

Mining multiple data sets for multiple no-take marine management areas (MMAs) in the Philippines
Danajon Bank, Bohol, Philippines

MMA Ecological Effectiveness, Philippines
Marine Management Area Science Program
Output 2.1.6 of the MMAS Collaborative Plan

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Final project report for Conservation International

Summary

Project Seahorse (PS) is very pleased to have contributed six primary research papers to help advance the work of the Marine Management Area Science (MMAS) program. In so doing, we have integrated natural and social science (3 papers) while also working focally in natural sciences (3 papers).

Our work directly supports the purpose of the MMAS program in mobilizing natural and social science to support design, diagnosis, and monitoring of effectiveness of marine management areas. We found that:

- community choice was at least as valuable as the available biological information in placing reserves (papers 1 & 2)
- it is possible to reduce monitoring effort in select ways without much loss of information (in a way that should affect participatory practices: papers 3 & 4)
- reserves were not universally beneficial for all fish populations (paper 5), and
- community perceptions of MPA recovery differed from biological findings in unexpected and important ways (paper 6).

All our work was conducted on Danajon Bank, a double barrier reef system in the central Philippines that is critically important for both marine diversity and human resources.

The results of our analyses are being returned directly to the people and agencies who have an immediate interest in the region's marine health; in collaboration with Project Seahorse Foundation for Marine Conservation (PSF), a Filipino NGO, we are engaged in feedback sessions with alliances of small scale fishers, local government units, non-governmental organizations and national line agencies. The results are also being integrated into policy documents for a Philippines' national workshop on marine protected area science and management, which we will co-host with PSF in mid-2010.

Our papers (50% more than required under the grant contract) were prepared with a budget of \$104,887 from MMAS and in-kind donations of \$531,700 from PS. We are grateful that the MMAS leadership was supportive through unexpected staff changes and

delays and delighted that our final contributions are so germane to the program's core strength.

Project activities

2006

The project's PI (Dr. Amanda Vincent) and Research Associate (Dr. Jeff Wielgus) visited the Philippines. They identified datasets on MPA biophysical and socioeconomic parameters, reached agreements with other NGOs to share data and develop research questions, (re)visited MPAs in Bohol and interacted with stakeholders to elicit their views on current issues affecting MPA effectiveness and management. Based on these interactions, the lead researchers and their Filipino counterparts (Amado Blanco, Wilson Barbon, and Hazel Panes) developed a set of preliminary research questions and a research plan.

2007

The first manuscript from the MMAS grant to PS was published: Samoilys et al. 2007. This drew on a small MMAS financial commitment to complete a large research initiative by PS.

After using five months of a one year MMAS salary, the research associate on this project (JW) resigned his position with PS leaving no manuscripts. In light of the substantial financial challenges, PS obtained permission from MMAS to meet its MMAS commitments through internal and external collaborations. The remainder of the year was spent developing such collaborations, seeking minimum cost and maximum intellectual effectiveness. This search led to a collaboration with Prof. Michael Jones and Gretchen Hansen from Michigan State University, one that also involved a recent PS doctoral student, Dr. Natalie Ban, and a PS postdoctoral fellow, Dr. Maï Yasué.

2008

We advanced three papers in productive collaborations. Two focused on marine conservation planning in a data poor context. The first of these papers (Ban et al. 2009) looks towards the future, exploring the impact of including or excluding existing reserves future marine planning scenarios. The second paper (Hansen et al. in prep) looks into the past, asking whether we might have selected different places for protection had a systematic rather than community-based approach been used. In the third paper (Yasué et al, in press), we compared community ecological changes in and around marine reserves as (a) perceived by communities and (b) detected in biological surveys.

2009

New PS postdoctoral fellow, Dr. Phil Molloy, mined an extensive database (newly available thanks to completion of a PS PhD) consisting of three years of monthly monitoring of all 400+ species encountered in the Danajon Bank. The ensuing

manuscript (Molloy et al, in review) showed that less monitoring, if strategically reduced, can still detect trends in fish species. This dataset was then combined with another database from Antigua to assess the accuracy and utility of family-level data in monitoring fish communities (Molloy et al. in prep).

Maï Yasué and Janna Rist (on behalf of Amanda Vincent) gave presentations of the MMAS work at the International Marine Conservation Congress (IMCC).

As a further note, the PI, Amanda Vincent spent most of 2007-2008 and 2009-2010 on parental leave with the arrival of her two children.

Project outputs, key results and messages

We here describe the six papers we have prepared: three are published or in press, one has been submitted, one is about to be submitted and one is still in draft.

Contribution 1. Ban, N.C, G.J.A. Hansen, M.L. Jones and A.C.J Vincent. (2009) Systematic marine conservation planning in data-poor regions: socioeconomic data are essential. *Marine Policy*. 33. 794-800.

Results

- When using a decision support tool for aiding MPA planning, biophysical information alone does not provide much guidance in identifying patterns of conservation importance in areas where the data available are poor.
- Socioeconomic data are needed to distinguish among possible areas for protection; but the availability of such data is often limited.
- Local knowledge and integrated understanding of socioeconomic realities may offer the best spatially explicit information for guiding MPA planning.

Messages

- Establishing MPAs based on community-driven criteria has biological and social value, but efforts should be made to collect both ecological and socioeconomic data to guide the continued creation of MPAs.
- Selection and location of MPAs based on community-driven criteria does not compromise or limit future options in developing a suite of MPAs on a broader scale. Rather, they can generate the support for MPAs and the social acceptance that is necessary for any larger future zoning effort.
- Establishing MPAs based on community-driven criteria has biological and social value, but efforts should be made to collect ecological and socioeconomic data to guide the continued creation of MPAs.

Contribution 2. Hansen, G.J.A., N.C. Ban, M.L. Jones, L. Kaufman, H.M. Panes, M. Yasué, and A.C.J. Vincent. Hindsight in marine protected area designation and planning: a comparison of community. Final draft for Biological Conservation.

Results

- There are very few biological data available on the scale required for regional conservation planning
- The costs of obtaining and analyzing biological data for conservation planning is often large relative to the resources typically available to conservation planners in developing countries
- The current system of MPAs, established based on community preference, protects more ecological features than would be expected by chance, although not as many as if a systematic approach had been used.

Messages

- More MPAs might be established by using social and political processes alone, than by investing limited time and money in trying to take a systematic approach
- A community-driven approach can be a valuable component of conservation planning, especially when biophysical data are sparse and considerations such as community acceptance are incorporated.

Contribution 3. Molloy P.P., J.A. Anticamara, J. Rist, and A.C.J. Vincent. Frugal conservation: what does it take to detect changes in fish populations? Submitted to Biological Conservation [ms BIOC-D-09-01204]

Results

- Monitoring of coral-reef fish populations using sampling protocols involving reduced effort can detect changes in fish populations and communities detected during more intensive monitoring
- The efficiency of monitoring protocols can be increased by reducing water time, number of species surveyed, survey frequency without compromising power for trend detection
- Power to detect seasonal trends decreased with less frequent surveying
- Most trends were also detected when surveying only easily-identified fish species or at least 75% of fished species

Messages

- Some selective sampling protocols can be as powerful as intensive surveys.
- The choice of protocol will depend on the objectives of the research or management programme

Contribution 4. Molloy P.P., J.A. Anticamara, J. Rist J, and A.C.J. Vincent. The accuracy and usefulness of family-level data in describing fish communities. Drafted for Biological Conservation or Marine Ecology Progress Series.

Results

- Family-level estimates of fish richness, evenness and diversity provide good proxies for species-level estimates of fish richness, evenness and diversity.
- When comparing across sites, increases in family richness and to a lesser extent diversity underestimate increases at the species-level
- When comparing across sites, increases in family evenness overestimate increases at the species-level

- Longitudinal trends in fish richness, evenness and diversity detected using family data are quantitatively similar to those detected using species data

Messages

- The use of family-level data may provide a useful way for marine ecologists to save time and money with little loss of information and may facilitate the inclusion of lay volunteers into conservation and monitoring programmes

Contribution 5. - Samoily, M.A., K.M. Martin-Smith, B.G. Giles, B. Cabrera, J.A. Anticamara, E.O. Brunio and A.C.J. Vincent (2007) Effectiveness of five small Philippines' coral reef reserves for fish populations depends on site-specific factors, particularly enforcement history. *Biological Conservation* 136, 584-601

Results

- Significant differences were found between fish communities inside and outside those marine reserves with the strictest compliance with fishing prohibition, and also between reserves and distant control sites. The strongest responses to reserve protection were found in predatory fishes (groupers and breams) and in butterflyfish. Other abundant fish families showed weak effects of protection.

Messages

- Reserves, even when small, can be beneficial for fish communities, and lead to increased fish abundance, including fished species, given good enforcement and compliance with fishing prohibition.
- When proposing new reserves adequate provision (funding, logistics, institutional support) must be made for ongoing enforcement whether by local communities or fisheries management agencies.
- Assessments of the impact of marine reserves are best done when considered alongside data on enforcement and protection
- The detection of fish responses to marine reserves can be complicated by potential spillover effects, site-specific factors (particularly compliance), and the difficulty of identifying appropriate control areas for comparison.
- Site specific effects mean that monitoring reserves at multiple sides is especially valuable

Contribution 6. In press: Yasué, M., L. Kaufman and A.C.J. Vincent. Assessing ecological changes in and around marine reserves using community perceptions and biological surveys. *Aquatic Conservation: Marine and Freshwater Ecosystems*. Accepted October 2009. [ms AQC-09-0017].

Results

- In a comparison of community perceptions of ecological changes with concurrent scientific data, perceptions of MPA effects differ from, and can be more positive than those shown by biological data.
- Community members perceived more fish within the MPA and slight increases in catch outside the MPA. In contrast, fish censuses showed a high degree of stochastic variation and only minor increases in fish abundance

Messages

- Community perceptions of MPA effects do not necessarily correspond to information obtained from Biological surveys
- Community perceptions of MPA effects could be influenced by temporal, spatial or species frames of reference and/or limitations to the biological survey technique.
- Community perceptions of MPA effects could also be influenced by wishful thinking, external influences (such as environmental education campaigns), a desire to please or confounding with other benefits.
- In order to understand changes that occur over time in an MPA and engender community support for the long-term viability of MPAs, it is important to develop diverse and efficient monitoring schemes.

Impacts and dissemination

This collaborative project had four objectives.

1. To extract as much understanding and management oriented information as possible from a suite of data sets relating to no-take marine protected areas (MPAs) in the central Philippines. By producing six primary papers, using both biological and socioeconomic data, we have generated and synthesised new knowledge and understanding in areas as diverse as MPA planning, monitoring, evaluation and effectiveness. All outputs have direct management implications for no-take MPAs in the central Philippines and beyond. We will also be able to extract many more papers from the same data sets and from additional newly available research, too, as resources allow.
2. To use new information to create continuous commitment for MPA management in the Danajon Bank focal region where the MPAs are sited. Members of PSF have been involved with the PS MMAS collaborative project since its inception. PSF biologists have always been integral to project planning and question identification and have contributed to and reviewed all PS MMAS outputs. PSF holds regular feedback sessions with coastal communities, people's organizations and Local Government Units (LGUs), during which the findings and key messages of the MMAS are relayed and incorporated into management planning. We have paid particular attention to communications with KAMADA, an alliance of about 1000 small-scale fishing families on Danajon Bank that PS initiated and still assists. In this manner we have been able to foster continued support for the establishment of new MPAs and the improvement and strengthening of older MPAs.
3. To collaborate with key stakeholder groups and target audiences in the Philippines and worldwide, in order to ensure the scientific results inform management practices and political decision-making. Through PSF, our earlier MMAs outputs have been, and later outputs will be, communicated to key partners and collegiate groups within the Philippines such as the FISH Project, The Coastal Conservation and Education Foundation (CCEF), and the Bohol Alliance of NGOs (BANGON). We next need to

reach out to national collegiate organizations and particularly to Conservation International in the Philippines, ensuring that they are aware of our work and discussing its potential application to our two programmes. We have also disseminated our findings internationally; in 2009 we presented two MMAs outputs at the International Marine Conservation Congress (IMCC) held in Washington DC. Further, PS contributions one (Ban et al. 2009) and two (Hansen et al. in review) will be featured in an article in MPA news, an information service on planning and management of marine protected areas produced by Marine Affairs Research and Education (MARE) in 2010.

4. To set the stage for future investigations about the extent to which the current array of MPAs (a) differs from what might have emerged from a scientific-based design approach and (b) represents a functional network in ecological, social and political terms. All six PS MMAS relate directly to these questions. Papers one and two explicitly address the first question and confirm that the current MPAs provide very reasonable ecological coverage, particularly given the limited amount of ecological information for the region.

Future activities and further research plans

PS and PSF plan to hold a national workshop in mid-2010 to share our MPA research findings to date with key actors and agencies in the Philippines. This national workshop will be used to convey, through discussion, the findings from (i) the MMAS outputs that integrate many individual streams of our research, (ii) three newly completed PhDs on MPAs executed by Filipino students with PS (on the cultural basis, participatory evaluation tools, and biological response of MPAs), and (iii) PS international / PSF long-term monitoring of a suite of MPAs. Detailed planning for this workshop is underway, and we will certainly invite Conservation International Philippines to participate.

We are planning immediately to further mine all of our MPA data sets. This year we hope to analyse anew our remarkable long-term data (fish, benthic, seahorses since 1998) from inside and outside MPAs and from distant fished sites; our last paper on this covered only the first six of twelve years. We also intend to explore new methods of (i) detecting fish change with the least effort for the greatest return and (ii) detecting benthic (especially coral) change in MPAs, a long-standing problem in MMAS analysis. Our third research thread will be to analyse the social, political and scientific process behind the establishment of the 33 MPAs that PS has supported to date, looking for ways to predict long-term effectiveness of the MPAs from those processes. We also want explicitly to link socioeconomic data for each village to its MPA success and to identify how MPA developments might enhance social capital in villages.

In management terms, PSF intends to work more explicitly with the local government units at the municipal level. They hold legal responsibility for coastal management to 15 km offshore, and need to become more engaged in MPA establishment in support of the villages and communities that are so eager to implement and support MPAs.

Strengthening our efforts at the municipal level should enhance the rate at which communities implement MPAs since this is currently primarily limited on Danajon Bank

by technical and financial support. PSF (with PS) will simultaneously assist the municipalities to improve their awareness of and technical competency in coastal resource management.