Sewage in Our Seas:
Unmonitored and Unregulated

Alex Martinez

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CEA CONSULTING

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REPORT SPONSOR

CEA Consulting (CEA) supports the work of environmental foundations and nonprofits, as well as sustainability-oriented businesses, with in-depth research and analysis, program design and evaluation, and strategic planning. CEA commissioned environmental consultant Alex Martinez to write this report.

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REVIEWERS

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(cover image) Source: iStock / Grafner

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Deception Bay near Brisbane, Queensland. Source: iStock / AlizadaStudios

Introduction and Summary

Around the world, human sewage often flows directly into the ocean with little to no treatment. For the most part, it's an invisible threat to coral reefs, coastal economies, and human health—loosely monitored and understudied. This report dives into this issue through the lens of five country-level case studies focused on Australia, Fiji, Honduras, Indonesia, and the Philippines. While each of the contexts are different, each country continues to grapple with the challenge of monitoring coastal water quality and regulating sources of pollution, particularly sewage. The following key themes emerged from the project:

Very few countries around the world effectively regulate sources of coastal water pollution, including sewage. With few exceptions, regulation of coastal water pollution is not a priority for most countries.

Even fewer countries regularly monitor coastal water quality. While many countries have regulations requiring regular monitoring of water quality, few seem to carry through on monitoring and publish the results of water quality testing.

Around the world, water quality monitoring and regulation is commonly delegated to local government. This applies to monitoring and regulation of both coastal waters and terrestrial water bodies. National governments often set standards and then leave it up to local governments to enforce those standards, or enact and enforce more stringent standards.

Pollution from agricultural runoff is also a major threat to coral reefs. When it comes to regulating coastal water pollution most countries start by focusing on industrial waste from cities, followed by sewage. However, less-concentrated pollution from agriculture and other land-use practices (such as logging) can be even more challenging to address. Even well-resourced countries like Australia continue to struggle to regulate dispersed pollution from agriculture.

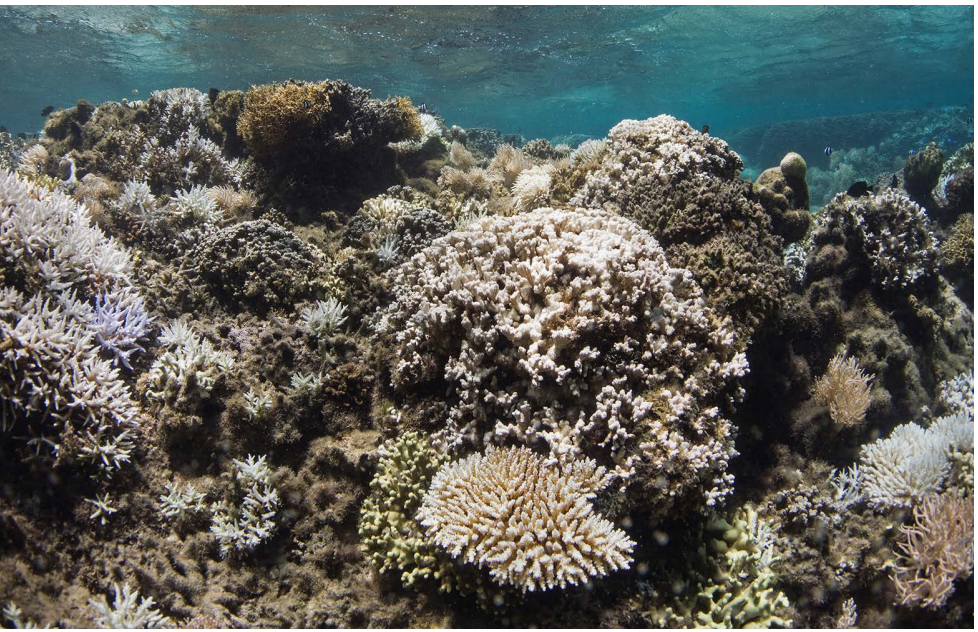
While there are many groups working on water, sanitation, and hygiene (WASH) in West Africa, there is surprisingly little readily available information on coastal water quality monitoring and regulation in the region. Compared to the other regions of inquiry, it was particularly difficult to secure interviews with government officials, academics, and NGOs working on coastal water quality in West Africa.

NGOs can have the greatest impact on coastal ecosystems by working in semi-urban areas on the verge of rapid growth, such as the Bay Islands in Honduras. For the most part, the coastal ecosystems (e.g., coral reefs, mangroves) around major urban areas have already been significantly damaged by degradation of coastal water quality. While there are major human benefits associated with working on the provision of clean water, sanitation, and hygiene (WASH) services in these urban areas, coastal ecosystems tend to take decades (or longer) to recover from the impacts of pollution.

It will also be very difficult to work in rural areas with dispersed sources of pollution from households and agriculture. Even high-income countries like Australia continue to struggle to reduce dispersed pollution from agriculture, which requires effective regulation and monitoring of land use practices, which often occur far from the ocean itself. The best opportunities for impact are likely found in semi-urban areas like the municipalities in Honduras' Bay Islands, which are experiencing rapid growth in population and tourism. In these areas, pollution is relatively concentrated from a single source (urban areas), but the quantity of sewage is not so great that coastal ecosystems have already been damaged beyond repair. There is an opportunity to prevent further degradation of coastal ecosystems before population growth and increased tourism degrade water quality. This will require making upfront investments in infrastructure, education, monitoring, and enforcement to prevent damage from sewage. While increased tourism presents a potential source of funding for water treatment, the challenge will be to find creative ways to finance these investments before major coastal development occurs.

The coastal ecosystems (e.g., coral reefs, mangroves) around major urban areas have already been significantly damaged by degradation of coastal water quality.

Pipes. Source: iStock / Tamara Caldwell;
A polluted canal in urban Manila, the Philippines. Source: iStock / InTouchPhotography



Research Methodology

The project began with a rapid review of scientific literature and government publications on coastal water quality monitoring and regulation. This initial review focused on countries named most vulnerable to the effects of coastal reef degradation by the World Resources Institute, the countries with the largest reef-associated populations,[1] and the countries home to coral reefs that, in the absence of other impacts, have a higher likelihood of surviving climate changes relative to other reefs as projected by Breyer et al. 2018.

Given the lack of available public information, interviews were conducted with 12 in-country experts to supplement the literature review (see the list of experts consulted). Based on insights from the desktop study and interviews, five country-level case studies were developed for Australia, Fiji, Honduras, Indonesia, and the Philippines.

EXPERTS CONSULTED

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Reef diversity, Fiji. Credit: Jayne Jenkins / Coral Reef Image Bank;
Bleached coral, Fiji. Source: The Ocean Agency / Xl Catlin Seaview Survey

1. Reef-associated populations are defined as those people living within 10 kilometers of the coast, and within 30 kilometers of reefs.

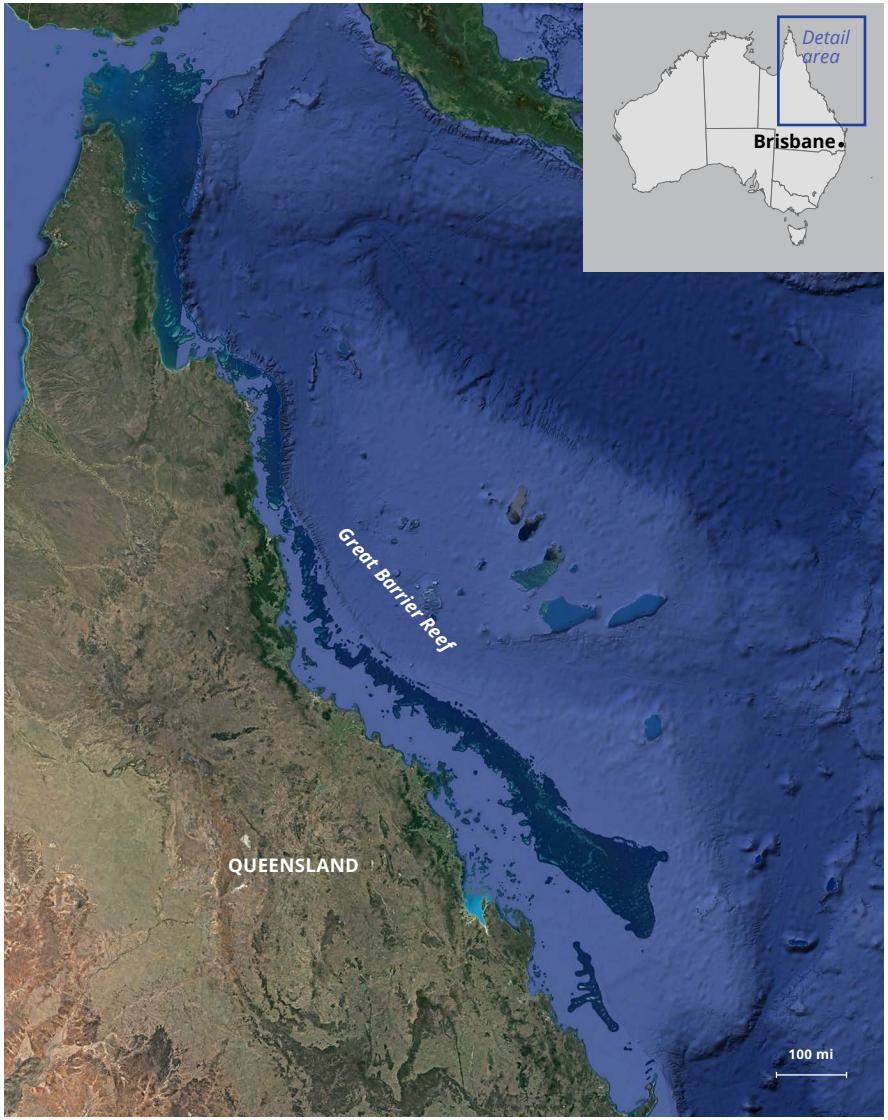
CASE STUDY

Australia

Australia is home to the Great Barrier Reef, which sees over 2.5 million visitors each year. Sewage management and treatment in Australia is heavily regulated and well-funded by government. Chemical pollution from agricultural runoff in Queensland is the greatest threat to water quality on the Great Barrier Reef. Along with the Great Barrier Reef Marine Park Authority (a division of the Australian government), the government of Queensland plays an active role in monitoring the quality of water entering the Great Barrier Reef. The current focus of reef protection in Australia is working to improve land use practices to reduce the harmful impacts of runoff on marine resources.

COUNTRY OVERVIEW

The Great Barrier Reef (GBR) off the coast of Queensland, Australia spans 344,400 square kilometers and consists of over 3,000 individual reef systems. The GBR accounts for 10 percent of all coral reefs globally. Queensland is home to just over 5 million Australians, but over 2.5 million people visit the GBR every year. Tourism and fishing along the GBR generate about $6 billion USD annually and support roughly 69,000 Australian jobs. Chemical pollution and sedimentation from agricultural runoff in Queensland is the greatest threat to water quality on the GBR.



Agriculture, rather than sewage, accounts for the vast majority of pollutants impacting water quality in Australia.

(facing) Brisbane. iStock / 4FR;
(above) Satellite view of the Great Barrier Reef. Source: Google Earth

POLLUTION SOURCES

Chemical pollution from rural agriculture accounts for the vast majority of pollutants impacting coastal water quality in Australia. During periods of flooding, sediment and farm chemicals run into rivers and are transported to the ocean. Nearly all urban wastewater is treated by sewage treatment plants. Treated wastewater contributes less than four percent of nitrogen loads and minimal amounts of sediment and pesticides to the total runoff from catchments flowing into the GBR. Most stormwater in Queensland is not treated, meaning that oils and chemicals in urban environments are flushed into waterways during storm events. Dredging for port development and other construction is another form of marine pollution in Australia. Dredging churns up sediments and can expose buried contaminants that can prevent plant growth.

WATER QUALITY MONITORING

Australia's GBR Marine Park Authority monitors water quality on the GBR and also oversees the Marine Monitoring Program, which monitors nearshore water quality and seagrass and coral reef condition between mainland Australia and the GBR. Monitoring is conducted by the Australian Institute of Marine Science, James Cook University, Howley Environmental Consulting, The University of Queensland, Queensland Parks and Wildlife Service, Reef Catchments, and community volunteers. The GBR Marine Park Authority monitors water quality of the GBR itself. Water quality indicators monitored include water clarity, chlorophyll *a* (as a proxy for dissolved inorganic nitrogen), suspended solids, particulate nitrogen, particulate phosphorus, sedimentation, temperature, and pesticide concentrations.

The Great Barrier Reef Marine Park Authority is managed by the federal government in partnership with the Government of Queensland. The two governments publish annual reef report cards with the results of the water quality monitoring efforts. The latest available report card (from 2018) shows that pollution to the reef is decreasing but more work is needed to meet the Reef 2050 Water Quality Improvement Targets (see Suggested Resources for more information on this program).

COASTAL WATER QUALITY MANAGEMENT

Most wastewater in Queensland is treated at sewage treatment plants built and operated by local governments. These plants provide tertiary treatment of sewage to remove nitrogen and phosphorous as well as organic waste. All sewage treatment plant operators must be licensed under the Australian Environmental Protection Act of 1994, which sets environmental standards for treated wastewater before it can be discharged into waterways. Sewage treatment is tightly regulated and there has been significant investment in treatment plants since the 1990s in Australia. Between 2000 and 2004, over $600 million AUD was invested in public sewage treatment plants. Between

Dredging is a major source of marine pollution in Australia.

Rural Queensland. Source: iStock Trevor Graham;
Dredging off the Queensland Gold Coast. iStock / John Carnemolla

2014 and 2015, local governments invested $230 million AUD in sewage plant upgrades. Outside of urban areas with built sewers, local governments may require households to install individual sewage treatment systems (e.g., septic tanks).

In 2017, the Australian and Queensland governments launched the Reef 2050 Water Quality Improvement Plan 2017-2022, which seeks to improve the quality of water flowing into the GBR. The plan sets sediment and nutrient load reduction targets for each of the river catchments discharging into the GBR. The plan is a partnership between industry and government, not a binding regulation. The primary focus of the plan is reducing pollution from agriculture, and it focuses on supporting farmers and ranchers to apply best practices and engage in land restoration across Queensland.

In 2019, the Queensland Parliament passed the Environmental Protection (Great Barrier Reef Protection Measures) and Other Legislation Amendment Act of 2019, which mandates new pollution reporting requirements and protection regulations for industrial and agricultural sources of nutrient and sediment pollution. Starting in December 2019, all grazers, sugarcane and banana producers in the Wet Tropics, Burdekin, Mackay Whitsunday, Fitzroy, and Burnett Mary Reef regions of Queensland must keep detailed records of all agricultural chemical and organic inputs applied to land or crops. The Act also establishes "minimum practice agricultural standards" that will be rolled out over the next three years. Starting December 1, 2020, all new, expanded, or intensified industrial development is subject to new discharge standards to prevent increases in nutrient or sediment pollutant loads into waterways.

SUGGESTED RESOURCES

Australian Institute of Marine Sciences. *Water Quality Monitoring*

Great Barrier Reef Marine Park Authority. (2018). *Marine Monitoring Program Quality Assurance and Control Manual 2016-2017*

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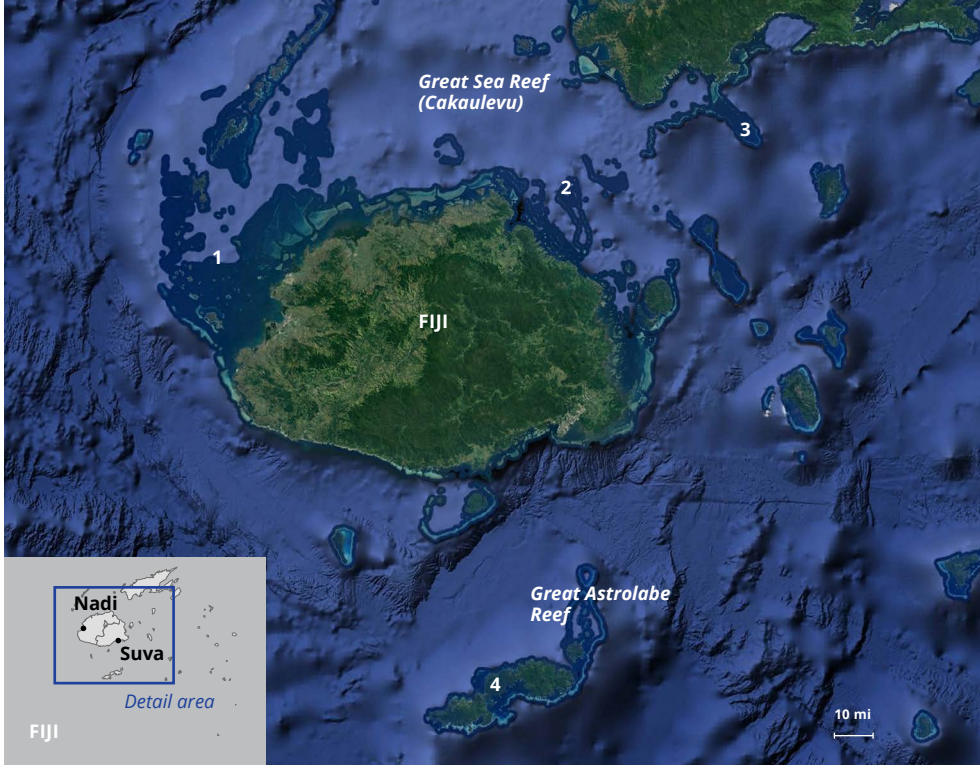
Qldwater. (2016). *Sewage Treatment Plants in Great Barrier Reef Catchments – Industry Discussion Paper*

Queensland Government. *Great Barrier Reef Innovation Fund*.

Queensland Government. *Reef Protection Regulations*.

Queensland Government. *Reef Water Quality Program Factsheet*.

Great Barrier Reef. Source: Katerina Katopis / Coral Reef Image Bank



CASE STUDY

Fiji

There is no systematic monitoring of coastal water quality in Fiji. While the Environmental Management Act of 2005 gives the Ministry of Waterways and Environment (MWE) the authority to monitor and regulate coastal water quality, the agency does not have the capacity to do this systematically. There are other operational water laboratories in Fiji, including at the Water Authority of Fiji, the Fiji Ministry of Health and Medical Services, and the Institute of Applied Sciences at the University of the South Pacific, which could be engaged for more regular monitoring.

COUNTRY OVERVIEW

With a population of 850,000, Fiji is one of the most populated island nations in the South Pacific. Indigenous Fijians own 87 percent of the country's land, with leases on land administered by the iTaukei Lands Trust Board (TLTB). According to the Fiji Hotel and Tourism Association, tourism contributes more than 40 percent of gross domestic product. Fiji is home to Cakaulevu Reef (also known as the Great Sea Reef), one of the largest barrier reefs in the Southern Hemisphere. The major reefs of Fiji also include the barrier reefs around Namena and Vatu-i-Ra islands on either side of the Vatu-i-Ra Passage, the Great Astrolabe Reef (also a barrier reef) at Kadavu, and the Nuku Reef in the Mamanuka Island Group of Fiji.

(facing) Development in Nadi, Fiji. Source: iStock / tobiasjo; (above) Satellite view of Fiji islands. Labeled islands: 1. Mamanuka Islands, 2. Vatu-i-Ra, 3. Namena, 4. Kadavu. Source: Google Earth; Foraging for seafood on the reef, Fiji. Credit: iStock / Peacefoo

Only 21% of households in Fiji are connected to a piped sewer system.

POLLUTION SOURCES

Coastal development is a major threat to Fiji's reefs. Logging is an ongoing challenge and contributes to sediment flows into reefs. The Fiji Department of Forestry has set the goal of preserving 40 percent of remaining natural forest (about 20 percent of Fiji's original natural forest), but the country lacks capacity for forest and land management. Sewage is another threat to Fiji's reefs. As of the 2017 census, 21 percent of households in Fiji were connected to a piped sewer system and 63 percent were connected to a septic tank system. The remaining 16 percent of households surveyed rely on various forms of pit latrines.

WATER QUALITY MONITORING

There is no regular monitoring of coastal water quality by the MWE or any other government agencies in Fiji, though some spot water quality monitoring is done as required for environmental impact assessments (EIAs) and development permits. The Water Authority of Fiji (responsible for water provision and wastewater services) does some monitoring of water quality for surface water sources in Fiji. The Water Authority of Fiji operates 11 wastewater treatment plants in Fiji. According to the Water Authority, effluent is treated based on standards set by local regulatory authorities or the World Health Organization prior to disposal to receiving waters, including the ocean.

COASTAL WATER QUALITY MANAGEMENT

Fiji's Environment Management Act of 2005 requires an EIA prior to the approval of any "development activity or undertaking."[2] Each EIA must specify any significant environmental impacts from the proposed development activity, which would include impacts of any pollutants stemming from the activity on marine resources. The MWE reviews each EIA before approving any development activity. The MWE has the authority to require ongoing monitoring of environmental impacts from the developer as a condition of approval for any EIA. In theory, this gives the MWE the authority to regulate coastal pollutants and require ongoing monitoring of coastal water quality. In practice, there are a number of challenges that limit the effectiveness of the permitting process, including no standard qualification requirements for EIA consultants and limited staffing resources to follow up on monitoring of permits approved with conditions.

2. Any activity or undertaking likely to alter the physical nature of the land in any way, and includes the construction of buildings or works, the deposit of wastes or other material from outfalls, vessels or by other means, the removal of sand, coral, shells, natural vegetation, sea grass or other substances, dredging, filling, land reclamation, mining or drilling for minerals, but does not include fishing.

SUGGESTED RESOURCES

Belson, K. (2018). *Paradise Threatened: Fiji's War Against Climate Change*. The New York Times.

Burke et al. (2011). *Reefs at Risk Revisited*. World Resources Institute.

Fiji Islands Environmental Management Act of 2005

Fiji: Ocean Health Index

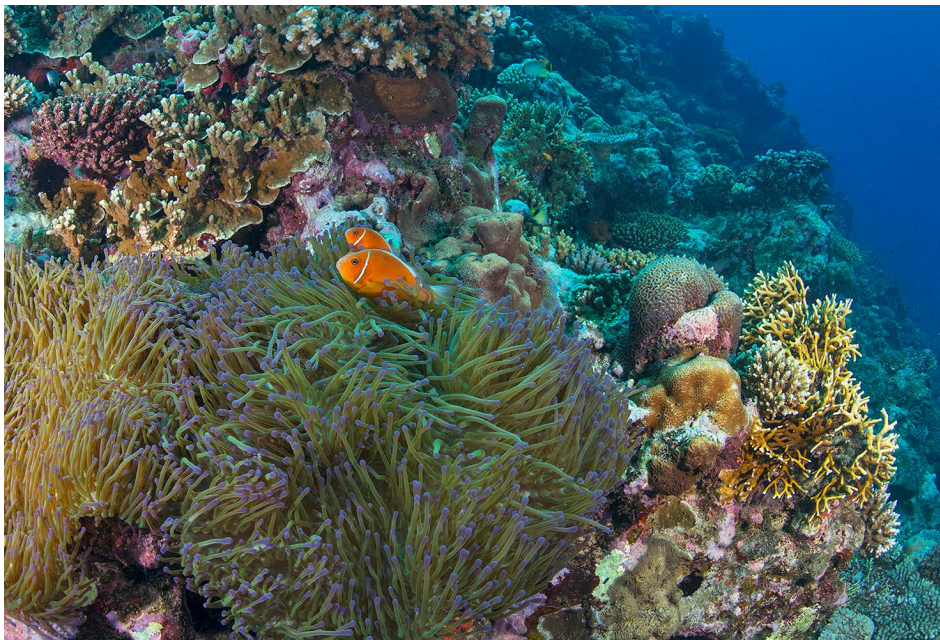
Olson et al. (2010). *Priority Forests for Conservation in Fiji: Landscapes, hotspots and ecological processes*. Oryx, 44(1), 57–70.

Population and Housing Census – Release 3. 2017. Fiji Bureau of Statistics.

Torres-Bennett, A. (2018). *As warming threatens reefs, fragile Fiji explores inland tourism*. Reuters.

Water Authority of Fiji

Fiji Reef. Credit: Jayne Jenkins / Coral Reef Image Bank



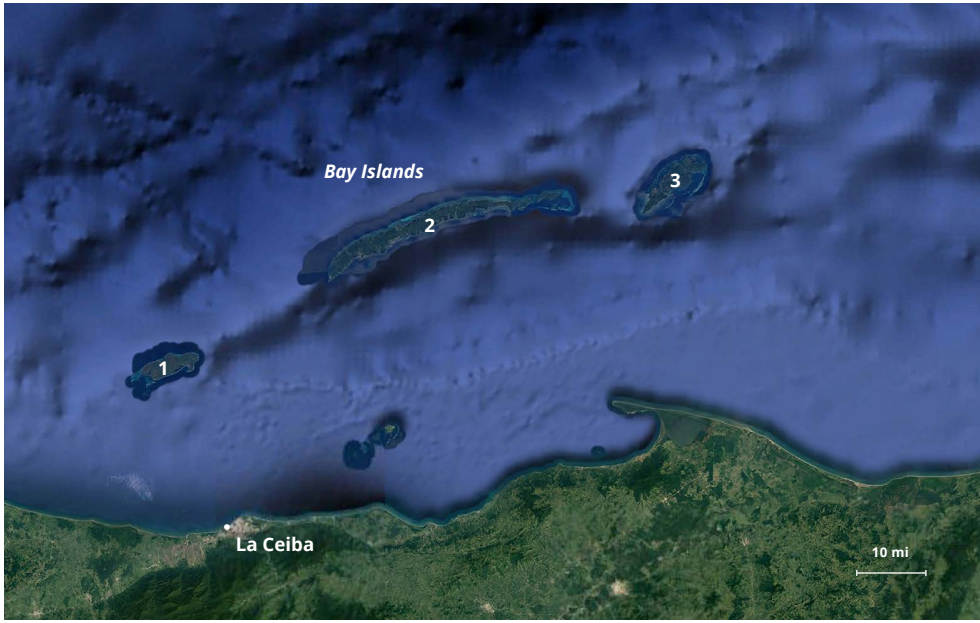
CASE STUDY

Honduras

Honduras' waters contain some of the most important reef ecosystems in the Western Hemisphere. Honduras' Bay Islands, which lie along the Mesoamerican Reef are undergoing rapid development as tourism grows, increasing sewage discharge into the reef. Although the government of Honduras does not monitor coastal water quality or manage coastal pollution rigorously, local NGOs have been collecting water quality samples since 2013. The Bay Islands and Honduras' coastal cities are the subject of a potential $160 million USD integrated water management loan from the Inter-American Development Bank to finance water infrastructure.

COUNTRY OVERVIEW

The Mesoamerican Reef is the largest coral reef in the Western Hemisphere and stretches 1,000 kilometers from Mexico to Honduras. Honduras' waters are home to over 500 fish species, 60 types of hard corals, and five species of marine turtles. It attracts one of the world's largest congregations of whale sharks. Tourism and coastal development are rapidly expanding on Honduras' Bay Islands, which are located right alongside the reef. The waters surrounding the three Bay Islands of Honduras are all part of the Bay Islands National Marine Park, covering a marine area of 647,152 hectares. The island of Utila is a destination for backpackers and scuba diving tourism. The island of Guanaja is a higher-end tropical tourism destination. Finally, the island of Roatán is by far the largest island and a major tourism destination with a commercial airport and two cruise ship docks. While the islands themselves are home to a local population of less than 200,000 people, they serve over a million tourists each year.



(facing) Cruise ships at Mahogany Bay, Roatán. Source: iStock / dstephens; (this page) Whale shark feeding. Credit: Amanda Cotton / Coral Reef Image Bank; Satellite view of the Bay Islands, Honduras. Source: Google Earth. The Bay Islands: 1. Utila, 2. Roatán, 3. Guanaja

Most of the pollution impacting the Mesoamerican Reef originates in Honduras.

POLLUTION SOURCES

The major pollution threats in Honduras and other areas along the Mesoamerican Reef are sewage and solid waste pollution due to increasing coastal and tourism developments and sedimentation from extensive and unsustainable use of watersheds and inland deforestation. A 2006 study of watershed pollution by the World Resources Institute found that the majority of the sediments and nutrient pollution impacting the Mesoamerican Reef originates in Honduras—over 80 percent of the total sediment load and over 50 percent of the nutrient load (both nitrogen and phosphorous).[3]

WATER QUALITY MONITORING

In general, governments tend not to focus on coastal water quality monitoring or management issues across the Mesoamerican Reef. The government of Honduras does not systematically monitor coastal water quality or publish information on current water conditions. However, since 2013, the Coral Reef Alliance (CORAL) and local NGO partners like the Bay Islands Conservation Association (BICA) have collected information on coastal water quality across over 50 monitoring sites in the Bay Islands.

COASTAL WATER QUALITY MANAGEMENT

Historically, the government of Honduras has effectively ignored coastal water quality, and there is little to no enforcement of coastal water pollution. That may be changing soon. In October 2018, Honduras became the 26th country to ratify the Cartagena Convention, which promotes regional cooperation for protection and sustainable development of the Caribbean Sea. The Convention requires its signatories to develop and implement plans to monitor coastal water quality and address sources of pollution. In theory, the protocol will provide the policy framework needed to strengthen and enforce water quality regulations for all of Honduras.

To date, water quality management in Honduras has been sporadic. For example, each of the Bay Islands has a wastewater treatment facility but they are rarely in operation due to a combination of engineering and financial problems. When new sewage pipes are installed, they often consist of a single main line but none of the connecting extensions to actually link homes and businesses to the system. The Summit Foundation, the Mesoamerican Reef Fund, the Healthy Reefs Initiative and CORAL have worked on Roatán to connect 282 of 360 homes and businesses located in the town of West End to the treatment network.

Similarly, there is little effort to regulate pollution generated by the tourism industry. Cruise ships are generally charged a fee per passenger when they dock at a port. In theory, those funds should be used to manage the waste generated by the cruise ships and their passengers, but in reality, the funds are often used for other purposes.

3. The study did not examine the flow of sewage into the Mesoamerican Reef.

SUGGESTED RESOURCES

Burke, L. and Sugg, Z. (2006). *Hydrologic Modeling of Watersheds Discharging Adjacent to the Mesoamerican Reef*. World Resources Institute.

Healthy Reefs for Healthy People (2010). *Report Card for the Mesoamerican Reef: An Evaluation of Ecosystem Health*.

Lopez, O (2017). *'I have a lot of enemies': the Honduran marine park rangers facing death threats*. The Guardian.

Mesoamerican Reef – WWF

The Caribbean Environment Programme, UN Environment (2018). *Honduras becomes latest country to ratify regional legal agreement to protect the Caribbean Sea*.

The Summit Foundation (2017). *Clean Water for Clean Reefs in Honduras*.

Wilkinson, C. (2008). *Status of coral reefs of the world: 2008*. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre, Townsville, Australia.

Banco Chinchorro, Mesoamerican Reef. Source: Philip Hamilton / Coral Reef Image Bank

CASE STUDY

Indonesia

The waters of Indonesia contain some of the most important reef resources in the world and over 60 million people in Indonesia live within 30 kilometers of a coral reef. Coastal development (including sewage) threatens at least 20 percent of Indonesia's reefs. There are no national laws in Indonesia specifically regulating municipal and household sewage treatment. Over 90 percent of households across Indonesia discharge sewage directly into waterways. Although water quality monitoring is mandated by national decree, outside of major urban and tourism areas there is little (if any) coastal water quality monitoring and almost no enforcement of water quality standards by the national government.

COUNTRY OVERVIEW

Indonesia is part of the Coral Triangle, a region that contains the highest diversity of marine life in the world, including more coral reef species than anywhere else on earth. Most of the reefs in the Coral Triangle are located in the waters of Indonesia and the Philippines, which together possess 77 percent of the region's coral reefs. Over 2,200 reef fish species have been documented in Indonesia's waters. The biodiversity of reefs tends to increase from west to east, with the world's highest concentration of coral species located around the Bird's Head Peninsula (which makes up the northwest portion of West Papua). The Raja Ampat Island just offshore of the Bird's Head Peninsula is considered the "center of the center" of the world's coral reef biodiversity. Southern West

(facing) Jakarta. Source: iStock / Yamtono_Sardi; (this page) Satellite map of Raja Ampat Islands. Source: Google Earth. The main islands: 1. Misool, 2. Salawati, 3. Batanta, 4. Waigeo, 5. Kofiau; Fisherman mending lines in Indonesia. Source: Martin Colognoli / Coral Reef Image Bank

Papua contains less abundant reefs but some of the world's most extensive mangrove forests. Indonesia is home to one fifth of the world's mangroves. Nearly 60 million people in Indonesia live within 30 kilometers of a coral reef, the largest reef-associated population of any country in the world. Western Indonesia, where most of the country's population is concentrated, faces the greatest threats to its coral reefs.

POLLUTION SOURCES

Reefs in Indonesia face significant global and local threats including climate change, overfishing, destructive fishing, and water pollution from coastal development. Based on the World Resources Institute's integrated local threat index,[4] nearly 95 percent of coral reefs in Indonesia are threatened by local human activities. Coastal development, which includes the impacts of sewage from coastal communities threatens about 20 percent of Indonesia's reefs. Watershed-based pollution (sediment and nutrient runoff from deforestation and agriculture) threatens over 40 percent of the country's reefs. Threats to reefs are particularly prominent around Java and the Lesser Sunda Islands, Indonesia's most populated regions. In addition to sewage and sediment and nutrient runoff, heavy metal pollution is becoming more and more recognized in Indonesia, particularly around Jakarta. A number of people in Jakarta have become sick in recent years from consuming green mussels, which absorb the pollutants in Jakarta Bay. Other sources of pollution include chemical pollution from mosquito repellent and antibiotic contamination. Mosquito repellent is sprayed on each night to prevent malaria and then washed off into waterways the following day. In Indonesia, antibiotics are widely available without a doctor's prescription. Antibiotics primarily wind up in waterways via human waste.

Many coral reefs are not located close enough to major municipal areas to study the impacts of large urban populations (and their sewage) on reefs. However, a 2006 study (see Cleary et al.) of Jakarta Bay's coral reefs suggests that the impacts of urban areas can be substantial. The study sampled reefs extending from the northwest coast of Java to reefs 80 kilometers out into the bay. The researchers observed a clear "disturbance gradient," with coral richness, cover, and composition all declining with proximity to Jakarta. Located in Java, Jakarta is one of the largest urban areas in the world with a population of more than 10 million people. Only 5 to 10 percent of households in Jakarta are connected to water treatment infrastructure. The remaining households discharge sewage directly into waterways flowing into Jakarta Bay.

4. WRI's Local Threat Index includes threats to coral reefs from coastal development, watershed-based pollution, marine-based pollution, and overfishing and destructive fishing. For each local threat, an indicator was developed using data reflecting various "stressors," such as human population density and infrastructure features (including the location and size of cities, ports, and hotels), as well as more complex modeled estimates such as sediment input from rivers. Threat diminishes with distance from each stressor. Thresholds for low, medium, and high threats were developed using available information on observed impacts to coral reefs.

WATER QUALITY MONITORING

Decree Number 51 of 2004 by the State Minister of the Environment delineates water quality standards for "sea water" in Indonesia. Indonesia classifies its coastal areas into three major types of "waters:" port and harbor waters, marine tourism waters, and sea biota waters. Each category is subject to different water quality standards. A port/harbor refers to an area consisting of land and the surrounding waters used as a base for government administrative and economic activities and used as a place for vessels to drop passengers, unload, or load goods. Marine tourism refers to recreational activity or tourism on the sea and on shore. Sea biota simply refers to various types of life forms found in the sea.

Provincial governments must enact water quality standards equivalent to or more stringent than the standards set out by the national decree. Provincial governments must also measure water quality at least two times per year. Even though water quality monitoring is required by decree it is unclear how many of the provincial governments actually monitor water quality regularly. By law, the results of monitoring must be made public, but the results are not published online. For example, the government of Jakarta (Java Province) does regular monitoring of Jakarta Bay but the data can only be accessed by in-person visits to the government office that maintains the data.

COASTAL WATER QUALITY MANAGEMENT

While the national Ministry of the Environment sets standards for water quality, there is essentially no enforcement of these standards by the national government. Governance responsibility for coastal resources has been the responsibility of the Indonesian Ministry of Marine Affairs and Fisheries since 1999. However, the provincial governments are really left to enforce the standards set at the national level and to take responsibility for mitigating poor water quality.

There is no regulation in Indonesia specifically related to treatment of municipal or household sewage. Essentially all sewage from human settlement goes into rivers or directly into the ocean. Indonesia does have regulations mandating wastewater treatment for certain industries, but these regulations are often not enforced.

Only 5–10% of households in Jakarta are connected to water treatment infrastructure. The remaining households discharge sewage directly into waterways flowing into Jakarta Bay.

In some instances, local tourism authorities have taken it upon themselves to monitor water quality and address wastewater pollution. In partnership with a local NGO called the Wisnu Foundation, Bali's provincial government constructed integrated sewage and drinking water treatment infrastructure that serves the coastal population from the Kuta beach area to the Suluban beach area. Unfortunately, integrated drinking water and sewage infrastructure is expensive and likely only viable in tourism-exclusive areas or areas immediately surrounding major tourism areas. Outside of major tourism areas, there appears to be effectively no enforcement of water quality standards by provincial governments.

While there are a number of international and local NGOs and international development agencies working on Marine Protected Areas, sustainable fishing, and coral reef conservation in Indonesia, there appear to be few organizations working on management of sewage and wastewater.

One local NGOs that does focus on properly treating sewage water is the IDEP Foundation. IDEP is headquartered in Bali and has worked on projects across Java, Sumatra, Kalimantan, West Papua (including Raja Ampat), Sulawesi, and Nusa Tenggara. IDEP has also conducted a project in Timor Leste. For a number of years in Bali, IDEP built community "Wastewater Gardens," developed by the Biosphere Foundation to treat household sewage. IDEP has since shifted the focus of its sewage and wastewater program, and now focuses on working with local communities to minimize sewage disposal into rivers, mangroves, and concentrated cesspools or "dump sites." Most of IDEP's work focuses on developing community awareness and offering training and support for very basic sewage management—i.e., proper construction of septic tanks. IDEP also has a separate (and apparently more developed) program in Bali focused on reducing overuse of groundwater, which Bali depends on for its drinking water supply.

SUGGESTED RESOURCES

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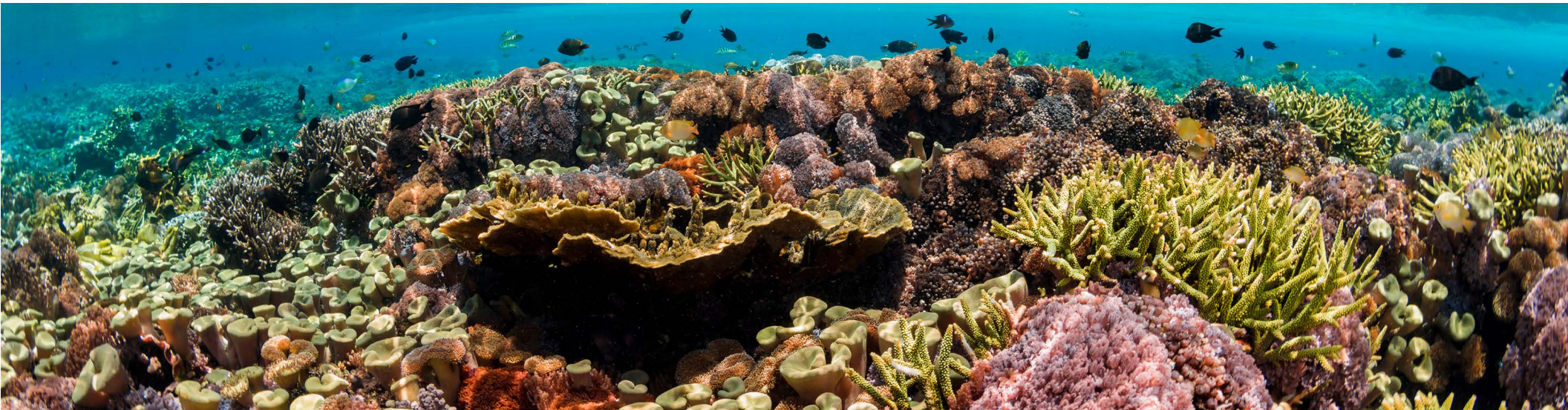
Coastal pollution threatens over 40% of Indonesia's reefs.

Komodo, Indonesia. Source: Beth Watson/ Coral Reef Image Bank



CASE STUDY

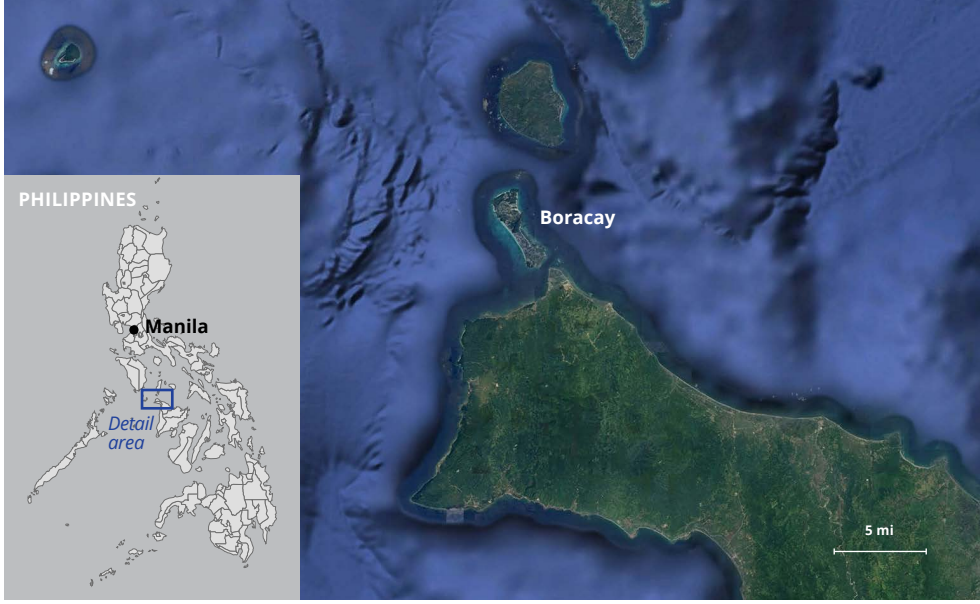
The Philippines

The waters of the Philippines contain about 9 percent of the world's coral reefs. More than 40 million people in the Philippines live within 30 kilometers of a coral reef and about 1 million fishers depend directly on reef fisheries. As of 2012, nearly 60 percent of the Philippines' reefs are threatened by coastal development and associated sewage. While the Philippines Clean Water Act sets strong standards for coastal water quality and mandates water quality monitoring, government does little to monitor or enforce these standards. Septic tank–based sewer systems dominate in the Philippines—even in Metro Manila.

COUNTRY OVERVIEW

The Philippines consists of about 7,641 islands divided into 17 regions and several levels of Local Government Units (LGUs). LGUs consist of 80 provinces, 138 component cities, nearly 1,500 municipalities, and more than 42,000 barangays (the smallest political unit). More than 40 million people in the Philippines live within 30 kilometers of a coral reef. About 2 million people depend on fisheries for employment and approximately 1 million fishers depend directly on reef fisheries.

The country's waters contain about 9 percent of the world's coral reefs, the third-largest reef area in the world behind Australia and Indonesia. The center of the country within the Verde Island Passage between Mindoro and Luzon and the Visayas region in the south contain the greatest concentration of marine biodiversity.



Many of Boracay's coral reefs have been irreparably damaged from years of poor water quality and poor tourism practices.

(facing) Aerial view of Boracay development. Source: iStock / Tatiana Nurieva; (above) Satellite map of Boracay. Source: Google Earth; Algal bloom in Boracay. Source: iStock / pashapixel

POLLUTION SOURCES

Based on the World Resources Institute's integrated local threat index,[5] nearly all coral reefs in the Philippines are threatened by local human activities. Sixty percent of the reefs in the Philippines are threatened by watershed-based pollution from agricultural runoff and erosion from deforested slopes. Coastal development and associated sewage threatens nearly 60 percent of the Philippines' reefs.

In addition to discharge of sewage into coastal waters, "reclamation projects" are another source of waste and sediment pollution in the Philippines' coastal waters. Reclamation projects refer to the process of transporting sediment from inland to fill coastal areas and create additional land for development. Reclamation projects are technically illegal without approval through a process that resembles a ballot referendum in U.S. elections. However, Local Government Units (LGUs) in the Philippines receive about 40 percent of their revenues from the national government and allotment is based on land-area, which creates incentives for LGUs to look the other way on illegal reclamation projects or serve as proponents of such projects.

WATER QUALITY MONITORING

The Philippine Clean Water Act of 2004 gives the national agency, the Department of Environment and Natural Resources (specifically, the Environment Management Bureau), responsibility for managing monitoring of water quality levels of both freshwater and ocean water. The actual monitoring falls on LGUs.

The Clean Water Act is quite comprehensive. Among other duties, it requires the Department of Environment and Natural Resources (in partnership with LGUs) to set effluent standards, categorize all point and non-point sources of pollution every two years, and report annually on the water quality of water bodies. However, it is unclear if the Environment Management Bureau and LGUs actually carry out water quality monitoring (and other requirements under the Clean Water Act) because information on water quality is almost never published or otherwise made available to the public.

5. WRI's Local Threat Index includes threats to coral reefs from coastal development, watershed-based pollution, marine-based pollution, and overfishing and destructive fishing. For each local threat, an indicator was developed using data reflecting various "stressors," such as human population density and infrastructure features (including the location and size of cities, ports, and hotels), as well as more complex modeled estimates such as sediment input from rivers. Threat diminishes with distance from each stressor. Thresholds for low, medium, and high threats were developed using available information on observed impacts to coral reefs.

More than 40 million people in the Philippines live within 30 kilometers of a coral reef.

Metro Manila. Source: iStock / Nikada; A channel in Manila. Source: iStock / rweisswald

COASTAL WATER QUALITY MANAGEMENT

The Clean Water Act mandates that each LGU construct sewage treatment facilities and specifically requires that Metro Manila and other "highly urbanized cities" (HUCs) construct piped sewage systems to manage domestic sewage collection, treatment, and disposal. In areas not considered HUCs, the Act requires LGUs to construct combined piped sewage and septic tank waste management systems. The Act also creates incentives for industrial water users to invest in industrial wastewater treatment collection and treatment facilities but largely leaves it up to industrial users to self-regulate. The Clean Water Act was passed in 2004, but as of 2019, piped sewage systems remain rare, even in Metro Manila.

However, in the past year the national government in the Philippines has exercised some of its power to protect water quality. In April 2018, Philippines President Rodrigo Duterte announced a six-month closure of Boracay—a popular tourist destination—until the island reformed its wastewater disposal and solid waste management practices. At the time of Boracay's closing, a survey found that 716 of 834 residential and business properties were dumping untreated sewage water directly into the sea. While the tourism ban has led to improvements in water quality, many of Boracay's coral reefs have been irreparably damaged from years of poor water quality and poor tourism practices (e.g., damage from ship anchors and divers).

The Philippines Department of Tourism is now scoping out other environmental hotspots such as El Nido (popular for diving) and Siargao (popular for surfing) to see if they would benefit from similar limits on tourism. The Philippines has experimented with tourism bans in the past, but some have questioned the effectiveness of these bans. When Thailand closed Maya Bay (a popular tourism destination) in 2018, tour operators simply moved to new locations, bringing tourists with them. It remains to be seen whether a similar pattern will emerge in the Philippines.

SUGGESTED RESOURCES

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Nearly all coral reefs in the Philippines are threatened by local human activities.

Dumaguete, Philippines. Credit: Gregory Piper / Coral Reef Image Bank