Decision support framework for prioritizing reefs in the U.S. Virgin Islands



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50 % visit for coral reef

50 % won't return if reef quality declines

Structural Decline of Caribbean Coral Reefs



Decline of live corals in the U.S. Virgin Islands



Source: Pittman et al. (2014) Marine Protected Areas of the U.S. Virgin Islands: Ecological Performance Report. NOAA Technical Memo 187.

Why prioritize?





Coral reefs are not made equal Biology & Ecology Ecosystem Services & Value Stressors Connectivity Resilience



Limited resources result in tough decisions



Legal framework can dictate priorities (e.g. ESA, CWA)



Quantitative spatial framework supports transparent and rigorous evidence-based decision support

Development of a decision support framework



Step 1: Determine decision support needs in coral reef conservation

Step 2: Develop conceptual framework & acquire data

Step 3: Prioritize ecologically & economically important coral reefs

Step 4: Map exposure to stressors

Step 5: Identify priority reefs from most to least at risk

Step 6: Identify reefs for priority action

Bridging Science to Policy

Integrated social-ecological data



Biodiversity & habitat complexity



- New 20 m res bathymetry product
- High complexity = good predictor of high biodiversity



Mapping fish richness hotspots





Special and vulnerable places





Sites with known *Acropora* locations & Models of ESA coral distributions



Fish spawning aggregations



Reefs with permanent monitoring sites

Accounting for seascape connectivity



Connectivity maintains productivity, biodiversity & resilience



Source: Pittman & Olds 2015 Seascape Ecology of Fishes on Coral Reefs. In Mora C. Ecology of Fishes on Coral Reefs

Proximity of reefs to seagrasses & mangroves





Distance to seagrasses



Distance to mangroves



Harnessing local SCUBA diver knowledge

Participatory GIS via online mapping tool using Google Earth





87 occupational SCUBA divers (~ 8 yrs experience) 7,993 pins placed on reefs (92 avg. per person)



Exposure to stressors: land-based sources of pollution

Reef exposure mapping 1 km buffer



Summit to Sea Revisited

Thermal Stress History (1985-2012)



SST ~4 km



Tracking ship movements over coral reefs: Threat from pollution & re-suspended sediments







Ecosystem Services: Coastal Protection Value of Coral Reefs



Adapted from van Zanten et al. 2014

Van Zanten et al. (2014) Coastal protection by coral reefs: a framework for spatial assessment and economic valuation. Ocean & Coastal Management 96: 94-103.

Ecosystem services: Mapping Fisheries Value of Coral Reefs



Annual value of USVI fishery = USD 3.3 Million

How are reefs ranked and risk evaluated?



Evaluate Possible Actions



High Value + High Threat = Management Priority Level 1? High Value + Low Threat = Management Priority Level 1? Or Mixed Portfolio to spread risk?

Question driven prioritization to meet specific needs

Acropora presence + Poor water quality =

High biodiversity sites + High, medium & low cumulative threats =

Important tourism dive sites 🕂 High cumulative threats

High priority sites in proximity to proposed development

High priority reefs outside of existing MPA network

Reefs with highest exposure to historical thermal stress



Support for:

EPA Clean Water Act Endangered Species Act

Coral Reef Conservation Act





Management Applications

- Support permit evaluation & risk assessments
- Marine Spatial Planning
- Prioritize coral reef conservation actions
- Evaluate design of MPA network
- Assess and value ecosystem services
- Optimize monitoring strategies (multi-agency)



Next steps: Operationalization (2016/7)



Complete by Oct 2016

Happy evidence-based decision makers

Operationalization =

Challenge of creating a tool that will be used by people!

Thanks to the project team

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