Mangroves & Water Quality and Ocean Acidification in near-shore waters: an emerging challenge for coastal zones

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Objectives

- Monitoring erosion due to the action of organisms (bioerosion) & process by which organisms build their calcium carbonate skeletons (calcification) by the NOAA Coral Reef Monitoring Program.
- Calcareous tropical organisms at risk e.g. Crabs, Conch, Lobsters, Corals. Photos: D.Sanabria
- Provide high quality observations
- Decoupling the temporal & spatial variability
  • Physical & biological drivers
- Identify local sources of OA
- Near and long term ecological services affected
- Water Quality & OA Observations
- Provide information for management strategies
  • Inorganic carbon
  • pH, TCO2, TA, pCO2
  • Organic carbon
  • CDOM, Chlorophyll
  • Oceanographic
  • Temperature, Salinity
  • Biology
  • O2, calcification, bioerosion

Coastal Ocean Acidification Hot - Spots

Mangroves
Bio Bays
Reefs
Estuaries

Input
High-CO2 ocean water

Input
Low alkaline riverine waters

Area
High respiration of organic matter

Carbon Pathway – Indirect OA driver

1. Organic carbon inputs: primary producers (mangroves) & river runoff
2. Physical processes transport organic carbon to nearby ecosystems
3. Regional variations in the metabolic balance of ecosystems
4. Respiration is favored over production
5. OA increases because of increased production of CO2

Attention environmental managers

indirect anthropogenic mechanisms can strongly influence coastal pH and carbonate chemistry

Absorption @ 350 nm α to seawater dissolved organic matter

Local water quality criterion for pH ?

High saturation state (Ω) values provide optimal conditions for marine calcifying organisms to “build” their skeletons. Both, high pH and Ω occurred during the Winter and Spring seasons.

pH (the measure of acidity) is a pollutant under the Clean Water Act. The National water quality criterion for pH ranges from 6.5 to 8.5. It is necessary to understand pH variability of local reef waters before adopting a criterion for tropical coral reef systems.

Given the observed relationship between pH and Ω it is apparent that exposure to SW pH of 6.5 posses a major threat to corals. Therefore, the need for determining and adopting a local pH criterion.

Reef optimal conditions?

Aragonite Saturation State and pH climatology for La Parguera, Puerto Rico - 5 years

Optimal conditions - Winter & Spring

Business as usual scenario for 2100
Ω>3 Tipping point for corals is compromised

pH inter-annual maximum variability is 0.13 units

Increase acidity