Report Card for the Mesoamerican Reef

An Evaluation of Ecosystem Health

2010

Healthy Reefs
for healthy people

WHAT'S INSIDE

The 2010 Report Card highlights three focal sections - an assessment on the current state of the Reef; an update on existing and emerging threats to reef health; and a sample of stories of hope and needed actions to foster healthy reefs and healthy people. A synopsis of key findings is presented up front in the "Taking Stock" section.

STATUS

First, this report card begins with a re-examination of the Indicators of Reef Health. It reviews the indicators that constitute the Healthy Reef Index as well as the grading criteria and threshold values for these indicators. New data collected in 2009 at 50 core sites are compared to data collected in 2006 to show change since the last Report Card. The two-page layout map provides a visual summary of the regional health data. A historical look at selected reefs with long term data is presented to underscore the degree and concern of coral reef decline. This report card does not contain new socioeconomic data because the results of the 2010 censuses were not available at the time of compilation.

THREATS

Next, the Report Card reviews the suite of threats facing the reef, including several newly perceived threats that were not known two years ago. On the fore front is the alarming, rapid and widespread invasion of the beautiful but deadly exotic lionfish, which are devastating local fish populations. Meanwhile the loss of large fishes, particularly commercially important fishes, large herbivorous parrotfishes and top predators like sharks, continues to impact how reefs function as well as the quality of people's livelihoods. Other looming threats such as coastal development, climate change and the potential for offshore oil exploration and drilling jeopardize the future of reef recovery and survival.

ACTIONS

Finally, the Report Card takes a look at positive reef management tools such as marine protected areas and protection of endangered species. Several successful case studies being implemented throughout the region are showcased to offer hope for the future of reef health.

Blue Ribbon Awards are given in recognition of sound reef management actions. Recommendations to improve and safeguard reef health conclude the report card.

HEALTHY REEFS FOR HEALTHY PEOPLE

Healthy Reefs for Healthy People (HRI) is a collaborative international initiative that generates user-friendly tools to measure, track, and report on the health of the Mesoamerican Reef Ecosystem (MAR). It includes a formal partnership of over 30 organizations and informal collaborations with government agencies, individual scientists, and other partners. HRI aims to improve reef management and decision-making to effectively sustain an economically and ecologically thriving MAR eco-region by delivering scientifically credible and respected report cards on ecosystem health and encouraging the implementation of effective management recommendations. In addition to the 2008 and 2010 Report Cards, other HRI publications include: the 2007 Healthy Reefs for Healthy People: A Guide to Indicators of Reef Health and Social Well-being in the Mesoamerican Reef Region describing indicators by which progress toward a healthy Mesoamerican Reef (MAR) can be quantitatively tracked and the 2008 Quick Reference Guide highlighting the 20 highest priority indicators and graphically illustrating their modern baseline values against reference conditions. All are available on: www.healthyreefs.org

THE MESOAMERICAN REEF

AN INTERNATIONAL ECOREGION

The spectacular Mesoamerican Reef includes the Western Hemisphere's longest barrier reef and a diverse array of reef formations linked together by complex oceanographic currents. Extending over 1,000 kilometers from Mexico to Honduras, this vast complex, with its neighboring seagrass meadows, deep and shallow lagoons, and coastal mangrove forests, forms a dynamic mosaic that nurtures the Mesoamerican "hotspot" of biological and cultural diversity.

The region's terrestrial topography includes the flat, low lying areas of the Yucatan, Mexico and the dry climate, few rivers, and unique subterranean water flows of northern Belize. Farther south, the landscape changes to tall coastal mountains, much more rainfall, and numerous large rivers in southern Belize, Guatemala, and Honduras.

The overall ecoregion covers approximately 464,419 km², with 192,648 km² in watersheds and 271,771 km² in diverse marine habitats. In 1997, the leaders of the four nations (Mexico, Belize, Guatemala, and Honduras) signed the historic Tulum Declaration, which pledged support for conserving this shared resource.

The region's economies are highly dependent on marine resources, especially tourism and fishing industries. In Belize alone, the reef was estimated to contribute approximately $395 - $559 million US dollars in goods and services each year.[2] Here more than most places, the health of our people—our communities and our economies—depends on our ability to restore, nurture, and maintain our healthy reefs.

Locator map and detailed map of the Mesoamerican Reef Ecoregion.

TAKING STOCK:

A WORLD OF CHANGES SINCE 2008

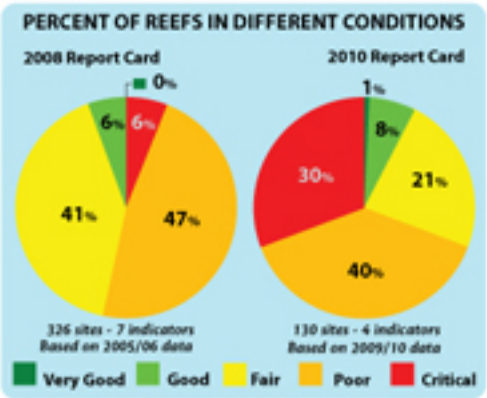
The last two years have been a time of immense change. At the time of launching the first Report Card in 2008, the world was just beginning to recognize the extent and implications of the global economic crisis and the expansion of the invasive lionfish into the Mesoamerican Reef had not yet been documented. In May 2009, reef managers in southern Belize and neighboring Honduras were rudely awakened to the substantial losses of coral reef habitat resulting from a major earthquake off the island of Roatan. Then, in April 2010, the entire world became keenly aware of the immediate and devastating effects on coastal and marine ecosystems caused by the oil rig blowout in the Gulf of Mexico. Suddenly, our "threats list" expanded.

As governments, civil society and the public struggle to deal with the burdens of economic crises and escalating crime and violence, reef managers struggle to keep the issue of saving our dying coral reefs on the front burner. Meanwhile, our planet's coral reefs are on life support and struggling to survive, as coral disease and bleaching further reduce coral cover and we face possible species extinctions due to massive coral mortality. Rampant pollution, habitat loss and increases in sea temperature and ocean acidification continue relentlessly in the shadow of a failed COP-15 that resulted in no concrete political action to aggressively address the unfolding global climate change crisis.

STATUS: HEALTH OF THE REEF

The 2008 Mesoamerican Reef Report Card gave us our first comprehensive look at the health of the region's coral reef ecosystem and the impact of our management and stewardship efforts. The 2008 Report revealed that our once pristine reef was now in danger, with more than half of the 326 sampled reef sites in 'poor' (47%) or 'critical' (6%) condition. Yet, the 41% reported in 'fair' condition gave us some hope for recovery, and the urgency for an increase in the modest 6% of the Reef currently listed in 'good' condition. The 2008 comprehensive assessment was based on 7 indicators of reef health combined into a single Index.

Regrettably, this 2010 Report Card does not describe a pattern of recovery but one of further decline in the health of the Mesoamerican Reef – see pages 5 to 8 for details. The overall condition of the 130 reefs surveyed (and evaluated with four indicators) found an alarming 30% of reefs in 'critical' condition, 40% in 'poor', 21% in 'fair', 8% 'good' and 1% 'very good' condition. The two Indices produce very similar results. Five times as many reefs experienced declines versus improvements in health, as measured by fifty core sites assessed in both 2006 and 2009. Regardless of which index is used the results clearly show more reef deterioration and call for stronger management actions. Clearly, more of the numerous 'fair' condition sites have declined in condition, signaling the reef ecosystem may be quickly approaching a critical tipping-point.



THREATS TO THE REEF

The list of threats to reef health has grown in scope and intensity. The four main threats (over-fishing, coastal development, inland land clearing and agriculture, and climate change) identified in 2008 continue with growing intensity. Less than 1% of the fish surveyed in the MAR were over 40 cm (16 inches) long and sharks are now largely absent. The invasive lionfish is now virtually everywhere in the MAR, although efforts to control this exotic species are underway throughout the region. The coastal development index for 2010 found the amount of modified areas increased from 22% to 34% of the coastal MAR. Climate Change is already impacting the reef and there is little chance of a global treaty that will protect coral reefs. There is a growing risk from increasing interest in offshore oil development.

ACTIONS TO SAFEGUARD THE REEF

Despite the intimidating threats listed above, numerous reef management actions are working to overturn the reef decline. Over 30 marine and over 30 coastal protected areas are now being managed in the MAR. While they cannot protect against all threats, MPAs do help manage many threats and help build ecosystem resilience to other threats. As one of the most threatened and biodiverse ecosystems on the planet, coral reefs are now being managed with some of the same tools that have been used with terrestrial endangered species for decades. Case studies highlighting coral propagation efforts, natural 'hope spots' and community enabled local conservation successes provide some hope in a sea of uncertainty.

Our leaders, globally and in the MAR region, must face the stark reality that "business as usual" will ultimately result not only in the loss of a magnificent marine ecosystem, but the loss of income from tourism, costly damage from natural disasters, and the loss of entire fish stocks that feed local people and support their livelihoods. It is just this linkage between healthy reefs and healthy people (economies, communities and individuals) that can help catalyze the transformational policies and actions that are required to save our magnificent reef.

INDICATORS OF REEF HEALTH

Measuring reef health is more complex than visiting your family physician for an annual check-up, because scientists are only now beginning to develop quantitative indicators to evaluate reef health. Indicators are practical, quantitative measures of reef or human health. Their purpose is to help translate the abstract concept of well-being into a suite of tangible, rigorously defined quantities by which progress can be assessed. Scientists analyze trends or spatial comparisons in individual indicators to gain insight into the most important variables at one site or over an entire region (the results are often dependent on the scale of the question).

The Healthy Reefs for Healthy People Initative is one of the first efforts to develop measurable ranking criteria for indicators of reef health (see 2008 Report Card for more information see: www.healthyreefs.org). The development of a single index value facilitates the mapping of reef health for a more comprehensive view across the region. It is our "bottom line" of reef health, akin to the Dow Jones Index in the stock market—not an exact measure of any particular stock, but a very useful indicator of general market trends. The "Integrated Reef Health Index" (IRHI) used in our previous report card has been simplified. The "Simplified Integrated Reef Health Index" (SIRHI) was developed in order to accommodate the use of additional datasets that did not include all seven of the original IRHI indicators. In particular, coral recruitment, algal heights (needed for the Macroalgal Index), *Diadema* abundance and coral disease were not consistently collected at all sites. The two fish indicators were replaced with simplified versions: key commercial species (snapper + grouper biomass) and key herbivores (parrotfish + tang / doctor fish biomass).

SIMPLIFIED INTEGRATED REEF HEALTH INDEX (SIRHI)

- **Coral cover** is a measure of the proportion of reef surface covered by live stony corals, which form the reef's three-dimensional framework. It is the most widely measured indicator.
- **Fleshy macroalgal cover** is a measure of the proportion of reef surface covered by fleshy algae or "seaweed". It is widely collected data along the same transects as coral cover

- **Herbivorous fish abundance** measures the biomass (total weight of fish per unit area) of surgeonfish and parrotfish, the most important fish grazers on plants that could overgrow the reef.
- **Commercial fish abundance** measures the biomass (total weight of fish per unit area).

HOW THE GRADES ARE CALCULATED

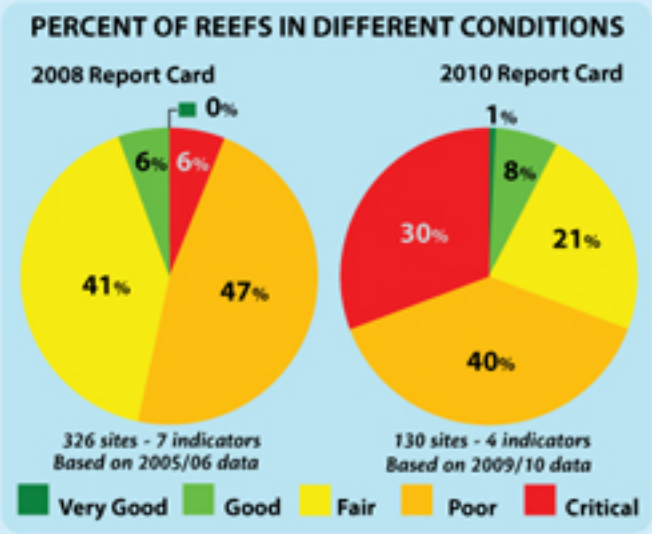
The grades are calculated by converting the mean data value of each indicator into a condition ranked from one ("critical") to five ("very good"), based on the data ranges given in the table below. The development of the data ranges relied heavily on the experience, data, and perspectives of the scientific review committee convened for this effort, as well as data from the Atlantic and Gulf Rapid Reef Assessment (AGRRA) database of over 800 Caribbean reef sites. The fleshy macroalgae cover thresholds were adopted from those being developed for the 2011 Reef @ Risk, originally developed by Reef Check. It represents a compromise position between grading for the ideal "pristine" reef conditions and what we can realistically hope to achieve in modern times and conditions.

SIMPLIFIED INTEGRATED REEF HEALTH INDEX

Threshold values by indicator for the Simplified Integrated Reef Health Index (SIHRI).

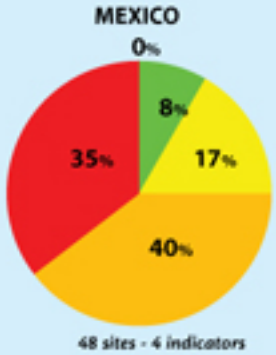
SIRHI INDICATORS	VERY GOOD (5)	GOOD (4)	FAIR(3)	POOR (2)	CRITICAL (1)
Coral Cover (%)	≥40	20.0–39.9	10.0–19.9	5.0–9.9	<5
Fleshy Macroalgal Cover (%)	0–0.9	1.0–5.0	5.1–12.0	12.1–25	>25.0
Key Herbivorous Fish ($g \cdot 100m^{-2}$) note: only parrotfish and surgeonfish	≥3480	2880–3479	1920–2879	960–1919	<960
Key Commercial Fish ($g \cdot 100m^{-2}$) note: only snapper and grouper	≥1680	1260–1679	840–1259	420–839	<420

REEF HEALTH IN THE MESOAMERICAN REEF



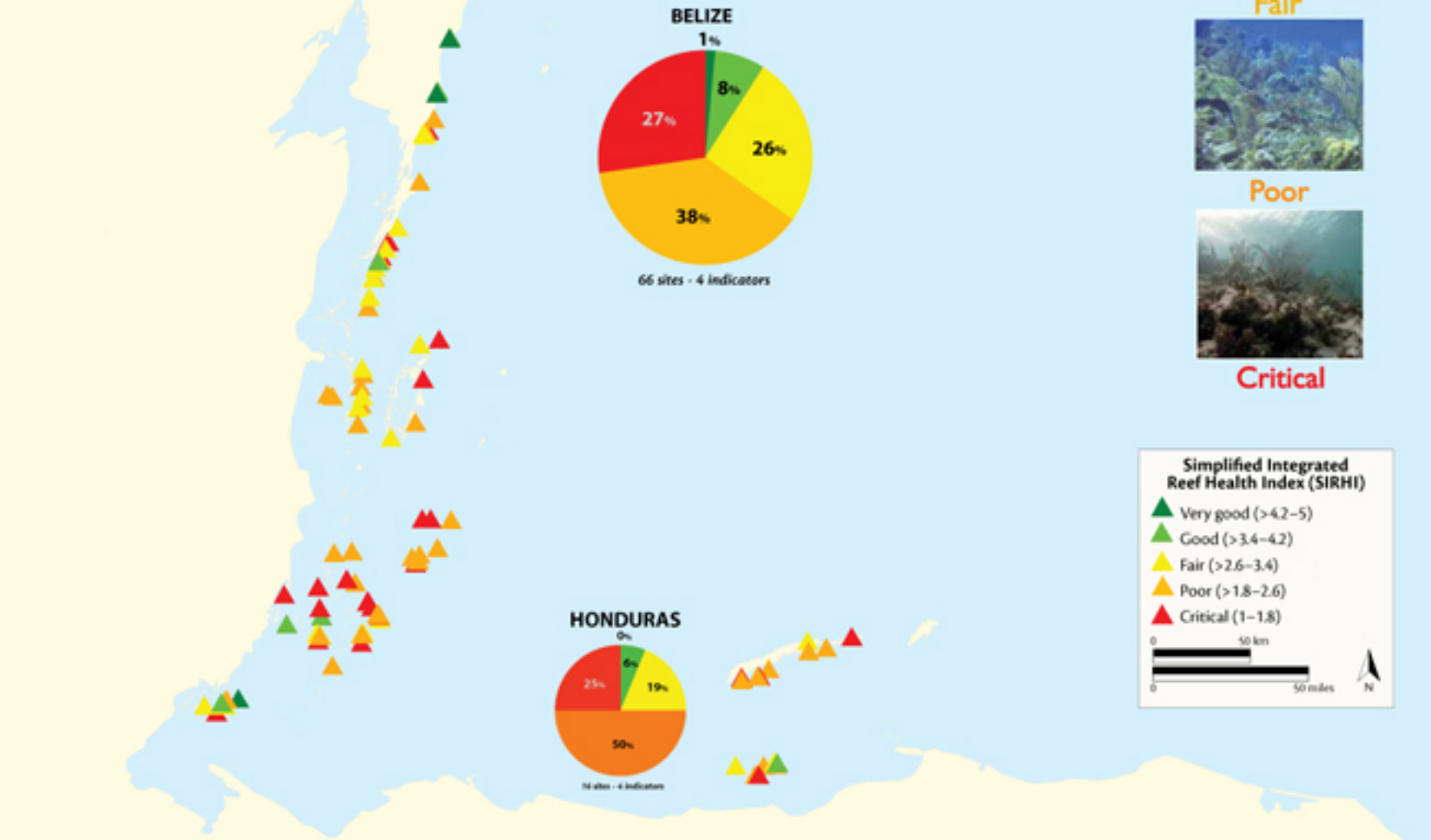
Number of Sites in Different Conditions

	MAR	MEXICO	BELIZE	HONDURAS
Very Good	1	0	1	0
Good	10	4	5	1
Fair	28	8	17	3
Poor	52	19	25	8
Critical	39	17	18	4
Total	130	48	66	16



Very good

Good



DATA SOURCES
BELIZE HRI/CORAL/CI (12 sites), UINC (6 sites), SEA (10 sites), TIDE (8 sites)
HONDURAS (HCRF /AGGRA / HRI (7 sites)
MÉXICO CONANP (12 sites), ECOSUR (6 sites), ASK (19 sites)
REGIONAL HRI (50 sites)

A full list of these contributors is found in the Online supplemental 2010 Report Card.
For the full list of participants see: www.healthyreefs.org

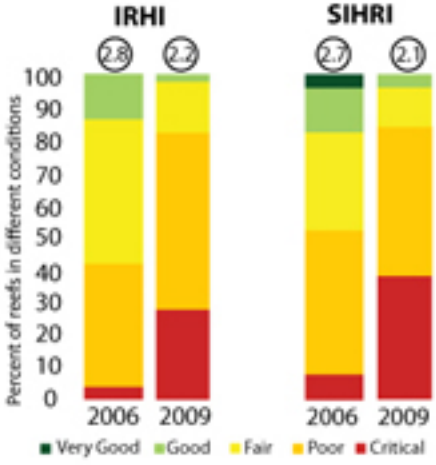
Healthy Reefs
for healthy people

CHANGES IN REEF HEALTH

REEF DECLINES OUTPACE IMPROVEMENTS FIVE TO ONE

Coral reefs naturally experience changes – fish swim in and out of survey sites, macroalgae have seasonal changes and corals can experience rapid mortality, but slower growth and recovery. A shift in the overall 'condition' category of any reef represents a more significant change. Between 2006 and 2009, five times as many of these significant changes in the condition of MAR reefs were declines - not improvements. If this trend continues we will soon lose the potential to promote the recovery of poor and fair sites towards good or very good condition. Experience from across the Wider Caribbean has shown that once reefs fall into a critical state they often remain in that condition for some time. Increasing fish biomass (i.e., by establishing fully protected replenishment zones) is the fastest way to improve health and counter these declines.

TWO INDICES- ONE STORY



Fifty core reef sites (31 in Belize, 8 in Honduras and 11 in Mexico) were originally surveyed in 2006 and then resurveyed in 2009 using the AGRRA methodology www.agrra.org, which included the full seven indicators of reef heath used in the IRHI Index developed for the 2008 Report Card. The two Indexes of Reef Health shown above were developed based on this data. Both Reef Health Indices signal just over a 20% decline in reef condition from 2006 to 2009 (2.8 to 2.2 for IRHI and 2.7 to 2.1 for SIRHI, out of a possible score of 5). The SIRHI suggests a slightly more negative condition – due to the greater weight that the fish categories have in the SIRHI (accounting for ~50% of the total SIRHI versus 29% of the total IRHI score). Fish biomass consistently ranks very low in the region. The SIRHI Index displays a greater 'spread' in the results - meaning sites are more distributed among condition categories. Both Reef Health Indices are valuable for tracking reef health and both signal declines in reef health. While an Index of Reef Health is a useful tool for summarizing the complexity of reef indicators into one easy to understand snapshot, it's also useful to take a closer look at individual indicators in order to understand the specific sources of declines or improvements.

A CLOSER LOOK AT THE CHANGES

The graphic below illustrates changes in four of the key reef health indicators - coral cover, fleshy macroalgal cover, herbivorous fish biomass, and commercial fish biomass. The most consistent indicator across all four countries was fleshy macroalgal cover, which was consistently 'fair' in 2006 and consistently 'poor' in 2009, with very little variation at the national scale. The most notable changes were the changes in herbivorous (parrot and surgeonfish) and commercial fish (snapper and grouper). Parrotfish and surgeonfish abundances in Honduras increased from 2006 to 2009, but overall biomass declined. The abundance of seabasses declined over 50% and snapper abundance also declined. Encouragingly, the amount of live coral cover increased in all three countries, with Mexico improving its condition ranking from 'poor' to 'fair' and Honduras maintaining a 'good' ranking. Over 20 sites in the region had >20% coral cover ("good" condition). Coral cover increases may be related to natural recovery after hurricanes in Mexico in 2005 and 2007 and the lack of significant coral mortality resulting from recent coral bleaching events. These increases in coral cover provide hope that with sound management the reef has a higher likelihood of recovery.

Time is a critical factor in facilitating this recovery. Bold conservation measures are required to reduce known threats and enable the reefs the opportunity for survival. Some important management actions have recently been taken in the region (see page 20) but there is an urgent need for more harmonization on a regional scale to secure the future of the entire Mesoamerican Reef (see pages 21-22).

REEF HEALTH INDICATORS BY COUNTRY

	MAR		Belize		Honduras		Mexico	
	06	09	06	09	06	09	06	09
Commercial Fish	1017	570	792	609	1579	73	1245.8	822
Herbivorous Fish	2415	1196	1842	1144	4791	831	2304.5	763
Fleshy Macroalgae	10%	17.8%	9%	17.3%	10%	20.3%	10%	17.4%
Coral Cover	13%	18.8%	12%	18.7%	22%	24%	9%	15%

Coral and fleshy algae are expressed as percent of benthic cover; fish are expressed in biomass (g/100m2).

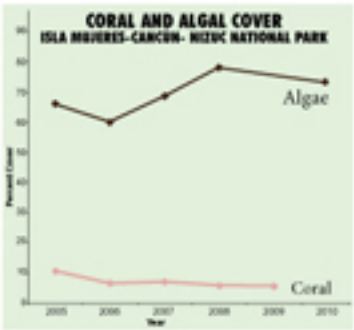
SHIFTING BASELINES AND REEF HEALTH

The term "shifting baselines," was coined by fisheries biologist Daniel Pauly in 1995 and is now being widely applied to a variety of socioeconomic and environmental issues. A baseline is an important reference point for measuring the health of ecosystems. It provides information against which to evaluate change. In an ideal world, the baseline would be what was there before humans had much impact. The crux of the shifting baselines problem is that many marine baselines have already shifted before scientists had a chance to document them, leaving today's scientists and managers to accept a degraded state as normal - or even as an improvement after a disturbance event.[1]

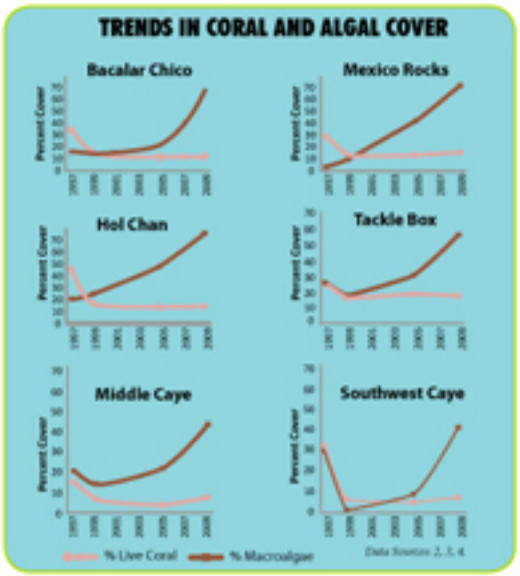
The scientific examination of the MAR only began around the early 1960's, with a very limited number of studies. The condition of the reefs described by these early studies is vastly different from the reefs of today. Despite this 'somewhat historical' perspective, we know the Caribbean reefs of the 1960's were actually far from pristine – as evidenced by the much earlier records of colonial explorers and later naturalists.

In the graphs on this page we see three sets of 'baselines' from which scientists and managers can evaluate changes in the amount of living coral over time. Given data for the past five years there can be an interpretation of 'fairly stable" or modest decline following Hurricane Wilma (2005) in Cancun. Given a longer time series (say a decade or more) as shown in the six sites from Belize, you may capture more of the real picture of recent reef changes over time, particularly since the time series brackets the lingering effect of major disturbances such as the 1998 coral bleaching event and Hurricane Mitch. However, the few data available that were collected before the 1980s mass mortality/disease outbreaks that decimated staghorn and elkhorn corals and the black sea urchin dramatically illustrate the extent of reef decline. Declines in fish populations and mega vertebrates (like manatees and sea turtles) likely occurred much earlier.

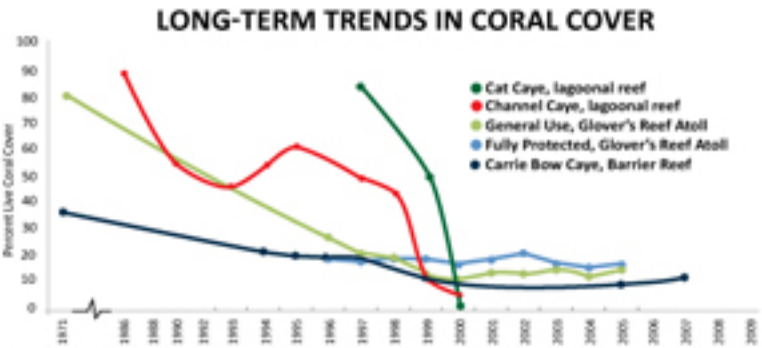
Scientists can explore even further back in time. By studying layers of coral skeletal remains they can see that the previous three thousand years had been relatively good and stable for coral reefs in the MAR. Research on both lagoonal and barrier reefs in Belize has demonstrated that an unprecedented die-off of the dominant staghorn corals and their fortuitous replacement by thin leaf lettuce coral was followed by the almost complete loss of all remaining corals during the 1998 bleaching event. Archeological evidence also points to a long history of marine resource exploitation and degradation in the MAR.



Data Source: Alejandro Vega Zepeda - CONANP



Data Source: Melanie McField, HRI (1997 & 1999); Nadia Bood, WWF(2005) and Clare Fessler, Duke University (2009)

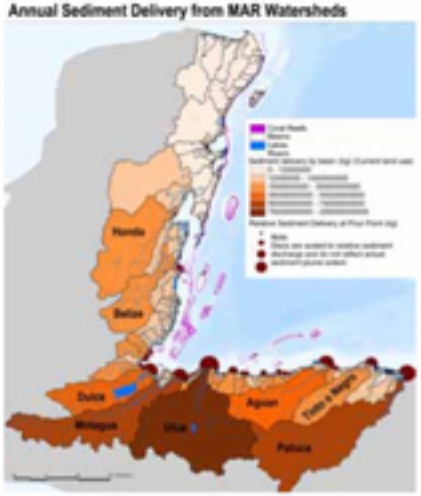


Data Source: Tim McClanahan, WCS (Glovers Reef), Karen Koltes, Smithsonian Institution (Carrie Bow Caye), Rich Aronson, FIT (Channel Cayes)

INCREASING THREATS TO REEF HEALTH

Two decades ago the Mesoamerican Reef Ecosystem was considered to be in better condition than most other reefs of the Caribbean—but this distinction is now unwarranted. Many of the reef health indicators (particularly fish abundance) now fall below the Caribbean average. Threats such as climate change, coastal development and tourism are accelerating. Others —such as invasive lionfish — are new, while the risks of offshore oil exploration are receiving heightened attention after the disaster in the Gulf of Mexico.

Annual Sediment Delivery from MAR Watersheds



Threats are human activities and natural events that directly or indirectly influence the integrity and health of the reef ecosystem. The combined impact of these activities and events may have long-term effects on ecological processes that may hinder a reef's ability to recover and persist. Recovery in the wake of disturbances is being delayed or not observed at all on many reefs. Disturbances that were once acute in nature (e.g., coral bleaching or disease outbreaks) are now becoming chronic.

The main threats to the reef are illustrated in the figure below. Threats of immediate concern in the MAR are further detailed in the following pages, including invasive lionfish, overfishing of big fish and sharks, coastal development, climate change and oil exploration. The issue of land use, agricultural run-off and pollution are not covered in this report card but will be focused on in the 2012 Report Card. A useful references on land-based threats can be found at: **Watershed Analysis for the Mesoamerican Reef** www.wri.org/publication/watershed-analysis-mesoamerican-reef and http://pdf.wri.org/mar_hydrologic_model_results_english.pdf The long-term persistence of the MAR's reef will depend on our ability to minimize and mitigate the impacts of these threats.

Conceptual diagram illustrating some of the main threats and human impacts to the health of the Mesoamerican Reef.

Coastal development and marine dredging (causing nutrient, sediment, and other pollution; and loss of nursery habitat (mangroves, seagrass)

Inland land clearing and agriculture (increasing pollution from agrochemicals, sediments, and nutrients, and decreasing natural riparian buffers)

Lionfish have become a problematic invasive species in the Caribbean. It was first reported in the MAR in late 2008

Over-fishing (reducing fish populations and disrupting food webs)

Hurricanes and storms (breakage and removal of corals)

Rising temperatures (increasing coral bleaching, diseases, and mortality)

As of October 2010 there is no active offshore oil drilling in the MAR, although there are some offshore concessions for exploration

BEAUTIFUL BUT DEADLY – THE LIONFISH INVASION

Miguel Angel Reyes - CozumelDigitalCreative.com

"Park ranger in Cozumel shows lionfishes caught on the north of the island"

The lionfish (*Pterois volitans*) is native to the Indo-Pacific, but is highly prized in the U.S. aquarium trade. It is considered an invasive species, due to its ability to alter the structure and composition of biological communities by out-competing native species and reducing overall species diversity. Although the lionfish invasion began in 1992, it remained fairly isolated in SE Florida for eight years then spread up the Atlantic seaboard as far north as New York. A gradual expansion into Bermuda and Bahamas ensued, until 2007 when they moved into Cuba and Turks and Caicos, then invaded Belize at the end of 2008 - followed by an explosive spread through most of the Caribbean down to Columbia by 2010.[1] The lionfish now ranges from coastal estuaries to 1,000 foot depths in the tropical western Atlantic.

Lionfish rapidly colonize here because they have no natural predators and a rapid rate of reproduction. Lionfish can lay 30,000 eggs in one spawn and can spawn every month. Their voracious appetites threaten to further deplete native fish and lobster stocks. They consume important reef fish and crustaceans that provide a source of livelihood for fishermen and an attraction to the marine tourism industry. Managers are encouraging fishing of the species and there are some recent reports of large groupers and moray eels learning to consume them. Lionfish are also a unique and appetizing delicacy for people, the venom is contained in the spines, rather than in the internal organs, so care must be taken only to avoid their spines while fishing or filleting. These fish are tenacious and full eradication will be difficult unless natural controls such as predators, competitors, parasites or diseases take over. By restoring large grouper populations and developing an active fishery for the species we can hope that it will reach an acceptable (to humans) state of equilibrium within the western Atlantic marine ecosystem.[2]

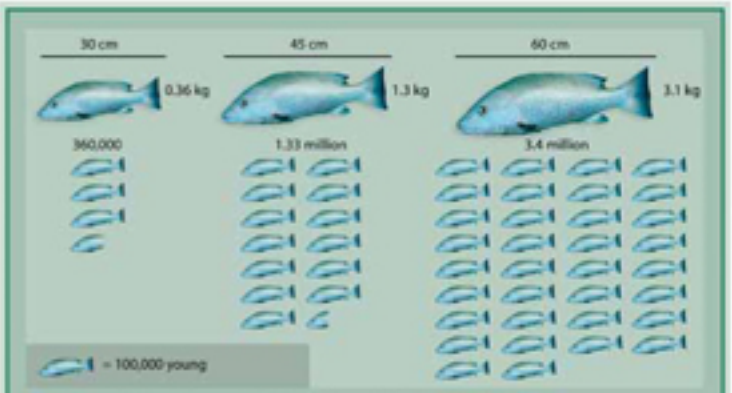
In Belize, lionfish have invaded practically the whole reef system in less than two years, from inshore mangroves out to Lighthouse Reef atoll. Monthly Lionfish Tournaments encourage competition within two key stakeholder groups – fishermen and tour guides – while providing needed statistics. They have landed over 2800 lionfish since May, including over 1100 in August alone. Roe (eggs) have been found in lionfish that are 20.1 cm (8.0 in) and larger. In July 2010, 57% of the lionfish were larger than this size, indicating the population has enormous breeding potential. Prey samples include jacks, wrasse, shrimp and crabs. Lionfish are reported to taste just like snapper and grouper. "Lionfish are always in season, don't hesitate to ask for seconds" is one of the catchy slogans being used to promote consumption of lionfish. Special signs that indicate "Lionfish Served Here" are being distributed to encourage restaurants to offer this tasty fish on their menus. Increasing human fishing pressure is one way to manage their population.[3]

In Honduras, over 530 lionfish were reported in one survey alone in the Roatan Marine Park between May 2009 and March 2010. Lionfish were present at 6 out of the 21 sites studied, preferring main reef habitats, followed by patch reefs and sea grass beds. Adult lionfish were found mostly in coral reef habitats, whereas juveniles inhabited sea grass habitats. At the micro-habitat scale, lionfish selected areas dominated by hard coral and overhanging structures.[4] Lionfish control efforts are successfully incorporating citizen volunteers. The Reef Environmental Education Foundation (REEF) has developed a survey for volunteer divers to record lionfish and other species as well as certain habitat characteristics. The data being collected by the Roatan Marine Park and others on lionfish occurrence and size illustrate a powerful form of citizen science. Additional surveys to record lionfish densities, behavior, and habitat relationships would also benefit managers.

In Mexico, the first lionfish sightings in the Caribbean occurred in early 2009 in Cozumel and increased along the Quintana Roo coast during this same year. In 2010, lionfish were found at Alacranes reef - 50 miles off the Yucatán coast - as well as along the coast of Campeche. Parque Nacional Arrecifes de Cozumel has a growing database of over 1200 lionfish caught in Cozumel since 2009. Outside of the Park, over 1000 fish were caught in September 2010 through a three month temporary employment program.[5] A regional workshop was held in August 2010 to generate a strategic plan to control lionfish throughout the Wider Caribbean Sea, develop better practices to control lionfish and improve ways to increase communication and collaboration.[6] Scientific studies on lionfish behavior are being conducted by Quintana Roo University to assist in the management of lionfish in several countries.[7]

BIG FISH PLAY A BIG ROLE IN HEALTHY REEFS

Overfishing is a global crisis - over 80% of the world fisheries are overexploited or have collapsed.[1] New research has found that decades of overfishing has not only decimated our ocean's fish populations, but also has reduced economic revenue and contributed to global malnutrition, hurting the world's poorest people the most.[2] The reasons to stop unsustainable fishing are more than just ecological – the implications to human health and economy are critical.



Average numbers of young produced by three different sizes of gray snapper.

Large fish are ecologically very important because they produce exponentially more young, thereby replenishing depleted populations. For example, a 40 cm grouper might produce 350,000 young, but if left to reach 60 cm length, it can produce ~3 million young.[3] In the MAR, 88,354 fishes were counted along AGRRA transects between 2005 and 2009, but only a startling 1% of these fish were over 40 cm (~16 inches) in length. This size would not have even been considered 'big' several decades ago. Large snappers and groupers were exceedingly rare, with most of the larger fish being chubs, parrotfish and barracudas. The absence of large fish is one of the main reasons for the low fish biomass found in the MAR, relative to the SE Caribbean.[4]

Herbivorous fishes like parrotfish and surgeonfish are also ecologically important because they reduce the macroalgae that could overgrow corals and help create suitable substrate for new corals to recruit. Large body parrotfish are especially valuable because they are effective grazers and can occur in large numbers. Yet these species are also common easy targets for fisherman. Of the 21,836 parrotfish recorded in the MAR between 2005 and 2009, more than 80% of these were <20 cm in length, but only 1% were >40 cm in length. Belize made a landmark step forward in April 2009 by establishing full legal protection to parrotfish and surgeonfish – thus safeguarding these species and ensuring their ability to maintain reef function.

Mickey Charteris

A critically endangered Goliath Grouper at West End, Roatan. "Ninety percent of the big fish are gone – but if we leave them alone they could come back." Ron O'Dor, senior scientist at The Census of Marine Life.

Fully-protected marine reserves are some of the last refuges for large fish and serve as critical replenishment zones. Of the four MAR countries, Belize currently has the most marine area under full protection: ~2% territorial sea (12 mile limit) or 4% (3 mile limit). Scientists have recommended at least 20% of the marine area should be fully protected in order to maintain key ecological functions and replenish depleted fish stocks. Increasing the area under full protection and properly enforcing these zones is one of the most efficient ways to increase the biomass of fish, sustain local fisheries and restore reef health. An international team of scientists has proposed that banning fishing gear- like spear guns, fish traps, and nets - could also aid in the recovery of reefs and fish populations devastated by coral bleaching events.[5] The team investigated the effects of five main types of gear and found that spear guns were the most damaging of all to corals themselves and to susceptible fish species. In addition, recreational and non-extractive uses of the ocean such as diving and sightseeing have growing economic benefits that should be encouraged as alternatives to unsustainable fishing.

SHARKS: MORE VALUABLE ALIVE THAN DEAD

Rachel T. Graham

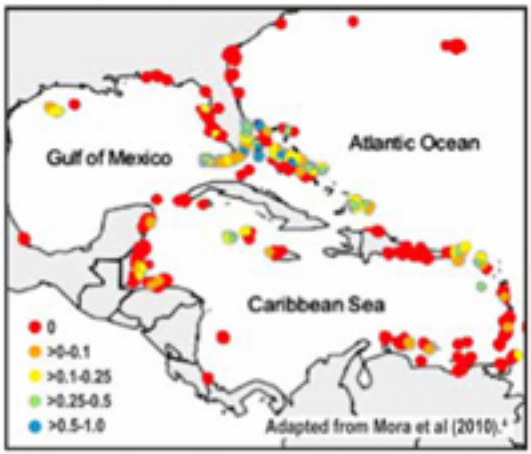
Large pregnant female blacktip shark being filleted on No-Name Caye in Southern Belize. People kill an estimated 73 million sharks for their fins alone - far faster than they can reproduce.

Sharks are top predators and are vital components of healthy and functional marine ecosystems; they play key roles in structuring fish communities and fostering reef resilience by weeding out the smaller and weaker fish in a population. Shark populations are now in global decline due primarily to fishing pressure, which is further compounded by their life history characteristics of slow growth, longevity, late maturity and low numbers of offspring. Over half of open-ocean shark species are considered "threatened with extinction".[1] Overfishing of sharks can also trigger a potential for a trophic cascade, a disruption of the food web that leads to an overabundance of secondary consumers and a scarcity of prey, both symptoms of ecosystem imbalance. Information on shark diversity, abundance and distribution, and current exploitation levels is sparse. Growing evidence suggests some shark species, although highly migratory, may return home, like salmon or sea turtles, to their area of birth or habitual feeding or mating grounds, during various times in their lives.[2] These findings have important implications on how managers can protect sharks and highlights the importance of conserving essential coastal habitats.

While the Mesoamerican Reef still possesses much of the reef, coastal and estuarine habitats considered essential for many sharks, their local populations are rapidly being impacted by overfishing and by uncontrolled development in their nursery habitats.[1] Of the estimated 400 species of sharks described globally, at least 30 species have been recorded in the MAR. Whale sharks have become a flagship species of marine conservation in the MAR and generate considerable ecotourism dollars. A recent study found that Gladden spit marine reserve, best known for its whale shark aggregation, produced US$ 4 million in benefits to tourism businesses, the local community and tourists in one year. This equates to US$13-29 million over the next 25 years.[3] Important whale shark aggregations and ecotourism activity also occurs near Hol Box, Mexico and Utila, Honduras.

A recent study of over 76,340 underwater surveys carried out by trained REEF volunteer divers between 1993 and 2008 found that human stressors in coastal areas, potentially dominated by exploitation, have likely led to the absence of shark populations on many reefs in the Caribbean. The map below shows the MAR has relatively few shark sightings as compared to some other areas. When compared to historical abundances, even as recently as the 1950's sharks were "expected anywhere at any time" in the west-Indian Caribbean; in contrast, the analysis of contemporary dive surveys indicate that, with the exception of nurse sharks, sharks are expected anytime almost nowhere.

Preventing the complete loss of sharks on reefs in MAR and the Greater Caribbean requires urgent management measures including bans on gillnets and longlines and restrictions of shark exports. "The fact that sharks still occur in densely populated areas where strong fishing regulations are in place indicates the possibility of management success and may encourage the implementation of conservation measures that would restore sharks together with their ecological and functional roles on reefs".[4]



Distribution and sighting frequency of sharks on reefs in the greater-Caribbean. Shown are sampled 1 km² cells for all species excluding nurse sharks.

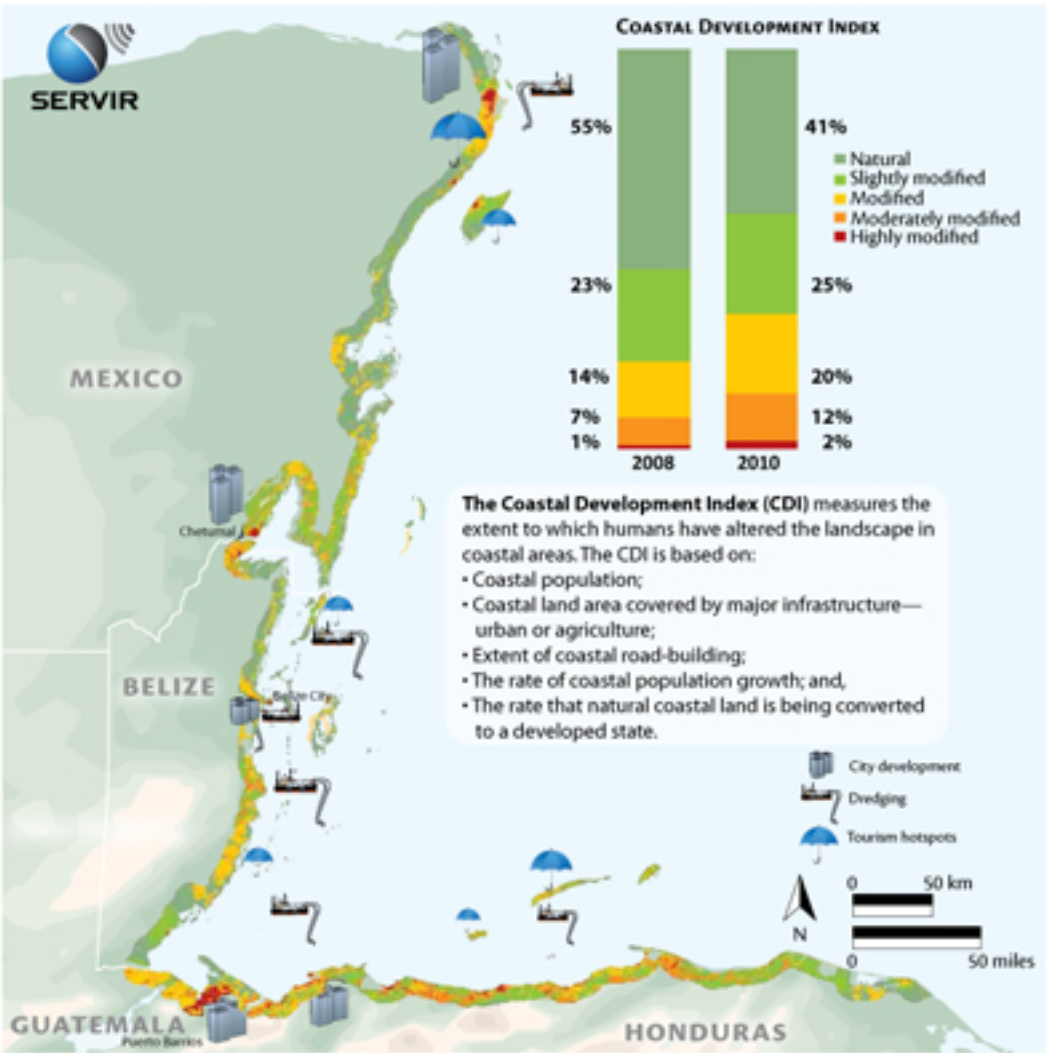
Showing Sharks a Little Respect: In 1998, Honduras fully protected whale sharks followed by a full ban on all shark fishing in 2010. Belize protected whale sharks in 2003 and has banned the use of gears like long lines and gill nets that are notoriously efficient at catching sharks inside its marine reserves. In 2008, Mexico prohibited shark finning and fully protected whale sharks and manta rays throughout its territorial waters. Mexico also recently created the Whale Shark Biosphere Reserve - a key seasonal feeding aggregation of at least 200 whale sharks - encompassing a surface area of 145,988 acres including Yum Balam and Holbox protected areas.

TRACKING COASTAL DEVELOPMENT

Significant changes in the state of coastal areas adjacent to the MAR have occurred in the past two years. The 2010 Coastal Development Index (CDI) shows over 14% percent of the coastline has been highly modified or moderately modified - nearly double the amount since 2008. The amount of area remaining in a natural state has declined by 25% leaving less than two-thirds of the coastal area in a natural or only slightly modified state. Areas of high development include the main cities, tourist areas like the Riveria Maya and Cozumel in Mexico and the Bay Islands in Honduras, and agricultural areas in Stann Creek, Belize and the North Coast of Honduras. If coastal development continues at this pace, the only large tract of natural, undeveloped coastline will be inside protected areas like the Sian Ka'an Biosphere Reserve in Mexico.

The higher the CDI, the greater the extent of development and, in general, the greater the risk of environmental degradation. The lowest possible CDI is zero, indicating an unpopulated, unaltered area and the highest possible CDI is one, indicating an area of rapid urban or agricultural development.

Geo-referenced aerial photography can be used to detect changes in areas that are too small to be detected through satellite images. Other types of coastal development, like marine dredging operations, may also need to be mapped through stakeholder inputs or through linking to permitting agencies.



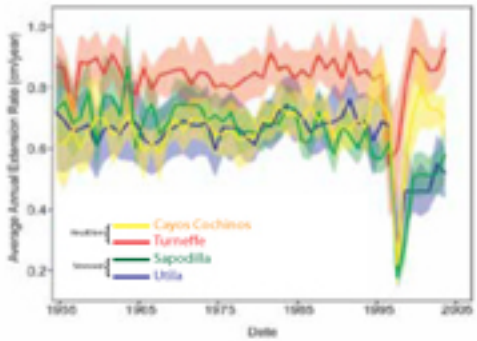
CLIMATE CHANGE: ALREADY IMPACTING OUR REEF

Oceans cover over 70% of the planet and are the primary force regulating climate. Oceans have already absorbed 25-50% of our human-created Carbon Dioxide (CO_2) emissions and are central to maintaining the planet's capacity to keep absorbing CO_2, but the ocean's absorptive capacity may have reached its limit. As a result of human-created climate change, our oceans are changing drastically – species are disappearing, diseases are more prevalent, food web dynamics are disrupted, and overall ocean productivity is declining.[1]

Coral reefs, in particular, may suffer catastrophic collapse from climate change within the next few decades unless there are major and immediate reductions in greenhouse gases. Coral bleaching events occur when rising sea temperatures force corals to expel their symbiotic algae that provide much of their food. Coral bleaching is expected to increase in frequency as global climate change increases ocean temperatures worldwide.

In the Mesoamerican reef corals have experienced bleaching events in at least 1995, 1998, 2003, 2005, 2008, 2009, and 2010. The most devastating mass coral bleaching occurred in 1998 and affected the entire MAR region to different degrees. To determine the extent of impact and amount of recovery, scientists examined x-rays of coral core samples to determine the coral's annual growth rate records since 1950, including the time before and after the 1998 major bleaching event. Mountainous star corals on more healthy reefs in Honduras and Belize were able to recover and grow normally within 2-3 years after the major 1998 bleaching event, while those corals living with greater local impacts, such as pollution and runoff from land, were not able to fully recover after 8 years.[2]

Corals that are "stressed out" by pollution and overfishing are less likely to recover from coral bleaching events and may be more susceptible to other disturbances. The reduction of localized stressors like sedimentation, nutrient pollution and overfishing that comes from poor coastal



Average coral growth rate (solid lines) and 95% confidence intervals (shading). Sapodilla and Utila remain suppressed after the 1998 bleaching event ($p<0.001$). Adapted from Carilli et al. (2009)

and fisheries management practices can help buy time for reefs, while global CO_2 reduction efforts take effect. The design and location of marine reserves can be focused on protecting coral reef areas that are naturally more resilient to coral bleaching.

Approximately 17% of all global greenhouse gas emissions come from the destruction of tropical forests. Mangroves are a tiny fraction of these forests but are up to six times more effective at capturing carbon per hectare than undisturbed rainforests.[3] Maintaining and replanting mangroves are an optimal strategy of climate mitigation that has many other social and economic benefits (for fisheries, coastal protection, tourism). Mangroves are now being included in the carbon sequestration trading schemes that enable tropical countries to receive carbon credit payments for conserving these ecosystems (tidal wetlands and seagrass beds are also marine carbon sinks that could potentially be quantified in the carbon market). Scientists are calling for dramatic and immediate steps to reduce CO_2 emissions and enhance nature's capacity to absorb CO_2. The ecologically significant target of a maximum of 350 ppm CO_2 (~equivalent to 1.5°C warming) must be achieved if the ocean and reefs are to survive.

The rapidly rising ocean temperatures caused by global warming increase the likelihood of more frequent and more devastating coral bleaching events, adding to the bleaching that has already reduced coral cover and vitality on the Mesoamerican Reef. Rising temperatures may also increase the prevalence of coral and fish disease and contribute to harmful algal blooms that impact human health and fisheries.

As more atmospheric carbon dioxide becomes dissolved in seawater, the oceans become more acidic - dramatically altering ocean chemistry. Marine organisms such as conchs, urchins, and corals will need to use more energy to grow their shells and skeletons, and will grow more slowly under these conditions, leading to an anticipated 17–35% reduction in coral calcification by 2100. A recent laboratory study found that crustose coralline algae (important for cementing the reef and facilitating the settlement of baby corals) and some corals were also more affected by bleaching under higher CO_2.[4]

The Mesoamerican reef has weathered many damaging storms and hurricanes. As seas continue to warm, the intensity (and possibly frequency) of storms and hurricanes could bring an increase in flood and high wave energy events that can devastate coastal communities and reefs, and leave insufficient time for coral recovery between events.

As the deeper reefs become more submerged by rising sea levels, diminished light penetration will probably leave these reefs unable to grow fast enough to keep pace. Shallow coastal lagoons and reefs may be dramatically altered by the submergence of coastal barriers that naturally maintain the integrity of these ecosystems.

THE LURE OF BLACK GOLD UNDER THE BLUE SEA

The threat of offshore oil drilling to marine ecosystems, even substantial distances away from the rigs, has been horribly demonstrated through the April 2010 Deep Horizon spill in the Northern Gulf of Mexico. That environmental, social and economic catastrophe has catalyzed discussion across the Mesoamerican region about the current status and risks of offshore drilling in the MAR. The following summarizes our best available knowledge as to the status of concessions and activities in the MAR.

In **Mexico**, the state-owned oil company, Petróleos Mexicanos (PEMEX), has continued and intensified exploratory activities in the coastal plain, continental platform and deep waters of the Gulf of Mexico, where the acquisition and interpretation of geological and geophysical information have permitted the estimation of the extent of petroleum potential in all of Mexico. The exploratory strategy is directed to the basins of the Southeast and the Deep Gulf of Mexico, outside the MAR region. Prior to the Deep Horizon spill, the IXTOC oil rig explosion, which occurred in the Southeast basins, was the world's largest oil spill. It was caused by a blow-out of an exploratory well, IXTOC, drilling in 150 feet of water which belched crude oil for 297 days, dumping nearly 3 million barrels (126 million gallons/477 million liters) of oil into the southern Gulf of Mexico, some of which eventually washed up on the Texas coast. The PEMEX strategy continues focusing on the exploitation of known reserves in the Gulf of Mexico, although there was some interest to explore around Alacranes Reef, which is within the MAR.

In **Guatemala**, there are currently 12 areas that have been identified for oil and gas exploration, and six of them will be open to tender for concessions shortly. Although there are three sites in the Pacific Ocean, these will not be included in the tender offer. The Vice-Minister of Mining and Hydrocarbons recently indicated that the tender process had been delayed because some of the zone boundaries were modified to avoid protected areas. This boundary redefinition occurred after a much-publicized reauthorization of a terrestrial oil-drilling license inside the Laguna del Tigre Protected Area in the Maya Biosphere Reserve, Peten, which was considered by several sectors as illegal. There are no known plans for offshore oil exploration in the Caribbean.

Belize has the most prolific concession strategy in the region, with the entire offshore marine territory being divided up into seven concession blocks. Seismic testing is currently or soon to be underway in several blocks, while exploratory wells are planned for 2012 at the earliest. The Belize Coalition to Save our Natural Heritage, an alliance of over 40 grassroots, business, labor and environmental groups, has called on the government to change its policy of exploitation in the offshore and in protected areas and improve environmental and safety management requirements in the remaining areas. The group has recently launched a petition to hold a national referendum on the issue.

Honduras has been debating a new law to regulate all oil exploration and exploitation since February of 2009. The National Congress has been swamped with requests from environmental and social groups to limit oil prospecting within the boundaries of protected areas, and establish safeguards and economic guarantees to remediate any impacts on natural resources on which the communities depend. Oil companies, on the other hand, are requesting to expand prospecting sites to include protected areas as well as continental waters within the country's EEZ. Debate was further fueled when former president Manuel Zelaya signed a deal allowing Petroleum Geo-Services ASA of Norway to explore for oil 10 kms off the Honduran coast. It is presently unclear if this permit is currently in effect. Four other companies, Petróleos de Venezuela, Chevron, PEMEX and Petrobras have expressed their desire to explore for oil. According to Mr. Tomas Vaquero, former Minister of Natural Resources, an area of 8,000 km^2 is currently being explored in the Honduran Caribbean. No official information is available on the government's policy or on whether any concessions have actually been granted.

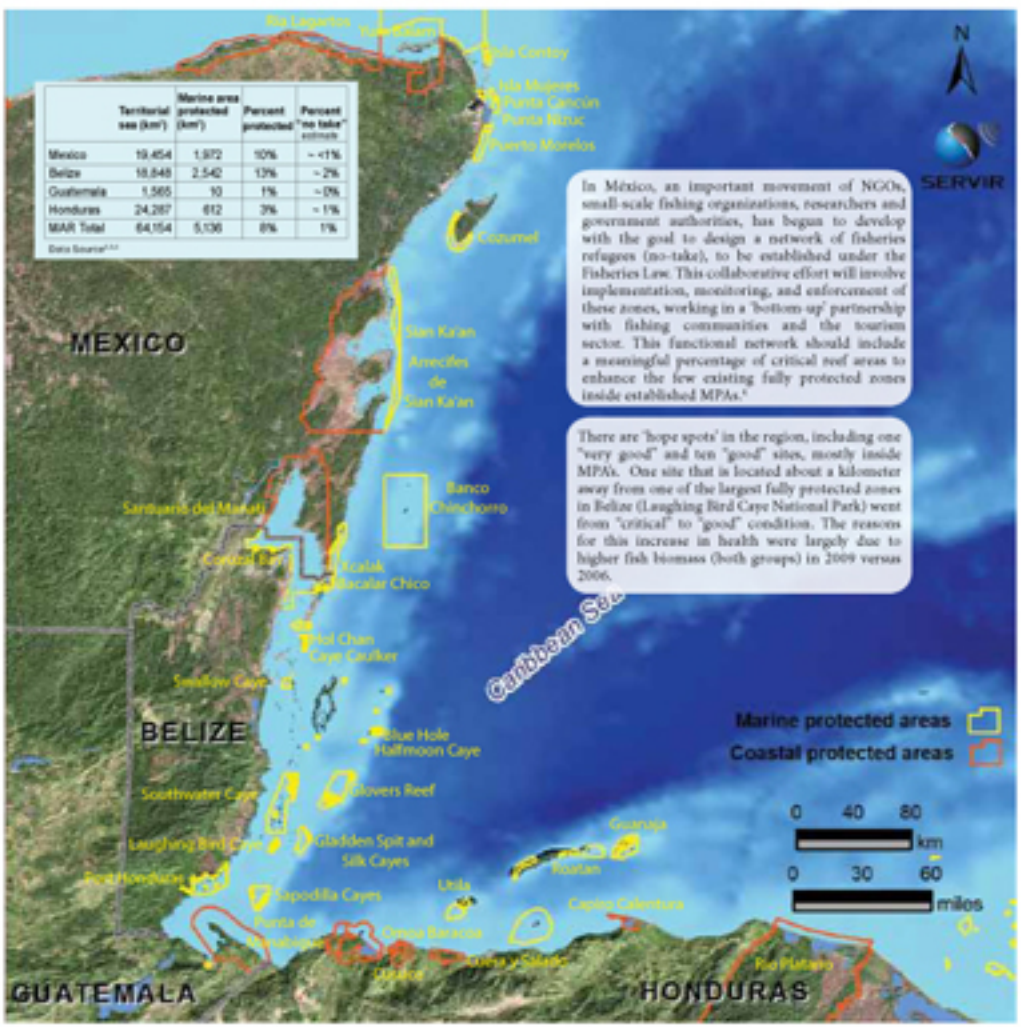
EXO © OCEANA Carlos Suárez

Offshore Oil development - with rigs, barges and pipelines - are now part of the seascape in the Gulf of Mexico and threaten to come to the MAR.

MARINE PROTECTED AREAS

Marine protected areas (MPAs) - underwater parks where fishing and other potentially harmful activities are regulated - are an effective tool of marine conservation, with over 4,600 MPAs established globally.[1] They aim to protect biodiversity, critical habitats, and ecosystem processes and give local communities a formal role in the management of these resources. A large body of scientific evidence has documented that MPAs generally achieve these goals, with the biomass, or the mass of animals and plants, increasing an average of 446%.[2] A recent global study found that, on average, coral cover in protected areas remained constant, but declined on unprotected reefs.[1] The benefit to corals takes about a decade longer than the benefit for commercial species such as fish, which generally increase in 4-5 years. When we also consider the popularity of MPAs for dive tourism, enhancement of food security, livelihoods, education and research, the full benefits of MPAs are enormous.

The use of networks of marine reserves, including substantial areas of fully-protected (no-take) zones or fisheries replenishment zones, is rapidly becoming an important tool to help natural marine recovery processes around the world. Nevertheless – ocean lags far behind the land in the overall protection: about 0.6% inside MPAs (with < 0.01% fully-protected) versus about 12% of land under protection. Recommended targets for the area under full protection range from 20-40% of marine area, to maximize ecological and economic benefits. There are over 30 designated MPAs covering about 8% of the marine territory in the MAR. However the percent of marine territory under full protection is much less than 1%.



	Territorial sea (km²)	Marine area protected (km²)	Percent protected	Percent "no take" estimate
Mexico	19,454	1,972	10%	~ <1%
Belize	18,848	2,542	13%	~ 2%
Guatemala	1,565	10	1%	~ 0%
Honduras	24,287	612	3%	~ 1%
MAR Total	64,154	5,136	8%	1%

Data Source[2,3,4]

In México, an important movement of NGOs, small-scale fishing organizations, researchers and government authorities, has begun to develop with the goal to design a network of fisheries refugios (no-take), to be established under the Fisheries Law. This collaborative effort will involve implementation, monitoring, and enforcement of these zones, working in a 'bottom-up' partnership with fishing communities and the tourism sector. This functional network should include a meaningful percentage of critical reef areas to enhance the few existing fully protected zones inside established MPAs.[5]

There are 'hope spots' in the region, including one "very good" and ten "good" sites, mostly inside MPAs. One site that is located about a kilometer away from one of the largest fully protected zones in Belize (Laughing Bird Caye National Park) went from "critical" to "good" condition. The reasons for this increase in health were largely due to higher fish biomass (both groups) in 2009 versus 2006.

SAFEGUARDING MARINE BIODIVERSITY

The IUCN Red List of Threatened Species (or The IUCN Red List) is the world's most comprehensive information source on the global conservation status of plant and animal species. It is based on an objective system for assessing the risk of extinction of a species if no conservation action is taken. In 2006 there were 5 critically endangered, 6 endangered, and 16 vulnerable marine species in the MAR. Despite strengthened conservation efforts, the changes in only four years are discouraging. In 2010, the numbers have grown to 7 critically endangered, 7 endangered, and 17 vulnerable marine species in the MAR. Many of these species have actually not been re-evaluated since 2006.

One-third of reef-building corals face extinction. The two Caribbean acroporid species (staghorn and elkhorn coral) were listed as Critically Endangered in September 2007 based on a population reduction exceeding 80% over the past 30 years due primarily to the effects of disease, as well as other climate change and human-related factors. The ecological implications of their decline are enormous – these two coral species are the primary shallow "reef builders" - forming the foundation of entire reefs including the protective emergent barriers to storms. Marine conservationists are taking more dramatic actions to save these species from possible extinction.

The other main reef framework builder, boulder star coral was also listed as Endangered, meaning the species is believed to have undergone a decline exceeding 50% over the past 30 years due to disease and bleaching, as well as other anthropogenic-related factors. Due to their extreme longevity, low rates of recruitment and long generation times, the potential for population recovery is limited. If current trends continue, this species may warrant listing in a higher category of threat.

The major threat to corals is global climate change, in particular, temperature extremes leading to bleaching and increased susceptibility to disease, increased severity of storms, and ocean acidification.[1] Unfortunately, more corals from the Pacific and Caribbean (pending completed data assessments) are expected to be included on the next Red List update since many species are currently considered to be data deficient.[2] More dramatic actions are needed to save endangered corals from possible extinction. These actions include the development of coral nurseries that propagate these local species for out-planting onto local reefs to more sophisticated efforts of freezing coral sperm and eggs as a bank of genetic material.

SPECIES	2010 STATUS
Epinephelus itajara - Goliath grouper	CE
Pristis perotteti - Largetooth sawfish	CE
Dermochelys coriacea - Leatherback seaturtle	CE
Eretmochelys imbricata - Hawksbill seaturtle	CE
*Hyporthodus nigritus** - Warsaw grouper	CE
Acropora cervicornis - Staghorn coral	CE
Acropora palmata - Elkhorn coral	CE
Caretta caretta - Loggerhead seaturtle	E
Pristis pectinata Smalltooth sawfish	E
Chelonia mydas - Green seaturtle	E
Lepidochelys olivacea - Olive Ridley seaturtle	E
Pagrus pagrus - Red porgy	E
Epinephelus striatus - Nassau grouper	E
Montastrea annularis - Boulder star coral	E

CE- Critically Endangered E- Endangered *Formerly *Epinephelus nigritus*

While much effort has recently been focused on the newly listed 'endangered' corals, attention to endangered fish is lacking. In fact, active fisheries are still underway in the MAR for the critically endangered goliath grouper (jewfish), the endangered Nassau grouper and several vulnerable species such as triggerfish, hogfish, cubera and mutton snappers. Clearly making MPAs that protect important spawning aggregations of these species (like Glovers Reef, Gladden Spit and Caye Bokel in Belize; Cordelia Banks and Sandy Bay-West End Marine Reserve in Honduras) are all the more important. Some marine life, including the sawfish, are so depleted there is no more fishery because none can be found. The last sawfish reported in Belize was over 15 years ago. Their historical aggregations in Chetumal Bay are legendary but gone. While most endangered terrestrial wildlife are valued as conservation icons and are fully protected from hunting, these threatened marine life are being fished commercially and recreationally. There is an urgent need to develop similar public appreciation and legal protection for endangered marine life.

Montastrea annularis

Arnold Thompson

Eretmochelys imbricata

Ian Drysdale

Acropora palmata

Juan Carlos Blanco CONANP

Epinephelus striatus

Ian Drysdale

SUCCESS STORIES

FRAGMENTS OF HOPE

In 2006, Caribbean staghorn and elkhorn corals were the first coral species to be officially listed by international conservation authorities as critically endangered– signaling they are just one step away from becoming extinct in the wild. The good news is that these corals are the fastest growing of all "reef building" species in the Caribbean, as they naturally reproduce asexually through fragmentation. Reef restoration projects in Belize since 2006 have taken advantage of nature's ability to affix loose coral fragments back to the reef after damage from storms or ship groundings. In Mexico this technique was used after Hurricanes Ivan (2004) and Wilma (2005).

In Belize, researchers began scaling these efforts up by establishing 11 coral nurseries in 2009. Staghorn and elkhorn corals can produce upward of 300% of their original mass in just ONE year using artificial substrates (e.g., ropes, metal frames and cement discs on tables). These restoration efforts in Belize emphasize the search for genotypes that are the strongest and most naturally resistant to global climate change and disease. We need to expand this strategy throughout the Caribbean Basin. A promising example is the Laughing Bird Caye National Park in southern Belize, which enjoys full protection (no fishing allowed). Research shows that in areas where lobster and other predators have been wiped out, coral-eating snails flourish, thus endangering nature's natural balance. Replenishment zones such as Laughing Bird need to be encouraged and supported.

Lisa Carne

A coral nursery frame at Laughing Bird Caye National Park, Belize showing one year's growth of staghorn corals that began as 10cm fragments.

For reef managers and local stakeholders who are increasingly disheartened about the fate of the Reef, this project is giving hope, as coral restoration using simple, relatively inexpensive techniques represents a replicable strategy that can be taken on by all stakeholders, including marine tour guides, marine reserve staff, and trained volunteers. As these undersea coral architects expand and recover, they will build habitat for other organisms, increase structure for fisheries, and better protect coastlines. For more information contact: lisasinbelize@gmail.com

CORDELIA - NEWLY DISCOVERED CORAL FOREST

Cordelia Banks is a group of three coralline banks located off the southern coast of Roatán Island (Honduras). One of banks alone extends over an impressive 52 acres of thriving marine life, made possible by a healthy "forest" of the prolific staghorn coral, which in spite of its proximity to the shore and heavy human activity, has been spared from the population crash caused by disease throughout the Caribbean. There is a good chance that Cordelia boasts the largest living stand of staghorn coral in the Caribbean. Just to the east of the Cordelia Banks lies one of the last productive grouper and snapper reproductive aggregation sites on the southern coast of Roatán, where upwards of 200 individuals have been seen displaying spawning behavior. Another nearby dive site is home to a large group of gray reef sharks. This amazing biodiversity is all the more curious given its location right between two busy towns – French Harbour and Coxen Hole – and directly in front of two active cruise ship docks!

Ian Drysdale

Carrying out a survey of live cover of staghorn coral in Cordelia Banks, alongside Roatán Institute for Marine Sciences (RIMS) and the Coral Reef Alliance (CORAL). This one bank was estimated to cover an area of 52 acres.

Protecting and managing Cordelia Banks is a major goal of several conservation organizations working in concert with local authorities. A sound marine recreation plan could secure the integrity and financial viability of this unique area. Organizations such as the World Wildlife Fund, the Roatán Marine Park, Coral Reef Alliance, MAR Fund and others are actively working to defend this jewel of our Mesoamerican Reef. For more information visit: www.roatanmarinepark.com

AKUMAL COLLABORATION FOR SUSTAINABILITY

Akumal – "the place of the turtle" in Maya– is a quaint coastal resort town south of Playa del Carmen (Mexico) that provides important feeding grounds for juvenile Green turtles, as well as nesting beach for Loggerhead and Green turtles. Over the past ten years, this area has witnessed substantial tourism growth, with controls and regulations lagging behind. Local residents have become tour operators overnight, but most have not complied with existing tourism, safety, and even business regulations. In many areas, waste water treatment plants were lacking or were inadequate, with wastewater being deep-injected into the ground, mixed with groundwater, then and making its way to sea.

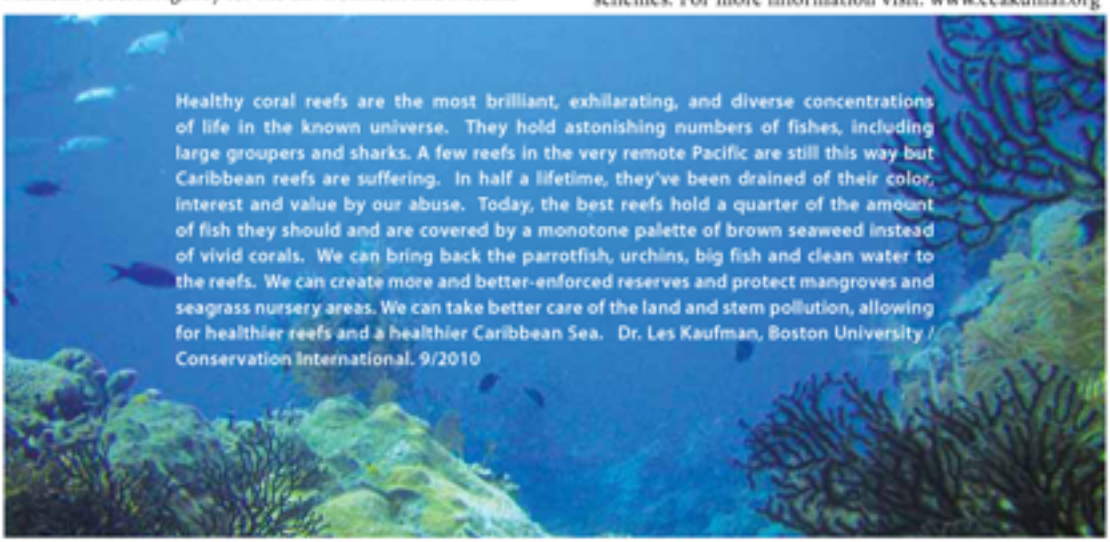
Since 1993, Centro Ecológico Akumal (CEA), a Mexican nonprofit environmental organization, has been working to make Akumal a replicable model for environmental sustainability through research, capacity building and policy. In close partnership with other environmental organizations, CEA is working with the municipal, state and federal government to study the underground water flows, water quality and impact on the Reef, ensure adequate number and operation of waste water treatment plants, strong law enforcement on waste water treatment, and to improve existing legal frameworks.

In Akumal Bay, a sound management program is in operation. Local stakeholders (i.e., hotels, dive shops, local tour operators, government agencies and CEA) have come together to better understand and direct natural resource use in the Bay to ensure environmental sustainability. The program is carried out through formal agreements among CEA, the tourism industry, and the Mexican Federal Agency for the Environment and Natural Resources (SEMARNAT). This innovative community-based program integrates for the first time into one single plan private property, federal concession and marine tourism rights and responsibilities that previously were handled in disarray under a myriad of laws and regulations. This management program allows for local administration of a local marine area. The agreements create a commitment by each stakeholder to participate in local tourism practices within a framework of federal environmental and business laws, even though the area is not an officially decreed federal marine protected area.

Paul Sánchez-Navarro-Rossell

Picturesque Akumal Bay, between Playa del Carmen and Tulum, is a model of cooperation and sustainability.

Building on the experience and results to date of this unprecedented cooperation among sectors and stakeholder, the next shared goal is to establish a formal marine turtle refuge, with proper zoning for various activities to protect the entire Akumal Bay complex, while securing financial sustainability through the exploration of innovative "payment for ecosystem services" (PES) schemes. For more information visit: www.ceakumal.org



Healthy coral reefs are the most brilliant, exhilarating, and diverse concentrations of life in the known universe. They hold astonishing numbers of fishes, including large groupers and sharks. A few reefs in the very remote Pacific are still this way but Caribbean reefs are suffering. In half a lifetime, they've been drained of their color, interest and value by our abuse. Today, the best reefs hold a quarter of the amount of fish they should and are covered by a monotone palette of brown seaweed instead of vivid corals. We can bring back the parrotfish, urchins, big fish and clean water to the reefs. We can create more and better-enforced reserves and protect mangroves and seagrass nursery areas. We can take better care of the land and stem pollution, allowing for healthier reefs and a healthier Caribbean Sea. Dr. Les Kaufman, Boston University / Conservation International. 9/2010

For technical references visit www.healthreefs.org

RECOGNITION OF REEF MANAGEMENT ACTIONS

The Healthy Reefs for Healthy People Initiative recognizes these outstanding reef management efforts, implemented in the last several years within the MAR.

In 2009 Belize fully protected key reef grazers (all parrotfish and tangs/doctor fish) to promote reef health; and fully protected the main sports fish (tarpon, bonefish and permit) to safeguard the valuable sports fishing industry.

In 2009 Belize approximately doubled the marine area under full protection by implementing such zones in the Southwater Caye, Sapodilla Cayes and Caye Caulker Marine Reserves.

In 2009 Guatemala completed its Coastal and Marine Policy, which was approved through a governmental decree. The design of the strategy and action plan is under development.

In 2010 Guatemala issued a five-year moratorium on the fishing of sea cucumber.

In 2010 Honduras issued a complete and permanent moratorium on fishing of all sharks.

In 2010 Honduras signed the parliamentary degree to solidify the Bay Islands Protected areas.

In 2008 Mexico declared the 4,257 hectares "Manglares de Nichupté" protected area, which is located between Cancun town and hotel zone, nearby to Isla Mujeres-Cancun-Nizuc National Park. In 2009, it was listed as a RAMSAR site for the international importance of its wetlands and mangroves, supporting four mangrove species, one palm and four animal species protected by the Mexican law.

In 2009 Mexico created the Whale Shark Biosphere Reserve, located in front of the north coast region of Quintana Roo, extending from the previous protected area of Yum Balam to Holbox covering an additional surface area of 145,988 acres.

CONTRIBUTORS

Melanie McField Healthy Reefs Initiative Director
Patricia Kramer, Perigee Environmental, Editor
Ian Drysdale Healthy Reefs Initiative Honduras
Marisol Rueda, Healthy Reefs Initiative Mexico
Armeid Thompson, Healthy Reefs Initiative Belize
Joaquin De La Torre, Communications consultant
Edita Pariente, Graphic design, Dolphin Productions

Reef Health Indicators: Judy Lang and Ken Marks, AGRRA
Shifting Baselines: Les Kaufman, Judy Lang; Alejandro Vega Zepeda, CONANP.
Lionfish: Ricardo Gómez Lozano, Abelardo Brito – CONANP Cozumel; Marilú López Mejía, UQROO Cozumel; Chris Biggs, Julian Olden, Lionfish Study Roatan; Linda Searle, EcoMar Belize.
Sharks: Rachel Graham, WCS; Peter Wilcox and Giacomo Palavicini - Shark Legacy Project
CDI and MPA map: Emil Cherrington, CATHALAC
Oil: Julie Stockbridge, Oceana
MPA: Luis Bourillón Moreno, Citlali García Sotelo, Comunidad y Biodiversidad (COBI).
Success stories: Lisa Carne, research consultant, Coral Nurseries; Jenny Myton, Banco Cordelia; Paul Sánchez-Navarro Russell - Centro Ecológico Akumal (CEA).

REVIEWERS

International Steering Committee
María José González, MAR FUND
Carlos Saavedra, Summit Foundation
Imani Fairweather Morrison, Oak Foundation
Nadia Bood, World Wildlife Fund
Janet Gibson, Wildlife Conservation Society
Fernando Secaira, The Nature Conservancy
Les Kaufman, Conservation International
Patricia Kramer, Perigee Environmental
Valerie Paul, Smithsonian Institution

Citation
Healthy Reefs Initiative (2010) Report Card for the Mesoamerican Reef

FSC LOGO HERE

This publication is printed by Franklin Communications, LLC, on FSC certified paper, using 10% PCW and soy-based inks. @ Smithsonian Institution, November 2010

** Focal group meeting and consultations were held with partners in each country. A full list of these contributors is found in the Online supplemental 2010 Report Card. For the full list of participants see: **www.healthyreefs.org**

Cover Photo; top half: © CAVUSITE.ORG / bottom half: Melanie McField

RECOMMENDATIONS

REGIONAL RECOMMENDATIONS BY 2012

Achieve 20% territorial sea under full protection (no-take) within MPAs. In two years, achieve at least five percent on a regional scale.

Continue to harmonize fishery regulations (size limits, closed seasons, gear restrictions) and increase enforcement.

Develop regional standards for coastal sewage treatment facilities with international and / or ecologically relevant guidelines – initiate at least one project per country.

Implement standardized regional reef monitoring and collaborative database including (at least) the seven indicators used in the Integrated Reef Health Index.

Develop a voluntary eco-certification program for marine recreation providers and hotels.

Government

Institute the necessary actions to get the Belize Barrier Reef Reserve System World Heritage Site removed from the Danger List.

A spatially explicit Belize Coastal Zone Management Plan approved by Cabinet with 10 % waters under full protection (within 2 years).

Enact pending regulations (mangrove regulations, fisheries act, trawling ban, end to open access fishery, catch shares).

NGO and Private Sector

Provide a science, social and climate based map of how to attain the 20% full protection target and give guidance on stepwise process to attain the 10% in 2 years.

Provide research for a national strategy for sustainable livelihood support for fishers and implement at least three pilot projects.

Belize Fisherman's Cooperative Association develops a sustainable fishery certification program with economic incentives including a formal MPA co-management arrangement with the Fisheries Department.

RECOMENDACIONES

RECOMENDACIONES REGIONALES POR 2012

Lograr que el 20% del mar territorial este bajo protección total (no-pesca) dentro de APM's. En dos años, al menos un cinco por ciento del territorio marino del SAM bajo este esquema.

Continuar el proceso de estandarizar las regulaciones pesqueras (tamaños, épocas de veda, artes de pesca permitidos) e incrementar la aplicación de las mismas.

Desarrollar estándares regionales para el tratamiento de aguas residuales en zonas costeras que cumplan con regulaciones internacionales y límites ecológicos permitidos –iniciar al menos un proyecto en cada país.

Implementar un programa de monitoreo arrecifal estandarizado para toda la región que integre (al menos) los siete indicadores utilizados en el Índice Integrado de la Salud del Arrecife, utilizando una base de datos colaborativa.

Desarrollar un programa voluntario de certificación ecológica para los proveedores de servicios recreativos marinos y hoteles.

Gobierno

Instituir las acciones necesarias para que el Sitio Patrimonio Mundial Reserva de Barrera Arrecifal de Belice sea removido de la Lista en Peligro.

Una Zona Costera que sea espacialmente explícita, aprobada por el Gabinete con el 10% de aguas totalmente protegidas (dentro de 2 años).

Aprobar regulaciones pendientes (manglares, pesquerías, no permitir pesca de arrastre y pesca sin permisos, límites de captura).

ONG's y Sector Privado

Proveer un mapa con bases científicas, sociales y climatológicas, de cómo obtener la meta del 20% de protección total y guiar en el proceso para obtener el 10% en 2 años.

Llevar a cabo una investigación que arroje luz en cómo desarrollar una Estrategia Nacional de Vida Sustentable para Pescadores e implementar al menos tres proyectos piloto.

BFCA desarrolla un programa de certificación de pesquerías sustentables con incentivos económicos incluyendo contratos formales de co-manejo de APMs con el Depto. de Pesquerías.

Create no-fishing areas in the Gulf of Honduras, specifically, Punta de Manabique site, including the identification of alternative economic options for the displaced fishermen, in order to create local buy-in and decrease illegal poaching.

Allocate part of the national budget to the management of MPA's.

Implement no-take seasons and enforce the laws during those times.

Report, through the proper channels, based on the CAFTA agreement, instances where the law is not applied or broken.

Share and publicize the Voluntary Standards for Marine Recreation Providers to the private enterprise government and general public.

Create easy to understand documents that reflect scientific findings.

Crear áreas de no-pesca en el Golfo de Honduras, especificamente en Punta de Manabique, que incluya la identificación de fuentes de trabajo alternativas para los pescadores, con el fin de crear aceptación local.

Designar parte del presupuesto Nacional al manejo de APM's.

Consolidar la Autoridad del Rio Motagua con el fin de minimizar el problema de contaminación que afecta a los arrecifes y recursos pesqueros.

Reportar, a través de los canales adecuados, y basándose en los acuerdos CAFTA, instancias de la no-aplicación de la ley.

Compartir los Estándares Voluntarios de Recreación Marina con el sector privado, el gobierno y el público en general.

Crear documentos cientificos que sean fáciles de entender.

Allocate part of the National Budget to the management of MPA's.

Participate, along with other stakeholders, in the economic valuation of reefs and other adjacent coastal-marine ecosystems.

Create and manage a standardized database for all protected areas.

Invest in basic sanitation infrastructure in the communities where tourism business is conducted.

Adopt and promote Social and Environmental Private Enterprise Responsibility.

Promote links between universities and local managers in order to support management of MPA's, acquire proper permits and share findings.

Designar parte del presupuesto Nacional al manejo de APM's.

Participar, en conjunto con otros interesados, en la evaluación económica de los arrecifes y ecosistemas marino-costeros adyacentes.

Crear y manejar una base de datos estandarizada para todas las áreas protegidas.

Invertir en la creación de infraestructura de saneamiento básico en las comunidades donde se lleva a cabo turismo.

Adoptar y promover la Responsabilidad Empresarial Social y Ambiental.

Promover alianzas entre universidades y administradores de APM's con el fin de apoyar el manejo de las áreas, adquirir los permisos correspondientes y compartir los resultados de las investigaciones.

Create a local environmental authority to implement a surveillance program that would be continuous and effective in the enforcement of federal regulations.

Participate and promote more federal programs for the marine resource management.

Create and enforce a new law for the residual water treatment in the Yucatan peninsula for the karstic (porous) zones.

Encourage the local organizations and civil community to be involved in the surveillance and enforcement of the law.

Encourage and participate in the adoption of the volunteer standards for good management practices in the whole Yucatan Peninsula.

Create brochures, technical opinions and using the mass media to organize meetings of local leaders and reef stakeholders to share and respond to public concerns.

Crear una autoridad ambiental local para implementar una vigilancia continua y efectiva para el cumplimiento de las leyes federales.

Participar y promover más programas federales para el manejo de los recursos marinos.

Crear e implementar una nueva ley para el tratamiento de aguas residuales en la península de Yucatán para las zonas cársticas.

Motivar organizaciones locales y sociedad para observar la vigilancia y cumplimiento de la ley.

Motivar y participar en la adopción de los estándares voluntarios para las buenas prácticas de manejo en la península de Yucatán.

Crear boletines, opiniones técnicas y medios de comunicación masivos para organizar reuniones con líderes locales y manejadores del arrecife para compartir y responder a la opinión pública.

** Focal group meetings with partners were held for each country. For the complete list of recommendations and participants see www.healthyreefs.org*

***Se realizaron reuniones con grupos focales de asociados en cada país. Para ver la lista completa de recomendaciones y participantes visite: www.healthyreefs.org*