Resilience concepts poised to aid management of coastal marine ecosystems

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Journal devotes section to how new approaches can benefit economically vital yet ecologically complex areas

The January 2008 issue of BioScience includes a special section entitled "Managing for Resilience in Coastal Marine Ecosystems." The four articles in the section highlight different aspects of attempts to incorporate modern concepts from mathematical ecology into ecosystem-based management of coastal marine areas.

Appreciation of the economic importance of services that marine ecosystems provide has grown in recent years, as has the awareness of those ecosystems' imperiled state and their susceptibility to sudden ecological shifts. To understand how to sustain these valuable ecosystem services in the face of overfishing, habitat destruction, and pollution, among other challenges, researchers need to know how marine ecosystems often continue to function despite disturbances--in other words, they need to know what makes these systems resilient when they are subjected to externally imposed changes.

The introductory article by Simon A. Levin and Jane Lubchenco provides an overview of the theoretical approach adopted by the authors of the other articles in the section. The theoretical constructs suggest a number of ways that management for resilience might be improved. Levin and Lubchenco emphasize that marine ecosystems are usefully seen as complex and adaptive. Interactions among the "agents" of these systems at small scales shape whole-system dynamics, which in turn affect the smaller scales.

The introduction is followed by an article that summarizes lessons learned about recovery, reversibility, and resistance to change of marine ecosystems. Authors Stephen R. Palumbi, Karen L. McLeod, and Daniel Grünbaum hold that these three components, ideally studied together, are key elements of resilience. They stress the need to analyze long-term population data to recognize trends in species' occurrence that could foretell far-reaching disturbances.

Gretchen E. Hofmann and Steven D. Gaines next discuss emerging technologies that can be used to understand natural variability in marine ecosystems, which is essential to managing marine ecosystems for resilience. The technologies they discuss range from space-based monitoring to tagging of large pelagic organisms to the use of genomics to assess the distribution, abundance, and health of marine life.

In the last article of the section, Mary Ruckelshaus, Terrie Klinger, Nancy Knowlton, and Douglas P. DeMaster describe practical experiences and scientific and governance challenges arising from attempts to use the concept of resilience in coastal marine management. Although comprehensive case studies of ecosystem-based management of marine areas do not yet exist, Ruckelshaus and her colleagues detail challenges for fisheries and conservation efforts in the Southern Ocean, the Bering Sea/Aleutian Islands, Australia's Great Barrier Reef, and coastal California that could be--and in some cases are being--alleviated by ecosystem-based management approaches. .

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