

Useful tools for assessing conservation targets and impacts on marine habitats - examples of waterbird populations and marine infrastructures

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Abstract

Offshore infrastructures, particularly wind farms, are being planned and built with an ever-increasing pace. To be able to estimate potential impacts of these strategic plans on protected areas and ecosystems in general we need to be able to describe processes and patterns of target populations and communities at different scales. A prerequisite for sustainable spatial planning is that we can estimate the distributions and size of target populations for marine conservation as well as the carrying capacity of their habitats. We show examples of tools capable of “tackling” these challenges in relation to the conservation and management of waterbirds in Danish waters. By using species distribution models (SDMs) it is possible to describe relationships between observed species and a range of different dynamic and static environmental variables reflecting the geophysical and biological environment as well as anthropogenic disturbance. This approach allows us to estimate population sizes and habitat displacement at a high resolution. We use two-part Generalised Additive Models (GAMs) to analyse data sets displaying zero inflation (an excess of zeros), spatial and temporal autocorrelation and non-linearity. We show successful applications based on both survey and telemetry data. We further show an application of individual-based modelling (IBM) for defining the carrying capacity of waterbird habitats and for predicting changes in species fitness following habitat alteration. IBMs relate individual behaviours such as feeding activity and food intake rates to environmental factors and allow assessment of the factors constraining species fitness. By using IBMs we can for example predict whether reduction in food resources will result in negative effects on bird survival. By using a combination of SDMs and IBMs we are able to generalise complex systems which makes an assessment of conservation targets and environmental impacts possible at different scales.