POSITION PAPER ON MARINE RESERVES

OREGON CHAPTER AMERICAN FISHERIES SOCIETY

(Approved by the Executive Committee on March 19, 2003)

Marine reserves are receiving increased attention as a tool to meet conservation and fishery objectives (Murray et al. 1999, NRC 2001). Executive Order 13158, issued by President Clinton on May 26, 2000, instructs federal agencies to work together to "develop a scientifically based, comprehensive national system of marine protected areas representing diverse U.S. marine ecosystems, and the Nation's natural and cultural resources." (www.mpa.gov)[1].

In Oregon, the Ocean Policy Advisory Council (OPAC) recently recommended to Governor Kitzhaber that Oregon establish a limited system of marine reserves in the Oregon territorial sea in order to test their effectiveness (www.oregonocean.org). California also is considering marine reserves as one component in the implementation of its Marine Life Protection Act (http://www.dfg.ca.gov/mrd/mlpa/index.html). Additionally, the Pacific Fishery Management Council is considering whether marine reserves can be used as an additional tool to meet its fishery management and conservation objectives under the Magnuson-Stevens Act (www.pcouncil.org). At present, this federal effort is focusing on reserves in the Channel Islands National Marine Sanctuary near Santa Barbara, CA.

Interest in marine reserves as a conservation and fishery management tool has been stimulated by the abundant and growing information that many recreationally and commercially important fish and shellfish species have been harvested at unsustainable levels (Ralston 1998, NMFS 1999, Pauly et al. 2002). There is also an increasing body of evidence indicating that some fishing practices significantly disturb and simplify seafloor habitats important to many species, greatly modify benthic communities, and alter ecosystem processes (Auster 1998, Auster and Langton 1999, Collie et al. 1997, Dorsey and Pederson 1998, Engel and Kvitek 1998, NRC 1999, Fogarty and Murawski 1998).

There is growing evidence that marine reserves can be an effective tool for conservation of species and biodiversity, serving the same purpose that national and state parks and wilderness areas do for some terrestrial species and habitat types. Halpern (2003) has reviewed 89 separate studies of marine reserves and has shown that, on average, values for species biomass, organism size and density, and species diversity are higher in reserve areas as compared to similar areas outside the reserve, or compared to the reserve area

[1] Marine protected area (MPA) refers to an area of the ocean receiving some particular legal protection from disturbance and/or harvest. Marine reserves generally refer to no-take areas, and are a particular type of MPA.

prior to its protection. These relative differences in size, abundance, and species diversity appear quickly and are independent of reserve size. It should be noted that most reserves, and most studies of reserves, are in tropical areas. However, there are good examples of reserve benefits from closed areas in New England (Murawski et al. 2000), for rockfishes in several small areas in California and Washington (Paddock 1996 as cited in NRC 2001; Palsson and Pacunski 1995) and for lingcod in British Columbia (Martell et al. 2000).

Much of the interest in marine reserves is driven by fishery management concerns and objectives to rebuild depleted stocks as rapidly as possible. Off the West Coast, nine species of groundfish are now legally classified as 'overfished' (www.pcouncil.org/groundfish/sfrebuild.html) and there is appreciable interest in whether marine reserves can contribute to more rapid recovery of these species and yield measurable fishery benefits at the same time. In New England, closures of significant portions of Georges Bank have led to greatly increased scallop abundance and average size, such that the New England Fishery Management Council has allowed some tightly controlled fishing on this increased scallop biomass (Murawski et al. 2000). This is one example of direct fishery benefits from closed areas.[2] Increases in the density and average size of fishes in reserve areas have been well documented and suggest that reserves can make a positive contribution to fishery management objectives (Halpern 2003, Murawski et al 2000, PISCO 2002). Generally, larger fishes produce many more progeny than smaller individuals, so we would expect that the per-capita reproductive potential of fishes and other organisms in reserve areas to be higher compared to areas outside the reserve. We would also expect there to be a spillover effect of fishes leaving the reserve area and becoming available to harvest outside the reserve (Roberts et al. 2001). The increased frequency of trophy size fishes captured in recreational fisheries outside the reserve near Cape Canaveral, Florida shows that spillover effects can occur. Although many groundfish on the Oregon coast are relatively sedentary, most undertake spawning migrations or move between habitats during their life history (Love et al. 2002); we expect spillover would be likely for many of our West Coast species.

Ocean processes strongly influence the population dynamics and geographic distribution of marine organisms, as well as physical habitat characteristics. Halpern's review shows that measurable differences can be found even in small reserves. In practice, the appropriate size, number and location of reserves will depend on reserve objectives, as well as local social, economic, legal and environmental factors. Some objectives may be met with a single small reserve while others may require larger reserves and/or a network of reserves. Quantifying the expected contribution of a possible reserve, or a possible set of reserves, to a particular conservation or fishery objective is beyond our ability as fishery scientists and ecologists to predict at this point. In part, this will depend on the relative magnitude of size and density differences for each species found inside and

[2] Marine reserves are generally thought of areas permanently closed to harvesting. The New England scallop example reflects the more traditional tool of rotated closed areas. In this sense, rotated closed areas may be seen as analogous to allowing fields to lie fallow in an agricultural context.

outside the reserve. Further, stock rebuilding of many species such as rockfishes will be dependent on highly variable recruitment events that are driven by ocean conditions. Most species show many years of recruitment failure punctuated by infrequent years of good recruitment when large numbers of progeny survive. Marine reserves contribute to increased numbers of progeny, and well-sited reserves may help increase progeny survival, but the complexity of ocean ecosystems off the West Coast and elsewhere means we cannot quantify the expected contributions. Therefore, reference sites will need to be monitored in order to account for oceanographic and climactic changes such as the Pacific decadal oscillations (PDO). It will be very important that the objectives established for reserves reflect an appropriate time-scale for expected results. For fisheries management, this will include the population dynamics and life-span of focal species. It must also include similar considerations for biological and physical processes that create or modify habitat features that we would expect focal species to respond to.

Decisions concerning reserve objectives must incorporate diverse social and economic values, and will require the collaboration and involvement of a wide spectrum of stakeholders, agencies with legal responsibilities and authorities, scientists, and the general public. There is probably a large degree of flexibility in how any chosen reserve objective can be met, translating to a wide spectrum of possible reserve designs with respect to number, size and location. Marine scientists can provide background information and help document reserve performance, but society as a whole will have to decide how knowledge will be applied, and how we will proceed when there remain unresolved questions. It is extremely important that the scientific/management objectives for implementation of a reserve be explicitly stated, and stated in such a manner that they can be evaluated as to the effectiveness of the reserve in meeting those objectives.

In conclusion, there has been a marked decline in population size of many harvested species off the West Coast, and research shows that marine reserves lead to increases in the abundance, size, and reproductive potential of focal species as well as species diversity within the reserve. Reserves also protect, and facilitate the recovery of, valuable habitat features that are important to the survival and growth of many marine species, whether or not they are sought be fishermen. Because ecological systems are not simply mechanical in nature, many questions seeking precise predictions concerning reserve performance, placement and size can only be answered through an open, adaptive and experimental approach. This should not be viewed as an argument against formation of marine reserves, but as a framework to be used in the evaluation of their efficacy. Marine reserves are one tool of many that are employed in conservation and fishery management. Society's objectives for marine reserves, and evaluation strategies, must take into account the broader context of management approaches employed where reserves may be considered.

The Oregon Chapter of the American Fisheries Society supports the OPAC recommendation for a network of marine reserves in the Oregon territorial sea, and encourages federal agencies to follow Oregon's lead and establish similar reserve areas in the federal waters off the Oregon coast. An initial focus on testing and evaluation will provide the opportunity for fishery scientists and stakeholders together to understand how

marine reserves will perform in Oregon waters. At the same time, we expect these reserves to contribute to the conservation and rebuilding of several rockfish species (Parker et al. 2000).

We also support the general recommendations for next steps put forward in the OPAC report including an inclusive process for all stakeholders and contributors to participate in:

1) defining reserve objectives and suggesting preliminary reserve sites,

2) assembly and review of available information on proposed reserve sites,

3) focused studies to establish baseline conditions for proposed sites, and

4) articulation of well-formed hypotheses that will serve as a basis for reserve evaluation.

We encourage federal and state agencies and legislatures to prioritize the funding and accomplishment of research and monitoring studies that will enable society to determine what effect reserves have, and whether the objectives society has for them are being met.

References

Auster, P.J. 1998. A conceptual model of the impacts of fishing gear on the integrity of fish habitats. Conservation Biology. 12(6): 1198-1203.

Auster, P.J. and R.W. Langton. 1999. The effects of fishing on fish habitat. In Fish Habitat: Essential fish habitat and rehabilitation. American Fisheries Society Symposium 22: 150 – 187.

Collie, J.S., G.A. Escanero, and P.C. Valentine. 1997. Effects of bottom fishing on the benthic megafauna of Georges Bank. Marine Ecology Progress Series. 155: 159-172.

Dorsey, E.M. and J. Pederson, eds. 1998. Effects of Fishing Gear on the Sea Floor of New England. Boston, Conservation Law Foundation.

Engel, J. and R. Kvitek. 1998. Effects of otter trawling on a benthic community in Monterey Bay National Marine Sanctuary. Conservation Biology. 1204 – 1214.

Fogarty, M.J. and S.A. Murawski. 1998. Large-scale disturbance and the structure of marine systems: fishery impacts on Georges Bank. Ecological Applications. 8(1-supplement): S6 – S22.

Halpern, B. 2003. The impact of marine reserves: do reserves work and does reserve size matter? Ecological Applications 13(1, supplement): S117 – S137.

Love, M.S. M. Yoklavich and L. Thorsteinson. 2002 The Rockfishes of the Northeast Pacific. Berkeley, University of California Press,

Martell, J.D., C.J. Walters and S.S. Wallace. 2000. The use of marine protected areas for conservation of lingcod (*Ophiodon elongatus*). Bulletin of Marine Science. 66(3): 729 – 743.

Murawski,S.A., R. Brown, H-L. Lai, P.J. Ruge and L. Hendrickson. 2000. Large-scale closed areas as a fishery-management tool in temperate marine systems: The Georges Bank experience. Bulletin of Marine Science. 66(3): 775-798.

Murray, S.N., R.F. Ambrose, J.A. Bohnsack, L.W. Botsford, M.H. Carr, G.E. Davis, P.K. Dayton, D. Gotshall, D.R. Gunderson, M.A. Hixon, J. Lubchenco, M. Mangel, A. MacCall, D.A. McArdle, J.C. Ogden, J. Roughgarden, R.M. Starr, M. Tegner and M.M. Yoklavich. 1999. No-take Reserve Networks: sustaining fishery populations and marine ecosystems. Fisheries. 11 – 25.

NMFS (National Marine Fisheries Service). 1999. Our living oceans: report on the status of U.S. living marine resources, Silver Spring, MD. Available online at: http://spo.nwr.noaa.gov/olo99.htm.

National Research Council 1999. Sustaining Marine Fisheries. Washington, D.C. National Academy Press.

National Research Council. 2001. Marine Protected Areas: Tools for Sustaining Ocean Ecosystems. Washington, D.C. National Academy Press.

National Research Council. 2002. Effects of Trawling and Dredging on Seafloor Habitat. Washington, D.C. National Academy Press.

Paddock, M.J. 1996. The influence of marine reserves upon rockfish populations in central California kelp forests. MS thesis. University of California, Santa Cruz.

Palsson, W.A. and R.E. Pacunski. 1995. The response of rocky reef fishes to harvest refugia in Pugest Sound. Proceedings, Vol 1: Puget Sound Research. Puget Sound Water Quality Authority, Olympia, WA.

Parker, S.J., S.A. Berkeley, J.T. Golden, D.R. Gunderson, J. Heifetz, M.A. Hixon, R Larson, B.M. Leaman, M.S. Love, J.A. Musick, V.M. O'Connell, S. Ralston, H. Weeks and M.M. Yoklavich. 2000. Management of Pacific Rockfish. Fisheries. 25(3): 22 – 30.

Partnership for Interdisciplinary Studies of Coastal Oceans. 2002. The Science of Marine Reserves. http://www.piscoweb.org.

Pauly, D., V. Christensen, S. Guenette, T.J. Pitcher, U.R. Sumaila, C.J. Walters, R. Watson and D. Zelter. 2002. Towards Sustainability in World Fisheries. Nature. 418: 689 – 695.

Ralston, S. 1998. The Status of Federally Managed Rockfish on the U.S. West Coast. Pp 6 – 16 in Yoklavich, M. ed. Marine harvest refugia for West Coast rockfish: a workshop. NOAA Technical Memorandum NMFS-SWFSC-255.

Roberts, C.M., J. A. Bohnsack, F. Gell, J.P. Hawkins and R. Goodridge. 2001. Effects of Marine Reserves on Adjacent Fisheries. Science. 294: 1920 – 1923.

Position Paper Preparers: Hal Weeks, Scott Heppell, Selina Heppell