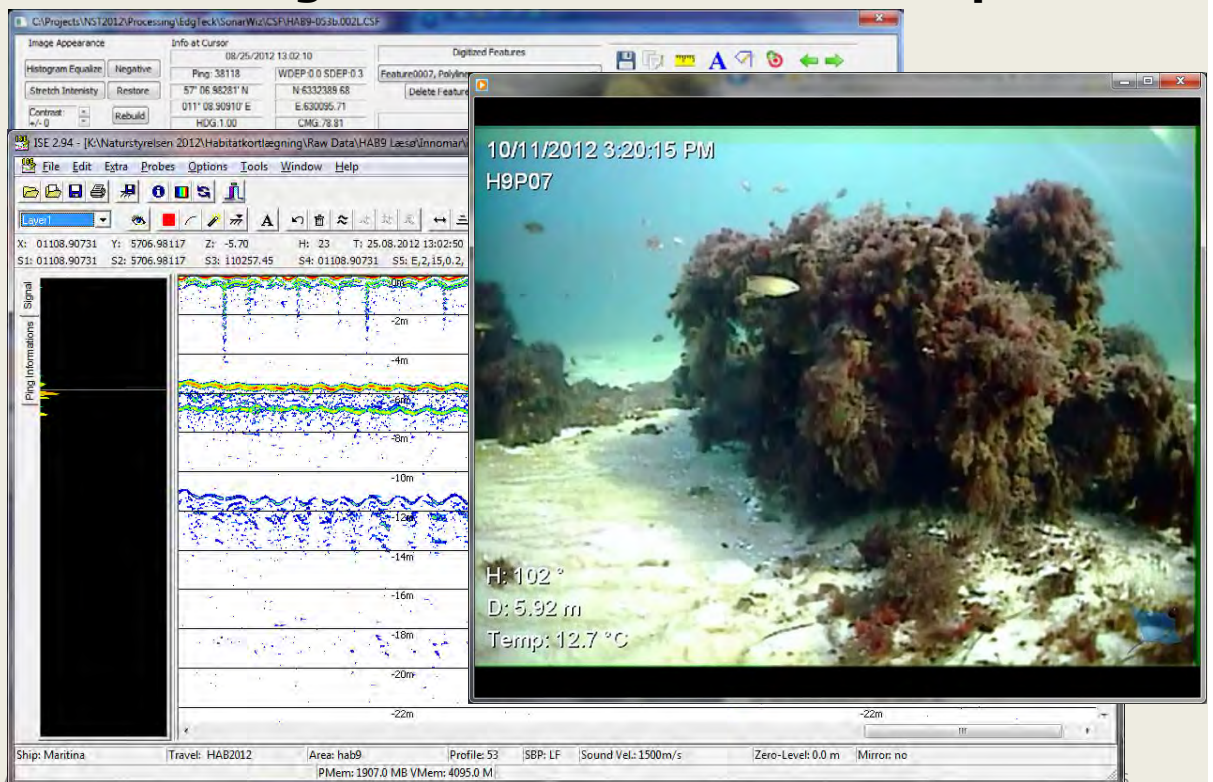
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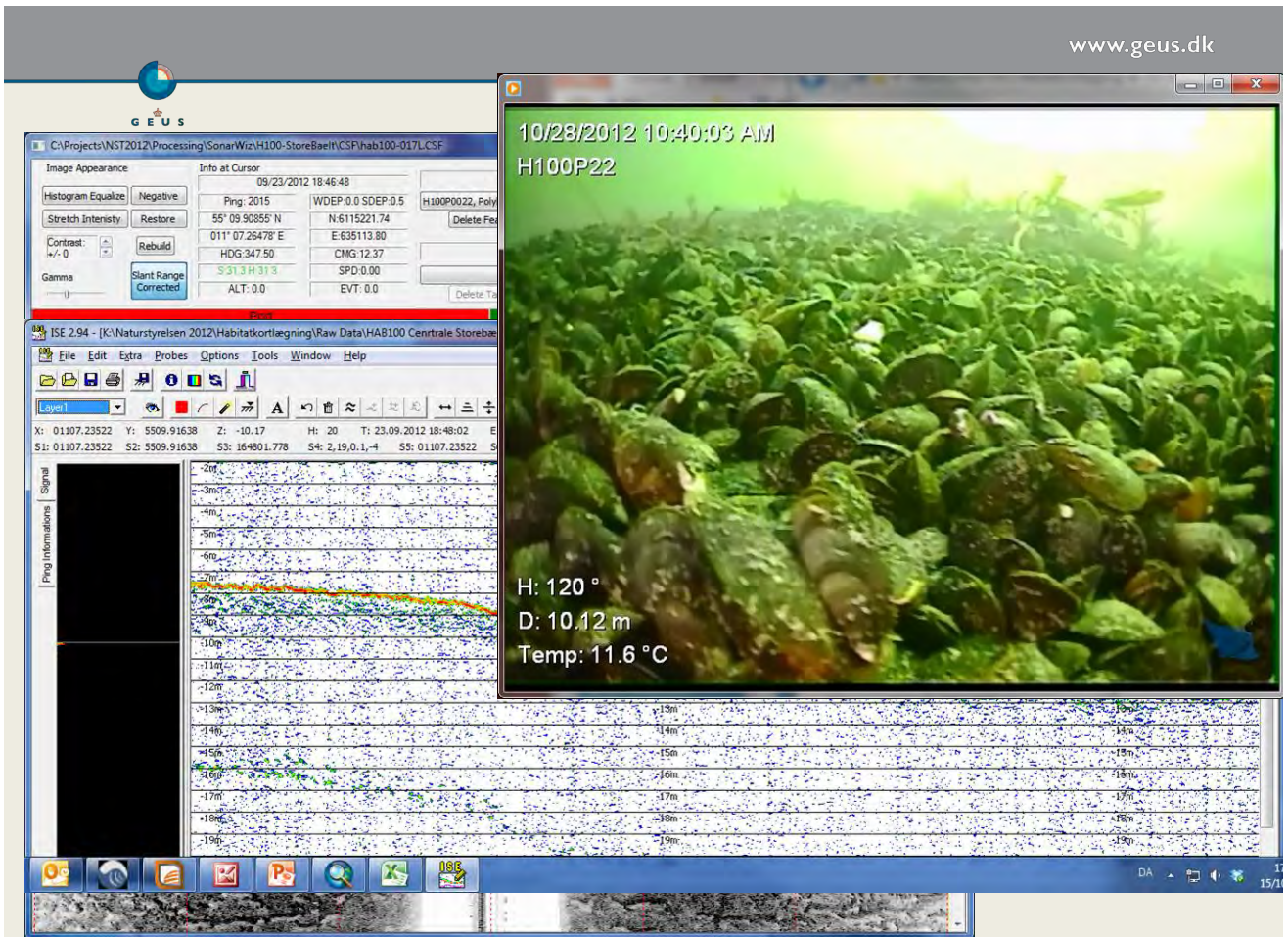
www.geus.dk



Combining sidescan and sub-bottom profiler



21.



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www.geus.dk



Recent application SASMAP project



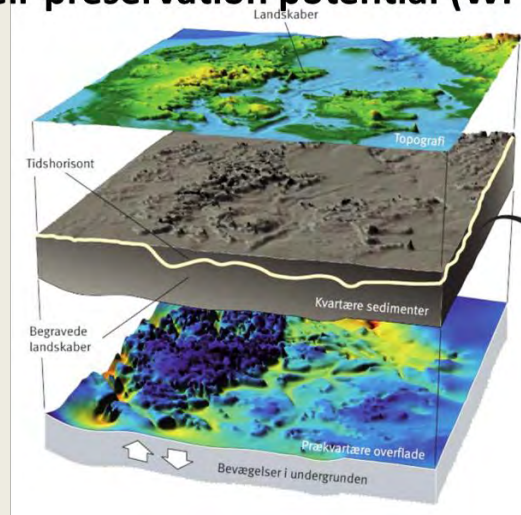
Development of Tools and Techniques to Survey, Assess, Stabilise, Monitor and Preserve Underwater Archaeological Sites: SASMAP

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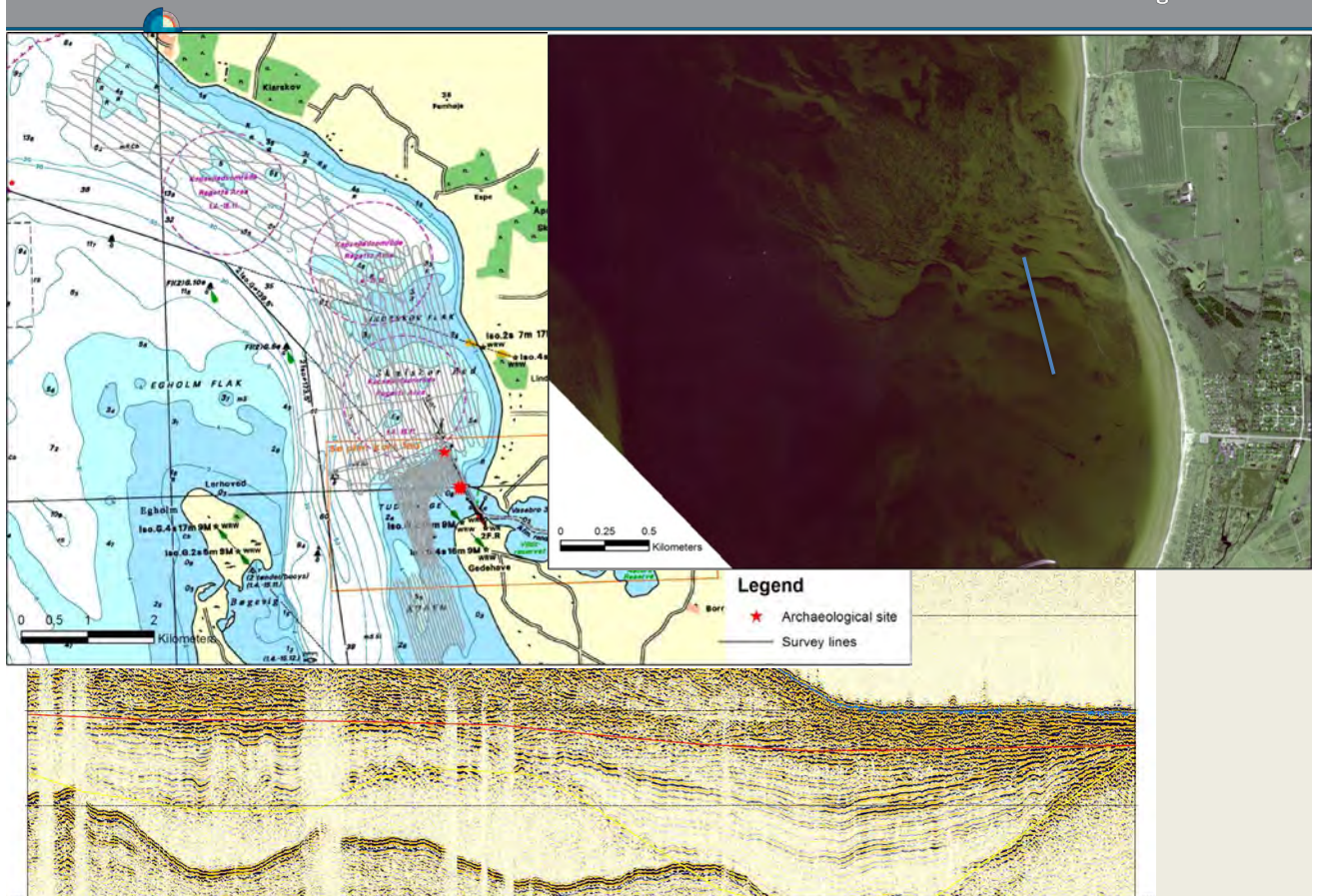


Geological models for regional evaluation of probability of archaeological sites and their preservation potential (WP1)

- 1.1 Satellite imagery analysis
- 1.2 Literature and report survey
- 1.3 Existing data database
- 1.4 Geo-modelling



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Final remark

- One of the basic parameters that contributes in producing habitat models in Europe is the seabed sediment map. Thus an **accurate, high resolution sediment map is a must** for producing accurate and confident habitat distribution model that will in-turn be used in management activities.
- In our work for mapping habitats in shallow and relatively deep water, **robust, highly accurate and user friendly** survey instruments is required.
- For any chosen equipment, apart from its performance, it is the **after-sale service** and the **clarity of the manual** plays an important role in evaluating the system and the company behind it.
- I have experienced both from Innomar, and we in GEUS are very much satisfied with the company and the system we have purchased.
- Innomar is a partner in SASMAP. We are looking forward for there innovative new **3D sub-bottom profiler** which will be used in the test sites in 2014.



I would like to extend my gratitude to my colleagues in the Marine Group / GEUS who contributed in the surveys and the interpretation of the data that follows.



Thanks