Designing Effective Locally Managed Areas in Tropical Marine Environments

A Facilitator's Guide to Help Sustain Community Benefits Through Management for Fisheries, Ecosystems, and Climate Change

CORAL TRIANGLE INITIATIVE
ON CORAL REEFS, FISHERIES AND FOOD SECURITY

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The USAID-supported Coral Triangle Support Partnership (CTSP) and its partners have collaborated on a project to provide biophysical principles to help practitioners design networks of tropical marine protected areas (MPAs) to achieve fisheries sustainability, biodiversity conservation, and ecosystem resilience in the face of climate change. CTSP partners have produced four products for different audiences to use:

1. A technical report that provides the scientific basis for this approach. The report provides a scientific review of the literature and 15 biophysical principles for MPA network design. It is available at http://www.coraltriangleinitiative.org/library/guidelines-biophysical-principles-designing-resilient-networks-marine-protected-areas
2. A guide for field practitioners that provides a succinct, graphic, and user-friendly synthesis of the best available scientific information for practitioners who may not have access to, or the time to review, the increasing amount of research literature regarding this issue. It can be downloaded from http://www.uscti.org/uscti/Resources/MPA%20Practitioner%20Guide%20Final%207Mar13.pdf
3. A brief for policy-makers that was designed for use by government departments and senior government officials. It can be downloaded from http://www.uscti.org/uscti/Resources/MPA%20Network%20Design%20Policy_Brief_Final_saveas.pdf
4. This guide, and its complementary booklet, which has been developed to support facilitators in community-based awareness-raising and planning processes that support the design of effective and resilient locally managed areas (LMAs) and LMA networks. Science-based principles from the first and second documents listed above were used to support the development of this guide.

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Table of Contents

APPENDICES

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About This Guidebook

INTRODUCTION

All communities want to live among healthy and abundant natural resources that provide many benefits, including food, income, medicine, and cultural value. However, coastal people throughout the world are now noticing severe impacts to their valuable natural resources, caused by both climate change and local threats. Over time, climate change will intensify the negative impacts from human activities that affect natural resources; for example, pollution from land clearing and declining populations of fish from overharvesting (Parry et al. 2007).

PURPOSE

This guide was developed to help improve the design of Locally Managed Areas (LMAs). Specifically, this guide will support facilitation of community processes for LMAs including:

- Outreach to understand key ecological and social factors that contribute to healthy and abundant resources, and the latest science-based recommendations for managing resources so they are healthy, abundant, and resilient; and
- Planning steps to develop zones and rules for LMAs that will help to build long-term healthy, abundant, and resilient coastal and marine resources.

A complimentary booklet, developed to share directly with community members and stakeholders throughout the process, is called "Designing Effective Locally Managed Areas in Tropical Marine Environments: A Booklet to Help Sustain Community Benefits Through Management of Fisheries, Ecosystems, and Climate Change." It provides the same illustrations, key messages, and zoning and rule recommendations as the Outreach Section of this Facilitator's Guide. The booklet does not provide detailed facilitation instructions for outreach activities or specific steps on how to carry out zoning and rule development.

This Facilitator's Guide is designed for use by small planning teams consisting of people from communities, agencies, and organizations that normally facilitate stakeholders through community based planning and implementation processes. Stakeholders include community leaders; community members who utilize or depend on coastal and marine resources; and/or agencies and organizations that have jurisdiction over or a supporting role in these areas. The guide can be used in areas that already have an LMA and want to improve its effectiveness and resilience, or as part of the design process for a new LMA or network of LMAs (see Figure 1).

This guide supports communities to undertake ecosystem-based adaptation (EBA) to climate change. EBA is defined by the Convention on Biological Diversity (CBD) as the "use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change" (CBD 2010). As further elaborated by Conference of the Parties to the CBD Decision X/33 on biodiversity and climate change, this definition also includes the "sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities" (CBD 2010). For coastal communities, opportunities—such as this guide—that improve management and maintain (or improve) the resilience of critical ecosystem services help people and communities adapt to the negative effects of climate change through EBA.

KEY CONCEPTS

Locally Managed Areas

This document focuses on supporting Locally Managed Areas (LMAs), which we define as all area of coastal lands and marine water that are managed by a local community and, where appropriate, in collaboration with government or non-governmental organizations. LMAs can also include areas managed by local governments in collaboration with local stakeholders. This definition was developed to be inclusive of other commonly used terms for this type of locally based management, including:

- Locally Managed Marine Areas (LMMAs);
- Territorial Use Rights in Fisheries (TURFs);
- Community Based Resource Management (CBRM); and
- Community Managed Marine Areas (CMMAs).

LMAs can be a tool for any or all of the following: fisheries management, biodiversity conservation, threatened species management, ecotourism development, and climate change adaptation.

No-Take Fishery Replenishment Zones

For most communities, one important purpose of management is to replenish and maintain the population and diversity of priority fisheries species so they increase and sustain catch, along with other benefits. This booklet highlights the importance of No-Take Fishery Replenishment Zones as a tool to be used within LMAs to help improve and sustain community fishery benefits.

For the purposes of this booklet, a No-Take Fishery Replenishment Zone is a zone within an LMA in which the taking of all plants and animals is prohibited for the long term (more than 20 years) or, preferably, permanently. These zones are also often referred to as "no-take areas" or "no-take zones."

Throughout the booklet, we use the term Fishery Replenishment Zone (FRZ) as a shorthand that emphasizes the primary purpose of these zones. These are areas that the community has agreed to set aside. In tropical marine environments, these are one of the most effective tools used for improving fish populations and catch. They can be effectively combined with many other types of fisheries regulations, rules, and zones to create healthy and effective LMAs that benefit communities in the long term.

Resilience

The booklet focuses on supporting local communities to improve and maintain the long-term health and abundance of marine resources that support coastal people. This is often referred to as "building resilience" to climate change and other threats. A social or natural system is resilient when it is able to successfully survive, adjust to, or recover from an event that causes stress or damage. Stress or damage can come from human activities, such as destructive fishing; from natural events, such as earthquakes and storms; and from climate change impacts, such as increasing sea and air temperatures. A strong and healthy system is likely to recover more quickly than an unhealthy system; in other words, a healthy system tends to be more resilient than an unhealthy system.

This is similar to the way that people respond to disease. Take, for example, two people who have the flu. If one person's immune system is already weak and unhealthy, he or she is likely to have a more difficult time recovering. The healthier of the two people is likely to recover more quickly. This person is said to be more resilient to the flu. In nature, take the example of two areas of coral reef that both bleach due to exposure to hot water. If one area recovers more quickly, this area is considered to be

more resilient to heat stress. Certain factors lead to resiliency in natural or human systems, promote long-term health, and encourage proper functioning. Maintaining good ecosystem health helps a system to be more resilient.

A growing number of communities are taking action to protect themselves against both local threats and climate change impacts. By planning for future changes and reducing negative impacts from local threats, communities are improving the overall health of their resources and ecosystems. This in turn helps them to become more resilient. Put simply, keeping resources healthy and abundant helps to keep them resilient.

DOCUMENT CONTEXT

Several approaches and guides are available to help in the establishment of LMAs. For example, the Locally Managed Marine Area (LMMA) Network provides excellent documents to support LMA planning and management processes (http://www.lmmanetwork.org/resourcecenter). Since this document is focused primarily on supporting the development of zones and rules for an area, it should be used in conjunction with a full process to establish and manage LMAs. This may include a management planning or Ecosystem Approach to Fisheries Management (EAFM) planning process. It is particularly important to ensure that a proper stakeholder analysis has been completed and that community engagement efforts are thorough. It is also important to establish legal authority for zoning and rule making. Where appropriate, approval from the local and/or national government should be sought. Figure 1 highlights when the process of LMA zoning and rule development generally occurs during LMA development, site planning, or EAFM planning.

If individual LMA's zoning and rules are well-designed, each can contribute to the long-term health and resilience of local areas as well as larger areas around it. Individual effective and resilient LMAs can be linked in networks of resilient LMAs as part of an EAFM planning process. This, in turn, can contribute to larger management frameworks like Fisheries Management Units (FMUs), National Networks of Marine Protected Areas, and Large Marine Ecosystems.

Phase 1: Initial Assessment and Getting Organized

- Community request and commitment to planning.
- Identify team and facilitators.
- Define broad goals and strategies.
- Identify and consult with stakeholders (courtesy calls, meetings).
- Develop a planning timeline (preliminary work plan).
- Review basic information about management plans and the planning process.
- Preliminarily determine the legal basis for management.

Phase 2: Stakeholder Engagement

- Assess stakeholder interest and commitment.
- Engage stakeholders through community organizing.
- Execute awareness-raising and empowerment activities.
- Engage in social marketing.

Phase 3: Design and Plan the LMA Using a Consultative Process

- Map the site and surroundings.
- Identify, prioritize, and map natural resource targets.
- Identify problems and solutions (issues) using a consultative process.
- Prioritize the threats.
- Develop goals and objectives (including desired benefits from the LMA).
- **Develop zones and rules to meet the goals and objectives**
  - Provide outreach to support the development of zones and rules. Include what species and ecosystems need to remain healthy, and incorporate climate change concepts.
  - Review and refine the benefits the community wants from the LMA.
  - Define the area of the LMA.
  - Map resilience features.
  - Collect social and ecological information to support effective and resilient LMA design.
  - Balance the community's needs and ecological needs to design an effective and resilient LMA.
- Identify management activities.
- Complete and formally adopt the management plan.
- Identify financing mechanisms.

Phase 4: Implementation and Monitoring of the Plan

- Establish conflict management mechanisms.
- Implement activities in the plan.
- Develop communication, education, and outreach materials about the plan, zones, and rules.
- Develop a plan to monitor the site's progress in implementing the plan.

Phase 5: Ongoing Adaptive Management

- Implement the plan.
- Monitor the progress of implementation.
- Adaptively manage the plan and the project.
- Scale up to include surrounding sites and LMA networks.

This guide can be used at the point during an LMA development or management planning process when the group is ready to develop zones and rules to achieve their objectives.

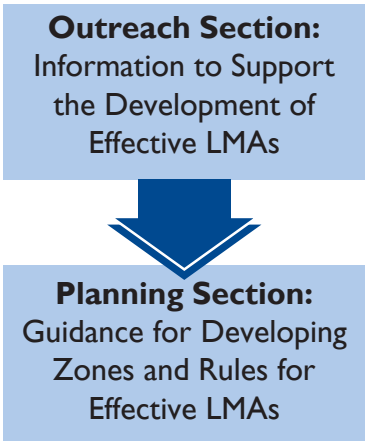
This guide will specifically help the group to understand ecological and social factors that must be considered in the design of zones and rules to support healthy, abundant, and resilient resources for long-term community benefit.

Figure 1. A general LMA development / EAFM management planning process.

DOCUMENT STRUCTURE

This guidance document is divided into an Outreach Section and a Planning Section. Each section includes several sessions. Most sessions include:

- Flip chart illustrations that show key social and ecological concepts needed to increase the abundance and resilience of marine resources (in the Outreach Section only);
- Key messages that describe the meaning of each flip chart page (in the Outreach Section only);
- Facilitation instructions that explain how to lead activities with a community; and
- Group exercises to help the community better understand the key messages or develop rules and zones for its LMA.



Many communities may already have their own methods for LMA zoning and rule making. While we encourage the continued use of these methods, we recommend that practitioners review the Planning Section of this guide to determine if the existing processes can be modified to better support the Nine Essential Factors and Nine Essential Zoning and Rule Recommendations from the Outreach Section.

For communities that do not have an LMA zoning and rule-making process, the Planning Section provides a series of sessions that groups can follow to design an effective LMA that benefits the community. Community facilitators should modify the process to best meet the community's needs and to integrate the process into previous or ongoing planning processes.

Outreach Section: Information to Support the Development of Effective LMAs

- **Session One:** What Are the Benefits of Being a Healthy Community in the Face of Major Threats Including Climate Change? - This session describes the benefits provided by healthy and abundant resources, as compared to unhealthy resources. It also provides information about climate change and its potential impacts to natural and social systems. It summarizes that one of the best ways to limit the overall impacts of climate change on both nature and people is to ensure that marine resources remain healthy and abundant.
- **Session Two:** How We Can Use LMAs to Maintain Healthy Communities? - This session provides a description of LMAs and how they can help support healthy communities.
- **Session Three:** What Do Resources Need to Remain Healthy and Abundant? - This session provides an overview of the basic needs required by marine resources to remain healthy and abundant, and thus support community benefits over time. It also thoroughly explores Nine Essential Factors that must be considered to ensure that the needs of marine resources are met.
- **Session Four:** What Zones and Rules Can Be Used to Address the Essential Factors in Your LMA? - This session describes different types of rules and zones that can be used in LMAs. It also summarizes Nine Essential LMA Zoning and Rule Recommendations that can be used to create zones and rules that support the Nine Essential Factors, and in turn help to maintain community benefits.

Planning Section: Guidance for Developing Zones and Rules for Resilient LMAs

People who will be involved in the planning process should first go through the Outreach Section. The Outreach Section provides critical information participants will need during the Planning Section. This is especially true for leaders within the group.

- **Session One:** Defining the Benefits the Community Wants From the LMA – This session helps the community define specific benefits they want to receive from its LMA. This will help to determine the best options for developing rules and zones.
- **Session Two:** Mapping the LMA – This session will provide a visual tool for the community to use when deciding what rules and zones to apply to the LMA. The exercise creates a base map that shows the various marine resources, their condition, and features that are important for developing zones and rules for an effective LMA.
- **Session Three:** Characterizing and Mapping Natural Resource and Social Targets – This session guides the community to collect specific information needed to develop the best rules and zones to support healthy, abundant, and resilient natural resources that benefit the community.
- **Session Four:** Developing Zones and Rules for the LMA to Provide the Greatest Community Benefits – This session provides guidance for working with the community to develop rules and zones that provide the benefits community members desire. An effective LMA utilizes rules and zones that will increase the ability of target resources, ecosystems, and communities to cope with, adjust to, and recover from external stresses and disturbances caused by climate change and other threats.
- **Session Five:** Ensuring That the LMA Uses the Nine Essential Zoning and Rule Recommendations – This session reviews the LMA's proposed zones and rules relative to the Nine Essential Zoning and Rule Recommendations to determine if the team needs to modify anything to improve the chances of reaching the desired benefits.
- **Session Six:** Incorporating the LMA Zones and Rules Into the Management Planning Process – This session helps the planning team integrate the new rules and zones into existing management plans or other community plans.

If an LMA planning team chooses to work with other local communities to create a network of effective LMAs, they can use Appendix A. An effective and resilient LMA network is an area of coastline and associated resources that spans across several communities and includes several individual effective and resilient LMAs. Each local community, in collaboration with government or nongovernmental organizations, manages individual LMAs within the network. However, individual LMAs are ecologically linked and are designed and managed to increase ecological and social benefits through partnerships or formal agreements with other LMAs in the area. LMA networks also increase the resilience of the whole coastal ecosystem.

STAKEHOLDER ENGAGEMENT

Before beginning the process of designing zones and rules for an LMA, all major stakeholders who will be impacted by management decisions should be involved. A stakeholder assessment or analysis should have been completed at some point through the LMA development, management planning, or other planning process. Before beginning this LMA zoning and rule-development process, revisit the stakeholder assessment and determine how you will include the stakeholders. Before each activity, always ask, "Are the right people to make these decisions in the room?"

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OUTREACH SECTION: Information to Support the Development of Effective LMAs

SESSION ONE:

WHAT ARE THE BENEFITS OF BEING A HEALTHY COMMUNITY IN THE FACE OF MAJOR THREATS INCLUDING CLIMATE CHANGE?

FEATURES THAT CONTRIBUTE TO A COASTAL COMMUNITY BEING HEALTHY AND ABLE TO PROVIDE BENEFITS

FEATURES THAT CONTRIBUTE TO A COASTAL COMMUNITY BEING UNHEALTHY

You will begin this session with a group activity. Read the key messages and facilitation instructions below before showing Flip Charts 1 and 2 to the group.

Key Messages From Flip Charts 1 and 2

Communities can receive the following benefits from a healthy coastal environment:

- Food from marine resources
- Income from the sustainable catch and collection of marine resources
- Opportunities for other income from nature-based tourism
- Ability to continue cultural practices and values
- Healthy quality of life from clean water and healthy food sources

The following features contribute to a community being healthy:

a. **Healthy coastal vegetation, mangroves, and beaches** protect against storm surges; stabilize the coastline and slow rates of erosion; help prevent salt spray from getting inland to crops and homes; provide feeding grounds, nursery areas, and habitat for important fish and invertebrates; and trap sediment from land and prevent it from getting onto the coral reef.

b. **Healthy seagrass beds** provide critical habitat, breeding grounds, nursery areas, and food for important fish and other marine life; trap sediment from land, improving water clarity and preventing sediments from getting onto the coral reef.

c. **Healthy coral reefs** buffer against storm surges by breaking wave energy, and provide nursery areas, habitat, and food for important fish, invertebrates, and other marine life (e.g., turtles and marine mammals).

d. **Healthy upland areas and watersheds** (including intact native forests, sustainable agriculture, sustainable forestry, and water management) provide benefits such as reduced erosion and sedimentation, increased soil fertility, and protection of freshwater.

e. **A community's healthy resources contribute to the livelihood and health of community members.** Healthy people are able to practice their culture and have pride in their community. Homes are safe from storms and landslides. People have access to safe drinking water. Healthy food is available through agriculture and fishing. A strong economy includes several sources of income (fishing, agriculture, tourism, and small business).

f. **If resources are healthy and intact, they have a better chance of surviving or recovering from the impacts of climate change and other threats. This is called "resilience." Therefore, healthy resources are more resilient resources.**

The following factors contribute to a community being unhealthy:

a. Many local threats can negatively impact natural systems. These include:
   - Overfishing and/or destructive fishing (e.g., blast fishing, poison fishing, spearfishing on SCUBA, bottom trawling, long lining, gill netting, coral mining, fishing on hookah, and night-time spearing);
   - Poorly planned coastal development; and
   - Land-based sources of pollution (e.g., trash, sediment, chemicals, sewage).

b. Communities are not able to receive the same levels of sustainable benefits from an unhealthy coastal and marine environment as they do from healthy environments.

c. Unhealthy coastal and marine ecosystems and resources are not able to function properly. When one area of a natural system is damaged, the benefits that area provides to the community and other natural systems will be lost.

Facilitation Instructions for Flip Charts 1 and 2

1. Before you show the flip charts, have the group complete the following activity. On flip chart paper, create two vertical columns. Write "healthy and benefits" at the top of one column, and write "unhealthy" at the top of the other. Ask the group to list the features that contribute to a coastal community being healthy and what benefits those features provide to the community. Write the group's answers on the flip chart paper. Then ask the group to list the features that contribute to a coastal community being unhealthy, and write the group's answers on the flip chart paper.

2. Display Flip Chart 1, the illustration of the community with healthy resources, next to Flip Chart 2, the illustration of the community with unhealthy resources, so that participants can see both illustrations side-by-side.

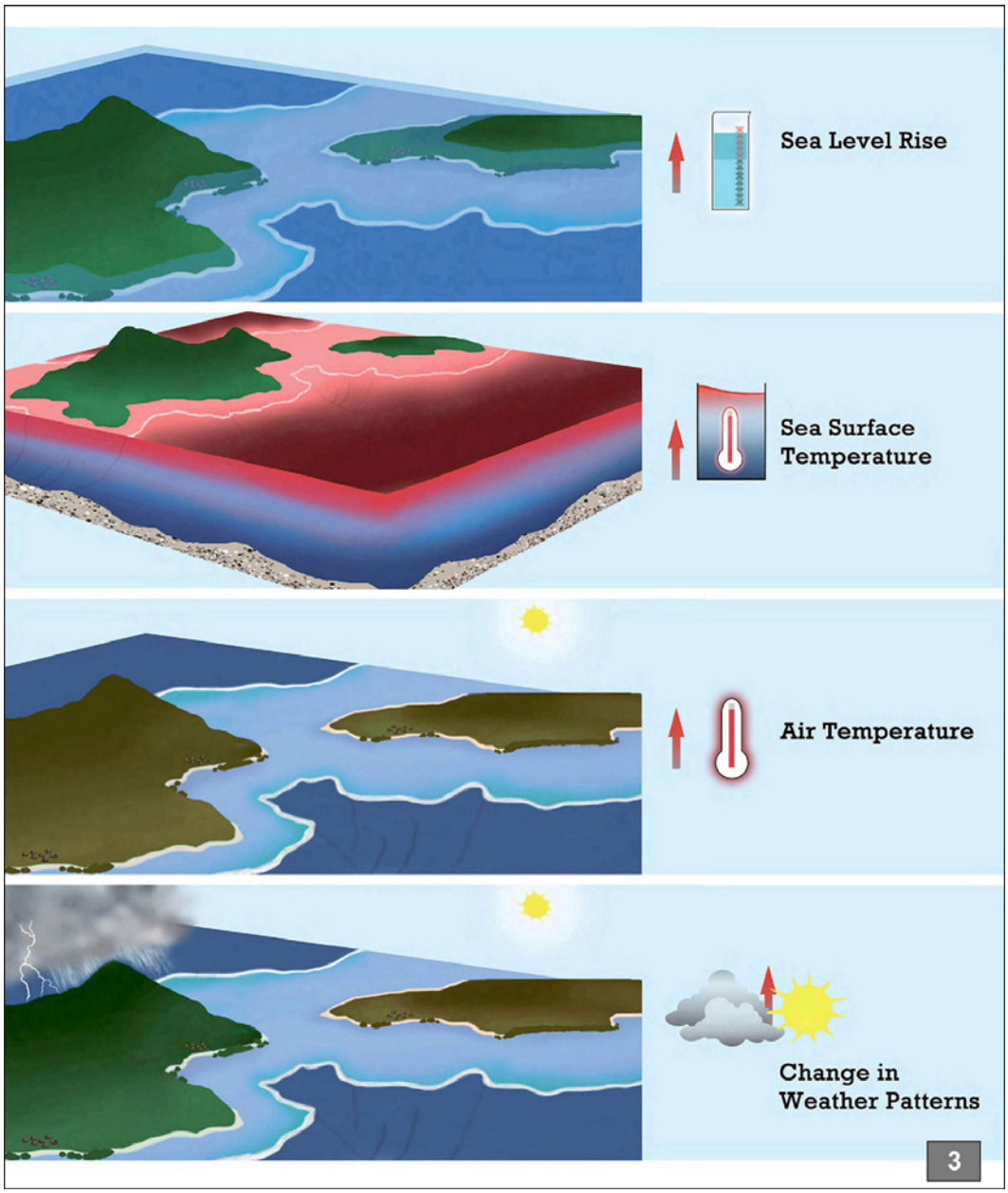
3. Review the flip chart illustrations, noting similarities between the illustrations' key messages and participants' answers in step one of this activity.

4. Explain to the group that before we can understand how the community's resources will be impacted by climate change, we must understand how healthy those resources are now.

5. Tell the group that the way humans use and manage their resources will have significant impacts on the health of the resources. For example, overfishing or habitat destruction will weaken the health of the ecosystem and resources.

6. Explain that the effective LMA process will lead the group to discuss factors that are essential for maintaining healthy and abundant resources that will continue to provide benefits to the community over time.

HOW WILL CLIMATE CHANGE IMPACT OUR COMMUNITY AND ITS RESOURCES?



Key Messages From Flip Chart 3

Climate change is expected to impact coastal communities. It will affect traditional and local uses of natural resources, including livelihoods and food security (e.g., agriculture and fisheries), in addition to community health and safety (e.g., safe drinking water, cultural practices, and infrastructure).

a. Hazards that are considered most significant for tropical coastal communities include the following:

   i. **Higher sea levels** will intensify storm surges, flooding, saltwater inundation and intrusion, and coastal erosion, which can cause loss of and damage to crops, homes, and coastal infrastructure. This leads to health hazards, loss of food and livelihoods, decreased land for living, and interruptions in community services.

   ii. **Higher sea surface temperatures** can change distribution patterns of fish species and cause coral bleaching, which can make corals weaken or die. This can result in a loss of habitat and nursery grounds for fish and marine life. Additionally, this can lead to loss of food, livelihoods, and coastal protection normally provided by healthy reefs.

   iii. **Increased air temperatures** can place stress on plants, crops, and people, which can lead to a loss of food and increased health hazards.

   iv. **More frequent and/or intense extreme events** such as rainfall, storms, and droughts are likely. Storms can cause flooding and landslides, while extreme drought can threaten drinking water, crops, homes, and infrastructure.

b. The impacts from existing threats are likely to increase over time with climate change. If resources are unhealthy, they will be more vulnerable and less likely to survive or recover from the impacts of climate change and other threats (Parry et al. 2007).

c. This is similar to the way that people respond to disease. Take, for example, two people who get the flu. If one person's immune system is already weak and unhealthy, he or she is likely to have a more difficult time surviving or recovering. The healthier of the two people is likely to survive and recover more quickly. This latter person is said to be more resilient to the flu.

d. In nature, take the example of two areas of coral reef that both bleach due to temporary exposure to hot water. If one area is already weak and unhealthy due to local threats, it is less likely to survive the impact of the hot water and will likely recover more slowly than a system that is already very healthy. Both areas will be impacted by the increase in water temperature, but the healthy system is more likely to both survive the impact and to recover more quickly once the water temperature has gone back to normal.

e. Protecting resources now increases the chances of their survival and their ability to meet community needs today and in the future. With or without climate change impacts, healthy resources help communities to be happier and healthier. LMAs can help achieve this.

f. The following table provides a few examples of climate hazards, their impacts, and the actions or situations that increase the impacts (U.S.-CTI 2013). Please note that there are many additional climate hazards. Please refer to specific climate adaptation guidance for more detailed information on climate hazards and impacts.

Hazard	Impact	Threats that aggravate or increase impact
Sea level rise	Coastal erosion from waves	▪ Removal of mangroves, corals, or seagrass beds weakens the coastal area and opens it up to waves. ▪ Building infrastructure upland from critical ecosystems does not provide room for movement inland as sea levels rise.
Increased sea surface temperature	Coral bleaching	▪ Blast fishing, coral mining, overfishing ▪ Runoff of sediments and nutrients

g. Protecting resources while preparing for unknown changes—known as the "precautionary principle"—is the best approach to building long-term community resilience and resource health. With or without climate change impacts, healthy resources help communities to be happier and healthier. LMAs can help achieve this.

Facilitation Instructions for Flip Chart 3

1. Review Flip Chart 3 and its key messages. Point to the associated flip chart picture to discuss each message.

2. If further information about climate change and its potential impacts is needed, many resources are available. Here are two:
   a. "Adapting to a Changing Climate"outreach toolkit:
      i. http://www.cakex.org/virtual-library/3440 - This flip chart describes climate change concepts to communities.
      ii. http://www.cakex.org/virtual-library/3441 - These are facilitators notes to be used in conjunction with the flip chart.
      iii. http://www.cakex.org/virtual-library/3439 - This booklet provides images and abbreviated notes from the flip chart. It was designed to be left with communities.

   b. Climate Change in the Pacific: Scientific Assessment and New Research, Volume 2: Country Reports. http://www.pacificclimatechangescience.org/publications1.html – This book provides climate information and projections for countries of the western Pacific.

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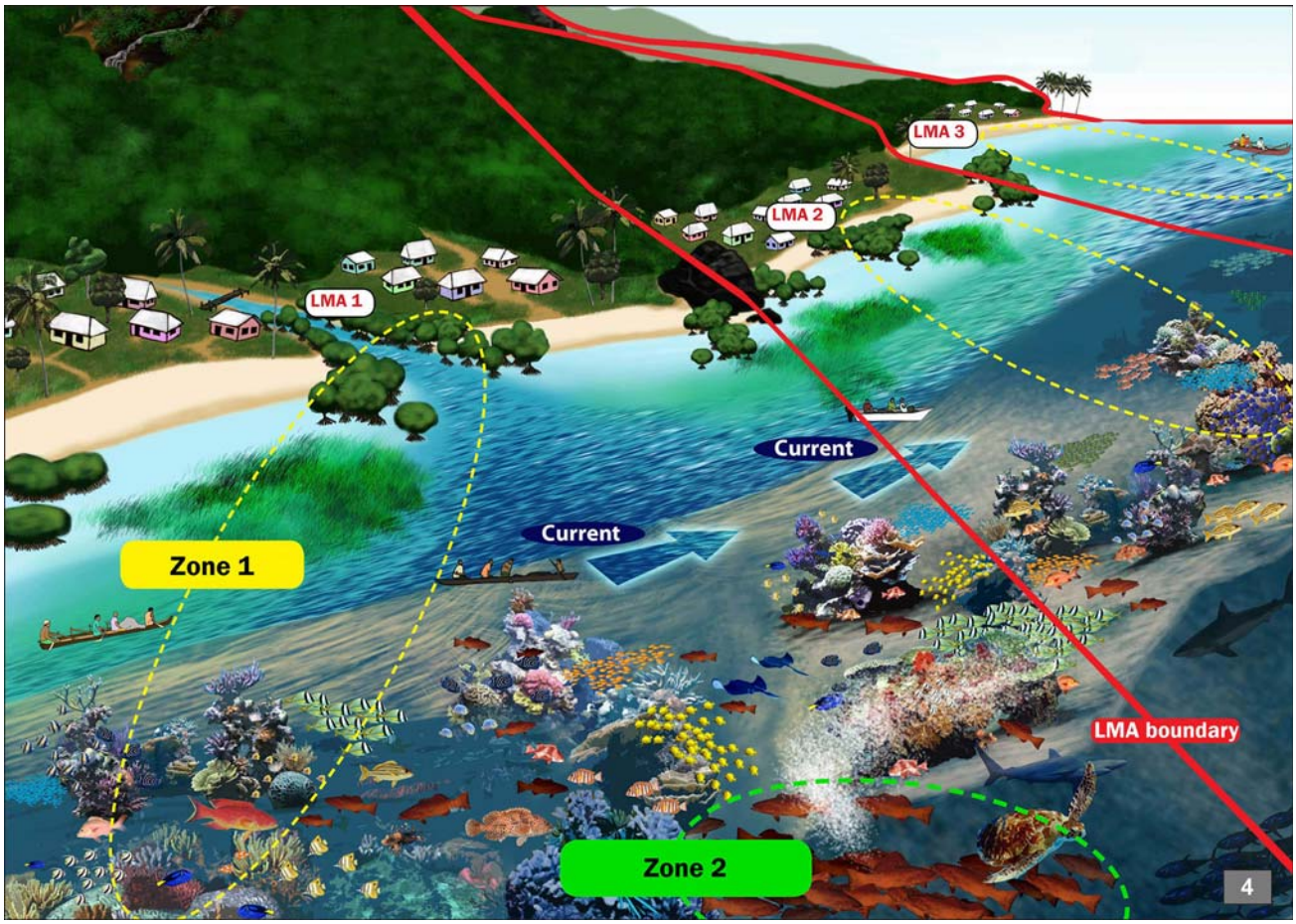
SESSION TWO:

HOW WE CAN USE LMAS TO MAINTAIN HEALTHY COMMUNITIES

LMAs HELP TO MAINTAIN THE LONG-TERM HEALTH AND ABUNDANCE OF COASTAL AND MARINE RESOURCES



Key Messages From Flip Chart 4

a. Establishing LMAs and LMA networks is one of the best ways that communities can maintain the long-term abundance and health of coastal and marine resources. Keeping them healthy and abundant will increase their resilience to climate change and other threats.

b. An LMA is an area of coastal land and marine resources that a community and partner organizations directly manage. It may include fisheries management rules and zones such as gear restrictions that ban destructive fishing practices, zones for limiting take during spawning, bans on clearing mangrove or mining coral, No-Take Fisheries Replenishment Zones (FRZs or no-take zones), and so on.

c. When properly designed and managed, zones and rules inside LMAs provide important species with the healthy habitats and protection that they need to eat, live, grow, and reproduce. Successful reproduction provides an abundance of marine resources. This abundance of resources in one area encourages both adults and larvae to "SPILL OVER" from protected zones to areas where community members can fish and continue to gain sustainable benefits from the zones within the LMMA.

d. Individual LMAs are important for maintaining the health of local natural resources and the community. However, it's also important to know that marine resources are connected to other areas through wind, currents, and the movement patterns of species. The health of one system often depends on the health of nearby and connected systems. Therefore, if you only manage one small area, it can be difficult to protect the system's overall health in the long term.

e. To maintain long-term health, it's important to work with nearby communities to manage larger connected areas through the establishment of LMA networks. These networks support the management of the larger areas needed by many marine species to eat, live, grow, and reproduce. Additionally, if one area is heavily impacted by a storm or other events, the other areas may help the affected area to recover.

Facilitation Instructions for Flip Chart 4

1. Review Flip Chart 4 and its key messages.

2. Explain that a single LMA can help build the resilience of local natural resources and the community by improving the health of these resources. However, local resources are connected to other areas through wind, currents, and the movement patterns of species. Therefore, the health of one system often depends on the health of nearby and connected systems. It can be difficult to protect all of the important habitats needed to maintain long-term health if you only manage one small area.
   a. Even if the fisheries in one community are healthy, they are affected by the way nearby communities manage resources. If nearby communities use destructive fishing methods or overfish their areas, for example, this may have negative long-term impacts on the healthy community. Therefore, it is important to try to work with nearby communities to keep a larger area healthy. If one area is heavily impacted by a disturbance, the other areas may help the impacted area to recover. This is what it means to develop a network of effective LMAs.
   b. Each individual LMA contributes to the long-term health and resilience of local areas as well as larger areas around them. Individual effective and resilient LMAs can contribute to networks of effective and resilient LMAs, which then can contribute to larger management frameworks like FMUs, National Networks of Marine Protected Areas, and Large Marine Ecosystems.

3. Explain that the rest this guide will provide information about both the Nine Essential Factors that contribute to healthy, abundant, and resilient resources and the Nine Essential Zoning and Rule Recommendations that can support LMAs that maintain healthy resources and communities.

SESSION THREE:

WHAT DO RESOURCES NEED TO REMAIN HEALTHY AND ABUNDANT?

GROUP ACTIVITY: What Do Resources Need to Remain Healthy and Abundant?

Facilitation Instructions

1. Prepare a piece of flip chart paper by creating two vertical columns. At the top of one column, write "Benefits." At the top of the other column, write "Resource Needs."

2. Ask the group to list the benefits they want from the marine environment. Tell the group to be very specific—even listing specific species. Write the group's answers in the appropriate column on the prepared flip chart.

3. Next, ask the group to explain what the resources themselves need to remain healthy and abundant so they can continue to provide those benefits. Ask the group to be specific. Write the group's answers in the "Resource Needs" column on the prepared flip chart paper.

4. Be sure the group has identified and discussed the following four basic needs that are required for marine resources to remain healthy, abundant, and resilient, so they can continue to provide benefits to the community:
   a. **Healthy Habitat** – Habitats are areas that are used by marine species to eat, live, grow, and reproduce. If a habitat used for any one of these functions is damaged, it could have negative impacts to the populations of all species that use that habitat during their life cycles.

   b. **Large Enough Areas of Habitat** – Different species have different movement patterns, both as adults and as larvae. In order to grow into large adults that successfully reproduce in the long term, marine species need a large enough area of habitat to move according to their natural patterns.

   c. **Successful Reproduction** – If a species cannot successfully grow into adults and reproduce, the population will decline over time. If babies or juveniles are removed before they become reproductive adults, there will not be any reproduction to maintain population numbers.

   d. **Effective Management That Provides Community Benefits** – The community must agree to effectively manage its resources. This includes establishing zones and rules that encourage successful reproduction, maintaining large enough areas of healthy habitats, and providing sustainable community benefits. For community members to remain supportive of management, they need to benefit from the management and from the sustainable utilization of their marine resources.

5. Next, explain that you are going to review the Nine Essential Factors that support these needs and that must be considered to keep resources healthy and abundant. Review the list below with the group.

NINE ESSENTIAL FACTORS THAT MUST BE CONSIDERED TO KEEP RESOURCES HEALTHY AND ABUNDANT	
Healthy Habitat	
Essential Factor #1:	Each Species Needs Different Healthy Habitats Where It Can Eat, Live, Grow, and Reproduce
Essential Factor #2:	Some Species Use Different Habitats at Different Times in Their Lives
Essential Factor #3:	Some Areas Survive and Recover Better Than Others
Large Enough Areas of Habitat	
Essential Factor #4:	Some Species Need Bigger Areas Than Others as Adults to Eat, Live, and Reproduce
Essential Factor #5:	Many Fish Larvae Stay Close to Home
Successful Reproduction	
Essential Factor #6:	Successful Reproduction Depends on Location, Numbers, Body Size, and Timing
Essential Factor #7:	Big Females Make More Babies
Essential Factor #8:	Some Species Are More Vulnerable and Recover More Slowly Than Others
Effective Community-Based Management	
Essential Factor #9:	Effective Management That Provides Community Benefits Is Critical

6. Next, explain that the Nine Essential Factors are the basis for the Nine Essential LMA Zoning and Rule Recommendations, which provide specific suggestions on the best ways to develop zones and rules using the latest marine science. Following these recommendations will help to support the Nine Essential Factors and keep marine resources healthy, abundant, and resilient over time, so they can continue to provide community benefits.

7. Tell the group that they will now review each of the Nine Essential Factors more thoroughly.

HEALTHY HABITAT

Essential Factor One: Each Species Needs Different Healthy Habitats Where It Can Eat, Live, Grow, and Reproduce

Key Messages From Flip Chart 5

a. Different species use different habitats for food, shelter, and reproduction, so it is important to protect all types of habitats. The following examples are numbered in accordance with the images on the illustration:

1. Mudshell or mangrove clam
2. Mangrove crab
   Habitat: River mouths, estuaries, and mangroves

3. Ark clams
   Habitat: Mudflats

4. Yellowfin goatfish
   Habitat: Sandy bottoms

5. Sea cucumbers
6. White-spotted rabbitfish
   Habitat: Seagrasses

7. Steephead parrotfish
8. Peacock hind-grouper
   Habitat: Coral reefs

b. Each of these habitats provides food, homes, nursery, and spawning areas for many species of fish and invertebrates.

Management Suggestions

Management should protect all types of marine and coastal habitats, especially those that are utilized by species that are important to the community. Management should prohibit all destructive activities and threats that could damage habitats, such as destructive fishing, and clearing of upland forests and mangroves.

Facilitation Instructions for Flip Chart 5

1. Use Flip Chart 5 to point out the key message examples, showing the different habitats that species use to eat, live, and reproduce. Key messages are numbered to match numbers on Flip Chart 5.

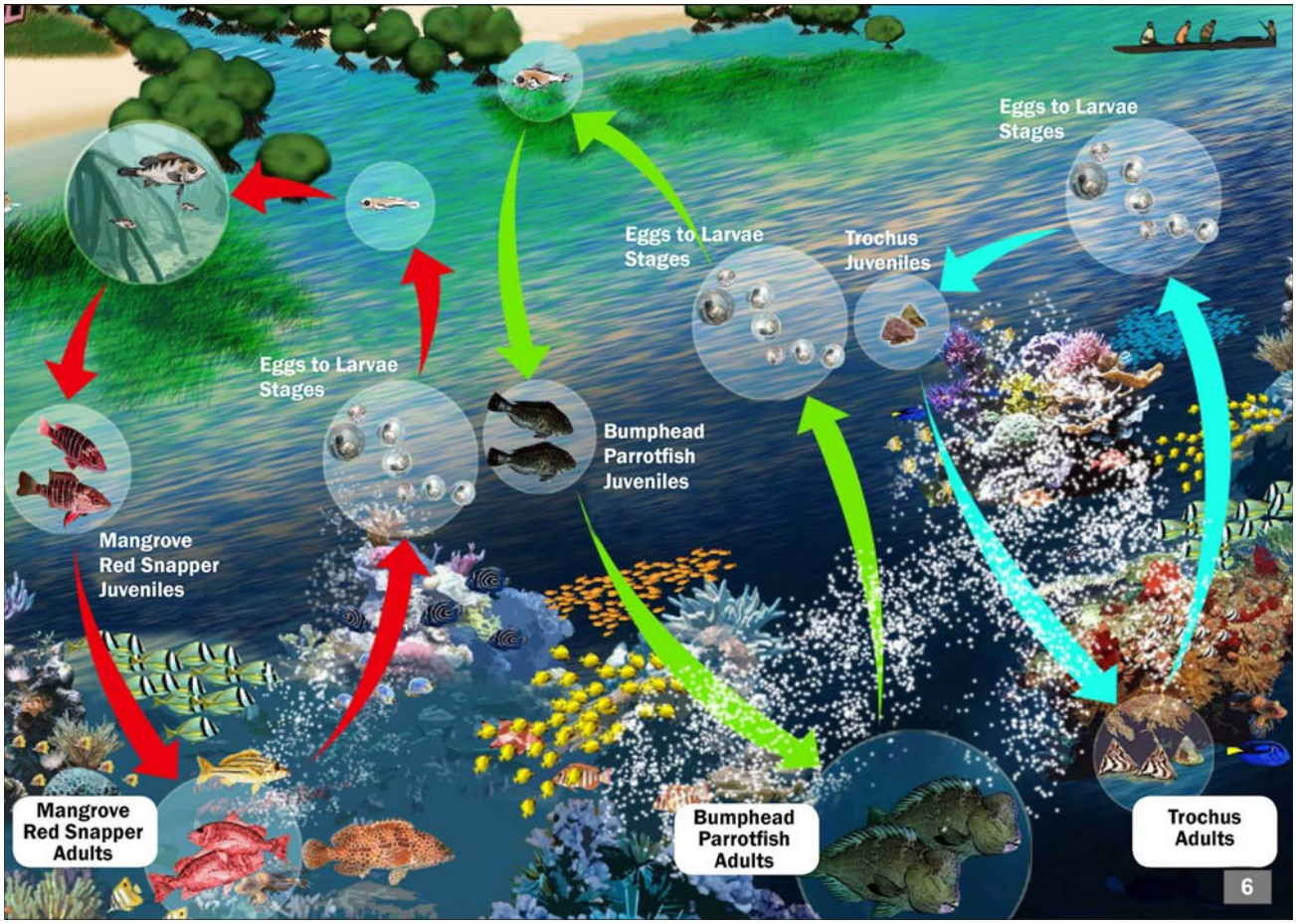
2. Ask the group to discuss what different habitats local fish use.

3. NOTE TO FACILITATOR: If anyone in the group has the complementary booklet and is following along, ask them to close the booklet now. There will be various times throughout the outreach section when you might want to have an open discussion with participants without the booklet so they can think through their answers before reading the suggestions provided. Be aware of this as you move through each session and decide if you want people to close the booklet after reviewing the key messages. To have these discussions, you can use an open forum or ask people to talk in small groups first before calling out their answers. You also can decide if you want to capture this information on flip charts or if you want to just keep it as a discussion without taking notes.

4. With booklets closed, ask the group what the key messages from this flip chart suggest about management.

5. Finally, review the "management suggestions" in this guide and compare the answers provided by the participants. Note if there were any differences and if so, why.

Essential Factor Two: Some Species Use Different Habitats at Different Times in Their Lives



Key Messages From Flip Chart 6

a. Many species use different habitats during different times in their lives, from larvae (babies) to juveniles to adults. It is important that all habitats are healthy, as they are connected by the species that use them throughout their life cycles. If any one habitat is damaged, it could negatively impact all species that use that habitat during their life cycles.

b. Examples of different species that use different habitats at different times in their lives are shown on the illustration and include these:

   1. Mangrove red snapper (Lutjanus argentimaculatus), also known as mangrove jack: Young fish live in mangrove areas, while larger fish usually feed on and live in reef areas (SPC 2011).
   2. Bumphead parrotfish (Bolbometopon muricatum): Juvenile bumpheads use sheltered lagoon habitats and inshore reefs (Aswani & Hamilton 2004).
   3. As bumphead parrotfish grow larger, they move to outer reefs that are more exposed. They also gather to breed on the outer reef fronts and passes (Hamilton et al. 2012).
   4. Trochus: Juveniles settle in coral rubble and then move to more open areas of the reef over time (K. Friedman, personal communication August 12, 2012).

c. Just among these three species, we can see the importance of seagrass, sandy areas, inner reefs, and outer reefs. If any of these habitats are damaged, it could negatively impact all the species that use that habitat at some point in their life cycles.

Management Suggestions

Management approaches should protect all key habitats used throughout the lifecycle of target species. If one community does not have authority to manage all critical habitats for target species, it is suggested that they work with neighboring communities to ensure all the different habitat types are included in management approaches and protected from destructive practices.

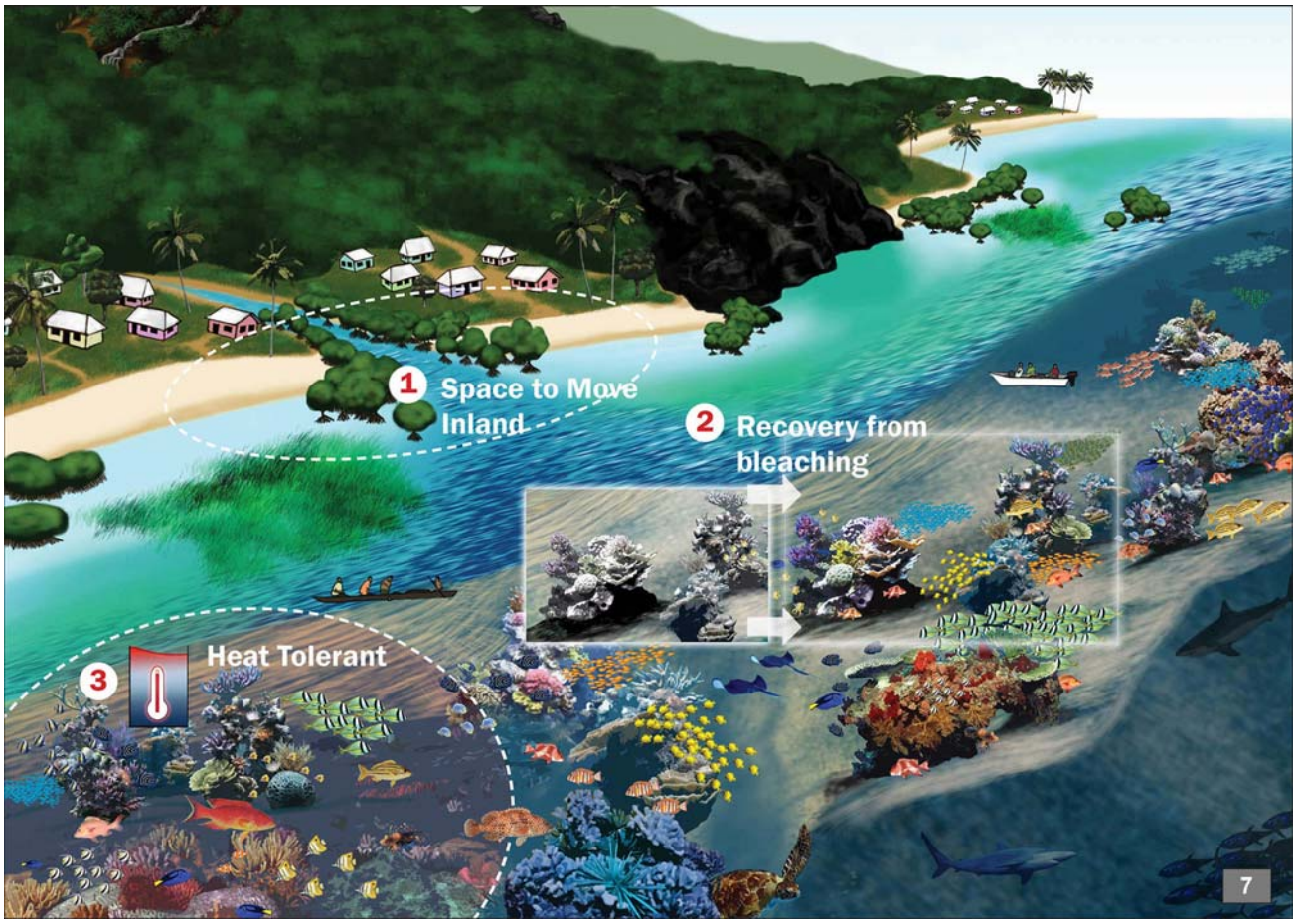
Facilitation Instructions for Flip Chart 6

1. Review Flip Chart 6. Point out the three examples described in the key messages, and explain how the species use different habitats during different parts of their life cycles.

2. With booklets closed, ask the group what the key messages from this flip chart suggest about management.

3. Finally, review the "management suggestions" in this guide and compare the answers provided by the participants. Note if there were any differences and if so, why.

Essential Factor Three: Some Areas Survive and Recover Better Than Others



Key Messages From Flip Chart 7

a. Some areas have characteristics that provide them with a better chance of surviving and recovering from threats, including climate change. These areas are more resilient. Examples shown on the illustration include these:

1. Mangrove forests that have space to move inland (for example, those not blocked by buildings or steep land) and have an adequate supply of sediment may adapt to sea level rise (McLeod & Salm 2006).

2. Ecosystems that have resisted damage or have been damaged repeatedly in the past and have recovered demonstrate resilience. These areas are usually better able to survive future threats.

3. Coral reefs have certain features that indicate resilience to rising sea temperatures (McClanahan et al. 2012) such as:
   - the presence of specific coral species that have demonstrated an ability to cope with stressors such as high temperatures;
   - an ability to live in areas with wide temperature fluctuations throughout the year, which can promote coral tolerance to abnormal temperatures;
   - high rates of successful recovery among young corals that settle and survive following a disturbance;
   - good conditions and limited local threats such as nutrient pollution, sedimentation, physical human impacts (e.g., anchor damage), fishing pressure, high algal cover, and coral disease; and
   - healthy and abundant herbivore populations that help to ensure that algae doesn't overgrow or out-compete corals (Green & Bellwood 2009). Herbivores are fish or invertebrates such as surgeonfish, parrotfish, and urchins that eat the algae that grow on coral reefs. If there are no herbivores to keep algae from growing on coral reefs, the reef can be smothered by fast-growing algae and die. Abundant herbivore populations can keep algae cover low, which provides room for new coral larvae to settle. Over time, this enables corals to recover after a disturbance such as bleaching.

Management Suggestions

It is important to protect areas that have demonstrated good survival or recovery over time or that have features that may be more resilient than other areas. This should include placing these areas in fishery replenishment zones and prohibiting all activities that could disturb or cause any damage to the area (e.g., removal of any coral, sand, or mangrove, or removal of herbivores).

Facilitator Instructions for Flip Chart 7

1. Review the illustration and key messages from Flip Chart 7 with the group. The key messages are numbered to match numbers on the flip chart that illustrate that message.

2. Ask the group if they know of any areas in their community that may survive and recover better based on the key messages.

3. With booklets closed, ask the group what the key messages from this flip chart suggest about management.

4. Finally, review the "management suggestions" in this guide and compare the answers provided by the participants. Note if there were any differences and if so, why.

Essential Factor Four: Some Species Need Bigger Areas Than Others as Adults to Eat, Live, and Reproduce

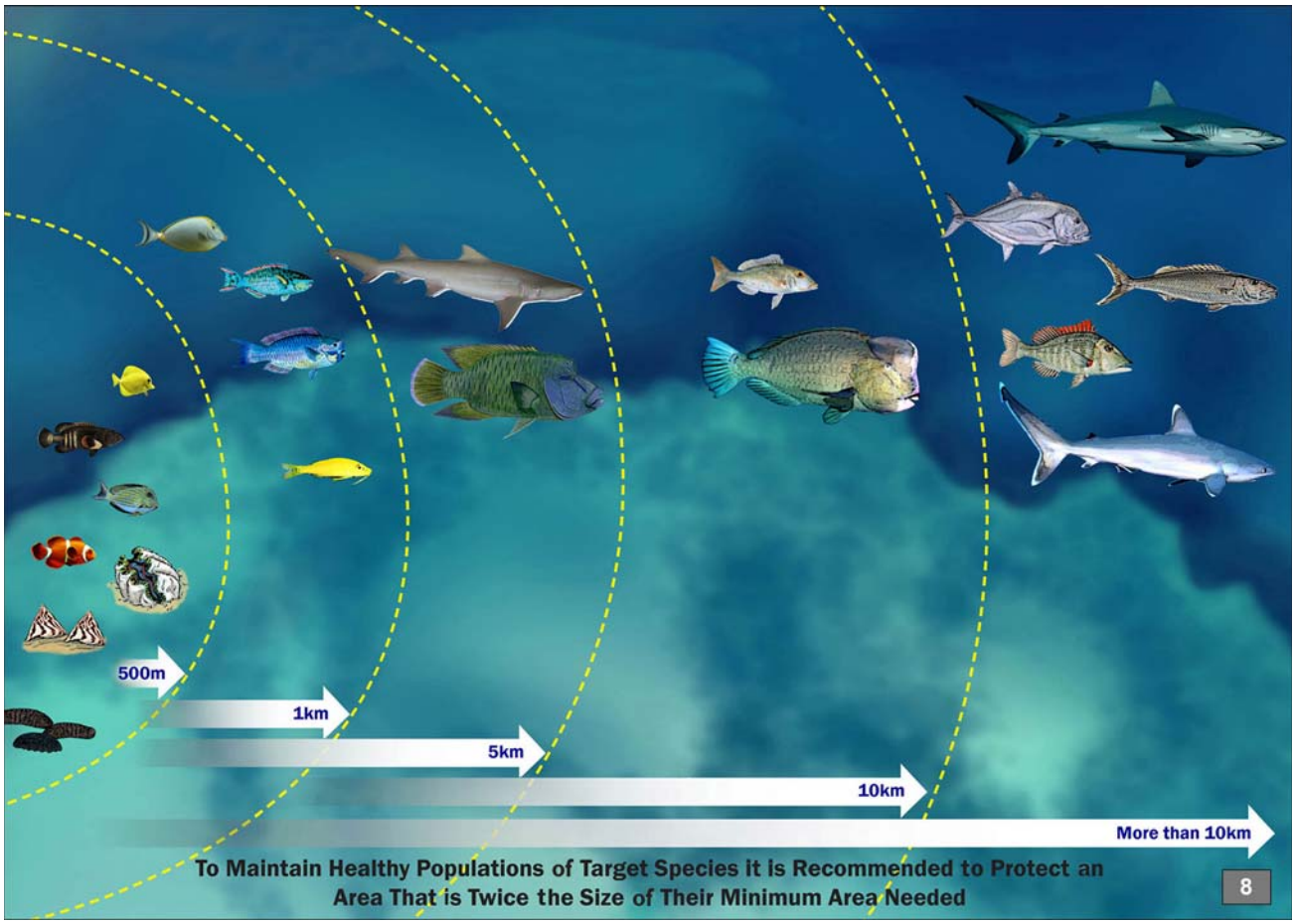


Illustration modified from Maypa (2012).

Key Messages From Flip Chart 8

a. Some species need bigger areas than others as adults to eat, live, and reproduce. The following examples describe how far different species move as adults and juveniles (Maypa 2012; Green et al. 2013). These are just a few examples. Scientists are regularly learning about the area needs of additional species to help guide management decisions.

1. **Very small distances (less than 500 m)**
   - Small groupers
   - Some surgeonfishes
   - Invertebrates (giant clams, sea cucumbers, and trochi)

2. **Small distances (less than 1km)**
   - Some unicornfish
   - Some goatfishes
   - Many parrotfishes

3. **Medium distances (less than 3km)**
   - Humphead wrasse
   - Lemon shark

4. **Large distances (less than 10km)**
   - Bumphead parrotfish
   - Some emperors

5. **Very large distances (less than 20 km)**
   - Some trevallies
   - Large emperors
   - Large reef snappers
   - Other sharks (white tip reef shark, grey reef shark, tiger shark)

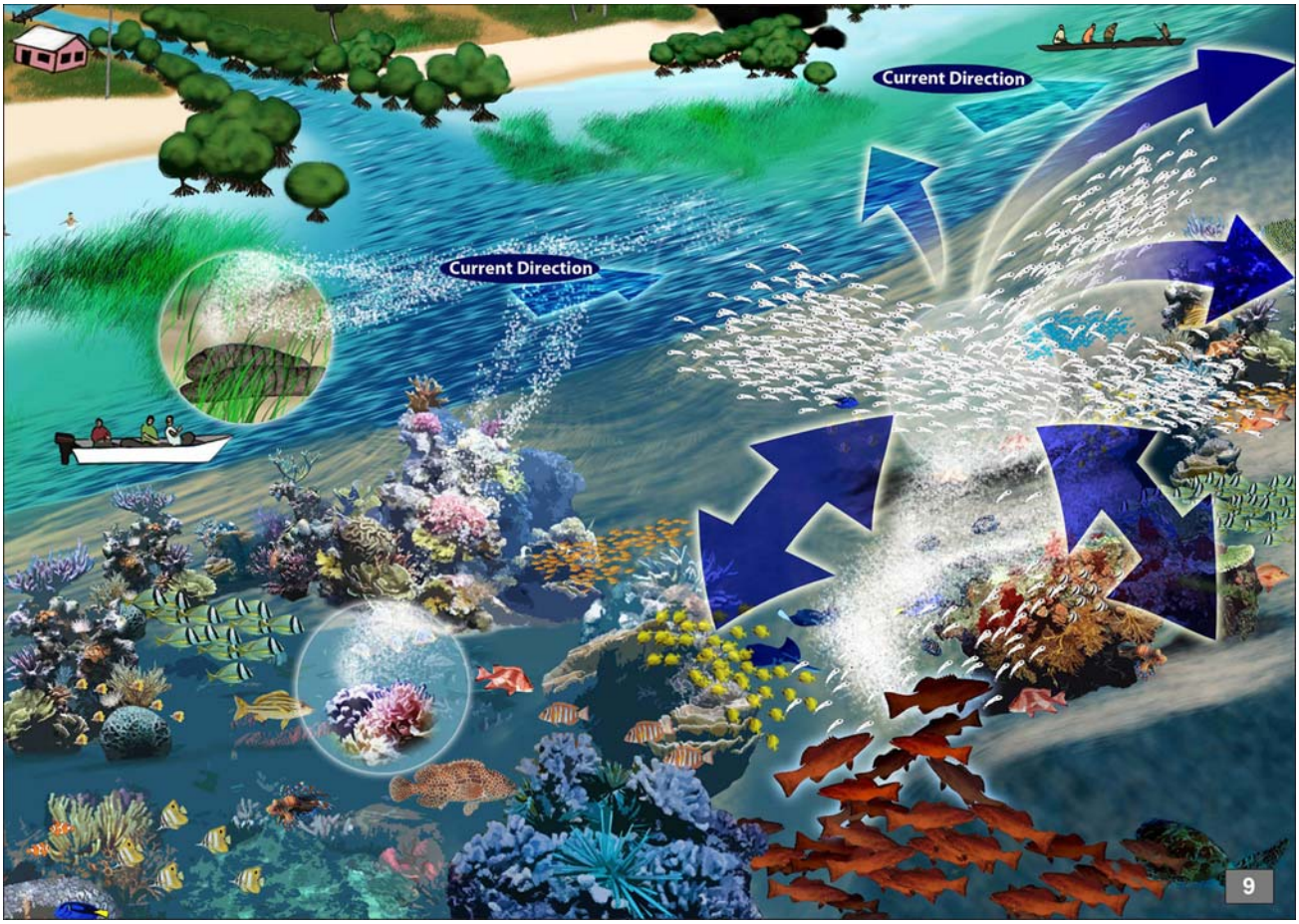
Management Suggestions

It is recommended that LMAs and LMA networks be designed to include no take fisheries replenishment zones that are large enough to ensure that even the largest target species have enough area to eat, move, and reproduce.

Facilitation Instructions for Flip Chart 8

1. Review the illustration, key messages, and examples describing the different sizes of areas needed for different species.
2. With booklets closed, ask the group what the key messages from this flip chart suggest about management.
3. Finally, review the "management suggestions" in this guide and compare the answers provided by the participants. Note if there were any differences and if so, why.

Essential Factor Five: Many Fish Larvae Stay Close to Home



Key Messages From Flip Chart 9

a. Previously, scientists believed that the distance fish larvae traveled before settling was determined mainly by (1) where local currents would take them and (2) how long they spent in the larval phase. As such, it was thought that larvae from locally managed areas would be taken by currents and transported far from the managed area. This could be discouraging since the communities that set up the managed areas felt they might not be receiving much of the benefit from new larvae.

b. However, scientists have recently found that many fish larvae remain close to the areas where they were spawned. When larvae stay close to where they were spawned, they are thought to provide benefits including these:
   - improving local populations of marine resources, because larvae will grow to become fish in the same general area;

- maintaining or improving nearby areas by sharing larvae through currents; and
- helping to replenish damaged or heavily fished areas that are adjacent to a managed area by supplying larvae and fish.

c. For example, a recent study of coral trout (Plectropomus areolatus) at Manus Island in Papua New Guinea measured how far larvae from a single community managed spawning aggregation moved. The study showed that within this community managed area, up to 25 percent of juveniles were produced by the aggregation. Additionally, up to 17 percent of juveniles were from the aggregation in four adjacent tenure areas. Overall, 50 percent of the larvae were believed to have settled within 14 km of the aggregation and contributed to fisheries replenishment up to 33 km away (Almany et al. 2013). As a result, we now see that managed areas do significantly benefit the community that established them because they retain high percentages of larvae, which can grow up to be part of the local fish population.

Management Suggestions

It is important to design LMAs with protected zones that are close together. If the protected areas are too far apart, then they may not be able to replenish or re-seed one another, which creates a bigger risk if there are disturbance events (e.g., storms, bleaching). Communities may need to work with one another to create several LMAs along the coastline (or LMA networks) to ensure that protected zones are close to each other and larvae can move between them.

This also suggests that each coastal community should have its own well-designed LMA so that it can benefit from local management and from the larvae that remain in its area. Since most larvae stay close to home, a community can't expect it will get a lot of fish larvae from other LMAs far away.

Facilitation Instructions for Flip Chart 9

1. Review the key messages from Flip Chart 9 with the group. Be sure to explain that recent science has shown that many larvae from fish remain close to the area where they were spawned. As a result, protecting the resources in the area will benefit the community by resupplying the area with larvae.

2. With booklets closed, ask the group what the key messages from this flip chart suggest about management.

3. Finally, review the "management suggestions" in this guide and compare the answers provided by the participants. Note if there were any differences and if so, why.

4. Tell the group that they will later learn about the "big female" concept: Areas that allow fish to grow larger will provide more and healthier eggs that can become larvae. Many of these larvae will remain close to where they were spawned, providing the community with the benefit of an increased fish population.

SUCCESSFUL REPRODUCTION

Essential Factor Six: Successful Reproduction Depends on Location, Numbers, Body Size, and Timing

Key Messages From Flip Chart 10

a. Successful reproduction is the main factor leading to species abundance over time. To have healthy and abundant populations, species must have the chance to become adults and reproduce. The flip chart illustrates different factors that are important to successful reproduction:
   1. LOCATION: Some species need specific areas to reproduce. For example:
      - Sea turtles use nesting beaches to lay their eggs.
      - Many invertebrates do not move very far (trochus, snails, sea cucumber) or at all (clams, oysters), so they need to live in groups to reproduce successfully. For successful reproduction, adults must be located near one another when they release sperm and eggs.

2. NUMBERS: As many individuals as possible need to grow to be adults and reproduce. If they are removed before they reproduce, they will not contribute to the population. For example:
   - Taking lobsters with eggs eliminates their ability to reproduce. Taking individuals with eggs is prohibited in many areas.

3. BODY SIZE: Different species enter their reproductive phases at different sizes. It is critical that each species is allowed to grow to its reproductive size before it is harvested. For example:
   - Female adult white tip reef sharks (Triaenodon obesus) are not able to reproduce until they reach maturity, usually at 100 centimeters in length and at about eight to nine years of age (Smale 2005).
   - Giant clams (Tridacna gigas) don't produce eggs until they are 50 cm, or about nine to 10 years old. Also, eggs from smaller females don't survive as well as eggs from older, larger females (Munro 1993).

4. TIMING: Some species come together to reproduce at specific times of the year (called a "spawning aggregation"). For example:
   - Many species of snapper, grouper, and other fish come together, or aggregate, during specific times of the year at specific sites to release eggs and sperm. The squaretail coral grouper (Plectropomus areolatus) and the coral trout (Plectropomus leopardus) shown in the illustration aggregate to spawn. This generally occurs at a particular stage in the lunar cycle over a period of months. If adults are harvested during aggregation, they are not able to reproduce successfully (Rhodes & Rhodes 2005).

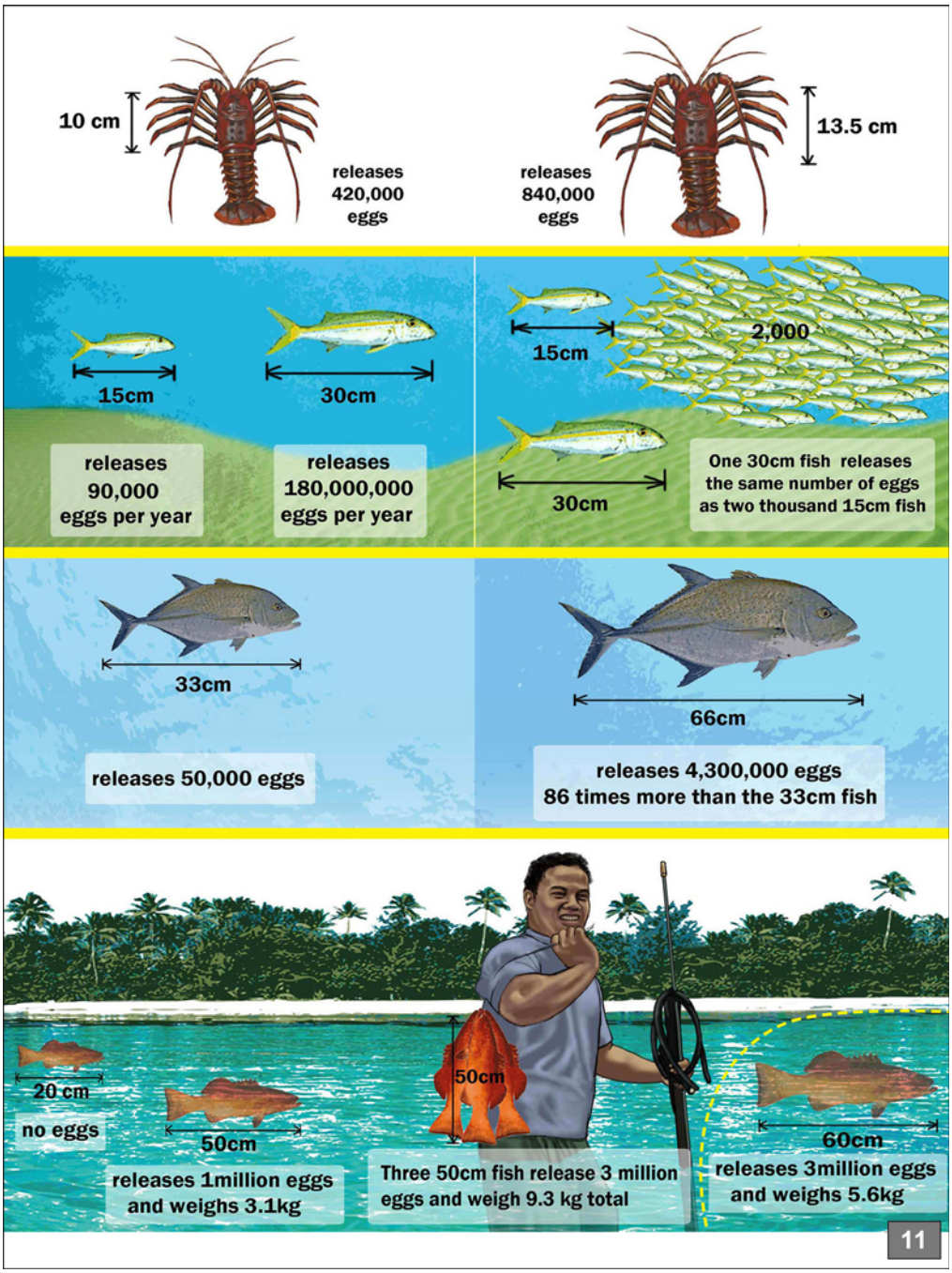
Management Suggestions

Management approaches must take the reproductive needs of each priority species into consideration and make sure that they can reproduce successfully. This can include restricting fishing in certain areas that are important for reproduction and/or at certain times of year when reproduction is happening. It may also include restricting the take of females that obviously have eggs and setting size limits to ensure that young individuals get a chance to reproduce and older large individuals who reproduce the most remain in the wild.

Facilitation Instructions for Flip Chart 10

1. Review Flip Chart 10 and its key messages. Point to the associated flip chart picture to discuss each message.
2. Ask group members if they know of any other examples of what certain species need to successfully reproduce.
3. With booklets closed, ask the group what the key messages from this flip chart suggest about management.
4. Finally, review the "management suggestions" in this guide and compare the answers provided by the participants. Note if there were any differences and if so, why.

Essential Factor Seven: Big Females Make More Eggs



Read the facilitation instructions before showing Flip Chart 11, as you will begin with a group activity. Also ask the group to close any booklets they are using to follow along.

Key Messages From Flip Chart 11

a. Larger individuals are more important than smaller ones for the long-term health and abundance of populations.

b. Large females make many more eggs and healthier eggs than smaller females and so will create more babies and increase populations.

c. It is important to protect target species so they can grow big and reproduce.

Management Suggestions

In addition to allowing target species to grow to be adults and reproduce, management should also consider protecting very large individuals who have the most reproductive power. This can include setting maximum allowable sizes for fishing. Also, one of the most effective ways to do this is to create fishery replenishment zones where the taking of all species is permanently prohibited. This allows individuals in that area to grow very large, reproduce successfully over many years, and provide spill-over benefits to areas where fishing is allowed.

Facilitation Instructions for Flip Chart 11

GROUP ACTIVITY

1. Hide the following pictures on Flip Chart 11 with several pieces of paper:
   - the big lobster's number of eggs;
   - the big goatfish's number of eggs (on the left-hand side of the example);
   - the number 2000 (on the right-hand side of the example);
   - the big trevally's number of eggs;
   - the number of eggs of the small, medium, and big fish; and
   - the weight of the medium and big fish.

2. With the group, review each example below. Ask the group to guess the answers to the questions.
   a. **Example One:** Lobster (Panulirus ornatus)
      - Ask, "How many eggs do you think a 10-cm lobster produces each year?"
      - After the group has offered answers, remove the paper to reveal the correct answer.
        o A 10-cm lobster produces 420,000 eggs annually.

- Ask, "How many eggs do you think a 13.5-cm lobster produces each year? It is only 3.5 cm larger than the smaller lobster."
- After the group has offered answers, remove the paper to reveal the correct answer.
  - The 13.5-cm lobster produces twice as many eggs (840,000 eggs annually) as a 10-cm lobster.
- Say, "With only 3.5 additional cm, you get double the amount of eggs—or double the number of potential new babies" (MacFarlane & Moore 1986).

b. **Example Two:** Yellowfin goatfish (Mulloidichthys vanicolensis)
- Ask, "How many eggs do you think a 15-cm adult female goatfish releases each year?"
- After the group has offered answers, remove the paper to reveal the correct answer.
  - A 15-cm adult female goatfish releases 90,000 eggs once a year.
- Ask the group to guess how many eggs are released each year by a 30-cm adult female—a fish that is double the size of the smaller fish?
- After the group has offered answers, remove the paper to reveal the correct answer.
  - A 30-cm adult female produces 45 million eggs four to five times per year. That amounts to more than 180 million eggs per year.
- Ask the group how many 15-cm goatfish they think it would take to make 180 million eggs per year.
- After the group has offered answers, remove the paper to reveal the correct answer.
  - One 30-cm fish makes the same number of eggs as 2000 15-cm fish. It takes 2000 15-cm fish to equal the reproductive power of just one 30-cm fish.

c. **Example Three:** Blue trevally (Caranx melampygus)
- Ask, "How many eggs do you think a 33-cm blue trevally produces annually?"
- After the group has offered answers, remove the paper to reveal the correct answer.
  - A 33-cm blue trevally produces 50,000 eggs.
- Ask the group to guess how many more eggs a 66-cm fish—a fish that is double the size of the smaller fish—would make.
- After the group has offered answers, remove the paper to reveal the correct answer.
  - One 66-cm fish produces 4,300,000 eggs, or 86 times more eggs than a 33-cm fish half its size (Sudekum et al. 1991).

d. **Example Four:** Coral trout (Plectropomus leopardus)
- Ask, "How many eggs do you think a 20-cm coral trout produces when it spawns?"
- After the group has offered answers, remove the paper to reveal the correct answer.
  - A 20-cm coral trout produces no eggs.
- Ask, "How many eggs do you think a 50-cm coral trout produces and how much it weighs?"
- After the group has offered answers, remove the paper to reveal the correct answer.
  - One 50-cm coral trout can produce 1 million eggs and weighs 3.1 kg.
- Ask, "How many eggs do you think a 60-cm coral trout produces and how much it weighs?"
- After the group has offered answers, remove the paper to reveal the correct answer.
  - One 60-cm coral trout can produce 3 million eggs and weighs 5.6 kg (PISCO 2007).

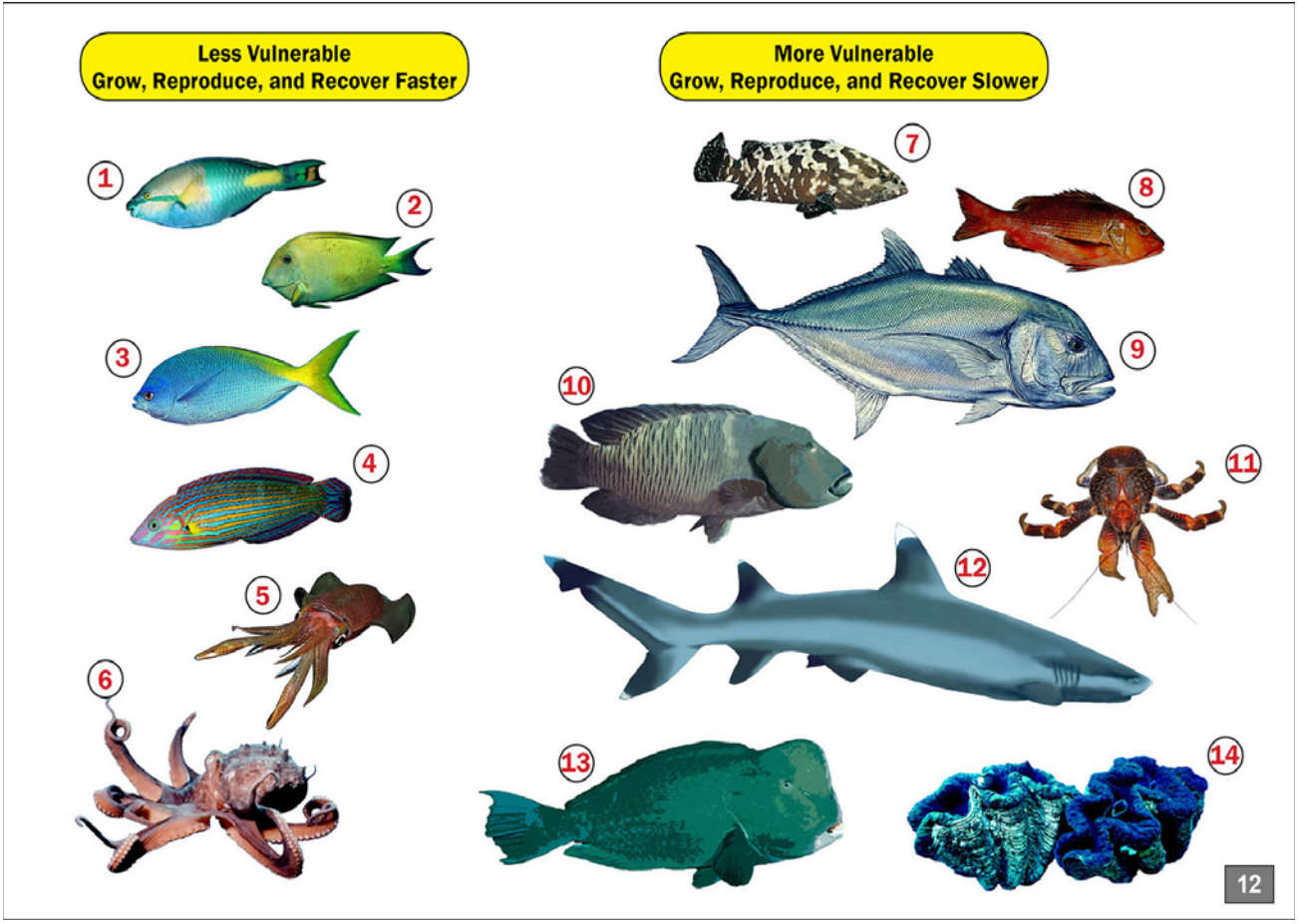
- Say, "You need three of the 50-cm fish to equal the reproductive power of one 60-cm fish." Explain that one 60-cm fish can produce the same amount of eggs as the three 50-cm fish and that the eggs of the 60-cm fish are healthier and have a better chance of surviving to adulthood.
- Ask the group what they think this could mean for a fisherman and his community.
  - After you hear the group's response, be sure to make the point that on Flip Chart 11, the fisherman and his community decided to follow good fishing practices.
  - They created a management zone that allows fish to grow as big as 60 cm or more without being harvested. (Point to the yellow zone boundary that is around the big fish.) They know it makes good sense to leave the 60-cm fish in the system because it will provide high reproductive potential for future generations of fish. This allows the fisherman to take more 50-cm fish from this management zone.
  - They also prohibited the harvest of coral trout that are too small and have not yet reproduced. (Show that the fisherman left the small fish in the water.)
- Now explain the benefits of these management actions:
  - Long-term reproductive potential is high because the management zone keeps big females in the system.
  - This fisherman was able to take three of the 50-cm fish from a fishing area. Although those fish can no longer reproduce and contribute to future generations, the one big female in the management zone has the same reproductive output and can help keep populations abundant.
  - One big fish weighs 5.6 kg, versus three medium fish that weigh a total of 9.3 kg. So this fisherman also got 3.7 more kg of meat from the three fish than if he had taken the one big fish. He can also eat one fish now and store the others for later, share the fish with family members individually, or sell them individually.

3. Review the key messages for Flip Chart 11.

4. Ask the group what the key messages from this flip chart suggest about management.

5. Finally, review the "management suggestions" in this guide and compare the answers provided by the participants. Note if there were any differences and if so, why.

Essential Factor Eight: Some Species are More Vulnerable and Recover More Slowly Than Others



Key Messages From Flip Chart 12

a. Some species are more vulnerable to human disturbances (e.g., fishing) or natural disturbances (e.g., hurricanes, unusually high sea temperatures) than others and take longer to recover from these disturbances.

b. The left side of the illustration shows examples of fish species that tend to be less vulnerable to disturbance and recover more quickly. These species tend to have smaller maximum sizes, don't live as long, grow more quickly, and begin reproducing more quickly. They include most herbivorous fishes, small carnivores, and some planktivores such as:
   - Most small- to medium-sized herbivores
   - Most parrotfishes (e.g., # 1, yellowfin parrotfish, Scarus flavipectoralis)
   - Most surgeonfishes (e.g., # 2, Ctenochaetus striatus)
   - Most fusiliers (e.g., # 3, yellowtail fusilier, Caesio cuning)
   - Small wrasses (e.g., # 4, tail-spot wrasse, Halichoeres melanurus)

c. The left side of the illustration also includes invertebrate species that are less vulnerable to disturbance and recover more quickly. These invertebrates are often able to move around to find a mate, aggregate in specific areas to spawn, grow quickly to a reproductive age, have many eggs, and have a short larval cycle (which means that they spend little time in the life cycle phase when they are at high risk to predation) (K. Friedman, personal communication June 8, 2013).These include:
    - Squid (e.g., # 5, bigfin reef squid, Sepioteuthis lessoniana)
    - Octopus (e.g., # 6, big blue octopus, Octopus cyanea)

d. The right side of the illustration shows examples of fish species that tend to be more vulnerable to disturbances and take longer to recover. These include fish that have a larger maximum size, live longer, grow slowly, and take longer to reproduce (e.g., large predatory reef fishes). These include:
    - Large carnivores
        - Groupers (e.g., #7, brown marbled grouper, Epinephelus fuscoguttatus)
        - Snappers (e.g., #8, two-spot red snapper, Lutjanus bohar)
        - Jacks (e.g., #9, giant trevally, Caranx ignobilis)
    - Large wrasses (e.g., #10, humphead wrasse, Cheilinus undulatus)
    - Coconut crabs (e.g., #11, Birgus latro)
    - Sharks (e.g., #12, white tip reef shark, Triaenodon obesus)
    - Large parrotfishes (e.g., #13, bumphead parrotfish, Bolbometopon muricatum)

e. The right side of the illustration also shows invertebrate species that are more vulnerable to disturbances and take longer to recover. These species are often sedentary (cannot move) and can therefore become isolated from potential mates; don't aggregate in specific areas to spawn; grow slowly to a reproductive age; have fewer eggs and young; and have a long cycle as larvae when they are at high risk to predation (K. Friedman, personal communication June 8, 2013). These include the following:
    - Coconut crabs (e.g., #11)
    - Giant clams (e.g., #14, elongate giant clam, Tridacna maxima) (Abesamis et al. in prep; Cheung et al. 2005; Dulvy et al. 2003; Reynolds et al. 2001 and 2005; and K. Friedman, personal communication June 8, 2013)

Species specific information above from the following sources: (Abesamis et al. in prep; Cheung et al. 2005; Dulvy et al. 2003; Reynolds et al. 2001 and 2003; and K. Friedman, personal communication June 8, 2013.)

Management Suggestions

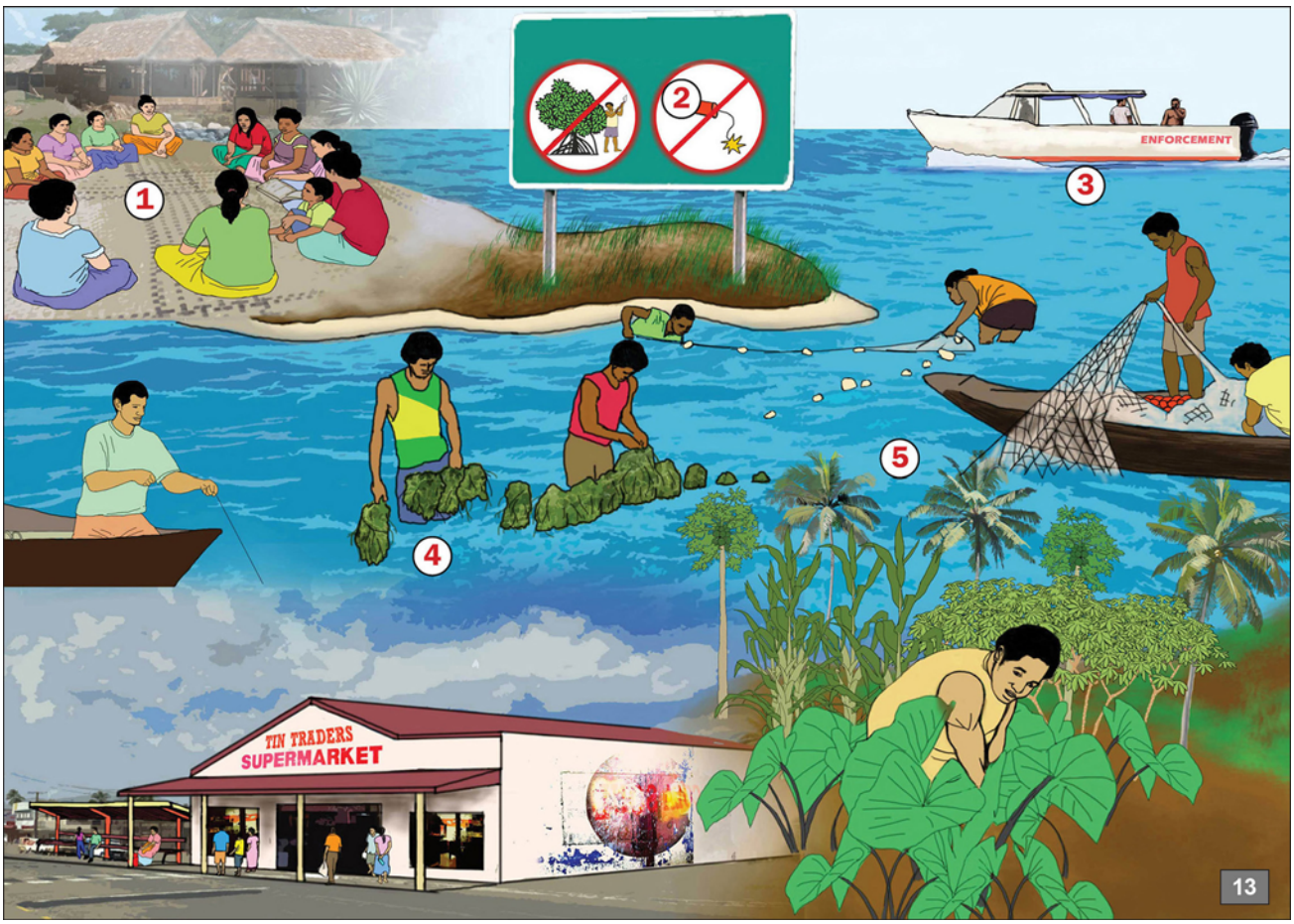
Many species that are important to tropical island communities (e.g., groupers, snappers, large parrotfish, giant clams) take long amounts of time to recover if their populations are damaged or depleted. Therefore, zones within the LMA that permanently prohibit harvesting of important species are the most effective. This allows all types of important species to recover and sustain healthy populations of large, highly reproductive adults that provide fisheries benefits outside the protection zones.

Facilitation Instructions for Flip Chart 12

1. Review Flip Chart 12 and its key messages.
2. Point to the flip chart images that relate to the messages about the vulnerability of different species and the speed with which they are able to recover.
3. With booklets closed, ask the group what the key messages from this flip chart suggest about management.
4. Finally, review the "management suggestions" in this guide and compare the answers provided by the participants. Note if there were any differences and if so, why.

EFFECTIVE COMMUNITY-BASED MANAGEMENT

Essential Factor Nine: Effective Management That Provides Community Benefits is Critical



Key Messages From Flip Chart 13

a. The way humans use and manage resources will significantly impact resource health and abundance over time. It is critical that the people who utilize and depend on marine resources effectively manage them to promote long-term sustainability so they can continue to benefit their communities.

b. Effective management of LMAs include actions that focus on:
   i. enabling marine species to successfully reproduce and habitats to remain healthy so they can remain abundant and resilient over time;
   ii. involving the community in decision making and ensuring that the LMA sustainably meets the needs of different community groups such as fishermen organizations, women's groups, youth groups, and more; and
   iii. designing zones and rules to ensure that that the community can continue to sustainably fish and receive food, income, and other benefits from the LMA.

c. The illustration portrays various activities that support effective management including these:
   1. meeting regularly to design and adapt the management of the LMA;
   2. providing outreach to the whole community so its members understand the benefits of the LMA and support rules that reduce threats and build health and abundance;
   3. actively managing resources and enforcing zoning and rules;
   4. supporting a diversity of income opportunities such as small businesses, agriculture, fishing, seaweed farming, tourism, and more, which can help people depend less on marine resources for income; and
   5. developing a diversity of food sources such as diverse agricultural crops, trees, fishing, and more, which can help people depend less on specific marine resources for food.

Management Suggestions

By involving the community in management, decisions will reflect the needs of the community and the benefits they want to receive from the LMA. It is also key that community members are well informed about the Nine Essential Factors and Nine Essential Zoning and Rule recommendations so they can help develop an LMA design that enables marine species to successfully reproduce and habitats to remain healthy, so they can remain abundant and resilient over time.

Facilitation Instructions for Flip Chart 13

1. Review Flip Chart 13 and its key messages with the group.

2. With the booklet closed, ask the group what the key messages from this flip chart suggest about management.

3. Finally, review the "management suggestions" in this guide and compare the answers provided by the participants. Note if there were any differences and if so why. Be sure to explain that all of the activities demonstrated in the flip chart will help improve management effectiveness.

4. Remind the group that the way humans use and manage resources will significantly impact resource abundance and resilience over time. The community must balance its needs with the needs of the resources so that the community continues to benefit from management. It is very important that community members—especially those who depend on the resources—are actively involved in decision-making and support management actions.

LET'S REVIEW: WHAT ARE THE NINE ESSENTIAL FACTORS THAT MUST BE CONSIDERED TO KEEP RESOURCES HEALTHY AND ABUNDANT?

Read the facilitation instructions before showing Flip Chart 14, as you will begin with a group activity.

Key Messages From Flip Chart 14

These are the four basic needs of marine resources required for them to remain healthy and abundant, so they can continue to provide benefits to the community:

a. Healthy Habitat
b. Large Enough Areas of Habitat
c. Successful Reproduction
d. Effective Management That Provides Community Benefits

NINE ESSENTIAL FACTORS THAT MUST BE CONSIDERED TO KEEP RESOURCES HEALTHY AND ABUNDANT	
Healthy Habitat	
Essential Factor #1:	Each Species Needs Different Healthy Habitats Where It Can Eat, Live, Grow, and Reproduce
Essential Factor #2:	Some Species Use Different Habitats at Different Times in Their Lives
Essential Factor #3:	Some Areas Survive and Recover Better Than Others
Large Enough Areas of Habitat	
Essential Factor #4:	Some Species Need Bigger Areas Than Others as Adults to Eat, Live, and Reproduce
Essential Factor #5:	Many Fish Larvae Stay Close to Home
Successful Reproduction	
Essential Factor #6:	Successful Reproduction Depends on Location, Numbers, Body Size, and Timing
Essential Factor #7:	Big Females Make More Babies
Essential Factor #8:	Some Species Are More Vulnerable and Recover More Slowly Than Others
Effective Community-Based Management	
Essential Factor #9:	Effective Management That Provides Community Benefits Is Critical

Facilitation Instructions for Flip Chart 14

1. Before showing Flip Chart 14, tell the group that you are going to quiz them about what they have learned. Ask, "What are the four basic needs of marine resources for them to remain healthy and abundant?" Capture the answers on flip chart paper.
2. Next ask them "What are Nine Essential Factors that support these four needs and that must be considered to keep resources abundant and resilient so they can continue to benefit us?" Limit each person to one factor so that many participants have a chance to answer.
3. Write the group's answers on a sheet of flip chart paper. Be sure the group identifies all nine factors. Review the key messages (e.g., Four Needs and Nine Essential Factors), and relate them to the group's answers. Point out each associated illustration on the flip chart.

SESSION FOUR:

WHAT ZONES AND RULES CAN BE USED TO ADDRESS THE ESSENTIAL FACTORS IN YOUR LMA?

EFFECTIVE LMA ZONING AND RULES MAINTAIN HEALTH AND ABUNDANCE OF MARINE RESOURCES

Key Messages From Flip Chart 15

a. LMAs can be managed with different zones and rules that not only support healthy and abundant resources, but that also provide the best chance of achieving desired community benefits (SPC 2011).
   - Rules are statements that clearly define what activities are prohibited or allowed within a certain area—for example, within a specific zone or the whole LMA.
   - Zones are defined areas within an LMA where there are specific rules that are aimed at a specific purpose—for example, protecting spawning fish or building herbivore populations. These additional rules apply only to that specific area or zone, as opposed to the whole LMA.

b. Different types of rules and zones, such as those below, are aimed at different results and provide different benefits.

Rule or Zone Name	Description	Benefits
Gear restrictions	Gear restrictions are rules or zones in which one or more type of fishing gear or method is prohibited because they are more damaging than other methods.	Gear restrictions can protect habitats or species that are sensitive to certain gear types or methods of fishing. For example, net fishing may not be allowed in certain nursery areas because nets can catch too many fish that have not yet grown large enough to reproduce. Alternately, some gear may be prohibited or banned throughout the entire area because it is destructive to most or all habitats and species (e.g., blast fishing).
Size limits (minimum allowable size for fishing and maximum allowable size for fishing)	Size limits are rules that prohibit the harvest of species below or above a certain size. Minimum size limits prevent harvest of individuals before they have reached a size that is large enough to reproduce. Maximum size limits prohibit the harvest of individuals that are very large and contribute a lot of eggs to the system. When rules are developed to prohibit the take of both very small and very large sizes, they are called "slot limits." With slot limits, the medium-sized individuals are the only ones that can be harvested. Information about the average size of species at first reproduction is required to effectively implement size limits.	Size limits can be used to ensure that target species are able to grow large enough to reproduce before they are harvested. This can help to ensure that populations do not shrink because fish are not able to reproduce. Also, prohibiting the harvest of large fish can help to ensure that the big females remain alive to provide more and healthier eggs to maintain populations.

Rule or Zone Name	Description	Benefits
Catch limits	Catch limits (also called bag limits) allow the harvest of only a specific number of individuals. These limits can reduce fishing pressure on populations and prevent too many individuals from being removed from the population. *Scientific expertise is required to understand the population dynamics of a species to set an appropriate limit.*	Catch limits can be beneficial because they allow some harvest while maintaining enough reproductive individuals to ensure that the population can be maintained or recover.
Species-specific zone	A species-specific zone is an area in which harvesting one or more specific species is prohibited. For example, an LMA may include a zone in which harvesting one or more important herbivore species (e.g., surgeonfish) is not allowed so that they remain abundant enough to control algae populations.	Species-specific zones allow specific species populations to recover in an area while also allowing fishermen to harvest other species. This allows target species that are protected from being harvested in the area to grow and reproduce. This type of zone can also allow females of the target species to grow large and release more and healthier eggs. Protecting certain species can support the health of ecosystem if those species play an important role, such as herbivores that help control algae growth. As these areas demonstrate success, fishermen may start to recognize the value of management and decide to include other species in management zones. For communities that are very dependent on fishing for their survival, species-specific zones are a good way to improve populations while allowing fishing.
Temporary closure zone	This is a zone that is closed at certain times and open at other times. These areas are very similar to traditional closures (e.g., tambu, tabu, sasi). They balance short-term protection with harvesting needs. These zones may be closed for much of the time but occasionally opened to harvest for special occasions such as feasts, weddings, or funerals.	Temporary closures provide short-term protection of species and some recovery of populations. They can be important for the short-term recovery of smaller, less vulnerable species that have faster recovery times. However, they do not provide long-term improvement to most fish populations (especially large predators such as snappers and groupers) or resilience. Temporary closures can also be important for supporting harvesting and/or cultural needs.

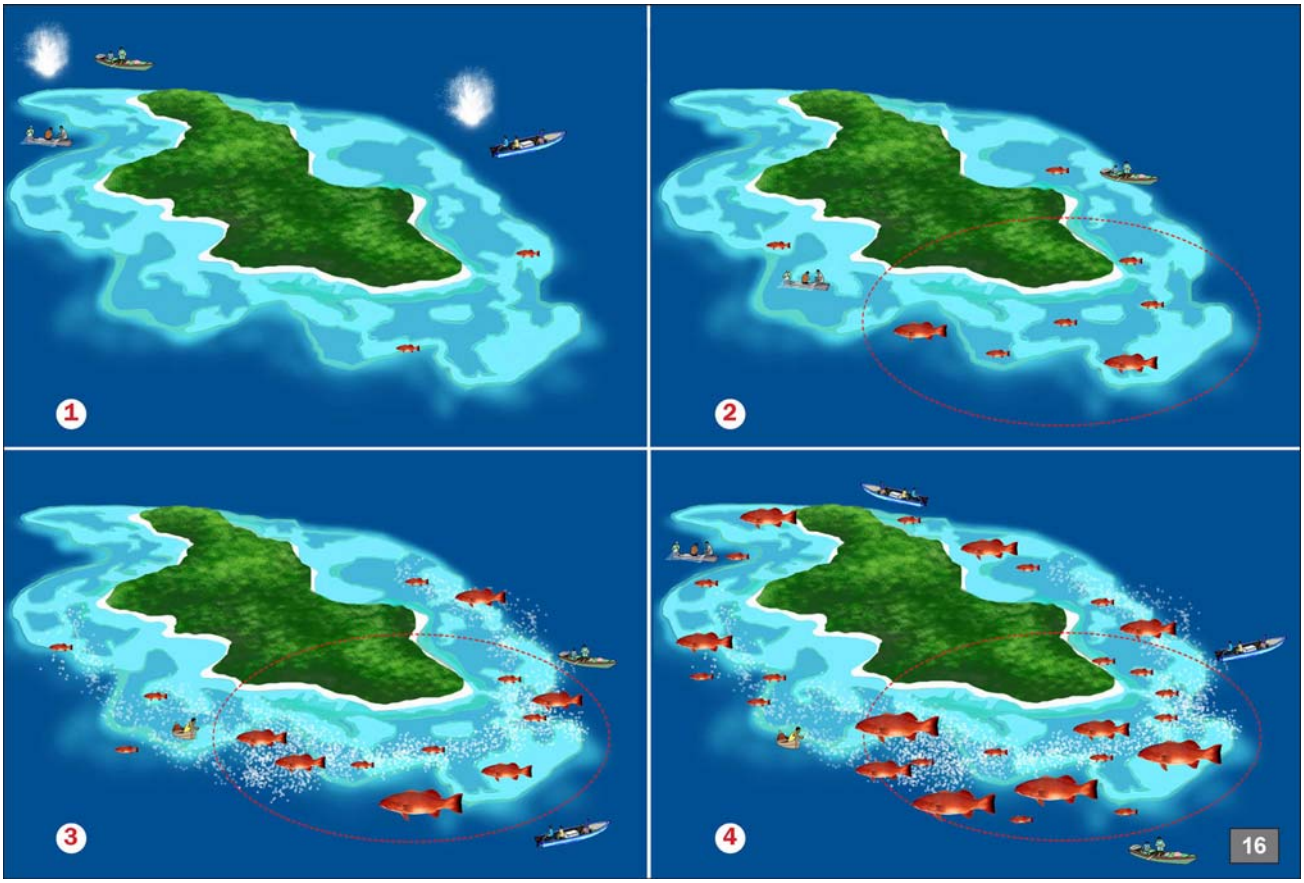
Rule or Zone Name	Description	Benefits
Seasonal zones	A zone that is closed during specific seasons when important natural events happen in the area, such fish spawning.	Seasonal closures provide short-term protection of species during critical times in their life cycle (e.g., spawning or nesting). Seasonal closures can provide long-term improvement to fisheries populations or resilience if harvesting is prohibited during these important natural events and species are able to reproduce successfully.
Rotational zones	A zone that is divided into two or more parts, each of which allows harvesting in rotation while the other area prohibits harvesting.	Rotational zones allow populations in closed areas to recover while allowing fishing in a neighboring area. The benefits are greatest if the rotation happens only after key species have had a chance to grow large enough to reproduce and if fishing pressure in the open areas is kept low through other management approaches, such as size or catch limits.
No-Take Fishery Replenishment Zones (no-take zones)	A zone that prohibits harvesting of all species for the long-term or permanently.	Benefits of FRZs are provided in the following illustration.

Facilitation Instructions for Flip Chart 15

1. Review the key messages and table of rules and zones for Flip Chart 15. Use the illustration to point out different types of rules and zones.

2. Remind the group that well-managed LMAs will include zones and rules that support the Nine Essential Factors.

THE BENEFITS OF NO-TAKE FISHERY REPLENISHMENT ZONES



Key Messages From Flip Chart 16

a. Fishery Replenishment Zone (FRZ): For the purposes of this guide, an FRZ is a zone in which the taking of all plants and animals is prohibited for the long term (more than 20 years) or, preferably, permanently. These areas are also often referred to as no-take zones. This is an area the community has agreed to set aside and not harvest. FRZs are one of the most effective ways to build long-term abundant fisheries populations and resilience (IUCN-WCPA 2008). The benefits of FRZs are as follows:

- They protect all habitats and species within them, allowing them to eat, grow, and reproduce without the threat of being harvested.
- They can be "fish banks"; they protect the species within them to allow them to become large adults, producing many eggs and larvae. Fish from these protected areas can support and replenish the local and surrounding populations in other FRZs or fishing grounds.
- They can help to populate areas outside the FRZ. If populations within the area become large and crowded, some adult fish may move out of the area. This effect is called "spillover." Scientists have studied this effect. While fish don't tend to move very far (usually hundreds of meters to less than one kilometer), fishermen have learned to "fish the boundaries" to benefit from the spillover effect.
- They can help to build the resilience of the area against the impacts of climate change and other threats by providing a safe area where baby fish are readily produced. These areas can help restore other FRZs and fished areas that have been damaged.

- They can help keep the natural balance of different species such as predators and herbivores (species that eat algae/plants). Maintaining a natural balance of species increases their ability to resist impacts from threats including climate change.
- FRZs can be easier to enforce than other fisheries regulations (for example, size limits or catch limits) because they limit access/use of a specific area. They are therefore more obvious to comply with and/or observe.

b. Examples of FRZ benefits in the Coral Triangle region include the following:
   - Fish population recovery: A study carried out on the Great Barrier Reef compared the density and biomass of coral trout before and 13 years after the establishment of FRZs.
     - o After 13 years with FRZs, coral trout populations had increased significantly within the FRZ but not outside (in areas where fishing was still occurring). The density and biomass of coral trout increased by more than six times.
     - o The study also compared the density of coral trout biomass within the FRAs compared to fished areas outside the FRZs after 13 years. Coral trout density and biomass were significantly higher (up to five times higher) in the FRZs than outside (in areas where fishing was still occurring) (Williamson et al. 2004).
   - Larval spillover: One study on the Great Barrier Reef found that while FRZs only accounted for 28 percent of the coral reef area, there was a rapid increase in biomass within the marine reserve that ended up contributing almost 60 percent of the larvae to fished areas within 30 km (Harrison et al. 2012).
   - Adult spillover: A study of Apo Island in the Philippines showed that the biomass of the surgeonfish (Nasovlamingii) tripled over 18 years (1983 to 2001) within the FRZ. Additionally, the biomass of this species increased by a factor of 40 outside the FRZ (within 250 m of the boundary but not greater distances away). Finally, in 2000 and 2001, fishermen who used hook-and-line within 200 m of the FRZ boundary (which covers only 11 percent of the total reef fishing area) caught 62.5 percent of the total catch of the entire area for this species (Russ et al. 2003).
   - Community benefits: A study was carried out at Fiji, Indonesia, Solomon Islands, and the Philippines. Researchers talked to more than 1100 local people to understand changes in the quality of life they had noticed since the establishment of local marine managed areas that included FRZs. Results of the study show that locals noticed:
     - o improved fish catches and resulting income in three sites due to spillover from FRZs;
     - o improved income from new jobs, mostly in eco-tourism;
     - o stronger local governance that involved the community in management and decision-making and reduced conflict within the communities and with neighboring communities;
     - o benefits to health from improved fish catches and the resulting increase in protein intake (specifically, there was a perceived improvement in children's health); and
     - o benefits to women, both economically and socially, mainly through alternative livelihoods that provided new ways of earning income (Leisher et al. 2007).

Facilitator Instructions for Flip Chart 16

1. Review Flip Chart 16 and its key messages, using the illustration to point out different types of zones.
2. If there is time, have the group play the game found in Appendix B. The game will help group members understand how FRZs work and the benefits they provide. The game requires about 30 minutes.
3. Remind the group that well-designed LMAs will include zones and rules that support the Nine Essential Factors.

TAKING MANAGEMENT ACTIONS THAT SUPPORT THE ESSENTIAL FACTORS

Group Activity – Using the Essential Factors to Manage Resources

Facilitator Instructions

1. Tell the group that some management approaches can very effectively support the Nine Essential Factors, improving the long-term abundance and resilience of marine resources and continuing to provide community benefits. Say that you are going to have the group practice using the information they learned about the Nine Essential Factors and what they mean for management, by applying it to how they can better manage their LMA.

2. Copy the table below to flip chart paper for use during this activity.

Nine Essential Factors	Zones and Rules to Support Factor
Healthy Habitat	
1. Each Species Needs Different Healthy Habitats Where It Can Eat, Live, Grow, and Reproduce	
2. Some Species Use Different Habitats at Different Times in Their Lives	
3. Some Areas Survive and Recover Better Than Others	
Large Enough Areas of Habitat	
4. Some Species Need Bigger Areas Than Others as Adults to Eat, Live, and Reproduce	
5. Many Fish Larvae Stay Close to Home	
Successful Reproduction	
6. Successful Reproduction Depends on Location, Numbers, Body Size, and Timing	
7. Big Females Make More Babies	
8. Some Species Are More Vulnerable and Recover More Slowly Than Others	
Effective Community-Based Management	
9. Effective Management That Provides Community Benefits Is Critical	

3. Have participants form small groups of four to five people. Ask groups to review each essential factor and, for each one, answer the following question: What types of zones and rules could you use to make sure this essential factor is addressed in your LMA? Have each group record its answers.

4. After the small groups finish deciding what zones and rules they would use to support the Nine Essential Factors, say, "Now let's review what zones and rules each group decided upon and how they compare to the Nine Essential Zoning and Rules Recommendations developed by scientists." Be sure to explain that these recommendations are guidelines, but that each community must design its LMA based on the benefits community members would like to receive; threats they want to address; and the social, cultural, and economic situation.

5. You will use the information provided in the text and table below to review Nine Essential Zoning and Rule Recommendations that support the essential factors. Review each essential zoning and rule recommendation and associated explanation and benefits. Compare each of the recommendations to the zones and rules developed by the group in #2 to see how close they came to the science-based recommendations. Where there were big differences, be sure to discuss the explanation and benefits of the science-based recommendation so people understand why it was developed, but remind people that these are guidelines.

NINE ESSENTIAL ZONING AND RULE RECOMMENDATIONS

The information below provides recommendations for zones and rules that are based on the best available scientific research to support the long-term health and abundance of marine resources. If followed, these recommendations will help a great deal in maintaining a long-term community benefit from fishing and other uses of the marine environment. However, these recommendations must be balanced with the immediate social, cultural, and economic needs of the community to ensure that the ninth essential factor (Effective Management That Provides Community Benefits Is Critical) is met.

To balance social and ecological needs, it is recommended that communities use a mixture of zones and rules that have the best chance of achieving the benefits the community wants to receive. Short-, medium-, and long-term closures should be considered, including FRZs (long-term, permanent) and temporary closures (short- or medium-term).

While it may not be possible to achieve all recommendations in the short-term, a carefully designed LMA that incorporates as many of these recommendations as possible will provide significant positive benefits for the community. By explaining the reasons for the recommendations and how they support benefits, it is possible that community members may become increasingly supportive of incorporating some or all of the recommendations into the LMA design.

It is important to note that for many communities and local governments, LMAs include their entire marine and terrestrial area. This is important as it enables the inclusion of as much habitat as possible. It's important that all LMA types are as large as possible in order to cover as much habitat as possible.

It's also important to develop zoning boundaries that are easy to understand and enforce by using natural or local landmarks that community members can recognize to determine if they are within a specific zone. Finally, zones should be designed to ensure that fishers have access to high-quality fishing grounds and spillover from FRZs.

NINE ESSENTIAL ZONING AND RULE RECOMMENDATIONS		
HEALTHY HABITAT **Essential Factors:** • **Each Species Needs Different Healthy Habitats Where It Can Eat, Live, Grow, and Reproduce** • **Some Species Use Different Habitats at Different Times in Their Lives** • **Some Areas Survive and Recover Better than Others**		
Essential Zoning and Rule Recommendations	**Explanation**	**Benefits of this Recommendation**
1. Establish strong fisheries regulations and other rules that prohibit destructive practices, and work to eliminate other threats over as large an area as possible.	Since different priority species use different habitats and many species use different habitats at different times of their lives, it is important to protect as much area of habitat as possible. Destructive practices and other threats that destroy habitat and populations of important species will significantly decrease the health and productivity of ecosystems. This will in turn greatly reduce community benefits. Destructive practices and other threats that should be eliminated include: • Blastfishing and the use of poisons • Bottom trawls or dragnets • Coral mining and anchoring in coral areas • Clearing of mangroves • Sedimentation from forest clearing and agriculture • Pollution including sewage, agricultural waste, and litter Additionally, the following fishing practices that primarily impact populations of target species should be eliminated across the LMA: • Illegal fishing and overfishing • Spearfishing on SCUBA, nighttime spearfishing, and fishing on hookah • Use of gear types that take high numbers of marine organisms like gill nets and lines with many hooks • Large-scale commercial fishing which is not sustainable in near-shore coral reef environments	Elimination or significant reduction of destructive activities and other threats over large areas will help to ensure that the diversity of habitats that are needed to support populations of priority species remain healthy and productive.

Essential Zoning and Rule Recommendations	Explanation	Benefits of this Recommendation
2. Aim to place 20 percent to 40 percent of each habitat type in FRZs (no-take zones that don't allow fishing or collection of any species). FRZs that include multiple habitat types are highly recommended.	Since different priority species use different habitats and many species use different habitats at different times of their lives, maintenance of ecosystem health can only be achieved if adequate areas of each type of habitat are protected in no take areas. FRZs that include multiple habitat types such as coral, seagrass, and mangroves are highly recommended. This provides species an opportunity to move between habitat types as needed. This management recommendation is designed to protect a minimum of 35 percent of the population of priority species. Fisheries scientists have determined that if 35 percent of the reproductive stock of a population of a marine species remains unfished and continues to reproduce, the population can be sustained and support ongoing fishing. Since we don't know what the healthy population level of each species was originally, the best way to protect 35 percent of the species populations is to protect between 20 percent and 40 percent of the habitat areas where the populations are found. If fishing pressure is low and there are other effective fisheries management approaches outside the FRZ, the percentage of area included in the FRZ can be lower (around 20 percent). If fishing pressure is high and there is little management outside the FRZ, the percentage of area FRZs should be higher (up to 35 or 40 percent).	Protecting this amount of each type of habitat will better enable the numbers of big reproductive individuals to increase and be sustained. This will sustain populations both within no-take areas and in nearby areas outside the no-take zones. **THE BENEFIT OF SPILL OVER** When populations of fish and other species within no take areas build up, adult fish, juveniles, and larvae will move out into areas where fishing is allowed. This greatly benefits local fishermen who are able to catch priority species in the long term.

Essential Zoning and Rule Recommendations	Explanation	Benefits of this Recommendation
3. Aim to ensure that each key habitat type (coral, mangrove, seagrass, etc.) is protected in two or three FRZs (no-take areas). This can be done within one LMA if it's large enough or through the development of LMA Networks.	Different species depend on different habitats for their survival. By protecting at least three areas of each habitat type, if one area is damaged, the other areas may help to sustain the community and replenish the damaged area. This idea is known as replication. No-take FRZs that include multiple habitats types are highly recommended. For LMAs that are small, it may be difficult to have more than one FRZ that replicates protection of habitat types. In this case, communities can work with neighboring communities to develop LMA networks that have FRZs that include the examples of the same habitat types.	Replication of habitat types in three or more FRZs can help to sustain populations of priority species that depend on different habitats, and to restore nearby areas if they are damaged from climate change or other threats. Neighboring coastal communities can each build healthy LMAs as part of a network that includes replication of habitats. This will help to ensure that all communities along a coastline benefit from improved catches. This will also reduce pressure from neighboring communities who may want to fish in another community's LMA if their own area is not healthy and well managed.
4. Be sure that any areas that have survived or recovered well from disturbance (or appear that they will) are included in no-take FRZs.	Certain areas tend to survive and recover better than others in the face of human, natural, and climate-related threats. Examples include coral areas that have recovered well from bleaching, areas that show tolerance to fluctuations in temperatures, and mangrove areas where there is space to move inland as the sea level rises. It is often possible to identify these areas based on local knowledge of how they recovered from impacts in the past. Please Note: It is important to maintain healthy herbivore populations (or species that eat marine plants and algae) in these areas. Herbivores can help control algae populations during times of disturbance (e.g., bleaching events). Keeping coral areas free of algae can help new corals resettle.	Protecting resilient areas will give an LMA the best chance of surviving or recovering from major threats including human impacts, natural threats such as earthquakes and tsunamis, and climate impacts such as increased storms or increases in water temperatures. If these areas are protected and survive or recover well after impacts, they may be able to provide larvae to help replenish nearby areas that have been damaged.

Essential Zoning and Rule Recommendations	Explanation	Benefits of this Recommendation
LARGE ENOUGH AREAS OF HABITAT **Essential Factors:** • **Some Species Need Bigger Areas Than Others as Adults to Eat, Live, and Reproduce** • **Many Fish Larvae Stay Close to Home**		
5. Create FRZs within LMAs that are at least two times as big as the range needed by target species.	Since some species need larger areas than others, this will help to ensure that all target species have enough area to eat, grow, and reproduce. If a community has a small LMA area it is important to network with other communities to make sure that the size of area needed for target species is included within FRZs. FRZs can be smaller if there are also strong fisheries management rules in the entire LMA (such as: size minimums and size limits and bans on all overly efficient gear types like gillnets.). If FRZs (or no-take zones) are used as the only management tool, they should be as large as possible.	If the areas that are large enough to meet the movement needs of target species are protected, individuals will grow to large adults that reproduce successfully. When there is an abundance of adults, this will support spill-over into fishing areas that can help to support local fisherman with benefits in the long term. Additionally, large adults produce many more eggs which can also spill over into nearby areas, promoting recovery of populations nearby.
6. Establish multiple FRZs (no-take zones) between one to 20 kilometers from each other.	Since it has been demonstrated that most of the larvae of many species of fish settle close to where they were spawned, it is important to establish multiple FRZs in a range of between one to 20 kilometers apart from each other. This will help to make sure that populations of important species remain biologically connected through the movement of larvae between the FRZs. It also helps to ensure that larvae that do not move very far have several safe places to settle and grow to be adults. Each coastal community should have their own well-designed LMA with as many FRZs as possible so that they can benefit from local management and from the larvae that remain in their area. If one community only has a small LMA, they can work with neighboring communities to establish networks of LMA that include multiple FRZs along a coastline.	Larvae from FRZs located in this range of distances will help to sustain populations of priority species over the larger area and help to restore any areas that are damaged from climate change or other threats. This also supports Essential Recommendation Number 3: Aim to ensure that each key habitat type (coral, mangrove, seagrass, etc.) is protected in two or three FRZs (no-take areas). This can be done within one LMA if it's large enough or through the development of LMA networks.

Essential Zoning and Rule Recommendations	Explanation	Benefits of this Recommendation
SUCCESSFUL REPRODUCTION **Essential Factors:** • **Successful Reproduction depends on Location, Numbers, Body Size, and Timing** • **Big Females Make More Eggs** • **Some Species Are More Vulnerable and Recover More Slowly Than Others**		
7. Establish long-term (20 to 40 years), or preferably permanent FRZs (no-take zones)	Since big females make more eggs and some species are more vulnerable to disturbance and recover more slowly than others, permanent protection in FRZs is the recommended management approach. This allows all types of important species to recover and sustain healthy populations of large, highly reproductive adults that provide fisheries benefits outside the FRZs. Within a relatively short period (up to five years), species that reproduce quickly, such as fusiliers and parrotfishes, are likely to recover within FRZs. Within six to ten years, they will provide both larval and adult spillover benefits that can be maintained by a permanent FRZ. Large carnivores (groupers, snappers, jacks, emperors) that reproduce slowly will require 20 to 40 years of full protection in FRZs to recover populations and provide adult and larval spillover effects. (Abesamis et al., in prep.) The specific amount of time needed for recovery will depend on site conditions such as habitat quality and recruitment success.	Establishing permanent FRZs will help to ensure that all priority species are able to successfully reproduce and create spill over of abundant fish and other species for the local community to use. Many communities are accustomed to closing areas for a few years and then opening them. This approach was often used in traditional systems where fishing pressure was relatively low. This approach can be effective at building up populations of species that reproduce quickly. However, it cannot sustain these populations or enhance populations of many important slower-growing species that take longer to reproduce. If communities still want to use short-term closures, these should be combined with other long-term or permanent closures.

Essential Zoning and Rule Recommendations	Explanation	Benefits of this Recommendation
8. Establish strong fisheries management rules and zones throughout the LMA that protect large individuals, individuals which are spawning or carrying eggs, and areas that are important for reproduction.	Since successful reproduction depends on specific locations, large numbers of reproductive individuals, larger females that make more eggs, and reproductive seasons or times, management should consider these factors including: • Setting minimum sizes for harvesting. This will prevent the taking of individuals who have not grown large enough yet to reproduce. • Setting maximum sizes for harvesting. This will help to make sure large highly reproductive individuals (big mamas) are not harvested. • Preventing the harvest of individuals that are visibly carrying eggs. • Preventing the harvest of eggs. • Protecting spawning aggregation sites during spawning times. • Preventing the destruction or damage to any areas critical for reproduction (for example, sea turtle nesting areas). The best size of fish to catch outside FRZs are medium-sized individuals that already have reproduced but are not so large that they are the most important breeders.	These regulations will help to ensure that individuals are able to reproduce before being harvested. This will help to sustain the population, including creation of new generations that can support sustainable fishing.

Essential Zoning and Rule Recommendations	Explanation	Benefits of this Recommendation
EFFECTIVE MANAGEMENT THAT PROVIDES COMMUNITY BENEFITS **Essential Factors: Effective Management That Provides Community Benefits Is Critical**		
9. Ensure that Community Members are involved in, supportive of, and benefiting from LMA management	Make sure that the community is actively involved in the management decisions and implementation, and that the management system helps to ensure the community continues to benefit. If the community does not benefit they are unlikely to support management in the long term. Implementation of the zoning and rule recommendations must be balanced with the shorter- and medium-term economic needs of the community.	Benefits from applying the zoning and rule recommendations should include maintenance or improvement of catch of target species in the areas that are open to fishing. They can also include improved opportunities for tourism, an overall improvement in ecosystem quality and the quality of life for local community members from a healthy environment and healthy food sources. To maximize shorter-term and longer-term benefits, community members need to design their LMA to balance the needs of their target species with the ongoing socio-economic needs of the communities. Some approaches that can help to maximize community benefits include: • Positioning no-take zones so that community members have easy access to good fishing grounds and will be able to catch fish that spill over from the no-take areas. Some communities may start by creating species-specific zones, which prohibit the harvest of one to three important species. Over time, as the community sees benefits from these zones, they begin expanding the zones to be larger and full FRZs to prohibit the harvest of all species. This approach allows the community to feel the benefits of management before committing to long-term no-take zones.

PRACTICE DEVELOPING LMA ZONES AND RULES

GROUP ACTIVITY: LMA Design Practice

Facilitation Instructions

1. Display Flip Chart 17. Explain to group members that they will now actively practice designing LMA zones and rules based on the Nine Essential Factors and the Nine Essential Zoning and Rule Recommendations discussed in the previous activity.

2. Have the participants form small groups of five or six people. Tell groups that they will now use the information they learned to develop what they think are the best zoning and rules for the LMA to maintain long-term health, abundance, resilience, and community benefits. Explain that groups will use the community from Flip Chart 17 for this activity.

3. Provide the participants with the following information about the community on Flip Chart 17:
   a. Priority species for this community are parrotfish, surgeonfish, grouper, snapper, mangrove crab, mudshell clams, and sea cucumbers.
   b. Most community members rely on fishing for food or income. Currently, there are very few opportunities for other income and food sources.
   c. Some people use dynamite fishing practices, gillnets, and night spearfishing.
   d. Some of the mangroves were removed recently to provide easier access to the beach.
   e. Many people dump trash and waste into the local stream.
   f. The community is noticing a decline in fish, especially parrotfish, surgeonfish, and large predators (e.g., grouper, snapper). They would like to see these fish populations improve so they can catch more.
   g. The community has noticed a decline in mangrove crab and mudshell clams. They want to see these populations improve so they can catch more.

4. Ask participants to discuss the following questions with their groups and record their answers and why they chose them, to be reported back to the larger group:
   a. What types of zones will be included in this LMA and why?
   b. How many zones will there be and why?
   c. Where will they place each zone and why?
   d. What rules will apply to the whole LMA and why?

   Explain that because the community wants to increase the population of fish and invertebrates, the best way to achieve that would be to follow the Nine Essential Zoning and Rule Recommendations as much as possible, while balancing the need to harvest resources. Have the groups begin the exercise by developing zones and rules that support the biological needs of the resources the community is targeting. The groups can then modify the design based on the socioeconomic needs of the community in order to ensure that the rules would be acceptable to the community.

5. Have each small group present its LMA design. Record each group's design ideas on a piece of flip chart paper. After each group presents, have participants discuss what they thought was really good about the design and what needed more work. If the following zones and rules were not discussed, raise them as good options:
   a. Prohibit dynamite fishing and other destructive fishing practices throughout the LMA to protect critical habitat for target species.
   b. Prohibit harvesting of mangrove in most or all of the LMA to protect critical habitat for target species.
   c. Prohibit dumping trash and waste into nearby streams to protect critical habitat for target species.
   d. Place at least 20 percent (but ideally 30 percent) of the area in an FRZ that includes mangrove, seagrass, and coral reef habitat. This will protect all important habitats and will allow fish to grow big and have more babies. Over time, adults and larvae will support fisheries outside the FRZ.
   e. Make the FRZ permanent. Snapper and grouper will take a long time to recover, so having the site permanent will ensure they are protected long enough to recover and provide benefits outside the FRZ. Also, be sure that the size of the FRZ is large enough to meet the areas needed for larger target fish species such as snapper and grouper. Have the community review the zoning design over time and consider making the FRZ larger if improvements are noticed within the site.
   f. Implement a seasonal closure for snapper and group spawning aggregations.
   g. Implement minimum size limits for mud clam and mangrove crab and target fish species to ensure they have grown large enough to reproduce before being harvested.

6. Explain that the next step in this guide will lead the LMA planning group and community through a process to design an LMA that meets the long-term needs of the community. The group can begin thinking about and discussing which of the Science-based Zoning and Rule Recommendations will be feasible for their LMA.

PLANNING SECTION:
Guidance for Developing Zones and Rules for Effective LMAs

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This section provides a process that can be used or modified to design an LMA that includes zones and rules that will support the Nine Essential Factors and Nine Essential Zoning and Rule Recommendations discussed in the Outreach Section. Some communities already have established their own methods for LMA zoning and rule making. If an effective process is already in place, then it should be used. However, it is recommended that the LMA planning or management team review the sessions below to decide if the existing process should be modified to better support the Nine Essential Factors and Nine Essential Zoning and Rule Recommendations from the Outreach Section.

For communities that do not have an LMA zoning and rule-making process, this step provides a series of sessions that a planning team can follow to develop zones and rules for an effective and resilient LMA that benefits the community.

Process facilitators should feel free to modify this process to best meet the planning team and communities' needs or to integrate it into previous or ongoing planning processes.

These are the sessions in this Planning Section:

- Session One: Defining the Benefits the Community Wants From the LMA
- Session Two: Mapping the LMA
- Session Three: Characterizing and Mapping Natural Resource and Social Targets
- Session Four: Developing Zones and Rules for the LMA to Provide the Greatest Community Benefits
- Session Five: Ensuring That the LMA Uses the Nine Essential Zoning and Rule Recommendations
- Session Six: Incorporating the LMA Zoning and Rules Into the Management Planning Process

Each session will provide background information and facilitation instructions on how to carry out the associated exercises. A planning team that can facilitate the process should lead all of the sessions and invite community members/stakeholders where appropriate. The planning team may also organize and summarize the information collected by community members in a clean document in order to ensure the planning information is properly captured. This summary document can shared back with community members to ensure it is accurate.

Before beginning the LMA zoning and rule development process, it is critical that you involve all major stakeholders who will be impacted by management decisions. Plan how you will include them in the process. Regularly ask, "Are the right people to make these decisions in the room?" It is also important that most people who are involved in the planning process go through the Outreach Section. This is especially true for the planning team and leaders/decision-makers within the community.

SESSION ONE:

DEFINING THE BENEFITS THE COMMUNITY WANTS FROM THE LMA

Before the planning team and community begins developing zones and rules for the LMA, it is important to define the results you are trying to achieve and the problems you are trying to address with an LMA. If the community has already defined objectives for the LMA, be sure to use those as a starting point for this session. Defining objectives (including benefits) that the community wants to achieve from the LMA will help the planning team determine what social and biological information is most important to support zoning and rules development.

Most communities are interested in increasing populations of important fish and invertebrate species that are used for food and income—grouper, snapper, trochus, and lobster, for example. Increasing populations and building health and resilience over the long term may require community members to address specific threats and/or make sacrifices in the short term. The LMA zoning and rules will need to balance biological and social needs. The Outreach Section of this guide identified Nine Essential Factors and related Nine Essential Zoning and Rule Recommendations that can contribute to abundance and resilience of marine resources. The more your community and planning team can adopt those nine essential recommendations based on science such as eliminating destructive practices and implementing FRZs now, the more benefits the community is likely to receive in the long term.

This guide encourages zoning and rules for LMAs that eliminate destructive practices, ban certain destructive or overly efficient gear types, and include permanent FRZs because they provide the most effective long-term fisheries benefits and resilience. If the community is not ready for these management strategies, the steps in this guide can be used to help the community think through how they will move toward utilizing them.

GROUP ACTIVITY: Defining the Benefits the Community Wants From the LMA

Facilitation Instructions

Ask the group the questions in the following table. Record the answers on a flip chart.

i. **What benefits does the community want from the LMA?**	
ii. **What are the top five to eight target species we want to maintain or improve?** If the group has identified these in previous planning processes, you can transfer information from that process here. Otherwise, have the group brainstorm about target species and prioritize the top five to eight. If the community has many more priority species, it is a good idea to lump species into as few categories as possible. This will help to keep the overall number of species to a manageable number.	
iii. **Is the community willing to eliminate destructive practices in the LMA–for example, blast fishing or clearing of mangroves?**	YES/NO If the answer is "no," then the planning team and community should discuss why and agree that they would like to move toward this eventually. This LMA planning process will help the community take steps toward this goal.
iv. **Is the community willing to include permanent FRZs (no-take zones) in the LMA?**	YES/NO Again, if the answer is "no," then the planning team and community should discuss why and whether the community will likely move towards this eventually. If a community is not able to utilize FRZs, it's important to utilize very strong fisheries regulations throughout the LMA to help reduce take of the most reproductive individuals and to fully protect key habitats.

SESSION TWO:

MAPPING THE LMA

This mapping exercise will help the planning team and community develop a base map that shows the various marine resources, their condition, and features that are important for developing zones and rules for an effective LMA.

If the community has already completed a mapping exercise, you can use the existing map. Review the existing map and use the information in the group activity below to determine whether changes or additions to the map are necessary. You will use the map as the basis for further mapping activities. Problem-Solution models can also be used in the group activity below to identify threats that should be on the map.

GROUP ACTIVITY: Mapping the LMA

Facilitation Instructions

1. Hang large sheets of flip chart paper on a wall, and tape the sheets together. The sheets should provide ample space to draw the community, with both marine and terrestrial features on a large enough scale for everyone in the group to see. On the paper, draw a line that approximates the boundaries of the LMA, including land and sea.

   LMAs generally include all of the marine and coastal area for which the community has management authority. Some communities also include their complete terrestrial territory as well. As a result, the map will cover the entire marine and coastal area over which your community has management control. This is important as it enables the inclusion of as much habitat as possible. It's important that all LMA types are as large as possible so to cover as much habitat as possible. The location of the features in the map can be estimated, and you will have future opportunities to draw more precise maps.

2. If you have a very large group, you may want to have the group work in small teams. Prepare a map for each team, follow the directions below, and then compile the information from each map into one master map.

3. Have the group discuss the questions below. Based on the answers, draw features on the map. Be sure to create a legend so the definitions of any symbols you use are clear.

   i. What are the key habitats and species within the LMA? Map coastal, terrestrial, aquatic, and marine habitats, including these:
      a. Mangroves
      b. Seagrass beds
      c. Mudflats
      d. Coral reef flats
      e. Coral slopes

f. Channels
g. Underwater seamounts
h. River mouths/estuaries
i. Bays
j. Streams
k. Tidepools
l. Access points
m. Forests
n. Sand dunes
o. Others

ii. Record on the map the quality of each key habitat–for example, healthy reef areas, damaged reef areas, healthy streams, polluted streams, clear water, turbid water, etc.

iii. Map the key socioeconomic and cultural features of the community, including these:
   a. Homes and other buildings
   b. Roads
   c. Wells
   d. Fish landing areas
   e. Cultural sites
   f. Agricultural areas
   g. Recreational areas
   h. Others

iv. Map the critical reproductive areas or resilience features in your area, including these:
   a. Spawning aggregations (including types of fish)
   b. Currents and their direction
   c. Areas of consistent, cool water (from currents or upwellings)
   d. Nesting/feeding areas (seabirds or turtles, for example)
   e. Areas of coral reef that have bleached in the past and have recovered
   f. Reef areas that are regularly subject to high temperatures
   g. Mangrove areas that have open space behind them (inland)
   h. Areas where herbivorous marine species are abundant

4. Once the map is completed, keep it safe for future use. If possible, take digital pictures of the map to capture and preserve the details.

5. Optional: Verify features on the perception map. If there are specific areas or features that need to be verified, the planning team can carry out basic field assessments to make sure the location and quality of the group's impressions are correct. A combination of techniques including coastal walks and snorkel- or SCUBA-based assessments can be used to review these areas. Afterward, make any necessary revisions to the map.

If feasible, a biologist or experienced conservation practitioner can also help with the design of assessment techniques and can work with the planning team and community to identify resources and their condition.

SESSION THREE:

CHARACTERIZING AND MAPPING NATURAL RESOURCE AND SOCIAL TARGETS

This session will help the planning team and community gather information that can be used to develop zones and rules for an LMA that has the best chances of providing community benefits by maintaining healthy, abundant, and resilient resources. A list of useful resources can be found in Appendix D, to help you find key information about target species.

GROUP ACTIVITY: Characterizing and Mapping Natural Resource and Social Targets

Facilitation Instructions

1. On the map the group created, circle all of the areas important for social and cultural uses. Write on the map what the areas are used for. Some examples follow:
   a. important fishing grounds (include type of fishing);
   b. important harvesting areas (include type of harvesting);
   c. important areas for tourism;
   d. important areas for recreation;
   e. aquaculture areas; and
   f. boat traffic areas.

2. Draw the following table on flip chart paper. Ask the planning team the questions below the table. Fill out the table using the team's answers. Add columns as needed up to eight species.

Key Ecological Information Needed	Information Will Help Determine:	Target Species 1 (_____)	Target Species 2 (_____)	Target Species 3 (_____)	Target Species 4 (_____)	Target Species 5 (_____)	Combined Information
Habitat needs (map)	Areas important for zoning						All habitats:
Spawning needs (map)	Areas important for zoning						All spawning areas: Seasonal spawning times:
Movement patterns (amount of area needed for each species)	Size of zones						Smallest: Largest:
Size and age at first reproduction	Zone duration (months/years) and rules to consider for the whole LMA						Zone duration: Size limits: Gear restrictions: Catch limits:

a. Review and confirm the five to eight top target species from Session 1, and list them in the top row.
b. For each of the target species, identify what key habitats each species needs throughout its life. Consider larval, juvenile, adult, and reproductive stages. Record habitats for each target species in the second row. On the map, draw circles around the best areas of habitat in your LMA for each species in each part of its life. This information will help you to determine where the group should consider placing specific zones.
c. Record the following information about the spawning of each species in the third row: specific areas needed, specific times of year, and any other requirements for successful reproduction. On the map, circle any areas critical for reproduction and note if there are specific times of year they are used for spawning. This information will help you to determine where the group should consider placing specific zones and whether they should be permanent FRZs or temporary closures.
d. Record the adult movement patterns of each target species in the fourth row. How big of an area does the species need? This information will help you to determine the size of zones.
e. Have the group discuss the size and age of first reproduction and best management practices that should be considered to protect each species throughout the LMA. Consider how quickly this species reproduces; if it reproduces slowly, the duration of the FRZ or other zone type may need to be longer. Also, consider minimum size limits, gear restrictions, or catch limits that can ensure reproduction of each species and minimize damage to habitat that is important for each species. This information will help the group to determine duration of zoning closures, as well as what rules they need to consider throughout the whole LMA. Record the information in the bottom row.
f. Combine all of the information from the previous columns in the "Combined Information" column to summarize the needs of all of the target species.

3. On the map, identify and circle areas where the threats or problems occur, including these:
   a. destructive fishing practices;
   b. land-based pollution (for example, sedimentation and pollution);
   c. coral bleaching;
   d. illegal fishing/poaching;
   e. coral mining or sand mining; and
   f. over-fishing or over-harvesting.

   This information can also be used to help identify where specific zoning should be placed and/or what rules might be good for the whole LMA.

4. Explain to the group that the information collected on the map and flip chart will be used in the next session to design the zones and rules for the LMA. This information will help the group to determine the best ways to manage the area so that it has the best chance of achieving the desired community benefits.

SESSION FOUR:

DEVELOPING ZONES AND RULES FOR THE LMA TO PROVIDE THE GREATEST COMMUNITY BENEFITS

Your group is now ready to develop zones and rules for an effective LMA that can maintain or improve the health and abundance of target species for the long-term benefit of the community.

This activity will require an open and honest discussion in order to develop the best LMA zones and rules—ones that balance the long-term health and resilience of their target species with the needs of the community. There isn't a single correct way to approach this session. The facilitators will need to keep the discussion open until consensus among the group is reached and people are comfortable with the area's zones and rules. Use the steps below to help guide the discussion.

GROUP ACTIVITY: Developing Zones and Rules for the LMA to Provide the Greatest Community Benefits

Facilitation Instructions

Explain to the group that this activity will be completed in these four sub-steps:

1. Getting organized, which includes reviewing important concepts and social and ecological information from the community;
2. Developing zones for the LMA;
3. Developing rules for the LMA; and
4. Reviewing the zones and rules for the LMA.

1. Sub-Step One: Getting Organized
   a. If it has been a while since the planning team and community completed the Outreach Section, review Flip Chart 14. This chart provides a summary of the Nine Essential Factors that lead to healthy, abundant, and resilient marine resources.
   b. Take time to review the concept of FRZs and other zones, including what they are, how they work, and the benefits they can provide. Use Flip Charts 15 and 16 and their key messages to review this concept.
   c. Finally, review the Nine Essential Zoning and Rule Recommendations to provide the best long-term fisheries and resilience benefits. If the community is not ready to implement all the recommendations at this time, the group can incorporate as many as possible as a start. Over time, as the community sees benefits, it may want to revise the LMA to incorporate more Zoning and Rule Recommendations and further increase the benefits.

2. Sub-Step Two: Developing Zones for the LMA
   a. Post the information from Session 3 (map and table) on a wall for group members to see and use.
   b. Begin this sub-step by reviewing the habitat needs and spawning needs of the community's top five to eight target species. Find this in the table and map developed in Session 3. This information indicates which areas the group should consider including in zones such as FRZs or seasonal closures.

c. Review the areas on the map that include important habitat or spawning areas for target species. Note that these circled areas are only potential areas for zoning—not final.
d. Next, review the adult movement pattern information collected in the table. This will tell you how large an area should be considered to protect each of the target species. It is best to consider creating zones such as FRZs to be as large as possible and at least twice as big as the largest size needed by the target species. The area would then also include the other species that need smaller ranges, if they also use that habitat.
e. On the map, indicate the best habitats needed for your target species that also reflect the size needed by your target species. Include different habitat types—for example, areas that contain mangroves, seagrass beds, and reefs. If the LMA is large, have the group consider including two or three different areas that have the same types of habitats within them.
f. Have the group discuss options for which zones could be FRZs and which areas could be other types of zones. Draw potential FRZs in one specific color and other zone types with other colors. Be sure to keep a legend.
g. Next, have the group discuss zoning options that support the Nine Essential Factors for long-term health and resilience of marine resources. As the group develops zoning options, ask the following questions:
    1. How much of this area are you willing to have in FRZs at this time?
    2. Are there any alternatives to the candidate FRZs?
        a. If there are, note the location of these areas.
    3. Are there activities that can be done outside of the candidate FRZs that will ensure that the community maintains access to high-quality fishing grounds and spillover from FRZs, in order to support income and food sources?
        b. List any alternative income sources. (Note whether any of the alternatives are destructive or will do more harm than good.)
h. After the group answers the questions and discusses various zoning options, continue to work with the group to decide which of the areas can remain in FRZs and other zones, and which need to be revised to meet the community's needs. Use a mixture of zones and rules that have the best chance of achieving the benefits the community wants to receive. Short-, medium-, and long-term closures should be considered, including FRZs (long-term, permanent) and temporary closures (short- or medium-term).

This process may require a repeated review of the Nine Essential Zoning and Rule Recommendations and community needs to revise the design until the group is satisfied with its decisions.

Be sure to get as close to the Zoning and Rule Recommendations as possible while also balancing community needs. Some communities have recognized that they need to take a stepwise approach to fully meeting all the recommendations so they can continue meeting their subsistence and economic needs. For example, the Locally Managed Marine Area Foundation in Indonesia has worked with communities to establish closed areas for certain species for a period of time, while still allowing the fishing of other species. Over time, as these protected species began producing fisheries benefits outside the closed areas, this has enabled the communities to protect additional species. In time, this has enabled communities to move to full no-take areas or FRZs while adequately supporting community needs throughout the process. The end result has been a great benefit to fisheries populations and the communities that harvest them.

There is not one right answer, so it will be up to group members to use the information they know and have learned to develop the best zones and rules. Remind the group that the community will have little chance to receive the benefits of the LMA if the zones and rules are not supported and, therefore, are not followed.

The most effective design will be the one that follows the Nine Essential Zoning and Rule Recommendations as much as possible but that also has the greatest community support.

3. Sub-Step Three: Developing Rules for the LMA
   a. Begin this sub-step by reviewing the table developed in Session 3, paying specific attention to habitats needed and the size of first reproduction for the target species (if available). Explain that the group can use this information to help determine possible rules about size limits, gear restrictions, and catch limits for the target species to ensure that they can have healthy habitats in which to live and can reproduce before being harvested.
   b. Review the recommendations for zoning and rules that support long-term health and abundance, and resilient resources. Recommendations #1 and #8 are specific to rules for the entire LMA, not just zones within the LMA.
   c. Make sure the map with the proposed LMA zones is posted on a wall where everyone can see it.
   d. Place a new piece of flip chart paper on a wall with the heading "Rules for the LMA."
   e. Ask the group to list what rules they should consider applying to the whole LMA. Record the answers on the flip chart paper. Again, this may require the group to repeat a review of the Nine Essential Zoning and Rule Recommendations and discuss community needs to determine the best rules possible for the site. It is critical that the entire LMA be well-managed.

      Rules outside of the FRZs should consider the long-term sustainability of the fishery. If fish outside the zoned areas are over-harvested, it is unlikely that the zoned areas alone will be able to maintain the populations of target species. Similarly, if habitats outside the zoned areas are destroyed, then marine animals will lose critical areas needed to eat, live, grow, and reproduce—again making it difficult to maintain or improve populations.

      Continue this discussion until the whole group is satisfied with the rules for the LMA.

4. Sub-Step Four: Reviewing the Zones and Rules for the LMA
   a. Make sure the proposed LMA zoning map and list of rules are posted next to each other on a wall.
   b. Review the group's design for the LMA. Review why the zones and rules were chosen. Assess the degree of support for the zones and rules.
   c. Review the placement of zoning boundaries to ensure they are easy to understand and enforce. Do they use natural or local landmarks that community members can recognize to determine if they are within a specific zone?
   d. Review the proposed zones and rules to ensure that they will support continued community benefits. It is possible that some short-term benefits may need to be sacrificed to help ensure longer-term benefits. However, it also is very important that the community can continue to make a living and meet its subsistence and economic needs.
   e. If the group does not support the design, continue discussions to achieve consensus. Once consensus is reached, determine a time when the group will come back together to review the design and determine whether revisions are needed to further support long-term abundance and resilience.

SESSION FIVE:

ENSURING THAT THE LMA USES SCIENCE-BASED ZONING AND RULE RECOMMENDATIONS

Prior to finalizing the LMA design, use the table below to assess whether the LMA considers, as much as possible, the Zoning and Rule Recommendations to support healthy and abundant resources that are resilient to climate change impacts and other threats.

If the design does not meet the recommendations, write a short description of how the group will move toward following the recommendations.

GROUP ACTIVITY: Ensuring That the LMA Uses Science-Based Zoning and Rule Recommendations

Facilitation Instructions

1. With the group, read through each science-based Nine Essential Zoning and Rule Recommendation in the table below, one by one. After reading each recommendation, review the zones and rules to assess whether the design meets the recommendation. If it does not, have the group either make changes to the zones and rules, or decide how they will move toward the recommendation in the future. For example, if, after reading the first recommendation, you notice that the group has not eliminated the clearing of mangroves throughout the LMA, ask if they would like to revise the rules. If they do not want to revise rules, then ask whether the group can move toward making this a rule in the next few years by exploring new options for building materials or firewood.

2. For each recommendation that is not addressed with the current LMA design, write on a piece of flip chart paper the group's approach to moving toward that recommendation in the future. This information can help guide the group to review and revise the zones and rules in the future. It also can inform the planning team of actions to include in the area's management plan.

Nine Essential Zoning and Rule Recommendations			
Essential Zoning and Rule Recommendations	**Explanation**	**Have you met this recommendation? YES or NO? If yes, how?**	**If "no," when and how can the group move toward this recommendation? *(Include specific dates.)***
Healthy Habitat Essential Factors: • Each Species Needs Different Healthy Habitats Where It Can Eat, Live, Grow, and Reproduce • Some Species Use Different Habitats at Different Times in Their Lives • Some Areas Survive and Recover Better than Others			
1. Establish strong fisheries regulations and other rules that prohibit destructive practices, and work to eliminate other threats over as large an area as possible.	Since different priority species use different habitats and many species use different habitats at different times of their lives, it is important to protect as much area of habitat as possible. Destructive practices and other threats that destroy habitat and populations of important species will significantly decrease the health and productivity of ecosystems. This will in turn greatly reduce community benefits. Destructive practices and other threats that should be eliminated include: • Blastfishing and the use of poisons • Bottom trawls or dragnets • Coral mining and anchoring in coral areas • Clearing of mangroves • Sedimentation from forest clearing and agriculture • Pollution including sewage, agricultural waste, and litter Additionally, the following fishing practices that primarily impact populations of target species should be eliminated across the LMA: • Illegal fishing and overfishing • Spearfishing on SCUBA, nighttime spearfishing, and fishing on hookah • Use of gear types that take high numbers of marine organisms like gill nets and lines with many hooks • Large-scale commercial fishing which is not sustainable in near-shore coral reef environments		

Essential Zoning and Rule Recommendations	Explanation	Have you met this recommendation? YES or NO? If yes, how?	If "no," when and how can the group move toward this recommendation? *(Include specific dates.)*
2. Aim to place 20 percent to 40 percent of each habitat type in FRZs (no-take zones that don't allow fishing or collection of any species). FRZs that include multiple habitat types are highly recommended.	Since different priority species use different habitats and many species use different habitats at different times of their lives, maintenance of ecosystem health can only be achieved if adequate areas of each type of habitat are protected in no take areas. FRZs that include multiple habitat types such as coral, seagrass, and mangroves are highly recommended. This provides species an opportunity to move between habitat types as needed. This management recommendation is designed to protect a minimum of 35 percent of the population of priority species. Fisheries scientists have determined that if 35 percent of the reproductive stock of a population of a marine species remains unfished and continues to reproduce, the population can be sustained and support ongoing fishing. Since we don't know what the healthy population level of each species was originally, the best way to protect 35 percent of the species populations is to protect between 20 percent and 40 percent of the habitat areas where the populations are found. If fishing pressure is low and there are other effective fisheries management approaches outside the FRZ, the percentage of area included in the FRZ can be lower (around 20 percent). If fishing pressure is high and there is little management outside the FRZ, the percentage of area FRZs should be higher (up to 35 or 40 percent).		

Essential Zoning and Rule Recommendations	Explanation	Have you met this recommendation? YES or NO? If yes, how?	If "no," when and how can the group move toward this recommendation? *(Include specific dates.)*
3. Aim to ensure that each key habitat type (coral, mangrove, seagrass, etc.) is protected in two or three FRZs (no-take areas). This can be done within one LMA if it's large enough or through the development of LMA Networks.	Different species depend on different habitats for their survival. By protecting at least three areas of each habitat type, if one area is damaged, the other areas may help to sustain the community and replenish the damaged area. This idea is known as replication. No-Take FRZs that include multiple habitats types are highly recommended. For LMAs that are small, it may be difficult to have more than one FRZ that replicates protection of habitat types. In this case, communities can work with neighboring communities to develop LMA networks that have FRZs that include the examples of the same habitat types.		
4. Be sure that any areas that have survived or recovered well from disturbance (or appear that they will) are included in no-take FRZs.	Certain areas tend to survive and recover better than others in the face of human, natural, and climate-related threats. Examples include coral areas that have recovered well from bleaching, areas that show tolerance to fluctuations in temperatures, and mangrove areas where there is space to move inland as the sea level rises. It is often possible to identify these areas based on local knowledge of how they recovered from impacts in the past. Please Note: It is important to maintain healthy herbivore populations (or species that eat marine plants and algae) in these areas. Herbivores can help control algae populations during times of disturbance (e.g., bleaching events). Keeping coral areas free of algae can help new corals resettle.		

Essential Zoning and Rule Recommendations	Explanation	Have you met this recommendation? YES or NO? If yes, how?	If "no," when and how can the group move toward this recommendation? *(Include specific dates.)*
Large Enough Areas of Habitat Essential Factors: • Some Species Need Bigger Areas Than Others as Adults to Eat, Live, and Reproduce • Many Fish Larvae Stay Close to Home			
5. Create FRZs within LMAs that are at least two times as big as the range needed by target species.	Since some species need larger areas than others, this will help to ensure that all target species have enough area to eat, grow, and reproduce. If a community has a small LMA area it is important to network with other communities to make sure that the size of area needed for target species is included within FRZs. FRZs can be smaller if there are also strong fisheries management rules in the entire LMA (such as: size minimums and size limits and bans on all overly efficient gear types like gillnets.). If FRZs (or no-take zones) are used as the only management tool, they should be as large as possible.		
6. Establish multiple FRZs (no-take zones) between one to 20 kilometers from each other.	Since it has been demonstrated that most of the larvae of many species of fish settle close to where they were spawned, it is important to establish multiple FRZs in a range of between one to 20 kilometers apart from each other. This will help to make sure that populations of important species remain biologically connected through the movement of larvae between the FRZs. It also helps to ensure that larvae that do not move very far have several safe places to settle and grow to be adults. Each coastal community should have their own well-designed LMA with as many FRZs as possible so that they can benefit from local management and from the larvae that remain in their area. If one community only has a small LMA, they can work with neighboring communities to establish networks of LMA that include multiple FRZs along a coastline.		

Essential Zoning and Rule Recommendations	Explanation	Have you met this recommendation? YES or NO? If yes, how?	If "no," when and how can the group move toward this recommendation? *(Include specific dates.)*
Successful Reproduction Essential Factors: • Successful Reproduction depends on Location, Numbers, Body Size, and Timing • Big Females Make More Eggs • Some Species Are More Vulnerable and Recover More Slowly Than Others			
7. Establish long-term (20 to 40 years), or preferably permanent FRZs (no-take zones)	Since big females make more eggs and some species are more vulnerable to disturbance and recover more slowly than others, permanent protection in FRZs is the recommended management approach. This allows all types of important species to recover and sustain healthy populations of large, highly reproductive adults that provide fisheries benefits outside the FRZs. Within a relatively short period (up to five years), species that reproduce quickly, such as fusiliers and parrotfishes, are likely to recover within FRZs. Within six to ten years, they will provide both larval and adult spillover benefits that can be maintained by a permanent FRZ. Large carnivores (groupers, snappers, jacks, emperors) that reproduce slowly will require 20 to 40 years of full protection in FRZs to recover populations and provide adult and larval spillover effects. The specific amount of time needed for recovery will depend on site conditions such as habitat quality and recruitment success.		

Essential Zoning and Rule Recommendations	Explanation	Have you met this recommendation? YES or NO? If yes, how?	If "no," when and how can the group move toward this recommendation? *(Include specific dates.)*
8. Establish strong fisheries management rules and zones throughout the LMA that protect large individuals, individuals which are spawning or carrying eggs, and areas that are important for reproduction.	Since successful reproduction depends on specific locations, large numbers of reproductive individuals, larger females that make more eggs, and reproductive seasons or times, management should consider these factors including: • Setting minimum sizes for harvesting. This will prevent the taking of individuals who have not grown large enough yet to reproduce. • Setting maximum sizes for harvesting. This will help to make sure large highly reproductive individuals (big mamas) are not harvested. • Preventing the harvest of individuals that are visibly carrying eggs. • Preventing the harvest of eggs. • Protecting spawning aggregation sites during spawning times. • Preventing the destruction or damage to any areas critical for reproduction (for example, sea turtle nesting areas). The best size of fish to catch outside FRZs are medium-sized individuals that already have reproduced but are not so large that they are the most important breeders.		
Effective Management That Provides Community Benefits Essential Factors: • Effective Management That Provides Community Benefits is Critical			
9. Ensure that Community Members are involved in, supportive of, and benefiting from LMA management.	Make sure that the community is actively involved in the management decisions and implementation and that the management system helps to ensure the community continues to benefit. If the community does not benefit they are unlikely to support management in the long term. Implementation of the zoning and rule recommendations must be balanced with the shorter- and medium-term economic needs of the community.		

SESSION SIX:

INCORPORATING THE LMA ZONING AND RULES INTO THE MANAGEMENT PLANNING PROCESS

Upon finalizing the LMA zones and rules, its design should be integrated into a management plan (new or existing) for the LMA. Specifically, the zoning map and the rules should be incorporated into the management plan.

Through the management planning process (see Figure 1), the planning team will develop the activities, budgets, and capacity needed to ensure that zones and rules are implemented and enforced.

The management plan also should consider activities that help community members be actively involved in, comply with, and benefit from the LMA. For example, management activities may include developing alternative livelihood programs to ensure that community members do not depend solely on one source of food or income. FRZs may limit the use of those resources, and climate change and other threats could negatively impact these resources.

The management plan should also include actions on enforcement of the LMA.

Finally, the management plan should be adopted formally, as appropriate to the area, including the zones and rules. This process helps to ensure that all stakeholders and leaders are supportive of the LMA's zones and rules.

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APPENDIX A

Designing a Network of LMAs for Long-Term Health, Abundance, and Resilience

The chances of improving the abundance and resilience of each individual LMA increases if there are other healthy and resilient areas nearby. These areas are all connected through winds, currents, and species' movement patterns. As a result, the development of networks of effective and resilient LMAs is recommended wherever appropriate and possible.

Before planning teams work together to design an LMA network, they should have first discussed the design of their own LMA. At a minimum, each planning team should have gone through the Outreach Section to understand the Nine Essential Factors that contribute to abundance and resilience, and the Nine Essential Zoning and Rule Recommendations that can be used to support the factors.

If nearby communities have not undertaken these steps, a good first step might be for community leaders to share their experience and understanding about effective LMA design. If other communities have completed the Outreach Section and have begun or completed LMA zoning and rule development (Planning Section), then this appendix can help facilitate the discussion between these communities to develop an effective network of resilient LMAs.

There are two sessions in this planning section.

- Session One: Deciding If It Is Best to Work With Other Communities to Develop a Network of LMAs
- Session Two: Reviewing Zones and Rules for the Network of LMAs to Provide the Greatest Benefits

SESSION ONE: DECIDING IF IT IS BEST TO WORK WITH OTHER COMMUNITIES TO DEVELOP A NETWORK OF LMAS

GROUP ACTIVITY

This activity will help a community decide whether it wants to coordinate with other communities to design a network of LMAs.

Facilitation Instructions

1. Explain to group members that now that their community has developed zones and rules for an effective LMA, it is time to decide if they will coordinate with nearby communities to work as a network of LMAs.

The Benefits of Effective and Resilient LMA Networks

- The chances of improving the abundance and resilience of each individual LMA increases if there are other healthy and resilient areas nearby. These areas are all connected through winds, currents, and species movement patterns.
- Working together can help improve management through information- and resource-sharing that supports collective goals.
- Working together may allow some communities to revise their LMA's design to gain community support while maintaining potential benefits. For example, a community may have trouble gaining support for an FRA that is twice as large as the area needed for the target species. However, in working with an adjacent community, the FRA can be placed next to the other community's FRA so that it adds up to be the best size to support target species. Individually, these communities would not be able to have an FRA that is large enough; by working together and placing the FRAs next to each other, they can essentially create one large FRA that supports target species between the two communities.
- Each community can still manage and make decisions regarding the zones and rules for its LMA. However, communities will share information and collaborate with one another to determine if revisions to their LMA designs would strengthen each LMA and the whole network.

2. Explain the benefits of effective and resilient LMA networks summarized in the box above.

3. Review the following statements to help the group decide if they would like to work with other communities.
   a. It may be best to work with other communities within a network of LMAs if the following conditions are true:
      i. The area the community manages is not large enough to encompass all important habitats needed by important species to keep them healthy, abundant, and resilient. Nearby communities may be able to protect important habitat and therefore increase the chances of improving resources' overall abundance and resilience.
      ii. The community is already working with other nearby communities in natural resource management or other efforts, and has good relationships with them.

b. It may be best to focus just on the community LMA in the short term if the following conditions are true:
   i. The area the community manages is large enough to include all important habitats needed by important species to keep them healthy, abundant, and resilient.
   ii. There is not enough time or capacity to expand efforts at this time.
   iii. The community has not been working with nearby communities in natural resource management.
   iv. This is the first time the community is carrying out a participatory process to manage resources, and group members are interested in focusing only on the community at this time.

SESSION TWO: REVIEWING ZONES AND RULES FOR THE NETWORK OF LMAS TO PROVIDE THE GREATEST BENEFITS

This session is the first to bring together planning teams from all of the communities that will potentially be part of the LMA network. To help to ensure that the interests of each community are represented in the process, it is best if each community has completed the Outreach Section and Planning Section individually. If they have not, be sure that they will go through those sections with their community to develop zones and rules for their individual LMA.

This activity will require an open and honest discussion to develop the best LMA network design that balances long-term abundance and resilience of target species with the needs of the communities involved. The facilitator will need to keep the discussion open until consensus among the group is reached and people are comfortable with the network's design. Use the activity below to help guide the discussion.

GROUP ACTIVITY: Developing Zones and Rules for a Network of Effective LMAs to Provide the Greatest Benefits

Facilitation Instructions

Session Two should be carried out through meetings with planning teams from all participating communities, now called the Network Planning Team. Further community meetings for each individual LMA will also be needed to review and verify and, possibly, revise individual LMA designs.

Explain to the group that this activity will be completed in these three sub-steps:

1. Review and revise individual LMA zones and rules to achieve network benefits (Network Planning Team);

2. Review and finalize revisions to individual LMA zones and rules (individual community planning team); and
3. Finalize the network rules and zones (Network Planning Team).

1. Sub-Step 1: Review and Revise Individual LMA Zones and Rules to Achieve Network Benefits (Network Planning Team)

a. To begin this process, bring together the Network Planning Team, which should consist of representatives and/or leaders from all of the communities that are interested in participating in a network of LMAs.

b. Use the Outreach Section to briefly review the Nine Essential Factors that must be considered to promote the abundance and resilience of marine resources, as well as the tools that can be used to support the Nine Essential Factors. Since most or all planning teams should have already reviewed this, there is no need to spend more than an hour going through this information.

c. Next, post the zoning maps from each community on the wall in geographical order. Also post the rules for each LMA next to each zoning map.

d. Draw the following table on several pieces of flip chart paper, and post them on a wall.

Community Name	Target Species	Desired Benefits
1.		
2.		
3.		

e. Ask each community's planning team to present the following information:
   i. top five target species;
   ii. benefits the community wants from the LMA;
   iii. threats the LMA will address;
   iv. zoning map, including each type of zone and why it was chosen; and
   v. rules and why they were chosen.

   Allow other teams to ask questions after each community presents. As each community presents, the facilitator should write in the table the community's top five target species, the desired benefits, and the threats to be addressed. The zoning map, the rules, and why zones and rules were chosen should already be posted on the wall.

f. After hearing from all communities, review the table, zoning maps, and rules. Note similarities between communities' targets, threats, and desired benefits.

g. Explain to group members that they will now explore how they can combine their efforts to increase the resilience of their marine resources and the benefits they provide. If needed, review the "Benefits of Effective and Resilient LMA Networks" from Session One (page 91).

h. Ask the group questions i through v, below. If they answer "no" to any of these questions, have them discuss if there are revisions that individual or all LMAs can make to change the answer to "yes." After the group discusses each question, be sure to write down any potential revisions to each individual LMA and/or the whole network on flip chart paper.

   i. Are there rules to prohibit destructive practices in all the LMAs?
   Write potential revisions. Include details about specific changes proposed in specific LMAs.

   ii. Throughout the whole network, are there two to three zones containing each of the important habitats for target species?
   Write potential revisions. Include details about specific changes proposed in specific LMAs, and indicate proposed revisions on the maps.

   iii. Throughout the whole network, are there at least three FRZs that protect at least twice the minimum range area by the widest ranging target species?
   Write potential revisions. Include details about specific changes proposed in specific LMAs, and indicate proposed revisions on the maps.

   iv. Are all the areas critical for the reproduction of target species protected in an FRZ or temporary closure?
   Write potential revisions. Include details about specific changes proposed in specific LMAs, and indicate proposed revisions on the maps.

   v. Are fishing management rules in place throughout the network to prohibit the taking of individuals that are small and have not been able to reproduce or are carrying eggs?
   Write potential revisions. Include details about specific changes proposed in specific LMAs.

   vi. Do FRZs (no-take zones) make up 20 to 40 percent of the total LMA network area?
   Write potential revisions. Include details about specific changes proposed in specific LMAs, and indicate proposed revisions on the maps.

i. Complete this session by reviewing the potential revisions with the group. Explain that each community planning team or representatives will now go back to their community to discuss the potential revisions and decide if they will accept them. If possible, set a date for the group to come back together to share the results of the individual community meetings.

2. Sub-Step Two: Review and Finalize Revisions to Individual LMA Zones and Rules (individual community planning team)

a. Each community planning team should bring the results from the Network Planning Team meeting back to its community through stakeholder meetings. These meetings should be used to share what was discussed and the results, including any possible revisions and the reasoning behind them.

b. Community stakeholders should decide which revisions they will accept and why, as well as which they will not accept and why. Write this information on flip chart paper.

3. **Sub-Step Three: Finalize the Network Rules and Zones (Network Planning Team)**
   a. Bring the Network Planning Team back together after each individual community has decided its final set of rules and zones.

   b. Ask each community's representatives to present their final zoning map and rules to the Network Planning Team.

   c. After all community representatives have presented, ask the group to draw a map of the entire network area that includes all of the individual LMAs. Use several pieces of flip chart paper to do this. Be sure to include the boundaries of the network area as well as the individual LMA boundaries.

   d. Do one final review of the complete network design. Discuss how the design provides the best chance to maintain abundant and resilient target species and long-term community benefits. Be sure the larger map of the entire network area is accurate.

   e. Discuss how network communities can work together to support the management of the network. This could include sharing resources to support outreach, monitoring, enforcement, or trainings. Setting up regular meetings among the Network Planning Team to review individual and network effectiveness and a need or interest in modifying zoning and rules may be useful. Working together to develop partnerships with local government offices or non-governmental organizations may also be helpful.

   f. Each planning team should be sure to update their individual LMA management plans with any changes made to zones and rules and/or any activities that were added through the Network Planning Team process.

APPENDIX B

Group Activity – Benefits of Fish Replenishment Zones Game

1. On a sheet of flip chart paper, draw a table with the following categories:

	Fisherman 1	Fisherman 2	Fisherman 3	Fisherman 4	Fisherman 5	Fish remaining	
Year 1							
Year 2							
Year 3							
FRA Year 1							
FRA Year 2							
FRA Year 3							

2. Explain that the group will be playing a game to understand how successful reproduction is the most critical key to the long-term health and abundance of species.

3. Organize everyone into the following two groups:
   a. Fishermen (no more than 25 percent of the group, up to a maximum of five group members): Fishermen must stand on one side of the room, designated as the "fish market." Explain that fishermen "fish" by walking around the room, catching a "fish," (everyone who is not a fisherman) and taking the fish to the fish market. They must bring each fish they catch to the market before they collect another.
   b. Fish (the rest of the group): Fish should disperse themselves around the room. Explain that fish are only allowed to move five steps from the spot on which they start the game, and then they must go back to that original spot. They then can move five steps in another direction. NOTE: If the group is less than about 20 people, use paper to represent fish instead of people. The facilitator can help disperse paper fish around the room.

4. Explain that every 30 seconds represents one year.

5. Explain that in the first game, fishermen will be allowed 30 seconds to collect as many fish as they can. Remind fishermen to walk and to take each fish back to market before fishing again. Start the game.

6. After 30 seconds, stop the game. Count the number of fish that each fisherman caught. Record the catch on the flip chart pages you prepared in the row labeled "Year 1." Also record the number of "uncaught" fish remaining.

7. Tell the group that the fish remaining have been able to grow big enough to successfully reproduce. Add another fish in the system for each one of the remaining fish.

8. Repeat steps five through seven (year two)—except this time add two fish for each fish that still remains in the system from year one and one fish for those remaining from year two.

9. Again, repeat steps five through seven (year three)—except this time add three fish for each fish that still remains from year one, two fish for those remaining from year two, and one fish for those remaining from year three.

10. At the end of year three, review the numbers with the group. Ask them the following questions.
    a. What is happening to the fish population over time? Why?
        i. It is likely that the population is decreasing because the fish cannot produce enough babies to replace the numbers being taken out of the system.
    b. What is happening to fishermen's catch over time? Why?
        i. It is likely that catch was good in the beginning but began to decline over time because there were many fishermen and not enough fish.
    c. By year three, did you target specific fish? If so, why?
        i. Fishermen might have noticed that the older fish were making more baby fish over time. They may have left them alone in favor of the smaller fish with less reproductive power.

11. Explain that the group will repeat this exercise. This time, though, the community has decided to establish an FRZ.

12. Have fishermen go to "market," and have fish disperse throughout the room. Then use tape or chalk to create a circle around about one-third of the fish, and explain that the circled area is an FRZ that cannot be fished. Explain that the fish have a lot to eat but that there is only enough food for a maximum of 15 fish.

13. Repeat steps five through ten. This time, however, fishermen cannot take the fish in the FRZ. Be sure to add fish into the system based on the fish remaining. If more than 15 fish end up in the FRZ, have the other fish move outside the FRZ.

14. At the end of the third round, discuss the following questions:
    a. What is happening to the fish population over time? Why?
        i. It is likely that the population has remained steady or increased as fish in the FRZ produced enough babies to replenish those fish being taken out of the system.
    b. What is happening to fishermen's catch over time? How does it compare to the first scenario?
        i. It is likely that fishermen's catch was steady or decreased at first but then increased. Fishermen had fewer fish to take when the FRZ was implemented, but catch began improving after the fish started reproducing.
    c. What do you think would happen if we kept playing this game?
        i. It's likely that the fish population would increase over time.
        ii. It's likely that fishermen's catch would increase over time as well.

APPENDIX C
Glossary

Adaptive management: The practice of monitoring conservation projects, including inputs, outputs, and outcomes, to measure advancement toward articulated goals. The basic steps of adaptive management are to conceptualize; plan actions and monitoring; implement actions and monitoring; analyze, use, and adapt; and capture and share learning (Conservation Measures Partnership 2013).

Climate change: A change in the state of the climate that can be identified (by using statistical tests, for example) by changes in the mean and/or the variability of its properties, and that persists for an extended period—typically decades or longer (Parry et al. 2007).

Climate change adaptation (CCA): Actions taken to help communities and ecosystems moderate, cope with, or take advantage of actual or expected changes in climate conditions. Adaptation can reduce vulnerability in the short term and long term (Parry et al. 2007).

Climate threats: The overall change in environmental conditions (e.g., increasing sea surface temperature) resulting from changes in climate due to increasing global greenhouse gas concentrations.

Ecosystem approach to fisheries management (EAFM): An approach to fisheries management and development that strives to balance diverse societal objectives by taking into account the knowledge and uncertainties about biotic, abiotic, and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries (Garcia et al. 2003).

Livelihood: "How we make our living, the things we use, and the choices we make to ensure that our lives run as we like." A sustainable livelihood, then, is a livelihood that "can continue into the future despite any changes and disasters and without losing that which makes the livelihood possible. This may include food production or being prepared for natural disasters. It is important to remember that income generation may be just one part of a livelihood" (Govan 2011).

Managed area: The spatial extent of the land or water that is identified for management integration. Managed areas, which should be as large as possible, may fall under the jurisdiction of one or more local communities, local governments, provincial or national governments, or a combination of all of these. Managed areas are ideally defined by ecological boundaries, resource use patterns, and governance jurisdictions. Examples of managed areas include seascapes, MPA networks, and FMUs. Examples of zones within managed areas include various types of MPAs, various types of FMUs, various types of land-based protected or managed areas, and others.

Management plan: An explicit set of rules governing how to apply the principles and framework of natural resource management in a given area. This plan may be adapted to changes in the natural and social environment or upon the basis of new information about how a system functions. It may or may not have a legal basis for implementation.

Marine protected area (MPA): Any area of intertidal or subtidal terrain—together with its overlying water and associated flora, fauna, and historical and cultural features—which has been reserved by law or other effective means to protect part or all of the enclosed environment (Kelleher 1999). "MPA" is used as a generic term to cover all sites that meet the International Union for Conservation of Nature (IUCN) definition, regardless of purpose, design, management approach, or name (e.g., marine reserve, sanctuary, no-take area, marine park) (IUCN-WCPA 2008).

Non-climate threats: The vulnerability of target resources can be affected by factors other than climate-related threats. Non-climate threats make existing resources more sensitive to climate impacts. Non-climate threats include natural hazards and man-made threats. Target resources may be exposed to natural hazards such as tsunamis and earthquakes. Upland deforestation, an example of a man-made threat, can cause sedimentation in nearshore waters, degrading coral reef habitats and making them more sensitive to climate impacts from increased sea-surface temperature and ocean acidification.

Resilience: The ability of an ecosystem to maintain key functions and processes in the face of human or natural stresses or pressures, either by resisting or adapting to change (Nystrom & Folke 2001). This concept applies to both ecological (natural) and social capacity to cope with, adjust to, and recover from external stresses and disturbances such as those brought on by climate change. It is the flip side of vulnerability. Therefore, if you increase the resilience of a community or resources, you will decrease their vulnerability.

Social Resilience: A community's ability to prepare for, withstand, adapt to, and recover from short- and long-term challenges to the material, social, economic, and cultural processes (Wongbusarakum 2012). In the context of LMAs, social resilience includes a community's ability to prepare for, withstand, adapt to, and recover from short- and long-term disturbances from climate change and other threats that cause significant negative impacts to marine resources that the community depends on.

Target species: The social and ecological assets of the community. Social assets may include people, homes, schools, hospitals, roads, businesses, and livelihoods. Ecological assets may include rivers, sand dunes, wetlands, estuaries, mangroves, coral reefs, and fish. Target resources are the focus of vulnerability assessments and adaptation planning.

APPENDIX D
Useful Resources

LMA Development/ Management Planning Process

- Govan, H., Aalbersberg, W., Tawake, A., & Parks, J. (Eds). (2008). Locally-managed marine areas: A guide to supporting community-based adaptive management. The Locally-Managed Marine Area Network. Retrieved from http://www.lmmanetwork.org/files/lmmaguide.pdf and http://bit.ly/z900Oa (Available in French at http://www.lmmanetwork.org/files/lmmaguide french.pdf)

- King, M., & Lambeth, L. (2000). Fisheries management by communities: A manual on promoting the management of subsistence fisheries by Pacific Island communities. Noumea, New Caledonia: Secretariat of the Pacific Community. Retrieved from http://bit.ly/TY8VBx

- International Institute of Rural Reconstruction (IIRR). (1998). Participatory methods in community-based coastal resource management (3 vols). Silang, Cavite, Philippines: IIRR. Retrieved from https://app.etapestry.com/cart/IIRR_2/default/index.php?search=Coastal+Resource+Management

Additional Outreach Posters for Resource Management

- Foundation of the Peoples of the South Pacific International (FSPI). (2007). Community marine resource management awareness posters (set of 13 posters and facilitators notes in English, Fijian, Solomon Islands, Tuvaluan, Kiribati, Vanuatu). Covers coral, MPAs/tabus, crown of thorns, logging, destructive fishing, reproduction, and larval drift. Retrieved from http://www.fspi.org.fj/index.php/coastal-community-resources/awareness-raising-materials or http://www.solomonseasustainables.com/ManageResources/InformationResources.aspx

Additional Fisheries Resource

- Secretariat of the Pacific Community. (2011). Guide to information sheets on fisheries management for communities. Noumea, New Caledonia: Secretariat of the Pacific Community. Retrieved from http://www.spc.int/DigitalLibrary/Doc/FAME/Brochures/Anon_11_ ISFC_00_ Guide.pdf

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