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# Home, Wet Home: Why Peter Auster Observes Fish in Their Landscapes

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Why Peter Auster Observes Fish in Their Landscapes *by Nancy C. Balcom*

Humans shape and are shaped by their environment every day. Where we live and work can have a lot of influence on how we think and behave. Compare a fisherman leaving the docks for a day of fishing off the New England coast with an office worker who commutes daily by train to his office in a high-rise in Stamford or New York. They essentially live worlds apart, even though they might live in the same town, or even on the same street. To each, his or her own particular "landscape" is familiar…comforting…supportive.

The ability to shape and be shaped by environment is not reserved for humans alone, but is shared by all life forms. The ways in which different organisms individually and collectively interact with their own "landscapes" are studied by biologists and ecologists the world over. However, some landscapes are easier to get to than others.

"A terrestrial biologist heading out to observe how individual animals interact with their environment might take a pair of binoculars or a spotting scope, and a notebook," muses Peter Auster, Science Director for the National Undersea Research Center and an adjunct faculty member of the University of Connecticut Department of Marine Sciences.

"To make similar observations of fish in the ocean, I need to use a boat, scuba, an ROV (remotely-operated vehicle), or a research submersible just to get to work."

Auster has dedicated much of his professional life to developing an understanding of how fish species are influenced by the landscapes in which they live. He does this by studying how individual fishes and whole communities of fish species interact with their local environment. This is accomplished through direct observation whenever possible using scuba or research submersibles (for deep water studies) or by using an ROV. Cameras mounted on the ROV, which is tethered to the boat by long cables and equipped with lights, send live images to the boat. The movement of the ROV below is directed by the operator on board the boat, using joysticks and watching the live feed. This high-tech equipment enables scientists like Auster to peer into the depths and observe the behavior of fish within their landscape, for example, without creating too much of a human presence.


photo: NURC

Going to work for marine biologist Peter Auster is a little different than the commute for most people. Here he mans a NOAAsubmersible vehicle to pay a scientific visit to fish in the habitats where they live.

"By studying how individual animals vary in their interactions with their environment, we can develop a unique and fundamental understanding of their ecological requirements…in other words, what they need to survive and reproduce successfully," says Auster.

Understanding what these diverse ecological requirements are is a critical first step towards being able to both utilize and conserve the diversity of species that exist within a fish community sustainably over time. Auster's studies are prompted by his personal interests in both basic ecological research and conservation. In the New England region, as well as many other parts of the world, research is needed, in part, to improve management of fish populations and communities.

In their research, Auster and his students use a variety of approaches to better understand the linkages between fish and landscapes. "The first is field work," says Auster, "where we look for patterns in the natural world, to see how the animals interact with their environment. Lab work then allows us to develop comparative rates of processes that are controlled or affected by habitat in some way–like predation–in a controlled setting," Auster continues. "Then we use computer modeling to take small-scale results from the field and lab work and apply them to the population as a whole."

Auster's current research has practical application beyond basic research. These applications can be understood through two primary questions. The first is, "What are the impacts of human-caused disturbances to both the species present and to the landscape itself?" A second question is, "What role can marine reserves play as a management tool to minimize these impacts?" (A marine reserve is an area within which fishing and possibly other activities are prohibited, as a conservation and management measure.) From a fisheries perspective, there are a number of

possible roles for a marine reserve. Well-sited marine reserves can protect spawning and nursery areas of key species, maintain age structure by retaining older, more fertile individuals, protect key habitats, and reduce bycatch.

Worldwide, a lot of work has been undertaken to examine the management role marine reserves can play in tropical coral reef settings and temperate kelp forests. For scientists working in the western Atlantic, the question is, how well do those research results apply to deeper water systems such as the outer continental shelf? Auster and his colleagues are trying to find out. Working with researchers and graduate students from UCONN, the University of Maine, the U.S. Geological Survey, NOAA Fisheries (National Marine Fisheries Service), and the Stellwagen Bank National Marine Sanctuary, Auster has been studying two deeper water systems, the western Gulf of Maine and the Georges Bank. These productive marine environments off the New England coast are home to many fish species, including heavily-exploited stocks of Atlantic cod, haddock, and yellowtail flounder. These stocks, and the commercial fishermen that harvest them, have been the focus of stringent regional fisheries management efforts for many years, but the recovery of the populations has been slower than expected. Auster and others have raised concerns about the disturbance to continental shelf habitats caused by mobile fishing gear (i.e. trawls and dredges), and its role in slowing or preventing the recovery of fish stocks by diminishing the capacity of seafloor habitats to enhance the survival of juvenile fishes. In particular, Auster is concerned about habitat integrity and community composition, and what effect changes to the characteristics of a particular habitat due to fishing activities may have over time on the biological diversity and sustainability of the outer continental shelf systems.

Thus far, the work of Auster and his colleagues has shown that the distribution of fishes is significantly influenced by variations in the landscape of the seafloor, whether it is sand or boulder reefs. Invertebrates that provide sheltering structure with their bodies, such as sponges, coral, and anemones, are also important components of fish habitat. Lab studies have shown that the number of sponges present in a cobble habitat affects predation success. Fewer sponges mean fatter predators, while greater numbers of sponges provide young fish with some shelter from predation. Computer modeling has also shown that when fishing activities reduce the amount of "structure" on the seafloor in an area, the survival rate of juvenile fish species that live on or near that seafloor can decline. To determine if these changes to the structure of the seafloor is permanent or reversible, studies of the recovery of areas within the western Gulf of Maine and Georges Bank that are closed to fishing activity are ongoing.

Seafloor habitats are difficult to study, and critical data are lacking. So how can scientists and resource managers identify and select areas of the continental shelf now for fish habitat conservation in the absence of good information on seafloor habitats? One solution is to utilize models to help guide the decision-making process.

A recent modeling effort by Post-Doctoral Fellow Rose Cook and Auster gives a good example of how this works. Following an established ecological theory that organisms tend to concentrate in their preferred habitat, they have been using a computer model to select areas of the continental shelf that are important habitats for multiple species of commercially-exploited fishes. "We will not have the maps and data needed to strategically select areas of the seafloor for protection for many, many years," says Auster, "so we need to use the best available data coupled with ecological theory to move forward now. There is an important, crucial link between patterns of diversity overall and fishes of economic importance. We need to more fully understand the role different landscapes play for different fish species, and how these deeper sea systems function in order to put in place the most appropriate and successful management strategies," Auster concludes. That said, Auster boards a vessel loaded with deep-sea gear and heads to his workplace landscape, which lies submerged, miles offshore in the western Atlantic Ocean.

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photo: P. Auster, NURC/UCONN

**"Everybody's gotta have a home,"** explained the boll weevil to the frustrated cotton farmer in an old pop ballad (Brook Benton), and this fish might agree today. Research by Peter Auster, done by observing fish where they live, shows that correct structure in the landscape is extremely important to their ability to thrive and survive. Peter took this picture in the Indian Ocean. What a beautiful, endangered, home!