POLICY BRIEF

Using Marine Protected Area Networks to Achieve Fisheries, Biodiversity and Climate Change Objectives

Biophysical principles for designing resilient networks of marine protected areas to achieve fisheries, biodiversity and climate change objectives simultaneously in the Coral Triangle

A project of the Coral Triangle Support Partnership

Purpose

The purpose of this policy brief is to:

- Outline how fisheries management within the Coral Triangle can benefit from marine protected area networks designed for multiple management and conservation objectives.
- Present a set of marine protected area network **design principles** that will aid governments, non-government organizations (NGOs) and community resource managers to:
  - Promote sustainable fishing practices,
  - Conserve the Coral Triangle's ecosystems,
  - Improve ecosystem resilience in the face of climate change, and
  - Achieve the goals of the Coral Triangle Initiative Regional and National Plans of Action.

What is a Marine Protected Area Network?

For the purposes of this brief, marine protected areas are defined as clearly-delineated marine managed areas that contribute to the protection of marine resources. While *marine protected area networks* are defined as collections of individual marine protected areas that are ecologically connected through the movement of larvae, juveniles and adults of key species. This 'connection' ensures that marine protected areas act as mutually replenishing networks to facilitate the recovery of populations after disturbance.

Within the six Coral Triangle countries, marine protected areas have different legal and practical definitions. Whilst marine protected areas are most commonly associated with 'no-take areas', they encompass a wide range of types and levels of protection. Because of their flexibility and their capacity to incorporate multiple uses in different zones, marine protected area networks are particularly suited to addressing multiple objectives within a variety of contexts.

Much of the research and advice presented here regarding marine protected area network design relates to the use of no-take areas. These areas, in the face of uncertainty and overexploitation, can benefit fisheries across a broad range of species. For this reason, it is suggested that no-take areas should be one of the types of protection offered within marine protected area networks designed to achieve fisheries management objectives. No-take areas are also an important tool for biodiversity protection in the face of climate change.

The Challenge

Maintaining two of the Coral Triangle's most important features – productive fish stocks and marine biodiversity – are not incompatible goals, since fisheries species are important components of both fisheries and biodiversity. The challenge lies in developing management strategies that result in **positive outcomes for both fisheries and biodiversity** in the face of climate change and other growing pressures.

In the Coral Triangle, overfishing and the loss of key habitats are undermining fisheries production, food security, livelihoods, biodiversity and the long-term health of marine ecosystems. Illegal and destructive fishing practices, coastal development and climate change present additional management challenges. Population growth will also increase the pressure on the region's marine resources.

The design principles presented here were developed with an awareness of this challenging marine resource management context. These design principles for marine protected area networks will contribute to **achieving fisheries, biodiversity and climate change objectives simultaneously.** Although this brief focuses primarily on the challenges and objectives of the Coral Triangle, **the information provided here is applicable to tropical marine ecosystems worldwide.**

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The Latest Science

Recent scientific advances have improved our ability to design marine protected areas to meet multiple objectives, particularly those relating to fisheries management and biodiversity protection. Research shows that:

- Adults and juveniles of coral reef and coastal pelagic species have home ranges of different sizes (**Figure 1**). While some species don't move very far, others move long distances.
- The scale of larval dispersal is much smaller than previously thought. Although coral reef fishes can move large distances during their larval stages (tens to hundreds of kms), larval dispersal tends to be more in the order of 5-15 km with many recruits returning to their natal area.
- By protecting fisheries species in no-take areas they increase in size, biomass and reproductive potential and contribute proportionally more larvae to fished areas than areas open to fishing.

Thus **if communities protect spawning stocks in no-take areas, they will benefit from recruitment to local fisheries.**

Figure 1 below provides a practical tool for working with communities and other stakeholders to determine the size of no-take areas based on the scale of movement of various species. For no-take areas to be effective, they must be able to sustain target species within their boundaries. Since adults and juveniles are vulnerable to fishing, no-take areas should be at least twice the size of the scale of adult and juvenile movement of the species they are aiming to protect. Ideal sizes of no-take areas will also depend on whether there are other effective marine resource management methods in place. If no additional effective methods of protection are in place, a mixture of small ($\geq$ 0.5 km across) and large (e.g. 4 to 20 km across) no-take areas will be required to achieve fisheries, biodiversity and climate change objectives. If effective marine resource management is in place for wide ranging species that move outside their boundaries, then networks of small no-take areas can achieve most of these objectives, particularly regarding fisheries management - provided they comply with the other design principles described below regarding representing 20-40% of each habitat and critical areas (e.g. spawning and nursery areas) in no-take areas.

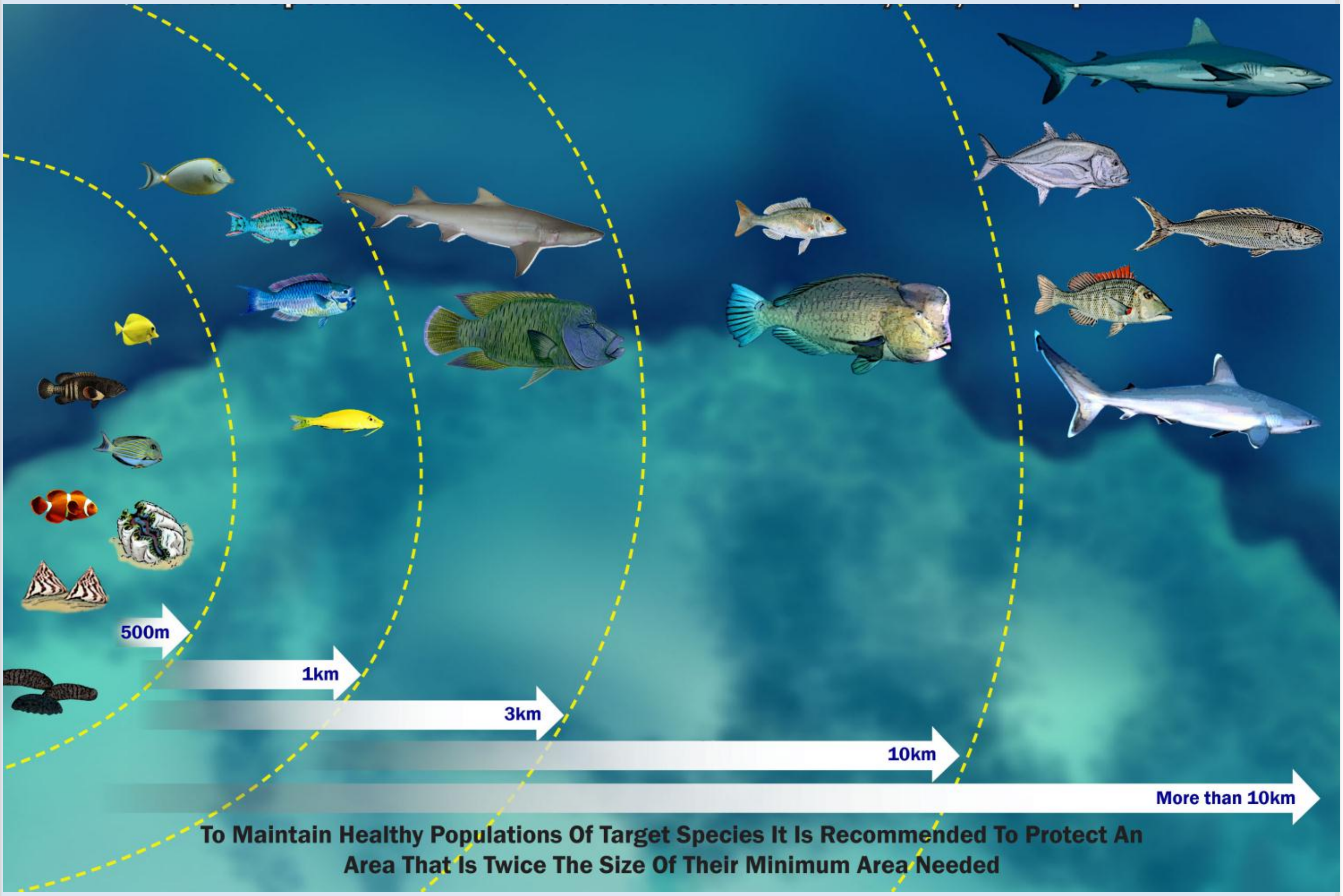

Figure 1. Different species have home ranges of different sizes (above), so they need different sized no-take areas.

Addressing Multiple Objectives

Existing marine protected area network design principles tend to focus on single management objectives. Typically there are separate sets of guidelines for achieving fisheries, biodiversity and climate change objectives. Although there are similarities among the principles that contribute to each of these objectives, there are also key differences. Where practitioners wish to address all three objectives, they may find that using separate sets of guidelines presents them with conflicting and often confusing advice, particularly regarding the size and duration of no-take areas. The principles presented here have been developed to enable the design of marine protected area networks that address fisheries, biodiversity and climate change objectives simultaneously. Integrating objectives in such a way allows practitioners to maximize the benefits of a marine protected area network.

What do fisheries stand to gain?

The overarching goals of an Ecosystem Approach to Fisheries Management, biodiversity conservation and climate change resilience are similar in many ways. As a result, achieving positive outcomes within one of these three objectives can also contribute to achieving the other two.

The benefits of marine protected areas (particularly no-take areas) are well documented, including an increase in the diversity, density, biomass, body size and reproductive potential of many species (particularly key fisheries species) within their boundaries. These areas can also provide fisheries benefits to surrounding areas, through the export of eggs, larvae and adults to other reserves and fished areas. Flow-on benefits for the region's subsistence and artisanal fisheries are critical, considering their contribution to livelihoods and food security.

Use of marine protected area networks as a management tool in accordance with the design principles presented here can maximize such benefits and deliver positive outcomes for fisheries and biodiversity conservation on multiple scales.

Design Principles

If well designed and effectively managed, marine protected area networks can be an effective tool for achieving multiple objectives. **The following are 15 biophysical principles for designing marine protected area networks to achieve fisheries, biodiversity and climate change objectives simultaneously.** There are often information gaps and socio-economic, cultural, political and other reasons that can prevent the full application of all of these principles. When required to compromise, managers should aim to achieve as many as possible in the order presented below.

1. **Prohibit destructive activities throughout the management area** (e*.g. blast and poison fishing, spearfishing on scuba, bottom trawling, gill netting, coral mining, fishing on hookah, and night time spearing).*

2. **Represent 20-40% of each habitat in no-take areas.** *If fishing pressure is high and the only protection offered is no-take areas, then the proportion of each habitat in no-take areas should be 30-40%. If effective fisheries management is in place outside of no-take areas, or if fishing pressure is low, then lower levels of protection (20%) can be applied.* **Include habitats that are connected through movement patterns of key species.**

3. **Replicate protection of habitats** *by including at least three widely-separated examples of each habitat in no-take areas.*

4. **Ensure no-take areas include critical habitats**, i*ncluding important aggregation sites (e.g. spawning, feeding and nursery areas).*

5. **Ensure marine protected areas are in place for the long-term (20-40 years), preferably permanently.** *This applies to all types of marine protected areas, including no-take areas and areas with other fisheries restrictions.*

6. **Create a multiple use marine protected area that is as large as possible** *that includes, but is not limited to, no-take areas.*

7. **Apply minimum sizes to marine protected areas,** *depending on key species and how far they move, and if other effective marine resource management methods are in place (see Latest Science above).*

8. **Separate no-take areas by a variety of distances from 1 to 20 km (with a mode of ~1-10km).**

9. **Include an additional 15% of key habitats in shorter-term no-take areas***, including seasonal, rotational or other temporally variable zones.*

10. **Locate marine protected area boundaries both within habitats and at habitat edges**, *depending on management priorities, local knowledge and the geography of a site.*

11. **Have marine protected areas in more square or circular shapes**, *subject to considerations of compliance.*

12. **Minimize and avoid local threats** *by choosing areas for protection that have been, and are likely to be, subjected to lower levels of damaging impacts.*

13. **Include resilient sites in no-take areas**, *including areas most likely to survive climate change impacts (refugia).*

14. **Include special or unique sites** e.g. habitats that are isolated or important for rare and threatened species (e.g. *turtle nesting areas).*

15. **Locate more protection upstream** *if connectivity patterns are unknown, and currents are known, strong and consistent. If currents are not known or consistent, then this principle does not apply.*

The scientific rational for each of these principles is provided in Fernandes et al 2012 and Green et al 2013.

Implementation

These biophysical design principles will need to be refined in each location based on local knowledge regarding the characteristics of each area. The capacity to apply these principles will also vary according to the availability of local information and expertise. While it may not be possible to apply all of these principles in each location, practitioners should aim to apply them as far as their constraints allow. These principles should also be used in combination with important social, economic and political considerations that take the needs and interests of local communities and other stakeholders into account.

In general, marine protected area networks function more effectively within a broader management framework such as an Ecosystem Approach to Fisheries Management. In particular, fisheries objectives can be achieved more effectively if marine protected areas are integrated with other fisheries management tools. It is hoped that these principles will be used to improve the contribution that marine protected area networks can make to a more integrated approach to fisheries management.

Technical Assistance

For further advice and technical assistance regarding the design principles and their application, please contact:

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Credits:
Cover photo: 'School of Fish' © Tomo.Yun (www.yunphoto.net/en/).
Photo of 'Local fishermen, Papua New Guinea' © R. Hamilton, TNC.
Figure 1: Gombos et al 2013

Further Reading

- ✓ Fernandes, L., Green, A., Tanzer, J., White, A., Aliño, P.M., Jompa, J., Lokani, P., Soemodinoto, A., Knight, M., Pomeroy, B., Possingham, H., Pressey, B. 2012. **Biophysical principles for designing resilient networks of marine protected areas to integrate fisheries, biodiversity and climate change objectives in the Coral Triangle**. Report prepared by The Nature Conservancy for the USAID Coral Triangle Support Partnership, 152 pp. Link: http://www.coraltriangleinitiative.org/library/guidelines-biophysical-principles-designingresilient-networks- marine-protected-areas

- ✓ Gombos, M., Atkinson, S., Green, A., Flower, K. (eds.), 2013. **Designing resilient locally managed areas in tropical marine environments: a guide for community based managers.** USAID Coral Triangle Support Partnership: Jakarta, Indonesia. 82 pp.

- ✓ Green, A., White, A., Tanzer, J. 2012. **Integrating fisheries, biodiversity, and climate change objectives into marine protected area network design in the Coral Triangle.** Report prepared by The Nature Conservancy for the USAID Coral Triangle Support Partnership, 105 pp. Link: http://www.coraltriangleinitiative.org/library/guidelines-biophysical-principles-designingresilient-networks- marine-protected-areas

- ✓ Green, A., White, A., Kilarsk, S. (eds.) 2013. **Designing marine protected area networks to achieve fisheries, biodiversity, and climate change objectives in tropical ecosystems: A practitioner guide.** The Nature Conservancy and the USAID Coral Triangle Support Partnership, Cebu City, Philippines. viii + 35 pp.

- ✓ IUCN World Commission on Protected Areas (IUCN-WCPA) 2008. **Establishing Marine Protected Area Networks — Making It Happen**. IUCN-WCPA, NOAA and TNC, Washington, DC. Link: http://www.iucn.org/about/work/programmes/marine/marine_our_work/marine_mpas/mpa_publications.cfm?uNewsID=2131

- ✓ PISCO 2007. **The science of marine reserves**. Second ed. International vers. Technical Report. PISCO, Oregon State University, Stanford University, University of California Santa Barbara and Santa Cruz, California. Link: http://www.piscoweb.org/publications/outreach-materials/science-of-marine-reserves-0