From Data To Action:
What The 2024 Healthy Reefs Report Card Means For Belize

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The Healthy Reefs Initiative (HRI) recently launched its 8th Mesoamerican Reef Report Card (McField *et al.*, 2024), providing an updated view of reef health across Belize, Honduras, Mexico, and Guatemala. As part of this effort, 110 sites across Belize were surveyed in 2023, by local organizations and independent scientists, with the report presenting key indicators of reef health: live coral cover, fleshy macroalgae cover, and commercial and herbivorous fish biomass. With a 32-page report card and 79 pages of supplementary information, how should stakeholders in Belize read and interpret this report? What does the 2024 Healthy Reefs report card mean for Belize?

What is the Report Card?

The Mesoamerican Reef Report Card provides a general overview of reef health across the Mesoamerican Barrier Reef (MAR). The report card makes use of stories, information on healthy or unhealthy reef characteristics, and data-driven visualizations and calculations to communicate the state of the MAR, both overall, for each country, and for subregions within each of the countries. The data itself originated from local data collectors trained in standardized methodology from the Atlantic Gulf and Rapid Reef

Key Messages:

1. The 2024 Mesoamerican Reef Report Card assesses the health of the Mesoamerican Reef across Belize, Honduras, Mexico, and Guatemala, highlighting indicators like coral cover, macroalgae, and fish biomass.

2. The report card uses indicators and a Reef Health Index to simplify complex reef data, making it easy to understand but may lack the granularity needed to capture detailed trends and localized nuances.

3. Additional data resources present in the supplementary provide a more detailed look at trends and outliers, helping stakeholders interpret underlying causes of reef changes, which can inform adaptive management for reef health in Belize.

4. While the report card offers an overview, Belizean stakeholders should use supplementary information and local insights to uncover deeper data trends in reef heath.

Assessment (AGRRA) Program (AGRRA, 2024). The data was then compiled and processed by Healthy Reefs for Healthy People (HRHP), the organization which leads the HRI (HRHP, 2024A). The collected data are extensive, and provide a wealth of information about the state of the reef, informing stakeholders on key areas of concern and action.

The report card serves an important role: to stimulate coordinated data collection by partners across the MAR, compiling the extensive resulting data and presenting the findings in a digestible format, without obscuring primary messages with excessive detail. The report card makes use of four primary indicators (measures of live coral cover, fleshy macroalgae cover, and commercial and herbivorous fish biomass) along with an overall Reef Health Index (RHI) to simplify large amounts of data into a format that is easy to read and reference. The indicators themselves are averages of transect-level data. For example, fish biomass is calculated on a transect-level, then averaged by site and averaged once again by subregion to reach the indicator value presented on the report card. The RHI is calculated from these four primary indicators, using condition ranges from 1-5 (HRHP, 2024B). The report card uses a consistent format from year to year, facilitating comparison over time, to monitor when and how key issues arise, such as the Diadema die-off or major coral bleaching events.

In Belize, the HRI partnership includes local organizations that fund and perform data collection; AGRRA, which provides standardized methodology, data management, and training; and HRHP, which compiles everything into a clean, readable document. This collaboration has brought value to the country by fostering international partnerships, facilitating national data sharing and discussions, and encouraging informed management and policy decisions based on real data.

Constraints of the Report Card

While the value of the Mesoamerican Reef Report Card for Belize is clear, there are also some distinct limitations regarding how the document uses data, which can be explored in more detail. Firstmost, is the use of the indicators. The purpose of the indicators is to provide a clear, uncomplicated overview of live coral cover, fleshy macroalgae cover, and commercial and herbivorous fish biomass in each country and subregion. While this simplification makes the report card easier to interpret, it also hides important nuances that may be key to Belize's actions and reactions regarding reef health and restoration. As the indicators are means of means (Boles et al., 2024A), the shape and distribution of the data cannot be observed by the indicators alone. If the coral cover for a subregion is 20%, there is no way for a reader to know if it is 20% coral cover evenly spread across the subregion sites, or whether it is actually much lower at most sites with a single site's high coral cover driving up the mean. Means are highly sensitive to outliers, in comparison with other summary statistics, such as the median, or a suitable scientific analysis. This is important because it is challenging for comanagers and other stakeholders to understand what is happening within the subregion of interest on a level which facilitates adaptive management actions from the indicator score alone.

The RHI scores themselves further create distance from the detail in the data. Each RHI is a single value from 1 to 5, where 1 represents critical reef conditions and 5 very good reef conditions. While the RHI increased for the MAR from 2.3 to 2.5 between 2021 and 2023, there is not a lot of direct utility that arises from those numbers. From these scores alone, the reef health appears to be poor but improving, which is an oversimplification of the complex dynamics of the reef. This is a general problem with such 'state of nature' metrics (Gambetta 2024). The report card does describe the general patterns underlying the RHI value, discussing how an increase in fish biomass contributed to the increase in score for the 2024 report card, and that while more subregions improved in conditions rather than declined there are some subregions in critical condition. However, having the focus be the indicators and RHI scores diverts attention from the underlying details. There is no clear cause of the trends when we are so far zoomed out from the data collected.

Two examples of these limitations include: (1) At Turneffe Atoll, the increase in coral cover from 15% in 2021 to 17% in 2023 is primarily driven by a single locality (Boles et. al., 2024B), suggesting that coral cover has not improved overall in this subregion but rather improved within this one locality. This crucial information, hidden by the averaged indicators, can inform management decisions at the atoll. It allows comanagers to ask, "What is it about this locality that led to this change?" and respond accordingly. (2) At Lighthouse Reef, the drastic increase in commercial fish biomass from 288 g/100 m2 (critical condition) to 1352 g/100 m2 (good condition) is driven almost entirely by outliers in the data, where data collectors encountered extremely large or numerous fish in a few distinct instances. Without these outliers, commercial fish biomass would still be classified as 431 g/100 m2 (poor condition) at Lighthouse Reef. Many more examples like those exist, for comanagers and stakeholders to investigate outside the bounds of the report card.

Interpreting the Report Card for Belize

The report card is a good tool for acquiring a clear, story-driven overview of reef conditions across the MAR. It may be used to evaluate changing conditions over time, get a sense of Belize in comparison to other MAR countries, and learn about general trends and recommended actions to prevent further decline in reef conditions. However, stakeholders in Belize should consider enhancing their understanding of reef conditions looking beyond the summarized indicator values to additional sources of information. While direct sources, such as accounts from surveyors in the water, fishers, and community members, as well as other forms of data, such as spawning or mangrove surveys, could help deepen knowledge in this way, the actual data behind the report card hides an incredible untapped wealth of information in itself.

The University of Belize Environmental Research Institute (UB-ERI) has collaborated with HRHP to develop two chapters of supplementary information to extend the resources available to stakeholders for interpretation of the data. Chapter 3. 'Presentation of Indicator Value Data Visualizations' (Boles et al., 2024B) provides readers with a set of data visualizations for each subregion across the MAR, showing transect-level data distribution of each indicator for each site, along with medians, means, and outliers. Readers can observe where the median (middle value of the data, which is less sensitive to outliers) may differ from the mean, which would indicate a skew in the data that could be investigated further. Comparing the data distribution between localities can show where there have been changes in indicators between years, and whether these changes are similar across all sites within the subregion, or whether some sites stand out.

> **Recommendations from the UB-ERI for interpreting Mesoamerican Reef Report Card indicators for Belize include:**
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> 1. Use the indicators and report card to get an overview of reef conditions in Belize, and across our local subregions. Identify key issues and recommended actions across the MAR.
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> 2. Identify any key areas that are important to you, or may be of interest. For example, any subregions that seem to have drastically increased in indicator or RHI values without clear cause.
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> 3. From there, use the supplemental data visualizations in Chapter 3 of the 2024 Report Card Supplement (Boles et al., 2024B) to explore further and investigate the shape and distribution of the data. Identify trends pertinent to your areas of interest, work, and/or research.
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> 4. From there, ask questions that arise from the data. For example, what caused this dramatic fish increase? Why is coral bleaching not occurring at this site? Take appropriate measures to investigate these questions or discuss them with data collectors, researchers, or other relevant professionals.
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> 5. Once the data are understood more clearly, and the trends identified and explored, make appropriate decisions on opinion, management, and/or policy-making

The 2024 Mesoamerican Reef Report Card and accompanying online supplement provide an update of reef condition across the MAR. The data behind the report card contains valuable information for Belize in understanding and interpreting national reef health. Tools and resources within the supplementaries allow stakeholders to further investigate their subregions of interest outside the pages of the report card itself.

Citations:

AGRRA (2024). Atlantic Gulf and Rapid Reef Assessment Program. https://www.agrra.org/

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