

VELMU surveys underwater biodiversity in the Baltic Sea





Aiming towards sustainable use and protection of the sea

VELMU's objective is to survey marine habitats in Finnish waters and give an overview of species occurrence.

Increasing pressures on the sea

Marine and freshwater species live side by side in the Baltic Sea. Since the salinity – low for some species, high for others – poses major challenges to biota, Finland's marine waters are home to communities characterised by a relatively low total number of species, where a few dominant species are found in high abundance. In addition to low salinity, variations in temperature and the ice cover in winter add to the challenges the animal and plant species face in the Baltic Sea.

Over the last century, the environmental state of the Baltic Sea has deteriorated, particularly as a consequence of eutrophication. Harmful substances present a further threat. The natural state of the sea is subject to constant change because of construction, extraction of aggregates, dredging, and disposal of dredge spoils. Moreover, oil and chemical transports, the spread of invasive species, and climate change threaten the natural balance.

Before it is possible to take measures to protect the most valuable habitats and species from destruction and harm arising from exploitation of marine resources, it is necessary to gather adequate information on the distribution and composition of the subsurface biota. Activities under VELMU – the Finnish Inventory Programme for the Underwater Marine Environment – are designed for this purpose.

VELMU's objective is to survey the marine habitats in Finnish waters, generate an overview of species occurrence, and develop a management system for data collected on the benthic marine environment. The information is needed, for instance, in assessing the status of threatened species and natural habitats, and in support of marine spatial planning. Marine biodiversity is affected by a number of activities, from wind power production to fishing.

VELMU expands on the current information on Finland's benthic marine environment

VELMU develops marine habitat mapping methods suitable for Baltic Sea conditions and provides the basis for an inventory of marine biodiversity in Finnish waters.

The VELMU programme is

- enhancing knowledge of the marine environment by producing an overview of the occurrence and distribution of the most important habitat types and species in Finland's marine waters;
- collating existing research data into a database;
- promoting the exchange of information between institutions engaged in marine biodiversity research and making biological, geological and physical data more easily available; and
- establishing a web-based resource for marine environment information, including a map service.

The Baltic Sea is a large, geologically young, brackish-water basin that offers a unique and challenging habitat for plants and animals. In the northern parts of the Baltic Sea, the rocky coasts host an array of macroalgae species, such as the brown alga bladderwrack (*Fucus vesiculosus*), filamentous red alga of the genus *Ceramium* (*Ceramium tenuicorne*), and the green gut weed (*Ulva intestinalis*), all shown here. Sea mats (*Electra crustulenta*), which belong to the bryozoans, or moss animals, form greyish colonies among the dark bay mussels (*Mytilus trossulus*).





(Large picture) In many places along the coast of Finland, eelgrass (*Zostera marina*), together with other vascular plants and some charophytes (Charophyceae), forms underwater meadows utilised by many fish and invertebrate species for feeding and reproduction.

(Small pictures) Charophytes are a group of green algae closely related to land plants that co-habit the same environments as aquatic plants. They are sensitive to changes in water quality and are unable to tolerate the increase in turbidity caused by, for instance, eutrophication or dredging.

Why is information on marine nature necessary?

Information on marine nature is needed to fulfil both national and international commitments and requirements regarding the use and protection of the marine environment.

Collecting information

Gathering information on the Baltic's subsurface environments is much more challenging than gathering information on terrestrial habitats and species. Consequently, the surveying of marine biodiversity is still in its early stages.

The information will be utilised in Finland, for example, in

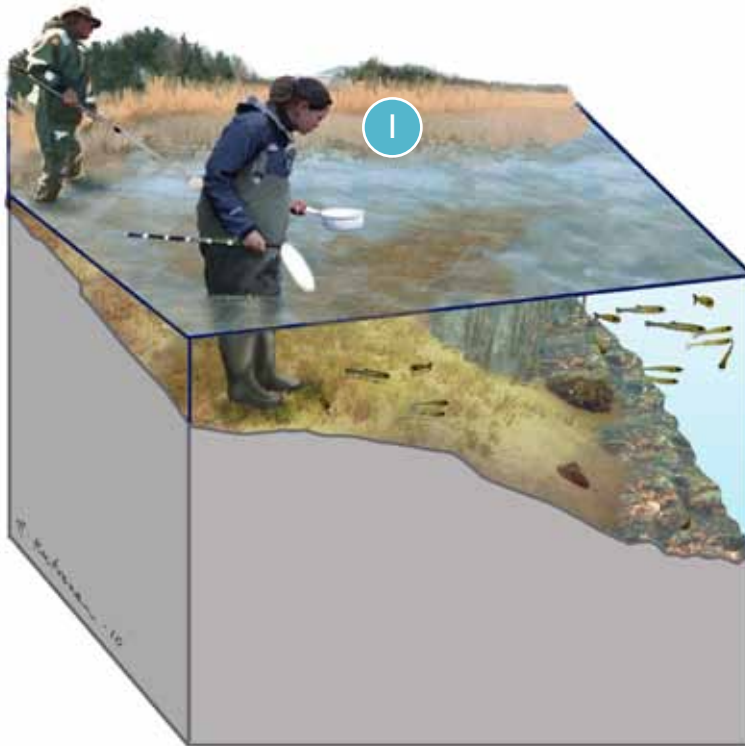
- planning the use of sea and coastal areas (for instance, the placement of offshore wind power, dredge spoil disposal and aggregate extraction)
- protecting marine habitats and biodiversity, including the assessment and further development of the marine protected area (MPA) network
- managing fish stocks
- assessing the risks of transporting hazardous goods, and combating oil and chemical spills

International commitments

Finland is committed to implementing a number of international conventions related to the protection of the sea and biodiversity, and the sustainable use of natural resources, for example, the Convention on Biological Diversity (CBD). Moreover, Finland must fulfil obligations under European Union programmes and legislation such as the European Marine Strategy Directive, the Habitats Directive, the Birds Directive, and the Water Framework Directive. Information collected under VELMU is also needed for achieving objectives set by the Baltic Marine Environment Protection Commission (HELCOM).

Methods for surveying fish breeding grounds

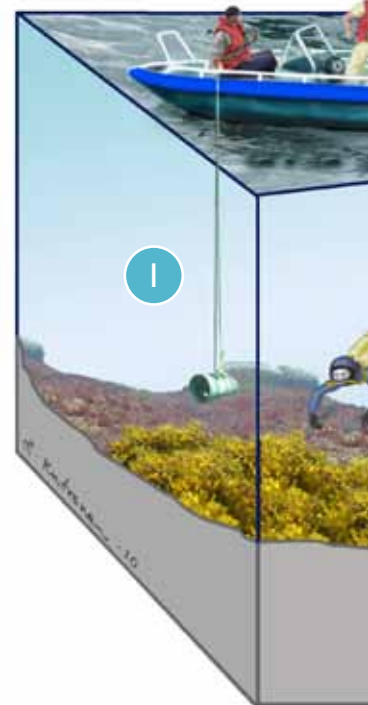
The coastal fish spawning and larval habitats are surveyed with the use of a variety of methods, depending on the fish species being studied and the habitat in which the survey is carried out. In near-shore areas with submerged vegetation (1), a white plate and scoop are used to sample fish larvae. In other shallow shore areas, a seine net is used, while Gulf ichthyoplankton samplers are used to conduct surveys in open waters.



HARRI KUTVONEN/GTK

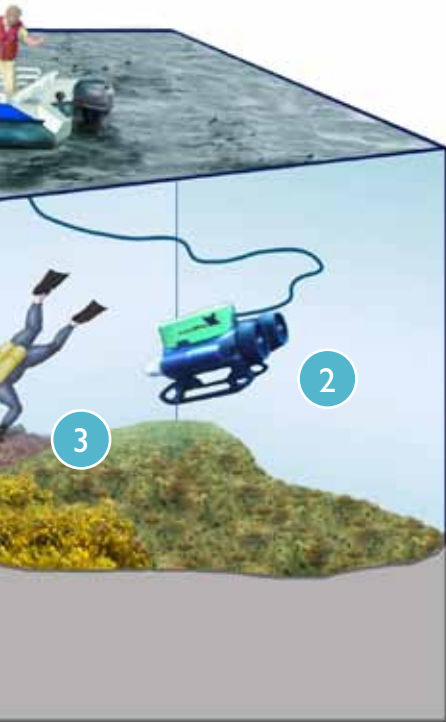
Benthic s

Video photography, sampling and direct o
The drop video method (1) is done by lo
to the sea floor; the video recordings are
photographic surveys can also be carried
this is an underwater robot controlled fro
direct observation and ensures the reliab
can also collect samples. Additionally, sam
sampler; which can be operated from a b



Survey methods

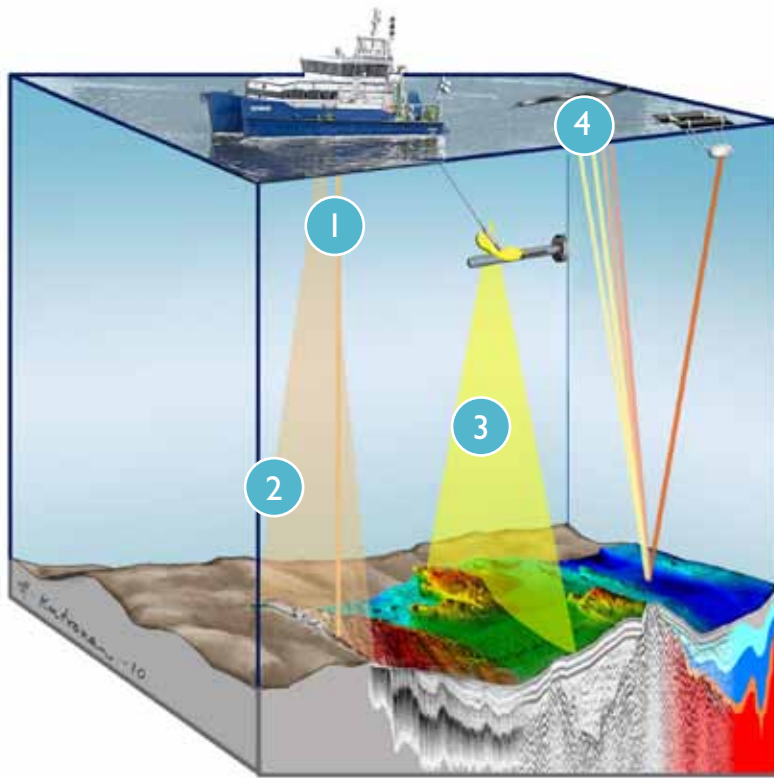
Observation are used to survey benthic habitats. Lowering a video camera attached to a cable close to the seabed allows for detailed observations. Video recordings are stored on a hard disk for further analysis. Video recordings can also be made out with a remotely operated vehicle (ROV) (2); ROVs are used to observe the seabed from a survey vessel. Diving (3) allows for direct observation and collection of samples. The diversity of results gained from video recordings. The diversity of soft-bottom fauna are collected with a grab sampler from a boat or research vessel.



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Geological survey methods

Marine geological surveys are mainly conducted using acoustic methods. The most common of these are (1) single beam echo sounding, (2) multibeam echo sounding, (3) side-scan sonar imaging, and (4) seismic reflection. Sediment sampling and video recordings of the seabed are ground-truthing methods that are used to verify interpretation of acoustic surveys.



HARRI KUTVONEN/GTK



How is the marine environment surveyed?

VELMU surveys both abiotic and biotic elements of the marine environment, in other words, both the geological properties of the sea floor and the species and habitats.

VELMU inventories started in coastal areas, but they are being extended throughout Finland's sea area, including the Exclusive Economic Zone (EEZ). The surveys will be particularly targeted at the sea floor and its flora and fauna, and the fish spawning and larval habitats. Observations of water quality, such as transparency and water temperature, will be collected during VELMU surveys or obtained from other sources.

From scuba diving to remote sensing

A variety of methods are used to inventory the marine environment, from scuba diving to remote sensing and modelling. Geological survey methods include echo sounding and bottom sampling. Selected physical and chemical measurements, including water turbidity, temperature and salinity, are included in some field surveys. Methods for biological inventories include underwater video photography, sampling of the bottom fauna and dive transects.

A white plate and scoop are used to survey fish spawning and larval areas in shallow shore areas with submerged vegetation, a seine net is used in waters with sand and gravel bottoms, and in open waters, Gulf ichthyoplankton samplers attached to the bow of a boat are used. Remote sensing methods such as aerial photography and satellite imagery are used, for example, in the planning of surveys and mapping of habitats in shallow areas.



RKTL 2006



GTK 2009

(Large picture) The selection of the survey method depends largely on the characteristics of the research area. Annually, underwater photography produces hundreds of pictures for VELMU revealing the diversity of the marine environment.

(Small pictures) Fish spawning and larval areas are surveyed along reed-covered shores with the use of a white plate and scoop, as shown here. From onboard a survey vessel, a variety of echo-sounding methods can be used to conduct geological surveys. Here, a side-scan sonar tow fish is being lowered into the water.

Information on the marine environment is processed and mapped

GIS data on habitats can be shown on maps. These maps are useful, particularly for the protection of species and key biotopes.

VELMU uses state-of-the-art GIS technology and statistical modelling methods to produce maps of the distribution of benthic species and habitats. Existing geographical data describing the environment of the Baltic Sea are linked to the biological, geological and physico-chemical data collected under the VELMU programme to synthesise new information that can be depicted in the form of maps. This will facilitate the generalisation of data collected in the field for describing the distribution of different species and habitats.

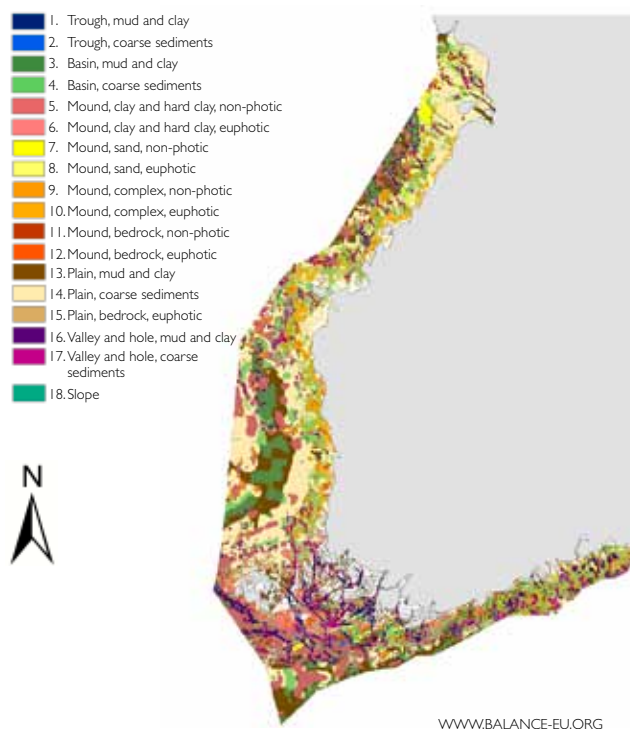
Once a specific species' environmental requirements are understood, the probability of its occurrence can be modelled, even in areas where only the environmental factors are known.

As the knowledge base expands, not only human uses of the sea, but also the value of marine biodiversity will be better taken into account in marine spatial planning.

Wide-ranging cooperation

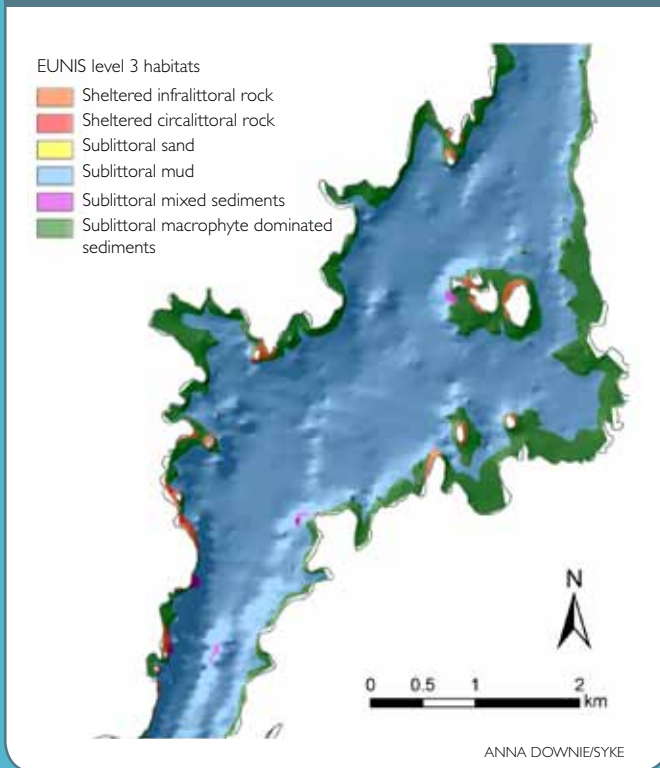
VELMU is implemented through cooperation between seven ministries. In addition to the Ministry of the Environment, the Ministry of the Interior, the Ministry of Defence, the Ministry of Education, the Ministry of Agriculture and Forestry, the Ministry of Transport and Communications, and the Ministry of Employment and the Economy are involved.

Map of marine landscapes in Finnish waters in the northern Baltic Sea (coarse resolution, national cover)

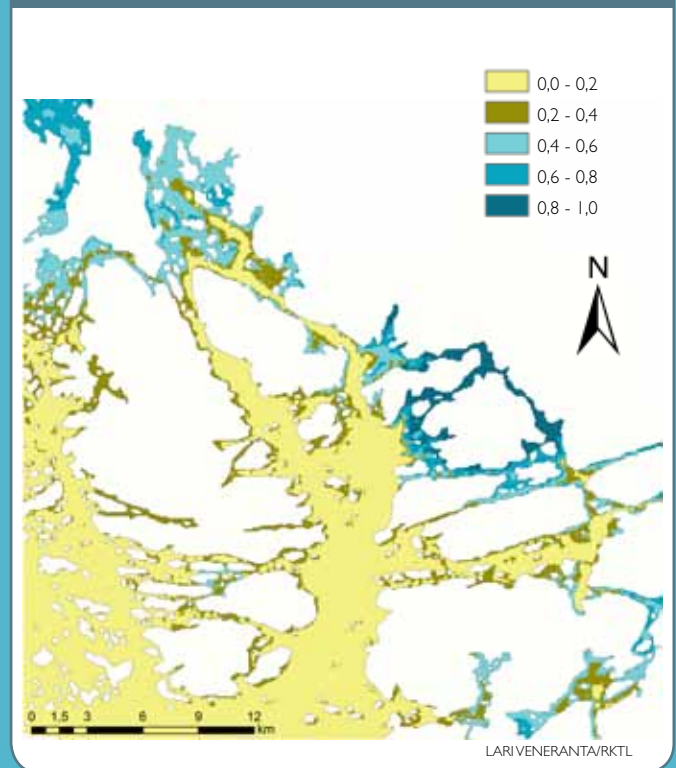


The programme is coordinated by the Finnish Environment Institute (SYKE). Other partners include the Geological Survey of Finland, the Finnish Game and Fisheries Research Institute, Metsähallitus Natural Heritage Services, the Naval Research Institute, Centres for Economic Development, Transport and the Environment located in coastal districts, and Åbo Akademi. Some other universities, higher education institutions and consulting companies are also involved in many aspects of VELMU. VELMU has been set up to incorporate input from end users as well as data producers. The information VELMU produces is needed, for example, by government and local authorities, experts, regional government authorities, non-governmental organisations, educational institutions and private citizens.

Map of benthic marine habitats (medium resolution, regional cover)



Map of species distribution and occurrence of pikeperch larvae (medium resolution, regional cover)



PICTURE 1:VELMU produces GIS data on marine landscapes, the habitats they include, and the distribution of species in the Finnish marine area. Coarse-scale maps of marine landscapes covering the entire Baltic Sea were produced under the international BALANCE project. The landscapes have been identified based on existing, coarse-scale data on the bottom topography and substrate types from around the Baltic Sea. The resulting maps are useful at the level of the Baltic Sea as a whole, but do not facilitate study at a more detailed level.

PICTURE 2:The map depicts benthic habitats classified according to the marine habitat classification system used as a part of the European Environment Agency's (EEA) EUNIS nature information system.

PICTURE 3:The map shows the modelled probability of finding newly hatched pikeperch larvae in the Archipelago Sea. Data on fish larval occurrence, water turbidity and bottom depth were used to produce the map. Areas shown in dark blue in the picture have a high probability of presence for newly-hatched pikeperch larvae. The map can be utilised in local marine spatial planning.



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Cover images: (upper left corner) Goby (*Pomatoschistus*) and filamentous red alga (*Ceramium tenuicorne*), photo by Johan Lindholm, Metsähallitus 2005.
(lower right corner) Bay mussel (*Mytilus trossulus*), photo by Heidi Arponen, Metsähallitus 2007.
(large picture) Bladderwrack (*Fucus vesiculosus*) and marine brown alga (*Dictyosiphon foeniculaceus*), photo by Heidi Arponen, Metsähallitus 2007.

Further information: www.environment.fi/VELMU
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Layout: Niina Silvasti, Ministry of the Environment
Printed by Helsinki University Print, May 2010
Brochure as PDF: www.environment.fi > publications > brochures