

HAMOD - HARD bottom MODeling

GIS-modeling of hard bottom species distributions



M. Isæus, T. Bekkby, T. Kroglund, F. Moy, K. M. Norderhaug, A. Pedersen, and E. Rinde

Contact author: Martin Isæus, Norwegian Institute for Water Research, P.O. Box 173 Kjelsås, N-0411 Oslo, Norway.

E-mail: martin.isaeus@niva.no

The overall goal of the HAMOD project is to develop a dynamic GIS model capable of modeling the spatial distribution of hard bottom species (reference conditions) and predict biological responses of human impacts. During the last years new management tasks like implementation of the EU Water Framework Directive (WFD) have created requirements for new spatial planning tools. GIS based models using basic physical criteria, such as wave exposure, depth and terrain variation, have been developed to indirectly predict the distribution of marine habitats. Norwegian Institute for Water Research (NIVA) holds long time series of physical, chemical and biological data from national monitoring programs, which represent a large source of data to develop these models

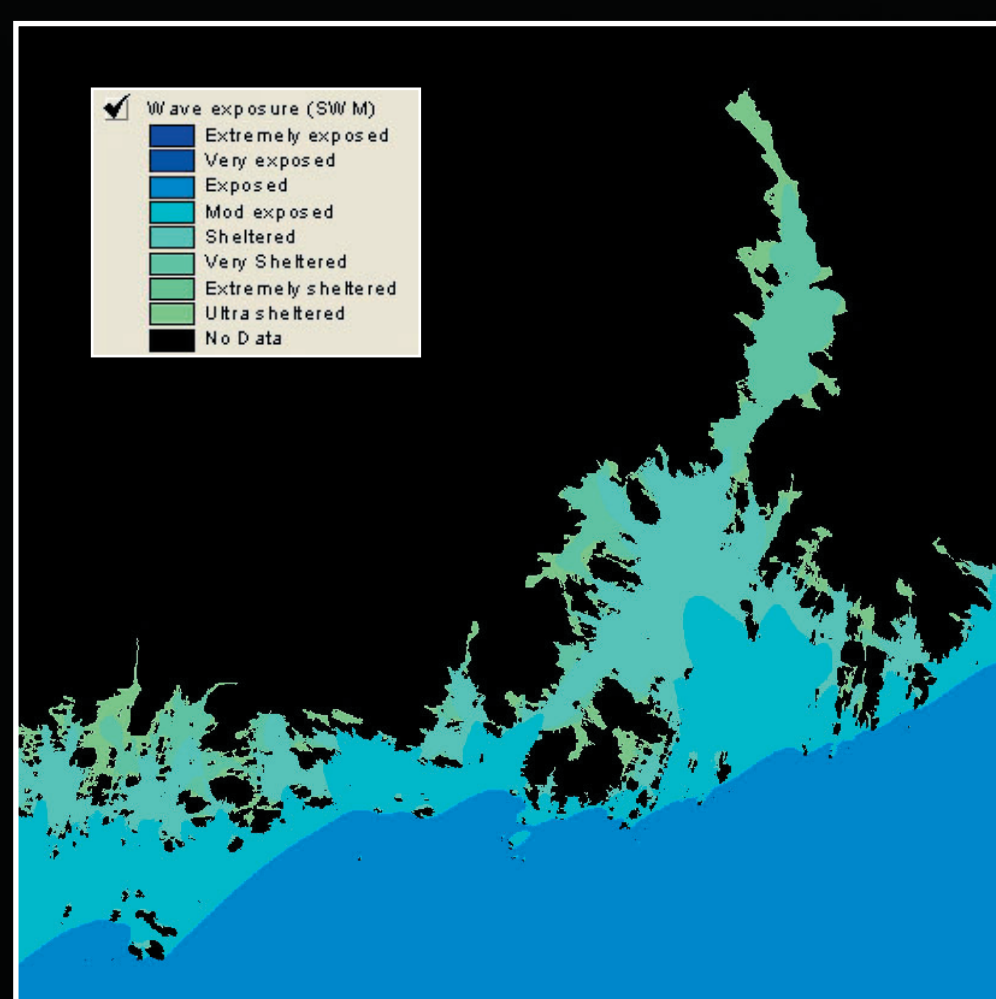
further. So far, available exposure models have been evaluated and compared with biological data and physical, chemical and biological data have been extracted from data bases and literature and arranged in a conceptual model. Results from the conceptual model will be transferred into a GIS-environment for modeling of species distributions. HAMOD also cooperate with the modeling project of the marine part of the national program on mapping and monitoring of biological diversity, on developing methods for habitat modeling and field validation. This project receives funding from the Directorate of Nature Management, the Fisheries Directorate and Ministry of Defense

Habitat mapping method

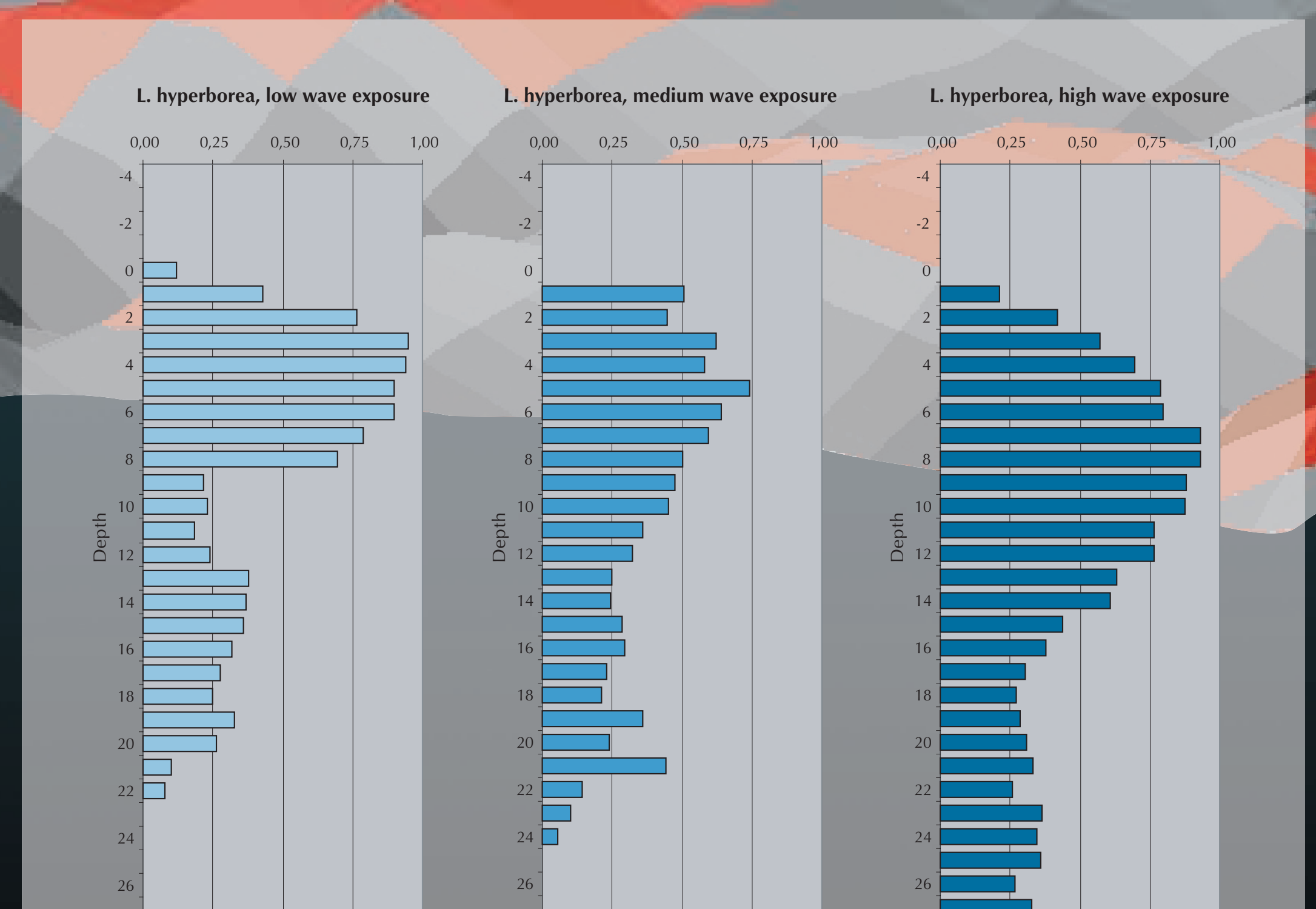
A new method for empirical based habitat modeling is currently under development. The method can use any combination of field data from point or transect inventories. First the maximum observed distribution (potential distribution) of each species along the range of each factor gradient is determined, optionally as variation of depth distribution in factor classes. Then the mean degree of observed coverage is calculated for sites, not excluded by the potential distribution (Fig. X). The resulting table together with factor grids (bathymetry, wave exposure, substrate etc), is used for producing a species distribution grid (see figure on top of the poster).

Wave exposure modeling

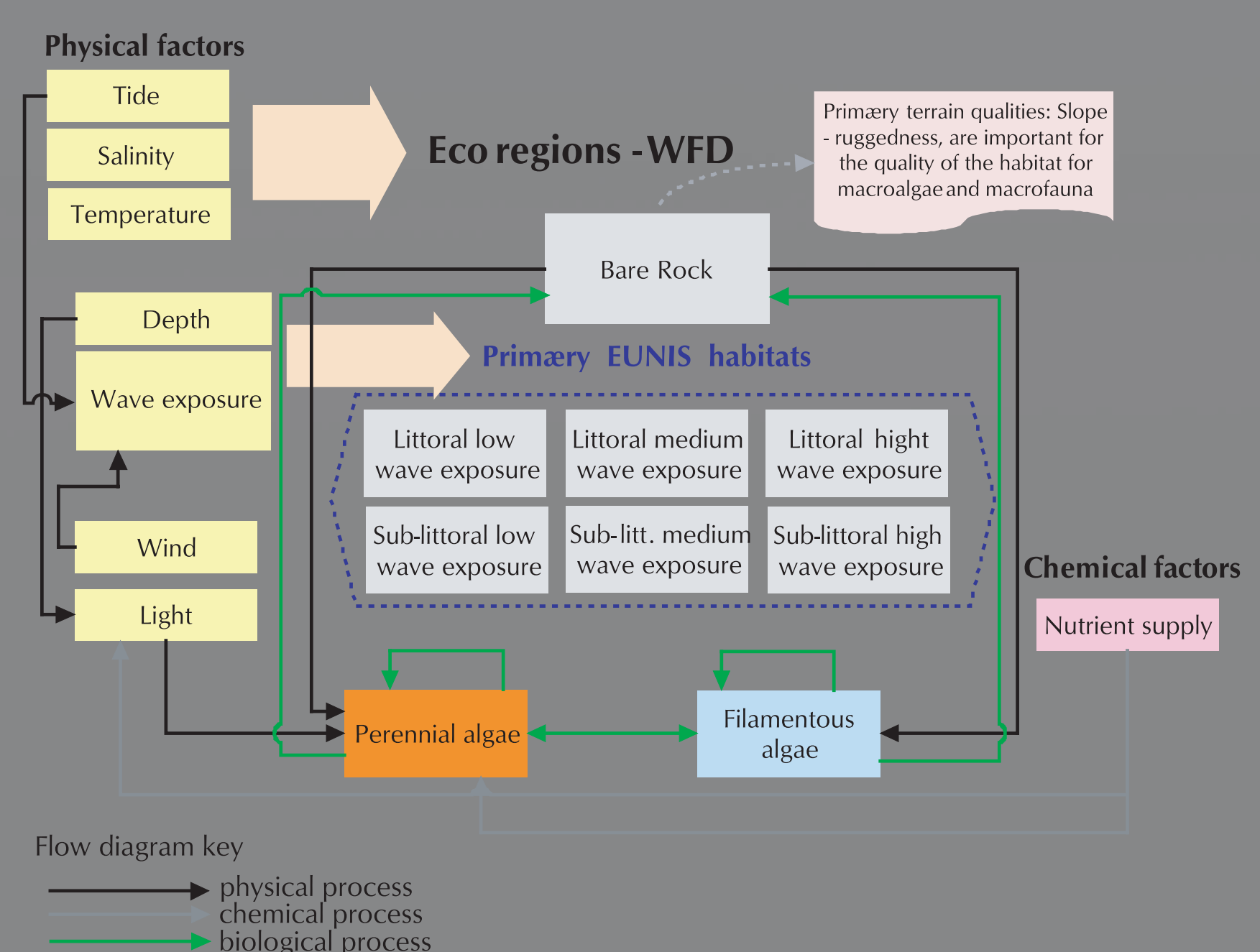
The wave exposure model Wave Impact, method SWM (Isæus 2004), was compared to three other methods (STWAVE, FWM, Bioexp) by analyzing how well their outcome correlated to a biological wave exposure index. SWM came out as best in this test, hence, SWM was adopted to the standard method at NIVA. SWM grids, at a 25 m resolution, have been generated for the whole Norwegian, Swedish and Finnish coasts. During fall 2005 the wave exposure values will be classified according to EUNIS habitat classification system. A new wave exposure method integrating the advantages of SWM into the well-established STWAVE model will be developed at NIVA shortly.



Wave exposure calculated from fetch and mean wind of 16 directions. Refraction/diffraction effects are simulated roughly. The grids have 25 m resolution and cover the coastal waters of Norway, Sweden and Finland. The classification according to EUNIS is preliminar and is currently being revised.



Vertical distribution of *Laminaria hyperborea* at three wave exposure classes. Field data from 15 years at 12 stations at the Norwegian south coast. The pattern is used for spatial modeling of *L. hyperborea*.



A conceptual model was developed to get an overview of factors affecting the littoral and sublittoral EUNIS habitats along the Norwegian coast. The communities' composition of the habitats varies from ecoregion to ecoregion along the Norwegian coast, which is included in the model. The conceptual model will be the framework for a potential dynamic model, which will be running different climate-, eutrophication- and management -scenarios to model changes in littoral assemblages.