Description of Indicators

Overview

In collaboration with The World Resources Institute (WRI) and local partners, the Healthy Reefs Initiative (HRI) recently implemented the first-ever Eco-Audit of the Mesoamerican Reef (MAR). The audit evaluates the collective efforts of Belize, Guatemala, Honduras, and Mexico to protect and sustainably manage the region's coral reefs. This audit will provide the foundation for subsequent assessments, which will be implemented every two years. The process has been reviewed by PriceWaterhouseCoopers Costa Rica (PwC) (see acknowledgments for further details). The audit's process, indicators, and criteria also are presented in this document. Detailed worksheets of Eco-Audit results and observations for each country and publicly available verification documentation are available online. A four-page brochure with a summary of high level Eco-Audit results is available online and in print. These products, along with additional information about the Eco-Audit, are available online at www.healthyreefs.org and www.wri.org/reefs.

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Collaborators

The Eco-Audit process in Belize, Guatemala, Honduras, and Mexico was implemented in collaboration with the organizations shown below and described in the acknowledgments.

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Contents

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[1] PricewaterhouseCoopers Costa Rica (PwC) is not executing this audit process, therefore PwC is not expressing an opinion, asseveration or other assurance regarding the results of the MAR Eco-Audit. PwC has revised and given recommendations on the Eco-Audit process, ensuring that it is sufficiently robust, replicable year after year, and consistent in order to be seen as credible for the intended users. Furthermore, recommendations made by PwC have focused only been on the audit process and not on the selection of indicators.

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Executive Summary

The Mesoamerican Reef (MAR) provides a diverse array of goods and services to the people of Belize, Guatemala, Honduras and Mexico. Unfortunately, the intensity and range of threats to the region's coral reefs have increased rapidly, much faster than efforts to effectively manage them. This has been documented by the Healthy Reefs Initiative's (HRI) *2008 and 2010 Report Cards for the Mesoamerican Reef.*[2] The decline stems, at least in part, from inadequate management of local pressures. We need to do much more to improve reef management, and do it faster.

The Healthy Reefs Initiative (HRI), in collaboration with The World Resources Institute (WRI) and local partners, recently performed the first-ever Eco-Audit of the MAR. The audit evaluates the collective efforts of stakeholders from Belize, Guatemala, Honduras, and Mexico to protect and sustainably manage the region's coral reefs. It also evaluates progress in implementing reef management actions recommended by HRI partners from each country in HRI's 2008 and 2010 *Reef Report Cards*.

The Eco-Audit communicates and celebrates reef management success stories, while also drawing attention to critical gaps and future opportunities. It is intended to catalyze faster, more effective management responses to coral reef degradation and to increase the accountability of governments, the private sector, and nongovernmental organizations (NGOs). It also seeks to establish a baseline understanding of the current status of reef management efforts.

The Eco-Audit also provides a mechanism for partners in each country to communicate, convene, and collaborate in addressing critical issues. Ultimately, this effort seeks to improve the health of the Mesoamerican Reef, thereby contributing to the national economies of the MAR countries and also restoring the natural wealth of these globally important coastal ecosystems.

Twenty-two standardized management indicators were developed across seven themes:

- marine protected areas
- ecosystem-based fisheries management
- coastal zone management
- sanitation and sewage treatment
- research, education, and awareness
- sustainability in the private sector
- global issues.

[2] The biennial *Reef Report Cards* for the Mesoamerican Reef—including a comprehensive overview of reef ecosystem condition, an update on existing and emerging threats to reef health, and a sample of stories of hope—are a key product of the HRI partnership. Each *Reef Report Card* also includes a number of recommendations across various themes that have been agreed on by HRI partners through national meetings. To date, HRI has produced two *Reef Report Cards* in 2008 and 2010. These *Reef Report Cards* and additional information on the HRI are available at: www.healthyreefs.org.

The ranking system uses a simple scheme: 1=very poor, 2=poor, 3=fair, 4=good, and 5=very good. Rankings are determined based on standardized grading criteria and are verified by documentation attached to the Eco-Audit results for each country. Three of the management indicators are regional in scope.

The Eco-Audit has been a collaborative effort, drawing on input and verification documentation from partners, stakeholders, and experts throughout its implementation. HRI and WRI convened four national workshops—with local partners and governments, NGOs, and private sector stakeholders—from September through October 2011. At these workshops, participants collectively ranked each management indicator and compiled documents to verify the rankings. The auditing firm of PricewaterhouseCoopers Costa Rica (PwC) reviewed the Eco-Audit methodology and provided feedback on the processes, indicators, and quality of the verification documentation.[3]

This first Eco-Audit provides the foundation for subsequent Eco-Audits, which will be implemented every two years. These biennial reports, along with the biennial HRI *Reef Report Cards*, will occur in alternating years, thereby providing a regular accounting of the reef's health and efforts to improve its health.

The results of this Eco-Audit should help guide data collection and compilation for future Eco-Audits. As data collection becomes more sophisticated and our foundational knowledge grows, we anticipate that the Eco-Audit will evolve, becoming more comprehensive in its evaluation of the impact of management efforts.

This document provides an overview of each management indicator used in the MAR Eco-Audit, including its justification, ranking criteria, and data collection methods. This paper does not provide the results from the audit. Those results are provided in the following products:

- **Results**: detailed worksheets of Eco-Audit results and observations for each country.
- **Verification Documents**: all publicly available verification documentation for each country, to ensure transparency of results.
- **Summary Results:** a 4-page brochure with a summary of high level Eco-Audit results.

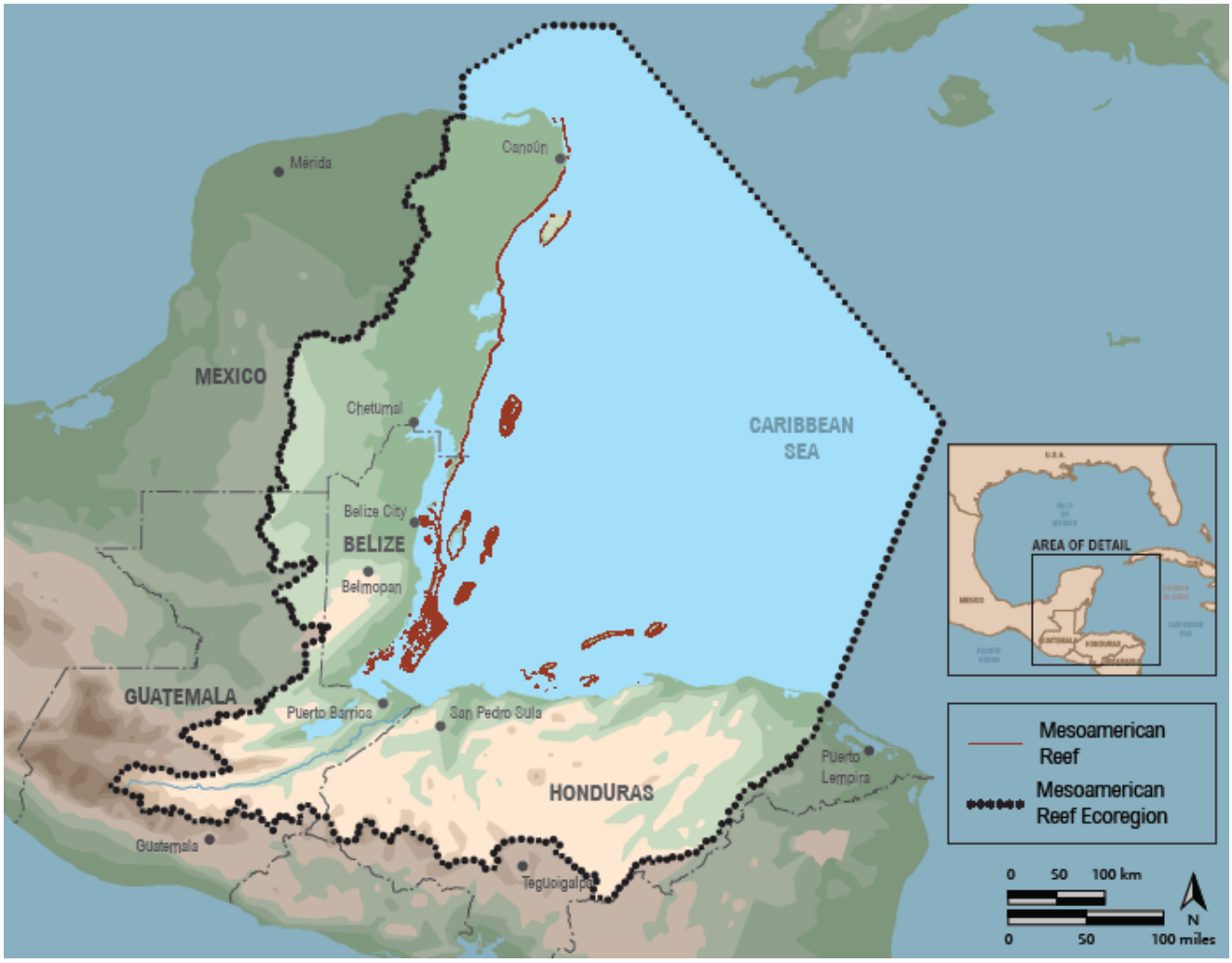
These products, along with additional information about the Eco-Audit, are available online at http://www.healthyreefs.org

[3] Since PricewaterhouseCoopers Costa Rica (PwC) is not executing this audit process, it is not expressing an opinion, asseveration, or other assurance regarding the results of the MAR Eco-Audit. PwC has revised and given recommendations on the Eco-Audit process, ensuring that it is sufficiently robust, replicable year after year, and consistent in order to be seen as credible for the intended users. Furthermore, recommendations made by PwC have focused only on the audit process and not on the selection of indicators.

Introduction

The Mesoamerican Reef (MAR) provides a diverse array of goods and services to the people of Belize, Guatemala, Honduras, and Mexico, including habitat for commercial, artisanal, and sport fisheries; shoreline protection; recreation and tourism; and food (Map 1). In particular, the region's economies are highly dependent on marine resources to sustain the tourism and fishing industries. Unfortunately, the intensity and range of threats to the region's coral reefs—including overfishing, climate change, runoff from land, coastal development, and tourism, among others—have increased rapidly, much faster than efforts to manage them. Between 2008 and 2010, 62 percent of monitored reef sites decreased in health, and reef declines outpaced improvements by a ratio of five to one.[i] Improved coastal and fisheries management is urgently needed to reduce pressures on MAR, allowing for recovery and promoting a sustainable, healthy reef system.

Map 1. Mesoamerican Reef Eco-region



In collaboration with the World Resources Institute (WRI) and local partners,[4] the Healthy Reefs Initiative (HRI) recently implemented the first-ever Eco-Audit for the Mesoamerican Reef. The report evaluates efforts by the four affected governments—Belize, Guatemala, Honduras, and Mexico—to protect and sustainably manage the region's coral reefs, as well as progress in implementing specific reef management actions recommended in HRI's *2008 and 2010 Report Cards for the Mesoamerican Reef*.

The Eco-Audit is intended to help catalyze faster, more effective management responses to coral reef degradation and to increase the accountability of governments, the private sector, and nongovernmental organizations (NGO) with a stake in and responsibility for maintaining the MAR as a healthy, biologically vibrant and economically viable resource for generations to come. It also seeks to facilitate communication and celebration of management success stories, and reveals critical opportunities for greater investment in coral reef conservation.

This document provides an overview of each management indicator used in the MAR Eco-Audit, including its justification, ranking criteria, and data collection methods. It does not provide the results from the audit. Those results are provided in the following products:

- **Results**: detailed worksheets of Eco-Audit results and observations for each country.
- **Verification Documents**: all publicly available verification documentation for each country, to ensure transparency of results.
- **Summary Results:** a 4-page brochure with a summary of high level results.

These products, along with additional information about the Eco-Audit, are available online at http://www.healthyreefs.org.

Box 1. Healthy Reefs Initiative (HRI)

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.

The biennial *Reef Report Cards* for the Mesoamerican Reef—including a comprehensive overview of reef ecosystem conditions, an update on existing and emerging threats to reef health, and a sample of stories of hope—are a key HRI product. Each report card also includes a number of recommendations across various themes that have been agreed on by HRI partners through national meetings. To date, HRI has produced two reef report cards in 2008 and 2010. These reports and additional information on HRI are available at <www.healthyreefs.org>

[4] The logos on page 2 reflect the list of partners.

An Innovative, Rigorous Process

HRI collaborated with WRI staff and local partners to develop management indicators, standardized ranking criteria, and means of verification documentation to understand the collective effort that national governments, NGOs, and the private sector are making toward achieving the regional recommendations made in the HRI *Reef Report Cards* (Box 2).[5] These recommendations have been implemented to varying degrees across the four countries. Just as the *Reef Report Cards* measure key indicators of biophysical reef health, measured against regionally standardized grading criteria, the Eco-Audit has developed standardized management indicators to understand the effort each country is making to improve its coastal, fisheries, and coral reef management.

Twenty-two standardized management indicators were developed across seven themes:

- marine protected areas
- ecosystem-based fisheries management
- coastal zone management
- sanitation and sewage treatment
- research, education, and awareness
- sustainability in the private sector
- global issues.

The ranking system uses a simple schematic: 1=very poor, 2=poor, 3=fair, 4=good, and 5=very good. Rankings are determined based on the standardized grading criteria and are verified by documentation attached to the audit results for each country. Three of the management indicators (2a, 5a, and 7a) are regional in scope.

The Eco-Audit has been a collaborative effort, drawing on input from partners, stakeholders, and key experts throughout its implementation. To develop each management indicator, HRI and WRI solicited feedback from partners. Their input was incorporated through meetings and communication with HRI staff. HRI and WRI convened four national workshops with HRI partners and government and private sector stakeholders in September and October 2011. Nearly 40 organizations and 100 people participated in this Eco-Audit. At these workshops, participants ranked each management indicator and compiled documents to verify the rankings.

[5] This first Eco-Audit has focused only on the regional recommendations presented in Healthy Reefs Initiative's 2008 and 2010 *Reef Report Cards*, and not the national recommendations. The recommendations from the *Reef Report Cards* were developed through national workshops in each country, representing a significant step toward building consensus on prioritizing management actions for MAR. We decided to evaluate only the regional recommendations for this first assessment, as partners in each country had not formally agreed to the national recommendations of other countries. However, these regional recommendations were most often evaluated at the national level. In the future, HRI plans to convene a regional workshop to establish recommendations for the *Reef Report Card*, which will be evaluated in subsequent Eco-Audits. It should be determined in this workshop if recommendations will be national, regional, or both.

Box 2. Selected Recommendations and Indicators

RECOMMENDATION	MANAGEMENT INDICATOR	SECTOR
2010 Report Card		
Achieve 20 percent territorial sea under full protection (no-take) within MPAs. In two years, achieve at least 5 percent on a regional scale.	**1a.** Percent of a country's territorial sea included in gazetted MPAs/ **1b.** Percent of a country's territorial sea included in fully protected zones	Not applicable
2008 Report Card		
Enact/enforce regulations to protect parrotfish (year round) and groupers (spawning season).	**2b.** Special regulations for grouper / spawning sites/ **2c.** Protection of key grazers (parrotfish)	Government
Support government efforts to fully protect more reefs, including those that are expected to be more resilient to climate change.	**7a.** Mapping of potentially resilient reefs to warming seas / coral bleaching	Non-governmental organizations
Develop and promote businesses that support biodiversity conservation.	**6a.** Voluntary eco-standards program for marine recreation providers/ **6b.** Participation of coastal hotels in eco-certification schemes/ **6c.** Adoption of seafood eco-labeling programs	Private sector
Clarify scientific findings and make information readily available to stakeholders, the general public, and key decision makers.	**5c.** Availability of understandable information on reef condition and threats	Research

Note: Please refer to Appendix II for a complete table matching each management indicator and relevant regional recommendation (taken from the 2008 and 2010 HRI *Reef Report Cards*).
Source: Healthy Reefs Initiative's *2008 and 2010 Reef Report Cards*.

This first Eco-Audit will provide the foundation for subsequent Eco-Audits, which will be implemented every two years by HRI. These biennial Eco-Audit reports—and the biennial HRI *Reef Report Cards*—will occur in alternating years, thereby providing a routine accounting of reef health and efforts to improve it.

To the best of our knowledge, this approach is innovative. While some individual organizations and private corporations have undertaken programmatic evaluations or environmental sustainability audits, we are not aware of any other multinational audit of conservation management actions that includes a variety of collaborating NGOs, government agencies, researchers, and the private sector, including transparently verified and publicly available results. To ensure the quality of our results, we engaged the financial and management auditing firm of PricewaterhouseCoopers Costa Rica (PwC) to review the methodology and provide feedback on the processes, indicators, and the quality of the verification

documentation.[6] PwC Costa Rica has not evaluated any individual organization, partner, or country, and has only assessed how well the Eco-Audit has been developed and implemented by HRI and WRI, in order to validate the findings and provide recommendations for strengthening future assessments.

Some data collection gaps remain in this Eco-Audit. Often, these gaps were not identified until after the preliminary evaluations and national workshops were completed. In other instances, data simply were not available or do not exist at this time. In subsequent Eco-Audits, additional data collection and compilation is needed (see "Data Gaps," page 34). This Eco-Audit is intended to guide data collection and compilation for more robust Eco-Audits in the future—as part of a continuing effort to galvanize increased efforts to implement the full range of management recommendations of the biennial *Reef Report Cards*. As data collection becomes more complete and our base of information grows, we anticipate that the Eco-Audit will evolve, becoming more quantitative and comprehensive in its evaluation of management efforts.

Box 3. Indicators and Criteria

General guidelines for indicators and ranking criteria:

- Indicators were evaluated at the national level except where noted.
- For all percentages in the document, we applied a standard rounding at .5, going up to the next whole number, and less than .5 going down to the whole number.
- Indicators were ranked "1" if there were no documents available that demonstrate effort.
- If a specific criterion could not be completely satisfied, the indicator ranking dropped to the next lowest ranking.

Indicator Themes

- Marine Protected Areas
- Ecosystem-Based Fisheries Management
- Coastal Zone Management
- Sanitation and Sewage Treatment
- Research, Education, and Awareness
- Sustainability in the Private Sector
- Global Issues

Eco-Audit Rankings

5 = Very Good (VG)
4 = Good (G)
3 = Fair (F)
2 = Poor (P)
1 = Very Poor (VP)

[6] PricewaterhouseCoopers Costa Rica (PwC) is not executing this audit process, therefore PwC is not expressing an opinion, asseveration, or other assurance regarding the results of the MAR Eco-Audit. PwC has revised and given recommendations on the Eco-Audit process, ensuring that it is sufficiently robust, replicable year after year, and consistent in order to be seen as credible for the intended users. Furthermore, recommendations made by PwC have focused only on the audit process and not on the selection of indicators.

THEME 1. MARINE PROTECTED AREAS

Marine Protected Areas (MPAs) are one of the most widely used management tools in reef conservation. MPAs help to foster reef resilience, allowing coral reefs to recover more quickly from a variety of threats, including diseases and coral bleaching.[ii] Within this evaluation, we used the International Union for the Conservation of Nature's (IUCN) definition of an MPA: "Any area of intertidal or subtidal terrain, together with its overlying waters and associated flora, fauna, historical and cultural features, which has been reserved by legislation or other effective means to protect part or all of the enclosed environment."[iii]

These indicators explore the spatial extent of MPAs and the degree of management and enforcement capacity in those MPAs. The evaluation of MPAs focuses exclusively on the MAR region. In the case of MPAs with both marine and terrestrial territory, this assessment was limited to marine territory only. A list of MPAs for each country included in the assessment is provided in Appendix III.

1a. Percent of a country's territorial sea included in gazetted MPAs

Justification: In order to be effective, networks of MPAs must cover an adequate percentage of the sea. Globally, scientists have estimated that between 20–40 percent of the sea should be protected.[iv, v]

Ranking Criteria

5 – At least 20 percent of territorial sea is inside MPAs
4 – At least 15 percent of territorial sea is inside MPAs
3 – At least 10 percent of territorial sea is inside MPAs
2 – At least 5 percent of territorial sea is inside MPAs
1 – Less than 5 percent of territorial sea is inside MPAs

Means of Verification: MPA boundary maps and regulations (includes management plans). Additionally, WRI and HRI partners agreed on data sets to distinguish land vs. water; MPA boundaries; coral reef locations; and maritime (territorial sea) boundaries. The evaluation was implemented using a Geographical Information System (GIS) with ArcView 10.0.

Calculation: ((Area of MPAs (marine area only/Area of territorial sea) X 100).

1b. Percent of a country's territorial sea included in fully protected zones

Justification: While MPAs in general offer a variety of conservation measures, the fully protected (nonextractive) zones or reserves provide the maximum benefits, allowing the replenishment of fisheries and restoration of ecosystem balance. Globally, scientists have called for between 10–40 percent of the ocean to be under full protection.[v]

The longer term target is 20 percent of territorial sea under full protection/fisheries replenishment zones. Future Eco-Audits will gradually increase the level of protection to meet this target.

Ranking Criteria

5 – At least 5 percent of territorial sea is fully protected (fisheries replenishment zones)
4 – At least 4 percent of territorial sea is fully protected (fisheries replenishment zones)
3 – At least 3 percent of territorial sea is fully protected (fisheries replenishment zones)
2 – At least 2 percent of territorial sea is fully protected (fisheries replenishment zones)
1 – Less than 2 percent of territorial sea is fully protected (fisheries replenishment zones)

Means of Verification: MPA boundary maps and regulations (includes management plans). Additionally, WRI and HRI partners agreed on data sets to distinguish land vs. water; MPA boundaries; coral reef locations; and maritime (territorial sea) boundaries. The evaluation was implemented using Geographical Information System (GIS) with ArcView 10.0.

Calculation: ((Area of fully protected marine zones/Area of territorial sea) X 100).

1c. Percent of mapped coral reef area included in fully protected zones

Justification: Ideally, the amount of sea under full protection will be representative of each habitat or ecosystem type, including seagrass beds, mangroves, sand flats, etc. Given the historical conservation focus and high value of coral reefs, this indicator specifically measures efforts in fully protecting a portion of this critical ecosystem.

The longer-term target is 20 percent of coral reef under full protection/ fisheries replenishment zones.[7] Future Eco-Audits will gradually increase the level of protection to meet this target.

Ranking Criteria

5 – At least 10 percent of coral reefs are inside full protection/fisheries replenishment zones
4 – At least 8 percent of coral reefs are inside full protection/fisheries replenishment zones
3 – At least 6 percent of coral reefs are inside full protection/fisheries replenishment zones

[7] The 20 percent conservation target applies to each major habitat, including coral reefs. Given that the main focus of existing MPAs is on coral reefs, the current percentage under full protection is already closer to the 20 percent target, and as a result has been adjusted upward, as compared to the current percent of territorial sea.

2 – At least 4 percent of coral reefs are inside full protection/fisheries replenishment zones
1 – Less than 4 percent of coral reefs are inside full protection/fisheries replenishment zones

Means of Verification: MPA boundary maps and regulations (includes management plans). Additionally, WRI and HRI partners agreed on data sets to distinguish land vs. water; MPA boundaries; coral reef locations; and maritime (territorial sea) boundaries. The evaluation was implemented using Geographical Information System (GIS) with ArcView 10.0.

Calculation: ((Area of coral reef in fully protected zones/Area of coral reef) X 100).

1d. Percent of MPAs with good management

Justification: The legal establishment of MPAs is an important milestone, but the attainment of conservation and management goals is only achieved through sound management. This indicator measures management capacity, which serves as a proxy for the overall quality of management. Management capacity is evaluated based on the existence of management plans, staff, and equipment.

Ranking Criteria

5 – At least 75 percent of MPAs must have a current management plan and adequate staff and equipment; and the remaining 25 percent should not be classified as having "no current management plan" or "no staff and equipment" or "inadequate staff and equipment."[8]
4 – At least 60 percent of MPAs have a current management plan and adequate staff and equipment; and from the remaining MPAs no more than 10 percent are classified as having "no current management plan" or "no staff and equipment" or "inadequate staff and equipment."
3 – At least 50 percent of MPAs have a current management plan and at least 50 percent have nearly adequate staff and equipment.
2 – At least 25 percent of MPAs have a current management plan and at least 25 percent have nearly adequate staff and equipment.
1 – Does not meet any of the above targets.

[8] Criteria for rating the management of MPAs are based on the following:

- Existence of an up-to-date management plan for the MPA updated within the past five years (**Yes-** updated management plan within the past 5 years exists; **Partial**-updated more than 5 years or an unapproved draft; **No**-no plan).
- Does the MPA have staff and equipment (**Adequate-**Optimal # of staff and equipment are covered; **Nearly Adequate-**At least 75 percent of optimal # of staff and equipment are covered; **Inadequate-** At least 50 percent of optimal # of staff and equipment are covered; **None-**there is no staff or equipment). Creating an official list of quantifiable ranges for optimal number of staff and equipment represents a "data gap" that must be addressed in subsequent audits. Please see "Data Gaps" on p.34.

Means of Verification: management plans, and MPA original data collection survey of managers to rate MPAs based on the existence of an up-to-date management plan and whether or not there is adequate, nearly adequate, inadequate, or no staff and equipment.

Calculation: ((Total # of MPAs with current management plans or adequate staff/Total # of MPAs) X 100); ((Total # of MPAs with no current management plan or no staff and equipment or inadequate staff and equipment/Total # of MPAs) X 100).

1e. Percent of MPAs with good enforcement

Justification: Sound management of MPAs requires both the capacity and political will to enforce regulations. [9] This indicator measures the degree of enforcement in each MPA. We recognize that both enforcement and compliance are important issues and coming up with a system to track this in MPAs is a recognized data gap.

Ranking Criteria

5 – At least 75 percent of MPAs have good enforcement and the remaining 25 percent have moderate enforcement.[9]
4 – At least 60 percent of MPAs have good enforcement and the remaining 40 percent have moderate enforcement.
3 – At least 50 percent of MPAs have at least moderate enforcement.
2 – At least 25 percent of MPAs have at least moderate enforcement.
1 – Fewer than 25 percent of MPAs have at least moderate enforcement.

Means of Verification: MPA original data collection survey of managers to rate MPAs as having good, moderate, low, or no enforcement. Also includes enforcement or patrol reports, and annual reports for rankings of 4 and higher.

Calculation: (Total # of MPAs with good enforcement or moderate enforcement/Total # of MPAs) X 100).

[9] Criteria for rating the enforcement of MPAs, Spawning Aggregation Sites (SPAGs), and parrotfish regulations are based on the following:

- How would you rate the level of enforcement? (**Good**-regular patrols, overall satisfactory compliance and ecological integrity is thought to be maintained; **Moderate**-regular patrols conducted, but poaching persists, legal outcomes are insufficient, and ecological integrity is impacted; **Inadequate-**irregular patrols conducted, poaching persists, legal outcomes are insufficient, ecological integrity is impacted**,** and local community feedback demonstrates a high level of concern). Creating an official list of quantifiable ranges for "regular patrols," "legal outcomes" (enforcement action), "poaching," and "ecological integrity" represents a data gap that must be addressed in subsequent audits. Please see "Data Gaps" on p. 34.

THEME 2. ECOSYSTEM-BASED FISHERIES MANAGEMENT

Overfishing and destructive fishing are the most widespread threats to coral reefs.[i] More than 80 percent of the world's fisheries are overexploited or have collapsed.[vi] The continued collapse of global fisheries will have far-reaching economic and ecological consequences. Recovery of fisheries requires the appropriate management of fishing areas and practices, as well as efforts to identify and address underlying social and economic factors leading to overharvesting.

2a. Harmonizing fisheries regulations among countries (regional indicator)

Justification: Over the past few years a number of regional initiatives have attempted to harmonize fisheries regulations for economically important fisheries such as lobster and conch. This indicator measures the extent of harmonization of regulations on size limits and closed seasons. Differences in these two regulations across countries have been shown to lead to substantial transboundary illegal and unreported fishing.[10]

Ranking Criteria

5 – Regulations for closed seasons and size limits are fully harmonized among the four countries and two commercial fisheries.
4 – Regulations for closed seasons and size limits are fully harmonized among three countries and two commercial fisheries.
3 – Regulations for closed seasons and size limits are fully harmonized among three countries and one commercial fishery.
2 – There has been some effort at harmonizing regulations (draft regulations, project planning, or joint research).
1 – No documented action that meets the criteria to achieve a higher score is available.

Means of Verification: copies of regulations or draft regulations, results of joint research, and project or consultation reports for initial efforts toward harmonization.

2b. Special regulations for grouper / spawning sites

Justification: The reef food web is highly complex. The removal of just one group of fish from the food web can have widespread effects throughout the reef ecosystem, ultimately weakening and destabilizing it. The reproductive behavior of groupers makes them particularly vulnerable during spawning, and many spawning aggregation sites (SPAGs) have already been overfished and depleted of grouper. This indicator measures efforts to protect these sites and species.

[10] The harmonization of fishery regulations refers to regulations that are equivalent.

Ranking Criteria

5 – At least 90 percent of known grouper SPAGs are fully protected (year-round in MPAs) with legal regulations and at least 50 percent of these have good enforcement.[9]

4 – At least 75 percent of known grouper SPAGs are fully protected (inside MPAs) and at least 20 percent have at least moderate enforcement.[9]

3 – There are closed seasons, size limits, or catch limits specific for grouper.

2 – There has been some effort at drafting regulations, research, or a public campaign on the topic.

1 – No documentation of actions that meet the criteria to achieve a higher score is available.

Means of Verification: list and location of grouper SPAG sites by country, official MPA list, copy or draft of fishery or MPA legislation, copy of consultation reports, number of enforcement actions, MPA original data collection as to the degree of enforcement at each SPAG site, and campaign strategies for conservation.

Calculation: Grouper SPAGs fully protected=((Total # of fully protected SPAGs/Total # of SPAGs) X 100); percentage with at least good enforcement=((Total # of SPAGs with good enforcement/Total # of fully protected SPAGs) X 100) and percentage with at least moderate enforcement=((Total # of SPAGs with good enforcement + moderate enforcement)/Total # of fully protected SPAGs) X 100).

2c. Protection of key grazers (parrotfish)

Justification: As the number of large predatory species declines due to overfishing, fishers often target smaller herbivorous fish. The removal of herbivorous fish results in increased algal overgrowth, and ultimately decreased resilience of the reef ecosystem. This indicator measures the degree of protection for parrotfish—the most significant family of herbivores due to their size and abundance—among the four countries.

Ranking Criteria

5 – Parrotfish are fully protected through regulations with at least good enforcement.[9]

4 – Parrotfish are fully protected through regulations with at least moderate enforcement.[9]

3 – There exist draft regulations or a public campaign on the topic.

2 – There has been some effort (strategic plans or consultation reports) at drafting regulations and/or educational outreach (development of educational brochures or pamphlets).

1 – No documented action that meets the criteria to achieve a higher score is available.

Means of Verification: evidence of enforcement (patrol logs and fish filet tissues analysis results to determine species), copy of legislation or draft legislation, copy of consultation reports, advertisements, strategic plans, and educational materials.

THEME 3. COASTAL ZONE MANAGEMENT

Coastal development—including human settlements, industry, aquaculture, or infrastructure—can dramatically alter nearshore ecosystems. Direct physical damage such as dredging or land filling, or indirect damage through increased runoff of sediment, pollution, and sewage, can greatly impact the health of a reef.

3a. Coastal zone planning regulations

Justification: Effective, integrated coastal planning emphasizing sustainable development, alongside enforcement of coastal development regulations, can greatly reduce the pressures of coastal development. This indicator measures the spatial extent of such plans or steps toward developing such plans.

Having a well-designed coastal zone plan is only the first step toward achieving successful coastal zone management. Effective enforcement of these plans is also essential. Due to a lack of data and record-keeping on enforcement of zoning and other regulations, it was not possible to define quantifiable ranges to assess the level and impact of enforcement efforts. This represents a gap that must be addressed in subsequent audits (see "Data Gaps," p. 34).

Ranking Criteria

5 – A spatially comprehensive[11] coastal zone plan or zoning regulations[12] exist for the country (or state within the MAR area) and have been legally adopted

4 – There is a coastal zone plan or zoning regulations (not spatially comprehensive) and they have been legally adopted for some areas.

3 – A spatially comprehensive coastal zone plan or zoning regulations have been completed (drafted) for the country (or MAR area) and submitted for approval.

2 – There is work (drafts in progress, consultation reports, research or strategic plans) at drafting a spatially comprehensive coastal zone plan or zoning regulations.

1 – No documentation of actions that meet the criteria to achieve a higher score is available.

Means of Verification: copies of zoning plans (table of contents, legislation #), documentation of planning ordinances and regulations (includes drafts), and consultation reports, research and strategic plans relevant to coastal planning.

[11] Spatially comprehensive refers to coverage of the entire coastline.

[12] Coastal regulations may include setbacks, restrictions on mangrove removal, sea walls, or permissible land use and development densities.

THEME 4. SANITATION AND SEWAGE TREATMENT

The high level of nutrients present in sewage can result in blooms of plankton that block light and encourage the growth of algae that compete for space on the reef. Sewage also contains bacteria and viruses known to harm marine life, including corals. Wastewater (including sewage and industrial effluent) must be treated and controlled to reduce the nutrients and toxins that reach coral reefs.

These indicators explore the extent to which regional standards for wastewater management and sewage treatment have been developed, adopted by countries, and applied to the construction of new sewage treatment infrastructure. In this audit, we are specifically considering biochemical oxygen demand (BOD) and total suspended solids (TSS). Ideally, we would have preferred to measure the percent of the coastal population, including tourists, connected to sewage treatment facilities, but data are not currently available. As a result, the indicators below have been developed as a proxy for sanitation and sewage treatment. We encourage additional effort to generate data in this area (see Data Gaps, p.34).

4a. Standards for wastewater management/sewage treatment

Justification: International efforts to improve sanitation, particularly near sensitive ecosystems such as coral reefs and seagrass (e.g. Class I waters), have evolved, specifically through the creation of regional standards for sewage treatment.[13] This indicator measures the extent of each country's adoption and implementation of these regional standards within the Cartagena Convention's Protocol Concerning Pollution from Land-Based Sources and Activities (LBSMP Protocol).

Ranking Criteria

5 – LBSMP Protocol for Class I waters are legally adopted and there is good implementation by the country.[14]

4 – LBSMP standards for Class I waters are legally adopted but there is inadequate implementation by the country.[15]

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[13] "Class II waters" means waters in the Wider Caribbean, other than Class I waters, that due to oceanographic, hydrologic, climatic or other factors are less sensitive to the impacts of domestic wastewater and where humans or living resources that are likely to be adversely affected by the discharges are not exposed to such discharges. "Class I waters" means waters in the Wider Caribbean area that, due to inherent or unique environmental characteristics or fragile biological or ecological characteristics or human use, are particularly sensitive to the impacts of domestic wastewater. Class I waters include, but are not limited to: (a) waters containing coral reefs, seagrass beds, or mangroves; (b) critical breeding, nursery, or forage areas for aquatic and terrestrial life; (c) areas that provide habitat for species protected under the Protocol Concerning Specially Protected Areas and Wildlife to the Cartagena Convention (the SPAW Protocol); (d) protected areas listed in the SPAW Protocol; and (e) waters used for recreation.

[14] Good implementation occurs when water quality meets the designated standards.

[15] Inadequate implementation occurs when water quality does not the meet designated standards.

3 – LBSMP standards for Class II waters have been legally adopted and there is good implementation by the country.
2 – LBSMP standards for Class II waters are legally adopted, but there is inadequate implementation by the country.
1 – No standards or standards below Class II.

Means of Verification: LBSMP Protocol and ratification map, copy of water quality reports documenting degree of implementation and compliance, national regulations/standards, and records from public service agencies showing testing that water quality meets standards.

4b. New infrastructure for sewage treatment (in the last 5 years)

Justification: In order to meet the LBSMP standards, new and improved sewage treatment facilities are typically required. Given the high cost of this infrastructure, change is likely to be incremental. This indicator measures the effort (relative to population size) in installing such facilities. The target of 5 percent of the coastal population refers to the additional population serviced by the installation of new infrastructure, and not the total population with sewage service (which would be much higher).

Ranking Criteria

5 – New coastal municipal sewage treatment plant(s), which meets the LBSMP standards for Class I waters, exists (serving at least 5 percent of the coastal population).
4 – New coastal municipal sewage treatment plant (s) for coastal population, which meets the LBSMP standards for Class I waters, is under construction, or approved (serving at least 5 percent of the coastal population).
3 – New coastal municipal sewage treatment plant (s), which meets LBSMP standards for Class I waters exists, is under construction, or approved (serving less than 5 percent of the coastal population).
2 – New coastal municipal sewage treatment plant (s), which meets at least LBSMP standards for Class II waters exists, is under construction or approved.
1– No documented action that meets the criteria to achieve a higher score is available.

Means of Verification: records of new facilities in existence or under construction, including effluent specifications, a copy of the LBSMP Protocol, and census data for records of coastal population.

Calculation: Percentage of coastal population served = population served/ total coastal population.

Please refer to Appendix IV for the Regional Standards for Sewage Treatment from the Cartagena Convention's Protocol Concerning Pollution from Land-Based Sources and Activities. In this report, we are specifically considering biochemical oxygen demand (BOD) and total suspended solids (TSS).

THEME 5. RESEARCH, EDUCATION, AND AWARENESS

The number of decision makers that understand reef ecosystems, threats, values, and management approaches has greatly increased in recent years. This knowledge has provided tools to better recognize problems, address threats, and gain political, financial, and public support for reef management and conservation. Nevertheless, a gap remains between our existing knowledge and measurable improvements in reef management. Closing this gap depends on implementing more actions to promote research, education, and awareness, and on developing opinion surveys and other instruments to measure the impact of this information.

5a. Standardized monitoring of coral reef health and information management (regional indicator)

Justification: This indicator measures the efforts of researchers and managers to standardize monitoring methods, apply them in regular monitoring of representative sites (those selected based on non-biased sampling of different habitat types), and share the information in a publicly accessible and up-to-date database.

Ranking Criteria

5 – A regional standardized monitoring program of coral reef health and a database with routine, up-to-date, and representative data both exist.[16, 17]

4 – A regional standardized monitoring program exists, and assessments have been performed for representative sites (at least once).

3 – Representative data have been collected on coral reef health.

2 – Plans to develop a regional standardized monitoring program and database are well under way (draft documents exist).

1 – No documentation of actions that meet the criteria to achieve a higher score is available.

Means of Verification: link to database, MBRS and AGRAA Methodology, Rapid Reef Assessment document, country map of AGRRA representative sites, and HRI 2008 and 2010 *Reef Report Cards*.

[16] An up-to-date database has monitoring data that is collected at least biennially.

[17] Representative data is based on the total area of different habitat types selected in a proportional, non-biased (randomized) sampling scheme, as described in AGRRA Protocol Version 5.4, which includes a discussion on how to select representative sites on pp. 3-4.

5b. Economic valuation of coral reefs

Justification: Economic valuation is a tool that can aid decision making by quantifying ecosystem services provided by coral reefs in monetary terms. Valuation also provides a tool for evaluating the costs and benefits of management and economic development options, with an emphasis on long-term benefits, which can help avoid short-sighted development.

Ranking Criteria

5 – A national valuation of coral reefs or valuation of selected ecosystem services associated with 50 percent of MPAs has been completed.
4 – A valuation of two or more MPAs has been completed.
3 – A valuation of one MPA has been completed.
2 – Assessments of coral reef economic contributions are currently being implemented.
1 – No documentation of actions that meet the criteria to achieve a higher score is available.

Means of Verification: copy of valuation assessment reports (key findings), MPAs included in assessment, and project or consultation reports of valuations currently (or recently) implemented in MAR.

Calculation: ((Total number of MPAs having completed a valuation/Total # of MPAs) X 100).

5c. Availability of understandable information on reef condition and threats

Justification: The public dissemination of information on reef condition and threats is essential to build an informed electorate that will support stronger reef protection regulations. This indicator measures the extent of these efforts through various media formats.

Due to statistical limitations we were unable to develop an indicator that specifically gauges impact. We encourage additional effort in this area (see "Data Gaps," p. 34).

Ranking Criteria

5 – Documents presenting scientific findings on coral reef condition and threats geared toward a general audience are widely available (print, television, social media, radio, and online).
4 – Documents presenting scientific findings on coral reef condition and threats geared toward a general audience are generally available (via three media types from the list above).
3 – Documents presenting scientific findings on coral reef condition and threats geared toward a general audience are available (for at least one media type from above) and more are being developed (strategic plans or outreach).
2 –Scientific findings have been collated and there are plans to develop accessible products from this information.

1 – No documentation of actions that meet the criteria to achieve a higher score is available.

Means of Verification: copy of documents, publications, media reports or video, records and compilation of reports and links, and strategic plans.

5d. Interdisciplinary partnerships combine social and ecological research for management

Justification: Humans are an integral part of an ecosystem, with social sciences being increasingly integrated into ecological research. This indicator measures the application of these social-ecological integrated studies to the improved management of coral reefs and coastal zones within the MAR region.

Ranking Criteria

5 – Findings of integrated social/ecological research have resulted in significant management action (e.g. a change in legislation) (can include both formal and informal partnerships).

4 –Two or more formal interdisciplinary partnerships exist, which integrate social and ecological research, and have published results.

3 – One or more informal interdisciplinary partnerships exist, and they are currently implementing joint integrated social/ecological research; or one formal interdisciplinary partnership exists and has published results.

2 – Groups working on integrated social/ecological research have begun to plan joint work (work plans, research proposals, or grant applications).

1 – No documentation of actions that meets the criteria to achieve a higher score is available.

Means of Verification: copy of agreements, number of collaborative papers published, and copies of research reports, proposals, and work plans.

THEME 6. SUSTAINABILITY IN THE PRIVATE SECTOR

Partnerships between the private sector and governments or NGOs can facilitate information exchange, training in best environmental practices, and collaborative efforts to find solutions to issues of shared concern. Such partnerships can also be beneficial for tourism and marine recreation providers, as well as the seafood industry, by increasing their attractiveness to tourists, operators, restaurants and consumers who prefer environmentally responsible options.

6a. Voluntary eco-standards program for marine recreation providers

Justification: Marine recreation providers depend on healthy marine ecosystems, especially reefs. Voluntary programs have been developed to help them be better stewards in their use of the reef for recreation. This indicator measures the degree of participation of marine recreation providers in programs that promote environmental sustainability.

Ranking Criteria

5 – A regional or national voluntary eco-standards program for marine recreation providers exists and more than 50 percent of all providers are participating.

4 – A regional or national voluntary eco-standards program for marine recreation providers is developed and more than 25 percent all providers are fully participating.

3 – A regional or national voluntary eco-standards program for marine recreation providers is developed and at least 10 percent of operators are participating.

2 – There has been some effort to create standards and at least 3-4 marine recreation providers are participating in these efforts (data collection, improved practices, or strategic plans).

1 – No documentation of actions that meet the criteria to achieve a higher score is available.

Means of Verification: official list of marine recreation providers from government agency (if available), list of participating marine recreation providers from organizations working on this issue, project or consultation reports, copy of national voluntary eco-standards, and manuals and training materials about how to achieve voluntary eco-standards.

Calculation: ((Total # of providers that participate/Total # of providers) X 100).

6b. Participation of coastal hotels in eco-certification schemes

Justification: Several eco-certification programs for coastal hotels have been initiated in the MAR area.[18] If designed and implemented well, these programs have the potential to reduce negative impacts on coastal ecosystems and promote environmental sustainability. This indicator measures the industry's extent of participation in these programs.

Ranking Criteria

5 – Over 25 percent of coastal hotels participate in one of the recognized eco-certification[19] schemes.
4 – 15–24 percent of hotels participate in eco-certification schemes.
3 – 5–14 percent of hotels participate in eco-certification schemes.
2 – Less than 5 percent of hotels participate in eco-certification schemes.
1 – No documentation of actions that meet the criteria to achieve a higher score is available.

Means of Verification: official list of total coastal hotels from government agency (if available), or unofficial list from recognized organization (if official list does not exist), official list of eco-certification schemes/standards and participating hotels.

Calculation: ((# of coastal hotels participating in eco-certification/Total # of coastal hotels) X 100).

6c. Adoption of seafood eco-labeling programs

Justification: Several different seafood labeling programs exist that promote sustainability.[20] The Marine Stewardship Council (MSC) is the most advanced and environmentally robust.[21] Several local eco-labeling efforts also promote sustainable seafood. This indicator measures the effort to develop and adopt these programs in the MAR region.

[18] "Coastal hotels" refers to hotels located within 5 km of the coastline.
[19] Eco-certification refers to a recognized certification program, including environmental criteria for hotels.
[20] Seafood eco-labeling refers to a program for seafood products intended to account for environmental concerns. Ideally, we would have a record of all restaurants and the percent that are participating in the eco-label program in order to quantitatively calculate the percentage (see "Data Gaps," p. 34).
[21] According to its website, The Marine Stewardship Council's mission "is to use our eco-label and fishery certification program to contribute to the health of the world's oceans by recognizing and rewarding sustainable fishing practices, influencing the choices people make when buying seafood, and working with our partners to transform the seafood market to a sustainable basis." Found online at <http://www.msc.org/>.

Ranking Criteria

5 – There exists a national seafood eco-labeling program, and at least one fishery in the country is certified by the MSC.

4 –There exists a national seafood eco-labeling program (within the MAR region), and at least one fishery has completed a full MSC assessment.

3 – Better management practices have been developed and agreed upon for the seafood industry, and a lead agency is developing the eco-labeling program.[22]

2 – Better management practices have been developed, but not agreed upon, or no national lead agency has been identified to develop the eco-labeling program.

1 – No documentation of actions that meet the criteria to achieve a higher score is available.

Means of Verification: MSC certification and/or assessment reports, copies of eco-labeling materials (environmental requirements for sustainability, lists of eco-friendly seafood, restaurants), copies of best management practices manual, memorandum Of understanding/agreement where better management practices have been adopted, and workshop notes and work plans for developing better management practices.

6d. Government incentives for conservation and sustainable businesses

Justification: Government tax and other incentives can provide an important stimulus for the private sector to adopt environmentally friendly practices and technologies. This indicator measures the degree to which each government in the MAR area has applied such incentives for conservation.

Ranking Criteria

5 – The national or provincial government provides incentives for four of the following: improvements in energy efficiency, improvements in the treatment of wastewater, reductions in waste production or recycling, alternative energy options, the adoption of four-stroke outboard engines, and land tax incentives for conservation.[23]

4 – Governments offer incentives for at least three of the above.

3 – Governments offer incentives for at least two of the above.

2 – Governments offer incentives for at least one of the above.

1 – No government incentives were identified.

Means of Verification: copies of relevant legislation or regulations.

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[22] Better management practices (BMPs) are tools that protect the environment by helping to measurably reduce major impacts of growing or harvesting commodities. Examples of BMPs include limiting the catch and sale of fish based on size, season, and species. More information can be found online at <http://wwf.panda.org/what_we_do/how_we_work/businesses/transforming_markets/solutions/methodology/better_management_practices/>.

[23] The use of four-stroke outboard engines represents an important conservation measure, as these engines have higher fuel efficiency and pollute less oil than alternative two-stroke engines.

6e. Private sector assistance to MPAs

Justification: Incorporating private sector assistance for local MPAs is an important component in their sustained success. This indicator assesses the degree of local business assistance as reported by MPA managers. Private sector assistance is evaluated based on the existence of financial, in-kind, or technical assistance.

Ranking Criteria

5 – At least 50 percent of marine protected areas have high levels of private sector support.[24]

4 – At least 50 percent of marine protected areas have at least moderate private sector support and at least 25 percent have high private sector support.[24]

3 – At least 50 percent of marine protected areas have at least moderate private sector support.

2 – At least 50 percent of marine protected areas have at least low private sector support.

1 – At least 50 percent of marine protected areas have no private sector support.

Means of Verification: MPA original data collection to rate private sector support of MPAs as having high, moderate, low, or none.

Calculation: percent of MPAs with high private sector support: ((Total # of MPAs with high private sector support/Total # of MPAs) X 100); percent of MPAs with at least moderate private sector support: (Total # of MPAs with high + moderate private sector support); percent of MPAs with at least low private sector support: (Total # of MPAs with high + moderate + low private sector support); and percent of MPAs with no private sector support: (Total # of MPAs with no private sector support/Total # of MPAs) X 100).

[24]Criteria for rating private sector support of MPAs is based on the following:

- How would you rate the level of private sector assistance? **High** (formal agreement with regular assistance); **Moderate** (regular assistance, but no formal agreement); **Low** (occasional assistance, typically low value); and **None** (no assistance). Includes the provision of financial, staff, or material assistance. Creating an official list of quantifiable ranges for "regular assistance" represents a data gap that must be addressed in subsequent audits (see "Data Gaps," p.34).

THEME 7. GLOBAL ISSUES

A global approach to protect coral reef ecosystems is essential to achieve meaningful action. We must work internationally, drawing on existing international frameworks and conventions, and also sharing knowledge, experience, and ideas to achieve solutions to global-scale threats such as climate change.

7a. Mapping of potentially resilient reefs to warming seas / coral bleaching (regional indicator)

Justification: Corals are highly sensitive to changes in temperature, resulting in bleaching. However, some species appear to be more tolerant, and some individual corals appear better adapted as a result of past exposure to stresses. Reefs that are better suited to avoid or tolerate bleaching are termed "resistant." Reefs that are affected but then recover to their original state are termed "resilient." Factors that appear to improve the resilience of a coral reef include minimizing local stressors, maintaining good connectivity to unimpacted or resistant reef areas, and enabling coral larvae to move in and establish the coral population. This indicator measures the extent to which a regionally accepted map of potentially resilient reefs has been adopted and utilized in the region.

Ranking Criteria

5 – Existence of an accepted regional map that identifies reefs most likely to be resilient and is integrated into two national-level plans and into at least 50 percent of MPA plans in those countries. [25, 26, 27]

4 – Existence of an accepted regional map that identifies reefs most likely to be resilient and is integrated into at least one national-level plan and into at least 25 percent of MPAs in that country.

3 – Existence of a draft MAR regional map of reef resilience using a regionally accepted method and is under review.

2 –National work to develop regionally standardized resilience indicators is under way (data have been collected to identify resilient sites) and has been applied to create a regional map.

1 – No documented action that meets the criteria to achieve a higher score is available.

Means of Verification: copy of resilience map, list of MPAs by country, copies of national and MPA plans that incorporate resilience, draft methodology to rank reefs based on resilience, reef resilience and workshop reports.

Calculation: ((Total # of MPAs with integrated plans/Total # of MPAs) X 100).

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[25] National-level plans include national development strategies, trade and industry plans, strategic plans, business plans, work plans, or management plans. Examples include a national biodiversity strategy, a national development strategy, a protected area network strategy, or a climate adaptation strategy.

[26] MPA plans include marine protected area management plans or work plans.

[27] A reef resiliency map is considered regionally accepted if it has been approved by at least three out of the four MAR countries.

7b. Engagement in international/regional treaties that support conservation

Justification: The following international treaties and conventions address solutions to issues relevant to marine conservation in the MAR area. This indicator measures the number of these treaties that have been ratified by each of the countries in the MAR area. [28]

Ranking Criteria

5 – At least 95 percent and higher score.
4 – Score of at least 85 percent.
3 – Score of at least 75 percent.
2 – Score of a least 65 percent.
1 – Score less than 64 percent.

Means of Verification: list of countries ratifying the stated treaties / protocols, verified by the national department or ministry responsible for international treaties.
Calculation: ((Total # of ratified treaties/Total # of relevant treaties by country) X 100).

- [28] 1982 United Nations Convention on the Law of the Sea. The Law of the Sea Convention defines the rights and responsibilities of nations in their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources.
- 1986 Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region. A comprehensive, umbrella agreement for the protection and development of the marine environment. This regional environmental convention provides the legal framework for cooperative regional and national actions in the Wider Caribbean Region.
- 1983 Protocol Concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region. The objective of the Protocol is to strengthen national and regional preparedness and response capacity in combating oil spills of the nations and territories of the region.
- 1990 Protocol Concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region. The objective of the Protocol is to protect rare and fragile ecosystems and habitats, thereby protecting the endangered and threatened species residing therein.
- 2010 Protocol Concerning Pollution from Land-Based Sources and Activities. Perhaps the most significant agreement of its kind with the inclusion of regional effluent limitations for domestic wastewater (sewage) and requiring specific plans to address agricultural nonpoint sources.
- 1971 Convention on Wetlands of International Importance Especially as Waterfowl Habitat. An intergovernmental treaty that embodies the commitments of its member countries to maintain the ecological character of their wetlands of international importance and to plan for the "wise" or sustainable use of all of the wetlands in their territories.
- 1992 United Nations Framework Convention on Climate Change. The objective of the treaty is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.
- 1992 Convention on Biological Diversity. A global agreement addressing all aspects of biological diversity: genetic resources, species, and ecosystems.
- 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora. An international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

Data Gaps

During the course of developing and implementing this first Eco-Audit, we identified a number of gaps in the data required to assess the indicators in a robust fashion ("criteria-based gaps"). Often, we did not identify these gaps until after the completion of preliminary evaluations and national workshops. In other instances, data simply were not available ("evidence-based gaps"). We also identified a number of instances in which we would like to encourage additional data collection to track the impact of management efforts for future Eco-Audits ("future Eco-Audits").

For data gaps relating to MPAs, the best solution was to have the resource managers evaluate these data-gap indicators based on qualitative criteria. For example, MPA managers were asked to rate the level of "adequate staff and equipment" based on their educated opinion and supported by evidence, rather than quantifiable ranges.

Below we highlight the data gaps in an effort to encourage data collection and compilation for the next Eco-Audit in 2013. In addition, we present methods to collect data and suggest potential partners to collect data.

Table 1. Data Gaps

Indicator	Data Gap	Suggested Data Collection Method	Suggested Responsible Parties
1d. Percent of MPAs with good management	No official list of quantifiable ranges for "staff and equipment" (criteria and evidence-based gap)	Optimal number of staff and major equipment (based on variables such as the type and level of threats, size of an MPA, etc.) compared with actual number of staff and major equipment	Collected by MPA managers and compiled by national authorities or national or regional NGOs annually; HRI and partners should work to develop quantifiable criteria
1e. Percent of MPAs with good enforcement / 2b. Special regulations for grouper spawning sites /2c. Protection of key grazers (parrotfish)	No official list of quantifiable ranges for "regular patrols," "legal outcomes," "poaching," and "ecological integrity" (criteria and evidence-based gap)	• Optimal number of patrols per week versus actual number of patrols per week (annual summary); based on variables such as the type and level of threats, size of an MPA, etc. • Optimal number of arrests and legal outcomes per month versus actual number of legal outcomes per month (annual summary); based on variables such as the level of threat, size of an MPA, etc. • Monitor changes/trends in terms of increasing or decreasing ecological integrity based on changes of key ecological indicators (i.e. the Reef Health Index/HRI *Reef Report Cards*-optimal could be no reduction in the index) (annual or biannual summary); based on variables such as the level of threat, size of a MPA, etc.	Collected annually by MPA managers and compiled by national authorities or national or regional NGOs; HRI and partners should work to develop quantifiable criteria

3a. Coastal zone planning regulations	No quantifiable data to gauge enforcement efforts to implement coastal zone management regulations (future Eco-Audits)	Develop and record quantitative measures to track enforcement efforts to implement coastal zone management regulations (log of citations, permits, denials, request for variance, etc.)	Government agencies that deal directly with coastal zone management and issue permits and fines
4b.New infrastructure for sewage treatment (in the last 5 years)	No publicly available and up-to-date official list of the coastal population (evidence-based gap)	Record coastal population (within 5km of coastline)	Government agencies that track census data
4b. New infrastructure for sewage treatment (in the last 5 years)	No publicly available and up-to-date official list of households/people/hotels connected to sewage treatment facilities, as well as no regular monitoring data available on BOD, TSS, etc. (evidence-based gap)	Record the level of sewage treatment each property is designed to achieve and the number of people serviced, and make details of this monitoring available for audits	Government agencies (such as public health) that regulate municipal and tourism sanitation facilities and also conduct coastal water quality monitoring
5c. Availability of understandable information on reef condition and threats	No quantifiable data to gauge impact of research, education, and awareness efforts (future Eco-Audits)	Record and develop quantitative measures to track the impact (opinion surveys, etc.) of efforts to promote education and awareness	NGOs that develop educational materials
6a. Voluntary eco-standards program for marine recreation providers	No publicly available and up-to-date official list of marine recreation providers or list of providers that have achieved eco-certification in all countries or communities (evidence-based gap)	Record all marine recreation providers achieving eco-certification under any recognized scheme and maintain an official registry (and licensing) of marine recreation providers or tour operators (as in Belize)	Government agencies that license hotels, restaurants, and tourism operations, NGOs, and other certification agencies maintain the list of providers participating in their programs (e.g. CORAL)

6b. Participation of coastal hotels in eco-certification schemes	No publicly available and up-to-date official list of coastal hotels, detailing the number of rooms (evidence-based gap)	Record all coastal hotels (within 5km of coastline) and number of rooms, and organize periodic surveys of their participation in eco-certification schemes	Government agencies that license hotels, restaurants, and tourism operations
6b. Participation of coastal hotels in eco-certification schemes	No publicly available and up-to-date official list of hotels that have achieved eco-certification (evidence-based gap)	Record all hotels achieving eco-certification under any recognized scheme; provide an officially recognized list of eco-certification schemes for the region	Government agencies that license hotels, restaurants, and tourism operations and/or NGOs that oversee certification schemes.
6c. Adoption of seafood eco-labeling programs	No publicly available and up-to-date official list of restaurants and fisheries that participate in seafood eco-labeling schemes (evidence-based gap)	Create a database of all fisheries and restaurants; note those that include seafood eco-labeling schemes in their menus or businesses (green guide for restaurants)	Government agencies that license hotels, restaurants, and tourism operations
6d. Government incentives for conservation and sustainable businesses	No quantifiable data to gauge impact of government incentives to promote conservation and sustainable business (future Eco-Audits)	Record and develop quantitative measures to gauge the level of adoption and level of impact of government incentives to promote conservation and sustainable business	Government agencies that deal directly with developing and implementing government incentives, conservation, and sustainable businesses
6e. Private sector assistance to MPAs	No official list of quantifiable ranges for “level of assistance” from the private sector to MPAs, or database of formal agreements (criteria and evidence-based gap)	Actual donations and other assistance from the private sector recorded and compiled annually, including formal agreements where applicable	Collected by MPA managers and compiled by national authorities or national or regional NGOs annually; HRI and partners should work to develop quantifiable criteria

7a. Mapping of potentially resilient reefs to warming seas / coral bleaching	No publicly available and up-to-date records that track the integration of reef resilience maps into national and MPA plans (evidence-based gap)	Record all national and MPA plans that incorporate maps of reef resilience	Collected by MPA managers and compiled by national authorities or national or regional NGOs annually
7b. Engagement in international/regional treaties that support conservation	No quantifiable data to gauge national/local application and impact of ratified international treaties important to reef conservation, as well as the extent to which they have been incorporated into national legislation (future Eco-Audits)	Record and develop quantitative measures to track national/local efforts to implement international conservation treaties	Government agencies that deal directly with ratifying and implementing government treaties

Looking Forward

This first Eco-Audit of the MAR establishes a baseline understanding of the status of reef ecosystem management efforts for all concerned stakeholders. The results are intended to guide data collection and compilation for more robust Eco-Audits in the future—as part of a continuing effort to galvanize increased efforts to implement the full range of management recommendations of the bi-annual *Reef Report Cards*. It is thus important that a regional meeting be held to build consensus on additional recommendations to be included in the *2012 Reef Report Card* and thus evaluated in the 2013 Eco-Audit. As data collection becomes more complete and our base of information grows, we anticipate that the Eco-Audit will evolve, becoming more quantitative and comprehensive in its evaluation of management efforts. This effort will ultimately instill a sense of urgency and shared purpose among NGOs, government, and private sector actors with a stake and responsibility for maintaining MAR as a healthy, biologically vibrant and economically viable resource for generations to come.

To learn more about the Eco-Audit please visit www.healthyreefs.org and www.wri.org/reefs.

Potential Eco-Audit Management Themes for the Future

Participants during the Eco-Audit National Workshop identified thematic gaps, and have proposed that these themes be considered in subsequent assessments.

These thematic gaps include:

- Climate change mitigation and adaptation strategies
- Mineral and extractive industries
- Maritime travel (cruise ships) and ballast water
- Lionfish invasion (invasive species)
- Important fisheries such as conch, sharks, sea cucumber, and shrimp (includes harmonization of fisheries regulations)
- Alternative livelihoods
- Terrestrial management, emphasizing “best practices” for agriculture
- Pollution from golf courses
- Degree to which economic valuation results have influenced decision making
- Degree to which government incentives are actually implemented

Appendix I: Abbreviations, Acronyms and Glossary

AGRRA	Atlantic and Gulf Rapid Reef Assessment
CBD	Convention on Biological Diversity
HRI	Healthy Reefs Initiative
GIS	Geographic Information System
ICRAN	International Coral Reef Action Network
LBSMP	Protocol Concerning Pollution from Land-Based Sources and Activities
NGO	Nongovernmental organization
MAR	Mesoamerican Reef
MSC	Marine Stewardship Council
MARPOL	International Convention for the Prevention of Pollution from Ships
MOU	Memorandum of Understanding
MPA	Marine Protected Area
OSPESCA	Organización del Sector Pesquero y Acuícola de Centroamerica
PwC	PricewaterhouseCoopers
SPAGs	Spawning aggregation sites
WRI	World Resources Institute

Glossary

Catch share. A general term used in several fisheries management strategies that dedicate a secure share of fish to individual fishermen, cooperatives, or fishing communities for their exclusive use.

Closed season. A legally defined time of year in which it is prohibited to harvest a particular species.

Coral bleaching. Often occurs when water is too warm, and corals will expel the algae (zooxanthellae) living in their tissues, causing the coral to turn white.

Eco-label. Labeling systems for food and consumer products aimed at informing consumers' environmental concerns by incorporating environmental measurements and accounting.

Fishery. Commercial activity of harvesting fish.

Fully protected / Fish replenishment zone. Legally defined zones in which it is prohibited to harvest any species, and is used as a fisheries management tool to encourage species replenishment.

Indicator. Metric developed to gauge effort to implement recommendations for reef management.

Marine Protected Area. Any area of intertidal or subtidal terrain, together with its overlying waters and associated flora, fauna, historical and cultural features, which has been reserved by legislation or other effective means to protect part or all of the enclosed environment.

Means of Verification Documentation. Evidence that provides proof of an assertion.

Ranking Criteria. A classification scheme organized by standardized grades.

Setbacks. The distance a structure must be from a landward edge of a beach.

Territorial Sea. Established by the 1982 United Nations Convention on the Law of the Sea as the coastal waters that extend 12 nautical miles from the baseline of a coastal state.

Appendix II: Table of Recommendations and Regionally Relevant Indicators

*Sector: GOV (government), NGO (nongovernmental organization), RES (Researcher), PS (Private Sector), and NA (Not Applicable)

RECOMMENDATION	INDICATOR	SECTOR
2010 Reef Report Card		
Achieve 20 percent territorial sea under full protection (no-take) within MPAs. In two years, achieve at least 5 percent on a regional scale.	**1a.** Percent of a country's territorial sea included in gazetted MPAs/ **1b.** Percent of a country's territorial sea included in fully protected zones	NA
Continue to harmonize fishery regulations (size limits, closed seasons, gear restrictions) and increase enforcement.	**2a.** Harmonizing fisheries regulations among countries	NA
Develop regional standards for coastal sewage treatment facilities with international and/or ecologically relevant guidelines—initiate at least one project per country.	**4a.** Standards for wastewater management/sewage treatment/ **4b.** New infrastructure for sewage treatment (in the last 5 years)	NA
Implement standardized regional reef monitoring and collaborative database, including (at least) the seven indicators used in the integrated Reef Health Index.	**5a.** Standardized monitoring of coral reef health and information management	NA
Develop a voluntary eco-certification program for marine recreation providers and hotels.	**6a.** Voluntary eco-standards program for marine recreation providers/ 6b. Participation of coastal hotels in eco-certification schemes	NA
2008 Reef Report Card		
Create and implement coastal zone management plans that include at least 20 percent of marine and coastal areas under full protection.	**3a.** Coastal zone planning regulations	GOV
Enact/enforce regulations to protect parrotfish (year round) and groupers (spawning season).	**2b.** Special regulations for grouper / spawning sites/ **2c.** Protection of key grazers (parrotfish)	GOV
Provide economic incentives for conservation and sustainable businesses.	**6d.** Government incentives for conservation and sustainable businesses	GOV

Support government efforts to fully protect more reefs, including those that are expected to be more resilient to climate change.	**7a.** Mapping of potentially resilient reefs to warming seas / coral bleaching	NGO
Promote more effective fisheries regulations to boost low abundance of herbivorous fish and sustain key commercial fisheries.	**2c.** Protection of key grazers (parrotfish)	NGO
Sustain local marine protected areas through financial, staff, or technical assistance.	**6e.** Private sector assistance to MPAs	PS
Adopt "better management practices," "codes of conduct," "eco-labels," and other mechanisms that reduce environmental impacts.	**6a.** Voluntary eco-standards program for marine recreation providers/ **6b.** Participation of coastal hotels in eco-certification schemes/**6c.** Adoption of seafood eco-labeling programs	PS
Engage in research that responds to questions posed by resource and protected area managers, including the identification of specific stressors impacting reefs.	**5a.** Standardized monitoring of coral reef health and information management/**5b**. Economic valuation of coral reefs/**5d**. Interdisciplinary partnerships combine social and ecological research for management	RES
Contribute to regional reef health monitoring and management developed by NGOs and private sector.	**5a.** Standardized monitoring of coral reef health and information management	GOV
Engage in international conventions and treaties that support conservation.	**7b.** Engagement in international/regional treaties that support conservation	GOV
Improve the effectiveness of conservation programs by increasing collaboration and joint planning.	**5d.** Interdisciplinary partnerships combine social and ecological research for management	NGO
Join in the MAR assessment program and in the Healthy Reefs for Healthy People program, <www.healthyreefs.org>.	**5a.** Standardized monitoring of coral reef health and information management	NGO
Join stakeholder consultations and eco-label programs.	**6a.** Voluntary eco-standards program for marine recreation providers/ **6b.** Participation of coastal hotels in eco-certification schemes/**6c.** Adoption of seafood eco-labeling programs	PS
Create opportunities to connect research, management, and stakeholder needs.	**5c.** Availability of understandable information on reef condition and threats	RES

Develop interdisciplinary partnerships that combine social and ecological research.	**5d.** Interdisciplinary partnerships combine social and ecological research for management	RES
Organize community meetings of local leaders and reef stakeholders to share information and respond to public concerns.	**5c.** Availability of understandable information on reef condition and threats	GOV
Ensure that MAR residents and tourists understand the importance and vulnerabilities of coral reefs.	**5c.** Availability of understandable information on reef condition and threats	NGO
Develop and promote businesses that support biodiversity conservation. See: <cms.iucn.org>.	**6a.** Voluntary eco-standards program for marine recreation providers/ **6b.** Participation of coastal hotels in eco-certification schemes/**6c.** Adoption of seafood eco-labeling programs	PS
Clarify scientific findings and make information readily available to stakeholders, the general public, and key decision makers.	**5c.** Availability of understandable information on reef condition and threats	RES

Appendix III: Mesoamerican Reef MPA List

MPA NAME	COUNTRY
Half Moon Caye Natural Monument	Belize
Blue Hole Natural Monument	Belize
Hol Chan Marine Reserve	Belize
Glovers Reef Marine Reserve	Belize
Laughing Bird Caye National Park	Belize
Bacalar Chico National Park and Marine Reserve	Belize
Gladden Spit & Silk Cayes Marine Reserve	Belize
South Water Caye Reserve Marine Reserve	Belize
Sapodilla Cays Marine Reserve	Belize
Swallow Caye Wildlife Sanctuary	Belize
Port Honduras Marine Reserve	Belize
Corozal Bay Wildlife Sanctuary	Belize
Caye Caulker Forest Reserve & Marine Reserve	Belize
Caye Glory Marine Reserve	Belize
Caye Bokel Marine Reserve	Belize
Dog Flea Caye Marine Reserve	Belize
Sandbore, Lighthouse Reef Marine Reserve	Belize
South Point, Lighthouse Reef Marine Reserve	Belize
Punta de Manabique	Guatemala
Cayos Cochinos	Honduras
Bay Islands (Roatan)	Honduras
Bay Islands (Guanaja)	Honduras
Bay Islands (Utila)	Honduras
Isla del Cisne	Honduras
Parque Nacional Cuyamel Omoa	Honduras
Cuero y Salado	Honduras
Punta Izopo	Honduras
Río Platano	Honduras
Punta Sal (Janeth Kawas)	Honduras
Banco Chinchorro	Mexico
Sian Ka´an / Uaymil/Arrecifes de Sian Ka'an	Mexico
Isla Contoy/Playa de Isla Contoy	Mexico
Yum Balam	Mexico

Costa Occidental Isla Mujeres- Punta Cancún- Punta Nizuc	Mexico
Arrecifes de Puerto Morelos	Mexico
Arrecifes de Cozumel	Mexico
Santuario del Manatí	Mexico
Arrecifes de Xcalak	Mexico
Tiburón Ballena	Mexico

Appendix IV: Regional Standards for Sewage Treatment

From Annex III of the Cartagena Convention's Protocol Concerning Pollution from Land-Based Sources and Activities

Discharges into Class II Waters

Each Contracting Party shall ensure that domestic wastewater that discharges into, or adversely affects, Class II waters is treated by a new or existing domestic wastewater system whose effluent achieves the following effluent limitations based on a monthly average:

Parameter	Effluent Limit
Total suspended solids	150 mg/l*
Biochemical oxygen demand	150 mg/l
pH	5–10 pH units
Fats, oils, grease	50 mg/l
Floatables	Not visible
Does not include algae from treatment ponds	

Discharges into Class I Waters

Each Contracting Party shall ensure that domestic wastewater that discharges into, or adversely affects, Class I waters is treated by a new or existing domestic wastewater system whose effluent achieves the following effluent limitations based on a monthly average:

Parameter	Effluent Limit
Total suspended solids	30 mg/l*
Biochemical oxygen demand	30 mg/l
pH	5–10 pH units
Fats, oils, grease	15 mg/l
Fecal coliform (Parties may meet effluent limitations either for fecal coliform or for *E. coli* (freshwater) and *enterococci* (saline water).)	Fecal Coliform: 200 mpn/100 ml; or a. *E. coli*: 126 organisms/100ml; b. *enterococci*: 35 organisms/100 ml
Floatables	Not visible
Does not include algae from treatment ponds	

[i] Healthy Reefs for Healthy People. 2010. *Report Card for the Mesoamerican Reef: An Evaluation of Ecosystem Health*. Miami, FL: Franklin Communications.

[ii] Mumby, P.J., and A.R. Harborne. 2010. "Marine Reserves Enhance the Recovery of Corals on Caribbean Reefs." *PLoS ONE* 5:e8657.

[iii] International Union for the Conservation of Nature. November 25, 2011. *Marine Protected Areas-Why Have Them?* Accessible at <http://www.iucn.org/about/work/programmes/pa/pa_what/?4646/Marine-Protected-Areas--Why-have-them>

[iv] IUCN. 2003. *Recommendations of the Vth IUCN World Parks* Congress. *Recommendation* 22: 56-60.

[v] "Nature Needs Half." November 30, 2011. Protection of the Seas and Oceans. Accessible at <http://natureneedshalf.org/protection-of-the-seas-and-oceans/>

[vi] Mora, C., R.A. Myers, M. Coll, S. Libralato, T. Pitcher, et al. 2009. "Management Effectiveness of the World's Marine Fisheries." *PLoS Biol* 7(6): e1000131. doi:10.1371/journal.pbio.1000131