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Scientific Theory of Marine Reserves To Be Released

Our findings show abundant evidence that marine communities respond quickly and strongly to reserve establishment. -- *Robert Warner professor, University of California, Santa Barbara*

(San Francisco, Calif.) The science of marine reserves -- protected areas of the ocean -- takes a major leap forward today with the release of findings by a prominent international group of scientists that marine reserves can be highly successful in preserving and increasing ocean life.

The group, working together since 1997 to analyze information from all over the world, was organized through the National Center for Ecological Analysis and Synthesis (NCEAS), a federally-funded think tank on questions of ecology, based at the University of California, Santa Barbara. Today the group presented this report -- the first large scale synthesis of marine reserve studies -- at the annual meeting of the American Association for the Advancement of Science (AAAS) in San Francisco. They will also present a new computer-based tool for designing marine reserves and release a consensus statement signed by 150 of the world's leading scientists.

"The findings represent the first large-scale synthesis of ecological data on this issue, and have really changed the way we look at marine reserves," said Steven D. Gaines, a member of the NCEAS group and director of the Marine Science Institute at UC, Santa Barbara.

NCEAS happens to be located near a protected ocean area, the National Channel Islands Marine Sanctuary (www.cinms.nos.noaa.gov), which is attracting national attention, as a variety of groups -- from fishing interests to environmental groups, and local and national government entities -- debate the future of the area.

The NCEAS team of scientists discussed the study of marine reserves at 9:00 a.m. Pacific Time, at the American Association for the Advancement of Science national meeting in San Francisco. At the symposium (and subsequent 12:30 p.m. press conference), the scientists released a signed consensus statement. A policy workshop was to follow the news conference.

"The declining state of the oceans and the collapse of many fisheries creates a critical need for new and more effective management of marine biodiversity, populations of exploited species and overall health of the oceans," said Jane Lubchenco, co-chair of the NCEAS group, past president of AAAS and chair of the Department of Zoology at Oregon State University. "At present less than 1 percent of U.S. territorial waters and less than 1 percent of the world's oceans are protected in reserves."

Marine reserves are areas of the sea completely protected from extractive activities, explained Lubchenco. Within a reserve all biological resources are protected through prohibitions on fishing and the removal or disturbance of any living or non-living marine resource, except as necessary for monitoring or research to evaluate the effectiveness of the reserve. Marine reserves are sometimes called "ecological reserves," "fully-protected marine reserves," or "no-take areas." They are a special category of Marine Protected Areas (MPAs). MPAs are defined as areas that have been designated to enhance conservation of marine resources but which often allow "extractive" activities. A network of marine reserves is a set of reserves within a biogeographic region that is connected by larval dispersal and juvenile or adult migration.

UC Santa Barbara graduate student Ben Halpern contributed a paper to the symposium entitled, "The Impact of Marine Reserves: Do Reserves Work and Does Reserve Size Matter?" In it he reviews the empirical work and discusses the theoretical literature to assess the impacts of marine reserves on several biological measures (density, biomass, size of organisms, and diversity), paying particular attention to the role reserve size has in determining those impacts.

"The results of 89 separate studies show that on average, with the exception of invertebrate biomass and size, values for all four biological measures are significantly higher inside reserves compared to outside -- or after reserve establishment versus before -- when evaluated for both the overall communities and by each functional group within these communities (carnivorous fishes, herbivorous fishes, planktivorous fishes/invertebrate eaters, and invertebrates)," Halpern states.

"Surprisingly, results also show that the relative impacts of reserves, such as the proportional differences in density or biomass, are independent of reserve size, suggesting that the effects of marine reserves increase directly rather than proportionally with the size of a reserve."

However, he notes that equal relative differences in biological measures between small and large reserves nearly always translate into greater absolute differences for larger reserves, and so larger reserves may be necessary to meet the goals set for marine reserves. The quality of the data in the reviewed studies varied greatly. To improve data quality in the future, whenever possible, studies should take measurements before and after the creation of a reserve, replicate sampling, and include a suite of representative species. Despite the variable quality of the data, the results from this review suggest that nearly any marine habitat can benefit from the implementation of a reserve. "Success of a marine reserve, however, will always be judged against the expectations for that reserve, and so we must keep in mind the goals of a reserve in its design, management, and evaluation," Halpern said.

The findings were in keeping with the results of another UC Santa Barbara study, published in Nature Magazine and described in Henry Fountain's New York Times article, from July 25, 2000, "Studies Find Young Saltwater Fish Returning to the Fold." By analyzing the "ear bone" of the fish, the scientists determined that a certain species of fish did not drift away during the young larval stage, but rather remained close to the parents who spawned them.

Warner states, "Given the very high fecundity of many marine organisms, a local population within a reserve could both sustain itself and provide substantial export to nearby non-reserve areas. Thus all stakeholders could be served by a common design for a system of marine reserves."

According to Gaines, the effects of oil spills, toxic run-offs, large storms and disease outbreaks can be minimized by creating a collection of reserves, as a sort of

insurance. He discussed such issues in his paper, "Catastrophes: Where the Unlikely Becomes the Probable."

The NCEAS workshop was organized by Lubchenco of Oregon State University, Gaines of UC Santa Barbara and Stephen R. Palumbi of Harvard University.

Workshop speakers were: Lubchenco, Hugh Possingham of the University of Adelaide, Loo Botsford, of UC Davis, Robert Warner of UC Santa Barbara, Fiorenza Micheli of Universita' di Pisa, Stephen R. Palumbi, Harvard University, and Gaines, of UC Santa Barbara.

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