Uncovering the biophysical forces shaping marine fish distributions

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Accurate predictions on how fish behave and move in response to changes in their physical environment are central to the effective management of commercially harvested stocks. Here, we explored how oceanographic forces influenced the distributional patterns of the Icelandic summer spawning (ISS) herring (*Clupea harengus*) stock over a 22-year time series (1991-2012). Large shifts have been observed in the overwintering (non-feeding) location of the stock during this time period; however, the factors governing these shifts remain uncertain. Commercial catch data from the autumn/winter purse seine fishery were compiled, and boosted regression tree and generalized additive models were used to examine the influence of ocean physics, as derived from a high-resolution hydrodynamic model, on the probability of herring occurrence and abundance during overwintering. Models were validated based on fishery-independent acoustic survey data. Habitat suitability maps will be created in the next phase of the project to define past and present winter distributions, and data on competition, predation and prey availability will be incorporated into the models to hindcast juvenile nursery use, and summer feeding and spawning distributions of ISS herring. We suggest that this approach is highly transferrable to other herring stocks and other commercially important pelagic species in the North Atlantic (i.e. Atlantic mackerel, capelin), and that the work will help achieve management objectives through minimisation of bycatch and improved predictions of species' distributions in response to environmental change.

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