

Designing Effective Locally Managed Areas in Tropical Marine Environments



A Booklet to Help Sustain Community Benefits Through Management for Fisheries, Ecosystems, and Climate Change



**CORAL TRIANGLE
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Designing Effective Locally Managed Areas in Tropical Marine Environments:

*A Booklet to Help Sustain Community Benefits Through
Management for Fisheries, Ecosystems, and Climate Change*



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For more information

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This booklet is an abbreviated version of the following companion Facilitator's Guide: Gombos, M., Atkinson, S., Green, A., & Flower, K. (Eds.). (2013). *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*. Jakarta, Indonesia: USAID Coral Triangle Support Partnership.

Please see the companion Facilitators Guide for full acknowledgements, references and works cited, and information about related resources produced by the Coral Triangle Support Partnership.

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About this Booklet

INTRODUCTION

All communities want to live among healthy and abundant natural resources that provide long-term benefits including food, income, cultural value, and quality of life. However, coastal people throughout the world are now noticing severe impacts to their valuable natural resources from both human activities and the consequences of climate change. Over time, climate change will intensify the negative impacts from human activities that threaten natural resources. For example, sedimentation from land clearing may become worse with more intense storm events, and declining populations of fish from over-harvesting may be further impacted by increases in water temperature (Parry et al. 2007).

This booklet was developed to help communities sustain the benefits that they receive from the marine environment. It provides important information and recommendations on some of the best ways to reduce threats and impacts to marine resources by improving the design of locally managed areas. It is based on a companion Facilitator's Guide, which provides detailed instructions on how to raise awareness and complete planning activities for effective LMA design. This booklet provides the awareness-raising illustrations and key messages from the Facilitator's Guide. It also provides a summary of zoning and rule-making recommendations based on the best available marine science.

AUDIENCE

This booklet is designed for use by community and local government leaders, as well as all community members who utilize or depend on coastal and marine resources (including women, men, youth, and elders). It can be used directly by community stakeholders to follow along with facilitated discussions and activities, and/or used on its own to further understand and share information. The booklet can be used by communities that are initiating the design of an LMA or LMA network and by communities that are working to improve the effectiveness of an existing LMA. Additionally, this booklet can be used by agencies and organizations that have jurisdiction over or a supporting role in these areas.

KEY CONCEPTS

Locally Managed Areas:

This document focuses on supporting Locally Managed Areas (LMAs), which we define as the entire 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.

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 STRUCTURE

This booklet is divided into five sessions. Most sessions include flip chart illustrations that show key social and ecological concepts needed to increase and sustain the long-term health and abundance of marine resources. This in turn will help to support community benefits in the long term. Most sessions also include key messages that describe the meaning of each flip chart page.

- **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 the 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.
- **Session Five:** How Can We Develop Zones and Rules for Our LMA? - This session provides an overview of steps that communities can take to collect information and design zones and rules for their LMA that have the best chance of maintaining the long-term health and abundance of marine resources.

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 BENEFITTING FROM THE MARINE ENVIRONMENT





KEY MESSAGES

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

1. Food from marine resources
2. Income from the sustainable catch and collection of marine resources
3. Opportunities for other income from nature-based tourism
4. Ability to continue cultural practices and values
5. 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; and 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.**

FEATURES THAT CONTRIBUTE TO A COASTAL COMMUNITY BEING UNHEALTHY



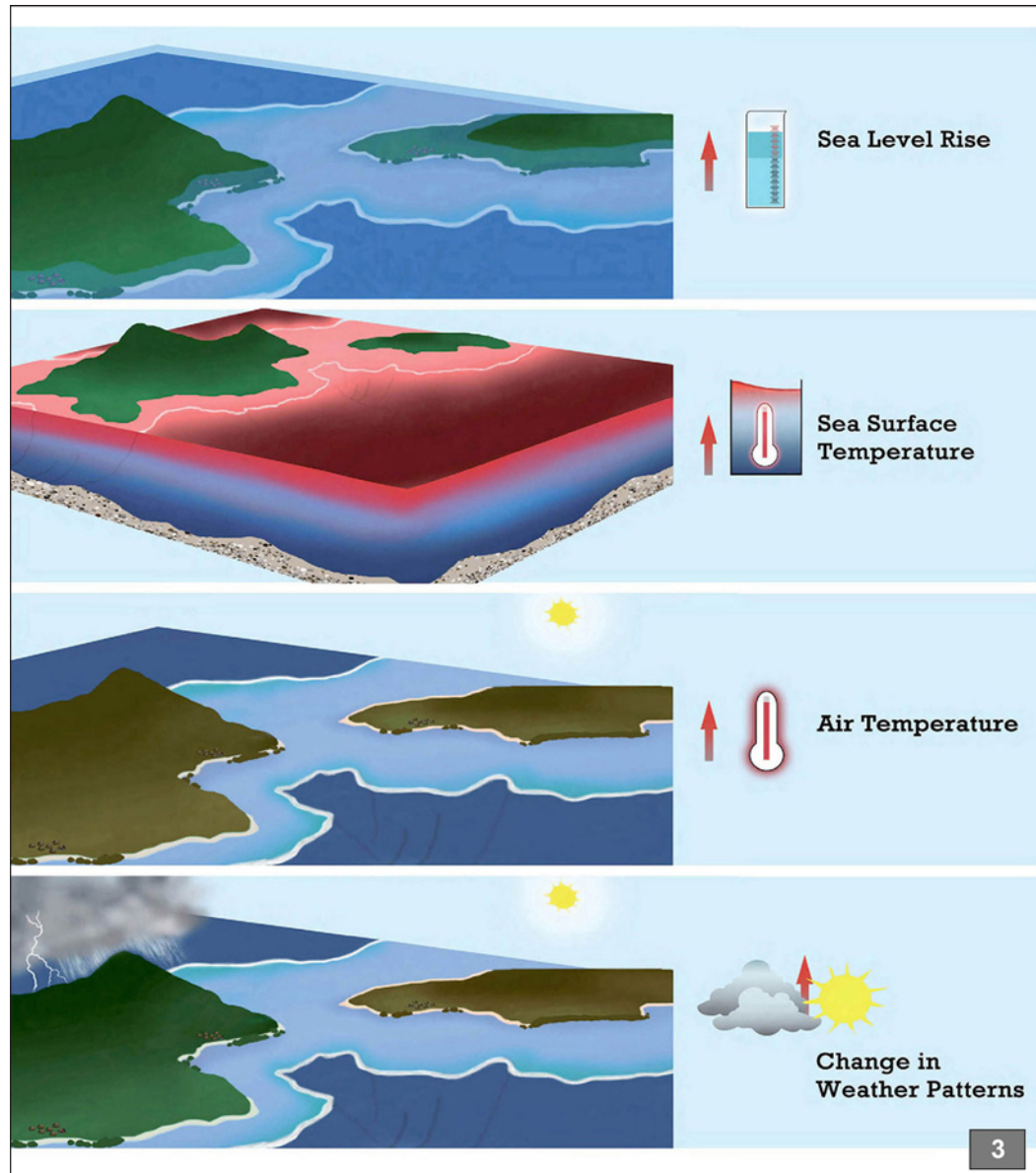
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 **KEY MESSAGES**

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.

HOW WILL CLIMATE CHANGE IMPACT OUR COMMUNITY AND ITS RESOURCES?





KEY MESSAGES

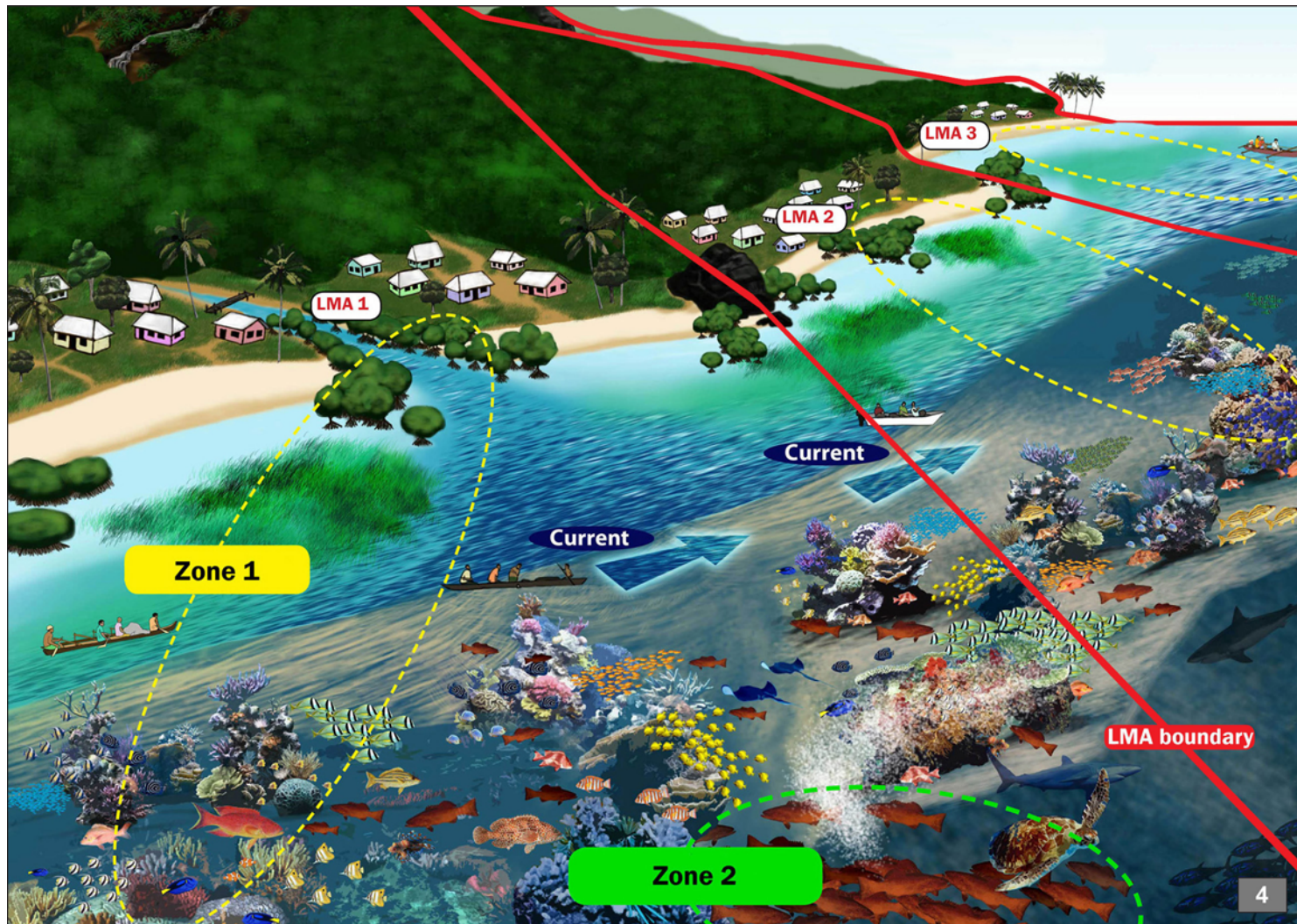
Climate change is expected to impact coastal communities. It will affect traditional and local uses of natural resources, including livelihoods and food security (e.g., agriculture and fisheries), in addition to community health and safety (e.g., safe drinking water, cultural practices, and infrastructure).

- 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.

SESSION TWO:

HOW WE CAN USE LMAs TO MAINTAIN HEALTHY COMMUNITIES

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



 **KEY MESSAGES**

- 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. Establishment of no-take FRZs is one of the most effective ways to build up populations of marine species that contribute to spill over and support sustainable fishing. A no-take FRZ or “no-take 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 permanently.
- 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.

SESSION THREE:

WHAT DO RESOURCES NEED TO REMAIN HEALTHY AND ABUNDANT?

1. The following are the four basic *needs* that are required for marine resources to remain healthy, abundant, and therefore 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 on the populations on all species that use that habitat during their life cycles.
 - b. **Large Enough Areas of Habitat** – Different species have different movement patterns 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 their 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.
2. The rest of this session will review the Nine Essential Factors that support these needs and that must be considered to keep resources healthy and abundant. The table below reviews the Nine Essential Factors.
3. 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 apply zones and rules. These recommendations were developed 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.

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

HEALTHY HABITAT

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



KEY MESSAGES

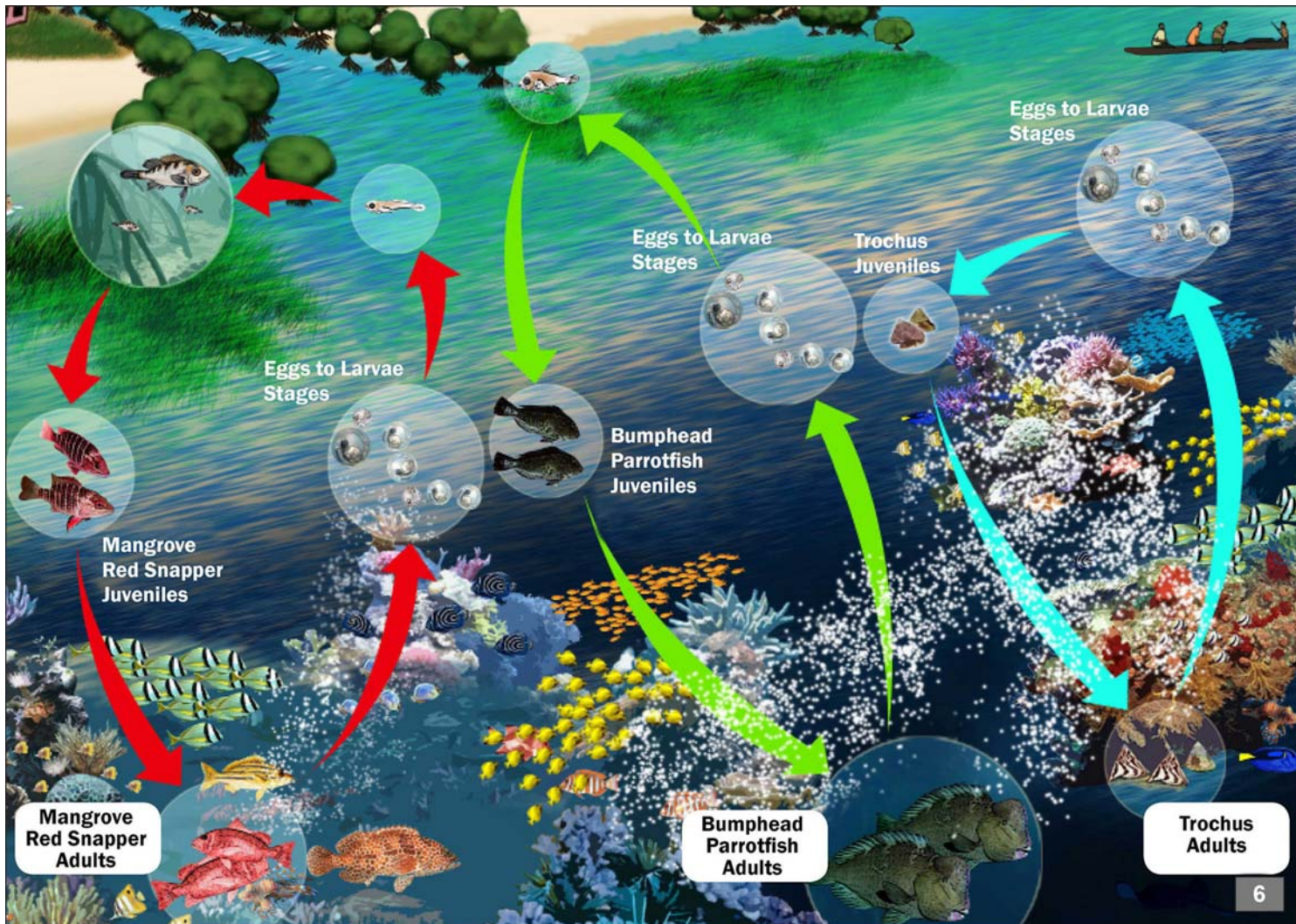
- a. Different species use different habitats for food, shelter, and reproduction, so it is important to protect all types of habitats. The following examples are numbered in accordance with the images on the illustration:
 1. Mudshell or mangrove clam
 2. Mangrove crab
Habitat: River mouths, estuaries, 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.

WHAT DOES THIS SUGGEST FOR MANAGEMENT?

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.

HEALTHY HABITAT

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



KEY MESSAGES

- 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, also known as mangrove jack: Young fish live in mangrove areas. Larger fish usually feed on and live in reef areas.
 2. Bumphead parrotfish: Juvenile bumpheads use sheltered lagoon habitats and inshore reefs. As they grow larger, they move to outer reefs that are more exposed. They also gather to breed on the outer reef fronts and passes.
 3. Trochus: Juveniles settle in coral rubble and then move to more open areas of the reef over time.
- 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.

WHAT DOES THIS SUGGEST FOR MANAGEMENT?

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 habitat types are protected from destructive practices.

HEALTHY HABITAT

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



KEY MESSAGES

- 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 that have certain features that indicate ability to survive and recover from rising sea temperatures (McClanahan et al. 2012) such as:
 - i. the presence of specific coral species that have demonstrated an ability to cope with stressors such as high temperatures;
 - ii. an ability to live in areas with wide temperature changes throughout the year, which can promote tolerance to abnormal temperatures;
 - iii. high rates of successful recovery among young corals that settle and survive following a disturbance;
 - iv. 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
 - v. 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.

WHAT DOES THIS SUGGEST FOR MANAGEMENT?

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).

LARGE ENOUGH AREAS OF HABITAT

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

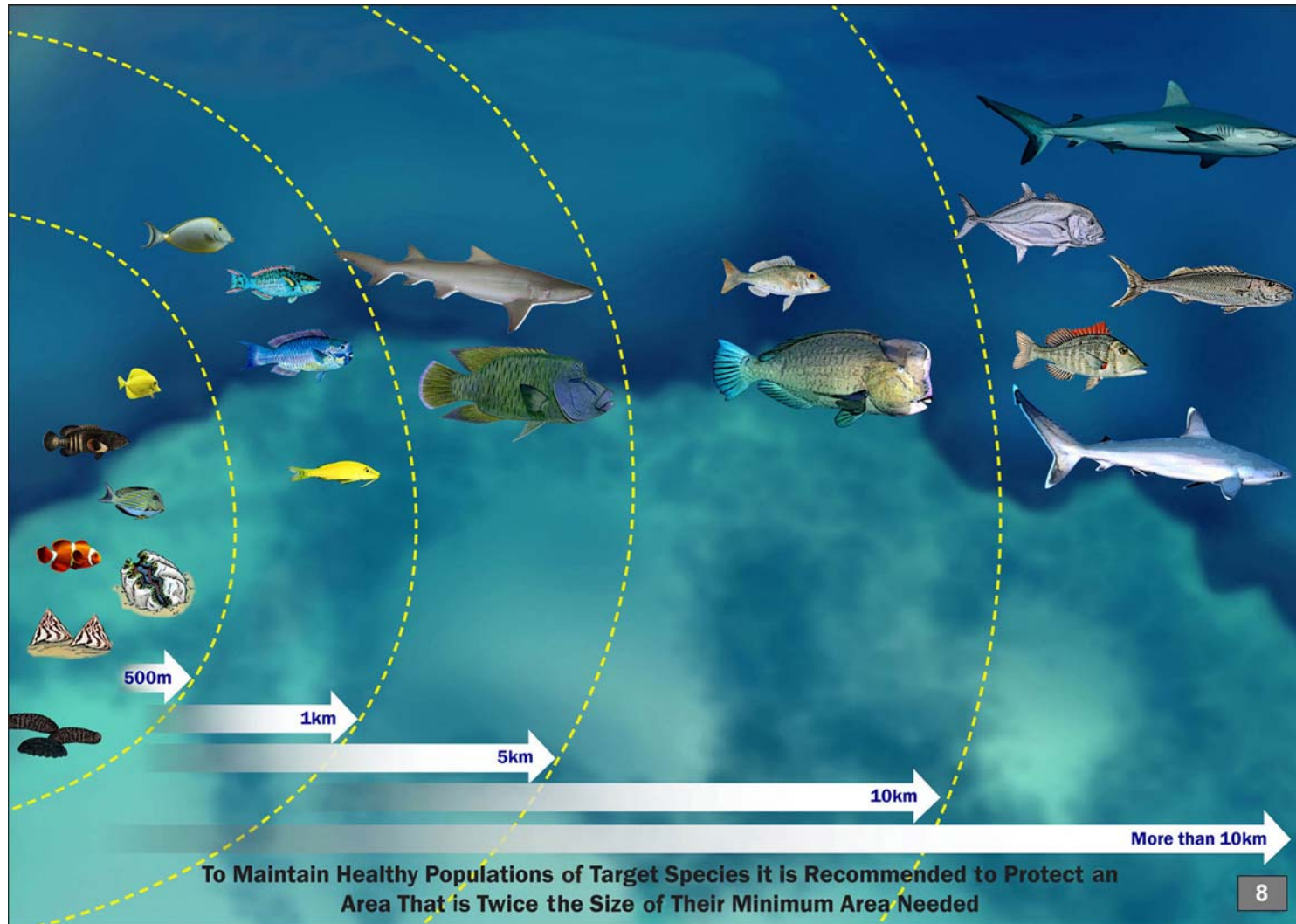


Illustration modified from Maypa (2012).

KEY MESSAGES

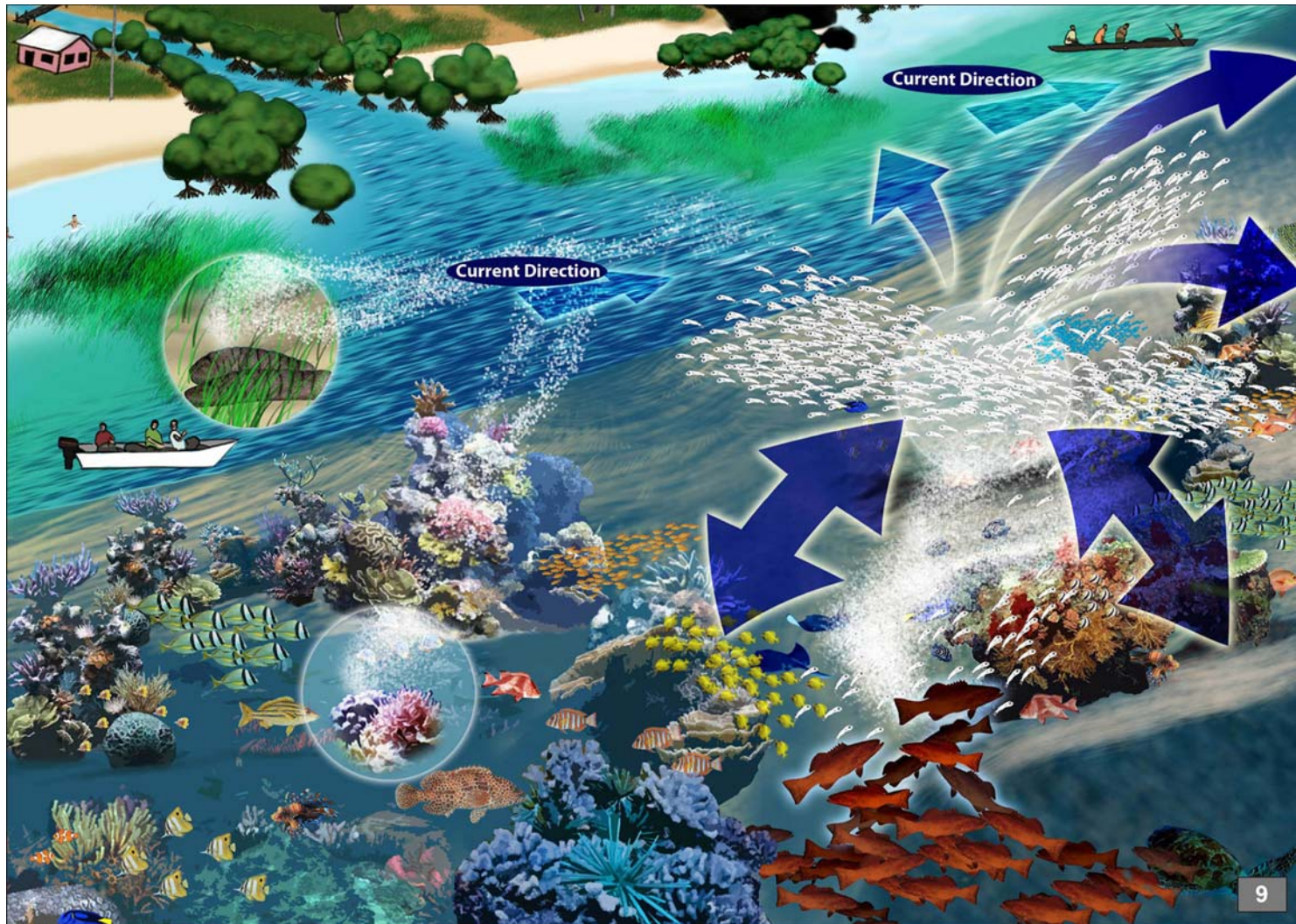
- a. Some species need bigger areas as adults than others to eat, live, and reproduce. The following examples describe how far different species move as adults and juveniles (Maypa 2012; Green et al. 2013). Scientists are regularly learning about the area needs of additional species to help guide management 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 1 km)
 - Some unicornfish
 - Some goatfishes
 - Many parrotfishes
 3. Medium distances (less than 3 km)
 - Humphead wrasse
 - Lemon shark
 4. Large distances (less than 10 km)
 - 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)

WHAT DOES THIS SUGGEST FOR MANAGEMENT?

It is recommended that LMAs and LMA networks be designed to include fishery replenishment zones that are large enough to ensure that even the largest target species have enough area to eat, move, and reproduce.

LARGE ENOUGH AREAS OF HABITAT

Essential Factor Five: Many Fish Larvae Stay Close to Home



KEY MESSAGES

- 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 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. As a result, we now see that managed areas do significantly benefit the community that established them because they retain high percentages of larvae that can grow up to be part of the local fish population (Almany et al. 2013).

WHAT DOES THIS SUGGEST FOR MANAGEMENT?

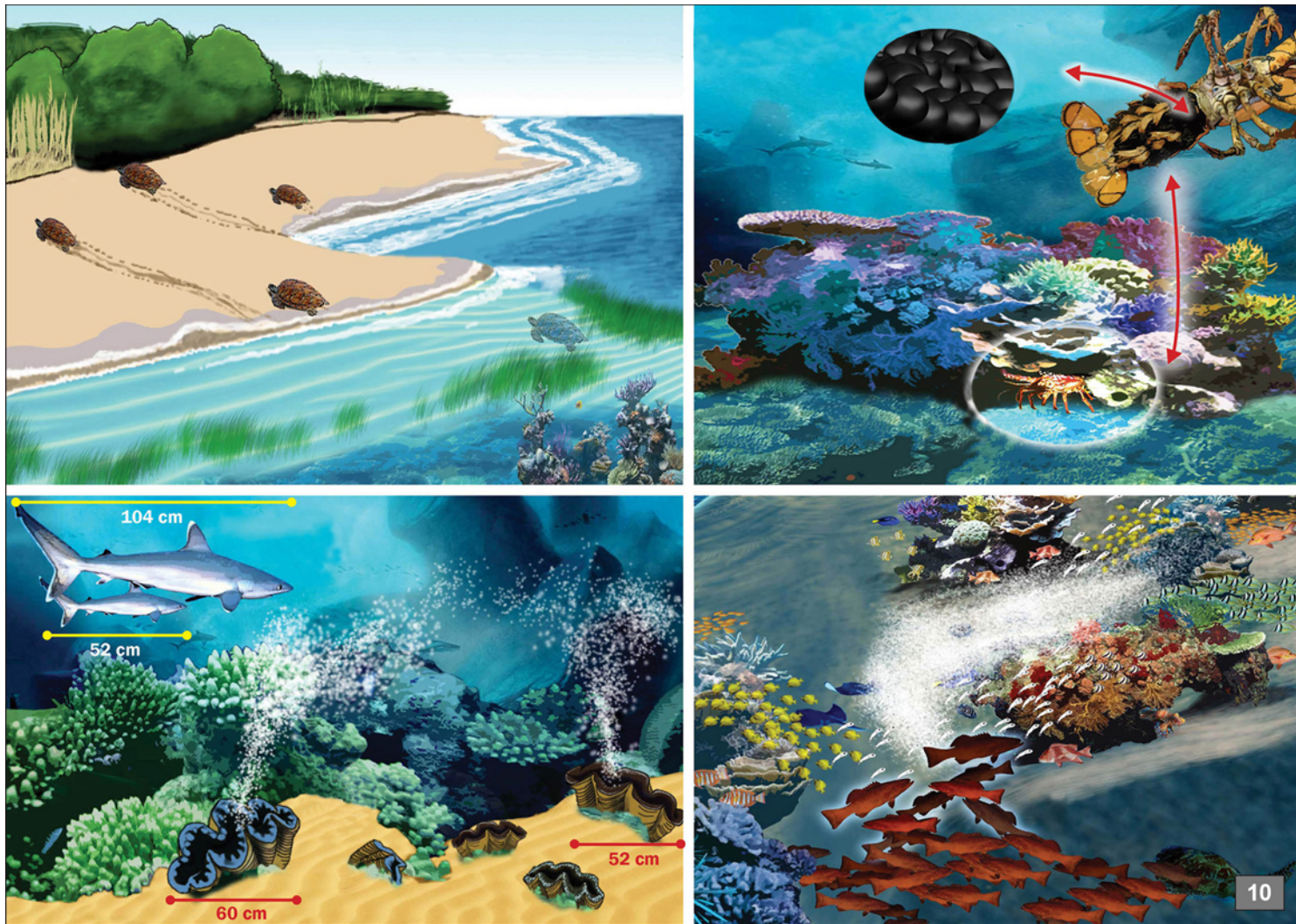
It is important to design LMAs with protected zones that are close together. If the protected areas are too far apart, then they may not be able to replenish or re-seed one another, which creates a bigger risk if there are disturbance events (e.g., storms, bleaching).

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.

SUCCESSFUL REPRODUCTION

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



KEY MESSAGES

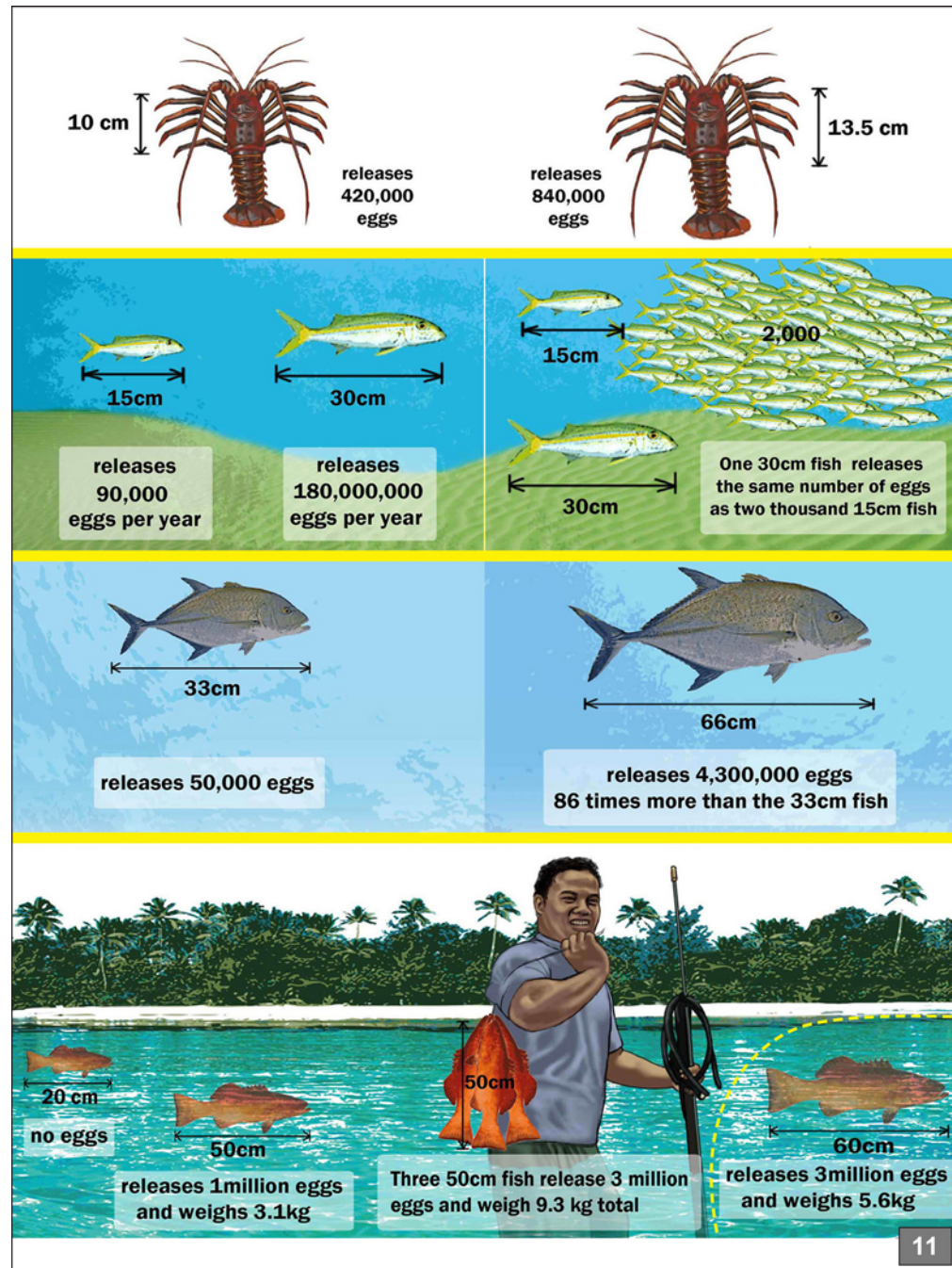
- a. Successful reproduction is the main factor leading to species abundance over time. To have healthy and abundant populations, species must have the chance to become adults and reproduce. The flip chart illustrates different factors that are important to successful reproduction:
 1. **LOCATION:** 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 are not able to reproduce until they reach maturity, usually at 100 centimeters in length at about eight to nine years (Smale 2005).
 - Giant clams 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 and the coral trout 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).

WHAT DOES THIS SUGGEST FOR MANAGEMENT?

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.

SUCCESSFUL REPRODUCTION

Essential Factor Seven: Big Females Make More Eggs



KEY MESSAGES

Large females make many more eggs and healthier eggs than smaller females; therefore, they will create more babies and increase populations. How many more eggs? Try to guess how many eggs different sized females shown on the flip chart produce each year:

Example One: Lobster (from MacFarlane & Moore 1986)	
A 10-cm lobster produces 420,000 eggs annually.	The 13.5-cm lobster, with only 3.5 additional cm, produces twice as many eggs (840,000 eggs annually) as a 10-cm lobster. This means double the number of potential new babies.
Example Two: Yellowfin goatfish	
A 15-cm adult female goatfish releases 90,000 eggs annually.	An adult female fish that is 30 cm, or double the size of the 15-cm goatfish, produces 45 million eggs four to five times per year. That amounts to more than 180 million eggs per year. 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!
Example Three: Blue trevally (from Sudekum et al. 1991)	
A 33-cm blue trevally produces 50,000 eggs annually.	An adult female fish that is 66 cm produces 4,300,000 eggs, or 86 times more eggs than the 33-cm fish half its size.
Example Four: Coral trout (from PISCO 2007)	
A 20-cm coral trout produces no eggs. One 50-cm coral trout can produce 1 million eggs and weighs 3.1 kg.	One 60-cm coral trout can produce 3 million eggs and weighs 5.6 kg. You need three of the 50-cm fish to equal the reproductive power of one 60-cm fish. One 60-cm fish can produce the same amount of eggs as the three 50-cm fish. The eggs of the 60-cm fish are healthier and have a better chance of surviving to adulthood.
<p>This fisherman's community is using good fisheries management measures. They created a management zone that allows fish to grow as big as 60 cm or more without being harvested (the yellow line shows the zone boundary where fish harvesting is not allowed). 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. They also prohibited the harvest of coral trout that are too small and have not yet reproduced. (The fisherman left the small fish in the water.)</p> <p>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.</p>	

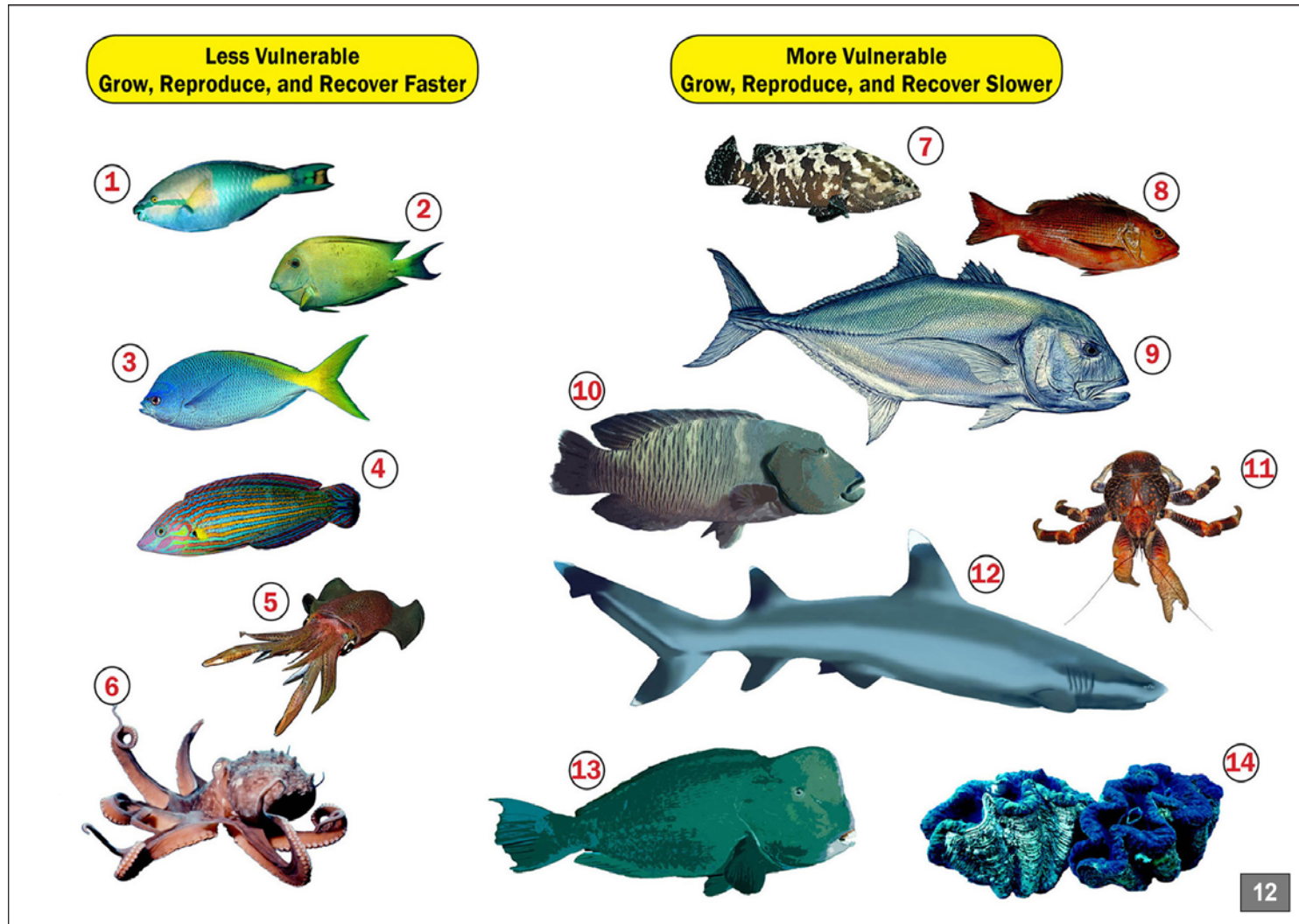


WHAT DOES THIS SUGGEST FOR MANAGEMENT?

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.

SUCCESSFUL REPRODUCTION

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





KEY MESSAGES

- 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, including most parrotfishes (e.g., #1 yellowfin parrotfish) and most surgeonfishes (e.g., #2 striated surgeonfish)
 - Most fusiliers (e.g., #3 yellowtail fusilier)
 - Small wrasses (e.g., #4 tail-spot wrasse)
- 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)
 - Octopus (e.g., #6 big blue octopus)
- d. The right side of the illustration shows examples of fish species that tend to be more vulnerable to disturbance 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 such as groupers (e.g., #7 brown marbled grouper); snappers (e.g., #8 two-spot red snapper); and jacks (e.g., #9 giant trevally)
 - Large wrasses (e.g., #10 humphead wrasse)
 - Sharks (e.g., #12 white tip reef shark)
 - Large parrotfishes (e.g., #13 bumphead parrotfish)
- 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. These include the following:
 - Coconut crabs (e.g., #11)
 - Giant clams (e.g., #14 elongate giant clam)

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.)



WHAT DOES THIS SUGGEST FOR MANAGEMENT?

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.

EFFECTIVE COMMUNITY-BASED MANAGEMENT

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



KEY MESSAGES

- 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 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.

WHAT DOES THIS SUGGEST FOR MANAGEMENT?

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.

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

1 Each Species Needs Different Healthy Habitats Where They 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

4 Successful Reproduction Depends on Location, Numbers, Body Size, and Timing

5 Many Fish Larvae Stay Close to Home

6 Some Species Need Bigger Areas Than Others as Adults to Eat, Live, and Reproduce

7 Heat Tolerant

8 Recovery from Bleaching

9 Space to Move

10 To Maintain Healthy Populations Of Target Species It Is Recommended To Protect An Area That Is Twice The Size Of Their Minimum Area Needed

11 Big Females Make More Eggs

12 Some Species are More Vulnerable and Recover More Slowly Than Others

13 Effective Management That Provides Community Benefits is Critical

14

 **KEY MESSAGES**

Be sure that you can list the four needs and nine essential factors that must be considered to keep marine resources healthy and abundant. Use the flip chart and table to review your answers.

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

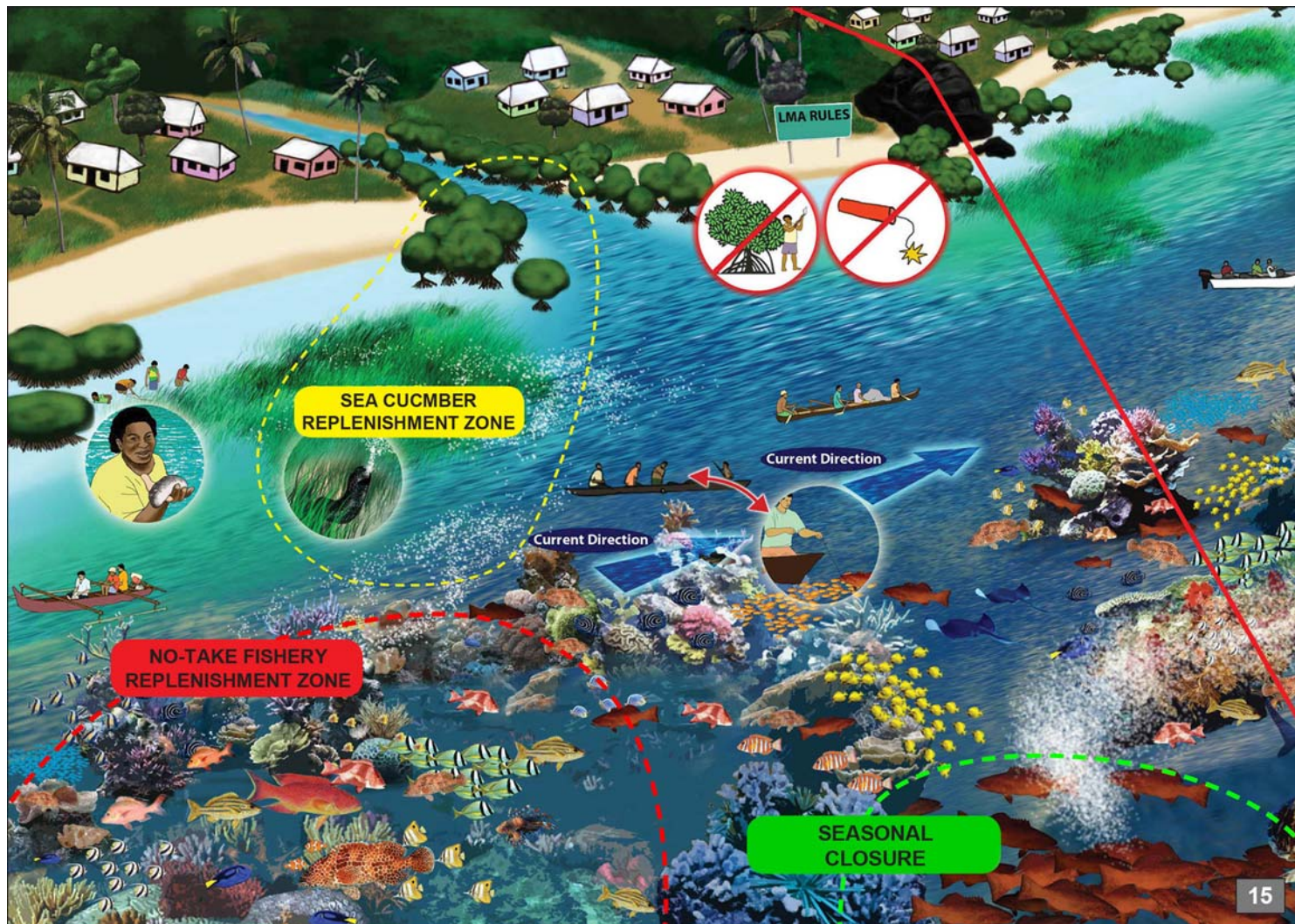
Effective Community-based Management

Essential Factor #9: Effective Management That Provides Community Benefits Is Critical

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

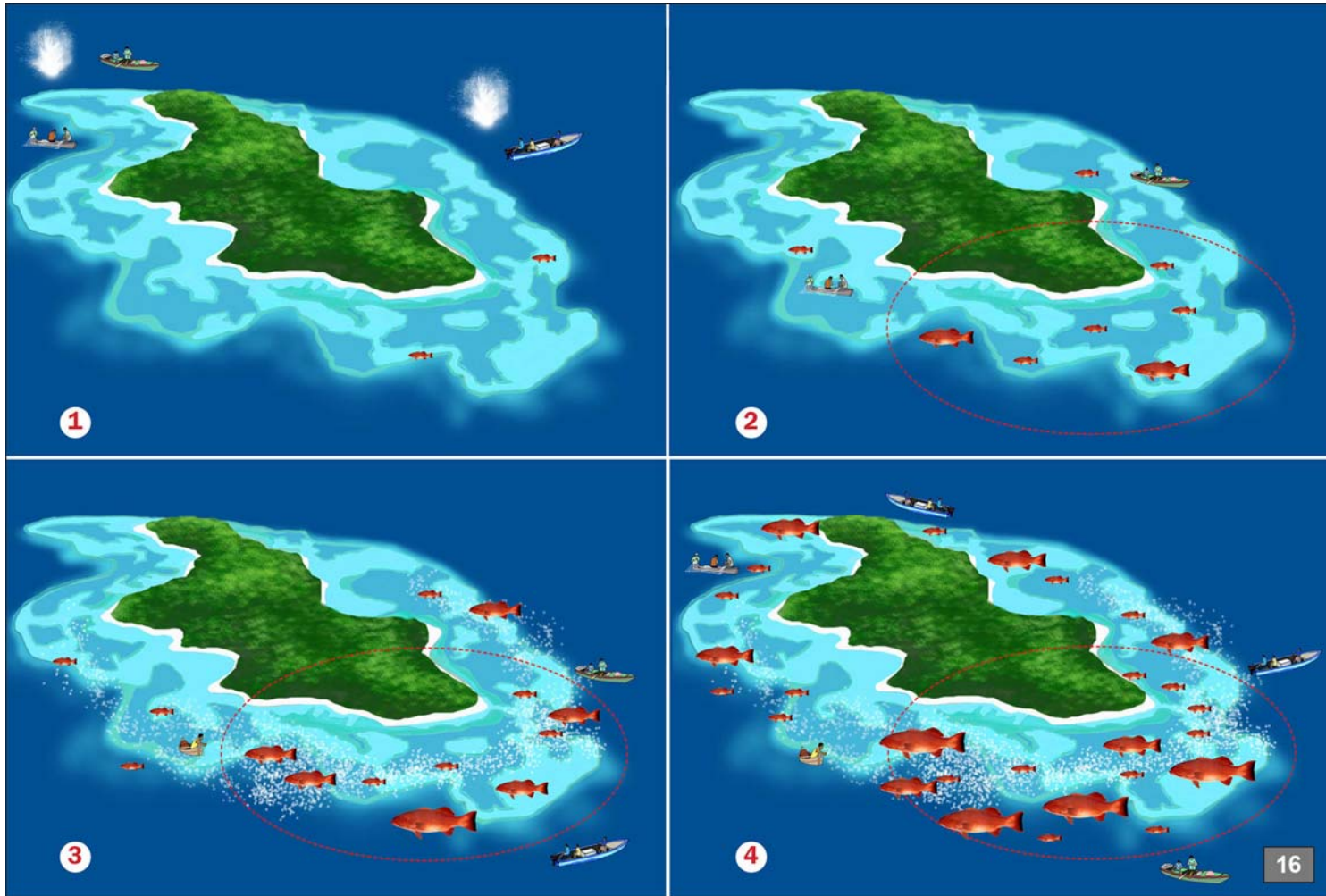
- a. Well-designed LMAs will include zones and rules that support the Nine Essential Factors. LMAs can be managed with different zones and rules that not only support healthy and abundant resources, but that also provide the best chance of achieving desired community benefits.
- b. There are many different types of zones and rules that can be included within an LMA. Below we summarize the options.
- c. Later in the booklet, we provide Nine Essential LMA Zoning and Rule Recommendations that discuss how best to apply these zones and rule options to achieve the greatest benefits.

TYPES OF ZONES AND RULES		
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)	<p>Size limits are rules that prohibit the harvest of species below or above a certain size.</p> <p>Minimum size limits prevent harvest of individuals before they have reached a size that is large enough to reproduce.</p> <p>Maximum size limits prohibit the harvest of individuals that are very large and contribute a lot of eggs to the system.</p> <p>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.</p>	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	<p>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. <i>Scientific expertise is required to understand the population dynamics of a species to set an appropriate limit.</i></p>	<p>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.</p>
Species-specific zone	<p>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.</p>	<p>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.</p> <p>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.</p>
Temporary closure zone	<p>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.</p>	<p>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.</p>

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.

THE BENEFITS OF NO-TAKE FISHERY REPLENISHMENT ZONES



 **KEY MESSAGES**

- a. No-Take Fishery Replenishment Zones (FRZs): For the purposes of this booklet, 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. These are areas that the community has agreed to set aside. In tropical marine environments, these are one of the most effective tools to improve 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.

- b. FRZs are one of the most effective ways to build long-term abundant fisheries populations and resilience (IUNC-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 provide larvae to replenish the local and surrounding populations.
 - 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 km), 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 FRZ 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.

- c. For example, a study of Apo Island in the Philippines showed that the biomass of the surgeonfish tripled over 18 years (1983 to 2001) within the FRZ. Additionally, the biomass of this species increased by a factor of 40 outside of 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).

TAKING MANAGEMENT ACTIONS THAT SUPPORT THE NINE ESSENTIAL FACTORS

Group Activity – Using the Nine Essential Factors to Manage Resources

- Several types of zones and rules can effectively support the Nine Essential Factors, improving the long-term health and abundance of marine resources and continuing to provide community benefits.
- In the table, write down the types of zones and rules your community could use to address each essential factor in your LMA design. Be sure to consider the management considerations in the key messages under each illustration!

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	

NINE ESSENTIAL ZONING AND RULE RECOMMENDATIONS FOR EFFECTIVE LMA DESIGN

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 to maintain 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 is met (Effective Management That Provides Community Benefits Is Critical).

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.

Review the zones and rules you developed in the group exercise and see how they compare to the list below, which describes zoning and rules that scientists recommend.

The following table has been modified from Fernandes et al. (2012).

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
<p>I. Establish strong fisheries regulations and other rules that prohibit destructive practices, and work to eliminate other threats over as large an area as possible.</p>	<p>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.</p> <p>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:</p> <ul style="list-style-type: none"> • 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 <p>Additionally, the following fishing practices that primarily impact populations of target species should be eliminated across the LMA:</p> <ul style="list-style-type: none"> • 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 	<p>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.</p>

Essential Zoning and Rule Recommendations	Explanation	Benefits of this Recommendation
<p>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.</p>	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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).</p>	<p>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.</p> <p>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.</p>

Essential Zoning and Rule Recommendations	Explanation	Benefits of this Recommendation
<p>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.</p>	<p>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.</p> <p>No-Take FRZs that include multiple habitats types are highly recommended.</p> <p>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.</p>	<p>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.</p> <p>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.</p>
<p>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.</p>	<p>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.</p>	<p>Protecting resilient areas will give a 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.</p> <p>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.</p>

Essential Zoning and Rule Recommendations	Explanation	Benefits of this Recommendation
<p>LARGE ENOUGH AREAS OF HABITAT</p> <p>Essential Factors: Some Species Need Bigger Areas Than Others as Adults to Eat, Live, and Reproduce Many Fish Larvae Stay Close to Home</p>		
<p>5. Create FRZs within LMAs that are at least two times as big as the range needed by target species.</p>	<p>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.</p> <p>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.</p> <p>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.</p>	<p>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.</p> <p>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.</p> <p>Additionally, large adults produce many more eggs which can also spill over into nearby areas promoting recover of populations nearby.</p>
<p>6. Establish multiple FRZs (no-take zones) between one to 20 kilometers from each other.</p>	<p>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.</p> <p>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.</p> <p>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.</p>	<p>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.</p> <p>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.</p>

Essential Zoning and Rule Recommendations	Explanation	Benefits of this Recommendation
<p>SUCCESSFUL REPRODUCTION</p> <p>Essential Factors: Successful Reproduction depends on Location, Numbers, Body Size, and Timing</p> <p>Big Females Make More Eggs</p> <p>Some Species Are More Vulnerable and Recover More Slowly Than Others</p>		
<p>7. Establish long-term (20 to 40 years), or preferably permanent FRZs (no-take zones)</p>	<p>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.</p> <p>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.</p> <p>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.)</p> <p>The specific amount of time needed for recovery will depend on site conditions such as habitat quality and recruitment success.</p>	<p>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.</p> <p>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.</p> <p>If communities still want to use short-term closures, these should be combined with other long-term or permanent closures.</p>

Essential Zoning and Rule Recommendations	Explanation	Benefits of this Recommendation
<p>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.</p>	<p>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:</p> <ul style="list-style-type: none"> • 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). <p>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.</p>	<p>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.</p>

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		
<p>9. Ensure that Community Members are involved in, supportive of, and benefiting from LMA management.</p>	<p>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.</p> <p>Implementation of the zoning and rule recommendations must be balanced with the shorter- and medium-term economic needs of the community.</p>	<p>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.</p> <p>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.</p> <p>Some approaches that can help to maximize community benefits include:</p> <ul style="list-style-type: none"> • 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. <p>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.</p>

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PRACTICE DEVELOPING LMA ZONES AND RULES



Group Activity: LMA Design Practice

1. Now you can 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. Use the information you learned to develop what you think are the best zoning and rules for the LMA to maintain long-term health, abundance, and community benefits. Use the community illustrated above for this activity. Here is some information about this community:
 - 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.

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. Begin the exercise by developing zones and rules that support the biological needs of the resources the community is targeting. Then modify the design based on the socioeconomic needs of the community to ensure the rules would be acceptable to the community.

3. Be sure to answer the following questions and record your answers and why they chose them:
 - 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 you place each zone and why?
 - d. What rules will apply to the whole LMA and why?

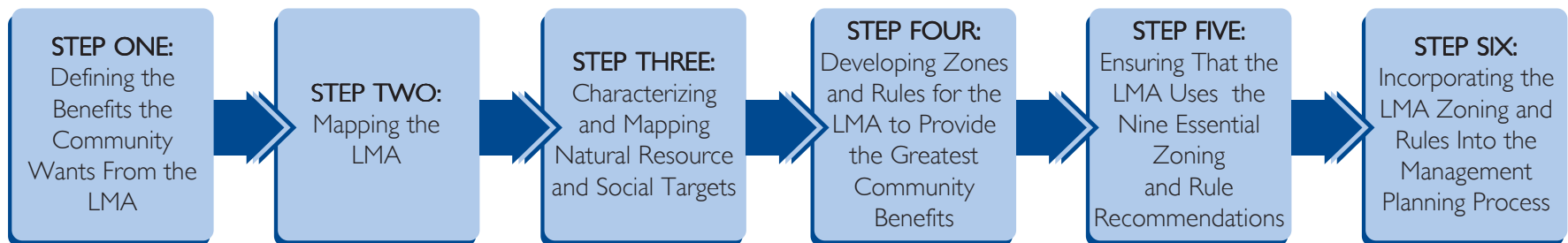
4. After your done developing zones and rules for the community on the illustration on page 54, review the following zones and rules which demonstrate good options to meet the ecological and social needs of this LMA. Compare these to the answers from your group and discuss any major differences:
 - a. 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.

SESSION FIVE:

HOW WE CAN DEVELOP ZONES AND RULES FOR OUR LMA

This section provides an overview of 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. 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 community and 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. These steps can be modified to best meet the planning team and communities' needs.

Steps that can be used to develop zones and rules for an effective LMA are summarized below. Instructions for a fully facilitated process to carry out these steps can be found in the companion guide to this booklet, "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." If a community wants to go through these steps, the facilitators can refer to the companion guide for details.



- I. Step One: Defining the Benefits the Community Wants From the LMA** — Before the planning team and community begin 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. 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 the populations and catch of important fish and invertebrate species that are used for food and income — grouper, snapper, trochus, and lobster, for example. This step has the community identify specific benefits they want to achieve, problems they want to address, and target species they are most interested in managing.

2. **Step Two: Mapping the LMA** — This exercise will help the planning team and community to develop a base map that shows the various marine resources, their condition, and features that are important for developing zones and rules for a resilient LMA (for example, all habitats, spawning aggregations, and areas that demonstrate good survival and recovery (e.g., resilience)). LMAs generally include all of the marine and coastal area for which the community has management authority. The map will provide the foundation for the community to visually develop boundaries for zones for the LMA.
3. **Step Three: Characterizing and Mapping Natural Resource and Social Targets** — This step will help the planning team and community gather and map important information about target species and social practices that can be used to develop zones and rules for an LMA that has the best chances of providing community benefits. Information that will be collected includes important fishing areas for the community, habitats that are important for target species, areas that are important for target species to spawn, movement patterns and sizes of areas needed by target species, sizes at first reproduction, and threats within the area.
4. **Step Four: Developing Zones and Rules for the LMA to Provide the Greatest Community Benefits** — This step uses all the information collected in the previous steps to draw zones and write rules for an LMA that can maintain or improve the health and abundance of target species for the long-term benefit of the community. This is done through open and honest discussion with a community facilitator to develop the best LMA zones and rules that balance long-term needs of target species with the needs of the community.
5. **Step Five: Ensuring That the LMA Uses Nine Essential Zoning and Rule Recommendations** — Prior to finalizing the LMA zones and rules, this step is completed to assess whether the LMA considers as much as possible the Nine Essential Zoning and Rule Recommendations. If the design does not meet the essential recommendations, the community is asked to consider how they might move toward them in the future. Please see the checklist in Appendix One below, which may be used both for checking the design of new LMAs and for reviewing the design of existing LMAs.
6. **Step Six: Incorporating the LMA Zoning and Rules Into the Management Planning Process** — After the planning team and community finalize the LMA zones and rules, this step is aimed at integrating the design into the LMA management plan (new or existing). Specifically, the zoning map and the rules should be incorporated into the management plan. Through the management planning process, the planning team and community 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, comply with, and benefit from the LMA. Finally, the management plan may 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.

Appendix One:
A Checklist for the Nine Essential Zoning
and Rule Recommendations for
Effective LMA Design

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: <ul style="list-style-type: none"> • 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.	<p>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.</p> <p>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:</p> <ul style="list-style-type: none"> • 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 <p>Additionally, the following fishing practices that primarily impact populations of target species should be eliminated across the LMA:</p> <ul style="list-style-type: none"> • 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.)
<p>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.</p>	<p>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.</p> <p>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.</p> <p>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.</p> <p>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).</p>		

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.)
<p>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.</p>	<p>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.</p> <p>No-Take FRZs that include multiple habitats types are highly recommended.</p> <p>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.</p>		
<p>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.</p>	<p>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.</p> <p>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.</p>		

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.)
<p>Large Enough Areas of Habitat</p> <p>Essential Factors:</p> <ul style="list-style-type: none"> • Some Species Need Bigger Areas Than Others as Adults to Eat, Live, and Reproduce • Many Fish Larvae Stay Close to Home 			
<p>5. Create FRZs within LMAs that are at least two times as big as the range needed by target species.</p>	<p>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.</p> <p>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.</p> <p>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.</p>		
<p>6. Establish multiple FRZs (no-take zones) between one to 20 kilometers from each other.</p>	<p>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.</p> <p>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.</p> <p>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.</p>		

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? <i>(Include specific dates.)</i>
<p>Successful Reproduction</p> <p>Essential Factors:</p> <ul style="list-style-type: none"> • 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 			
<p>7. Establish long-term (20 to 40 years), or preferably permanent FRZs (no-take zones)</p>	<p>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.</p> <p>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.</p> <p>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.)</p> <p>The specific amount of time needed for recovery will depend on site conditions such as habitat quality and recruitment success.</p>		

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.)
<p>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.</p>	<p>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:</p> <ul style="list-style-type: none"> • 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). <p>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.</p>		

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? <i>(Include specific dates.)</i>
Effective Management That Provides Community Benefits Essential Factors: <ul style="list-style-type: none"> • Effective Management That Provides Community Benefits is Critical 			
9. Ensure that Community Members are involved in, supportive of, and benefiting from LMA management.	<p>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.</p> <p>Implementation of the zoning and rule recommendations must be balanced with the shorter- and medium-term economic needs of the community.</p>		

If resources are healthy and intact, they have a better chance of resisting or recovering from the impacts of climate change and other threats. This is called “resilience.”



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