Current Coastal Change Research/Management Projects and Priority Information Needs in from Cook Inlet through Southeastern Alaska

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Outline

• Introduction: Why conduct a coastal change project synthesis?
• Methods:
  • Coastal change project definition
  • Project search
  • Synthesis of project information
• Results
• Summary
  • Utility for coordination and learning
  • Recommendations
Coastal Change Impacts

• Changes to species or habitat
  • Changes in species migration and spawning patterns
  • Species introduction / extinction
  • Coastal erosion
  • Ocean acidification

• Coastal Communities
  • Damage to infrastructure
  • Impacts to drinking water supplies
  • Changes to traditional subsistence use
Coastal research needs
Tillmann and Siemann 2011

- Funded by the NPLCC
- Reviewed the current state of the coast within the NPLCC region
  - CO₂ Concentrations, Temperature, & Precipitation
  - Major Climate Impacts on Marine & Coastal Environments
  - Implications for Marine & Coastal Ecosystems
  - Implications for Coastal Nearshore Habitats & Ecosystems
  - Implications for Species, Populations, & Communities
  - Implications for Key Fish, Wildlife, Plants, Plankton, & Shellfish
- Developed key information and research needs

Introduction
Why a coastal change synthesis

Benefits of a coastal project synthesis:
• Track existing projects
• Incorporate project findings
• Gauge remaining research gaps
• Prioritize future project support
Previous synthesis work

- WALCC report (Brown et al. 2015)
- Coastal Hazards Workshop
- 86 current coastal change projects (2010-2015)
- 33% of current projects met at least one of the recommended priority needs
- Key recommendations were underrepresented in the final database.
  - Bathymetry
  - Tidal benchmarks
- https://accap.uaf.edu/W_AK_LCC_Coastal_Change_Research
Project scope and goals

Goals

- **Short term:**
  - Create a coastal change database
  - Report that compiles current coastal change projects

- **Long term:**
  - Foster coordination of coastal change research in Alaska
  - Help practitioners and scholars learn from one another
  - Identify research gaps that need to be addressed
Project scope

• Alaska region of NPLCC
  • Cook Inlet – Southeast Alaska

• Provide continuity with Brown et al 2015

• Current coastal change projects
  • Ongoing or started or ended after October 31, 2010
Coastal change project definition

• Project criteria:
  • focus on **coastal drivers** (storms, erosion, sea level rise, nearshore sea ice)
  • projects in **coastal communities** that are investigating coastal change
  • **shoreline projects** (e.g. mapping, stabilization surveys)
  • **coastal habitat** (including estuaries and delta habitats)
  • **nearshore projects** (lagoons, eel grass communities)
  • **estuary projects**
  • **marine mammal** projects as they relate to their land or nearshore habitats
  • **subsistence projects** including **marine mammals** or **coastal birds**
  • **fish** projects at coastal sites

Methods
Identify existing projects

- Internet search
- Listservs
  - ACCAP, NPLCC, PNW Tribal CC Network, Southeast Alaska Fish Habitat Partnership
Identify existing projects

- Word of mouth and personal communication
- Sent out calls for information
- SE Alaska Climate Change Summit
- Confirmed projects with key experts in the region
Coastal change project contacts

<table>
<thead>
<tr>
<th>ABR, Inc.</th>
<th>National Center for Ecological Analysis and Synthesis</th>
<th>Sitka Sound Science Center</th>
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<tr>
<td>Alaska Climate Science Center</td>
<td>National Marine Mammal Lab</td>
<td>Sitka Tribe of Alaska</td>
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<td>Alaska Department of Environmental Conservation (DEC)</td>
<td>National Oceanic and Atmospheric Administration (NOAA)</td>
<td>Southeast Alaska Fish Habitat Partnership</td>
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<td>Alaska Department of Fish and Game (ADF&amp;G)</td>
<td>National Park Service (NPS), Coastal Research Program</td>
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<td>Alaska Native Tribal Health Consortium</td>
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<td>Tyonek Tribal Conservation District</td>
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<td>Pacific Northwest Tribal Climate Change Project</td>
<td>U.S. Geological Survey (USGS)</td>
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<td>City of Juneau</td>
<td>Pacific States Marine Fisheries Commission</td>
<td>U.S. Natural Resources Conservation Service (NRCS)</td>
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<td>Coastal Research and Education Center</td>
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<td>University of Alaska Anchorage</td>
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<td>Environmental Protection Agency (EPA)</td>
<td>Sealaska</td>
<td>University of Alaska Fairbanks, School of Fisheries and Ocean Sciences</td>
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<td>Greater Southeast Conservation Community</td>
<td>Kachemak Bay National Estuarine Research Reserve</td>
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<td>vegetation</td>
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Biological system projects:
- Birds
- Marine mammals
- Fish
- Vegetation
- Coastal/nearshore habitat

Human system projects:
- Subsistence
- Local observation
- Coastal change adaptation

Landscape-Geophysical projects:
- Coastal erosion
- Shoreline mapping
- Bathymetry
- Hydrologic
- Climatological

Oceanographic system projects:
- Biophysical processes
- Currents/waves
- Storm patterns
- Sea ice
- Tidal
## Identified research needs

<table>
<thead>
<tr>
<th>Gap Id</th>
<th>Headings for Information gaps from Tillmann and Siemann 2011</th>
<th>Current trend need identified for AK</th>
<th>Future prediction need identified for AK</th>
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<td>N</td>
<td>Altered food web dynamics</td>
<td>yes</td>
<td>yes</td>
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<td>R</td>
<td>Habitat loss, degradation, and conversion</td>
<td>yes</td>
<td>yes</td>
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<tr>
<td>S</td>
<td>Shifts in species range and distribution</td>
<td>yes</td>
<td>yes</td>
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<tr>
<td>T</td>
<td>Altered phenology and development</td>
<td>yes</td>
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<tr>
<td>U</td>
<td>Shifts in community composition, competition, &amp; survival</td>
<td>yes</td>
<td>yes</td>
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<td>V</td>
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<td>yes</td>
<td>yes</td>
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<tr>
<td>W</td>
<td>Sea and shorebirds</td>
<td>no</td>
<td>yes</td>
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<tr>
<td>Z</td>
<td>Pacific lamprey (Lampetra tridentata)</td>
<td>yes</td>
<td>yes</td>
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</table>
Total Coastal Change Projects

- Biological system (n=50)
- Human system (n=15)
- Landscape/Geophysical system (n=22)
- Oceanographic system (n=6)
Biological system projects

Results

- bird (n=6)
- coastal/nearshore (n=19)
- fish/shellfish (n=37)
- marine mammal (n=9)
- vegetation (n=8)
Human system projects

- climate adaptation (n=6)
- local observation (n=8)
- subsistence (n=11)

http://photos.lifeasahuman.com/
Landscape-Geophysical system projects

Results

- bathymetry (n=1)
- climatological (n=5)
- coastal erosion (n=1)
- hydrologic (n=17)
- mapping (n=5)
Oceanographic system projects

Results
## Identifying research gaps

<table>
<thead>
<tr>
<th>Gap Id</th>
<th>Headings for Information gaps from Tillmann and Siemann 2011</th>
<th>Current trend need identified for AK</th>
<th>Future prediction need identified for AK</th>
<th>Number of NLPCC projects addressing gap</th>
<th>Project IDs</th>
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<td>T</td>
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<td>U</td>
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<td>V</td>
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<td>yes</td>
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<td>W</td>
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<td>Z</td>
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</table>

### Results

Identifying research gaps
Overall identified research needs and gaps

• 75 of our 93 projects (81%) were meeting at least 1 identified gap
• For 43 projects (46%) met more than one research need; 15 projects met 3 or more identified needs.

Top categories of research needs being met included:
- U - shifts in community composition, competition, and survival (13)
- S - shifts in species range and distribution (16)
- Y - Pacific salmon (28)
- F - altered hydrology (11)

Research needs not being met (Gaps):
- G - altered ocean currents
- M - altered ocean productivity
- K - altered patterns of coastal hypoxia and anoxia

Research needs met by 1 project (Gaps):
- AA - Eelgrass
- A - CO2 concentrations
- C - precipitation
- H - altered frequency and severity of storms
- I - sea level rise
- J - Altered patterns of coastal upwelling
Research needs and gaps by focus area

Biological systems

• Priority research needs:
  • S (Shifts in species range and distribution)
  • T (Altered phenology and development)
  • U (Shifts in community composition, competition, & survival)
  • X (Pacific lamprey)
  • Y (Pacific salmon)
  • AA (Eelgrass)

• Projects meeting the research need Y (Pacific salmon) often also met need U (shifts in community composition, competition) and S (shifts in species range and distribution)

• 1 project mentioned AA (Eelgrass) habitat

Human systems

• None identified in Tillmann and Siemann
• Human systems are providing data and research for many other topic areas

http://www.habitat.noaa.gov/
Research needs and gaps by focus area

Landscape Geophysical systems

• No priority needs identified.
• All of research needs are being met by at least 1 coastal change project.
• However, unlike with research gap subcategories related to biological systems, the numbers of projects addressing these needs was smaller
  • A (Carbon dioxide (CO2) concentrations, n=1)
  • B (Temperature, n=2)
  • C (Precipitation, n=1)
  • L (Altered nutrient cycling, n=5)
  • P (Altered patterns of coastal erosion and increased coastal squeeze, n=3)
  • F (Altered hydrology, n=11)

Oceanographic systems

• Priority research needs:
  • D (ocean acidification)
  • E (increasing sea surface temperature)
  • G (altered ocean currents)
  • I (sea level rise)
  • M (altered ocean productivity)
  • K (altered patterns of coastal hypoxia and anoxia)
• Needs being met
  • D, E, & I
• Information gaps
  • G M & K
  • H, M & Q (not priority needs)
Summary

• Half of the projects described as biological; many classified as fish projects

• Few identified projects focused on oceanographic research

• Large portion of projects meeting identified scientific and research needs

• For several categories had many projects meeting needs: shifts in community composition, competition, and survivals, shifts in species range and distribution, Pacific salmon, and altered hydrology

• Gaps remain in the research areas of Eelgrass and Pacific lamprey and altered interactions in: non-native and invasive species, ocean currents, ocean productivity, patterns of coastal hypoxia and anoxia, frequency and severity of storms, patterns of coastal upwelling, and sedimentation patterns
Conclusions and recommendations

• Projects in the biological and landscape system projects well matched to identified needs but research gaps remain
• Some project types may be underrepresented
• Better data results in more complete analysis
• Mechanism for continued data sharing and collaboration

The goal of this effort is to identify current coastal research and management projects taking place in this region. Once identified, we will synthesize the information into a report that documents the project landscape for communities facing change, decision-makers navigating change, researchers pursuing projects, and agencies prioritizing where to allocate resources.

Requesting information regarding coastal projects in Southeastern Alaska and Cook Inlet

Michaela Swanson is compiling a list of projects taking place in Cook Inlet and Southeastern Alaska through conversations with key partners, researchers and stakeholder groups active in the region. If you are involved in a coastal change project underway in the region, please contact Michaela and she will add the project information to the database. Also, if you know of other projects in the region, please send Michaela any contact information of the appropriate people involved.

We are defining “coastal projects” as those that have at least one of the following criteria:

- Focus on coastal change (erosion, sedimentation, etc.), or sea-level rise

For more information, visit the ACCAP website:

https://accap.uaf.edu/NPLCC_CoastalChangeProjects
Acknowledgments

• NPLCC for funding
• Staff of the NPLCC and WALCC
• Reviewers and members of the NPLCC steering committee
• Allison Bidlack, Kathy Lynn, Davin Holen and Deborah Hart
• ACCAP
• University of Alaska Fairbanks
• Shorezone
• The stakeholders, students, researchers, community members and partners that submitted projects information!!
Questions

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