Managing National Marine Sanctuaries in a Changing Ocean

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Ocean Acidification

• Human-released Carbon-dioxide ($CO_2$) is causing the ocean to become more acidic

• Acidic water makes it difficult for animals to make and maintain shells
Ocean Acidification at Olympic Coast NMS
Ocean Acidification at Olympic Coast NMS

- Waters in the region are particularly susceptible to acidification

- Waters are projected to increase in acidity up to 50% by 2100.

- Potential impacts:
  - larval shortages of mussels and oysters
  - regional disappearance of pteropods
Rising Ocean Temperatures

- As global temperatures rise, the ocean has taken up more than 90% of the excess heat

- Ocean temperatures are rising world-wide
Rising Ocean Temperatures at Stellwagen Bank NMS
Ocean temperatures in the region rising faster than 99% of the ocean due, in part, to shifting Gulf Stream. Potential impacts include shifting fish, increased lobster disease, shifts in prey important to endangered North Atlantic right whales.
Sea Level Rise

- Relative sea level is rising (or falling) at different rates in different places

- Melting glaciers and land ice contribute water to the ocean

- Warming expands, which is responsible for about 1/3 of sea level rise
Sea Level Rise at Papahānaumokuākea MNM
Sea Level Rise at Papahānaumokuākea MNM

- Sea level rise in the region is expected to be higher than the global average.

- Many islands in the monument could be submerged in the next 50-100 years.

- Potential impacts:
  - Loss of nesting and pupping habitat for seabirds, sea turtles, and Hawaiian monk seals.
Changing Storm Patterns

• Higher water temperatures fuel stronger storms while changing circulation alters their paths

• Some locations are expected to experience storms while others are expected to be impacted less frequently.
Changing Storms at Papahānaumokuākea MNM
Changing Storms at Papahānaumokuākea MNM

- Projections of stronger tropical storms tracking closer

- **Hurricane Walaka (2018)**
  - Caused extensive damage to a diverse coral reef
  - Caused East Islet to lose over 95% of its emergent land overnight
Changing Ecological Communities

• Climate impacts can interact with physical and biological factors to produce unexpected changes to ecological communities

• Changing conditions encourage range shifts and alter ecological communities
Changing Communities at Greater Farallones NMS
Changing Communities at Greater Farallones NMS

• High temperatures between 2012 and 2016
  • Triggered a cascade of events leading to the loss of 90% of the area’s kelp canopy cover

• Resulted in shift from kelp forest to urchin barren
How can we possibly address climate change?
Climate-Smart

SMART
Specific
Measurable
Achievable
Results-oriented
Time-fixed

- Management objectives and goals should be climate-SMART
Climate-smart planning cycle
Understand
Understand

• Gathering and synthesizing relevant climate data

• Greater Farallones NNMS’ Climate Change Impacts Report.

[Click to download!]

CLIMATE CHANGE IMPACTS

GULF OF THE FARALLONES AND CORDELL BANK
NATIONAL MARINE SANCTUARIES


Editors John Largier, Brian Cheng, and Kelby Higgason.

June 2010
Tools to Understand

• NOAA’s climate.gov
  • Science and information for a climate-smart nation

• Our Coast Our Future
  • Tools to help understand, visualize and anticipate vulnerabilities to sea level rise and storms

• The Climate Explorer
Plan

• Develop plan for accomplishing goals
  • Goals should be climate-smart!

• Strong guidance documents lead to a robust adaptation plan

• Greater Farallones NMS’ 2016 Climate Adaptation Plan
Tools for Planning

• **Climate Smart Conservation**

• **Guide for Planners and Managers to Design Resilient Marine Protected Area Networks in a Changing Climate**

• **Scientific Guidelines for Designing Resilient Marine Protected Area Networks in a Changing Climate**
Assess
Assess Climate Vulnerability

What is most vulnerable and why?
1. Select a resource
2. Answer questions about the resource regarding climate vulnerability
3. Compare relative vulnerabilities of resources
Climate Vulnerability Assessments

• Can and should inform planning and vice-versa

• Often the biggest step towards successful climate adaptation management
Many Sanctuaries have done this

• Gray’s Reef NMS: 17-person 1.5-day vulnerability workshop
• Greater Farallones NMS: 60-person 3-day vulnerability workshop
• Papahānaumokuākea MNM: series of workshops and interviews
• Olympic Coast NMS: plan to test a new strategy
• NMS American Samoa: workshops including local stakeholders and village leaders in addition to experts
Tools for Assessing Climate Vulnerabilities

• North American Marine Protected Area Rapid Vulnerability Assessment Tool

• Fourth National Climate Assessment Volume II: Impacts, Risks and Adaptation
Adapt
Adapt

Take Action!

• Develop and implement management actions to reduce climate vulnerabilities

• Greater Farallones NMS develops management actions as a result of the 2016 Climate Adaptation Plan
How to identify strategies and actions

Use the components of vulnerability as a framework
How to identify strategies and actions

Use the components of vulnerability as a framework

Courtesy of Sara Hutto
How to identify strategies and actions

Use the components of vulnerability as a framework

[Diagram showing the components of vulnerability: Exposure, Sensitivity, Potential Impact, Adaptive Capacity, Vulnerability]
How to identify strategies and actions

A few other ideas:
- Reduce non-climate stressors
- Enhance connectivity
- Protect refugia
- Promote education/outreach
- No active intervention

Courtesy of Sara Hutto
No Regrets

CLIMATE SUMMIT

WHAT IF IT'S A BIG HOAX AND WE CREATE A BETTER WORLD FOR NOTHING?

- Energy Independence
- Preserve Rainforests
- Sustainability
- Green Jobs
- Livable Cities
- Renewables
- Clean Water, Air
- Healthy Children
- Etc. Etc.
Tools for Adapting

• CEC/EcoAdapt Climate Adaptation Tool Kit

• Panorama: Solutions for a Healthy Planet Marine and Coastal Solutions
Monitor
Monitor

- Monitor to track the efficacy of the management actions, as well as the response of the resources

- Sanctuaries monitor the efficacy of their climate management actions

- Olympic Coast NMS as an Ocean Acidification Sentinel Site
Tools for Monitoring

- **CoastAdapt**: Monitoring and Evaluation in Climate Change Adaptation
- **Sentinel Sites**
- **NOAA Coral Reef Watch**
Evaluate
Evaluate

• Important to evaluate the effectiveness of the climate adaptation and mitigation

• Adapt management actions as necessary to improve resilience of the resources
Tools for Evaluation

• European Climate Adaptation Platform: Monitoring and Evaluation
Communicate
Communicate

Present at every step

• Sanctuaries integrate climate messaging across all programs

• Sanctuaries work with partners to commute local effects of climate change and actions we can take

• Greater Farallones NMS Ocean Climate Program Story map
An online toolkit designed for educators and communicators to teach about the impact of ocean acidification on Dungeness crab.
Communicate - Dungeness Crab Case Study

Partners in Development:
• NOAA National Marine Fisheries Service: Paul McElhany, Shallin Busch, Shelley Trigg
• NOAA Ocean Acidification Program
• National Marine Sanctuary Foundation
• USC Sea Grant
• NOAA Office of National Marine Sanctuaries
Sanctuary Advisory Councils

• Advise on many aspects of Sanctuary management

• Diverse areas of expertise

• Represent diverse community interests and help build partnerships
Partnerships

• Sanctuaries are always interested in climate change partnerships
What about climate mitigation?

• Growing level of interest within Sanctuaries

• Greater Farallones NMS conducted an Emissions Inventory
How does it all fit?

Condition Reports: **Assess** current conditions

Management Plans: set **management** strategies
How does it all fit?

Condition Reports: **Assess** current conditions

Management Plans: set management strategies

Climate Vulnerability Assessments: **Assess climate** vulnerabilities
We *can* manage our national marine treasures in the face of climate change.
Questions?

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