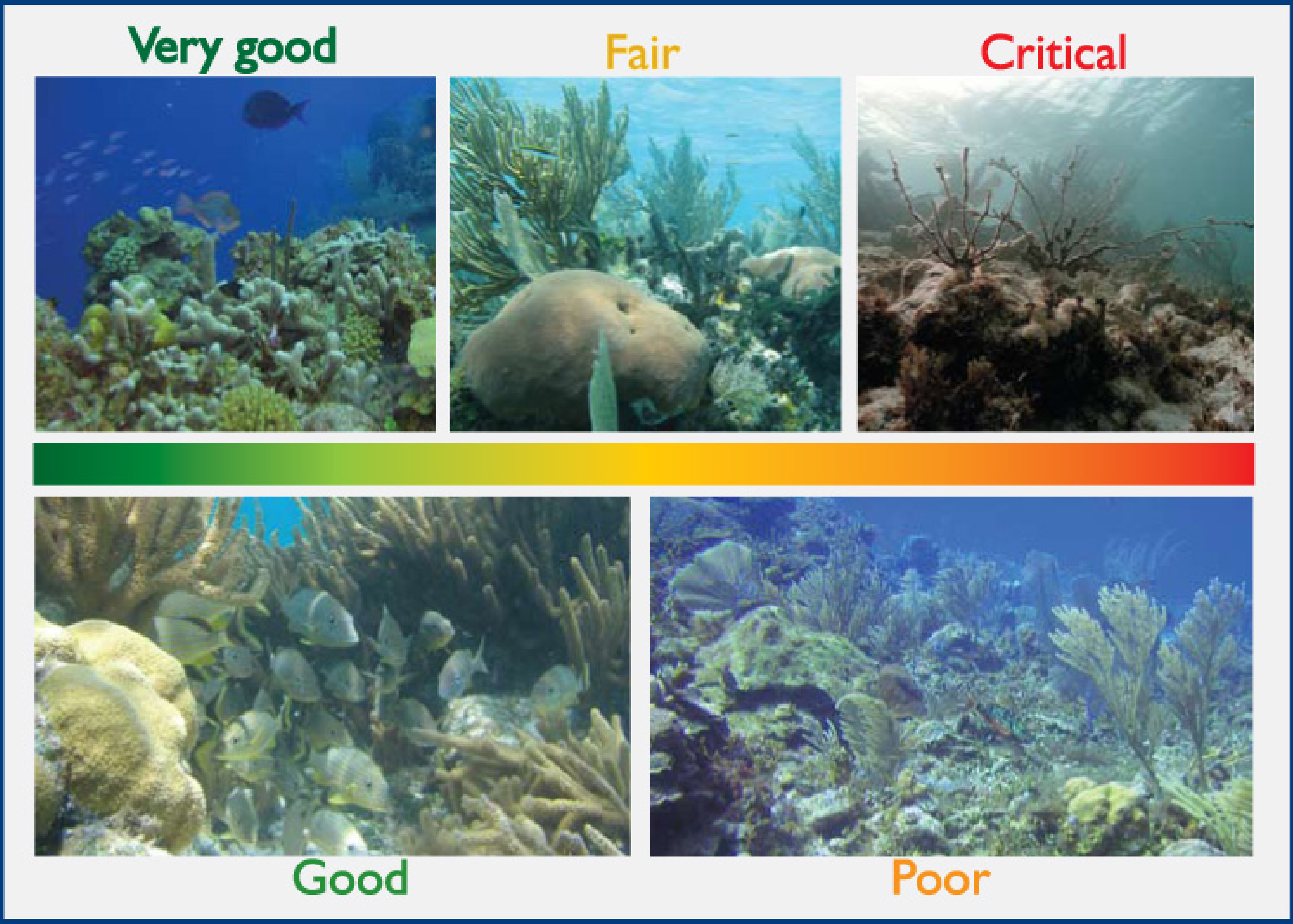
Report Card for the Mesoamerican Reef



An Evaluation of Ecosystem Health

2008

THE MESOAMERICAN REEF

AN INTERNATIONAL ECOREGION

The spectacular Mesoamerican Reef—the Western Hemisphere's longest barrier reef—stretches more than 1,000 kilometers from Mexico to Honduras (Figure 1). 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. Here more than many places, the health of our people—our communities and our economies—depends on our ability to restore, cherish, and maintain our healthy reefs.

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 is approximately 516 km^2, with 212 km^2 in the watersheds and 304 km^2 of 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.

MapResources and World Resources Institute

Figure 1. Locator map and detailed map of the Mesoamerican Reef Ecoregion.

HEALTHY REEFS FOR HEALTHY PEOPLE

Gomez, oil on canvas

Healthy Reefs for Healthy People is a collaborative international initiative that generates user-friendly tools to measure the health of the Mesoamerican Reef Ecosystem, delivers scientifically credible reports to assist decision-making, and serves as a networking hub for science and conservation partners to improve environmental management and stewardship of reef resources.

In 2007, the Healthy Reefs Initiative published *Healthy Reefs for Healthy People: A Guide to Indicators of Reef Health and Social Well-being in the Mesoamerican Reef Region*, which describes four main components of eco-health and details 58 potential indicators by which health can be quantitatively tracked. Then in 2008, the Quick Reference Guide followed, with updates and highlights of the 20 highest-priority indicators and graphically illustrated their modern baseline values against reference conditions. Together these publications provide needed background and historical context to improve our understanding of current reef conditions that are presented in this report card.

CONTENTS OF THE REPORT CARD

Papo, oil on canvas

This eco-health report card is the first comprehensive health assessment of the Mesoamerican Reef Ecosystem (MAR). It aims to provide timely, accurate, and reliable information on the condition of the MAR resources and our degree of success at managing these resources. It will be produced every other year through the Healthy Reefs for Healthy People Initiative.

The report card presents an easy-to-understand overview of reef ecosystem condition and stewardship by providing a straightforward five-point grading system from 'very good' to 'critical' for seven reef indicators. It also describes the novel Integrated Reef Health Index (IRHI), which synthesizes all the ecological reef data into one "Dow Jones" style index, and enables a spatial distribution of healthy and unhealthy reefs to be mapped for the first time (centerfold map). Due to humans being a fundamental part of the ecosystem (Figure 2)—the report card also describes the main threats to the ecosystem and evaluates our impact and management efforts through the newly developed Coastal Development and Tourism Development Indices. Environmental stewardship and management are further evaluated through three additional socioeconomic and performance indicators. Finally, conclusions are presented on page 15 and recommendations are on the back cover.

This first report card shows the overall picture of a reef in danger, in need of immediate protection. Our collective efforts to manage the drivers of ecosystem change have had mixed success. Given the tight coupling between environmental and human health, there is great urgency to improve our track record of management. At the same time, there are some elements of reef health in good condition and others that can readily be improved through better management choices.

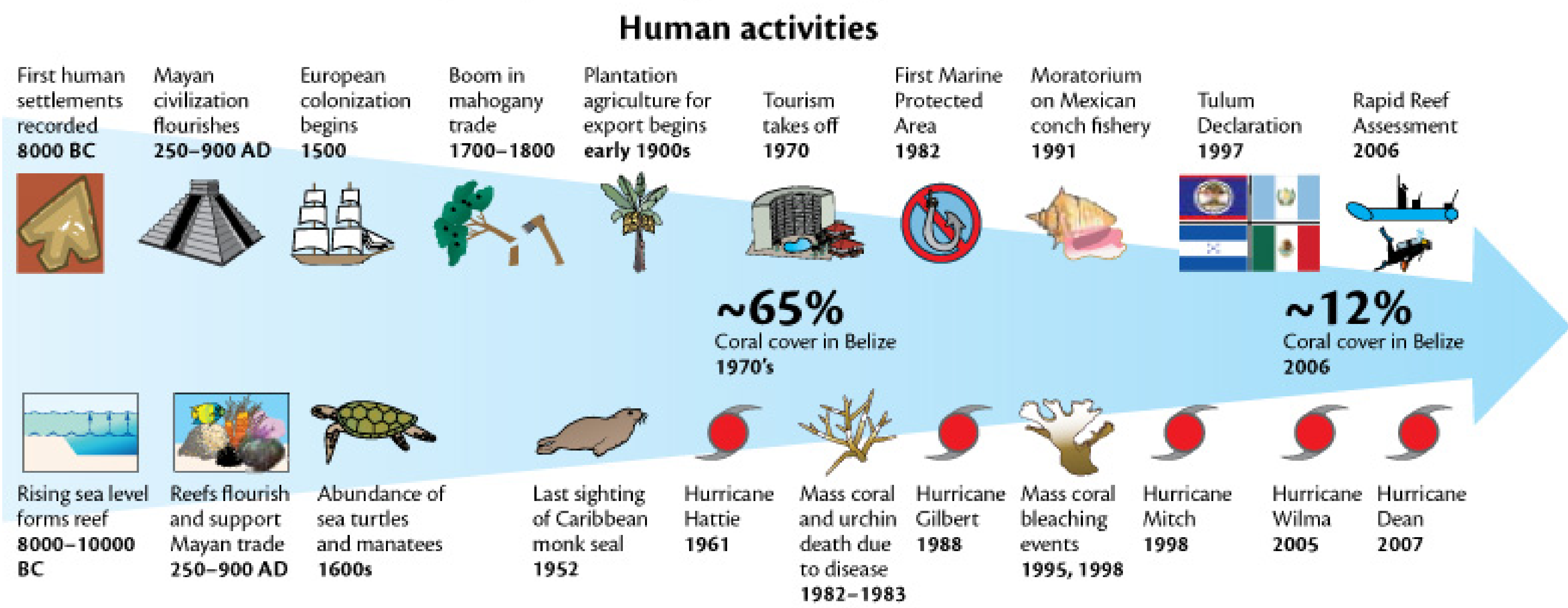
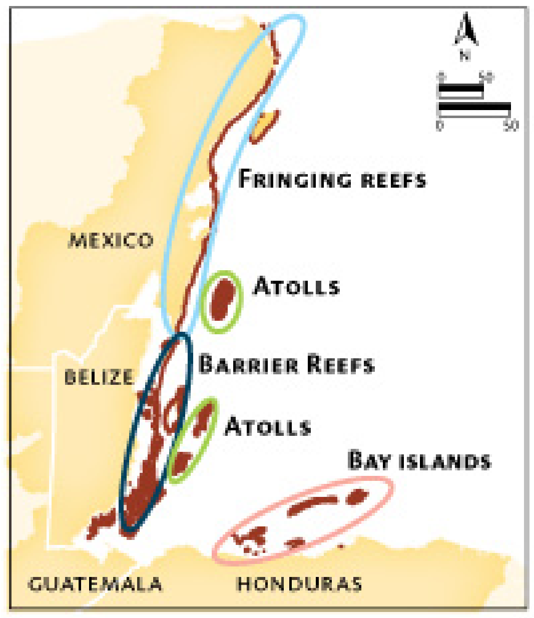


Figure 2. Historical timeline of the Mesoamerican Reef Ecoregion, with emphasis on human activities that have contributed to changes in reef health (e.g., tourism, establishing protected areas), and specific reef impacts (e.g., bleaching, hurricanes).

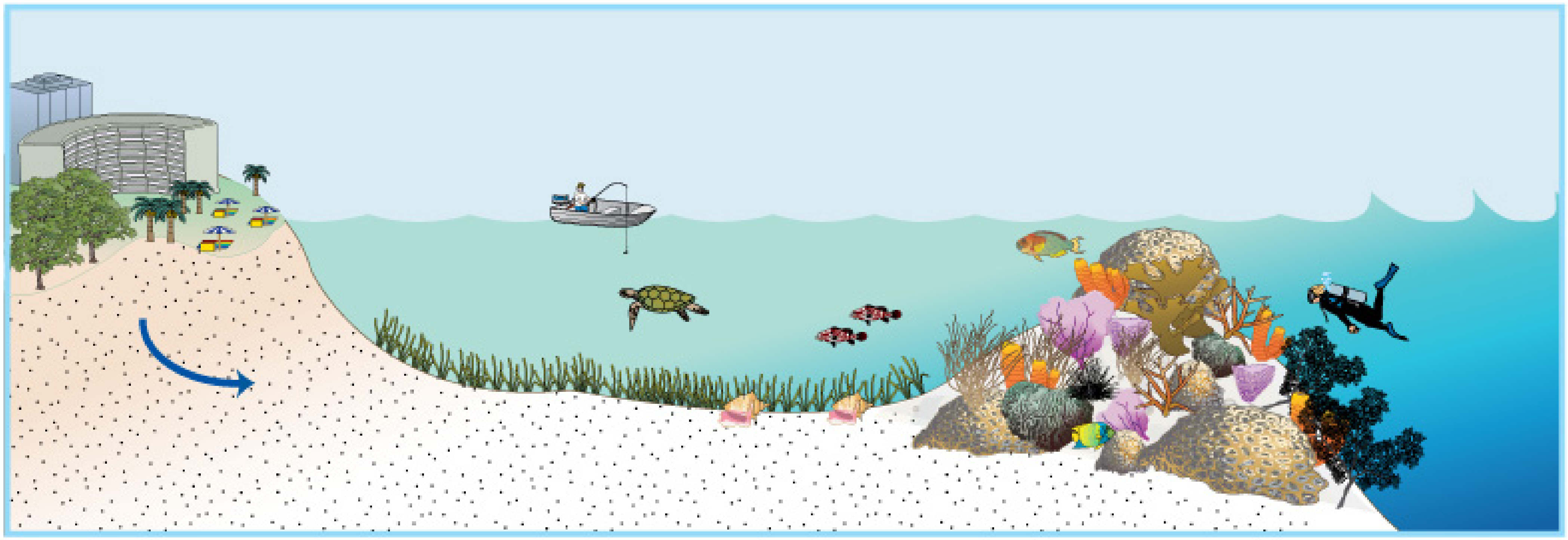
FROM RIDGE TO REEF

A MOSAIC OF LAND-SEA INTERACTIONS



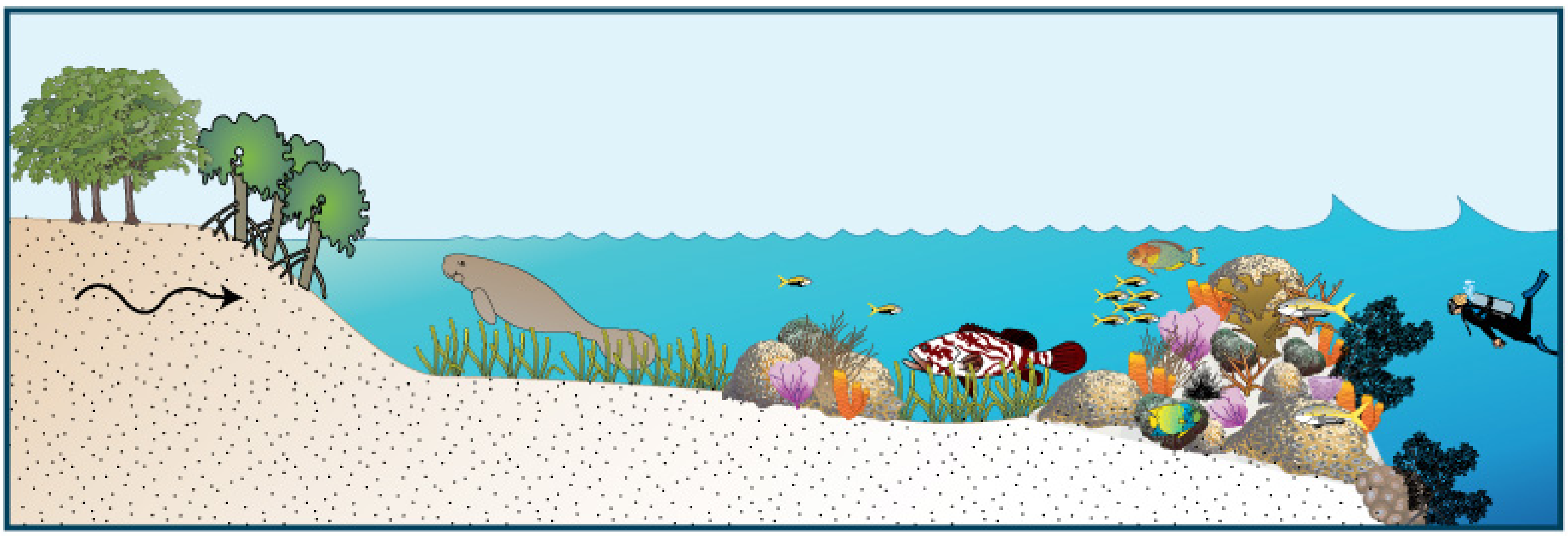
The diverse mosaic of coral reefs varies throughout the region due in part to the interconnection between land and sea. The nature of the terrain and climate influences the distance of the reefs from shore and creates a variety of reef types, including fringing, barrier, atoll, and island reefs. This diversity of reef types and morphologies has made the MAR region a haven for scuba enthusiasts who explore the rich diversity of reefs and their marine inhabitants. Guatemala's narrow coast along the Caribbean consists mainly of mangroves, seagrass beds, and coastal lagoons. Large river flows limit coral reef development to a few isolated coral communities and small patch reefs. Similarly, few coral reefs are found along Honduras mainland coast due to elevated runoff from high rainfall from the mountainous terrain. The following conceptual diagrams highlight key features of the four main reef types in the MAR Ecoregion.

MEXICO FRINGING REEFS



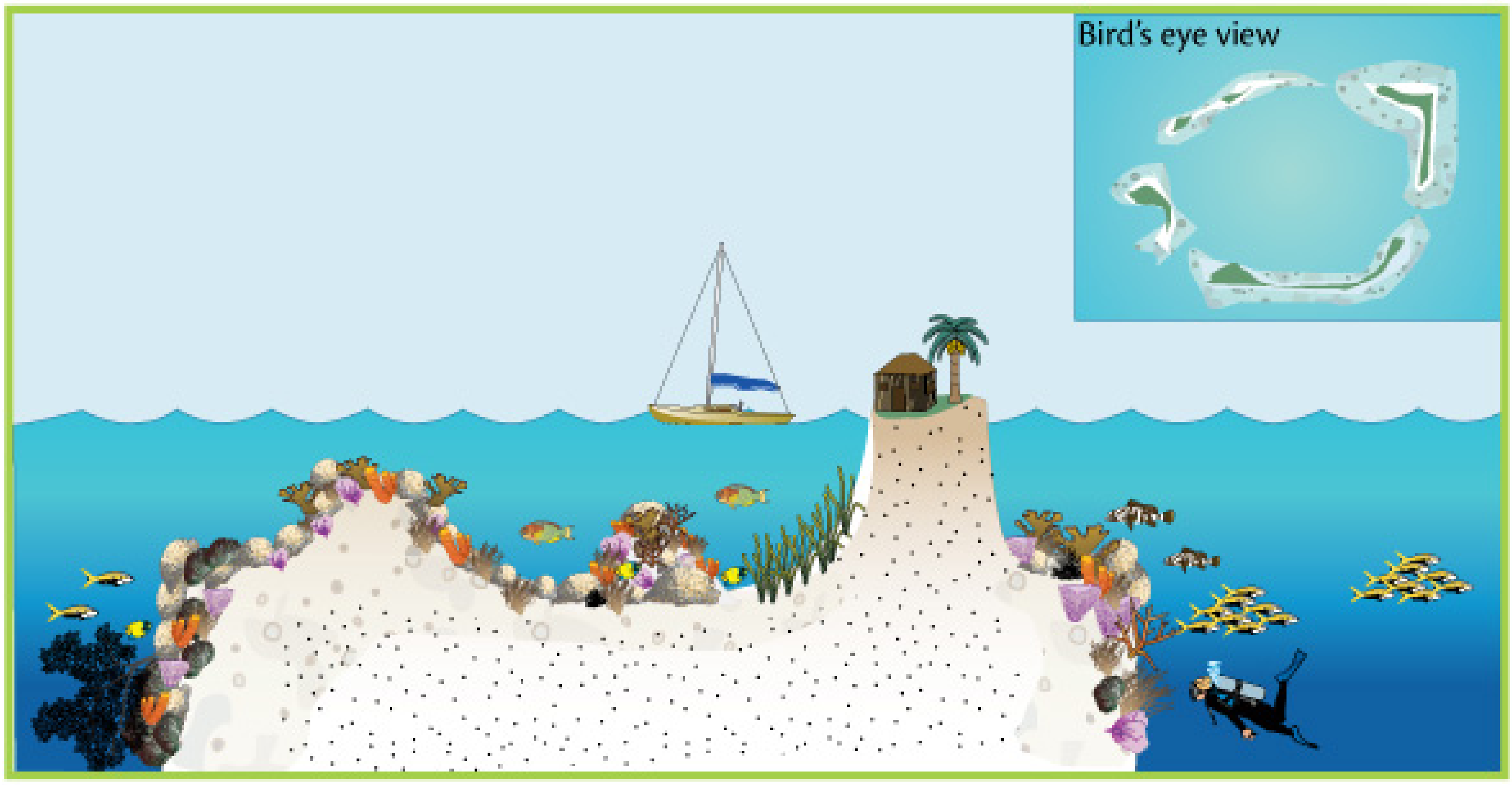
Along the Yucatan peninsula, Mexico, a long fringing reef separated by a narrow lagoon parallels nearly 350 kilometers of coastline from Isla Contoy south to Xcalak. The reefs in the south are larger and more continuous than those to the north. Well-developed reefs are also found around the island of Cozumel and at the Banco Chinchorro atoll.

BELIZE BARRIER REEFS



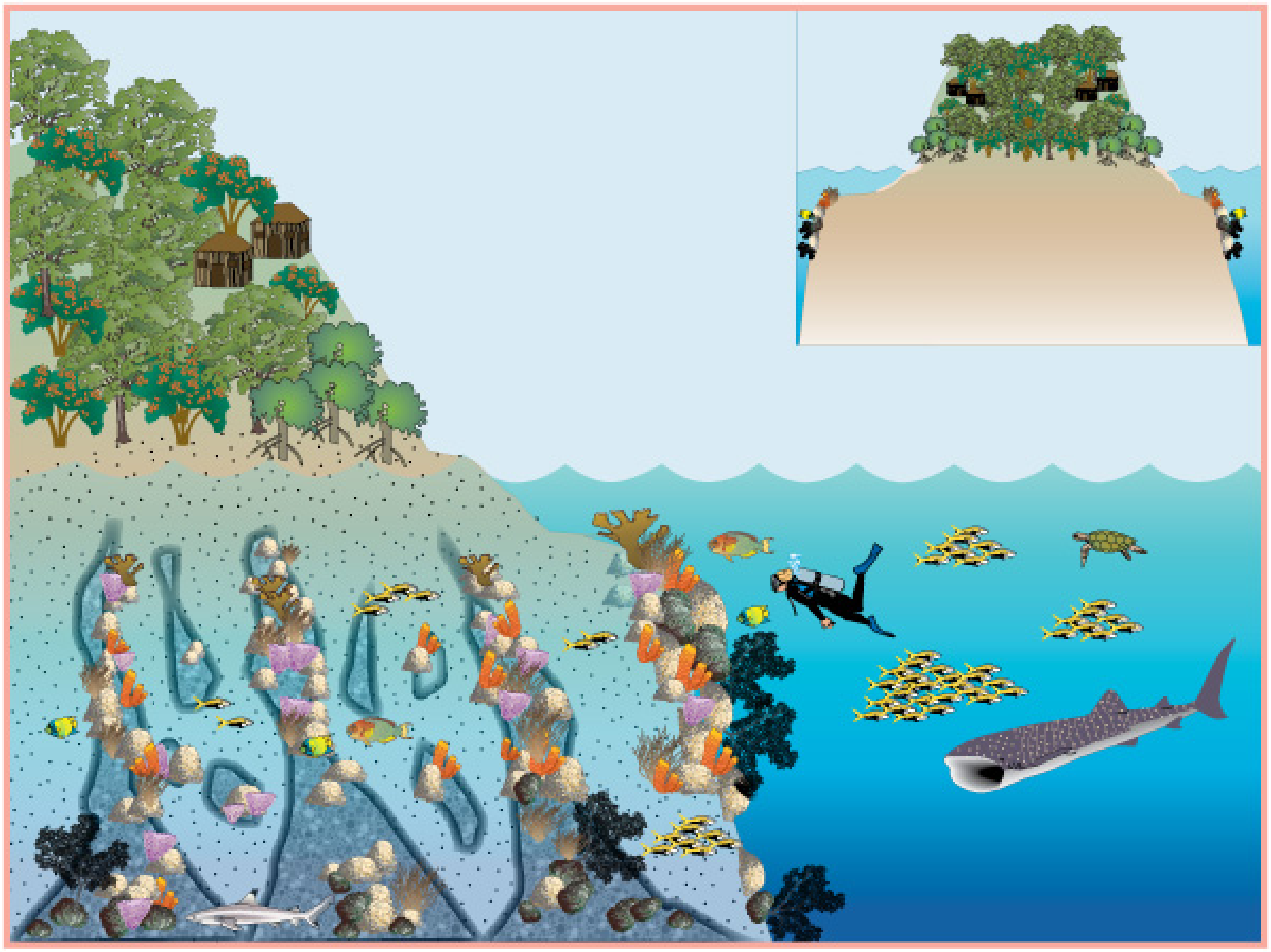
Belize hosts a complex mosaic of lagoonal patch reefs, fringing reefs, barrier reefs, and offshore atolls extending nearly 250 kilometers along its coastline. The northern-central barrier reef is well developed. The lagoon separating the reef from the land widens and deepens to the south. When mangroves are present along the coastline they help to filter pollutants and trap sediments that can smother nearshore seagrasses or reefs. Unique rhomboidal-shaped shoals or faroe reefs are found in the southern barrier reef lagoon, while the barrier reef becomes somewhat less developed in the far south.

MEXICO AND BELIZE ATOLLS



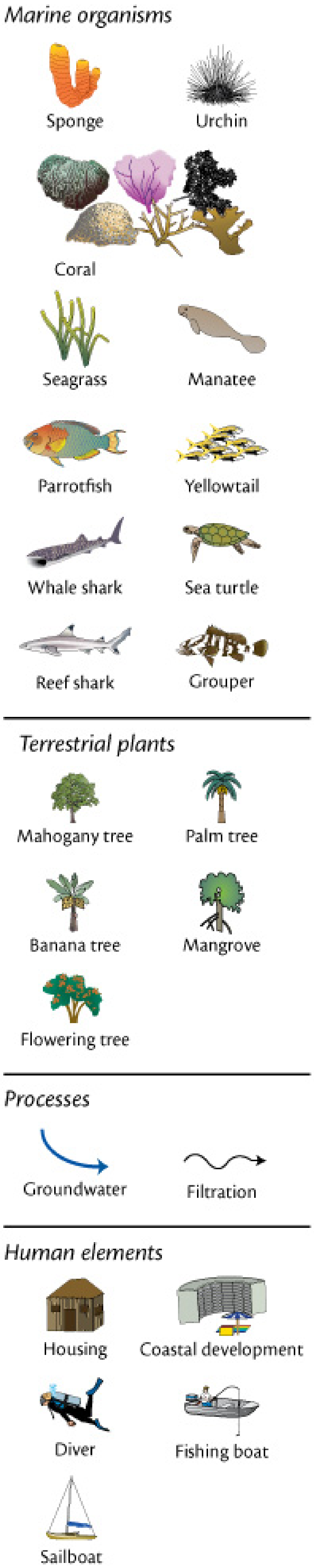
Atolls are circular-shaped reefs that emerge from deep water with vertical walls of coral surrounding a central lagoon. They are quite rare in the Caribbean—but the MAR has four, including: Banco Chinchorro in Mexico and Turneffe, Lighthouse, and Glover's Reefs in Belize. Turneffe has the largest extent of land and mangroves, with over 200 mangrove islands providing critical nursery habitat to a variety of marine organisms. Lighthouse Atoll is best known for the famous Blue Hole, a crystal blue sinkhole over 90 meters wide and over 120 meters deep.

HONDURAS BAY ISLANDS



More extensive reefs are found around the offshore Bay Islands, Honduras, including the four large islands of Roatan, Utila, Guanaja, and Cayos Cochinos. Well-developed coral reefs fringe the islands' narrow, shallow (9–12 meters) banks, then plunge downward in walls of coral extending to 75 meters depth.

SYMBOLS LEGEND



THE SEVEN CORE INDICATORS OF REEF HEALTH

Measuring reef health is more complex than visiting your family physician for an annual check-up. Scientists are only now beginning to develop quantitative indicators to evaluate reef health. This report card is one of the first such attempts for a diverse reef ecosystem. We have selected seven key indicators* that have sufficient data coverage and the ability to help detect differences among reef sites.

The objective is to use an optimum amount (6–10) of indicators to measure reef health. We have combined three coral-focused indicators into a Coral Index and four other indicators into the Reef Biota Index. The two sub-indices are then averaged to attain the overall Integrated Reef Health Index (IRHI), which serves as the ultimate measure of reef health.

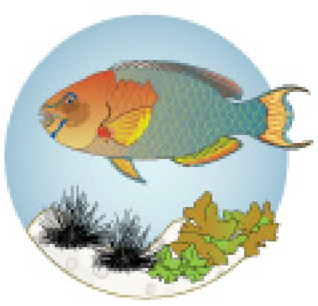
CORAL INDEX

The Coral Index includes the following three indicators:

- **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.
- **Coral disease prevalence** is the percentage of total colonies visibly affected by disease.
- **Coral recruitment** is the process by which tiny, drifting coral larvae attach to the bottom and begin to grow. It is measured as the number of recruits per square meter on the reef, and is critical to recovery after disturbances.

M. McField

REEF BIOTA INDEX



The Reef Biota Index includes the following four indicators:

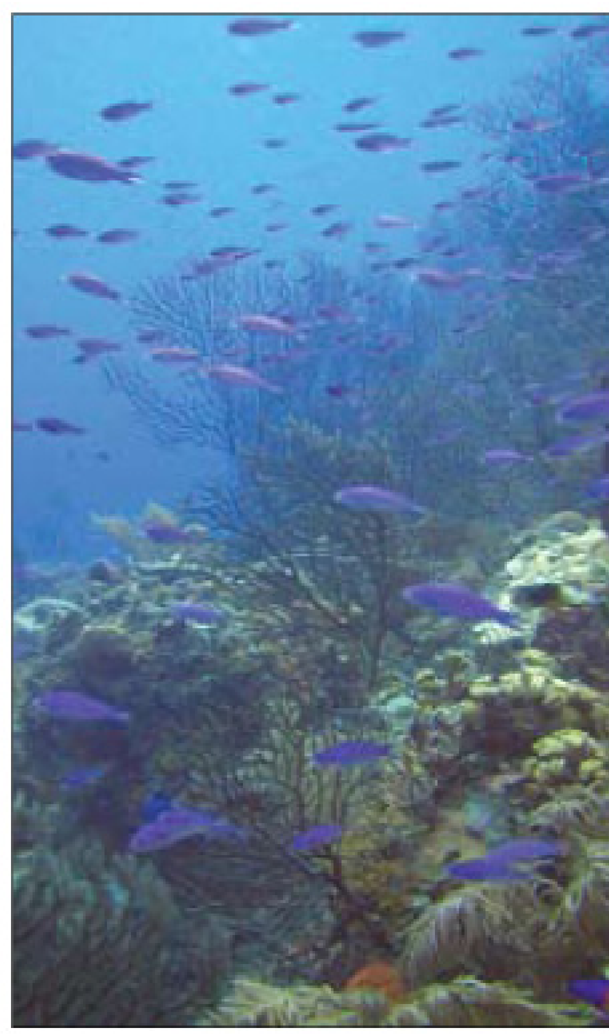
- **Fleshy macroalgal index** measures the amount of fleshy algae or "seaweed" on a reef. It is defined as the product of fleshy macroalgae cover and canopy height.
- **Herbivorous fish abundance** measures the biomass (total weight of fish per unit area) of surgeonfish and parrotfish, the most important fish grazers on plants that could overgrow the reef.
- **Commercial fish abundance** measures the biomass (total weight of fish per unit area) of commercially significant fish species, as defined by the AGRRA method (see next page).
- ***Diadema* abundance** measures the density of the long-spined sea urchin, a key grazer of algae that otherwise compete with corals for precious reef space.

M. McField

INTEGRATED REEF HEALTH INDEX

The IRHI is the average (mean) of the coral and reef biota sub-indices. 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 development of a single index value facilitates the mapping of reef health (centerfold map) for a more comprehensive view across the region.

**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 health can be assessed.



M. McField

TRACKING REEF HEALTH AT 326 SITES

MEASURING INDICATORS ON THE REEF

In 2006, The Nature Conservancy/World Wildlife Fund Rapid Reef Assessment along the Mesoamerican Reef was the largest reef survey ever carried out in the Caribbean region. The study provided a representative region-wide snapshot of reef health and forms the foundation of this report card.

Representative reef sites were remotely selected within each of the reef types, based on the Millennium Coral Reef Mapping Project map products (*http://eol.jsc.nasa.gov/reefs/Overview2003/mill.htm*). The 326 reef sites surveyed consisted of various reef geomorphological types, including shallow fore, patch, pinnacles, and back/reef flat. The survey used the Atlantic and Gulf Rapid Reef Assessment (AGRRA) V.4 (2005) protocol which called for six benthic transects (10m each) and ten fish transects (30m each) at each site.


N. Bood

Diver surveying a reef in the Mesoamerican Reef Ecosystem.

The comprehensive nature of the study was made possible through the participation of a number of local and international partner organizations. All data collectors were trained in the methodology during a series of regional training events.

REPORTING REGIONS

In this analysis we have evaluated a representative number of reef sites across the entire MAR region and compared individual reefs to regional averages. The 326 reef sites surveyed included a wide range of reef types (e.g., reef crest, patch reefs, reef flats, fore reefs) and differences in status may be due in part to their natural differences (i.e., a well-developed elkhorn reef may naturally have more fish than a reef flat community that lacks structural habitat). Thus, the evaluation system may be more reliable on larger scales (e.g., at the level of reporting regions or countries) rather than at a particular site level, which may be influenced by unique factors. Considerable variation among habitats exists within each reporting region, which may account for some of the total variability within these management-influenced reporting regions. This should be taken into account before comparing the survey data in this study to other data.

The 12 reporting regions (Figure 3) used in this study were delineated based on natural geomorphologic and socio-political features (management zone boundaries, political boundaries) that helped divide areas of similar habitat and facilitate management responses by sub-region.

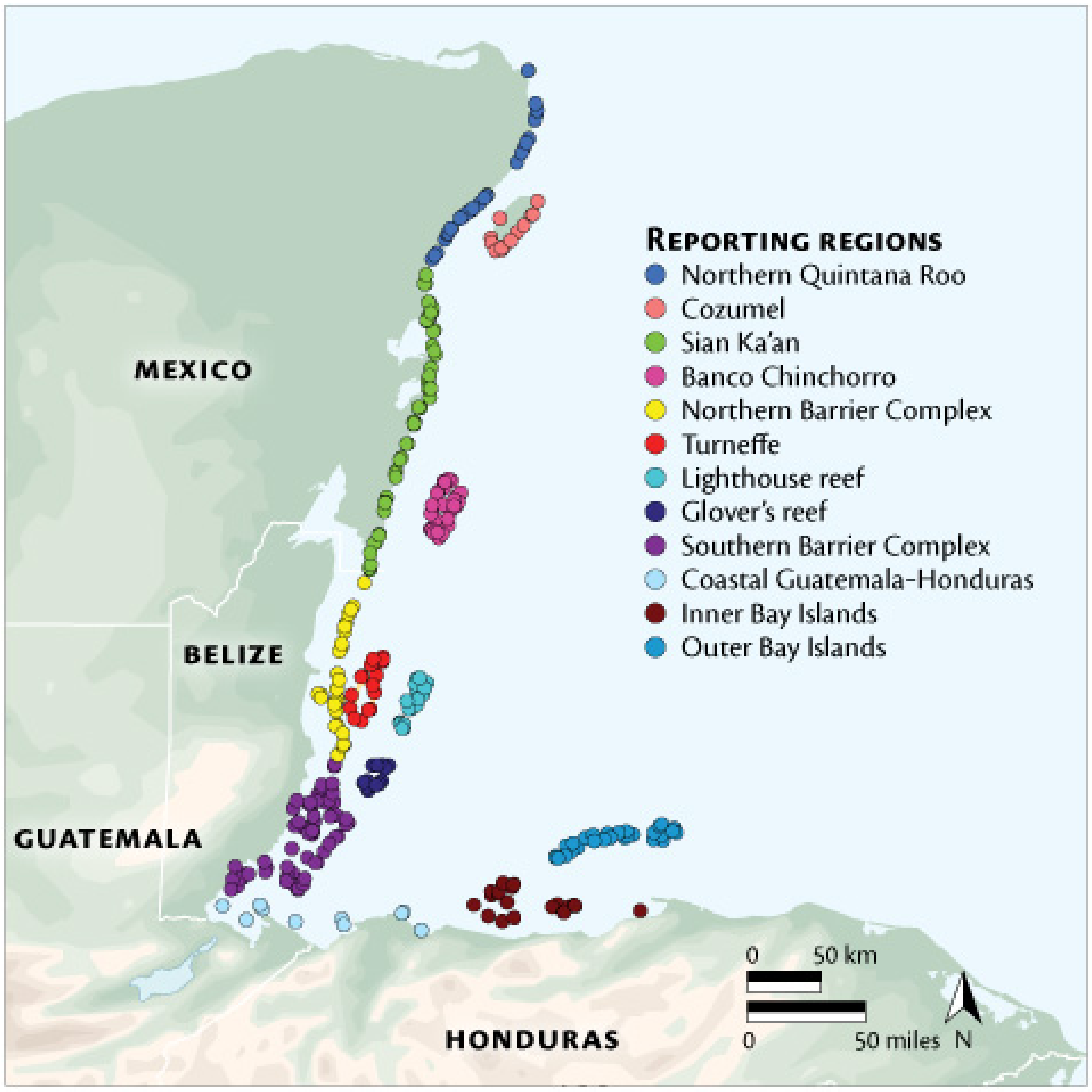
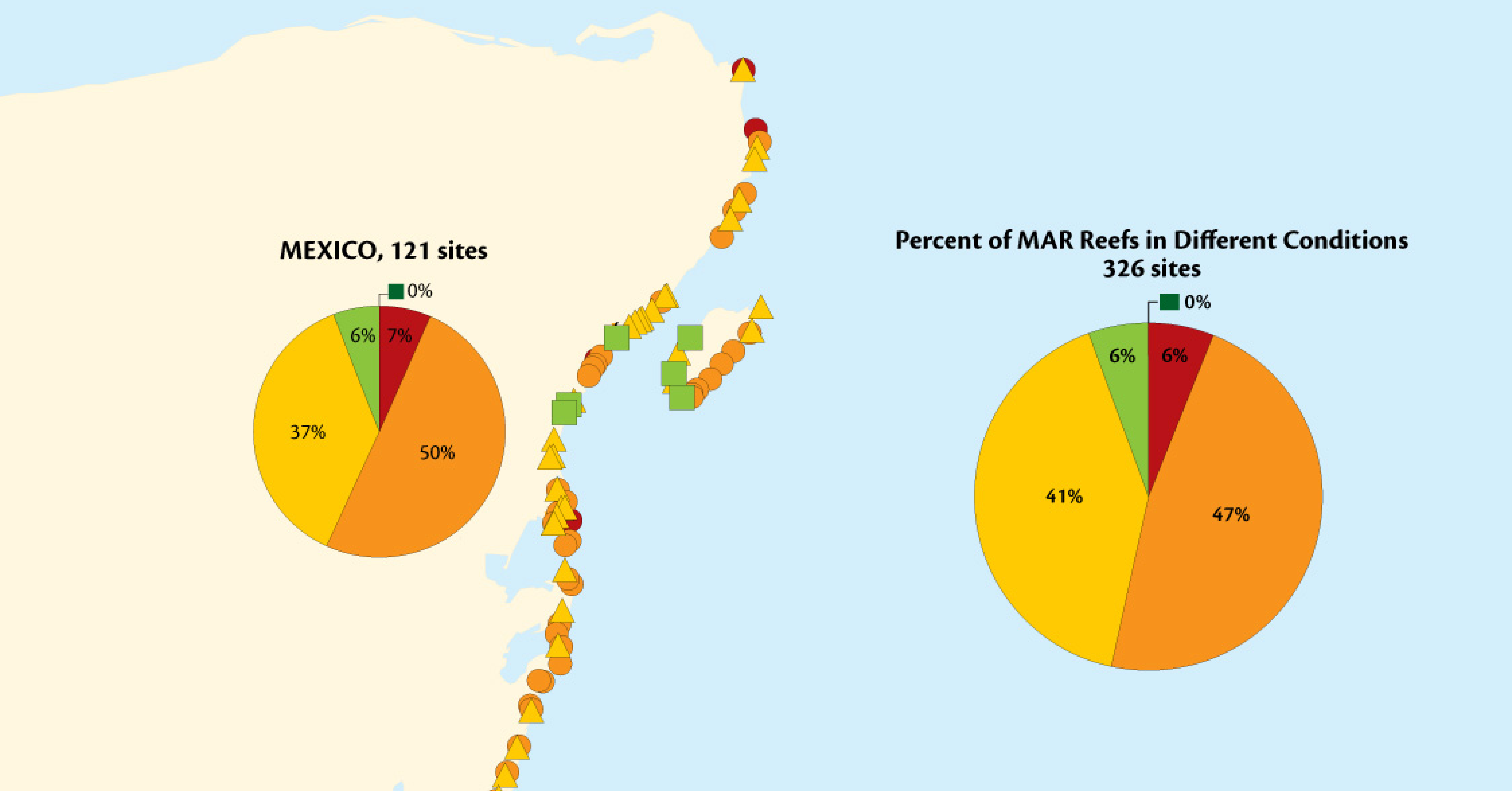
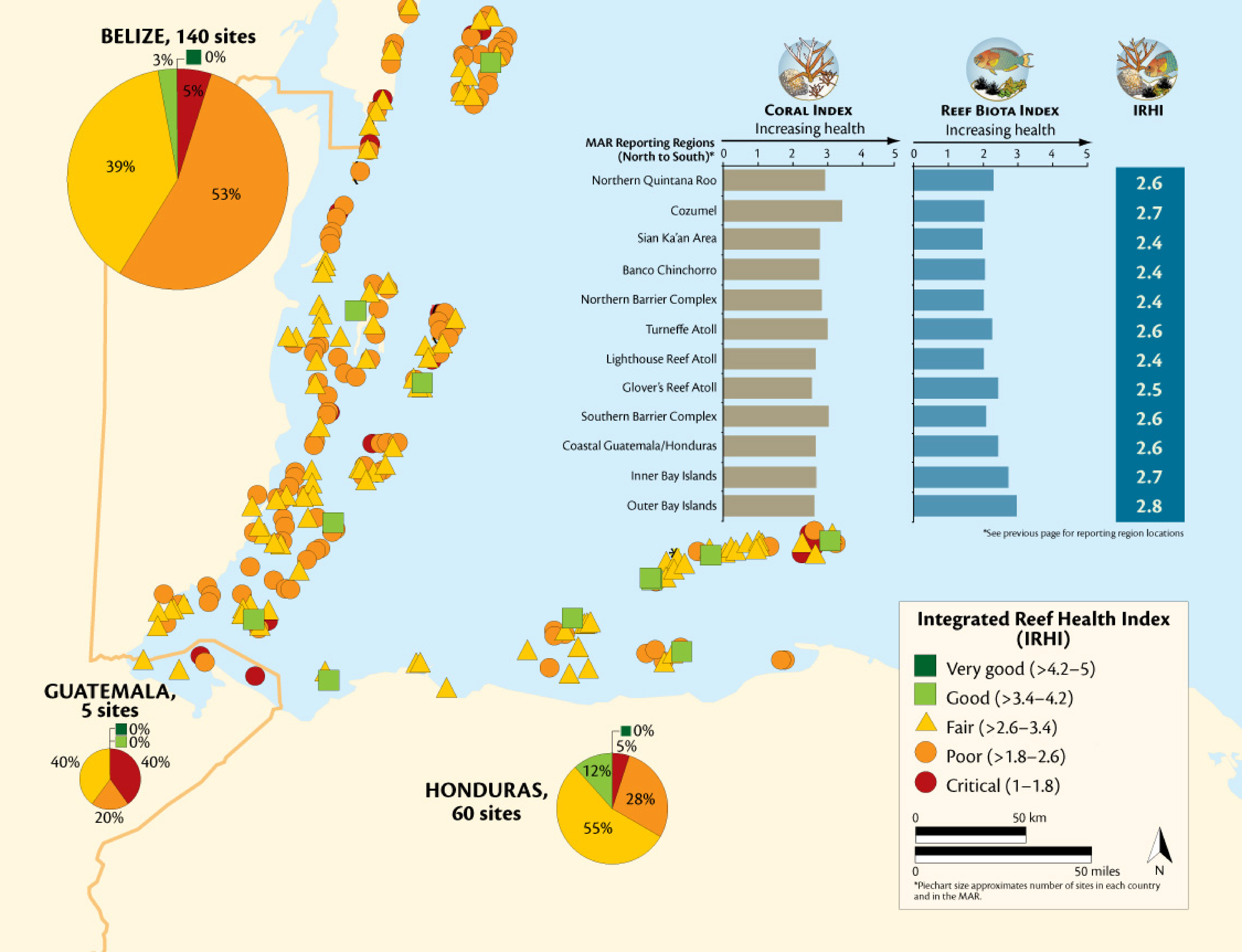


Figure 3. Map of reporting region of each site. Determination of reporting regions was based on geography and natural breaks.

THE INTEGRATED REEF HEALTH INDEX FOR THE MESOAMERICAN REEF




BELIZE, 140 sites
3%
0%
5%
39%
53%
GUATEMALA,
5 sites
0%
0%
40%
40%
20%
HONDURAS,
60 sites
0%
5%
12%
28%
55%
Coral Index
Increasing health
Reef Biota Index
Increasing health
IRHI
MAR Reporting Regions
(North to South)*
0 1 2 3 4 5
Northern Quintana Roo 2.6
Cozumel 2.7
Sian Ka'an Area 2.4
Banco Chinchorro 2.4
Northern Barrier Complex 2.4
Turneffe Atoll 2.6
Lighthouse Reef Atoll 2.4
Glover's Reef Atoll 2.5
Southern Barrier Complex 2.6
Coastal Guatemala/Honduras 2.6
Inner Bay Islands 2.7
Outer Bay Islands 2.8
*See previous page for reporting region locations
Integrated Reef Health Index
(IRHI)
Very good (>4.2–5)
Good (>3.4–4.2)
Fair (>2.6–3.4)
Poor (>1.8–2.6)
Critical (1–1.8)
0
50 km
0
50 miles
N
*Piechart size approximates number of sites in each country and in the MAR.

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 ranked scores for each of the three coral indicators were then averaged for the Coral Index, while the remaining four indicators were averaged into the Reef Biota Index. These two sub-indices were then averaged to calculate the Integrated Reef Health Index. Thus the individual indicators of the Coral Index have slightly more influence on the result.

The development of the data ranges (Table 1) was the single most difficult component of this analysis and 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. 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.

Table 1. Threshold values used to determine ranking for each indicator.

INDEX/ INDICATOR	VERY GOOD (5)	GOOD (4)	FAIR(3)	POOR (2)	CRITICAL (1)
Coral Index					
Coral cover (%)	≥40	20.0–39.9	10.0–19.9	5.0–9.9	<5
Coral disease prevalence(%)	<1	1.1–1.9	2.0–3.9	4.0–6.0	>6
Coral recruitment (m^{-2})	≥10	5.0–9.9	3.0–4.9	2–2.9	<2
Reef Biota Index					
Fleshy Macroalgal Index	<10	10–19	20–39	40–59	≥60
Herbivorous fish abundance ($g \cdot 100m^{-2}$)	≥4800	3600–4799	2400–3599	1200–2399	<1200
Commercial fish abundance ($g \cdot 100m^{-2}$)	≥2800	2100–2799	1400–2099	700–1399	<700
Diadema abundance (m^{-2})	>2.5 (and <~7)	1.1–2.5	0.5–1.0	0.25–0.49	<0.25

AN UNLIKELY HERO

The long-spined sea urchin (*Diadema antillarum*) is an important reef resident whose presence or absence can change the very nature of a reef. Urchins are key algae grazers on the reef and their long spines provide shelter for small fish and invertebrates. The recent increase in these urchins is some of the best news in this report card, due to their amazing ability to keep damaging macroalgae in check. These urchins were decimated by disease throughout the Caribbean in the early 1980s. The majority of MAR reefs still have few to no urchins, yet their return in a number of reefs was enough to bump up their average density to a "good" level, and make a noticeable reduction in the macroalgae at these particular reefs. We hope for more good news in the future as their populations fully rebound.

M. McField

The long-spined sea urchin is making a come back on the Mesoamerican Reef.

MANY THREATS TO REEF HEALTH

A decade ago the Mesoamerican Reef Ecosystem was considered to be in better condition than most other reefs of the Caribbean—but this distinction is now unlikely. Many of the reef health indicators (particularly for fish abundance) are now in worse condition than the Caribbean average, and threats such as coastal development and tourism are rapidly accelerating. The main threats to the reef are illustrated in Figure 4 below and include:

- 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);
- Over-fishing (reducing fish populations and disrupting food webs);
- Hurricanes and storms (breakage and removal of corals); and,
- Rising temperatures (increasing coral bleaching, diseases, and mortality).

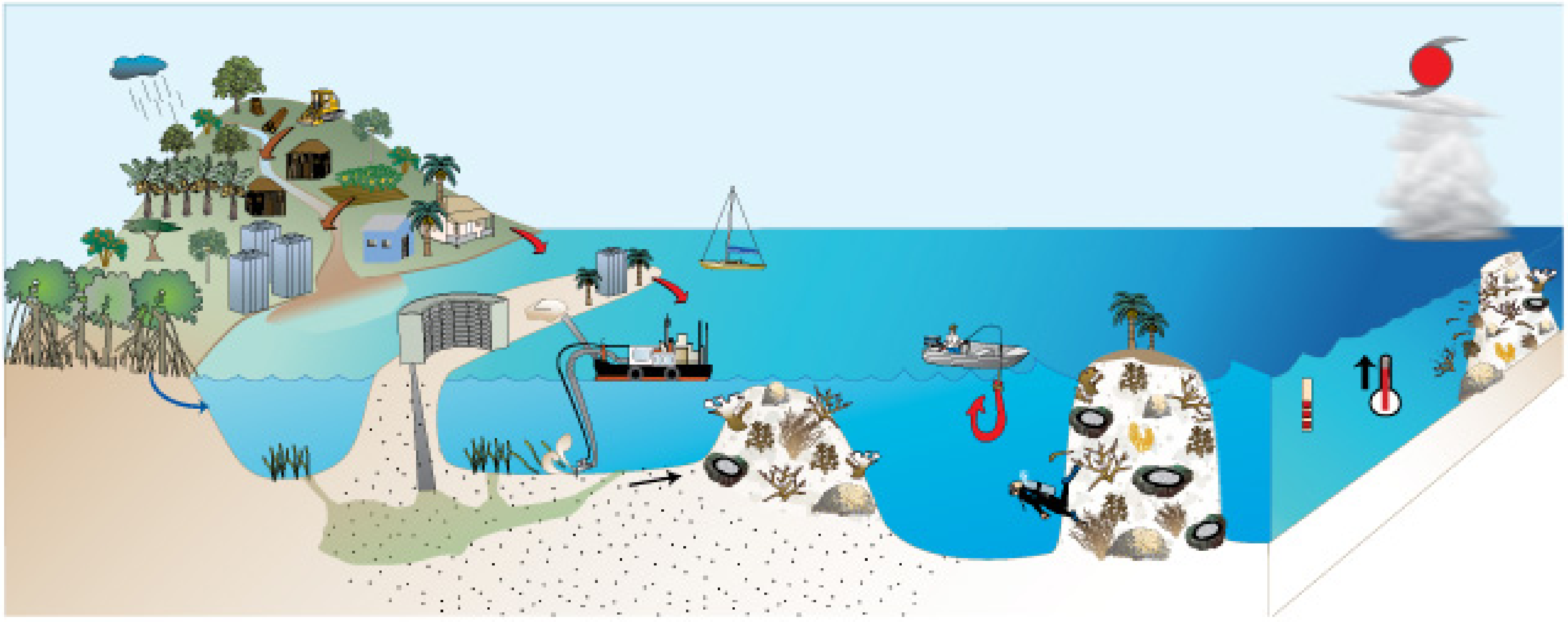


Figure 4. Conceptual diagram illustrating some of the main threats and human impacts to the health of the Mesoamerican Reef.

CLIMATE CHANGE IMPACTS ON THE MESOAMERICAN REEF

The Mesoamerican Reef is a dynamic ecosystem that is both fragile and resilient. It is critical to the survival of tropical marine ecosystems and hence to the local people. Local resource managers need to incorporate planning for climate change in their efforts to conserve reefs.

- 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.
- The Mesoamerican reef has weathered many damaging storms and hurricanes, and 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, which devastates coastal communities and reefs, and leaves insufficient time for 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.

T. Sharp

A PATCHWORK OF COASTAL DEVELOPMENT

The Coastal Development Index (CDI, Figure 5) measures the extent to which humans have altered the landscape in coastal areas. Five factors are built into the index:

- Coast population;
- Coastal land area covered by major infrastructure—urban or agriculture;
- Extent of coastal road-building;
- The rate of coastal population growth; and,
- The rate that natural coastal land is being converted to a developed state.

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 extensive, rapid, "maxed out" development.

One important feature of this index is that the data are amenable to spatial analysis and mapping. However, the coarse scale of satellite-based measurements of land cover change may prevent detection of important alterations along the coastal strip. Additional measurements and monitoring using aerial photography may be needed for small cayes and thin coastal strips under high pressure for development.

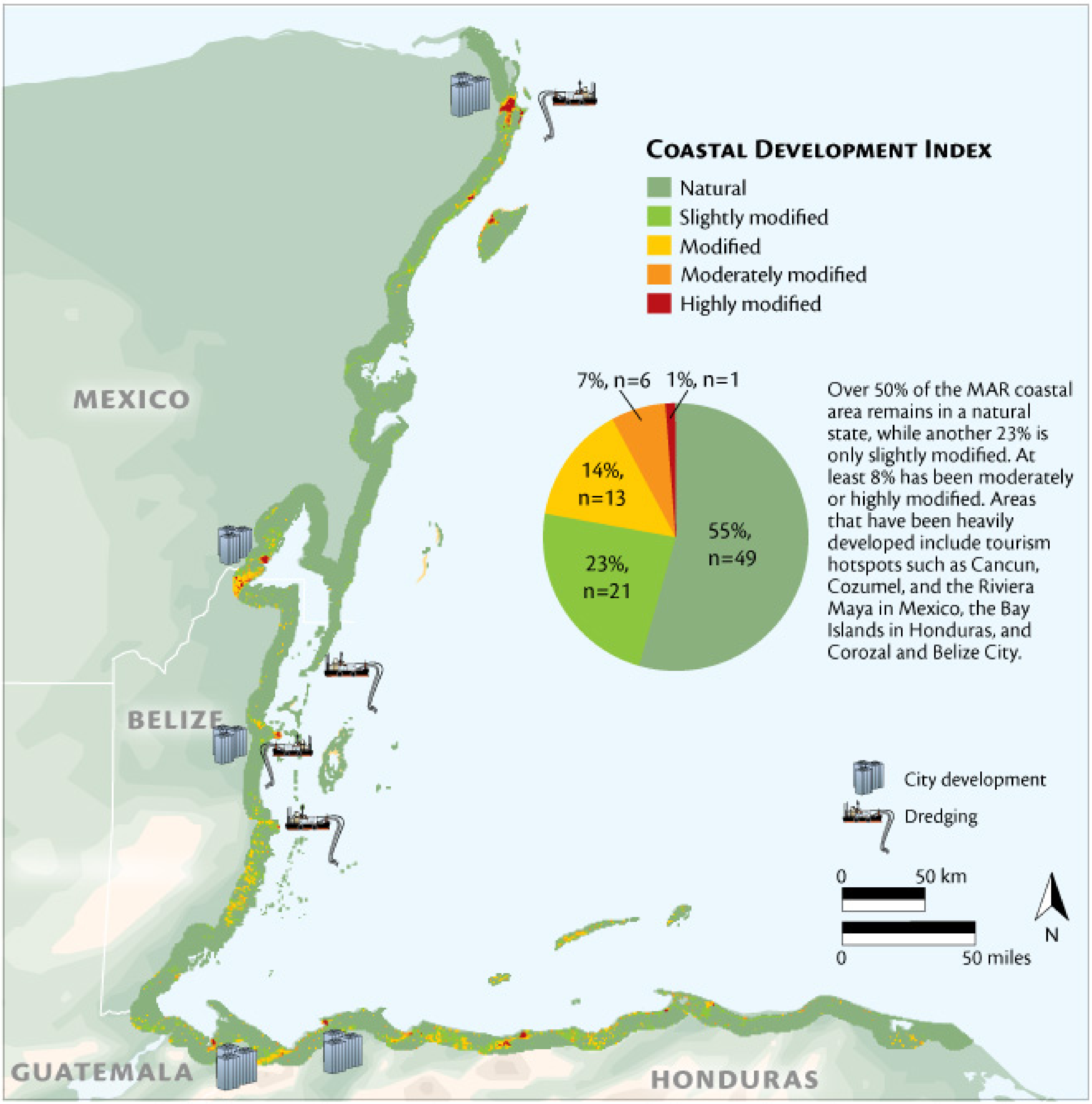


Figure 5. Coastal development adjacent to the Mesoamerican Reef. The Coastal Development Index is based on factors such as population density and growth, area of major infrastructure, and rates of land development. Major development concerns are highlighted with a symbol.

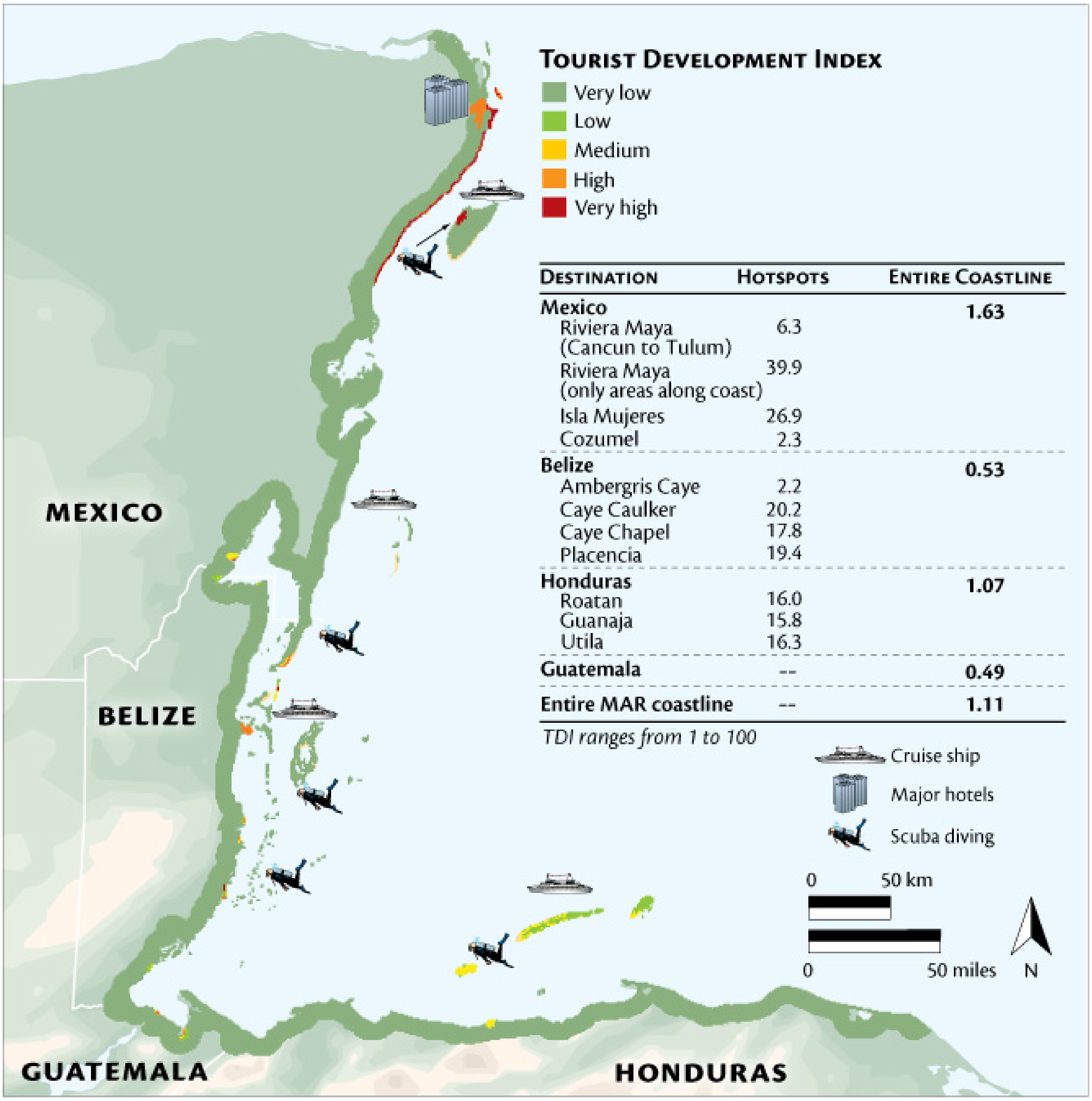
TOURISM CONCENTRATED IN HOTSPOTS

The Tourism Development Index (TDI, Figure 6) measures the growth and contraction of tourism, currently the fastest growing industry in the MAR region. For each tourism zone or destination, the TDI is calculated from five variables:

- The size of the tourist population compared to the resident population;
- The number of hotel rooms in the area;
- The hotel occupancy rates;
- The amount of money spent daily by tourists; and,
- The number of cruise ship visits each year.

The data are then applied to 1km² grid cells within 10km of the coastline.

Tourism is the primary economic sector that is shaping the livelihoods of many in the MAR region. Globally, ecotourism is the fastest growing sector, although cruise ship tourism has been the fastest growing sector in some areas of the MAR in recent years, particularly in Cozumel and Riviera Maya in Mexico, Belize City in Belize, and the Bay Islands in Honduras. Tourism—even ecotourism—can result in significant and lasting environmental degradation if undertaken without a sound, legally binding coastal zone management plan that encompasses cumulative effects through an ecologically appropriate zoning scheme and addresses the need for adequate infrastructure (particularly solid waste and sewage).



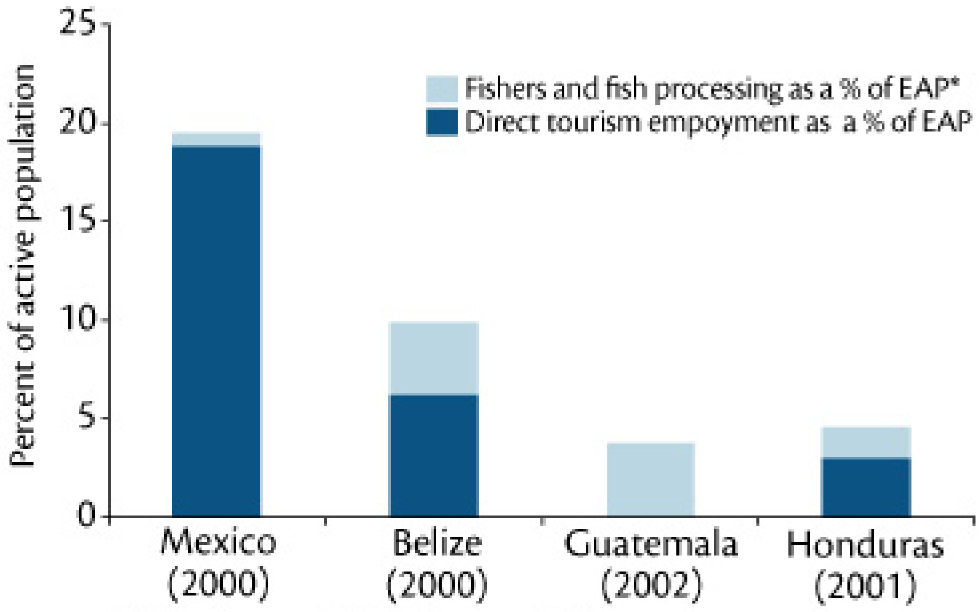
Destination	Hotspots	Entire Coastline
Mexico		**1.63**
Riviera Maya (Cancun to Tulum)	6.3	
Riviera Maya (only areas along coast)	39.9	
Isla Mujeres	26.9	
Cozumel	2.3	
Belize		**0.53**
Ambergris Caye	2.2	
Caye Caulker	20.2	
Caye Chapel	17.8	
Placencia	19.4	
Honduras		**1.07**
Roatan	16.0	
Guanaja	15.8	
Utila	16.3	
Guatemala	--	**0.49**
Entire MAR coastline	--	**1.11**

TDI ranges from 1 to 100

Figure 6. Baseline assessment of the extent of tourism development in the coastal zone (10km from coastline and island) of the MAR region, as quantified by the Tourism Development Index (TDI). Symbols identify the location of different types of tourism.

PEOPLE AND REEFS BENEFIT FROM GOOD ENVIRONMENTAL MANAGEMENT

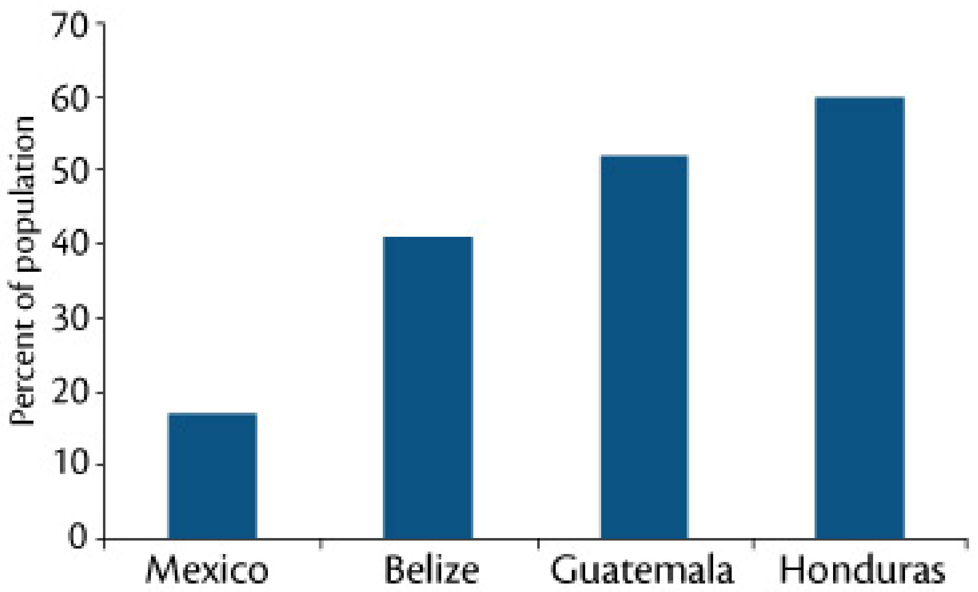
DIRECT DEPENDENCE ON MARINE RESOURCES



* EAP = Economically active population

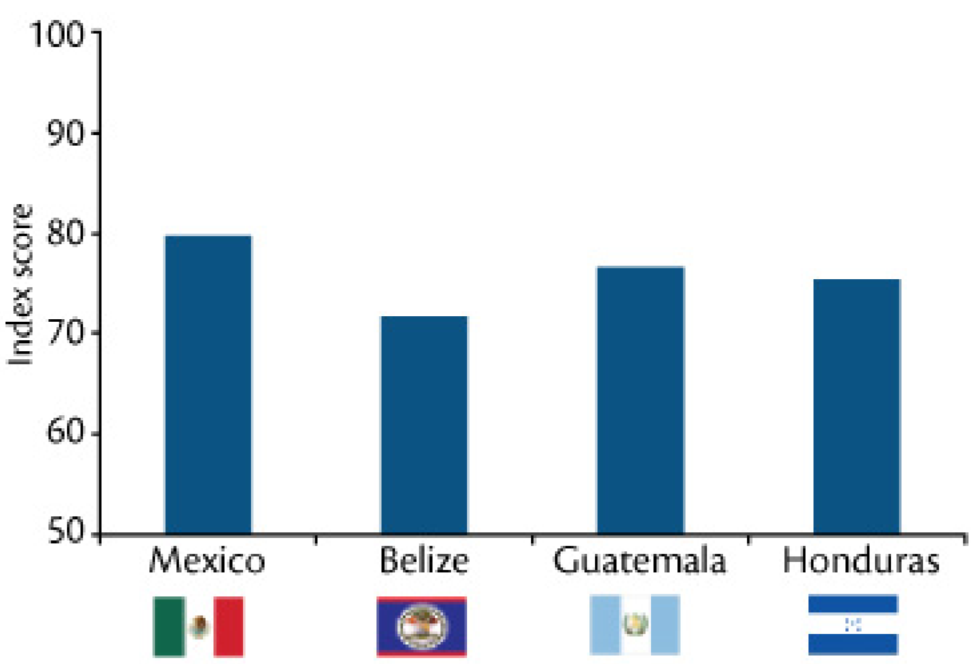
People in coastal areas rely on tourism and other marine-related activities to make a living to varying degrees within the MAR. Municipalities in northern Quintana Roo, Mexico, are the most dependent on marine-based activities overall, primarily due to tourism. Coastal communities of Guatemala primarily depend on fish consumption and processing, although some tourism-related employment also likely exists. Belize and the northern Honduran coast rely on both tourism and fishing, with the former being the larger contributor of income. The Bay Islands, in particular, rely almost exclusively on tourism. Areas with higher direct dependence on marine resources (like Mexico) have strong economic incentives to manage them wisely to maintain this level of employment.

COASTAL POVERTY RATES



Poverty rates indicate whether the local economy, including tourism and marine-based activities provide coastal residents with a reasonable standard of living. On average, coastal poverty rates are lower than national averages. In Mexico, poverty rates are highest in the areas of Fellipe Carrillo Puerto (almost 50%) and lowest in Solidaridad (3%). The region's highest poverty rate is in the Todelo District of Belize (79%). In Guatemala, over 50% of people in the coastal area of Izabal live below the poverty line, although this is lower than rates reported six years earlier. In Honduras, poverty rates are between 50–70% in all but one coastal municipality—La Ceiba (39%). With a lack of infrastructure and services to meet basic needs in many coastal areas, resource protection tends to be a low priority. The lower poverty and higher dependence on marine resources in Mexico illustrates that use of marine resources could possibly help reduce poverty if they are managed sustainably.

ENVIRONMENTAL PERFORMANCE INDEX

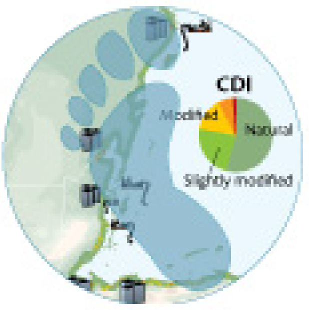


The 2008 Environmental Performance Index (EPI) is an independent gauge of each of the four countries long-term progress and success in protecting natural resources. The EPI (*http://epi.yale.edu/Home*) ranks countries on 25 indicators across six policy categories: Environmental Health, Air Pollution, Water Resources, Biodiversity and Habitat, Productive Natural Resources, and Climate Change. In the MAR, Mexico has the best score of 79.8, which ranks 47th in the world, followed by Guatemala (69th), Honduras (73rd), then Belize (84th). Comparatively, Switzerland is the country with the best environmental performance, Costa Rica ranks 5th, and Haiti ranks 119th out of the 149 countries that are evaluated. The EPI provides a data-driven and independent performance standard for national governments, non-governmental organizations and donors, to compare environmental performance and hopefully elicit continual improvements.

CONCLUSIONS

ABOUT REEF HEALTH

- The Mesoamerican Reef (MAR) is not healthy, on average scoring only about half the ideal Integrated Reef Health Index (IRHI).
- More than half the reefs sites are compromised, with 47% in poor and 6% in critical condition.
- Many reefs (42%) are in fair condition and could easily change for better or worse, depending in part on the effectiveness of management actions.
- Only 6% of the 326 reef sites evaluated are in good condition—and none ranked as very good.
- Healthy and unhealthy reefs can be found throughout the region, illustrating the importance of local management actions.
- Signs of poor reef health include low coral cover, low fish and urchin abundance, diseased corals, and relatively high amounts of algae.
- Even remote reefs, like the four atolls, are impacted, likely by overfishing and storm damage.



ABOUT THE HUMAN FOOTPRINT

- Global climate change poses an additional overarching stress on reefs and on human society. Adaptation strategies need to be incorporated into all management plans and policies.
- Unregulated coastal development and tourism, overfishing, and poor agricultural practices are major contributors to poor reef health—although some economic activities such as tourism also present opportunities for conservation.
- Although approximately half the coast is still largely in a natural state, rapid changes are occurring around key population centers and tourism hotspots.

ABOUT SOCIAL WELL-BEING

- Higher levels of dependence on marine resources, especially in the form of tourism, correlate with lower poverty levels and higher income.
- Harvesting of marine resources from the MAR remains the best opportunity for economic development in many areas where tourism development is not viable.
- Improving economic conditions of coastal populations presents an opportunity to improve environmental management and reduce pressure on marine resources.
- All four countries in the Ecoregion display mid-range Environmental Performance Index scores, suggesting some degree of environmental stewardship, but with considerable room for improvement.

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For technical references visit www.healthreefs.org

RECOMMENDATIONS

	To Governments	To NGOs	To Private Sector	To Researchers
PROTECT	• ***Create and implement*** coastal zone management plans that include at least 20% of marine and coastal areas under full protection. • ***Enact/enforce*** regulations to protect parrotfish (year round) and groupers (spawning season). • ***Provide*** economic incentives for conservation and sustainable businesses.	• ***Support*** government efforts to fully protect more reefs, including those that are expected to be more resilient to climate change. • ***Promote*** more effective fisheries regulations to boost low abundance of herbivorous fish and sustain key commercial fisheries.	• ***Sustain*** local marine protected areas through financial, staff, or technical assistance. • ***Adopt*** "Better Management Practices," "Codes of Conduct," "Ecolabels," and other mechanisms that reduce environmental impacts.	• ***Engage*** in research that responds to questions posed by resource and protected area managers, including the identification of specific stressors impacting reefs. • ***Find*** ways to improve the spatial and temporal resolution of the Coastal Development and Tourism Development Indices.
PARTICIPATE	• ***Contribute*** to regional reef health monitoring and management initiatives developed by NGOs and private sector. • ***Engage*** in international conventions and treaties that support conservation.	• ***Improve*** the effectiveness of conservation programs by increasing collaboration and joint planning. • ***Join*** in the MAR assessment program and in the Healthy Reefs for Healthy People program, *www.healthyreefs.org*	• ***Join*** stakeholder consultations and ecolabel programs.	• ***Create*** opportunities to connect research, management, and stakeholder needs. • ***Develop*** interdisciplinary partnerships that combine social and ecological research.
COMMUNICATE	• ***Organize*** community meetings of local leaders and reef stakeholders to share information and respond to public concerns.	• ***Ensure*** that MAR residents and tourists understand the importance and vulnerabilities of coral reefs.	• ***Develop*** and ***promote*** businesses that support biodiversity conservation. See: *http://cms.iucn.org/about/work/programmes/*	• ***Coordinate*** with local practitioners and communities early on during project design. • ***Clarify*** scientific findings and make information readily available to stakeholders, the general public, and key decision-makers.