European Commission

Science for Environment Policy

Understanding how fish move can improve management of fisheries

Understanding the way fish use their habitat is necessary for a science-based approach to fisheries management, according to a new scientific review. The paper summarises the current state of knowledge and tools available to assess fish movement patterns in relation to freshwater fisheries, and recommends more systematic use of these tools to inform the management of fish populations.

Spatial ecology examines how a species uses its habitat in both space and time. Understanding spatial ecology in fisheries can provide information on critical fish habitats, species interactions, population dynamics and the impact of human activities, such as fishing pressure, all of which are important for the effective management and conservation of fish populations. Despite the importance of integrating spatial ecology into management, there are limited examples of this being done effectively in inland fisheries.

This is partly because assessing the movement of fish is technically challenging. Fish move around their habitats for a variety of reasons, such as to find food or for breeding and spawning. Freshwater fish in inland fisheries are highly mobile, making biological assessment of their populations difficult. However, recent technological advances have facilitated the study of spatial ecology in fish populations. In the current review paper, researchers summarised the tools and knowledge available to help improve fisheries assessment and management.

New technologies available for assessing fish spatial ecology include forms of electronic tagging, such as the use of radio telemetry, acoustic telemetry and passive integrated transponders. Similar to radio collaring mammals on land, electronic tagging of individual fish allows their movements to be tracked accurately. As such, these technologies have enabled the collection of more detailed data on fish movement patterns and habitat use and can improve understanding of freshwater fish ecology in a variety of habitats and life stages. Other tools recently developed include genetic profiling using small repetitive parts of DNA called microsatellites and DNA inside a part of the cell called the mitochondria. This provides information on population genetics, which gives insights into how populations are connected and their spatial structure over different generations. In addition, otolith chemical analysis (analysing the concentrations of chemicals inside fish ear bones and comparing them to those in the water, to assess where the fish has been) can now be used to examine fish migration histories and how different sub-populations are connected.

The review also outlines how spatial ecology can be integrated into fisheries assessment and management. Fisheries assessment protocols should take into account factors such as population structure and location of spawning habitat. For example, assessment equipment may need to measure the age class structure of a fish population (how many fish there are at different stages of the life cycle at any given time) to ensure the population size is estimated correctly. Knowledge of species' spatial ecology can also help avoid bycatch of unwanted species, by identifying periods when bycatch species are less likely to overlap with target species. Habitat connectivity (including for migration corridors) and fish stocking strategies can also be informed by spatial ecology, as can understanding population dynamics and the effects of environmental drivers and ecological processes (e.g. water temperature or river flow rates).

This review highlights how spatial ecology can aid the design and implementation of fisheries assessment tools and inform management and conservation strategies. The researchers emphasise that the tools available to practitioners involved in fisheries management have increased in availability and substantially reduced in cost in recent years. Using spatial ecology data should therefore be encouraged, as the economic and conservation costs of not doing so may be significantly higher.

12 August 2016
Issue 466
Subscribe to free weekly News Alert

Source: Cooke, S.J., Martins, E.G., Struthers, D.P., Gutowsky, L.F.G., Power, M., Doka, S.E., Dettmers, J.M., Crook, D.A., Lucas, M.C., Holbrook, C.M. & Krueger, C.C. (2016). A moving target—incorporating knowledge of the spatial ecology of fish into the assessment and management of freshwater fish populations. *Environmental Monitoring and Assessment* 188: 239. DOI: 10.1007/s10661-016-5228-0.

Contact:
steven_cooke@carleton.ca

Read more about:
Biodiversity, Environmental technologies