Integrating Resilience Into MPA Design

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Introduction

Climate change poses new threats for marine protected area (MPA) managers which challenge them to develop appropriate responses at multiple scales. At the broadest scale, is the establishment of MPA networks that are designed to be resilient in the face of change. In this workshop, five case studies will be presented to demonstrate different approaches used to address biophysical and sociopolitical aspects necessary to achieve resilience. The first case study will address the sociopolitical approach that is being used in Palau to establish a nationwide network of resilient protected areas. The second will address the political process as well as biophysical aspects of design for a multinational MPA network encompassing the Mesoamerican Reef. The third will address how resilient coral reefs were identified in Mexico using rapid reef assessments. The fourth will address the use of the decision support tool, MARXAN, to design resilient networks of MPAs at the ecoregional level in Indonesia. The final case study will address the design and zoning of an MPA at the site level in Grenada.

Together, the case studies identify how far resilience principles have been successful in application to date, and some of the problems and challenges being faced. A broad range of detailed recommendations were highlighted in questions and discussion during the session, which were aggregated into four summary recommendations.

Case Studies

1. Building a Resilient Network of Protected Areas in Palau

Eric Verheij[2] and Joe Aitaro[3]

In November 2003, the Palau Protected Areas Network (PAN) Act was signed into law. The PAN Act has dual purposes: a) management of natural resources, and b) the conservation of Palau's biodiversity. Both marine and terrestrial protected areas are included in the PAN. The development of the PAN is based on four broad, interrelated components: a) effective governance and management, b) building capacity, c) sustainable financing, and d) strong science. The Nature Conservancy's resilience model—which incorporates the need for effective management, representation and replication, refugia, and connectivity—has been an important aspect of the design of the PAN. The current design of the network includes connectivity only through surrogates; the assumption being that sufficient representation and replication will, in part, address connectivity issues. This is a challenging issue requiring more attention.

The data layers of the recently completed Ecoregional Assessment included refugia, all marine habitats, and aspects of representation, replication in the MARXAN analysis and identified priority areas. A GAP analysis was conducted to identify the gaps between the target conservations goals and those captured by the existing protected areas. The

[1] Asia Pacific Coastal Marine Program, The Nature Conservancy
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result of this analysis indicates that, if effectively managed, several of the conservation goals are already fully met. If the expansion of the PAN acquires the priority areas identified in the GAP analysis, then the PAN will meet, or exceed, all conservation goals and will be as close as possible to a resilient network of protected areas.

Challenges

- Using national framework legislation to support state level action. It is up to individual states (16) to determine where they want protected areas.
- Two of the existing MPAs have management plans, but remaining MPAs are no-take areas with no management plans
- The existing protected area network required 12 years of working at community/state level to build the necessary support for a nationwide protected areas network (time, time, time)
- Coordination of national government agencies, state governments, NGOs, and individuals to support the PAN given their different priorities and agendas

Lessons learned

- Hydraulic cooling model not necessary for network
- Local community leaders engagement from the start is essential but also political will is needed
- Fine level gap analysis necessary to identify network deficiencies
- A percent goal is not enough to achieve representation. Assessments should be completed to inform which areas should be protected to ensure that a representative range of habitat types is selected and protected

2. Building a Resilient Network of MPAs in the Mesoamerican Reef

Alejandro Arrivillaga and Nestor Windevoxel[4]

The Meso-American Reef (MAR) region, also known as the Western Caribbean, is comprised of the coast of the Mexican State of Quintana Roo, the national coasts of Belize and Guatemala and the central and eastern coast and the Bay Islands of Honduras. The region includes the second largest barrier reef in the world and the largest in the Western hemisphere. The region is home to close to 2 million people that depend, to a large extent, on the reef and associated resources. The Nature Conservancy's MAR Program and local partners have made substantial efforts to identify and advance the development of a network of resilient reefs sites in the region. Based on the TNC reef resilience toolkit and model, we have concentrated our initial efforts on the elements of representation and replication, and refugia through a region-wide rapid reef assessment and the development of an ecoregional assessment for the identification of priority conservation sites.

We have primarily identified different reef habitats using the Millennium Project Maps, and randomly selected survey sites to conduct a rapid reef assessment using the AGRRA protocol. We are working to produce a classification scheme of reef types and major reef zones that will ensure a more complete representation of biodiversity protection. We are applying a range of factors to help identify potential resilient reefs including: high ratio of live to dead coral, a broad range of coral colony size and age

[4] Meso-American Reef Program, The Nature Conservancy

distribution, reefs that survived previous high temperature or bleaching events and reefs with overall high coral species diversity. Lastly, a MAR ecoregional assessment is focusing on the development of a portfolio of priority conservation sites, based on the geographic distribution of conservation targets that are functionally linked to reefs by physical and ecological processes. Finally, designing conservation strategies in an ecoregion that includes four countries presents a suite of challenges. During the ecoregional assessment process, the participation of local stakeholders and governments has helped bring knowledge and the necessary political support to the process.

Challenges

- Multi-national (4 country) network (large)
- Numerous partners (State, Federal, BINGO, local NGO's)
- Communicating concepts of resilience to partners and local communities
- Rapid assessment can only identify "potential" resistant or resilient sites, these still need to be validated

Lessons learned

- Need to build capacity within lead organization and not rely on consultants
- During the ecoregional assessment process, the participation of local stakeholders and governments has helped bring knowledge and the necessary political support to the process
- MARXAN outputs only provide a starting point for PA portfolio- local input at workshops necessary to refine into practical MPA design solution

3. Rapid Reef Assessment to Identify Potential Bleaching Resistance and Resilient Sites in Quintana Roo, Mexico

Rosa Maria Loreto Viruel[5]

In Mexico there are three distinct coral reef areas. The Pacific coast has patch reefs and small coral communities often restricted by cool temperatures. The Southwest Gulf of Mexico contains platform reefs off Veracruz which are influenced by high turbidity from the coast. The Caribbean coast includes an extensive fringing reef along the Quintana Roo state coast, where tourism and fisheries are the major activities, imposing new threats to these reefs. Reefs in Q. Roo represent the Mesoamerican Barrier Reef System (MBRS) in Mexico. The MBRS is about 400 miles in length, including fringing reef, offshore islands and the Banco Chinchorro atoll.

Since 1991, Amigos de Sian Ka'an (ASK) and The Nature Conservancy (TNC) have been involved in a wide range of national and international reef conservation initiatives and have amassed an extensive knowledge base of the coral reefs of Quintana Roo. During that period, ASK has surveyed, analyzed and monitored an astonishing extent of the Mexican portion of the MBRS. The results of these activities have been used to produce management recommendations and to establish six marine protected areas, and their management plans. From August 2005 to 2006, TNC and ASK completed a rapid reef assessment of the entire reef on Q. Roo focusing on six resilience zones identified using the ASK's preliminary studies using the Atlantic and Gulf Rapid Reef Assessment (AGRRA) methodology. The purpose of the survey was to 1) identify ecological characteristics of the area; 2) get an overview of general reef conditions; and 3)

[5] Amigos de Sian Ka'an A. C- Programa Arrecifes Coralinos

identify potential bleaching resistant and resilient sites for inclusion in a long term monitoring program. Sampling design was based on benthic habitat reef maps and principles of generalized random tessellation sampling which ensures full representation of all reef types uniformly distributed across the reef zone of interest. All of the sites of the six resilience zones identified have been assessed. Now we are preparing the data analysis and we are defining a scope of work to assess reef resilience in the Mesoamerican Barrier Reef System in Mexico.

4. MARXAN and Resilience - Lessons Learned from Application of a Decision-Support Tool at Four sites and One Seascape in Indonesia

Peter J. Mous and Muhammad Barmawi[6]

Spatial planners increasingly use the decision-support tool MARXAN to design networks of marine protected areas throughout the world. In 2006, we introduced this methodology in Indonesia through four workshops for conservation practitioners from environmental NGOs and government agencies. We applied MARXAN at the site level to design no-take zones, and at the seascape level to design a network of MPAs. Aspects of resilience that could be implemented in a straightforward manner were representation and replication, and we partly addressed connectivity through clump size and distance parameters.

We found that MARXAN makes the process of spatial planning more transparent and consistent, requiring planners to document their choices. We also found that the methodology can be applied by technicians who have limited background in GIS, though misunderstandings on the conceptual and mathematical background of MARXAN occasionally resulted in planning errors. A drawback is that the challenge of applying a new software tool may distract attention from the quality of the input data on habitats, species occurrences, and resource use patterns. Furthermore, inexperienced technicians may be tempted to present zoning and network designs without explaining the ecological background that was the basis of the MARXAN-supported design process.

Challenges

- The results of MARXAN are not directly usable. For example, if small planning units are used, the MARXAN output requires some editing to remove isolated or small clusters of planning units before it can be shown to stakeholders as a proposed zoning plan
- Major problems can exist with data quality (e.g., under-representation of deeper reefs and inclusion of spawning aggregations that no longer exist). Because MARXAN does not evaluate the quality of input data, planners can be tempted to use low-quality data to get quick results
- Parameter values for MARXAN (e.g., Boundary Length Modifier, Species Penalty Factors) are case-specific, and therefore field teams from different sites could not build on each other's insights by applying the same values
- Currently, MARXAN cannot address inter-feature connectivity in a straightforward way (e.g. atoll reef – fringing reef, reef-seagrass-mangrove).

[6] Coral Triangle Program, The Nature Conservancy

However, TNC is currently working with the developers of MARXAN to add functionality that will help planners to identify clusters of solutions

Lessons learned

- MARXAN proved valuable as a tool to integrate data on spatial patterns in conservation features, use and management
- MARXAN-assisted design forces planners to be transparent in formulation of design criteria
- MARXAN-assisted design ensures that criteria are applied consistently
- Applying MARXAN ensured that the design process remains result-oriented, in the sense that proposed design concepts were quickly translated into clear design criteria
- The use of MARXAN enhanced collaboration among field teams, who worked together to solve problems

5. Incorporating Resilience into the Design and Zoning of a Marine Protected Area in Grenada.

James Byrne[7]

The Sandy Island/Oyster Bed Marine Protected Area (SIOBMPA) is located on the West coast of Carriacou. Carriacou, the largest of the Grenadine islands in Grenada, is part of a chain of small islands, rocks and cays situated in between the main island of Grenada and St. Vincent and commonly know as the Grenadines. The visible islands are the summits of ancient submerged volcanic mountains creating a series of unique marine habitats around which the SIOBMPA has been developed. These include extensive reef development, seagrass beds and mature mangrove stands. The SIOBMPA benefits from strong community support, yet currently lacks sufficient technical and financial resources for achieving conservation success. With input from the community, and through a strong partnership with the Government of Grenada and the Caribbean Regional Environmental Programme, The Nature Conservancy developed a management plan for the MPA which fully incorporates the principles of resilience: effective management, refugia, connectivity and risk spreading and representation.

To ensure effective management of the SIOBMPA, The Nature Conservancy is using its long established Conservation Action Planning methodology to identify priority conservation targets and priority threats. The Conservancy has devised a management plan that is easy to implement, demonstrates results, has the support of the community, and incorporates a sustainable financial plan. The management plan addresses the remaining resilience principles. An integral part of this management plan includes the Zoning Plan for the MPA. Through this zoning plan, principles of refugia and risk spreading and representation are addressed by the selection of the no take zones around the three separate occurrences of the major reef habitat within the SIOBMA, while the connectivity principle is addressed by the inclusion of the major nursery habitat and the fringing reef system connecting it with the major reef areas.

Challenges

[7] Eastern Carribean Program, The Nature Conservancy

- Very small area with delineation of boundaries not based on biological critieria which poses challenges for rezoning
- Heavily utilized resources (reef dependent islanders, large-scale marinas, yacht anchoring, recreational diving)
- Small Island Developing State (capacity, funding, amount of resources all limited)
- Communicating concepts of resilience to partners and local communities

Lessons learned

- Use of on-site partners to communicate to local communities between planning workshops
- Need to inform fishermen about the ecological linkages between habitats (nurseries)
- Need to incorporate local knowledge of fisheries into the zoning plan
- The most effective way to convey resilience concepts to partners and local communities was to "tell the story of the resources" – e.g. proving locally relevant analogies of resilience principles

Summary Recommendations

Case studies in this session dealt with a consistent model of applying resilience principles to MPA design in a learning framework. Principal recommendations are listed below and detailed recommendations from the various case studies grouped in the next section.

- Evaluate the use of resilience planning tools in the next four years to refine tools and MPA design and management strategies
- Need to include management effectiveness indicators early on in network design process (too much focus on biophysical mapping, not enough on socioeconomic data, and not enough data on operational aspects of MPA management)
- Need to provide a vehicle for managers to convey pressing issues to IUCN working group to address
- Need to build flexibility, adaptability, and learning into our strategies/zoning-moving from static boundaries and plans to dynamic decision support systems

Detailed List of Recommendations

A) General

- Significant progress since last ITMEMS in implementation of resilience principles into MPA design, zoning, and management
- Need to come up with specific targets on climate change threat to reduce carbon emissions (e.g., limit climate change to less than < 2 degrees)
- Need global resilience support group (IUCN Science Advisory group). Awareness and accessibility have to be raised so that site managers can approach a certain group to ask for advice. IUCN is working on building greater integration between various resilience groups. We need to create a strong network of MPA managers throughout the world that addresses resilience (e.g. UNEP network in Caribbean)

B) Planning and context

- Need to initially assess and identify perceptions, threats, and needs within communities to align with network design strategies

- Integrate resilience into MPA design within a learning framework to learn from experiences
- MPA not necessarily always a viable strategy. Concepts of resilience could be used in other marine conservation strategies (e.g., Ecosystem based management)
- One of major uses of resilience is integration. Most elements are good principles in MPA network design anyway. Resilience theory provides comfort to government and public that there is a point in conservation. Resilience is a good organising and fund-raising tool. Good positive message of hope.
- Need to focus resilience science around addressing management needs so it will directly result in tools (e.g., targeted coral reef group LOICZ – global; Caribbean Scenarios project)

C) Data, methods and application

- Need to clarify use of resilience terms (e.g., narrow ecological versus all encompassing social/ecological/representative)
- Availability of a suite of tools, partnerships, and networks for managers
- Many tools are available for monitoring, response plans, and measures for management effectiveness. How do we identify the appropriate tools for our sites?
- Baseline ecological data should be a priority for all sites to inform monitoring strategies (long-term and rapid response to disturbance events)
- Need to develop resilience framework to include synergies between managing functional groups and other strategies to achieve resilience
- Need to develop resilience value indicators that are quantifiable (human dimensions) – in the absence of the ability to "verify" resilience you can take human perceptions of valuable reefs (x% coral cover, x% fish cover etc) to identify reefs to select with broad support for protection in lieu of scientific evidence to support criteria
- How do you incorporate and prioritize factors that contribute to resistance/resilient. Each individual factor can easily be tested/measured, but how to integrate all the factors? (e.g. upwelling, shading, etc)

D) Political will and stakeholder buy-in

- Resilience can be a framework for negotiating with stakeholders. Resilience is not just used as a management tool, but also for identifying important biological and socio-economic concerns
- Marine habitats and ecosystems do not follow national boundaries, therefore it is essential to develop strategies across political boundaries to maintain the functionality of the system
- It was mentioned that we underestimate the need to work at national policy level getting their buy-in into climate change threats/resilience. Highlighted need to focus training and capacity building at the higher-level policymakers. Need science-based recommendations to get political support for MPA networks and help government leaders define priorities

E) Communication

- Need to identify how we communicate resilience science to policy makers and communities to create change

- Improve communication of resilience science to communities and policy makers (quantitative measures for assessing behavioural changes)
- Need help conveying climate change message to communities and policy makers, e.g., public service announcements for raising public awareness of how climate change can affect ecosystems
- Need to mention that "more is better" in MPA design, i.e., an increase in the total area of protection. It was mentioned that it may be more effective to focus on increasing the size of protected areas rather than trying to determine which resilience factors are going to work in a particular area

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