

Optimizing survey data for ecological niche modelling of rare species: A case study with starry ray from the North Sea

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Ecosystems in the higher latitudes are usually inhabited by a small number of highly abundant and a high number of rare species. Particularly rare species may be of high conservation concern, but based on their rarity, knowledge gaps frequently exist about their biology, ecology and population status. Regarding marine fishes, extensive monitoring data are available for some parts of the world such as the North Sea, which is a major advantage compared to most other taxa. Nevertheless, the corresponding surveys have typically developed over time and are not optimized for monitoring rare species, which often leads to non-representative sampling and reduced data quality. Chondrichthyans are an important example of rare species with data limitations. A high number of species have declined worldwide and this is also apparent for the North Sea, where several species are supposed to be threatened.

Ecological niche modelling is an approach to estimate the fundamental niche of a species. It requires only little species information (at least presence records) that is readily available by North Sea monitoring data. However, the low prevalence of rare species could negatively affect predictive performance of estimated models. Thus, this study aims for optimizing available monitoring data from the North Sea to develop ecological niche models of rare species. This is done by filtering techniques and adjustments of the spatial sampling units. Here, we focus on starry ray *Amblyraja radiata*, which nowadays is the most abundant of the rare skates in the North Sea. If significant models can be obtained from the developed optimization techniques, this method could be applied to other even rarer species.

Keywords: North Sea; chondrichthyan species; ecological niche models; data optimization