Climate Adaptation Toolkit for Marine and Coastal Protected Areas

Reduce Coastal and Nearshore Pollutants

An Adaptation Brief

Overview

Many coastal and nearshore marine habitats are impacted by nutrient loading and other pollutants, which may occur as point source pollution (i.e., direct discharge of pollutants from an identifiable source such as factory pipes) or non-point source pollution, which occurs when runoff from the land carries nutrients or contaminants into waterways and flow downstream, impacting coastal and nearshore habitats. Reducing nutrients and other pollutants improves water quality, increasing ecosystem health and resilience to climate stressors.

Identifying Climate and Non-Climate Vulnerabilities

Potential future changes and associated impacts of climate change on coastal and marine habitats and species include:

Warmer temperatures

- → Reduce the amount of dissolved oxygen
- → Increase harmful algal blooms, particularly during dry periods

Longer dry periods

- → Reduce freshwater inputs, affecting salinity

More frequent and/or severe storms

- → Increase flooding and alter sediment flow
- → Increase turbidity and changes in salinity due to sudden influxes of freshwater into the system

Ocean acidification

- → Changes water chemistry and reduces calcification rates in marine organisms

Climate changes such as those listed above are likely to exacerbate the negative impact of nutrient and other pollutant loading on coastal and nearshore habitats by further increasing runoff, concentrating contaminants in drying habitats, and enhancing the risk of harmful algal blooms in warmer waters, among other interactions.

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Reducing Vulnerabilities through Adaptation Actions

The following are examples of adaptation actions that may be used to reduce coastal and nearshore pollutants and/or nutrients, with the goal of reducing climate change vulnerability:

ACTION: Use forest or grass buffer strips to reduce agricultural runoff

- ✔ Slows and absorbs runoff, preventing excess sediment and fertilizer from entering waterways
- ✔ Reduces the risk of harmful algal blooms that occur in warm, nutrient-rich waters

ACTION: Improve stormwater management (e.g., by using bioswales and permeable pavement) **to reduce urban runoff**

- ✔ Decreases turbidity and drops in salinity associated with large influxes of freshwater into coastal/nearshore systems
- ✔ Reduces lethal and sub-lethal impacts of contaminants on fish and wildlife
- ✔ Reduces erosion of streambanks and channels

ACTION: Increase water quality testing designed to monitor nutrients, bacteria, and other pollutants

- ✔ Allows managers to evaluate the effectiveness of management actions and/or respond to changing conditions by adapting management plans and actions

Case Studies

The following case studies demonstrate how this adaptation strategy is being used to reduce climate change vulnerability in habitats ranging from mangroves to coral reefs.

INCREASING AWARENESS AND RESILIENCE OF COASTAL WETLANDS AND REEFS IN QUINTANA ROO

State of Quintana Roo, Mexico

The *Centro Ecológico Akumal* (CEA) incorporates **a water quality improvement program** into their conservation efforts, with the goal of increasing climate resilience of coastal wetlands, mangroves and nearshore coral reefs within the region.

In addition to gathering water quality data for a vulnerability analysis of the Mexican Caribbean region, the CEA is working to stop the use of shallow injection wells because polluted water can leak from these wells and release nutrients and toxins into coastal and nearshore areas.

For more information: ***Increasing Awareness and Resilience of Coastal Wetlands and Reefs in Quintana Roo case study***

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REDUCING FERTILIZER RUNOFF IN THE STATE OF QUEENSLAND

Great Barrier Reef of Queensland, Australia

Kyle Taylor via Flickr (CC BY 2.0).

Runoff of agricultural fertilizer into local waterways has degraded water quality in the Great Barrier Reef, with increased nutrient levels causing algal growth that drives coral-eating crown-of-thorns starfish outbreaks and has contributed to declines in coral cover across the Reef.

The Queensland Government's Reef Water Quality Program has funded a number of collaborative projects focused on reducing agricultural runoff. These efforts have included:

- **Providing one-on-one support to farmers for the development of nutrient management plans** that achieve productivity goals while also keeping fertilizer out of waterways
- **Piloting catchment repair and treatment systems**
- **Increasing local-scale water quality monitoring**
- **Supporting industry development of a voluntary best management practice system** that gives accreditation to farmers whose practices meet industry standards
- A variety of other programs and support tools that help sugar cane, banana, and horticultural farmers adopt improved farming practices that reduce nutrient runoff

For more information: ***Reducing Fertilizer Runoff in the State of Queensland case study*** and ***Queensland Government project webpage***

REDUCING NUTRIENT LOADING IN TAMPA BAY

Tampa Bay, Florida, United States

Pierre Markuse via Flickr (CC BY 2.0)

Tampa Bay, a shallow estuary on the west coast of Florida, experienced severe eutrophication in the mid-1900s as a result of rapidly increasing human population in the region. The Tampa Bay Estuary Program developed from a shared desire to restore and protect the bay's living resources, including its extensive seagrass habitat and estuarine-dependent fish and wildlife communities.

Efforts to reduce nitrogen loading have resulted in a 60% reduction in total nitrogen compared to the 1970s. Successful strategies have included:

- **Developing science-based targets** for nitrogen loads, chlorophyll a, and water clarity, with the goal of restoring seagrass cover to 1950 levels;
- **Reducing residential fertilizer** use through citizen-led initiatives
- Forming the Tampa Bay Nitrogen Management Consortium, a public-private partnership that has led over **250 watershed-based initiatives** addressing issues such as **stormwater treatment**, **fertilizer manufacturing**, and **agricultural practices**, among others.

For more information: ***Tampa Bay Estuary Program case study***

Key Resources

- **Intervention Options to Accelerate Ecosystem Recovery From Coastal Eutrophication**: A peer-reviewed article that discusses broad-based, comprehensive approaches to control eutrophication at an ecosystem scale.
- **Reef Protection Regulations and Best Management Practices for Farmers**: Includes information to help farmers comply with government directives designed to reduce runoff impacts on the reef.
- **ReefResilience.org**: Education, community involvement approaches, management strategies, case studies, and tools that include information on reducing threats (e.g., pollutants).
- **San Francisco Green Streets Program**: A program created by the San Francisco Estuary Partnership, which focuses on reducing urban runoff into the San Francisco Bay.
- **EPA Better Assessment Science Integrating Point & Non-Point Sources Climate Assessment Tool**: A tool that integrates environmental data, analysis tools, and watershed and water quality models to help inform watershed management and total maximum daily load (TMDL).
- **OpenNSPECT (Nonpoint Source Pollution and Erosion Comparison Tool)**: A broadly applicable tool used to investigate potential water quality impacts from development, other land uses, and climate change.
- **Suffolk County Harmful Algal Bloom (HAB) Action Plan**, New York: A synthesis report detailing the causes and impacts of harmful algal blooms, as well as potential management actions (e.g., addressing nutrient loading and runoff).

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This brief is based on adaptation strategies and case studies from the **Climate Adaptation Toolkit for Marine and Coastal Protected Areas (MPA Toolkit)**, an online resource created to make climate adaptation planning a simple, direct, and feasible process for marine protected area managers. The MPA Toolkit contains:

- A step-by-step guide to undertaking a Rapid Vulnerability Assessment for marine and coastal areas
- Structured and searchable adaptation strategy ideas with supporting case studies, reports and tools
- Foundational adaptation resources
- Selected experts who can be contacted for technical guidance

Find the Toolkit at https://www.cakex.org/MPAToolkit

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