



**Climate Change Site Scenarios:
Gulf of the Farallones and Cordell Bank
National Marine Sanctuaries Pilot Project**

Kelley Higgason, GFNMS

MBNMS Advisory Council Meeting

October 22, 2009



BACKGROUND: ONMS CLIMATE CHANGE COORDINATION

ONMS Green Team

- ✓ Promote greening efforts throughout the system and sets minimal green standards

ONMS Climate Subcommittee

- ✓ Coordinate climate efforts into a cohesive national program
- ✓ Maximize ability to prepare for and protect resources
- ✓ ONMS as part of the larger climate effort within and outside of NOAA

Climate Smart Sanctuaries (in development)

- ✓ Site completes condition report, site scenario (climate story), and action plan (addressing research & monitoring, education & outreach, adaptive management specific to climate change at minimum)
- ✓ Site achieves minimal green operating standards

DRAFT ONMS SITE SCENARIO TEMPLATE

Main Climate Change Impact Drivers

Sea Level Rise

Variability in Weather Patterns

Ocean Circulation

Ocean Acidification

Interaction of Drivers with Other Stressors

Potential Changes, Impacts and Vulnerabilities

Ecosystem Resilience

Maritime Heritage/Cultural Resources

Community Adaptation and Natural Hazards

Potential Changes/Impacts to Society and Economic Sectors

GFNMS/CBNMS CLIMATE CHANGE SITE SCENARIO

Executive Summary

1. Introduction

2. Background

3. Physical Effects of Climate Change

3.1 Atmosphere

3.2 Precipitation and Land Runoff

3.3 Ocean Currents and Waves

3.3.1 Ocean Circulation

3.3.2 Waves

3.3.3 Coastal Upwelling

3.3.4 Estuarine Circulation

3.4 Sea Level Rise

3.5 Coastal Erosion

3.6 Ocean Water Properties

3.6.1 Temperature

3.6.2 Ocean Acidification

3.6.3 Salinity

3.6.4 Nutrients

3.6.5 Dissolved Oxygen

4. Regional Biotic Responses

4.1 Physiology

4.2 Range Shifts

4.3 Phenology

4.4 Population Connectivity

4.5 Plankton

4.6 Macroalgae and Plants

4.7 Invertebrates

4.8 Fish

4.9 Seabirds

4.10 Marine Mammals

5. Ecosystem and Community Response

5.1 Offshore Pelagic Habitat

5.2 Offshore Benthic Habitat

5.3 Offshore Island Habitat

5.4 Sandy Beach Habitat

5.5 Rocky Intertidal Habitat

5.6 Nearshore Subtidal Habitat

5.7 Estuarine Habitat

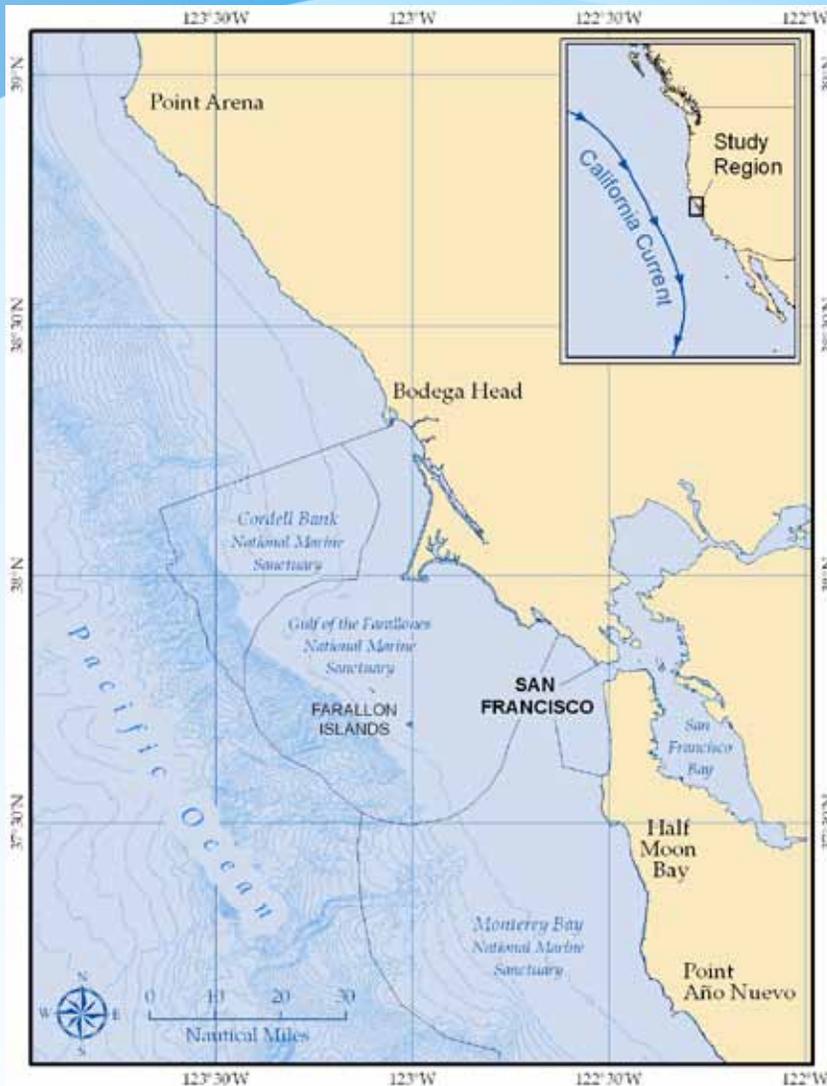
6. Multiple Ecosystem Stressors

7. Direct Impacts on Humans

8. Conclusion

“... outlines observed climate change effects in this region as well as changes that are considered to be highly likely and changes that are considered to be of notable concern (even if their likelihood is uncertain). It should not be considered an assessment of current conditions, or a prediction of future; instead it is a scoping document that discusses potential issues as they relate to a changing climate through both observation and science-based expectations.”

GFNMS/CBNMS CLIMATE CHANGE SITE SCENARIO



- Jointly developing with Cordell Bank NMS as pilot project for NMSS
- Downscale information - Point Arena to Año Nuevo
- WG of just under 30 scientists, project manager, coordinator, 2 superintendents
- 3 in-person meetings; WG helped author/edit sections; 1 year process
- Identifying relevant climate change impacts to habitats and biological communities
- Foundation to guide development and prioritization of R&M activities, ultimately informing future policy/management actions

GFNMS/CBNMS CLIMATE CHANGE SITE SCENARIO WORKING GROUP

November 4th

Time	Topic	Lead
10:45	Attendees arrive and light refreshments	
11:00	Welcome <ul style="list-style-type: none"> - Background on GFNMS and CBNMS - Explanation of site scenario document 	Maria Brown, Superintendent, GFNMS & Dan Howard, Superintendent, CBNMS
11:20	Outline agenda	Maria Brown, Superintendent, GFNMS & John Largier, Bodega Marine Lab
11:30	Introductions	Maria Brown, Superintendent, GFNMS
11:45	Discussion on drivers of regional change: Sea level rise	John Largier, Bodega Marine Lab
12:15	Lunch (provided)	
1:00	Discussion on drivers of regional change cont. (30 min each): <ul style="list-style-type: none"> - Winds and waves - Land runoff - Ocean circulation 	John Largier, Bodega Marine Lab
2:30	Break	
2:45	Discussion on regional environmental change (30 min each): <ul style="list-style-type: none"> - Upwelling and water types (TSNX) - Changing water chemistry (pH, CO₂, DO) - Shoreline erosion and inundation - Stratification and vertical mixing 	John Largier, Bodega Marine Lab
4:45	Summary	John Largier, Bodega Marine Lab
4:55	Wrap-up	Maria Brown, Superintendent, GFNMS
5:00	Adjourn	

GFNMS/CBNMS CLIMATE CHANGE SITE SCENARIO WORKING GROUP

November 5th

Time	Topic	Lead
8:45	Attendees arrive and light refreshments	
9:00	Review day's agenda	Maria Brown, Superintendent, GFNMS
9:05	Discussion on changing habitats (30 min each): <ul style="list-style-type: none"> - Pelagic - Estuaries and plumes - Shoreline and nearshore 	John Largier, Bodega Marine Lab
10:40	Break	
10:45	Discussion on first-order biotic impacts for both nearshore and offshore environments (30 min each): <ul style="list-style-type: none"> - Population range/distribution - Population connectivity - Phenology - Invasive species 	John Largier, Bodega Marine Lab
12:45	Lunch (provided)	
1:30	Discussion on other stressors	John Largier, Bodega Marine Lab
2:00	Discussion on biophysical impacts to humans	John Largier, Bodega Marine Lab
2:30	Discussion on linkages between drivers and impacts	John Largier, Bodega Marine Lab
3:00	Discussion on food webs	John Largier, Bodega Marine Lab
3:30	Break	
3:45	Summary	John Largier, Bodega Marine Lab
4:00	Next steps for this group and the site scenario document	Maria Brown, Superintendent, GFNMS & John Largier, Bodega Marine Lab
4:30	Wrap-up <ul style="list-style-type: none"> - Final questions and comments 	Maria Brown, Superintendent, GFNMS
4:45	Adjourn	

GFNMS/CBNMS CLIMATE CHANGE SITE SCENARIO WORKING GROUP

April 8, 2008

Time	Topic	Lead
9:15	Attendees arrive and light refreshments	
9:30	Welcome <ul style="list-style-type: none"> - Review process and timeline 	John Largier, U.C. Davis, Bodega Marine Lab & Brian Cheng, U.C. Davis
9:45	Discuss potential external referees for document	John Largier, U.C. Davis, Bodega Marine Lab
9:55	Discuss press conference	Kelley Higgason, GFNMS
10:05	Discuss authorship	John Largier, U.C. Davis, Bodega Marine Lab & Brian Cheng, U.C. Davis
10:15	Edits to site scenario document <ul style="list-style-type: none"> - Introduction - Drivers of Regional Change - Regional Environmental Change - Changing Physical Habitat Structure 	John Largier, U.C. Davis, Bodega Marine Lab & Dan Howard, CBNMS
11:30	Break, gather lunch (provided)	
11:45	Edits to site scenario document <ul style="list-style-type: none"> - Biotic Responses - Community/Ecosystem Responses - Additional Drivers of Change - Direct Human Impacts 	John Largier, U.C. Davis, Bodega Marine Lab & Dan Howard, CBNMS
1:00	Discuss key points to include in conclusion and gaps in information	John Largier, U.C. Davis, Bodega Marine Lab
1:40	Discuss future involvement in research recommendations for Ocean Climate Initiative Action Plan	Kelley Higgason, GFNMS & John Largier, U.C. Davis, Bodega Marine Lab
1:50	Wrap-up	John Largier, U.C. Davis, Bodega Marine Lab & Dan Howard, CBNMS
2:00	Adjourn	

GFNMS/CBNMS CLIMATE CHANGE SITE SCENARIO

TIMELINE:

- WG Meetings Nov 08 and April 09
- v.1 April 09, v2. July 09, v.3 Sept 09, v.4 Oct/Nov 09
- WG comments on current draft due 10/23
- Final draft distributed to WG for final review late Oct/early Nov 09
- Final draft goes to 3 week external peer review in Nov 09
- Final document anticipated December 09



FKNMS CLIMATOLOGIES



Integrated Marine Protected Area Climate Tool

Pilot study in the Florida Keys to develop climate decision-support tools for MPA managers



In the last decade, progress has been made in refining global climate models; however uncertainty remains about climate changes at finer geographic scales. Entrusted with the stewardship of many of the most ecologically, economically and socially important marine resources in U.S. waters, managers at NOAA's Sanctuaries need accurate and timely decision-making tools to take proactive steps in facing the threat climate change poses to the resources.

Basic climate information must be readily available to inform managers of current and expected climatic conditions in their specific region. Like their Marine Protected Area (MPA) colleagues at the local, state and regional level, sanctuary managers are generally ill-equipped to analyze raw climate data on their own. Rather, sanctuary managers require tailored products at scales appropriate to informing them of the status and trends of resources and the changes they should expect both locally and regionally as a result of a changing climate.

DESCRIPTION:

Building upon existing partnerships, NOAA will develop a comprehensive set of climate products, including climatologies, for MPAs through a pilot project at the Florida Keys National Marine Sanctuary (NMS).

This multi-year pilot project will involve:

- 1) creating long-term climatologies (current climate conditions, historical averages and extremes, ranges of possible changes) for the Florida Keys NMS;
- 2) assessing expected ecological responses of marine resources resulting directly or indirectly from climate change; and
- 3) evaluating the usefulness of the product in the field.

Through this exercise, the NOAA partnership hopes to

- 1) create a prototype decision-making tool for similar constituents, and
- 2) identify gaps in the data record necessary to refine global climate models to smaller geographic scales and adequately assess climate impacts.

These climate products will integrate historical atmospheric, oceanographic and biological data in order to establish a climatological baseline at the scale of an MPA, and will allow scientists and managers to better understand how marine resources may be affected by climate change within sanctuary boundaries.

Results from this work will be used by resource managers, researchers and policy makers alike as an important aspect of educational and outreach efforts, and will support NOAA's role in ecosystem-based science and management through marine spatial planning.

These climate products will improve overall management strategies and reduce uncertainty in estimating the effects of climate change on crucial marine resources.

NOAA Team: NESDIS/NCDC,NODC,STAR; NOS/ONMS, NCCOS, OCRM, NERRS; OAR/AOML; NMFS/Region, S&T Partners: University of South Florida; DOI/NPS FWS

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PILOT PROJECT TO:

- 1) create long-term climatologies (current climate conditions, historical averages and extremes, ranges of possible changes) for the Florida Keys NMS;
- 2) assess expected ecological responses of marine resources resulting directly or indirectly from climate change; and
- 3) evaluate the usefulness of the product in the field.

DATA DRIVEN AS OPPOSED TO LITERATURE REVIEW; MORE COSTLY

GFNMS OCEAN CLIMATE INITIATIVE

GOAL: Provide solutions on a local, state, and federal level through partnerships, research collaborations, education, and policy reform

- Ocean Climate Summit, April 2008: <http://sanctuaries.noaa.gov/science/conservation/higgason.html>
- GFNMS/CBNMS Climate Change Site Scenario Document, final anticipated December 2009
- Research Gap Analysis through Working Group
- Action Plan: Research & Monitoring; Education & Outreach; Policy & Planning; Green Operations

THANK YOU

**ONMS Headquarters Contact, Sanctuary Smart
Certification/Site Scenario:**

Elizabeth Moore

ONMS Headquarters Contact, FKNMS Climatologies:

Catherine Marzin

**Questions Regarding GFNMS/CBNMS Site Scenario
and Ocean Climate Initiative:**

Kelley Higgason