Solving the Mystery of MPA Performance: Linking Governance to Ecological Outcomes

Ligando la Gobernabilidad a los Resultados Ecológicos para Resolver el Misterio del Rendimiento de las Areas Marinas Protegidas

Relier la Gouvernance aux Résultats Écologiques pour Résoudre le Mystère de la Performance des Aires Protégées Marines

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EXTENDED ABSTRACT

Marine Protected Areas (MPAs) are increasingly being employed as a tool to promote biodiversity conservation (Thomas et al. 2014), however, their implementation has had varying levels of success (Lester et al. 2009, Mascia et al. 2010). Results from numerous case studies suggest that MPA governance is a major factor in explaining this variation in MPA success (Pollnac et al. 2001, Walmsley and White 2003, McClanahan et al. 2006, Guidetti and Claudet 2010), however few studies have sought to examine the effects of MPA governance at multiple scales (Fox et al. 2014). Drawing upon the seminal work of Elinor Ostrom, the SESYNC MPA Pursuit is a two year project that seeks to identify the governance and contextual factors that contribute to successful marine conservation outcomes.

This research utilized a cross-disciplinary theoretical framework (Mascia et al., in prep) to test our central hypothesis that ecological outcomes at MPA sites are affected by governance. More specifically: inclusive decision making arrangements, active and accountable monitoring and enforcement systems, clearly defined and equitable resource user rights, and accessible conflict resolution mechanisms (Mascia 2004). This framework combines the hypotheses and classification system of Ostrom's common pool resource theory and Social-Environmental System framework (Ostrom 1990, 2009, Agrawal 2003), together with the experimental procedures of impact evaluation (Ferraro 2009, Rosenbaum 2010). By developing and utilising a cross-disciplinary theoretical framework and a common analytic platform (i.e., database), the results provide considerable insights into the relationship between governance attributes and ecological outcomes.

Using a novel compilation of datasets, we compiled ecological data from over 14,000 underwater surveys and governance data from over 300 MPAs globally to explore the relationship between MPA governance and ecological outcomes at a global scale. While controlling for potentially confounding factors using a statistical matching process (Sekhon 2009), preliminary analyses of over 250 MPAs/MPA zones demonstrate (on average) increases in fish population metrics (e.g. species richness, total biomass) within MPA boundaries. Preliminary analyses also suggest that designating part or all of the MPA as a no-take zone enhances these metric levels even further. Detailed governance data were available in approximately 50 MPAs/MPA zones, and from that sample, the results show a positive relationship between governance attributes such as inclusive and established decision making arrangements and well-defined resource use rights, and fish biomass and species richness. These preliminary results appear to confirm and extend previous research on the relationships between MPA governance and performance (Mascia 2004, Fox et al. 2012), providing novel insights for evidence-based ocean policy. The

datasets also include numerous sites with high quality ecological data from within the Caribbean, allowing for future analysis of governance-outcome linkages at a regional scale.

KEY WORDS: MPAs, conservation, governance, social-environmental systems

LITERATURE CITED

Agrawal, A. 2003. Sustainable Governance of Common Pool Resources: Context, Methods, and Politics. *Annual Review of Anthropology* **32** (1):243-262.

Ferraro, P.J. 2009. Counterfactual Thinking and Impact Evaluation in Environmental Policy. *Environmental program and policy evaluation: Addressing methodological challenges. New Directions for Evaluation* **2009**(122):75-84.

Fox, H.E., J.L. Holtzman, K.M. Haisfield, C.G. McNally, G.A. Cid, M.B. Mascia, J.E. Parks, and R.S. Pomeroy. 2014. How Are Our MPAs Doing? Challenges in Assessing Global Patterns in Marine Protected Area Performance. *Coastal Management* **42**(3):207-226.

Fox, H.E., M.B. Mascia, X. Basurto, A. Costa, L. Glew, D. Heinemann, L.B. Karrer, S.E. Lester, A.V. Lombana, R.S. Pomeroy, C.A. Recchia, C.M. Roberts, J.N. Sanchirico, L. Pet-Soede, and A.T. White. 2012. Reexamining the science of marine protected areas: linking knowledge to action. *Conservation Letters* **5**(1):1-10.

Guidetti, P., and J. Claudet. 2010. Comanagement practices enhance fisheries in marine protected areas. *Conservation Biology* **24**(1):312-318.

Lester, S., B. Halpern, K. Grorud-Colvert, J. Lubchenco, B. Ruttenberg, S. Gaines, S. Airamé, and R. Warner. 2009. Biological effects within no-take marine reserves: a global synthesis. *Marine Ecology Progress Series* **384**:33-46.

Mascia, M.B. 2004. Social Dimensions of Marine Reserves. Pages 164-186 in: J. Sobel and C. Dahlgren (eds) *Marine Reserves: A Guide to Science, Design, and Use*. Island Press, Washington D.C. USA.

Mascia, M.B. [in prep]. Analyzing Conservation Impacts: Evaluation, Theory, and Marine Protected Areas.

Mascia, M.B., C.A. Claus, and R. Naidoo. 2010. Impacts of marine protected areas on fishing communities. *Conservation Biology* **24** (5):1424-1429.

McClanahan, T.R., M.J. Marnane, J.E. Cinner, and W.E. Kiene. 2006. A comparison of marine protected areas and alternative approaches to coral-reef management. *Current Biology* **16**(14):1408-1413.

Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press, New York, New York USA. 298 pp.

Ostrom, E. 2009. A general framework for analyzing sustainability of social-ecological systems. *Science* **325**(5939):419-422.

Pollnac, R.B., B.R. Crawford, and M.L.G. Gorospe. 2001. Discovering factors that influence the success of community-based marine protected areas in the Visayas, Philippines. *Ocean and Coastal Management* **44**(2001):683-710.

Rosenbaum, P.R. 2010. *Design of Observational Studies*. Springer Series in Statistics. Springer, New York USA. 384 pp.

Sekhon, J.S. 2009. Opiates for the Matches: Matching Methods for Causal Inference. *Annual Review of Political Science* **12**(1):487-508.

Thomas, H.L., B. Macsharry, L. Morgan, N. Kingston, R. Moffitt, D. Stanwell-Smith, and L. Wood. 2014. Evaluating official marine protected area coverage for Aichi Target 11: appraising the data and methods that define our progress. *Aquatic Conservation: Marine and Freshwater Ecosystems* **24**(S2):8-23.

Walmsley, S.F., and A.T. White. 2003. Influence of social, management and enforcement factors on the long-term ecological effects of marine sanctuaries. *Environmental Conservation* **30**(4):388-407.