Evaluation of different habitat mapping techniques in Kvarken UNESCO World Natural Heritage Site, Baltic Sea

Wildlife & Parks Finland
Björkman Ulrika and Riihimäki Anu
ulrika.bjorkman@metsa.fi anu.riihimaki@metsa.fi

Objectives

The need for detailed information about our marine habitats is increasing as the demand on the management of marine protected areas (MPA's) is growing. Shallow areas are of particular interest because they are inhabited by a wide array of species and a large part of human activity tend to be concentrated to these near shore areas.

Wildlife & Parks Finland (WPF) governs all state owned water in Finland a total of over 3 million ha (not including EEZ). During the past eight years WPF have, through various projects, collected different types of data along the Finnish coast.

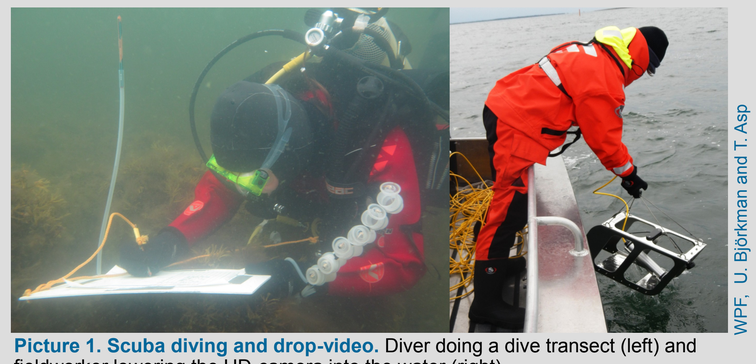
Apart from collecting biological data along the Finnish coast, one aspiration has been to test different data collection techniques. Another objective has been to use GIS-modelling to generate maps that can be used for planning and conservation purposes.

The area of interest in this presentation is the Kvarken archipelago in Finland (**map 1**).

Map 1. The area of interest. Since 2006 Kvarken archipelago (Finland) is a UNESCO Natural World Heritage Site together with Höga Kusten (Sweden)

Methods

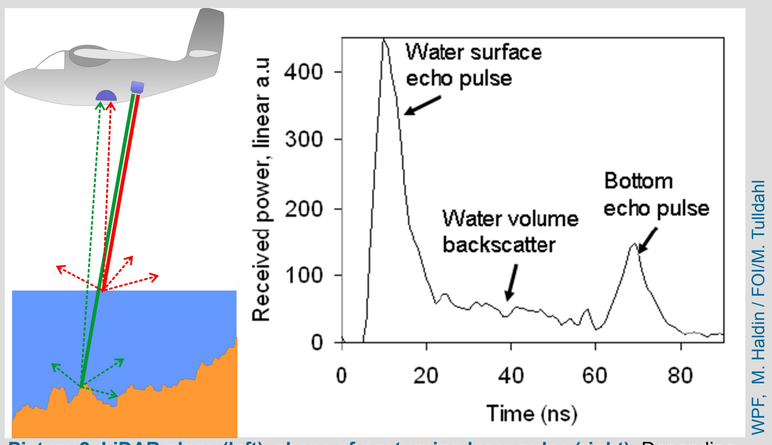
During the years 2006-2014 scuba diving and drop-video (**picture 1**) was used to investigate the spatial occurrence of sessile species and different substrate along the Finnish coast. This was done with the help of a number of national projects (e.g. VELMU and Finmarinet)



WPF, U. Björkman and T. Asp

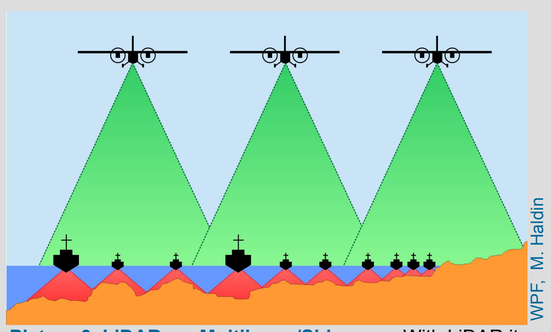
Picture 1. Scuba diving and drop-video. Diver doing a dive transect (left) and fieldworker lowering the HD-camera into the water (right).

In 2010, thanks to the project SUPERB, there was an opportunity to collect LiDAR data (**picture 2 & 3**) from Norrskär in the Kvarken archipelago. In 2013 WPF started collecting underwater data using a side scan sonar (**picture 3**).



WPF, M. Haldin / FOI/M. Tulldahl

Picture 2. LiDAR plane (left), shape of a returning laser pulse (right). Depending on the shape of the return pulse depth and bottom features can be calculated



WPF, M. Haldin

Picture 3. LiDAR vs. Multibeam/Side scan. With LiDAR it is possible to cover shallow areas quicker than with for example multibeam.

In 2013 HELCOM published the HELCOM underwater biotope classification system (HUB), and during the past year GIS-modellers at WPF have started to test the classification system on the data collected over the past years.

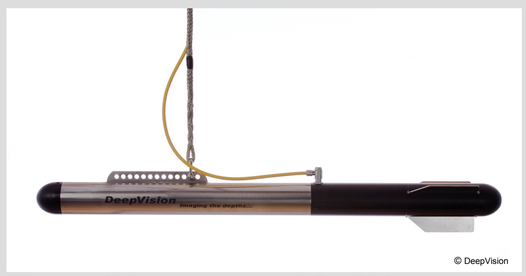
Results

Equipment for underwater video and scuba diving are relatively easy to acquire and the basic techniques are fairly easy to learn. The methods give accurate spatial and biological data and are well suited to be used as ground-validation methods in shallow areas. However, spatial coverage is limited and the quality of the camera and the biologists degree of knowledge, does affect the results.

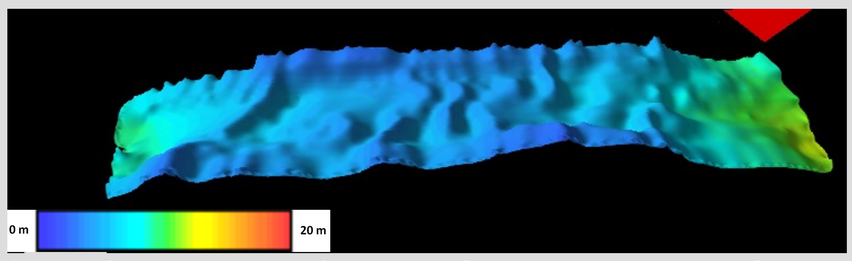
The LiDAR data was used together with drop video data to create maps showing substrate classes and Fucus sp. coverage (**map 2, picture 6**). Scuba diving was used as ground validation method.

Side scan sonar proved to be very useful when trying to find and map geological features, like sandbanks and moraines, on the sea floor (**picture 5**)

The initial HUB-biotope modelling (**map 3**) was done with the environmental variables; depth, exposure, salinity, bottom texture and general topographical features, in combination with the collected biological data. The first trials gave very promising results.



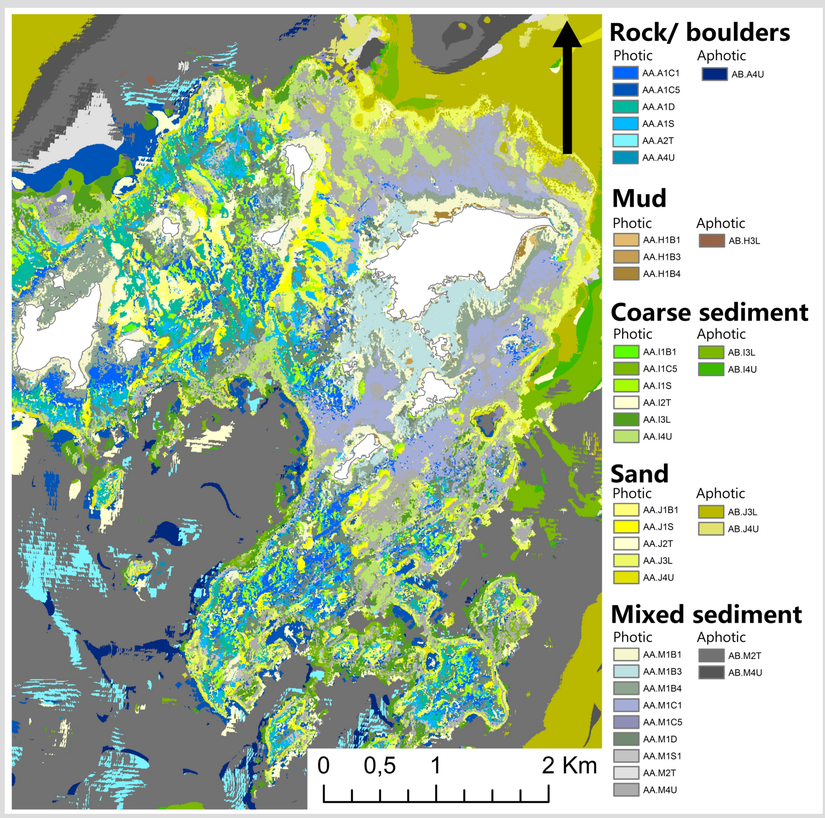
Picture 4. Side scan sonar used. DeepVision sonar systems is a small Swedish company that develops portable seabed mapping systems for smaller boats.



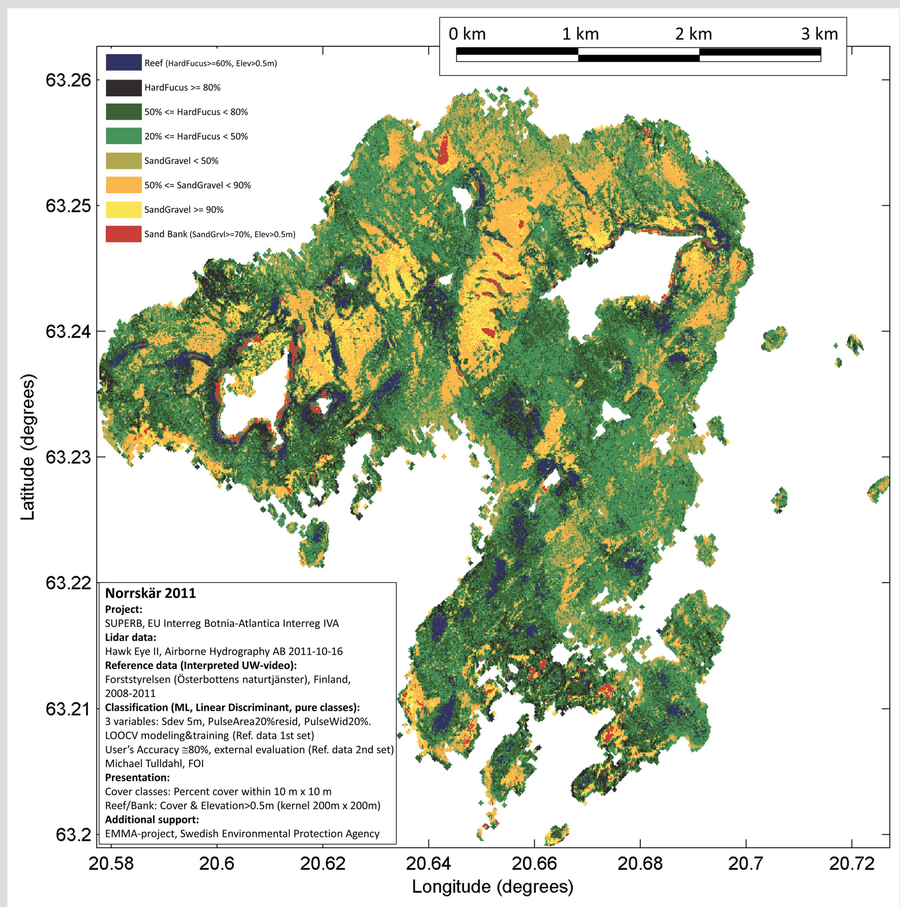
Picture 5. Side scan sonar image from Norrskär. Clear ridges are visible on the seafloor. Dives have confirmed that these are sandbanks (Natura 2000 habitat)

ELY, U Björkman

Picture 6. Fucus vesivulosus (top) and F. Radicans (bottom) endemic to the Baltic sea. These where the species of Fucoids that where modelled with LiDAR



Map 3. Initial modelling with HELCOM HUB-biotops. Island of Norrskär in Finland, the map represents only the most likely dominating biotopes according to the collected data. Modelling by Matti Sahla at WPF



Map 2. Modelling done with LiDAR data, Norrskär in Finland. Showing the substrate classes and the occurrence of Fucus sp. and NATURA 2000 habitats. This was the result of modelling with LiDAR-data covering the whole area and drop video data. Modelling by Michael Tulldahl at FOI.

Conclusions

It has been estimated that if one field team was to map the biological features of the Finnish waters by the means of drop-video it would take approximately 10 000 years. However, video and scuba diving are methods that should not be forgotten amongst all the new remote sensing techniques. With these methods it is possible to observe the habitat up close and actually determine species, this makes for good ground-validation method.

Both LiDAR and side scan sonar have the advantage of covering extensive areas effectively. LiDAR is very well suited for spatially complex areas where boat access might be a problem. There are, however, some limitations like turbidity, but the technology in this field is developing continuously. As for the side scan sonar, the model used in Kvarken is light and portable, it can be operated from smaller boats hence it can be used in shallower areas. But interpreting the data from these two techniques requires knowledge that is not yet common among biologists. Even so, basic interpretation of the side scan sonar data is something that is not to difficult to learn.

The initial modelling done with the HUB-classification looks very promising. This work will continue and the next step is to add more variables to the models. HUB is an international system (based on the EUNIS-classification) adapted to the Baltic Sea and this can hopefully become a common tool that will make cross boarder planning and communication between countries easier.

METSÄHALLITUS FORSTSTYRELSEN
Länsstyrelsen Västerbotten
FOI
MERENKURKKU KVARKEN WORLD HERITAGE SITE
VELMU
SUPERB
Botnia-Atlantica
Gränsöverskridande samarbete över fjäll och hav
Meret, vuoret ja rajat ylittävä yhteistyö
Grenseoverskridende samarbeid over fjell og hav
Cross-border cooperation over mountain and sea
EUROPEISKA UNIONEN
Europeiska regionala utvecklingsfonden
www.botnia-atlantica.eu