Toward developing a complete understanding:

A social science research agenda for marine protected areas

Introduction

Marine protected areas (MPAs) have emerged as a popular tool for marine conservation and fisheries management. Experiments in MPAs are taking place throughout the world in diverse physical, biological, institutional, cultural, and political settings. A commonly cited definition of MPAs is the following.

> 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. (Resolution 17.38 of the IUCN general assembly [1988] reaffirmed in Resolution 19.46 [1994])

Although many types of MPAs exist—including reserves, sanctuaries, and parks—each involves a group of people collectively engaged in decision-making and most MPAs have both biological and social goals. Biological goals include rehabilitating damaged habitats, sustaining biodiversity, protecting marine life, and providing a laboratory for basic natural science inquiry. Examples of social goals include restoring commercial, recreational, or subsistence fisheries, creating ecotourism experiences, generating economic opportunities, and empowering coastal communities. Biological and social goals may be contradictory or unequally appealing to different constituency groups, resulting in controversy and conflict. These dynamics contribute to the high rate of MPA failure—approaching 90% in some countries (White et al. 2002).

In most cases, MPA design and impacts are examined principally from a biological perspective. Use of mainly biological evaluation criteria may contribute to MPAs being categorically defined as a successful, when, in fact, the story is more complex (Christie in press). A particular MPA may be both a biological "success"—resulting in increased fish abundance and diversity and improved habitat—and a social "failure"—lacking broad participation in management, sharing of economic benefits, and conflict resolution mechanisms. Short-term biological gains will likely disappear unless these social issues are addressed (Pollnac et al. 2001; Christie et al. 2002)

Social science research is conducted too late in the design process to influence policies despite the understanding that such research is fundamentally important (Salm et al. 2000; NRC 2001; Mascia et al. 2003; Pomeroy and Hunter in press). In general, social science research that is "too little, too late" in the MPA design and implementation processes results in a poor understanding of frequently contentious social interactions operating on multiple levels (local, national, international, gender, class, ethnicity), unintended negative consequences, missed opportunities for positive change and reallocation of resources, and an incomplete scientific record. For example, managers involved in the Florida Keys National Marine Sanctuary acknowledge that they initially underestimated the importance of a broadly participative process grounded in a sound understanding of constituents' interests and activities—a costly oversight that set back the management process considerably (Suman et al. 1999; Causey 2000).

Patrick Christie
Bonnie J. McCay
Marc L. Miller
Celia Lowe
Alan T. White
Richard Stoffle
David L. Fluharty
Liana Talaue McManus
Ratana Chuenpagdee
Caroline Pomeroy
Daniel O. Suman
Ben G. Blount
Daniel Huppert
Rose-Liza Villahermosa Eisma
Enrique Oracion
Kem Lowry and
Richard B. Pollnac

Christie is assistant professor at the School of Marine Affairs and Henry M. Jackson School of International Studies, University of Washington, Seattle. He can be reached at patrickc@u.washington.edu. McCay is the Board of Governors Distinguished Service Professor and chair of the Department of Human Ecology, Cook College, Rutgers the State University, New Brunswick, NJ; Miller is professor at the School of Marine Affairs, University of Washington, Seattle; Lowe is assistant professor in the Department of Anthropology, University of Washington, Seattle; White is chief of party, Coastal Resources Management Project, Cebu City, Philippines; Stoffle is full research anthropologist, Bureau of Applied Research in Anthropology, University of Arizona, Tucson; Fluharty is associate professor, School of Marine Affairs, University of Washington, Seattle; McManus is associate professor at the Rosenstiel School of Marine and Atmospheric Science, Miami, FL; Chuenpagdee is senior research fellow, Social Research for Sustainable Fisheries, St. Francis Xavier University, Antigonish, Nova Scotia; Pomeroy is associate research scientist, Institute of Marine Sciences, University of Santa Cruz, Santa Cruz, CA; Suman is professor of marine affairs and policy, Rosenstiel School of Marine and Atmospheric Science, Miami, FL; Blount is professor, Department of Anthropology, University of Georgia, Athens; Huppert is associate professor, School of Marine Affairs, University of Washington, Seattle; Villahermosa Eisma is executive director of the Coastal Conservation and Education Foundation, Cebu City, Philippines; Oracion is associate professor, Silliman University, Department of Anthropology, Dumaguete City, Negros, Philippines; Lowry is professor and chair of the Department of Urban and Regional Planning, University of Hawai'i at Manoa, Honolulu; Richard B. Pollnac is professor, Anthropology Department, University of Rhode Island, Kingston.

In addition, social science considerations, when they appear, are often inadequate and misleading. For example, a recently described computer modeling method applied to MPA network design in the Gulf of California, Mexico measures the human component only as "the number of small boats," while offering a diverse array of biological and habitat measures (Sala et al. 2002). Such simplifications atomize human dimensions and trivialize evolved relations of human communities with their environment. They may also lead to erroneous findings by underestimating the importance of ethnic diversity and types of fishers and fisheries. This oversight is also problematic for planning purposes. MPAs based on models with very limited social variables may fail to consider existing management regimes and the willingness of local fishers to participate in MPA efforts—a fundamental, but too often ignored, design principle (White et al. 1994; Pollnac et al. 2001; Christie et al. 2002). In the particular case referred to above (Sala et al. 2002), the use of such natural science-driven planning tools in their current form could, for example, result in the selection of sites for MPAs that meet the desired criteria of high biodiversity, critical habitats, fish spawning aggregations, and low fishing pressure (measured only as density of small boats) that are already actively managed by the local community of Seri fishers.

We assert that MPAs are destined to fall short of biological and social goals unless social sciences are deliberately integrated into the design and evaluation process. Potential conflicts could then be identified, mitigation designed, and constituents engaged in a substantial manner. This essay therefore remarks on MPA science and management and advances an initial social science research agenda.

MPA science

Often cited scientific reports (e.g., Russ and Alcala 1996) have had broad influence on the acceptance of particular MPA management models—in this case small-scale, community-based MPAs. In the Philippines, MPAs were perceived as a panacea in the 1990s for declining fish stocks and coral reefs. Increasingly, it is becoming apparent that this management tool, without broader policies covering larger areas, is unable to fully address underlying environmental issues in most tropical countries including declining fish stocks and habitat degradation (Christie et al. 2002; Agardy et al. 2003). Social and economic conditions, such as poverty and the lack of political will, have thus far hindered the implementation of comprehensive fishery policies within which MPAs should be embedded (White et al. 2002). In other words, MPAs are an important, but incomplete, management tool to maintain fisheries, habitats, and biodiversity. In a context of social and ecological crisis, glimmers of success appear to have had disproportionate effect on the donor, scientific, and management communities. The documentation of successes, tempered by acknowledgement of limitations, is a prudent course if MPAs are not to be discredited as falling short of (unreasonable) expectations.

In other cases, complex issues associated with MPA implementation are overlooked. For example, the Soufrière St. Lucia case is offered as an MPA success story (Roberts et al. 2001), highlighting positive biological impacts and alleged increasing social acceptance. However, the conclusion that the Soufrière MPA is widely accepted is based on poorly described survey methods that are not up to standards of rigorous social science and is offered without consideration of equally pertinent narrative accounts of conflict and local resistance (Trist 1999; Sandersen and Koester 2000).

> Soufrière's marine environment has also become the focus of national and international conservation efforts, culminating in the enforcement of a system of marine reserves that exclude fishing. Contrary to the tropical tranquility implicit in tourism marketing, Soufrière's marine space is a site of heated political struggles over conservation and resource access among fishermen, yachters, scuba divers, and conservationists, each of whom deploy contending representations to substantiate their claims. (Trist 1999: 383)

Scientists and managers widely accept that controversy and conflict are associated with almost all MPAs, making the subject worthy of increased examination within the MPA science agenda. The possibility and implications of coercive management and enforcement systems favoring MPA establishment, either by a minority or majority, should be examined.

MPA designation and management

MPAs tend to be of two sorts: the "park" model, whereby a government agency declares an area out-of-bounds for some or all activities, and the "community-based" model, whereby coastal communities assume many of the responsibilities for implementing, monitoring, and enforcing rules for the protection of marine areas. Both models have spread globally through the efforts of researchers, conservation groups, international donors, and national policy-makers. One of the challenges that calls for greater attention to the social and political

PATRICK CHRISTIE

Filipino fisher constructing bamboo fish trap.

dimensions of MPAs is to adapt them to the exigencies of local situations, recognizing that each location has its unique social, cultural, and ecological contexts that influence the trajectory of MPA implementation and impact. For example, community groups in the Philippines and San Juan Islands, Washington, are utilizing comparable community-based management strategies tailored to their local contexts (White et al. 1994; Winger 2001). The success of these MPAs appears to be largely influenced by the degree to which the management process garners citizen support through addressing local pressing challenges such as collapsing fish stocks and unresponsive institutions.

The initial excitement surrounding community-based approaches has been tempered. For example, this model, based largely on initial success at Apo Island (Russ and Alcala 1996), has been replicated throughout the Philippines with little attention to context and institutional capacity, resulting in a high rate of failure (White et al. 2002). The San Juan Islands' eight voluntary no-take areas have gained significant attention as an innovative model for ground fish recovery, but face challenges of gaining formal regulatory status and state recognition (Christie unpublished data).

There has been an emerging interest (largely based on biological arguments) in abandoning the community-based approach, which typically involves smaller areas, for the park model, which generally involves larger MPAs (Brechin et al. 2002; Agardy et al. 2003). Strengthened enforcement mechanisms, often dependent on the support of international donors and conservation non-government organizations (NGOs), are established to ensure that regulations are followed (Lowe 2003). This trend is noteworthy, particularly because such dramatic and predictably controversial actions are being taken without a clear understanding of responses by affected constituencies and implications for long-term conservation goals. Without constituency support, rates of compliance will likely be low and achieving long-term conservation goals ever more dubious or costly. Matching the appropriate management model to the context requires at the very least a comprehensive understanding of constituency interests, institutional capacities, economic trade-offs, and legal contexts.

The MPA science-management complex

At present, MPA design is shaped principally through the efforts of at least three, perhaps four, important communities. The first community consists of many kinds of scientists who are engaged in the development of knowledge. The second consists of various kinds of managers who have authority to regulate human conduct. The third may be thought of as advocates of MPAs, such as conservation NGOs and donors. Interrelations among members of these communities are complex and multi-stranded. Understanding the dynamics of this science-management complex helps explain how MPAs are portrayed in academic and management arenas. Since MPAs affect a fourth community—resource users—design should be shaped cooperatively. Social science research can contribute to managing the cooperative planning process.

A growing number of scientists are engaged in evaluating the biological and social impacts of MPAs. Some of these scientists are also involved in developing educational materials that advocate for MPAs from an environmentalist perspective (e.g., Roberts and Hawkins 2000). While educational materials are useful, there is a growing concern that partnerships between advocates of MPAs (e.g., conservation NGOs and donors) and scientists may lead to biased or incomplete representations of MPAs and their impacts on ecological and social systems. One may think of the issue in terms of "mandate-responsive" and "mandate-independent" research.

Scientists, managers, and others working toward increasing society's acceptance of MPAs are engaged in "mandate-responsive" science and management (e.g., Roberts and Hawkins 2000). Such mandate-responsive science and management is characterized by a standardization of scientific procedures and general agreement as to effective regulatory techniques. For example, it is widely held that dive tourism is an appropriate activity within coral reef MPAs. If well managed, it is believed to provide alternative livelihoods for resource users and possible user fees for management (Vogt 1997). Economic valuation studies are frequently conducted to determine the appropriate level for visitor's fees used to fund conservation (Tongson and Dygico in press).

Mandate-responsive research can have a notably positive effect on MPA success. For example, Silliman University Marine Laboratory in the Philippines has played an important role in monitoring and providing timely advice to managers of Apo Island's MPA. This ongoing relationship between a coastal community and academic institution, based on mutual respect and trust, is one reason that Apo Island's MPA has remained in place almost 20 years despite considerable challenges. Social science research can be part of mandate-responsive work, as in the economic valuation studies mentioned above.

Another social science approach is "mandate-independent" (Nichols 1999; Trist 1999; Lowe 2000, 2003). Such research challenges MPA orthodoxies through the consideration of innovative science and management alternatives as well as the underlying goals and assumptions associated with MPA agendas. These researchers consider the ramifications of foreign NGOs, scientists, advisors, and donors promoting MPAs in tropical countries with colonial histories and enormous disparities in income and influence (Trist 1999; Lowe 2003). They consider the trade-offs associated with allowing dive tourism within MPAs while banning fishing and whether linking MPAs with tourism will lead to enclave areas of pristine reefs for

elites surrounded by devastated reefs for locals (Oracion 2003). Both mandate-responsive and mandate-independent research approaches are necessary to ensure that MPA models are not driven by overly simplistic "rules of thumb" (Agardy et al. 2003) or marginalizing for particular constituencies who may eventually derail MPA implementation. There should be improved dialogue between proponents of MPAs and skeptics.

The development of a MPA social science research agenda

Aware of these and other concerns, the social science community, together with managers, biologists, agency personnel, and donors, has begun to develop a research agenda for MPAs that balances social and biological considerations, and that has the potential to contribute to more objective, mandate-independent research. One such agenda was developed at a three-day, U.S. government-sponsored conference engaging 70 social scientists (NOAA 2002). Increasing focus on social dimensions of MPAs is supported by recent guidebooks on evaluation methods (Bunce et al. 2000).

A framework for this agenda has the following assumptions and features. Pertinent social sciences, that should inform all phases of management, include sociology, political science, cultural anthropology, economics, legal studies, and geography. MPA social science should rely on a broad suite of research tools to evaluate values, decisions and ideas in order to illuminate (a) the characteristics and behaviors of constituencies, (b) what constituencies want, and (c) what constituencies know (Miller et al. 1987; Goldman 2000; Mascia et al. 2003). Traditional scientific and evaluative methods—best suited to establish baselines, objective measures of progress, and general theory—should be complemented by participatory ones engaging constituents in a self-reflective process (Walters et al. 1998; Christie et al. 2000). Scientific and evaluative methods are likely to meet the needs of donors, scientists, NGOs, and government agencies most effectively. Participative methods are likely to strengthen constituent support for MPAs through increased process ownership and heightened consciousness (Pollnac et al. 2001). Both types of social science should be integrated in MPA design, policy and education documents, program evaluations, management plans, historic accounts, legal analyses, and critiques. The effective management and utilization of such information, especially in locations with weak institutions, is a significant challenge.

MPA social science has a growing agenda covering an increasing number of important issues. The following areas of inquiry require attention: (a) measures of success, (b) social mechanisms of conflict and cooperation, (c) regulatory compliance, (d) diffusion of innovations, and (e) social justice. The use of comparative research developing general principles is particularly useful as a complement to the current array of case studies.

Only by critically examining the whole, through balanced interdisciplinary research, is a broad understanding of MPAs and their impacts possible. As highlighted in recent conferences (e.g., 2003 American Anthropological Association, 2003 American Fisheries Society), increasing numbers of managers and researchers recognize the importance of understanding the social dimensions of MPAs, particularly since social information is critical for solving the conflicts that accompany MPA implementation (Causey 2000). While portrayals that delve into controversies may be troubling to some advocates, a critical examination will improve the likelihood that MPAs succeed in meeting both social and biological goals.

What has GRANT SYSTEMS ENGINEERING INC. got for ME?

COMPATIBILITY
MODULARITY
AFFORDABILITY

and more than ten years of field experience designed and built into every one of our products provide real solutions.

ORION — weatherproof, modular DSP receiver/data logger with low power consumption

PISCES — field programmable coded tag with long operating and shelf life

Antenna switch — internal combiner reduces loss, streamlines installation & balancing

Antennas — aerial or underwater antennas, engineered for radio telemetry

Amplifiers — 25 dB low noise amplifiers for underwater or surface use, also variable gain model

Receiving systems — from large project to small, cost effective DSP technology — ask us about MITAS™

Signal generators — coded, shielded, waterproof

RF engineering — remote download technology and software

System performance monitoring — beacon transmitters, power monitors

Our field experience makes all the difference!

Want to know more:
www.grant.ca
radiotelem@grant.ca
905.833.0061

References

Agardy, T., P. Bridgewater, M. P. Crosby, J. Day, P.K. Dayton, R. Kenchington, D. Laffoley, P. McConney, P. A. Murray, J. E. Parks, and **L. Peau.** 2003. Dangerous targets? Unresolved issues and ideological clashes around marine protected areas. Aquatic Conservation: Marine and Freshwater Ecosystems 13:1-15.

Brechin, S. R., P. R. Wilshusen, C. L. Fortwangler, and **P. C. West.** 2002. Beyond the square wheel: toward a more comprehensive understanding of biodiversity conservation as social and political process. Society and Natural Resources 15:41-64.

Bunce, L., P. Townsley, R. Pomeroy, and **R. B. Pollnac.** 2000. Socioecomic manual for coral reef management. National Ocean Service, NOAA, Silver Spring, MD.

Causey, B.D. 2000. Designing marine protected areas: The need to integrate the scientific and practical approaches. Page 152 *in* Proceedings of the Ninth International Coral Reef Symposium. International Society for Reef Studies, Dempasar, Bali, Indonesia.

Christie, P. In press. MPAs as biological successes and social failures in Southeast Asia. *In* No-Take Aquatic Protected Areas as a Fishery Management Tool. American Fisheries Society Symposium, Bethesda, MD.

Christie, P., D. Bradford, R. Garth, B. Gonzalez, M. Hostetler, O. Morales, R. Rigby, B. Simmons, E. Tinkam, G. Vega, R. Vernooy, and **N. White.** 2000. "Taking care of what we have": participatory natural resource management on the Atlantic Coast of Nicaragua. International Development Research Centre and The University of Central America, Ottawa, ON.

Christie, P., A. T. White, and **E. Deguit.** 2002. Starting point or solution? Community-based marine protected areas in the Philippines. Journal of Environmental Management 66: 441-454.

Christie, P., D. Buhat, L. R. Garces, and **A. T. White.** 2003. The challenges and rewards of community-based coastal resources management. Pages 231-249 in S.R. Brechin, P.R. Wilshusen, C.L. Fortwangler, and P.C. West, eds. Contested nature, promoting international biodiversity with social justice in the twenty-first century. State University of New York Press, Albany.

Goldman, L. R. (ed.). 2000. Social impact analysis: an applied anthropology manual. Oxford University Press, New York.

IUCN—The World Conservation Union. 1988. Resolution 17.38 of the 17th session of the general assembly of the IUCN. IUCN, Gland, Switzerland and Cambridge, UK.

_____. 1994. Resolution 19.46 of the 19th session of the General Assembly of the IUCN. IUCN, Buenos Aires, Argentina.

Lowe, C. 2000. Global markets, local injustice in Southeast Asian seas: the live fish trade and local fishers in the Togean Islands of Sulawesi. Pages 234-258 *in* C. Zerner, ed. People, plants and justice: the politics of nature conservation. Columbia University Press, New York.

_____. 2003. Sustainability and the question of "enforcement" in integrated coastal management: the case of Nain Island, Bunaken National Park. Indonesian Journal of Coastal and Ocean Management (special edition) 1:49-63.

Mascia, M. B., J. P. Brosius, T. A. Dobson, B. C. Forbes, L. Horowitz, M. A. McKean, and **N. J. Turner.** 2003. Conservation and the social sciences. Conservation Biology 17:649-650.

Miller, M. L., R. P. Gale, and **P. J. Brown.** 1987. Social science in natural resource management systems. Westview Press, Boulder, CO.

NOAA (National Oceanic and Atmospheric Administration). 2002. Marine protected areas social science workshop notes from breakout groups. NOAA National MPA Center, Santa Cruz, CA. Available at www.mpa.gov/

NRC (National Research Council). 2001. Marine protected areas: tools for sustaining ocean ecosystems. National Academy Press, Washington, DC.

Nichols, K., 1999. Coming to terms with "integrated coastal management": problems of meaning and method in a new arena of resource regulation. Professional Geographer 51:388-399.

Oracion, E. 2003. The dynamics of stakeholder participation in marine protected area development: a case study in Batangas, Philippines. Silliman Journal. 44(1):95-137.

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 44:683-710.

Pomeroy, C., and **M. Hunter.** In press. The Channel Islands marine reserve process: the role of the social sciences. *In* O.T. Magoon, H. Converse, B. Baird and M. Miller-Henson, eds. California and the world ocean '02. American Society of Civil Engineers, Reston, VA.

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.

Roberts, C. M., and **J. P. Hawkins.** 2000. Fully-protected marine reserves: a guide. World Wildlife Fund, Washington, DC.

Russ, G. R., and **A. C. Alcala.** 1996. Do marine reserves export adult fish biomass? Evidence from Apo Island, central Philippines. Marine Ecology Progress Series 132:1-9.

Sala, E. O., Aburto-Oropeza, G. Paredes, I. Parra, J. C. Barrerra, and **P. K. Dayton.** 2002. A general model for designing networks of marine reserves. Science 298:1991-1993.

Salm, R. V., J. Clark, and **E. Siirila.** 2000. Marine and coastal protected areas: a guide for planners and managers. International Union for Conservation of Nature and Natural Resources, IUCN, Washington, DC.

Sandersen, H. T., and **S. Koester.** 2000. Co-management of tropical coastal zones: the case of the Soufrière Marine Management Area, St. Lucia, WI. Coastal Management 28:87-97.

Suman, D., M. Shivlani, and **J. W. Milon.** 1999. Perceptions and attitudes regarding marine reserves: A comparison of stakeholder groups in the Florida Keys National Marine Sanctuary. Ocean and Coastal Management 42:1019-1040.

Tongson, E., and **M. Dygico.** 2004. User fee system for marine eco-tourism: the Tubbataha reef experience. Coastal Management. 32:17-23

Trist, C. 1999. Recreating ocean space: recreational consumption and representation of the Caribbean marine environment. Professional Geographer 51: 376-387.

Vogt, P. H. 1997. The economic benefits of tourism in the marine reserve of Apo Island, Philippines. Pages 2101-2104 *in* Proceedings for the Eighth International Coral Reef Symposium. International Society for Reef Studies, Panama City, Panama.

Walters, J. S., J. Maragos, S. Siar, and **A. T. White.** 1998. Participatory coastal resource assessment: a handbook for community workers and coastal resource managers. Coastal Resource Management Project and Silliman University, Cebu City, Philippines. Available at oneocean.org/pcra/

White, A. T., L. Z. Hale, Y. Renard, and **L. Cortesi** (eds.). 1994. Collaborative and community-based management of coral reefs: lessons from experience. Kumarian Press, West Hartford, CT.

White, A. T., A. Salamanca, and **C. A. Courtney.** 2002. Experience with marine protected area planning and management in the Philippines. Coastal Management 30:1-26.