

Integrating disparate datasets to model the functional response of a marine predator: a case study of harbour porpoises in the southern North Sea

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Abstract

1. Quantifying consumption and prey choice for marine predator species is key to understanding their interaction with prey species, fisheries, and the ecosystem as a whole. However, parameterising a functional response for large predators can be challenging because of the difficulty in obtaining the required datasets on predator diet and the availability of multiple prey species. 2. This study modelled a Multi-Species Functional Response (MSFR) to describe the relationship between consumption by harbour porpoises (*Phocoena phocoena*) and the availability of multiple prey species in the southern North Sea. Bayesian methodology was employed to estimate MSFR parameters and to incorporate uncertainties in diet and prey availability estimates. Prey consumption was estimated from stomach contents data of stranded harbour porpoises. Prey availability to harbour porpoises was estimated based on the spatial overlap between prey distributions, estimated from fish survey data, and porpoise foraging range in the days prior to stranding predicted from telemetry data. 3. Results indicated a strong preference for sandeel in the study area. Prey switching behaviour (change in preference dependent on prey abundance) was confirmed by the favoured Type III functional response model. Variation in the size of the foraging range (estimated area where harbour porpoises could have foraged prior to stranding) did not alter the overall pattern of the results or conclusions. 4. Integrating datasets on prey consumption from strandings, predator foraging distribution using telemetry and prey availability from fish surveys into the modelling approach provides a methodological framework that may be appropriate for fitting MSFRs for other predators.

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