Data revealing migrations of larval reef fish vital for designing networks of marine protected areas

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Networks of biologically-connected marine protected areas need to be carefully planned, taking into account the open ocean migrations of marine fish larvae that take them from one home to another sometimes hundreds of kilometers away.

Research published today in the international journal Oecologia sheds new light on the dispersal of marine fish in their larval stages, important information for the effective design of marine protected areas (MPAs), a widely advocated conservation tool.

Using a novel genetic analysis, researchers at the University of Windsor, Canada, and the United Nations University's Canadian-based Institute for Water, Environment and Health (UNU-INWEH) studied dispersal and connectivity among populations of the bicolor damselfish -- a species common to Caribbean coral reefs and a convenient proxy for many coral reef fish species with similar biology, including a typical 30-day larval stage.

Using samples of newly settled juvenile fish from sites in Belize and Mexico, they traced the origins of hundreds of individual fish larvae back to putative source populations.

"This is the first time that genetic 'assignment tests' have been used to delineate the pattern of connectivity for a marine fish in a region of this size (approximately 6,000 square kilometers)," says lead author Derek Hogan of the University of Windsor, now at University of Wisconsin.

"We found that larvae of this species, on average, traveled 77 km from home in the 30-day larval period," says Dr. Hogan. "Although some fish remained close to home in the same period, some traveled almost 200 km - roughly the distance from New York City to Albany - an impressive feat for a larva about the size of a baby fingernail."

The scientists were surprised to find that patterns of larval dispersal among reefs changed from year to year, driven perhaps by changes in oceanographic currents or meteorological events.

"These results show that it is possible to characterize the pattern of connectivity for selected species, with considerable detail" says co-author Prof. Daniel Heath of the University of Windsor.

"These studies are invaluable for understanding how to design networks of marine protected areas effectively," says Dr. Hogan. "The functioning, and therefore the success, of networks of MPAs designed for conserving species depends fundamentally on our deep understanding of larval migrations."

The authors caution that more work is needed to determine factors that cause larval dispersal to fluctuate from year to year.

"Our results reveal that developing a precise understanding of connectivity patterns is going to be more difficult than previously assumed, because they vary through time," says co-author Peter F. Sale, Assistant Director at UNU-INWEH.

"Long-term, we need to be building models that can simulate connectivity in ways that reproduce these year-to-year changes. Models that can do that will be broadly applicable and powerful management tools."

The study is part of the Coral Reef Targeted Research Project (CRTR), a World Bank and University of Queensland-led project funded by the Global Environment Facility. CRTR involves over 100 investigators from universities and research centers worldwide. Its Connectivity Working Group, led by Dr. Sale and managed by UNU-INWEH, focuses its research activity primarily in the western Caribbean.

These results add to the CRTR Project's impressive total of new science results on selected questions deemed key to improving management of coral reef systems worldwide.

Provided by United Nations University

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