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Perspective: Fisheries Research Needs to Change Course

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Editor's note: Andrew Johnson is a recent graduate of the University of Bangor (UK) with a Ph.D. in marine ecology.

Governments and scientists invest significant money and time every year in trying to understand where fish live and why, for the purpose of informing fisheries management. But it turns out that the research, as it historically has been conducted, is too often neglecting some very important factors.

Recently at Bangor University (UK), a review of fisheries literature revealed that research in the field of demersal fish habitat determination may benefit from changing direction (www.thefishsite.com/articles/contents/demfisheriesmay12.pdf). Namely, if we are to successfully and sustainably manage our marine fish stocks, it is essential that fisheries scientists and managers better understand the link between fish populations and habitat as well as the spatial scales over which these relationships occur. The development of sound, predictive science in the field of demersal fish habitat determination - particularly in the context of informing conservation efforts - will require a reduction in study scale and an integration of biotic habitat variables.

By analyzing the results of over 100 peer-reviewed studies since 1976, my research team demonstrated that many studies tended to be spread across large areas of ocean ($\geq$100km^2) and focus on the physical (abiotic) properties of habitat such as depth, sediment type, and salinity. Many therefore neglected small spatial scale associations and important biological (biotic) habitat variables like prey resource, predation, and competition between fishes.

Bias toward large areas, abiotic variables does not serve local-scale conservation or fisheries management

The common use of abiotic habitat variables is likely to be related to the ease with which such data can be gathered and the numerous annual scientific and commercial fishery surveys that operate over large sea basin scales. The collection of biotic data on the other hand often relies on time-consuming methods such as visual censuses and the analysis of whole marine communities. Analyzing fish stomach contents and seafloor communities, for example, can provide information about food web dynamics and the often-overlooked habitat variables of predation, prey resource, and competition.

Granted, the planning and management of large areas - including enormous MPAs designated in the Chagos archipelago (640,000 km^2 in area) and Kiribati (408,000 km^2) - may benefit from research that focuses on abiotic habitat variables over larger spatial scales. However, area closures to manage fish stocks and marine biodiversity are more typically implemented over much smaller spatial scales. The UK, for example, is currently planning a coherent network of MPAs, and few of these areas match the common scales noted in our study. It is important that we increase the number of studies analyzing the relationship between fish and habitat at small spatial scales and the number of biological variables integrated in analyses if future management strategies plan to use findings from these studies in the design of smaller-scale MPAs.

Our analysis also showed a significant lack of studies looking at the relationship between fish and habitat over time. This is an especially important consideration for species whose habitat preferences change significantly with life stage development (e.g., juvenile to adult development) or for migratory species that may move in and out of already established management areas. If a species is known to migrate to a spawning ground every spring, for example, it is important not only to study the annual patterns of habitat association but also the finer time scale changes in habitat preferences during the important migration and spawning period. If this is neglected, management plans set up to close fishing in migration corridors and areas suitable for spawning may incorrectly assign closures to substandard spawning grounds, reduce fisheries productivity, and fail to protect spawning stock biomass during the spawning period.

If a more temporal approach is taken, it means that scientists can also begin to understand how fish habitat associations change over longer time scales. This will allow management to evaluate current practices more thoroughly and adapt them to reflect changes in fish stocks, climate, and so forth.

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