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Modelling Laminaria hyperborea kelp forest distribution in Norway



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Laminaria hyperborea kelp forests cover large areas along the Norwegian coast, being highly productive, hosting a broad diversity of species and providing basis for commercial kelp harvesting and coastal fishing.







Field work - Field data were collected along geophysical gradients using underwater camera.

Norway has a long and complex coastline, and detailed mapping is practically and economically difficult. Consequently, other approaches are needed.





Statistical analyses - We analysed the influence of geophysical factors using Generalised Additive Models (GAMs). As a tool for model selection, we used the Akaike Information Criterion (AIC).



Predicting kelp forest distribution - Based on the response curves from the GAM analysis, we used the program GRASP to develop a matrix of predicted values (look-up tables) to produce the spatial probability model (AUC=0.79). The field observed classes of kelp density was positively correlated with predicted probabilities (F=51.98, p<0.001).

Statistical analyses, model selection and spatial modelling was used to predict the distribution of *L. hyperborea*, identify kelp forest areas grazed by sea urchins (*Strongylocentrotus droebachiensis*) and predict the number of sea urchins within a region.

The results show that geophysical factors may predict the distribution of kelp forest with a high degree of certainty, and that the distribution and number of seaurchins may be modelled. These results may for instance be used to estimate the magnitude of kelp forest loss and suggest areas for restoration initiatives.



Most relevant publications:

- Bekkby, T., Rinde, E., Erikstad, L. and Bakkestuen, V. 2009. Spatial predictive distribution modelling of the kelp species Laminaria hyperborea. ICES Journal of Marine Science 66(10): 2106-2115.
- Gundersen, H., Christie, H. and Rinde, E. 2010 (Norwegian, English summary). Sea urchins from problem to commercial resource. Estimates of sea urchins as a re sources and an evaluation of ecological gains by sea urchin exploitation. NIVA report LNR 6001-2010.
- Norderhaug, K.M., Isæus, M., Bekkby, T., Moy, F. and Pedersen, A. 2007. Spatial predictions of Laminaria hyperborea at the Norwegian Skagerrak coast. NIVA report LNR 5445-2007.

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