A Reef Reborn

Facilitator's guide

PART II

My Environment

The film is about time travel within an ocean. It is the story of an ecosystem that collapsed and a community that nurtured its recovery. Today, this story is a symbol of hope.

Introduction

***A Reef Reborn* Facilitators' Guide** was created to synthesize the lessons learned at Cabo Pulmo. It is intended as an instrument for those who wish to provide communities with a process that guides them to make decisions and take actions to care for their natural heritage, in consideration of their current and future generations' welfare.

The facilitator's role is different from the role of a teacher, because in this case there are no right answers. It acknowledges that each individual, group and community has its own history, values and vision. Based on these, they will forge their own pathway and destination. Thus, the facilitator is a companion that supports a learning process in a participatory way.

In the activities presented in the guide, the community envisions their future by exploring their past and present relationship with the environment, based on the following ideas:

1. All changes start within ourselves.
2. We are products of our family values.
3. How we live in our community, and its direct impact on our environment with possible global consequences.
4. We are all connected: what happens in the world could affect our environment, community, family and ourselves.

Finally, the activities have been designed using the premise that everyone is unique and has different talents: some people learn more by observation, others by listening and so on. This guide uses various tools such as games, contemplation, introspection, correlation and reflection to make the process accessible to all.

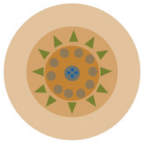
***A Reef Reborn* Facilitators' Guide** is structured in three parts:

Part 1. Me and my family

Objective: To lead the participants to contemplate their deepest "self" thereby raising awareness of their own unique presence in the world. They will also reflect on the positive values they acquired from their families that have enriched their lives.

Part 2. My Environment

Objective: Sensitize the participants to identify and recognize the benefits derived from their environment and orient them so they can develop conservation initiatives based upon ecological principles.



Part 3. My Community and My World

Objective: Motivate the participants to discover and build a community vision. Recognize the role of organization in collective and cohesive action.

Welcome to ***A Reef Reborn*** project.

We have developed this guide to provide a tool for those who wish to help communities recognize the value of their natural resources, wherever they may be, and ways in which they can conserve them.

This guide is a description of 20 activities. They are ideas or proposals. Everything depends on what you encounter in the community. With your experience you will surely improve what is proposed here.

If you would like to share your experience with the broader community, please write to facilitators@areefreborn3d.com, because we want to hear from you. By pooling our collective knowledge we can create a support network.

We recommend to begin the workshop by preparing the participants by:

1) Screening the film ***A Reef Reborn***;
2) Use the activities proposed in Appendix 1 (included in Part 1);
3) Follow the activities in Parts 1, 2 and 3.

"Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has."

Margaret Mead

1 LISTEN, OBSERVE AND FEEL

Estimated time: 60 minutes

OBJECTIVE: To understand the close link between nature and ourselves to become aware about what the environment provides us.

IN THE FILM: The people of Cabo Pulmo and its visitors appreciate and enjoy the benefits of the environment.

CONCEPTS: It is important to use all our senses to acquire the consciousness to completely understand our environment.

MATERIALS: *"Particles"* ***A Reef Reborn*** music (Appendix 1), *Reeflections* workbooks (Appendix 7), pencils.

BACKGROUND: Air and water are the most important elements that surround us and yet we pay little heed to all the benefits they provide. Our bodies are largely made of water and without it there would be no life. The air is equally necessary for us and almost all living things to breathe.

These two elements are essential for life and health, but also for the Earth as well. More than 70% of the Earth's surface is covered by water. Our atmosphere has 21% oxygen that we breathe to survive. Water and air help to cleanse and purify the environment as well as our bodies. But when they are contaminated they can carry diseases and cause sickness. Everyone has the right to pure air and water. If these two elements are clean in our communities we should value them as a privilege; if they are not, we need to take additional steps to procure them.

ACTIVITY: Invite the group to get comfortable and propose a challenge. Ask participants to stay still for a few minutes—then ask them if they are moving. Someone will answer that they are not moving. You respond by saying, "*we are always moving.*" Then ask: "*Why we are moving?*"

Suggest they pay attention to the involuntary movements of their bodies, to feel how the entire time they are moving —for example, their hearts, lungs, blood, among others things— that are all moving. Also, ask them whether they perceive how our planet is in constant motion with us on it. Sometimes we lose sight of many things simply because we do not pay attention to them.

Ask the participants to take their workbooks and find a confortable place outside to be alone for 20 minutes. Then think about the following idea: The things we pay no attention to.

"Breathe deeply a few times and then answer the questions —what does the air smell of? Feel where the breeze is coming from. Sense how the air enters through your nose. Listen to your breathing. Feel how the air fills your lungs and imagine how this passes into your blood. Now listen to the beating of your heart. Your blood is flowing and moves through your body. You are composed of 70% water, like our planet. Pay attention and look! Where is there water around you? Where are the veins in your community?"

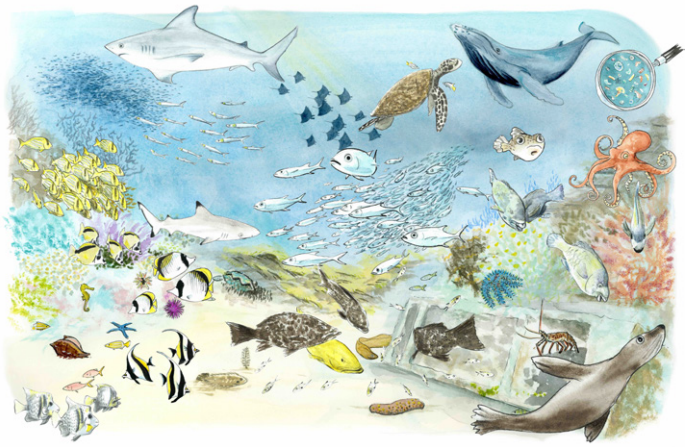
REFLECTIONS: When everyone is back together ask them to share their experiences. Present to them the following thought:
We are always in contact with air and breathing, water and a beating heart, nature and our health, but we often take them for granted, when in fact these are vital, fragile elements.
What would happen if we had no clean air or water?
What other aspects of nature do you think we ignore or forget?
How else does nature support our lives and keep us healthy.

Turn on the music and give the participants time to write their reflections in the workbook.

KEY WORDS: air, water, welfare, awareness, health, connection.

2 1,2,3 REEF!

Estimated time: 40 minutes



OBJECTIVES: To identify and understand what a coral reef is and to learn about its importance as a place of shelter for many organisms, where they can also feed and breed.

IN THE FILM: Different species hunt, hide and feed among the corals on the reef.

CONCEPTS: Corals are built by tiny animals called polyps. Corals are both producers and consumers of vital elements in the ecosystem. They are considered producers because they gain energy through a unique relationship with tiny unicellular algae that live within them and produce sugar through photosynthesis. They are also consumers that use tentacles to catch small organisms (plankton) carried by the currents.

Coral reefs provide a wide variety of physical spaces that promote an abundance and diversity of a large number of species.

MATERIALS: *"On the Beach"* ***A Reef Reborn*** music (Appendix 1), Printed image of a reef from ***A Reef Reborn*** (Appendix 2), *Reeflections* workbooks (Appendix 7), pencils, cloth sheets of various sizes but large enough to conceal a person (approximately one for every two participants) and an open space the size of a basketball court.

BACKGROUND: Coral reefs are similar to rain forests where a great diversity of species live and interact. They provide refuge for species that use them as places to rest, feed, reproduce, protect their eggs or raise their young.

Reef-building corals require special conditions to survive: The water temperature has to be just right—neither too hot, nor too cold. They require lots of sunlight to be healthy; therefore, reef-building corals are only found in the tropics in clear, shallow waters where sunlight penetrates easily.

ACTIVITY: Before starting the activity, ask the group to take a good look at the image of a coral reef, paying particular attention to detail. Ask participants the following questions: What do you see in the image? What do corals need to survive? Where do they live? Direct the discussion toward reaching the following conclusions:
1. Coral reefs are primarily constructed by corals.
2. They are located in tropical climates where the water is clear and shallow so sunlight penetrates easily.
3. Coral reefs support a great diversity of species.

Then ask the group to remember some of the species in the film and what they do. For example: "Moray eels live and hunt among rocks and corals and machetes feed on sardines."

Another possible question: *What do other species on the reef do?*

For example: Activities such as protecting, resting, feeding, reproducing and growing.
Therefore, coral reefs are important places of refuge for many species.

Conduct the next part of the activity in a big open space the size of a basketball court.

Randomly distribute the cloth sheets on the ground and give participants the following instructions: Send the entire group to one end of the area and place yourself at the opposite end. As the facilitator you have to close your eyes. The goal is to see which of the participants can reach you first without being seen. To reach you, the participants must run from one piece of cloth to the next and hide under it where it serves as a refuge. The pieces of cloth may not be moved from place. Soon after the game starts, as the facilitator, you shout slowly: "1,2,3 Reef!"— and you open your eyes. If you see someone uncovered they must return to the starting point and begin again. Repeat this several times. When the first participant reaches you the game ends or you can restart it.

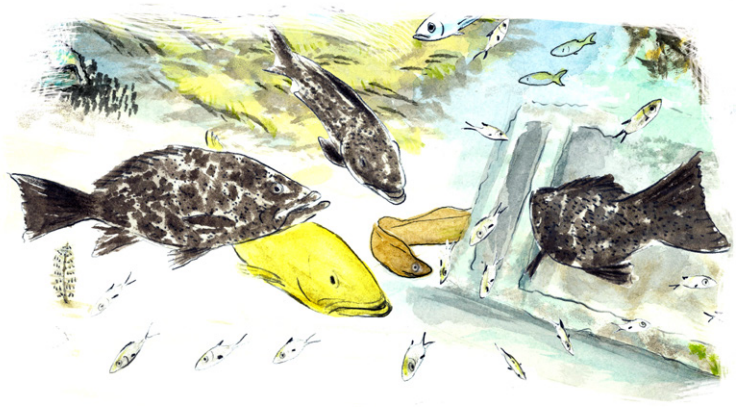
REFLECTIONS: Now ask the participants to imagine that the open space is the sea and the sheets of fabric are sheltering places within the reef. Then discuss the following questions: What would happen if we had double the number of fabric sheets? What if we have only half the number?
What happens if we destroy such places over time?
What would be affected first? Who would be affected after?

Turn on the music and give the participants time to write their reflections in the workbook.

KEY WORDS: shelter, reproduction, migration, feeding, hunting.

3 WHO EATS WHOM?

Estimated time: 30 minutes



OBJECTIVE: To learn what food chains and food networks are, in order to understand the flow and accumulation of energy in an ecosystem such as a coral reef.

IN THE FILM: Some fish such as scissortail damselfish feed on plankton. These fish in turn are eaten by predators like the groupers.

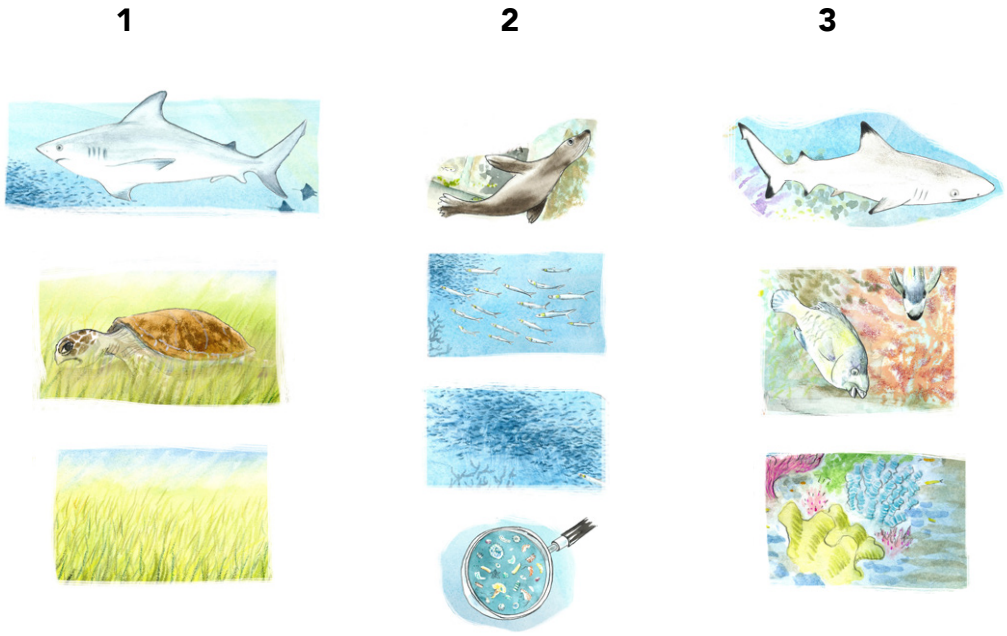
CONCEPTS: The food web involves energy relationships between defined groups of organisms, ranging from primary producers to top predators.

MATERIALS: ***A Reef Reborn*** *coral reef* watercolor (Appendix 2) poster size and letter-size image (one for every three participants), ***A Reef Reborn*** Food chain cards (Appendix 3), *Reeflections* workbooks (Appendix 7), pencils and markers.

BACKGROUND: As a general rule, organisms that produce their own food do so by capturing the sun's energy. These organisms are known as the producers and on coral reefs they are represented by algae, phytoplankton (plant plankton) and corals. The latter are animals, but are regarded as producers because the zooxanthellae within their tissues capture the sun's energy. A food chain links the producers to other species that eat them, which are in turn eaten by others and so on. In nature, most living things eat more than one thing, so that food chains are really interconnected to form food webs, representing all the energy relationships between the species in an ecosystem. Food chains and food webs describe how each species gathers nutrients and how the energy they contain is transferred from one individual to the next.

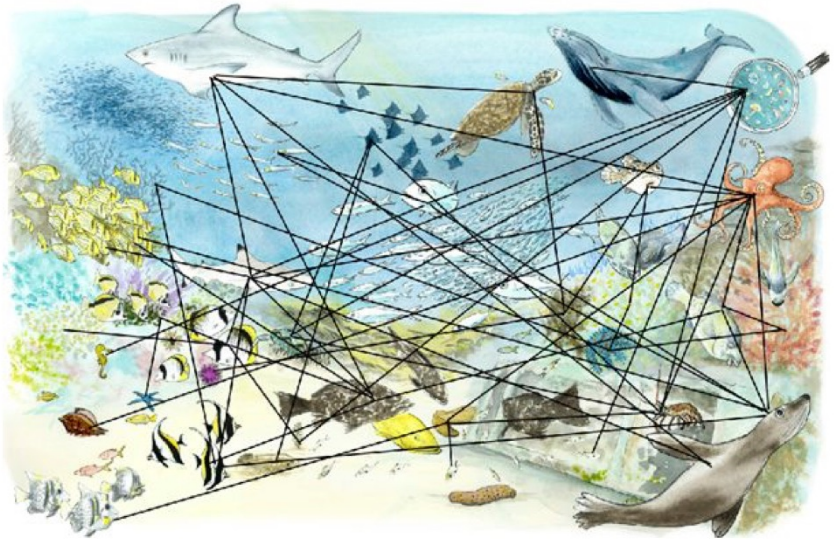
In all cases, energy is captured by the producers that transfer those nutrients and their energy to herbivores that in turn are eaten by predators (carnivores). Ultimately everything dies. Scavengers and bacteria then break down what remains of the original energy and all nutrients are recycled. So the cycle never ends.

ACTIVITY: Ask the participants to examine the 10 food chain cards. While looking at these examples ask: "*If plants on land produce their own food using energy absorbed from the sun, what does the same job in the ocean?*" (Confirm that the correct responses are plankton, algae and seagrasses, for example). Corals also produce energy because they live together with small algae in their tissues that harness the sun's energy. Ask them to place the cards indicating the direction of the flow of nutrients and energy. Examples: 1) Algae—turtle—shark. 2) Plankton—sardine—machete—sea lion. 3) Coral—parrotfish—blacktip shark.



Using ***A Reef Reborn*** watercolor poster invite participants to locate three of the primary producers (i.e. algae, plankton and corals). Then, invite a volunteer and ask him/her to try to build a food web starting with any of the primary producers. Everybody participates and discuss the example.

Later, you will ask them to form teams of three people. Each group is given a watercolor poster and markers. They should consider all food options for each animal. The challenge is to connect the right ones together.



At the end participants will have a drawing full of lines like the example. Ask them to exchange sheets between teams and observe the differences. It is possible that everyone has different connecting lines?

REFLECTIONS: Present the first three examples as a chain because each species is like a link, attached to the next link. Then consider combining the connections from the different sheets. Perhaps what they have drawn separately looks more like a network when combined. Ask why.

After listening to the answers, tell them that food chains in nature are interconnected and really the energy relationships more closely resemble food webs.

Subsequently, ask the teams to look at the food webs they drew and ask them to count the number of lines. Then ask them to imagine how many lines exist in reality; use the lines to form networks because most animals have multiple food options. Each line represents a transfer of energy.

Finally, ask the group: *What happens when the top predators die? Where does all that energy go?* Remind them that all living things need nutrients and energy to grow. We need to be fed, but at the same time we are also food. Although it might seem that there is a cap at the top of the food web, when predators die, they serve as food for bacteria and scavengers. It is an endless cycle.

The first law of thermodynamics is the application of the conservation of energy principle: *"Energy is neither created nor destroyed, only transformed."*

KEY WORDS: Food chain, food web, primary producers, predators, relationships, nutrients, food, energy.

4 WEB OF LIFE

Estimated time: 40 minutes

OBJECTIVE: To understand the interrelationships and complexities that exist in the coral reef ecosystems and how they are affected by the loss or reduction of some species.

IN THE FILM: ***A Reef Reborn*** illustrates the interrelationship between some reef organisms (such as morays, groupers and castanets) and how the Cabo Pulmo community was affected by decreased populations of pearl oysters, turtles and sharks.

CONCEPTS: A natural system is the set of living beings and environmental factors (such as climate, soil or water), which are all related to each other. These systems are part of larger systems, which are also related. The organisms of a system are related in various ways: they reproduce, they clean or are cleaned, they shelter, associate, compete, etc. Relationships involving keystone species have a profound effect on the community in which they live, so that if they disappear such a change may have a severe impact on a large number of organisms and the structure of the system.

MATERIALS: *Reeflections* workbooks (Appendix 7), pencils and an open/large space is required.

BACKGROUND: A system is a set of interrelated components requiring energy to perform a function. The complexity of systems depend on the number of components and the number of interrelationships between them.

In natural sciences, Ludwig von Bertalanffy applied the concept in his research on the "open system," which explains that all systems are part of a larger system so there are exchanges and connections between them.

Of all the relationships that can be found in a system in nature, those involving keystone species are the most important. These species—despite the fact that they may not be very large or abundant—exert a huge influence on the community in which they live. If lost, such species can affect a large number of other organisms and the system structure itself. The most common examples of these species are predators that regulate the abundance in other levels of food webs.

ACTIVITY: Begin by mentioning that feeding is not the only relationship between organisms.

Ask the following question: What other relationships have you seen or know about between organisms? Ask participants to think about what they have seen in their lives. In the film for example, there are fish cleaning other species like turtles; instead of eating each other, species often may hunt cooperatively like the groupers and morays.

Invite the group to stand. You must make sure they have enough space to move around. Ask each participant to think of two people in the group—preferably two that have a better relationship. These are each participant's two references that will be identified as number 1 and 2.
The aim of the exercise is for participants to move and stand in a position equidistant between their references: 1 and 2.
Call for four volunteers to illustrate these instructions and, at the count of three, these volunteers move to find that place equidistant with respect to their two references.

This group activity should last just 2 or 3 minutes (the more people there are in the group, the longer it takes, but it should not exceed 5 minutes). Then, without stopping the dynamics, warn them that some people will be withdrawn randomly, but the group must keep moving. You will remove only 20% of the participants (2 out of 10, 4 out of 20, etc.). Continue the exercise for a minute. Announce again you are now removing more participants, but they should not stop. Continue removing people in this way until only half of the group is left.

Here, you explain that what they did was behave like a system: each of them represents a component that is related to another system.

REFLECTIONS: When you finish the exercise, invite the group to sit in a circle and give the following instruction: *"Try to visualize all the movements that were happening simultaneously during the activity."* Do the participants have difficulty doing so?

After exchanging answers, point out that there were just four people active in the exercise and they were relating only ONE way. Then try to imagine what happens in nature when millions of living beings interact in multiple ways at the same time: for example in nature, while trying to eat, you have to take care not to be eaten—predator and prey are both in the same situation. Added to this, there are the dynamics of competition and cooperation. This makes systems so complex we cannot yet fully understand exactly how nature works.

Allow participants to reflect for a few minutes and then ask them what happened when you removed some of the participants from the dynamics. *Why did that happen?*

Follow it up by using an actual example. Ask them to think about what would happen if a species were lost. For this exercise return to example of the food web that was presented in the activity "Who Eats Whom?" Ask the group: *What if we lose sharks in our example?*

Encourage them to think of a keystone species for their community, and suggest some examples —corals, mangroves, kelp forests, sea grass—that are keystone species in their own ecosystems. Sharks and killer whales are predators. Sea otters are not top predators but they are a keystone species because they regulate the populations of sea urchins. Therefore, systems may stop working properly if they lose too many functional elements or keystone species.

KEY WORDS: ecosystem, interrelationships, complexity, fishing, balance, keystone species.

5 LOTTERY OF ECOSYSTEMS

Estimated time: 40 minutes

OBJECTIVE: To understand which key coastal ecosystems provide which environmental services, and how their ecological functions make them important.

IN THE FILM: ***A Reef Reborn*** shows that a coral reef is home to many marine species and provides the basic livelihood in the form of food and employment for people in the Cabo Pulmo community. But the reef goes far beyond this to provide additional benefits. For example, the system is a source of oxygen. It exports nutrients, energy and the spawn of many, many species. It also provides a protective barrier against hurricanes.

CONCEPTS: The processes within an ecosystem provide what we term environmental services that benefit both humans and all species.

MATERIALS: Beans (raw), ***A Reef Reborn*** Lottery of Ecosystems (Appendix 4) printed in cardboards, participants divided into four teams, *Reeflections* workbooks (Appendix 7) and pencils.

BACKGROUND: An ecosystem is defined as a system in a predetermined area in which all living beings interact with each other and with their environment (air, soil, water, etc.). On our planet, the ecosystems act like the vital organs of a living being. Ecosystems provide essential environmental services for life, such as capturing and storing water, producing food and oxygen,

moderating the climate, maintaining fertile soils or supplying vital products such as medicines or minerals.

Coastal ecosystems provide the following services:

Beaches…
Recreation.
Access to the ocean.
Areas for shelter, feeding and breeding.
Seafood.

Estuaries…
Areas for shelter, feeding and breeding.
Recreation.
Protect coastlines from waves and hurricanes.
Seafood.
Produce oxygen.

Coastal dunes…
Supply sand for beaches.
Recreation.
Protect coastlines from waves and hurricanes.
Prevent mixing of seawater and freshwater.

Mangrove forests…
Areas for shelter, feeding and breeding.
Nurseries for commercial species.
Recreation.
Protect coastlines from waves and hurricanes.
Produce oxygen.
Supply food for other organisms.
Seafood.

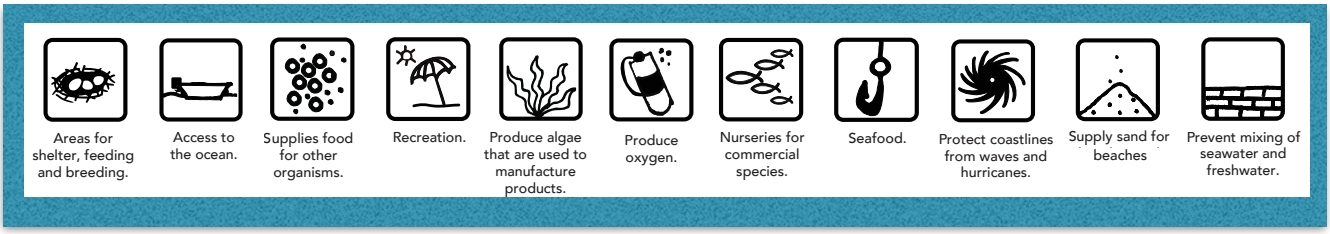
Marshes…
Protect coastlines from waves and hurricanes.
Supply food for other organisms.
Areas for shelter, feeding and breeding.
Recreation.
Seafood.

Seagrasses…
Nurseries for commercial species.
Supply food for other organisms.
Areas for shelter, feeding and breeding.
Seafood.
Produce oxygen.

Macro algae forests…
Protect coastlines from waves and hurricanes.
Produce algae that are used to manufacture products.
Nurseries for commercial species.

Produce oxygen.
Areas for shelter, feeding and breeding.
Seafood.
Supply food for other organisms.

Coral reefs…
Protect coastlines from waves and hurricanes.
Nurseries for commercial species.
Produce oxygen.
Areas for shelter, feeding and breeding.
Seafood.
Supply food for other organisms.



ACTIVITY: Before starting the activity, invite the group to divide into teams of four, (there are several dynamics to for doing this in a fun way; please look at other manuals). Give the teams a copy of the A Reef Reborn cardboard Lottery of Ecosystems and asked them to match the images with the icons. Then invite volunteers to use their own words to describe the services provided by marine ecosystems.

Before the game starts, distribute the beans and get everybody in place, ready to go. But this lottery is different! All cards have the same images. The dynamics are quite simple and transparent. Instead of naming the ecosystem the players will call out one of the services that the ecosystem provides. Note! Several of the cards with different ecosystems may provide the same service—ask the participants to place a bean on each of those cards. Those who pay the closest attention will finish fastest. The rule is that all team members must find where to place the beans but only one person will be in charge of actually placing them—to avoid chaos. The game will be repeated several times until ultimately all the ecosystem service phrases are explained.

REFLECTIONS: After the game, the participants will reflect on: *Which ecosystems in the lottery do we have in our community? How are these ecosystems important to us? Why?* Speculate about the consequences to communities if they lost their ecosystems, which provide benefits that frequently are not valued because we do not know about them. They are very important and we need to make an effort to keep them healthy.

Allow the participants the time to write the answers in their workbooks.

KEY WORDS: Environmental services, abundance, shelter, reproduction, feeding, welfare, protection, water, coastal ecosystems, beaches, mangroves, salt marshes, seagrass beds, estuaries, coastal dunes, kelp forests, coral reefs.

6 RECOGNIZING MY WATERSHED

Estimated time: 60 minutes

OBJECTIVES: Locate the community's watershed on the map, and the key ecosystems along the drainage basin. Raise awareness about the importance of these resources to our lives, the land and the ocean.

IN THE FILM: Some scenes show the general landscape of Cabo Pulmo: specifically, the community, the beaches, the reef, the hills and dunes. All of them are located on the coast within a watershed that provides the resources needed for survival.

CONCEPTS: Water is the single most essential resource for communities and ecosystems to exist. The definition of a watershed is useful for analyzing our interaction with water and its relationship with the rest of the system.

MATERIALS: "*Home*" ***A Reef Reborn*** music (Appendix 1), Image of ***A Reef Reborn*** Watershed (Appendix 5) or a flip chart, Post-it notes, *Reeflections* workbooks (Appendix 7), pencils, colored markers, cardboard, plasticine, magazines, fabric pieces, etc.

BACKGROUND: Watersheds are areas of land that function as large containers that collect water, which then flows by gravity on the surface or below it into a river, lake, aquifer, estuary or the sea. Much of the water in a basin is underground and filters down through the different layers of soil into basins called aquifers.

Each watershed is different. There may be one or more ecosystems in watersheds, depending on their size and where they are located, such as deserts, marshes, mangroves and oceans, among others. These resources and human communities depend on high-quality water and its availability. Water is used for drinking, cooking, washing, for agriculture, fishing, etc. In addition, it often carries away much of our trash and debris, unfortunately.

There is almost no place in the world that does not belong to a watershed. In areas where there are natural resources and human communities, our activities often create negative consequences for ourselves and the environment.

ACTIVITY: Before beginning, ask all the participants to look at the watershed drawing that comes in their workbooks. Explain what a watershed is. Now invite them to draw a map or sketch their own community's watershed. They can use the illustration of ***A Reef Reborn*** Watershed (must be printed in poster size) or a piece of white cardboard. Write a list of the main components making up the watershed on a flip chart, including:

- The community.
- Where the springs originate and the streams and rivers flow.
- Nearby hills and mountains.
- Ecosystems such as: Deserts, forests, riparian habitats, lagoons, marshes, esturaries, mangroves, beaches, coastal dunes, forests, stands of macroalgae, sea grass beds, coral reefs.
- Agricultural fields, cattle ranches, industries, aquaculture farms, fishing camps, roads, salt works and desalination plants.
- Anything else that may be relevant in their maps such as a landfill or trash dump.

The participants will decide where to place the resources. Turn on the music and give some time. When they are done with the drawing, invite them to discuss how their community and each of the ecosystems on their maps use water (example: Near the community there is a mangrove forest where we harvest oysters). Write these answers on Post-it notes and place them on the relevant parts of the drawings. When finished, participants present their maps, pointing out the resources one by one and explaining all the productive activities carried out within their watersheds.

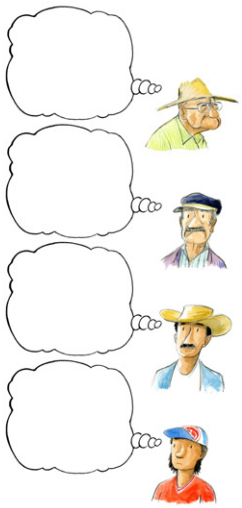
REFLECTIONS: To complete this activity, review some important interactions within the watersheds by answering the following questions: *Where does the water for our community come from? What if we run out of it? What happens to the waste we produce and where does it go?*

At the end of this discussion, give everyone a little time to answer the questions in their workbooks.

KEY WORDS: Aquifer, watershed, groundwater, activities, consequences, ecosystems, water, basin.

7 CHANGES OVER TIME

Estimated time: 60 minutes



OBJECTIVE: Using a timeline, identify environment changes over time and determine what are natural changes caused by long-term events or natural cycles and what may be caused by humans.

IN THE FILM: After the pearls ran out Jesus began to hunt sharks and later, when sharks were gone, he and others hunted turtles instead. Each generation of fishermen learned from the one before that the inhabitants of the reefs were changing over time until there were very few left.

CONCEPTS: The environment and the communities that inhabit it changes over time as the population expands altering the quantity and quality of space and non-renewable natural resources. The nature of these changes will define the lifestyles of future generations.

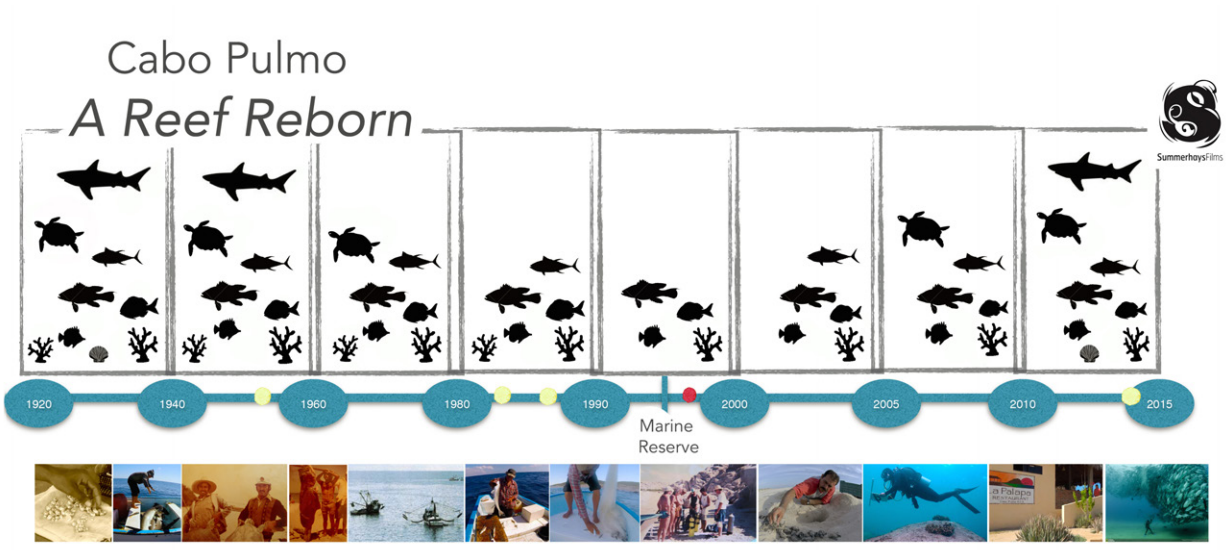
MATERIALS: ***A Reef Reborn*** Cabo Pulmo Timeline printed at Tabloid/A3 size paper (11"x17") (Appendix 6), markers, four sheets of white flip chart paper (previously prepared with lineage charts of great-grandparents, grandparents, parents and the current generation), *Reeflections* workbooks (Appendix 7).

BACKGROUND: The history of small communities is rarely documented. In the past, history was related by telling stories, generation to generation, in the oral tradition. Making decisions about the future is based upon experiences of the past. Without a history one cannot learn, making it difficult to decide about the future, both for individuals and a community.

Recollection triggers thoughts about events that have happened in the past. Collective memories gathered from a group of individuals help reconstruct the history of change that has taken place and this can provide a basis upon which to make future decisions. Preparing a timeline orders a sequence of recollections that helps identify the timing of events, their causes and consequences.

Ecosystems are dynamic: their composition and structure change naturally over time. Natural events such as hurricanes, droughts, fires and frost are caused by weather. Other, long-term natural changes may be caused by one-time astronomical events or may be part of a longer cycle that occurs every few years, such as El Niño, or over tens of thousands of years—such as Milankovitch Cycles. But other changes are sometimes entirely due to human influences. They may be subtle or extreme.

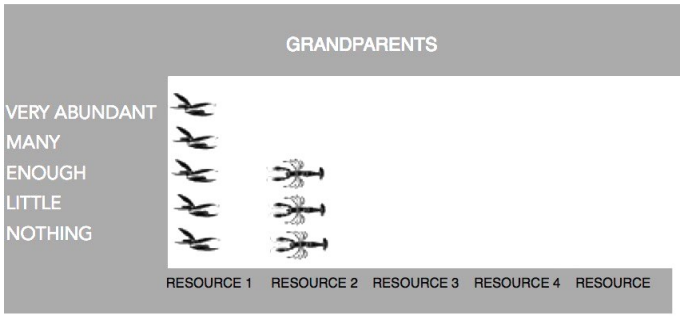
ACTIVITY: Gather the group around to look at the Cabo Pulmo Timeline and open the discussion. *What happened? How did the marine resources change over time? Why did this happen? What happened to corals? What do those red and yellow dots mean?* Give participants time to think about it. The yellow and red dots indicate El Niño years. Red indicates the year in which the corals were most heavily affected.



Turning to our own community: *Do you think the environment has changed in the last 100 years? If so, how?*

Next, divide the participants into five groups and show them the maps of the watersheds (produced during Activity 6) and ask them to choose 5 natural resources that are used for consumption or trade.

Based on personal knowledge or from what they learned from others, each team should reconstruct what happened to those resources over time from four generations ago to the present. If there is enough time, they can interview/call members of the community. Each team will then estimate the abundance of their resources and record them on the flip chart as shown in the example below:



When all five teams have completed their reports, ask them to analyze which of these resources has changed most and which has changed least—and why. Open up the discussion to the group to analyze the changes. Were they due to natural changes or were we responsible? Record their answers on the flip chart. Each participant will record the conclusions from all the different teams and enter his or her own conclusions and the consequences in their workbooks.

REFLECTIONS: When we talk about nature it is often from the viewpoint that human and natural worlds are separate. Everything is connected on this planet. We are part of it. We have the right to use from nature what we need to survive, but with the responsibility not to destroy the environment in the process.

KEY WORDS: Deterioration, recovery, natural resources, environment, alteration, collective memory, disturbances, natural cycles, consumption, responsibilities, rights.

8 FISHING FOR EVERYBODY

Estimated time: 60 minutes

OBJECTIVE: To consider the current status of fisheries, the means of analyzing them and the existing mechanisms to make them sustainable by regulation.

IN THE FILM: ***A Reef Reborn*** shows us how the rich abundance of fish that once existed in Cabo Pulmo was diminished over the years. Fishermen had to work farther and farther away from home. Some even had to retire from fishing. Ultimately, the community decided to make a change and, with the support of scientists, requested the government to create a protected area.

CONCEPTS: Overfishing brings grim consequences for fishing communities and for one of the main sources of food for humans. It also threatens certain species with extinction.

MATERIALS: Chocolates and candies of different sizes, shapes and colors (20 pieces per player), items to represent the habitat (shells, stones, pieces of wood, etc.), simulated fishing gear in the form of 1 cup, 1 stick, 1 fork, 1 spoon or tongs (per player), a flip chart, board or poster board, markers, chalk, crayons, ribbon, string or yarn (about 200 centimeters), preferably a round table, *"Tomorrow"* ***A Reef Reborn*** Music (Appendix 1), *Reeflections* workbooks (Appendix 7) and pencils.

BACKGROUND: The ocean provides one of the healthiest food sources for humans. However, the ocean's resources are not inexhaustible. In recent decades, technological innovation has greatly increased the extractive vulnerability of fisheries. Indiscriminate extraction and the lack of regulation have endangered marine stocks worldwide and have placed families who depend on fishing at risk.

Worldwide many commercial stocks of fish have been reduced by as much as 90%. There are still relatively few fish stocks that are sustainably harvested. In just a few places in the world,

fishermen, scientists, government and the global community have made agreements that lead to sustainable extraction of marine resources.

This activity introduces participants to the issues faced by fisheries in a dynamic and interactive way. The activity combines the facilitator reading while the fishing game is played. This game evolves in subsequent rounds by building on the information gained with each iteration to illustrate what happens to our oceans because of fishing. Depending on the particular situation of each community, you may modify the number of rounds. This activity comes from the curriculum of the Environmental Defense Fund—an international organization with extensive experience working to improve the situation of fisheries worldwide.

Begin by explaining to the group that in many parts of the world fishermen face increasingly tough challenges, as resources are overexploited and the fishermen's livelihoods become increasingly tenuous. To combat this, fishermen have begun to organize. By employing new strategies, they have found allies in scientists, non-profit organizations and government, who are helping them find different solutions. With this game, the participants will explore how fisheries operate and the opportunities they offer.

Round # 1: How are we fishing?
Why do we need to manage our fisheries? Why do we need to establish limits on how much fish we catch and how we catch them?
The answer is simple. If there is open access to resources, no one is responsible for looking after them. A fisherman may think, "If I do not fish all that I can today, someone else will take it tomorrow." This results in what we call the "Race for Fish", where fishermen increase their efforts and their time at sea to fish more and win the competition. Normally this is what happens with "the tragedy of the commons."

This leads to overfishing, wasting a portion of the catch that still has value, low-quality product, falling prices and accidents at sea. The race for fish always results in more costs, more risk and less profit. In addition, with open access there is no incentive to conserve marine resources and eventually the fisheries will end.

ACTIVITY: To start, gather everyone around the table on which there are chocolates and sweets to simulate fish of different sizes, species and ages in a common fishing area. Tell the participants that the game is about each person fishing in the traditional way. Each participant can choose different gear and make changes whenever he or she wants. Fishing has no restrictions.

REFLECTIONS: At the end of this round, lead a discussion.
- What happens when we have no limits—no rules?
- How much was captured?
- Did you try to capture more when you saw the others fishing too much? Why?
- Is that how we fish now?
- Does this game look like your fishery? What happens in your fishing area?
- How do we measure the status of our resources?

Round # 2: The essential places for our fishery resources
What are our fisheries' resources concentrated?

When you go fishing, do you have favorite places? Spots where you know there will be more resources? Of course! Generation after generation of fishermen around the world have noticed that some places in the ocean are more productive than others are. Many factors contribute to this variation: The presence of nutrients that nourish marine life, habitats such as mangroves or coral reefs that offer protection, the quality of habitat present and the phenomenon of reproductive aggregations. These factors contribute to what we call essential areas for marine life (essential fish habitat), which are key to the survival of a population or a marine species. If we understand the characteristics of marine species and their habitat requirements, their food sources and reproductive history (where females spawn, how many eggs are produced by an individual, the age of sexual maturation) we can design fishery management systems to ensure sustainable populations. In this round we will explore the impact we have on the sustainability of marine resources when we concentrate our efforts on essential areas for marine life (essential fish habitat).

ACTIVITY: In some areas on the table there are wood chips or shells representing structural areas were marine life aggregate such as reefs, mangroves and estuaries (as there is are in the community). Ask the participants to indicate where the aggregations or areas essential to marine life are within their community fishing areas and reflect on their importance. Invite fishermen to distribute fish on the table, based on where they believe they would find them in the ocean—hoping that many will be placed on the structural areas. If someone wants to change his or her gear, say it is perfectly fine to do so. In this round there will be no rules on time or type of gear—just START!

REFLECTIONS: At the end of this round ask the following questions and guide a discussion based on the background information of this round.

- Where were there more fish? Why?
- What happened to the population of your resource?
- How many seasons can one continue fishing a spawning aggregation before it disappears?
- How similar is this game to your fishery?

Round # 3: Marine reserves as tools to manage fisheries

Marine reserves are areas where fishing is limited or where extraction of marine resources is prohibited. Marine reserves can be tools to improve fisheries because they are like having a savings account at a bank and living off the interest. This is like having a safe or lockbox for the fish.

For this to work well, the area for the reserve has to be chosen carefully (we must know that it encompasses essential fish habitat). We must also ensure the support of all the interested parties, including fishermen, scientists and fishery managers. With this activity we will explore under what circumstances marine reserves work.

ACTIVITY: This activity can be divided into 2 rounds representing 2 seasons. The same resources are on the table. The participants will incorporate their reflections on Round 2 and explore what happens if they protect spawning aggregation sites. Ask them to use a ribbon or string to mark out a Marine Protected Area (MPA) with the idea that they can fish around it.

START! Once they have fished they are told that for every fish that remained in the reserve, there are two new ones. Here there may be a second round, where they see the benefits of MPAs.

REFLECTIONS: At the end of this round the facilitator leads a discussion with the background information of the round.

- Did participants fish in the Marine Protected Area?
- What happened after their resource reproduced?
- Did they do better economically in Season 1 or 2?

Finally suggest to them that this is only one of the management tools for fisheries that exists, and there are others: restrictions on fishing gear, closed seasons, rights-based management and refuge areas, etc.

To make the best decision about which management tool to use, one must have the best possible information on both the resource and the fisheries. Stock assessments describe the past and present states of the resource populations and provide information to make informed decisions. Fishermen and scientists are equally valuable in describing the fishery and each resource to evaluate it.

Management of fisheries worldwide aims to calculate where the resources increase to the point of sustainability and not to regress back to overfishing. However since all fisheries are different, there may be other management objectives such as conservation, biodiversity, maintaining traditional lifestyles, sources of employment, economic and recreational opportunities that must be considered.

———- . ————

To conclude, turn on the music and give the participants time to write their reflections in the workbook.

KEY WORDS: Fisheries, tools, management, sustainable, common areas, biodiversity, sources of employment, economic opportunities, monitoring, stock assessments.

APPENDICES

1) *A Reef Reborn* music.

Activity	Soundtrack	Comments
2.1 *Listen, observe and feel*	Particles https://drive.google.com/open?id=0Bx84o8uuK36_VkNscldMa0JwMkU	You are sitting in a place surrounded by beauty. Then you are looking down from the air at that same scene. Where are you? There you are - small in a grand landscape . How does your life fit in to this place?
2.2 *1,2,3 Reef!*	On the Beach https://drive.google.com/open?id=0Bx84o8uuK36_SkExajRxLVk0STQ	The regret of making a mistake - such as in a relationship with the sweetness, the passion - the environment?
2.6 *Recognizing my watershed*	Home https://drive.google.com/open?id=0Bx84o8uuK36_RGxUM3RKM2pGOGROaWktN1d1LUdxV2JlTzkw	The group is building the map of their watershed. I can see languid rivers, lakes and streams! It speaks of home…
2.8 *Fishing for everybody*	Tomorrow https://drive.google.com/open?id=0Bx84o8uuK36_S0RxLWtEb0lwV1E	Imagine that this music describes the moments in your life where you came to a decision or a change point - and how the music veers in another direction, while maintaining the general theme… as you are true to yourself.
During the breaks and at the end of the workshop	A Reef Reborn Theme https://drive.google.com/open?id=0Bx84o8uuK36_YWZSUl8yay1TUHc	Triumph.

2) ***A Reef Reborn coral* reef picture.** Available to print in poster-size: https://drive.google.com/open?id=0Bx84o8uuK36_bHJVd0FyVGdUWnc

3) **Image of *A Reef Reborn* food chain.** Available to print letter-size: https://drive.google.com/open?id=0Bx84o8uuK36_QUh6SnhsSVFHZWs

4) **Image of cardboard lottery of *A Reef Reborn* ecosystems.** Available for printing in Tabloid (double letter-size): https://drive.google.com/open?id=0Bx84o8uuK36_M3Q1SXgyWkthdm8

5) **Image of *A Reef Reborn* watershed.** Available to print poster-size: https://drive.google.com/open?id=0Bx84o8uuK36_TXBoZThlYXdqUGM

6) **Image of *A Reef Reborn* Cabo Pulmo Changes in Time.** Available to print, poster-size: https://drive.google.com/open?id=0Bx84o8uuK36_M0tES0xrVng5WVE

7) ***A Reef Reborn Reeflections* workbook Part 2: "My Environment".** We recommend printing this on Recycled legal - sized paper. Ready to print format available in: https://drive.google.com/open?id=0Bx84o8uuK36_dkRDdzR3cUNTNWM

My Environment

A Reef Reborn

Reeflections

Name

Date Place

Throughout this process I will reflect, understand and remember:

- [ ] 1. The link between me and my environment.
- [ ] 2. The importance of refuges.
- [ ] 3. The food web and the importance of energy accumulation.
- [ ] 4. Keystone species.
- [ ] 5. Functions of coastal ecosystems.
- [ ] 6. Our watershed and its resources.
- [ ] 7. Changes over time in my community and my environment.
- [ ] 8. How do we fish today and forever?

1 Listen, Observe and Feel

Breathe deeply a few times and then answer the questions:

What do you smell?

Where is the breeze coming from?

Sense how the air enters through your nose. Feel how the air fills your lungs. Imagine it entering your bloodstream.

Listen to the beating of your heart. The blood flowing through your body is composed largely of water, just like the surface of our planet.

Pay attention and look! Where is water around you?

Where are the arteries in our community?

What are the consequences if we don't have clean air and water?

What aspects of nature do you think we are ignoring or forgetting?

How do we depend upon nature for our health and well-being?

2 1, 2, 3 Reef!

Ecosystems such as coral reefs attract life because they provide shelter, a place to feed and reproduce: A home.

What happens if we destroy such places over time?

What would be affected first?

Who would be affected later?

3 Who Eats Whom?

All living things need energy.

Everything needs energy, but in turn passes it on to others.

It's an endless cycle.

"Energy cannot be created or destroyed, only transformed".

How does food energy make its way through nature?

In a straight line, like a chain? ☐ or through many different routes, like a web? ☐

Why?

4 Web of Life

Within an ecosystem, species are interrelated in many ways.

Keystone species have a profound effect on the environment regulating the ecosystem's dynamic balance. If they disappear, the ecosystem and a large number of organisms are affected.

Name some keystone species in our ecosystems?

5 Ecosystem Game

Ecosystems are like the vital organs of our planet.
They provide environmental services that are essential for life.

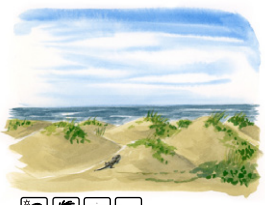
Coastal ecosystems provide the following services:

- Supplies food for other organisms.
- Seafood.
- Nurseries for commercial species.
- Recreation.
- Areas for shelter, feeding and breeding.
- Access to the ocean.
- Prevent mixing of seawater and freshwater.
- Produce algae that are used to manufacture products.
- Produce oxygen.
- Protect coastlines from waves and hurricanes.
- Supply sand for beaches and materials for building.

Seagrasses

Beaches

Dunes



Kelp Forest

Mangroves

Coral Reefs

5 Ecosystem Game

Estuaries

Marshes

What ecosystems do we have near our community?

How are these ecosystems important to us?

What would happen to us if we destroyed our ecosystems?

6 Recognizing My Watershed

Most of the rainwater that we need collects in a watershed.

Watersheds support terrestrial ecosystems and all life within them.

Our health and welfare depends on the availability of high quality water.

How can I conserve water?

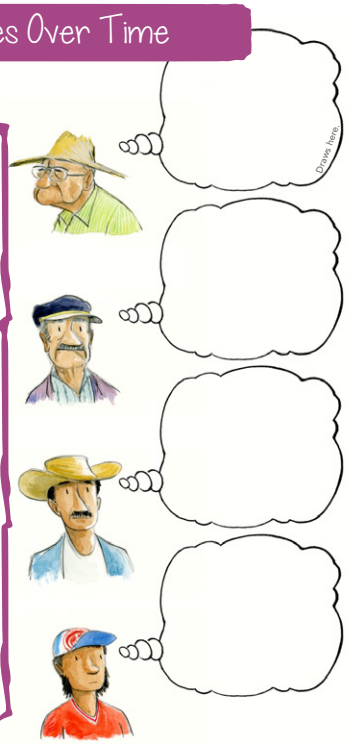
How can I avoid polluting our water and trashing our natural areas?

7 Changes Over Time

What changes have we observed in our community's environment?

What changes have we observed to our natural resources?

What are the consequences of these changes?



8 Fishing For Everybody

What happens if fishing is unrestricted?

What can we do today to ensure our fisheries last forever?

SummerhaysFilms

www.areefreborn3d.com • facilitators@areefreborn3d.com

A Reef Reborn program is possible thanks to the support of:

The Cabo Pulmo community
The San Diego Natural History Museum - TheNat
International Community Foundation
Paul M. Angel Family Foundation
Walton Family Foundation
Candeo

And special thanks to:
All persons and organizations working for the conservation of the Gulf of California who generously shared their useful tools for developing this program.

The program was brought to the community by:

A Reef Reborn Facilitators Guide and Reeflections were produced with dedication and passion by:
Antonia Hernández, Diego Azcotia and Paulina Godoy (Contents)
Norma Chacón (Spanish Editorial Review)
Victor Solís (Illustrations)
Gabriela Jiménez (Graphic Design)
Kevin Cox (English Editorial Review)
Alan Reeves (Music)
Paulina Godoy and Soames Summerhays (Coordination)

REFERENCES AND OTHER RELATED ACTIVITIES

Activity 1: LISTEN, OBSERVE AND FEEL

- *Trickle down: Is access to clean water a human right?*. Scientific American, 2011. http://www.scientificamerican.com/article/the-right-clean-fresh-water/

- *Water, water everywhere.* Student activity to observe a brief demonstration on the distribution of the world's water and then calculate how much water they use on a daily basis, both directly and indirectly. From Population Education Organization. https://drive.google.com/file/d/0Bx84o8uuK36_UDFWVWZLbDJ4QkE/view?usp=sharing

Activity 2: 1, 2, 3 REEF!

- NOAA/NSTA Coral Resources for Educators. http://coralreef.noaa.gov/education/educators/

Activity 3: WHO EATS WHOM?

- *A Teacher's Guide to Navigating Change.* Grade 4 and 5. An Educational voyage to motivate, encourage and challenge us to take care of our land and sea. NOAA. http://coralreef.noaa.gov/education/educators/resourcecd/lessonplans/resources/nav_change_c.pdf

Activity 4: WEB OF LIFE

- *Food Chains and Food Webs.* Lecture from Ecology Education Consulting, Inc. http://www.ecologyedu.com/ecology_education_resources/what_is_a_food_chain_what_is_a_food_web.html

- *Web of life.* Student activity: Through an interactive story, students explore how everything in the natural community is interconnected. Curricula: Earth Matters, from Population Education Organization. https://drive.google.com/file/d/0Bx84o8uuK36_X05lSlBNbVRPS0U/view?usp=sharing

Activity 5: ECOSYSTEM LOTTERY

- NATURE'S SERVICES A guide for primary school. WWF, Sweden. 2013.

- Fisher, Brendan; Costanza, Robert; Turner, R. Kerry; Morling Paul (2007) : Defining and classifying ecosystem services for decision making, CSERGE Working Paper EDM, No. 07-04. https://www.econstor.eu/bitstream/10419/80264/1/571829937.pdf

Activity 6: RECOGNIZING MY WATERSHED

-*Why invest in watershed management?* FAO, 2009. Rome. https://drive.google.com/file/d/0Bx84o8uuK36_Uzc5elNIem04SVE/view?usp=sharing

- *Watershed management guidebook.* A Publication by Integrated Environmental Restoration Services, Inc. Produced in collaboration with the Lahontan Regional Water Quality Control Board and the Tahoe Resource

Conservation District. https://drive.google.com/file/d/0Bx84o8uuK36_aFFKS2NtVmh3NGs/view?usp=sharing

- The book "*Thinking Like a Watershed"* written by Jack Loeffler, points our understanding of our relationship to the land in new directions. It is shaped by the bioregional visions of the great explorer John Wesley Powell, who articulated the notion that the arid American West should be seen as a mosaic of watersheds, and the pioneering ecologist Aldo Leopold, who put forward the concept of bringing conscience to bear within the realm of "the land ethic."

Produced in conjunction with the documentary radio series entitled *Watersheds as Commons*, this book comprises essays and interviews from a diverse group of southwesterners including members of Tewa, Tohono O'odham, Hopi, Navajo, Hispano, and Anglo cultures. Their varied cultural perspectives are shaped by consciousness and resilience through having successfully endured the aridity and harshness of southwestern environments over time.

Activity 7: CHANGES OVER TIME

- Community and Biodiversity (COBI) is a non-profit organization dedicated to promoting the conservation of marine biodiversity in coastal communities of Mexico. COBI works hand in hand with the communities to strengthen public participation in order to take decisions on how to manage the natural capital. Shifting Baseline Syndrome. http://cobi.org.mx/en/strategic-lines/marine-reserves/shifting-baseline-syndrome/

A Reef Reborn program

is possible thanks to the support of:
The Cabo Pulmo community
The San Diego Natural History Museum - *TheNat*
International Community Foundation
Paul M. Angell Family Foundation
Walton Family Foundation
Candeo

And special thanks to all persons and organizations working for the conservation of the Gulf of California who generously shared ideas and tools for developing this program:

Amigos para la Conservación de Cabo Pulmo / Aines Castro / Ana Karina Pelaez (PROBEA) /Ana Suarez (Environmental Defense Fund) / Arturo Hernandez and Alfonso Romero (Comunidad y Biodiversidad AC) / Bárbara Cardoso and Antonio Diego (Conservarte) / Carlos Godinez and Alma Alicia Chavez (Parque Nacional Cabo Pulmo, CONANP) / Elizabeth Hammond (Ecology Project International) / Gaby Anaya / Iliana Ortega / Liliana Gutierrez and Malu Tamayo and fishermen from El Manglito (Noroeste Sustentable) /Norma Sánchez, Pablo Castro and Sergio Gonzalez (Pronatura Noroeste) / Meredith de la Garza, Amy Hudson and Sarahi Gomez (Sociedad de historia natural Niparajá) / Dr. Oscar Arizpe and Dr. Héctor Reyes (Universidad Autónoma de Baja California Sur) / Sofía Gomez (Costa Salvaje) / Yadira Trejo and Anibal Murillo (Grupo Tortuguero de Las Californias).

This Guide and *Reeflections* workbook were produced by:
CONTENT
Antonia Hernández, Diego Azcotia and Paulina Godoy Aguilar
SPANISH EDITORIAL REVIEW
Norma Chacón
ILUSTRATIONS
Victor Solís
GRAPHIC DESIGN
Gabriela Jiménez
ENGLISH EDITORIAL REVIEW
Kevin Cox
MUSIC - COMPOSER / PERFORMER
Alan Reeves
COORDINATION
Paulina Godoy Aguilar and Soames Summerhays

www.areefreborn3d.com facilitators@areefreborn3d.com