**NRT Case Study:**

**Applying a socio-ecological system framework to reduce management outcome uncertainty and increase overall success: The case of marine reserves in Oregon**

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**Topic:**

What makes a marine reserve (MR) ecologically and socio-economically successful? How (can) we integrate the different types of data that are used to evaluate the different components of the socio-ecological system (e.g. recruitment, adult fish stocks, compliance, economic benefits, social acceptance, social literacy, etc.)? Will the integration of data help inform policy and ensure management success?

**Background:**

In January 2016, the last of Oregon’s five marine reserve sites was implemented within state waters as part of Oregon’s marine reserve system, following OPAC policy recommendations and statutes passed by the Oregon Legislature (ORS 196.540 through 196.555). Marine reserves can be contentions, with significant differences among stakeholder groups regarding the efficacy, purpose, and inclusivity of marine reserve processes (Fox et al., 2013). However, reserves also present an opportunity to increase community cohesion and local ocean pride (Alcala and Russ, 2006), economic benefits (e.g. Sala et al., 2013), ecological benefits (e.g., Lester et al., 2009), human well-being (Reithe et al., 2014), and educational opportunities (e.g., Leisher et al., 2012).

The Oregon Legislature has called for an evaluation of the Oregon Marine Reserves Program and a report submitted to the Legislature in the year 2023. The evaluation will reflect upon all aspects of the Program in relation to the marine reserves goals, objectives, and policy directives including: site management; ecological and human dimensions scientific monitoring and research; outreach; community engagement; compliance and enforcement; and funding for the five marine reserve sites. The evaluation is to look across the five sites to examine what has worked well, where there are deficiencies, and what has been learned to date. There is general agreement from the scientific community that this timeframe is too brief for detection of substantive ecological changes due to marine reserve protections. However, this duration does provide time for constructive ecological and human dimensions research that helps inform marine reserves science and nearshore resource management in Oregon. The Program evaluation in 2023 marks the point where the state will consider if and how marine reserves will continue to be used as a nearshore resource management tool moving into the future.

**NRT Project Goals:**

Beyond the explicit call to “avoid significant adverse social and economic impacts on ocean users and coastal communities”, to date there is no specific mandate to outline stakeholder expectations or perspectives of what a successful marine reserve would accomplish in Oregon. Similarly, there is a dearth of information on how these expectations/perceptions of success could be better integrated into the formal marine reserve monitoring program. In the context of the 2023 evaluation deadline, **our goal for this NRT cluster is to explore mutually enforcing, interrelated outcomes of the marine reserve system through the identification of mechanisms for merging social and ecological measures of marine reserve success.** In order to achieve this goal, students will: (1) Aggregate existing cultural, social, and economic data on marine reserves and assess similarities and differences across data sets to establish guiding principles of success. (2) Identify key ecological and social measures of marine reserves success. (3) Explore practical mechanisms for socio-ecological data integration. (4) Identify most appropriate theoretical framework for integration, taking into account established MR goals.

Our proposal is based on the assumptions that “success” is a socio-ecological process that is better suited to explain the holistic outcomes of marine reserves for human-ecological systems, and that these systems move in response to each other. Effectively linking community and stakeholder expectations of success with ecological outcomes is critical for increasing resource management success (risk and policy) and can help refine monitoring and evaluation processes (Bennett, 2016). It can also help explain why stakeholders might or might not be satisfied with the outcomes of marine reserves (uncertainty). In addition, these will constitute valuable baseline data that can be traced across time to see if collective perspectives, social expectations, and the satisfaction of stakeholders move in response to, or parallel with, ecological and economic metrics monitored by the ODFW Marine Reserves Program and their research partners (minimize risk and uncertainty to improve policy).

**Existing Data:**

Baseline and continuing ecological datasets are already being collected and analyzed by ODFW and other researchers for ecological monitoring and evaluation purposes. Likewise, ODFW’s human dimension’s research program focuses on studies of coastal communities, uses, attitudes and perceptions of implementation and management, and market and non-market valuation of the reserves. In this respect, specific data needs include: ecological data sets and human dimensions data. It is quite possibly that one of the findings of the project is the existence of gaps in human dimensions data that will then need to be collected for future integration to the socio-ecological analysis and framework of marine reserve success.

**Desired Area(s) of expertise for students:**

* *Human dimensions component:* The HD student will be co-advised by Drs. Spalding and Marino. Ideal areas of expertise include anthropology, geography, sociology or economics; with strong skills in the analysis of ethnographic data, social network analysis, survey analysis, qualitative data management and coding.
* *Bid data component:* The BD component of this project will be the social and ecological data provided by ODFW and others. We have identified two potential areas for students:
	+ Modeling socio-ecological systems (Math and probability theory, potentially advised by TBD)
	+ Ecologist/ecosystems science/ fisheries biologist (potentially advised by Dr. Grorud-Colvert)

**Works Cited**

Alcala, A. C., and G. R. Russ. 2006. No-take marine reserves and reef fisheries management in the Philippines: a new people power revolution. Ambio 35:245–254.

Bennett, N. J. 2016. Using perceptions as evidence to improve conservation and environmental management. *Conservation Biology*. doi: 10.1111/cobi.12681.

Fox, E., M. Miller-Henson, J. Ugoretz, M. Weber, M. Gleason, J. Kirlin, M. Caldwell, and S. Mastrup. 2013. Enabling conditions to support marine protected area network planning: California’s Marine Life Protection Act Initiative as a case study. *Ocean & Coastal Management* 74:14–23.

Leisher, C., S. Mangubhai, S. Hess, H. Widodo, T. Soekirman, S. Tjoe, S. Wawiyai, S. Neil Larsen, L. Rumetna, A. Halim, and M. Sanjayan. 2012. Measuring the benefits and costs of community education and outreach in marine protected areas. Marine Policy 36:1005–1011.

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

Oregon Ocean Policy Advisory Council (OPAC). 2008. Oregon marine reserves policy recommendations: a report to the governor, state agencies and local governments from OPAC. August 19.

Reithe, S., C. W. Armstrong, and O. Flaaten. 2014. Marine protected areas in a welfare-based perspective. Marine Policy 49:29–36.

Sala, E., C. Costello, D. Dougherty, G. Heal, K. Kelleher, J. H. Murray, A. A. Rosenberg, and R. Sumaila. 2013. A general business model for marine reserves. PLoS ONE 8:e58799.