

Marine Reserves: An Escape from Extinction

Society can conserve animal species on land through a variety of strategies, including restricting urban development, limiting greenhouse gas emissions, banning lumbering, and setting up restricted areas for animal habitat. In the ocean, scientists and policy makers must consider different kinds of conservation strategies¹. Human activities such as fishing practices, coastal development, land-based chemical and nutrient pollution, etc., have altered the structure and function of marine ecosystems globally². Overfishing can remove species with influential roles, resulting in disturbances in food chain¹. Governments have begun to develop marine reserves to help restore the population of endangered species and maintain healthy marine ecosystems. In this section, the benefits and importance of marine reserves will be evaluated in detail. The criteria and challenges of constructing marine reserves will also be the center of discussion.

Marine Protected Area (MPA) and Marine Reserves¹

Before the establishment of marine reserves, there were Marine Protected Areas (MPAs). The definition of a MPA is: “any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical, and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment.” Under the MPA, fishing is sometimes allowed, but fishing in certain area can be restricted. These special areas are called marine reserves. A marine reserve provides “a spatially explicit form, often permanent, that permits a degree of restriction on human activities that is not universally appropriate.” Marine reserves can increase the density and average size of species, which will result in increasing reproductive output.

Benefits⁴

According to Lubchenco, marine reserves offer several benefits, namely:

1. protection of habitat;
2. conservation of biodiversity;
3. protection or enhancement of ecosystem service;
4. recovery of depleted stocks of exploited species;
5. export of individual to fished area;
6. insurance against environmental or management uncertainty; and
7. sites for scientific investigation, baseline information, education, and inspiration

Goals³

There are five main goals for the establishment of marine reserves. First, marine reserves aim to replenish populations of endangered species or species undergoing serious reduction in quantity, by decreasing fishing pressure or restricting human activities in the specific area. Second, reserve should increase the reproductive potential of economically important species, assisting the fishery industry in the long-term. Third, marine reserves will conserve sufficient critical habitat for marine species. Maintaining critical habitat is especially important for species dwelling in that area because destructions made to the habitat will directly and negatively affect the species. Fourth, the reserve can serve as a research laboratory for scientists to understand more about marine ecosystems. Lastly, marine reserves can be a tourist site for the visitors so that the public can acknowledge the importance of marine reserves.

Reserve Network

A marine reserve network is “a set of marine reserves within a biogeographic region, connected by larval dispersal and juvenile or adult migration.”² A reserve network offers greater benefits than the sum of individual reserves because it serves as a buffer to individual reserves¹. Also, interaction among populations in protected areas and those in unprotected areas can be maximized¹. In June 2006, President Bush announced the construction of the world’s largest marine reserve in Hawaii, surpassing Australia's Great Barrier Reef Marine Park⁴.

The Scientific Consensus (quoted from *National Center for Ecological Analysis and Synthesis*)⁵

The first formal marine reserve was established more than two decades ago. Recent analyses of the changes occurring within these marine reserves allow us to make the following conclusion:

Ecological effects *within* reserve boundaries:

1. Reserves result in long-lasting and often rapid increases in the abundance, diversity, and productivity of marine organisms.
2. These changes are due to decreased mortality, decreased habitat destruction, and to indirect ecosystem effects.
3. Reserves reduce the probability of extinction for marine species resident within them.
4. Increased reserve size results in increased benefits, but even small reserves have positive effects.
5. Full protection (which usually requires adequate enforcement and public involvement) is critical to achieve this full range of benefits as marine reserves.

Ecological effects *outside* reserve boundaries:

1. In the few studies that have examined spillover effects, the size and abundance of exploited species increase in areas adjacent to reserves.
2. There is increasing evidence that reserves replenish populations regionally via larval export.

Ecological effects of reserve *networks*:

1. There is increasing evidence that a network of reserves buffers against the vagaries of environmental variability and provides significantly greater protection for marine communities than a single reserve.
2. An effective network needs to span large geographic distances and encompass a substantial area to protect against catastrophes and provide a stable platform for the long-term persistence of marine communities.

Challenges¹

There are many issues to consider before constructing a marine reserve. Choosing sites for marine reserves is a difficult task because the sites must be accepted by the public and approved by the government. Other factors such as climate and ocean current would significantly affect populations of species of specific sites. Moreover, marine reserves are susceptible to natural or man-made catastrophes such as hurricanes and oil spills (which can poison and smother marine populations). A marine reserve must be effective in both current and future conditions. Also, the size, number, and distribution of marine reserves must be seriously considered.

Conclusion

Marine reserves have shown to be powerful management and conservation tools for marine populations². Governments should allocate more resources to the construction of marine reserves or reserve networks in order to better manage marine resources.

Additional Resource:

Microdocumentary about *Marine Parks*: www.stanford.edu/group/Palumbi/microdocs.html#marine.

Sources:

1. Allison, G. W., et al., 1998. Marine Reserves are Necessary but not Sufficient for Marine Conservation. *Ecological Applications* 8: S79-S92.
2. Lubchenco, J., et al., 2003. Plugging a Hole in the Ocean: The Emerging Science of Marine Reserves. *Ecological Applications* 13: S3-S17.
3. Allison, G. W., et al., 2003. Ensuring persistence of Marine Reserves: Catastrophes Require Adopting an Insurance Factor. *Ecological Application* 13: S8-S24.
4. Eilperin, Juliet. "Hawaiian Marine Reserve to Be World's Largest." *Washington Post* 15 June 2006. <www.washingtonpost.com/>.
5. National Center for Ecological Analysis and Synthesis. "Scientific Consensus Statement on Marine Reserves and Marine Protected Areas." 17 Feb 2001. <www.nceas.ucsb.edu/consensus>.
6. Palumbi, Stephen. *Marine Parks Microdocumentary*: <www.stanford.edu/group/Palumbi/microdocs.html#marine>.