Climate-Smart Adaptation Working Group of the North-central California Coast and Ocean
April 22, 2015

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Gulf of the Farallones National Marine Sanctuary
Climate-Smart Adaptation for the North-central California Coast and Ocean

Goal
Protect and maintain healthy ecosystems by enhancing the resilience of species, habitats and ecosystem services to the impacts of climate change through collaboratively developed adaptation actions that are feasible, effective, and nature-based.
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Geographic Scope
Año Nuevo, San Mateo County to Alder Creek, Mendocino County
Two Big Questions:

1. How vulnerable to climate change are the species, habitats, and ecosystem services that we manage? [Phase 1: Vulnerability Assessment]

2. What can we do to limit or reduce vulnerability? [Phase 2: Adaptation Planning]
Climate-Smart Adaptation Process

Phase 1

1. Identify Conservation Target(s)
   - Species
   - Habitats
   - Ecosystems

2. Assess Vulnerability to Climate Change
   - Sensitivity
   - Exposure
   - Adaptive Capacity

Phase 2

3. Identify Management Options
   - Reduce Sensitivity
   - Reduce Exposure
   - Increase Adaptive Capacity

4. Implement Management Options
   - Changes in Policy
   - Changes in Practice
   - Institutional Changes

Glick et al. 2011 Scanning the Conservation Horizon
Phase 1: Vulnerability Assessment

Two Decision-Support Workshops:
1. Define focal resources (11 Feb 2014)
2. Assess resource vulnerability (10-11 June 2014)
Phase 1: Vulnerability Assessment
Phase 1: Vulnerability Assessment

- Sensitivity Narratives* + Score
- Exposure Narratives* + Score
- Adaptive Capacity Narratives* + Score

Overall relative vulnerability

Confidence Evaluation*

Vulnerability Assessment Report

Background literature

Peer Review

*documenting uncertainty
Climate Change Vulnerability Assessment for the North-central California Coast and Ocean
Phase 2: Adaptation Planning

Use assessment results to develop management strategies that will...

...in a variety of plausible future climate scenarios
Working Group Goal:

*Develop and prioritize climate-smart adaptive management recommendations that can be feasibly implemented by managers to reduce the vulnerability of select focal resources, while considering a range of plausible future climate scenarios for the region.*

*Recommendations will be presented to the Sanctuary Advisory Council at their November meeting in the form of a basic write-up.*
After the Working Group

Recommended actions presented to the Sanctuary Advisory Council

Internal planning process via a Sanctuary Implementation Plan

Made available to other management agencies via a Phase II Summary Report
Proposed Project Timeline

**Phase 1**
- 2014: Decision Support Workshops
- 2015: Vulnerability Assessment Reports
- 2015: Final Vulnerability Assessment

**Phase 2**
- 2015: Climate-Smart Working Group
- 2015: Presentation of recommendations to SAC
- 2016: Implementation Plan
- 2016: Phase 2 Summary Report
Today’s Objectives:

- *Determine which focal resources should be the focus of adaptive management recommendations.*
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• *Based on group exercise and discussion, select the top two or three most uncertain and impactful drivers of change in the region.*
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• *Determine which focal resources should be the focus of adaptive management recommendations.*

• *Based on group exercise and discussion, select the top two or three most uncertain and impactful drivers of change in the region.*

• *From these drivers, develop plausible future scenarios for the study region – these will serve as a framework for the development of adaptive management recommendations.*
Adaptation planning through the use of scenarios

Why scenario planning?

*Process to identify most robust management actions in an uncertain future. Proposed actions that find overlap among divergent scenarios will rise to the top.*
Today’s Objectives:

• *In small groups, build a storyline for each scenario and evaluate the potential implications of the scenario on the region’s most vulnerable resources.*
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- *In small groups, build a storyline for each scenario and evaluate the potential implications of the scenario on the region’s most vulnerable resources.*
- *Develop criteria for adaptive management recommendations.*
- *Determine future meeting schedule and work plan.*
# Climate-Smart Adaptation Working Group

<table>
<thead>
<tr>
<th>Time</th>
<th>Subject</th>
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<tbody>
<tr>
<td>8:45 – 9:00</td>
<td>Sign-in and Coffee</td>
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| 9:00 – 9:30 | Welcome and Introductions  
Anne Morkill, Working Group Chair, GFNMS Advisory Council |
| 9:30 – 10:00 | Project and Meeting Overview, Working group goals and tasks  
Sara Hutto, GFNMS |
| 10:00 – 10:30 | Vulnerability Assessment Results – which resources should we focus our adaptive management recommendations towards?  
Sara Hutto, GFNMS |
| 10:30 – 11:30 | Selection of scenario drivers – large-group exercise and discussion  
Sam Veloz, Point Blue Conservation Science |
| 11:30 – 12:30 | Small groups: Develop scenario storyline and report back to larger group |
| 12:30 – 1:30 | Lunch                                                                   |
| 1:30 – 2:30 | Small groups: Evaluate potential implications of scenario and report back |
| 2:30 – 3:45 | Next steps and close-out:  
- Feedback – what worked and what didn’t work?  
  Lara Hansen, EcoAdapt  
- Prep for next meeting  
  o Finalize criteria for management recommendations  
  o Set future meeting schedule and work-plan  
Sara Hutto, GFNMS |
Vulnerability Assessment Results

Low Vulnerability

High Vulnerability
ADAPTIVE CAPACITY

SENSITIVITY & EXPOSURE

Low (1)  Low-Mod (2)  Mod (3)  Mod-High (4)  High (5)

Low Vulnerability

Habitats

1. Offshore Rocky Reefs
   - Nearshore
2. Pelagic Water Column
   - Kelp Forest
   - Rocky Intertidal
     - Estuaries
3. Cliffs
   - Beaches & Dunes

High Vulnerability
Ecosystem services

SENSITIVITY & EXPOSURE

Low (1)  Low-Mod (2)  Mod (3)  Mod-High (4)  High (5)

Low Vulnerability

Recreation & Tourism
Food Production
Water Purification
Flood & Erosion Protection
Carbon Storage Sequestration

High Vulnerability
## SENSITIVITY & EXPOSURE

<table>
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<tr>
<th>Low (1)</th>
<th>Low-Mod (2)</th>
<th>Mod (3)</th>
<th>Mod-High (4)</th>
<th>High (5)</th>
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**ADAPTIVE CAPACITY**

**Low Vulnerability**

**Birds***
- Cormorant
- Common murre
- Tufted puffin
- Pigeon guillemot
- Cassin’s auklet

**Inverts***
- Copepod
- Gaper clam
- Mole crab
- Red abalone
- Sea urchin
- CA hydrocoral/red sponge

**Fish***
- Blue rockfish
- Pacific sardine
- Widow rockfish

**ALL SPECIES**

**High Vulnerability**

- Blue whale
- Black oystercatcher
- Snowy plover
- American dune grass
- Olympia oyster
- Sea palm
- CA mussel
- Pteropod
- Inverts*
  - Copepod
  - Gaper clam
  - Mole crab
  - Red abalone
  - Sea urchin
  - CA hydrocoral/red sponge

**Coralline algae**

**Tidewater goby**

**Southern sea otter**

**Black rail**

**Ashy storm petrel**

**Pacific krill**

**Ochre seastar**

**Fish***
- Blue rockfish
- Pacific sardine
- Widow rockfish

**American dune grass**
<table>
<thead>
<tr>
<th>Most impactful for top 3 habitats</th>
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<tbody>
<tr>
<td><strong>Climate Stressors:</strong></td>
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<tr>
<td>1. Wave action</td>
</tr>
<tr>
<td>2. Sea level rise</td>
</tr>
<tr>
<td>3. Coastal erosion</td>
</tr>
<tr>
<td>4. pH</td>
</tr>
<tr>
<td>5. Precipitation</td>
</tr>
<tr>
<td><strong>Non-Climate Stressors:</strong></td>
</tr>
<tr>
<td>1. Roads and armoring</td>
</tr>
<tr>
<td>2. Overwater/underwater structures</td>
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<td>3. Invasive/problematic species</td>
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Which resources should be the focus of your adaptation planning?

Our initial thoughts:
1) Focus on the habitat level, and species and ecosystem services will benefit as well
2) Focus on the top 3 most vulnerable habitats: beaches/dunes, estuaries, rocky intertidal
3) Develop list of vitally important species that may not be adequately addressed by habitats?
Considerations for Recommendations

• Consistency with project goal (protect and maintain healthy ecosystems by enhancing the resilience of resources)

• Feasibility
  – Cost
  – Capacity (who can do this?)

• Climate-Smart characteristics:
  – Effectively reduce vulnerabilities
  – Address near-term and long-term changes
  – Robust to uncertainty
  – Minimize carbon footprint
  – Adaptive and flexible
  – Avoid maladaptation (any unintended consequences?)
  – Mitigation benefit

• Important Species (e.g. eelgrass for estuarine habitat)
Working Group Workplan (proposed)

Next 2 meetings:

Goal: Develop adaptive management actions for the study region within each scenario.

Small groups will rotate through each scenario to:
1. Brainstorm potential adaptive management responses for each scenario (build upon work from previous small groups or start fresh?).
2. Evaluate how well each action will perform in the scenario.

Meeting 2 (June?): Each group works within 2 of the identified scenarios to brainstorm actions and evaluate efficacy.

Meeting 3 (August?): Each group works within the 2 remaining scenarios to brainstorm actions and evaluate efficacy.
Final Meeting:

Goal: Categorize and prioritize actions and make final recommendations.

1. Organize actions into categories - by resource, location, management type, timing, cost, or key climate stressor.
2. Screen actions against criteria to remove those that may not be feasible or may have unacceptable consequences.
3. Evaluate final list of adaptation actions using a criteria table that enables participants to score each action for each criterion.
4. Decide on final recommendations and develop a brief document to present to the advisory council.

Meeting 4 (October?): The working group comes back together to make final recommendations.