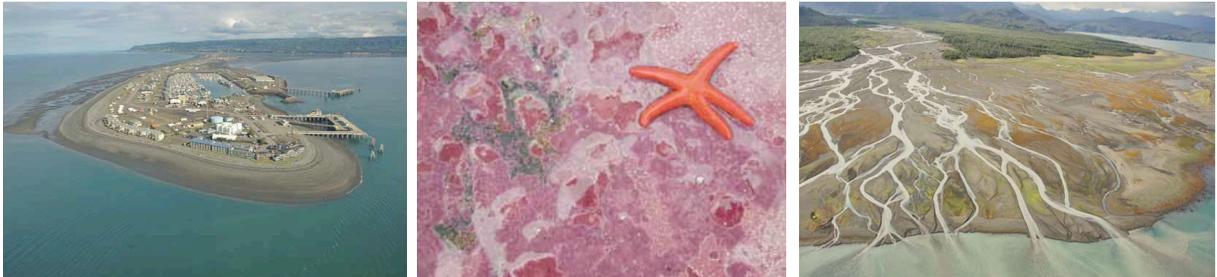


Alaska Center for Climate Assessment and Policy
Project Report

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

By
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Photos: Alaska ShoreZone

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

M.M. Swanson^{1,2} and S.F. Trainor^{1,3}

Abstract

Research on coastal change in the north pacific has increased rapidly in recent years, making it challenging to track existing projects, understand their cumulative insights, gauge remaining research gaps, and prioritize future work. Coastal resources and communities in the North Pacific have experienced the tangible impacts of climate change due to rising sea surface temperatures, increased seasonal precipitation, and a decline in marine pH levels. The goals of this project are to foster better coordination about coastal change studies, help practitioners and scholars learn from one another, identify existing research gaps, make research more transparent and easily accessible to stakeholders in the region, and provide a framework for better understanding how projects interact. To identify coastal change projects, we conducted an extensive internet search utilizing existing databases and online resources and sent out requests for information to stakeholders from a diverse range of university, state, federal, tribal and local institutions. Projects from the North Pacific Landscape Cooperative (NPLCC) Coastal Change Database were categorized into several topic areas. Of the 107 current coastal change research and management projects we identified throughout the Alaska portion of the NPLCC located from Cook Inlet in Southcentral Alaska through Southeast Alaska, over half (55%) of these were best described as biological system projects with research and analysis on coastal birds and bird populations, marine mammals, fish, vegetation, and coastal and nearshore habitats. Forty-six of the projects that were primarily biological in nature focused on Pacific salmon and often related to habitat, stream flow, and subsistence needs. These projects made up our largest keyword group overall, highlighting the importance of this species for the region. Human system, landscape geophysical system, and oceanographic system projects made up the remainder of the projects, 21%, 18% and 6%, respectively. The high number of projects related to biological systems represents the large amount of research focused on salmon, a very important resource for subsistence, recreation and commercial interests in the region. We analyzed whether identified current coastal change research projects were meeting identified gaps in current trends and future predictions for the region. Overall, a large portion of projects we identified were meeting known scientific and research needs in current trends and future predictions. However, this analysis suggests there is still work to be done in certain areas such as research on eelgrass and Pacific lamprey and altered interactions in several categories: 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. This report provides a synthesis of current research and management studies in the Alaska portion of the NPLCC that may (1) help to foster better coordination about coastal change in the NPLCC, (2) help practitioners and scholars learn from one another, and (3) identify information gaps that need to be addressed.

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List of Common Abbreviations

Alaska Center for Climate Assessment and Policy (**ACCAP**)
Alaska Department of Fish and Game (**ADF&G**)
Alaska Ocean Observing System (**AOOS**)
Coastal and Marine Ecological Classification Standard (**CMECS**)
Gulf of Alaska (**GOA**)
Landscape Conservation Cooperative (**LCC**)
National Estuarine Research Reserve's (**NERR**)
National Park (**NP**)
National Park Service (**NPS**)
National Oceanic and Atmospheric Administration (**NOAA**)
North Pacific Landscape Conservation Cooperative (**NPLCC**)
South Central Alaska (**SC Alaska**)
South Eastern Alaska (**SE Alaska**)
U.S. Fish and Wildlife Service (**UFWS**)
University of Alaska Anchorage (**UAA**)
University of Alaska Fairbanks (**UAF**)
University of Alaska Southeast (**UAS**)
Western Alaska Landscape Conservation Cooperative (**WALCC**)

Background and Prior Work

Research on coastal change in the North Pacific has increased rapidly in recent years, making it challenging to track existing projects, understand their cumulative insights, gauge remaining research gaps, and prioritize future work. Coastal resources and communities in the North Pacific have experienced and will increasingly experience the tangible impacts of climate change due to rising sea surface temperatures, increased seasonal precipitation, and a decline in marine pH levels (Tillmann and Siemann 2011). Ecosystem impacts also include an increase in coastal storm intensity, coastal erosion and habitat loss, and variations in sea level rise (Tillmann and Siemann 2011), while societal impacts include damage to infrastructure, impacts to drinking water supplies, and changes to traditional subsistence patterns (Burkett and Davidson 2012). Additionally, coastal ecosystems in this region are and have been impacted by other forms of anthropogenic change such as the 1989 Exxon Valdez oil spill and the resource harvest of multiple fish species from the Gulf of Alaska (GOA) and Southeast Alaska. Impacts from these forces can be expected to interact with those of projected climatic changes. The NPLCC region of Alaska has more than 15,000 miles of shoreline (USFWS 2010). Over $\frac{3}{4}$ of the population lives in coastal regions, which support more than 80% of the economy (USFWS 2006) of the region. Prior research has highlighted a range of potential environmental change impacts to coastal regions (Scavia et al. 2002), as well as linked social-ecological coastal vulnerabilities (Boruff et al. 2005), but has not focused specifically on the Alaska region.

In Alaska, state and federal agencies, non-profits and research institutions have all highlighted coastal change research needs (Cochran 2004, ADFG 2006, Hopcroft et al. 2008, State of Alaska 2008, Kinner 2009, State of Alaska 2009, Brubaker 2011, Golder Associates 2011, NOAA 2011). Many of these assessments agree that there is a need for more baseline data, including coastal mapping, wave and wind monitoring, and tidal benchmarks. Other common research needs include better understanding of severe storms, rising sea surface temperatures, coastal modeling for the North Pacific, community observations, and regional trends in ocean pH and other indicators of ocean acidification.

Multiple simultaneous projects, funded by groups such as the NPLCC, NOAA, NSF, AOOS, and others, exist in the NPLCC region. While significant progress has been made addressing research questions, an overall synthesis of coastal change research in the NPLCC has not been produced. This project identifies existing coastal change research in Cook Inlet, Southcentral and Southeast Alaska, synthesizes each project's focus, approach, and findings to document the research landscape for communities facing change, decision-makers navigating change, researchers pursuing projects, as well as funding agencies trying to prioritize where to

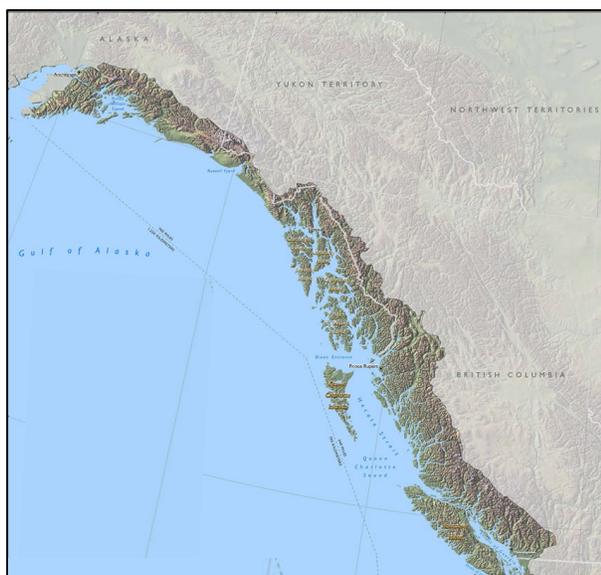


Figure 1. Geographic scope of North Pacific Landscape Conservation Cooperative projects

allocate resources. It will help decision makers and community members better understand existing research in the NPLCC region and its implications for their local area. It will also help researchers network, learn from, and collaborate with others exploring similar topics in the region. Finally, it will provide funders, specifically the NPLCC, with a compendium of current projects and analysis of the extent to which these projects address identified regional needs. Finally, this project will help the NPLCC meet its mission of coordinating, developing, and disseminating applied science to inform conservation in the context of climate change.

Goals:

The main goal of this effort is to identify current coastal research and management projects taking place from Cook Inlet in Southcentral Alaska through Southeastern Alaska.

Short Term: (1) Create a coastal change database that compiles current coastal change research occurring in Cook Inlet and Southeastern Alaska, and (2) to produce a report that compiles current coastal change projects occurring in the above geographic region.

Long Term: (1) Foster coordination of coastal change research in Alaska, (2) help practitioners and scholars learn from one another, and (3) identify research gaps that need to be addressed.

Objectives:

The specific steps to be taken in order to reach these goals are: (1) identify research projects that are occurring in the NPLCC region through existing databases and web-searches, (2) expand this list through interviews with NPLCC stakeholders, researchers, community members and others knowledgeable about research in the region, (3) confirm the list with help from key experts in the region, (4) compile information on each project from summaries, reports, publications, as well as conversations with PIs, (5) synthesize current efforts and create a readable and useful resource for understanding the current state of coastal research in the North Pacific, (6) compare current research efforts with identified information needs, and (7) disseminate results of the synthesis to both research and practitioner communities.

Previous Relevant Efforts:

In 2015, ACCAP completed the project “Current Coastal Change Projects and Priority Information Needs in Western Alaska.” The report synthesized information that was obtained from conversations with a diverse group of coastal contacts from the region, as well as an extensive internet search. The report summarized the list of projects into key disciplines and topic areas and then compared the list of current coastal projects to a list of key recommended needs identified from the 2012 Coastal Hazards Workshop. The work proposed here will expand upon ACCAP’s previous research, synthesis, and needs assessment of climate related research needs in Alaska.

Description of Methods

Coastal Project Definition:

The geographic boundaries for the project were defined by the regions of the NPLCC within Alaska, extending along the coastline from Southcentral through Southeastern Alaska (Figure 1). To provide continuity between this report and the previous report compiled for the

Western Alaska LCC we also included coastal land along Cook Inlet west of Augustine Island (Brown et al. 2015). We extended in-land only where projects were related to coastal changes (e.g. estuaries) or migratory populations (e.g. salmon spawning streams). All lands in this geographic scope will herein be referenced as those of the NPLCC.

Next, we defined “coastal projects” with help from NPLCC staff, as those that met at least one of the following 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 or species response projects (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 bird species/populations
- fish projects at coastal sites

Finally, we were interested in identifying existing or current projects, so we bounded our search by projects that were ongoing or had started or ended after October 31, 2010.

Identify Existing Projects:

We began our search by utilizing available online resources including the [NPLCC Website](#), [AOOS website](#), [Gulf Watch Alaska](#) and UAF, UAA, and UAS websites. We searched the web for research and studies related to coastal change in the North Pacific using combinations of terms including: coastal change, coastal research, coastal processes, climate change, North Pacific, environmental change, shoreline, coastline, global warming, southeast Alaska, Gulf of Alaska, and Prince William Sound. We added projects to our database as they were identified.

A range of stakeholders may be conducting coastal assessments, not all of which are documented in databases or websites. In order to connect with key coastal decision-makers we identified, with the help of NPLCC staff, a list of stakeholders and other interested regional partners. This list was composed of contacts with knowledge of the region from research institutions, local organizations, agencies, tribal councils and town governments. We contacted 86 individuals and institutions via email or phone and provided a project description, call for information and our contact information (Appendix A). Initially, we received a low (<5%) response rate. If we did not receive confirmation from our stakeholder contacts, we sent a second follow-up email.

To supplement this list, we initiated discussions with colleagues, funders, and long-term residents. This list was expanded through “word-of-mouth” and online requests for information on the Pacific Northwest Tribal Climate Change Network (PNW Tribal CC Network), the Southeast Alaska Fish Habitat Partnership, ACCAP, and NPLCC websites and list-serves. We used the Alaska Department of Fish and Game (ADF&G) database, the [Community Subsistence Information System: \(CSIS\)](#) (per personal communication: Davin Holen) to gather information on additional projects/contacts. During this phase, we confirmed the drafted list of current coastal change projects through communication with key experts who are familiar with the region and existing projects. We emailed a draft project list to the members of the NPLCC

steering committee as well as key experts identified in the area for review and suggestions for other projects.

Gather Information About Projects:

For each project that met our criteria, we collected information on the project, including name, internet link, the principle investigator(s), collaborator(s) or collaborating institution(s), contact information, geographic scope, project duration, funding source, funding amount and abstract/project description (Table 1). If this information was not available online or through existing databases, we attempted to contact the principle investigators to collect this information.

Summarize Existing Projects:

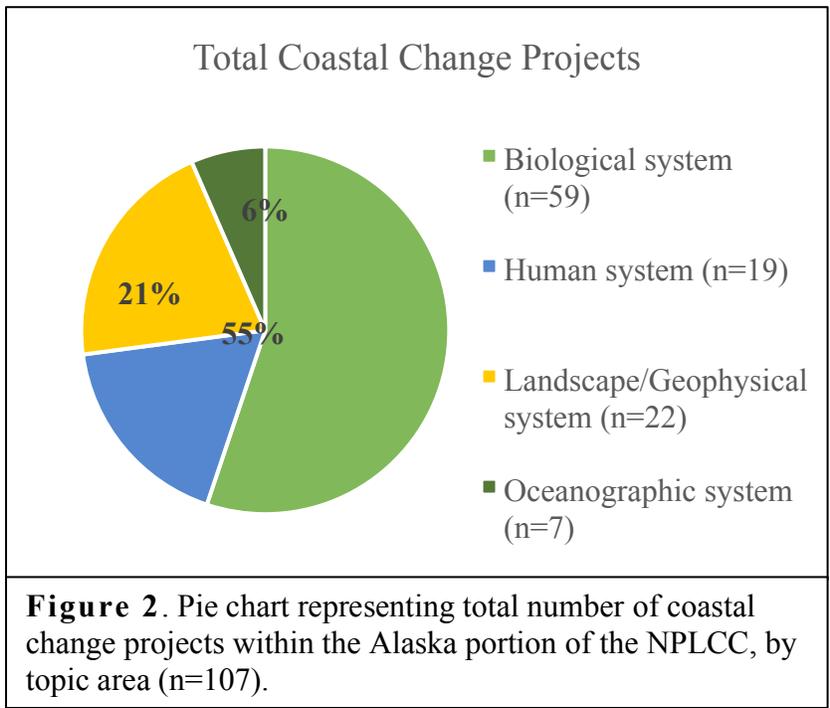
Once the information was collected for each project, we organized projects into topic areas. For consistency and comparison of coastal projects throughout the state of Alaska we used the topic and keyword definitions laid out by Brown et al. (2015). Topic areas included human systems, biological systems, landscape/geophysical systems, and oceanographic systems. These topic areas are broad in scope, however, are meant to facilitate a quick search by future users when utilizing the database.

Keywords for each topic area were given as a descriptor or term that identifies the primary focus or discipline for each project. Each keyword is related to one of the four focus areas. It is important to note that interdisciplinary or cross disciplinary projects will often have more than one focus. Thus, we assigned projects a primary keyword and a secondary keyword if necessary. Projects that have one focus will only have one keyword. For example, a study tracking salmon harvest will only be given the keyword FISH/SHELLFISH. Another project, documenting subsistence harvest of Pacific salmon, will be given two keywords FISH/SHELLFISH and SUBSISTENCE. We then totaled the number of project keywords to compare more specific research and studies across disciplines (Fig. 3-5). We organized the total number of projects in each topic area based on their primary keyword, which allowed us to compare current projects along the coastline from Southcentral through Southeast Alaska. We created a database that organized each topic area (based on their primary keyword) in Microsoft Excel. Projects in the database were assigned an ID based on their primary focus area using the letters: **B** (biological system projects), **H** (human system projects), **LG** (landscape geophysical system projects) and **O** (oceanographic system projects). They were also assigned a number based on the number of projects in each focus area. For example, **LG2** is the second project in the landscape geophysical focus area. In this report project IDs will be highlighted in bold text.

For those interested in learning more about particular projects the complete database can be downloaded from the ACCAP website: <https://accap.uaf.edu/>. The database provides a structure from which users can search projects by keywords, project names, location, etc., by sorting the excel database by their area(s) of interest.

Project Summaries

We identified 107 current coastal change research and management projects within the Alaska portion of the NPLCC from Cook Inlet in Southcentral Alaska through Southeast Alaska (Table 1). Projects were assigned a topic area based on their primary key word. Over half of the current research projects in this area were biological systems projects (n=59) (Figure 2). Eighteen percent of the projects were human system projects and 21% were landscape and

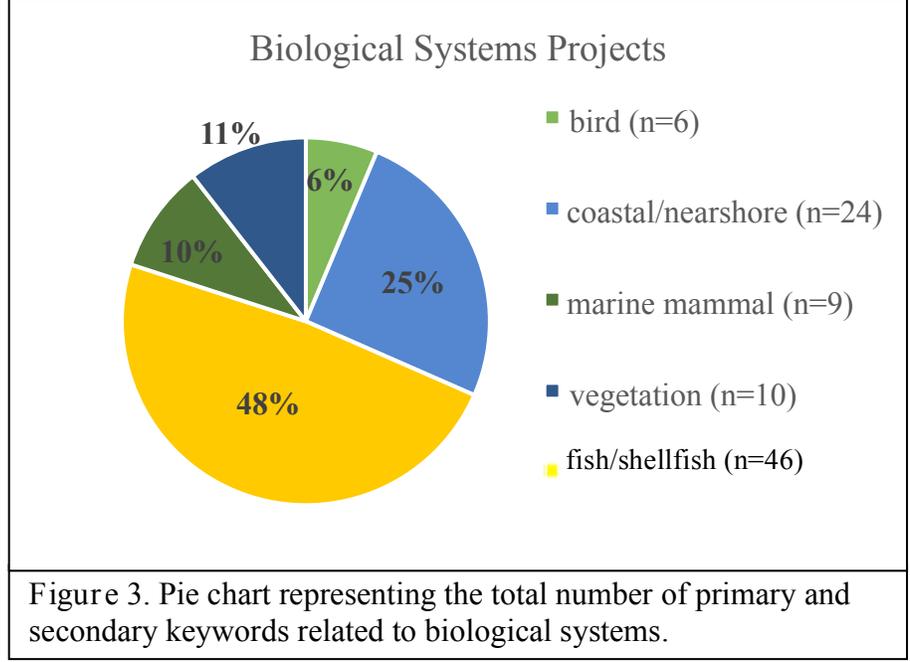


geophysical system projects (n=22). We identified relatively few oceanographic projects (n=6). The next section discusses projects grouped by keywords within each of these topic areas. However, it was common that projects could be well described by multiple keywords. For example, many fish projects were also hydrologic projects and so the category, fish includes projects that were described as fish by either their primary or secondary keyword. Figures show the total number of projects in groups of either

primary or secondary keywords.

Biological System Projects

This topic area includes projects associated with coastal and nearshore habitats, species and biological processes. The projects in this topic area were characterized by five keywords including: 1) bird, 2) marine mammal, 3) fish, 4) vegetation, and 5) coastal and nearshore habitat projects. Projects related to biological systems made up the largest proportion of projects we identified within the region; 85 projects in total (Figure 3, Table 1). Over half of these projects were fish or shellfish projects (n=46). Another large group were coastal and nearshore habitat projects (n=24). Projects related to



marine mammals (n=9), vegetation (n=10), and birds (n=6) had similar numbers (Figure 3, Table 1).

Bird Projects:

Bird projects focus on sea, shore or water bird populations in coastal areas of the NPLCC. Alaska is an important area for migratory bird species. The USGS, Kachemak Bay National Estuarine Research Reserve, Alaska Maritime National Wildlife Refuge, and the National Park Service (NPS) conduct ongoing annual monitoring of shorebird populations (**B11, B16, B45, B46**). Some projects investigate rare or otherwise important seabird species including Black-legged kittiwakes (*Rissa tridactyla*) (**B11**) and Kittlitz's murrelet (*Brachyramphus brevirostris*) (**B16**). A few projects (e.g. **B1**) focus on understanding the population dynamics and coastal habitats of these bird species. These projects provide managers information on diet, habitat use, colony dynamics and food abundance. Other projects focus on bird and marine mammal populations in protected areas like Glacier Bay National Park (e.g. **B11**).

Marine Mammal Projects:

Marine mammals are important constituents of marine ecosystems and are sensitive to variation in coastal conditions. Most marine mammal projects along the coast of the Gulf of Alaska and into Southeast Alaska focused on either sea otters (*Enhydra lutris*) (**B3, B5, B35, B36, 38**) or humpback whales (*Megaptera novaeangliae*) (**B10, B39, B40**). One study looked at whale populations in the wake of the 1989 Exxon Valdez oil spill (**B39**) and another looked at interactions between whales and salmon populations (**B40**). To do this work, researchers rely on the help and support of volunteers in citizen science projects (**B10**). Sea otters were once extirpated from the coastal Gulf of Alaska from trapping and the Exxon Valdez oil spill but their populations have recovered in this region in recent years. Sea otters are listed under the Endangered Species Act as threatened in California and Southwest Alaska. They are an important marine mammal in this ecosystem and can act as indicators of environmental change (**B36**). Additionally, research has been conducted to study the effects of sea otters as a marine mammal predator of commercially important fisheries by: 1) collecting data to estimate sea otter predation on shellfish at varying spatial scales as a function of history of sea otter habitation in southern Southeast Alaska, and 2) visiting communities and individuals affected by sea otter recolonization in southern Southeast Alaska to gain local and traditional knowledge and communicate project results (**B40**). The USGS conducts nearshore surveys of a wide array of marine birds and mammals throughout Glacier Bay National Park on an ongoing basis, most recently in March of 2016, to provide some idea of changes in abundance and distributions of marine animals.

Fish Projects:

We defined fish projects as those that occurred in coastal areas (e.g. river deltas or estuaries). Fish and shellfish projects made up the largest category of projects both overall and related to biological systems. This high proportion of projects from the biological systems represent the large amount of research in the regions that is focused on salmon (**B2, B7, B12, B13, B14, B20, B22, B23, B24, B25, B28, B29, B30, B34, B37, B39, B40, B41, B44, B50, B51, B52, B56, H2, H3, H4, H5, H6, H14, H15, H16, LG5, LG7, LG8, LG9, LG10, LG11**). This is not surprising as salmon are an enormously important resource for subsistence, recreation and commercial interests in the region. Salmon projects often focused on the health of nearshore and

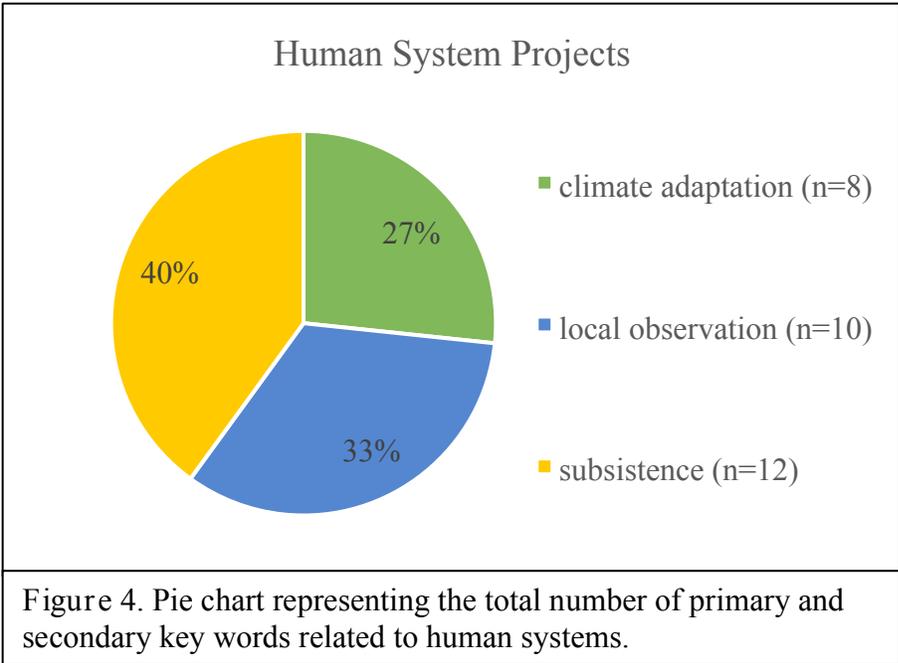
coastal habitats (B47, B48, B2). For example, the ADF&G Division of Sport Fish initiated a 2-phase project to investigate spatial and temporal fish habitat use patterns. Captured fish and measurements of biotic and abiotic environmental parameters were used to determine which habitat variables had significant association with the presence of juvenile Pacific salmon (B2). Many of the salmon projects were also related to subsistence (B12, B13, H3, H4) and hydrologic dynamics (LG11, LG5, LG6, LG7, LG8). ADF&G monitors annual harvests of salmon for subsistence and recreational purposes. Other projects looked directly at the projected implications of climate change on salmon health and survival (LG11, LG5, LG6, LG7), and the genetic changes in salmon populations that may result from these selection pressures (B29, B30). Other fish important to the region being studied include skate (*Bathyraja parmifera*) (B32), eulachon (*Thaleichthys pacificus*) (B4), Sablefish (*Anoplopoma fimbria*) (B53, B55) groundfish (B49) Pacific herring (*Clupea pallasii*) (B12), and Alaska halibut (*Hippoglossus hippoglossus*) (B33), but with much less frequency. One project (B5) investigated the impacts of sea otter recolonization on four commercially important species and their associated fisheries: southeast Alaska sea cucumbers (*Parastichopus californicus*), red sea urchins (*Strongylocentrotus franciscanus*), Dungeness crabs (*Metacarcinus magister*), and geoduck clams (*Panopea generosa*).

Vegetation Projects:

Vegetation projects focused on coastal and nearshore plant species (e.g. sea grasses). Vegetation projects made up a small proportion of projects related to biological systems (n=8). Rarely was research on vegetation the sole or primary component of the research (except B8); more often it was part of a larger project that focused on interaction between vegetation and fish (B14, B44) or effects on hydrologic dynamics (B8, LG12, LG13). For example, the University of Alaska Southeast and the Alaska Coastal Rainforest Center finished a project in 2015 that investigated “Stream discharge, snow-cover, soil drainage and yellow-cedar (*Cupressus nootkatensis*) decline in the NPLCC region of southeast Alaska.” The University of Alaska Fairbanks (UAF), College of Fisheries and Ocean Sciences (CFOS) is also conducting two projects looking at intertidal communities and kelp forests in Kachemak Bay (B43, LG12). One project in particular is looking directly at how the productivity and dynamics of the coastal Gulf of Alaska ecosystem will respond to anticipated future changes in environmental conditions and human disturbances within coastal waters. They have identified mid-trophic-level groups that act as critical energy transfer nodes between the plankton and upper trophic level groups and studied the dynamics of these groups in the face of past environmental variability (H8).

Coastal and Nearshore Habitat Projects:

Coastal habitats are areas along the coastline at the interface of land and sea (e.g. estuaries and deltas). The NPS has several ongoing projects in Glacier Bay that monitor freshwater (B7) and airborne (B17) contaminants in these delicate ecosystems. Several projects classified as coastal and nearshore habitat projects studied wetland and estuary ecosystems along the coast (B18, B19, B42, B52 B56, B58, LG3). For example, the Southeast Alaska Estuaries Initiative is focusing on determining the monetary value of Tongass estuaries and to disseminating data to develop information and elevate awareness of the value of the Tongass estuaries (B19). Other projects assessed the vulnerability of the coastal and nearshore regions to climate and other anthropogenic change, made specific predictions about the future health of



these ecosystems, and made recommendations for protecting and conserving these resources (LG4, B20, B47).

Human System Projects

This topic area includes projects that focus on communities within the NPLCC region and organizations or individuals being affected by coastal

change. Keywords for human system projects included: 1) subsistence, 2) local observation, and 3) coastal change adaptation. There were 19 current projects within this region that we classified as primarily human systems projects (Figure 2, Table 1). We found 12 projects related to subsistence activities including the harvest and use of wild resources. Eight projects assessed adaptations to anthropogenic or climatic changes and ten projects utilized observations from local residents of the area. Most (75%) of the projects with keywords related to human systems could be described with multiple keywords, most commonly fish/shellfish and coastal and nearshore habitats (Figure 4, Table 1).

Subsistence Projects:

Subsistence projects concentrate on the harvest and processing of wild resources for food, raw materials, and other traditional uses. ADF&G is involved in most of the subsistence research in this region of Alaska. They publish an “Annual Subsistence Salmon Report,” for all of Alaska (H4). In recent years, they have also investigated the harvest and use of wild resources through in-person interviews. In conjunction with the Sitka Tribe of Alaska (STA), ADF&G also monitors subsistence harvest of Pacific herring spawn in Sitka Sound on an ongoing basis and has published an annual report since 2011. ADF&G documents subsistence harvests in the area affected by Exxon Valdez oil spill. This ongoing harvest assessment compares current harvest and use of wild resources, including local perceptions of abundance and recovery of keystone species with earlier harvest assessments (H13).

Local Observation Projects:

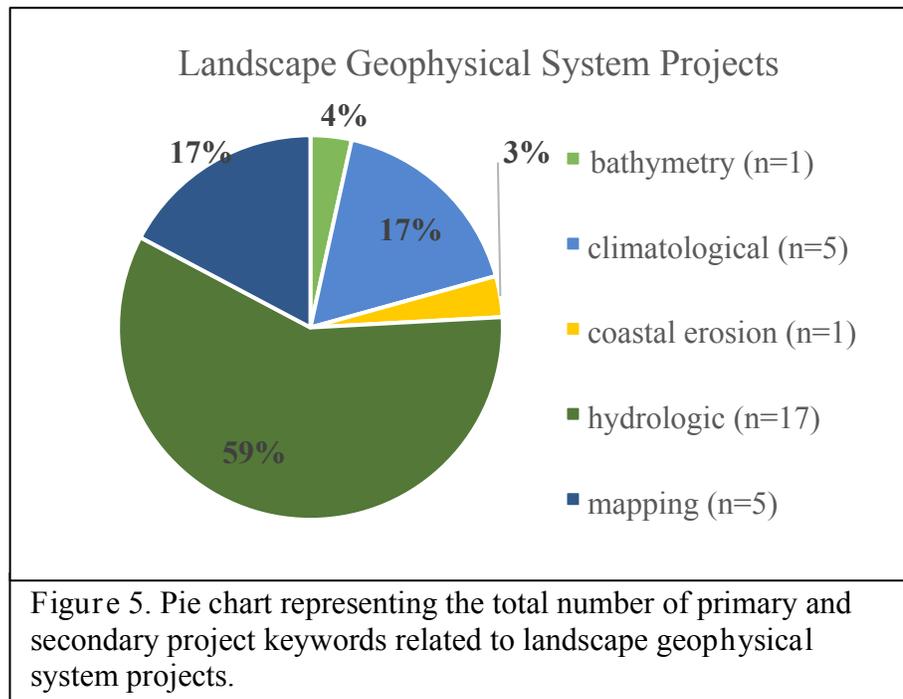
Local observation projects utilized both historic and current knowledge of community members to catalog, track, and compare changing coastal conditions. Projects by or collaborations with local and tribal leaders as well as volunteers and community members provides a more comprehensive picture of coastal changes which could not be accurately assessed with modern scientific methods alone. As mentioned above several local observation

projects were focused on the subsistence use of salmon and other local resources. Several local observation projects could also be described as biological (**B42, B9, B10, H2, H16, H17**) or landscape geophysical projects (**LG9, LG10**). Kachemak Bay National Estuarine Research Reserve is conducting a project titled, “Assessing Coastal Uplift and Habitat Changes in a Glacially Influenced Estuary System.” This project relies on local observations, and news articles on isostatic rebound from melting glaciers to understand changes occurring in Kachemak Bay (**B42**).

Coastal Change Adaptation Projects:

Coastal change adaptation projects are those that examine how individuals, families and coastal communities might adapt to changing resource and environmental conditions. For example, changing storm patterns, ice conditions, and marine wave and current activity can introduce various environmental conditions that adversely affect human activity and infrastructure in coastal areas. In one unique project funded by the NPLCC, the Organized Village of Kasaan (OVK), which is located on Prince of Wales Island, is conducting a project entitled, “Determine if climate change can affect the gathering calendar and natural resources.” OVK is investigating the effects of climate change on natural resources and ecosystems by conducting in-person interviews and establishing baseline data for the community (**H15**). The NPLCC is currently funding a project to assess climate adaptation in the Tongass National Forest (**H9**). The USGS recently completed a

study on pedestrian evacuation modeling for tsunami hazards in Alaskan coastal communities (**H10**)—a serious threat to coastal communities in this region. Projects with this keyword included a wide range of institutions including the Bamfield Marine Sciences Center (**H8**), Chilkoot Indian Association (**B4**), and the University of Hawaii-Manoa (**H1**).



Landscape Geophysical System Projects

This topic area includes projects that are related to geophysical processes along the coastline or nearshore stretches of land. It describes projects related to: 1) coastal erosion, 2) shoreline mapping, 3) bathymetry 4) hydrologic projects, and 5) climatological projects. Projects with a primarily landscape/geophysical focus made up about a quarter of our total

projects (n=22). The clear majority of projects with keywords related to landscape and geophysical system projects were related to hydrological dynamics. We found five projects related to mapping and climatological processes and only one project related to either coastal erosion or bathymetry (Figure 5, Table 1).

Coastal Erosion Projects:

Coastal erosion resulting from anthropogenic activity and environmental change is a serious concern for communities throughout the NPLCC. However, we only identified one project with this description. A project titled, “Alaska Native Village Adaptation to Climate Change Impacts and Disasters—Legal Barriers and Strategies for Resilience” is assessing coastal erosion in Alaska Native coastal communities throughout Alaska (**H1**). This project, to be completed in 2019, seeks to understand how Alaska Native communities are adapting to and planning for climate change (e.g. increased flooding, erosion, and subsistence impacts) and related disasters, and how different strategies either help or hinder adaptation. The investigators will assess how communities are assessing whether to remain in place or relocate, and how they might become more resilient in the face of continuing climate change, legal and institutional challenges, and the ability of Alaskan Native communities to obtain disaster declarations and funding.

Shoreline Mapping Projects:

Mapping the shoreline of the NPLCC is an important step in understanding coastal processes and measuring changes in coastal storm characteristics and impacts. We identified five current coastal mapping projects in this region (**LG3, LG10, LG21, LG22, H7**). NOAA is conducting a comprehensive mapping project for all of Alaska. The ShoreZone project is using a standardized coastal habitat mapping and classification system. Georeferenced aerial imagery has been collected throughout the state to integrate geological and biological features of the intertidal zone and nearshore environment. The Southeast Alaska portion was completed in 2011 (**LG21**), except for approximately 1,100 km of unmapped shoreline in Glacier Bay and the Barren Islands in the GOA which is expected to be completed in April 2016. ADF&G completed a coastal GIS module for Southeast Alaska in 2011 (**LG22**). Using the Federal Coastal Impact Assistance Program, the City of Juneau undertook a survey of coastal habitat in and around Juneau that will be used to enforce a no-development setback from salmon streams and to develop accurate wetland maps. Mapping projects were often associated with the biological components of coastal and nearshore habitats (**LG3, O2**) and in several cases overlapped in the human focus area (**H7, LG10**). The NPLCC funded Ecotrust to develop an open source, spatially explicit, conservation and restoration priorities tool that will assist in climate adaptation planning (**H7**).

Bathymetry Projects:

Bathymetry projects measure the depth of nearshore areas off the coast. We were only able to identify one current coastal bathymetry project for this region. The USGS and the NPS completed mapping of seafloor geology and potential marine benthic habitats throughout the West Arm of Glacier Bay NP between 2010 and 2013 (**LG14**). These institutions utilize multibeam sonar, ground truthed observations, and geological interpretations and follow the recently developed Coastal and Marine Ecological Classification Standard (CMECS). This research shows that the West Arm is divided into a dynamic upper fjord and a relatively static

lower fjord—two very different environments—and serve as baseline for ongoing and future mapping efforts. The USGS has completed other bathymetry projects in this region, but they were completed outside the date range for the scope of this analysis.

Hydrologic Projects:

Hydrologic projects were those that related to the movement, distribution, and quality of fresh water along the NPLCC coastline. The majority of these projects were related to glaciers. Hydrologic projects were our largest keyword group related to primarily landscape and geophysical process (**LG1, LG2, LG5, LG6, LG7, LG8, LG11, LG12, LG13, LG17, LG18, LG19, LG20**) and the second largest category overall. We found 22 total projects. The projects were most often associated with biological processes (**B7, LG2, B41, LG11, LG5, LG6, LG7, LG8, B8, LG12, LG13**), mainly fish and salmon or coastal and nearshore habitats. More than a quarter of the projects (**B8, LG13, LG1, LG17, LG18, LG19**) looked directly at the implications of increased stream flow, which is important for understanding the ecological implications that melting glaciers—predicted for this region—will have on salmon habitat and nearshore kelp communities throughout Southcentral and Southeast Alaska.

Climatological Projects:

Climatological was not a keyword used to describe projects in Brown et al. (2015). These projects were defined as those that involved understanding current or future weather conditions along the coastline of the GOA and Southeast Alaska that did not deal directly with storms or processes involved with waves or currents. We found five projects that could be defined by this keyword group (**LG4, LG9, LG15, LG16, O1**). The NPS and the Southeast Alaska Inventory and Monitoring Network conduct ongoing weather monitoring in Glacier Bay National Park (NP) and Klondike Gold Rush National Historic Park (NHP) (**LG15**). Climate conditions for the region have also been used in climate change vulnerability assessments such as the University of Alaska Fairbanks, Scenarios Network for Alaska and Arctic Planning's (SNAP) project, "Tongass National Forest Climate Change Vulnerability Assessment" (**LG4**) and the Forest Service's project, "Climate Change Vulnerability Assessment for the Chugach National Forest and the Kenai Peninsula" (**LG9**).

Oceanographic System Projects

This topic area is devoted to projects on ocean currents, waves, biochemical fluxes, and physical properties that occur within the oceans and coastal environments in our NPLCC focal area. In Brown et al. (2015) there were five keywords that described projects in this topic area including: 1) biophysical, 2) storm patterns, 3) wave/currents, 4) tidal projects, and 5) sea ice. Similar to the WALCC, the oceanographic topic area had the fewest total projects of any topic area in the NPLCC (n=7). We did not identify any projects within this region that related to storm patterns, wave/currents, tidal projects, and sea ice. All six of the projects that we identified were related to biophysical processes (Table 1).

Biophysical Projects:

Biophysical projects measure both biotic and abiotic processes in the marine environment. Many of the projects related to oceanographic systems are long-term or ongoing monitoring projects. Kachemak Bay Research Reserve operates an ongoing program known as

System-Wide Monitoring Program (SWMP) that started in 2001 (O2). The Kachemak Bay Research Reserve is part of the National Estuarine Research Reserve's (NERR) program operating at 28 sites nation-wide collecting baseline data for coastal and estuarine environments such as water temperature, salinity, dissolved oxygen, pH, turbidity, chlorophyll-a, and nutrients (nitrite + nitrate, ammonium, orthophosphate, and silicate). The NPS operates ongoing monitoring of marine contaminants in Glacier Bay NP, Klondike Gold Rush NHP, and Sitka NHP (O3). The Prince William Sound Science Center also monitors oceanographic conditions in the Prince William Sound in the wake of the Exxon Valdez Oil Spill (O6). Long term data sets such as these are important for addressing complex ecological problems/questions. For example, SWMP information is used to validate ocean circulation models to help understand the transport of larval organisms in the bay. Another study used modeling to study carbonate system variability in the northern GOA (O5).

Findings Summary

Of the 107 current coastal change research and management projects we identified throughout the Alaska portion of the NPLCC from Cook Inlet in Southcentral Alaska through Southeast Alaska over half of these were best described as biological system projects (n=59) with a focus on research and analysis of coastal birds and bird populations, marine mammals, fish, vegetation, and coastal and nearshore habitats. Forty-six of the 59 projects that were primarily biological in nature were focused on Pacific salmon and often related to habitat, stream flow, and subsistence needs. These projects made up our largest keyword group overall, highlighting the importance of this species for the region. Human system projects, or those focused on subsistence, local observations and climate adaptation, made up 18% (n=195) of total projects. Overall this number is less than were found along the coastline of Western Alaska in 2015 (Brown et al. 2015). We suspect that more current human system projects exist in the region. For example, local observation projects, by their very nature, are often small-scale community based projects not published on websites or in online databases, thus making it harder for researchers and managers to access their objectives, methods or findings. While we made significant efforts to find such projects we believe that these projects may be under represented in our database. Landscape and geophysical system projects made up 21% of the total projects (n=22). We identified a relatively small group of projects primarily described as oceanographic projects (n=7) and entirely composed of projects related to biophysical processes. Additionally, we identified few projects related to bathymetry and coastal erosion, and no projects related to storm patterns, waves and currents, tidal projects, or sea ice—previously described keywords used to categorize projects along the Western Alaska coastline (Brown et al. 2015).

We were often unable to obtain funding amounts for projects; however, we did collect this information for 52 of the 107 projects. We estimate the total cost of coastal change research for these 52 projects to be just approximately 14 million dollars. We believe that this is an underestimate as many PIs indicated that they were not including salary costs that may be funded by their primary research institution such as the University of Alaska. Nevertheless, this estimate underlines the enormous amount of resources directed at coastal change research in the region.

Research Needs and Current Research Gaps

In 2011, the NPLCC funded a project titled, “Moving from Impacts to Action: Expert Focus Groups for Climate Change Impacts and Adaptation Strategies in Marine and Freshwater Ecosystems of the NPLCC.” For this project twelve expert focus groups met to discuss climate change effects and adaptation strategies in marine, coastal, and freshwater ecosystems, challenges of science or research tool gaps, and climate impacts in terrestrial ecosystems. One result of these focus groups was the publication of a report, “Climate Change Effects and Adaptation Approaches in Marine and Coastal Ecosystems of the North Pacific Landscape Conservation Cooperative Region” (Tillman and Siemann 2011). This report provides detailed information, data and analysis of current trends and projected future implications of environmental change throughout the region, as well as pointing out gaps in research in each of these categories. Tillmann and Siemann also rely on two documents written by Sigler et al. in 2008 titled, “Forecast fish, shellfish and coral population responses to ocean acidification in the north Pacific Ocean and Bering Sea: An ocean acidification research plan for the Alaska Fisheries Science Center,” and “In climate impacts on U.S. living marine resources: national marine fisheries service concerns, activities and needs,” to discuss coastal research gaps in the region.

Tillman and Siemann organize their report into 5 sections: (1) CO² concentrations, temperature, and precipitation, (2) major climate impacts on the marine and coastal environments, (3) implications for marine and coastal ecosystems, (4) implications for near-shore habitats and ecosystems, (5) implications for species populations and communities, and (6) implications for key fish, wildlife, plants, plankton, and shellfish. Within each of these larger subsections there are more specific categories. For instance, sea level rise is a subsection under the category (3) implications for marine and coastal ecosystems. To identify which gaps were and were not addressed by the current coastal change research we identified, we matched the Tillmann and Siemann subcategories to one of our four focus areas (biological, human, landscape geophysical, and oceanographic systems) and determined which of the projects within in our focus areas were meeting identified research needs. Identified coastal projects had already been assigned a focus area and keyword and given a project ID such as LG13. In addition to these assignments, we gave all the specific subcategories in Tillmann and Siemann a letter (A-Z and AA-BB). This report refers to these letters, representing subcategories, as gap IDs. Thus, all identified projects have a project ID, one or two keywords and between zero and three gap IDs depending on how many research needs they are addressing. Project IDs and Gap IDs are indicated with bold type. Table 2 documents the research needs identified in Tillman and Siemann by gap ID and lists current coastal change projects we identified that address these scientific data gaps and research needs as a main component of their work.

We found that overall 89 of our 107 projects (83%) were meeting at least one identified research need/gap (Table 2). Fifty projects (47%) met more than one research need, and 17 (16%) projects met three or more identified needs. The top categories of research needs being met included **U** (shifts in community composition, competition, and survival n=19), **S** (shifts in species range and distribution, n=18), **Y** (Pacific salmon, n=32) and **F** (altered hydrology n=14). However, there were some research needs identified that were only met by one identified project (**AA** Eelgrass, **A** CO₂ concentrations, **C** precipitation, **H** altered frequency and severity of storms, and **J** altered patterns of coastal upwelling), and some that were not addressed at all including: **G** (altered ocean currents), **M** (altered ocean productivity) and **K** altered patterns of

coastal hypoxia and anoxia). Tillman and Siemann also discuss the essential need for vulnerability assessments. Since this report was released there have been several projects that have conducted this important work in specific regions including the Tongass National Forest (LG4) and the Chugach National Forest and the Kenai Peninsula (LG9).

Biological systems

This category contained about half of the current coastal change projects we identified and likewise there were many research needs addressed by projects related to biological systems: (N altered food web dynamics, P altered patterns of coastal erosion and increased coastal squeeze, R habitat loss, degradation, and conversion, S shifts in species range and distribution, T altered phenology and development, U shifts in community composition, competition, and survival, V altered interaction with non-native and invasive species, W sea and shorebirds, X shellfish, Y Pacific salmon, Z Pacific lamprey, AA Eelgrass and BB Plankton) (Table 2). Some research needs were highlighted as specifically lacking in the Alaska region of the NPLCC including: S shifts in species range and distribution, T altered phenology and development, U shifts in community composition, X shellfish, Y Pacific salmon, and AA Eelgrass. Most of these gaps have been or are currently being addressed by several projects related to biological systems: S (shifts in species range and distribution, n=18), T (altered phenology and development, n=4), U (shifts in community composition n=19), X (shellfish, n=8), Y (Pacific salmon, n=32). For example, Tillman and Siemann indicate that information is needed to understand the genetic adaptation and phenotypic plasticity of salmonids in response to climate change, and the consequences for abundance, distribution, and survival for Pacific salmon species. One project by ADF&G (B34) is meeting this research gap. Additionally, projects meeting Y (Pacific salmon) were often associated with U (shifts in community composition, competition) and S (shifts in species range and distribution) (B20, B28, B34, H6, LG8). However, only one project mapping area along the coastline mentioned Eelgrass habitat (LG21) revealing a research gap for this region.

Human systems

Tillman and Siemann did not specifically describe any data and research needs with topics related to human systems. Nevertheless, coastal change projects considered primarily related to human systems are providing data and research for many other topic areas including: N (altered food web dynamics, H8), R (habitat loss, degradation, and conversion, H14, H7), S (shifts in species range and distribution, H15, H2, H6), U (shifts in community composition, competition, & survival, H15, H2, H6), V (altered interaction with non-native & invasive species, H14), Y (Pacific salmon, H11, H12, H13, H2, H3, H4, H5, H6), BB (plankton, H8), and P (altered patterns of coastal erosion and increased coastal squeeze, H1, H14) (Table 2). In particular, these reports are contributing to several research areas where gaps in research and data are being met with few other projects (e.g. plankton and coastal erosion).

Landscape geophysical systems

Identified gaps related to landscape geophysical systems include A (CO2 concentrations), B (temperature), C (precipitation), F (altered hydrology), L (altered nutrient cycling), and P (altered patterns of coastal erosion and increased coastal squeeze) (Table 2). Unlike for other topics (e.g. biological systems, oceanographic systems) no sub-categories of research needs were identified as particularly lacking from either the GOA or SE Alaska. In fact, there were no data

gaps in either current trends or future predictions for subcategories: **A** (CO₂ concentrations), **B** (temperature), and **C** (precipitation). However, Tillmann and Siemann note that research is needed on data gaps of precipitation extremes and models specific to precipitation and streamflow patterns. Climate information and predictions for watershed and ocean habitats are needed as well as future projections for global patterns of nutrient cycling and quantitative data for the extent of current and projected erosion at different locations within the NPLCC geography (2011). All of these research gaps are being met by at least one coastal change project. However, unlike with research gap subcategories related to biological systems, the numbers of projects addressing these needs was small: **A** (CO₂ concentrations, n=1), **B** (temperature, n=2), **C** (precipitation, n=1), **L** (altered nutrient cycling, n=7), and **P** (altered patterns of coastal erosion and increased coastal squeeze, n=3). While the small number of projects is of note, it may reflect the abundance of sound and robust data for Alaska that already exists in these categories as they were not identified as a prominent research need. The exception was for projects meeting **F** (altered hydrology, n=14) that had a relatively large number of projects associated with (**Y**, Pacific salmon).

Oceanographic systems

There were a number of data and research gaps in current trends and future predictions for categories related to oceanographic systems: **D** (ocean acidification), **E** (increasing sea surface temperature), **G** (altered ocean currents), **H** (altered frequency and severity of storms), **I** (sea level rise), **J** (altered patterns of coastal upwelling), **M** (altered ocean productivity), **Q** (altered sedimentation patterns), and **K** (altered patterns of coastal hypoxia and anoxia) (Table 2). There were six research needs noted that were particularly lacking in data for the Alaska region of the NPLCC: **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). GOA surface and vertical ocean pH and carbon specific measurements are needed (Siemann and Tillmann 2011). Sigler et al. (2008) indicated the Tate fine-scale surface and vertical temperature, salinity, oxygen, and nitrate and chlorophyll fluorescence data are needed. It is also important that we gather data to understand changes in ocean circulation in the GOA such as sea level and pressure maps, and on regional scale atmospheric circulation including winds. Trends in hypoxia and anoxia off the coasts of Southcentral and Southeast Alaska were also underlined as a research need (Siemann and Tillmann 2011). We did not have many projects in this focus area so it is unsurprising that there were several related research gaps related that were unaddressed. Of the gaps in current trends and future predictions especially important for this region of Alaska only three are being addressed by identified current coastal change projects. **D** (ocean acidification, n=2, **B6**, **LG20**), **E** (increasing sea surface temperature, n=5), **LG20**, **O1**, **O2**, **O5**, **O6**), and **I** (sea level rise, n=3, **B47**), and the number of projects meeting research needs in these categories were not especially large. Thus, the areas of **G** (altered ocean currents) **M** altered ocean productivity, **K** (altered patterns of coastal hypoxia and anoxia) remain under addressed and important areas of coastal change research for the Alaska portion of the NPLCC; as do **H** (altered frequency and severity of storms, **B6**), **J** (altered patterns of coastal upwelling, **LG18**), **Q** (altered sedimentation patterns, **B42**, **LG14**), as they have few projects meeting these needs as a primary component of their research or investigations.

Conclusions

It is encouraging that a significant portion of projects we identified were meeting known scientific and research needs for the region. However, this analysis suggests there is still work to be done in certain areas. In general, projects related to biological and landscape geophysical systems were well matched to the categories of needs identified in Siemann and Tillmann (2011), though some categories had a small number of matched projects such as **AA** (eelgrass), **V** (altered interaction with non-native & invasive species) and **Z** (Pacific lamprey). Projects related to Salmon have a very high number of projects (n=32) meeting this research gap considering that Tillman and Siemann do not indicate that the data is particularly lacking for the region, as assessed in 2011. Contrastingly, we found few projects overall that were primarily focused on oceanographic research. This left many gaps in data in this discipline including for the categories: **G** (altered ocean currents) **M** altered ocean productivity, **K** (altered patterns of coastal hypoxia and anoxia), **H** (altered frequency and severity of storms), **J** (altered patterns of coastal upwelling), and **Q** (sedimentation patterns), as they have few projects meeting these needs as a primary component of their research or investigations.

Our ability to determine if identified needs were addressed was limited by the information we were able to obtain. It is possible that some projects we identified are meeting additional scientific and research needs, however, if this information was not disclosed on websites, abstracts or other accessible project documents we were not able to use this information in our analysis.

This report provides a synthesis of current research and management studies in the Alaska portion of the NPLCC that may (1) help to foster better coordination about coastal change in the NPLCC, (2) help practitioners and scholars learn from one another, and (3) identify information gaps. Tables 1 and 2 have been published as an online database that will allow communities and researchers to better understand and coordinate research efforts. We hope that researchers and community groups working along the coastline of the GOA through Southeast Alaska and elsewhere in the NPLCC region will use this database to share resources and coordinate with others doing similar work.

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Table 1

Current coastal chance projects identified within the Alaska portion of the NPLCC. A full version of this database including project contact information can be found at: https://accap.uaf.edu/NPLCC_CoastalChangeProjects.

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------|--------------------|-------------------|---|--------------------|--|---|---------------------|-------------------|
| B1 | Biological | coastal/nearshore | bird | Population Status and Ecology of North Pacific Seabirds | Colleen Handel | U.S. Geological Survey | Cook Inlet | 2001 | 2017 |
| B2 | Biological | fish/shellfish | coastal/nearshore | Salmonid use of nearshore marine and estuarine habitats of the Taku River and Inlet, 2010-2011 | Kercia Schroeder | Alaska Department of Fish and Game | Taku Inlet and Taku River estuary | 2010 | 2011 |
| B3 | Biological | marine mammal | coastal/nearshore | DOI on the Landscape - Pacific Nearshore Project - Coastal Ecosystem Responses to Influences from Land and Sea | James Bodkin | U.S. Geological Survey | Southeast Alaska | 2009 | 2013 |
| B4 | Biological | climate adaptation | fish/shellfish | Identifying climate vulnerabilities and prioritizing adaptation strategies for Eulachon populations in the Chilkoot and Chilkat rivers and the application of local monitoring systems. | Brad Ryan | Chilkoot Indian Association | Chilkoot river, up to Chilkoot lake which feeds the river | 2012 | 2013 |
| B5 | Biological | marine mammal | fish/shellfish | Impacts of Sea Otter Recolonization on Marine Resources and Coastal Communities in Southern Southeast Alaska | Ginny Eckert | University of Alaska Fairbanks, School of Fisheries and Ocean Sciences | University of Southeast Alaska | 2/1/2012 | 1/31/2016 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------|-------------------|-------------------|--|--------------------|--|--|---------------------|-------------------|
| B6 | Biological | vegetation | fish/shellfish | Coastal Resilience in Sitka Sound: Monitoring Pinto Abalone and Kelp Forests in a Changing Climate | Victoria O'Connell | Sitka Sound Science Center | Sitka Sound | 2/1/2015 | 1/31/2017 |
| B7 | Biological | coastal/nearshore | hydrologic | Development of freshwater contaminants monitoring design | Chris Sergeant | National Park Service, Southeast Alaska Network, Inventory and Monitoring Division | Glacier Bay NP, Klondike Gold Rush NHP, and Sitka NHP | 2012 | ongoing |
| B8 | Biological | vegetation | hydrologic | Stream discharge, snow-cover, soil drainage and yellow-cedar decline in the NPLCC region of southeast Alaska | Jason Fellman | University of Alaska Southeast, Alaska Coastal Rainforest Center | Pacific coastal temperate rainforest (PCTR), SW Alaska | 2014 | 2015 |
| B9 | Biological | coastal/nearshore | local observation | Hoonah Native Forest Lands Partnership | Lauren Sill | Alaska Department of Fish and Game | Port Frederich and surrounding watersheds | 2015 | 2019 |
| B10 | Biological | marine mammal | local observation | Citizen Science Whale monitoring | Andy Szabo | Alaska Whale Foundation | | | ongoing |
| B11 | Biological | bird | marine mammal | Marine bird and mammal nearshore surveys of Glacier Bay | Dan Esler | USGS | Glacier Bay National Park | Mar-16 | Ongoing |
| B12 | Biological | fish/shellfish | subsistence | The subsistence harvest of Pacific herring spawn in Sitka Sound | Lauren Sill | Alaska Department of Fish and Game | Sitka Sound | 2002 | ongoing |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------|-------------------|-------------------|---|--------------------|---|---|---------------------|------------------------|
| B13 | Biological | fish/shellfish | subsistence | The harvest and use of wild resources in Haines, Hoonah, Angoon, Whale Pass, and Hydaburg, Alaska | Lauren Sill | Alaska Department of Fish and Game | Haines, Hoonah, Angoon, Whale Pass, Hydaburg | 2012 | 2014 |
| B14 | Biological | fish/shellfish | vegetation | Applying portfolio effects to the Gulf of Alaska ecosystem: Did multi-scale diversity buffer against the Exxon Valdez oil spill? | Kristin Marshall | University of Washington | Prince William Sound | Mar-15 | Ongoing |
| B15 | Biological | bird | | Food abundance, kittiwake life histories, and colony dynamics in the Northeastern Pacific: implications of climate change and regime shifts | Simone Vincenzi | Center for Stock Assessment Research and Department of Applied Mathematics and Statistics, University of California | Gull, Duck and Middleton Islands (Alaska) | | 11/18/2014 (published) |
| B16 | Biological | bird | | Ongoing Kittlitz's murrelet monitoring | Chris Sergeant | National Park Service, Southeast Alaska Inventory and Monitoring Network | Glacier Bay NP | 2009 | ongoing |
| B17 | Biological | coastal/nearshore | | Development of airborne contaminants monitoring design | Michael Bower | National Park Service, Southeast Alaska Network, Inventory and Monitoring Division | Glacier Bay NP, Klondike Gold Rush NHP, and Sitka NHP | 2009 | ongoing |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------|-------------------|-------------------|---|--------------------|--|--|---------------------|-------------------|
| B18 | Biological | coastal/nearshore | | An Estuarine Habitat Classification for a Complex Fjordal Island Archipelago | David Albert | The Nature Conservancy | Southeast Alaska | 2008 | 2013 |
| B19 | Biological | coastal/nearshore | | Southeast Alaska Estuaries Initiative | Lety Hopper | Rivers Without Borders | Southeast Alaska | 6/1/2015 | 3/1/2017 |
| B20 | Biological | coastal/nearshore | | Predicting the vulnerability of nearshore species and habitats to climate change effects | Deborah Reusser | USGS, Western Fisheries Research Center | Gulf of Alaska, Fjord Lands, Puget Sound, Oregonian, and Northern California | 6/30/2011 | 12/31/2013 |
| B21 | Biological | coastal/nearshore | | Understanding Ecological Change in Intertidal Areas of Coastal Regions in Alaska Important to the Department of the Interior Through Long-Term Monitoring and Process Studies | Gail Irvine | U.S. Geological Survey | Southeast Alaska | 1994 | 2012 |
| B22 | Biological | fish/shellfish | | Northern Cook Inlet Chinook Salmon Marine Harvest | Adam St. Saviour | Alaska Department of Fish and Game (ADF&G) | Northern Cook Inlet: Tyonek, Anchorage, Soldotna Area | 2014 | 2016 |
| B23 | Biological | fish/shellfish | | Imaging sonars in the Copper River delta | Robert Campbell | Prince William Sound Science Center | Copper River delta | 1-Mar-16 | 15-Jun-16 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------|------------------|-------------------|---|--------------------|--|--|---------------------|-------------------|
| B24 | Biological | fish/shellfish | | The Economic Geography of Salmon: A conceptual framework and preliminary characterization of the spatial distribution of economic values associated with salmon in the Mat-Su Basin, Alaska | Tobias Schwörer | UAA Institute of Social and Economic Research | Mat-Su Basin | | |
| B25 | Biological | fish/shellfish | | The Seasonal and Inter-annual Patterns of Larvaceans and Pteropods in the Coastal Gulf of Alaska, and Their Relationship to Pink Salmon Survival | Russell Hopcroft | University of Alaska Fairbanks, Institute of Marine Science | Gulf of Alaska | 7/1/2010 | 12/31/2013 |
| B26 | Biological | fish/shellfish | | Nutrition and Condition of Red King Crab Larvae: Enhancement of King Crabs to Improve Sustainability of Alaskan Coastal Communities | Ginny Eckert | University of Alaska Fairbanks, School of Fisheries and Ocean Sciences | Kodiak, Alaska; Juneau, Alaska; Seward, AK and Newport, Oregon | 2/1/2012 | 1/31/2016 |
| B27 | Biological | fish/shellfish | | Surviving the gauntlet: A comparative study of the pelagic and demersal and special linkages that determine groundfish recruitment and diversity in the Gulf of Alaska ecosystem. | Shannon Atkinson | University of Alaska Fairbanks | central and eastern Gulf of Alaska | 6/1/2010 | 9/30/2015 |
| B28 | Biological | fish/shellfish | | Susitna Coho and Chum Salmon Research | Peter Cleary | Alaska Department of Fish and Game | Susitna River | 1-Jul-08 | 30-Jun-13 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------|------------------|-------------------|---|--------------------|---|--|--------------------------------|------------------------------|
| B29 | Biological | fish/shellfish | | Earlier Migration Timing, Decreasing Phenotypic Variation, and Biocomplexity in Multiple Salmonid Species | Ryan Kovach | U.S. Geological Survey, Northern Rocky Mountain Science Center, Glacier Field Station | Auke Creek near Juneau, Alaska | 1972 (data collection started) | 2010 (data collection ended) |
| B30 | Biological | fish/shellfish | | Genetic change for earlier migration timing in a pink salmon population | Ryan Kovach | U.S. Geological Survey, Northern Rocky Mountain Science Center, Glacier Field Station | Auke Creek near Juneau, Alaska | 1983 | 2011 |
| B31 | Biological | fish/shellfish | | Middle Trophic Level: Temporal and spatial axes of variability in the structure of Gulf of Alaska forage fish communities | Olav Ormseth | Alaska Fisheries Science Center | Study has 2 regions: the eastern, comprising the outer coast of southeast Alaska, and the western, comprising the east side of Kodiak Island and the southern coast of the Kenai Peninsula | 10/1/2010 | 1/31/2015 |
| B32 | Biological | fish/shellfish | | Economic Viability of a Directed Skate Fishery in the Gulf of Alaska | Andrew Seitz | University of Alaska Fairbanks, School of Fisheries and Ocean Sciences | Cordova, Homer, Kodiak, and Seattle | 2/1/2014 | 1/31/2018 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------|------------------|-------------------|---|--------------------|--|---|---------------------|-------------------|
| B33 | Biological | fish/shellfish | | CATCH - Economic Implications of a Strategy to Purchase Alaska Halibut Fishery Commercial Fishing Sector Quota Shares to Create a Recreational Guided Angler Sector Harvest Common Pool | Shannon Davis | The Research Group, LLC | International Pacific Halibut Commission's (IPHC) regulatory areas 2C and 3A. | 40756 | 41487 |
| B34 | Biological | fish/shellfish | | Mixed Stock Analysis and Age, Sex, and Length Composition of Chinook salmon in the Eastside Set Gillnet Fishery in Upper Cook Inlet, Alaska. | Tony Eskelin | Alaska Department of Fish and Game (ADF&G) | Upper Cook Inlet, Eastern shore from Ninilchik to Boulder Point | 2013 | unknown |
| B35 | Biological | marine mammal | | Development of adaptive optimal design for monitoring sea otters in Glacier Bay | Jamie Womble | National Park Service Southeast Alaska Network and Southeast Coastal Cluster | Glacier Bay NP | 2016 | ongoing |
| B36 | Biological | marine mammal | | Sea Otter and Nearshore Marine Ecology Research | Brenda Ballachey | <u>U.S. Geological Survey</u> | Southeast Alaska | 2005 | 2019 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------|------------------|--------------------|---|--------------------|---|--|---------------------|-------------------|
| B37 | Biological | fish/shellfish | coastal/nears hore | Long-Term Records of Abundance and Effects of Large Scale Climate Change on Alaska Peninsula Sockeye Salmon | Nicole Misarti | University of Alaska Fairbanks, Water and Environmental Research Center | Fieldwork will take place in July 2014 at Sapsuk Lake, near the village of Nelson Lagoon on the Alaska Peninsula. Laboratory activities will take place in the Idaho State University Sediment Core Analysis Laboratory, the Water and Environmental Research Center at the University of Alaska Fairbanks, and the ADFG Kodiak Island Laboratory. | 2/1/2014 | 4/30/2017 |
| B38 | Biological | marine mammal | fish/shellfish | Ecological, Economic, and Social Changes as a Result of Sea Otter Recolonization in Southern Southeast Alaska | Ginny Eckert | University of Alaska Fairbanks, School of Fisheries and Ocean Sciences | University of Southeast Alaska | 2/1/2010 | 01/31/2013 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------|------------------|-------------------|--|--------------------|---|--|---------------------|-------------------|
| B39 | Biological | marine mammal | fish/shellfish | Recovering Humpback Whales and the Future of Alaska's Hatcheries, Fisheries and Coastal Communities | Janice Straley | Sitka Sound Science Center | Fieldwork will take place in Chatham Strait, Southeast Alaska. The study will also incorporate data previously collected in Tenakee Inlet and Sitka Sound in Southeast Alaska. Energetic analysis of prey samples will occur at Ted Stevens Marine Research Institute in Juneau. | 2/1/2014 | 1/31/2017 |
| B40 | Biological | marine mammal | fish/shellfish | Industry-Based Documentation of the Effectiveness of F3 "Whale Pingers" at Reducing Humpback Whale Interactions with Alaska Salmon Fisheries | Kate Wynne | University of Alaska Fairbanks, Marine Advisory Program | Researchers will work with fishermen and convene fleet-specific meetings in Petersburg, Kodiak, and Sand Point, Alaska, and meet with an Industry Working Group in Anchorage in April 2014. | 2/1/2014 | 1/31/2016 |
| B41 | Biological | fish/shellfish | hydrologic | Salmon under the Ice: Juvenile Coho salmon Overwintering on the Anchor River | Coowe Moss Walker | Kachemak Bay, National Estuarine Research Reserve | Anchor River | 2010 | 2014 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------|-------------------|-------------------|--|--------------------|---|--|---------------------|-------------------|
| B42 | Biological | coastal/nearshore | local observation | Assessing Coastal Uplift and Habitat Changes in a Glacially Influenced Estuary System | Angela Doroff | Kachemak Bay, National Estuarine Research Reserve | Kachemak Bay | 2010 | 2013 |
| B43 | Biological | coastal/nearshore | vegetation | Long-term Monitoring of Intertidal Communities in Kachemak Bay | Brenda Konar | UAF SFOS, Institute of Marine Science Director, Coastal Marine Institute Director | Kachemak Bay | 2011 | 2016 |
| B44 | Biological | fish/shellfish | vegetation | Salmon in the Hills: Landscape Linkages to Juvenile Salmon Rearing in Headwater Streams | Coowe Moss Walker | Kachemak Bay, National Estuarine Research Reserve | Anchor River, Deep Creek, Stariski Creek and Ninilchik River | 2012 | |
| B45 | Biological | bird | | Population Ecology of Pacific Seabirds | Scott Hatch | U.S. Geological Survey | | 1978 | 2012 |
| B46 | Biological | Bird | | Seabird Diet Monitoring | Angela Doroff | Kachemak Bay, National Estuarine Research Reserve | Alaska Maritime National Wildlife Refuge | 2010 | September 2013 |
| B47 | Biological | coastal/nearshore | | Assessing the Vulnerability of Alaska's Coastal Habitats to Accelerating Sea-level Rise Using the SLAMM Model: A Case Study for Cook Inlet | Patty Glick | National Wildlife Federation | Kenai Peninsula and Anchorage areas | 2008 | Dec-10 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------|-------------------|-------------------|---|--------------------|---|-----------------------|---------------------|-------------------|
| B48 | Biological | coastal/nearshore | | Assessing Threats of Marine Invasive Species and Harmful Algal Blooms: Planning, Monitoring, and Research for the Kachemak Bay Research Reserve | Angela Doroff | Kachemak Bay, National Estuarine Research Reserve | Homer, AK | 2006 | June 2011 |
| B49 | Biological | fish/shellfish | | Resilience of Estuarine Groundfish Communities to Future Changes in Glacial Effluent | Carolyn Bergstrom | University of Alaska Southeast, Natural Sciences Department | 4 estuaries in Juneau | 5/1/2015 | 4/30/2017 |
| B50 | Biological | fish/shellfish | | Salmon in the Flats: Juvenile Salmon Estuarine Rearing Habitats | Coowe Moss Walker | Kachemak Bay, National Estuarine Research Reserve | Fox River estuary | 2008 | September 2013 |
| B51 | Biological | fish/shellfish | coastal/nearshore | Navigating the predator gauntlet: Impacts of nearshore marine fishes on hatchery and wild juvenile salmon in Southeast Alaska | Anne Beaudreau | University of Alaska Fairbanks, College of Fisheries and Ocean Sciences | Southeast Alaska | 2016 | 2018 |
| B52 | Biological | coastal/nearshore | fish/shellfish | Tracking energy flow to fishes in glacially-influenced estuaries of Southeast Alaska | Anne Beaudreau | University of Alaska Fairbanks, College of Fisheries and Ocean Sciences | Southeast Alaska | 2014 | 2016 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------|-------------------|-------------------|---|--------------------|---|------------------|---------------------|-------------------|
| B53 | Biological | fish/shellfish | | Cooperative research on sablefish between Ted Stevens Marine Research Institute (TSMRI) and UAF fisheries | Anne Beaudreau | University of Alaska Fairbanks, College of Fisheries and Ocean Sciences | Southeast Alaska | 2011 | 2014 |
| B54 | Biological | fish/shellfish | | Ecological interactions among groundfish predators in the Gulf of Alaska | Anne Beaudreau | University of Alaska Fairbanks, College of Fisheries and Ocean Sciences | Southeast Alaska | 2015 | 2018 |
| B55 | Biological | fish/shellfish | | Graduate studies on sablefish feeding ecology | Anne Beaudreau | University of Alaska Fairbanks, College of Fisheries and Ocean Sciences | Southeast Alaska | 2014 | 2017 |
| B56 | Biological | coastal/nearshore | fish/shellfish | Ecological role of freshwater subsidies to estuarine food webs | Anne Beaudreau | University of Alaska Fairbanks, College of Fisheries and Ocean Sciences | Southeast Alaska | 2013 | 2015 |
| B57 | Biological | coastal/nearshore | vegetation | Decision Analysis for Management of <i>Elodea</i> in Alaska: Is it worth taking a gamble or better to play it safe? | Joseph Little | UAF School of Management, Department of Economics | Kenai Peninsula | 4/1/2014 | 11/30/16 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------|--------------------|-------------------|--|--------------------|---|---|---------------------|-------------------|
| B58 | Biological | coastal/nearshore | | Monitoring of Salt Marsh Habitats | Angela Doroff | Kachemak Bay, National Estuarine Research Reserve | Salt marsh habitats in Kachemak Bay: Beluga Slough, Fox River Flats, China Poot, Sadie Cove | 2002 | 2013 |
| B59 | Biological | fish/shellfish | | Building a Foundation of Decision-Support Tools Integrating Existing Mapping and Monitoring Information for the Benefit of Long-Term Shellfish Sustainability and Management in Kachemak Bay and Cook Inlet, Alaska. | Angela Doroff | Kachemak Bay, National Estuarine Research Reserve | All of Kachemak Bay, Anchor Point, and Port Graham | 2015 | 2017 |
| H1 | Human | climate adaptation | coastal erosion | Alaska Native Village Adaptation to Climate Change Impacts and Disasters—Legal Barriers and Strategies for Resilience | Elizaveta Ristroph | University of Hawaii-Manoa | All of Alaska | Apr-16 | Apr-19 |
| H2 | Human | local observation | fish/shellfish | Local and Traditional Knowledge of Chinook Salmon in the Stikine River and its Tributaries | Joshua Ream | Alaska Department of Fish and Game (ADF&G) | Petersburg, Wrangell, and Telegraph Creek | 2013 | 2014 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|-----------|--------------------|-------------------|---|--------------------|--|--|-------------------------------|-------------------|
| H3 | Human | subsistence | fish/shellfish | The harvest and use of wild resources in Cantwell, Chase, Talkeetna, Trapper Creek, Alexander/Susitna, and Skwentna, Alaska | Davin Holen | University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, Alaska Sea Grant Marine Advisory Program | Cantwell, Chase, Talkeetna, Trapper Creek, Alexander/Susitna, and Skwentna | 2013 | 2013 |
| H4 | Human | subsistence | fish/shellfish | Annual Subsistence Salmon Report | James Fall | Alaska Department of Fish and Game (ADF&G) | All Alaska communities | A report is produced annually | N/A |
| H5 | Human | subsistence | local observation | The harvest and use of wild resources in Tyonek, Alaska, 2013 | Bronwyn Jones | Alaska Department of Fish and Game (ADF&G) | Tyonek | 2014 | 2014 |
| H6 | Human | subsistence | local observation | Changing patterns in the Haines Management Area subsistence Chinook salmon fishery | Meredith Marchioni | Alaska Department of Fish and Game (ADF&G) | Chilkat River/Haines management area | 2014 | 2014 |
| H7 | Human | climate adaptation | mapping | A Conservation Priorities Tool for the North Pacific LCC | Allison Bidlack | University of Alaska Southeast, Alaska Coastal Rainforest Center | entire North Pacific LCC geographic area. | 9/15/2011 | 12/30/2012 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|-----------|--------------------|-------------------|---|--------------------|--|--|---------------------|-------------------|
| H8 | Human | climate adaptation | vegetation | Understanding changes in the Coastal Gulf of Alaska Ecosystem: Analysis of Past Dynamics to Improve Prediction of Future Response to Natural and Anthropogenic Change | Thomas Okey | Bamfield Marine Sciences Center | Coastal Gulf of Alaska | Jan-15 | Jan-17 |
| H9 | Human | climate adaptation | | Climate Change in the Tongass National Forest – Fostering Strategic Collaboration and Informing Sustainable Management of Priority Resources | Julianne Thompson | jethompson02@fs.fed.us | Alaska | 8/1/2015 | 3/31/2018 |
| H10 | Human | climate adaptation | | Pedestrian-evacuation modeling for tsunami hazards in Alaskan coastal communities | Nathan Wood | <u>U.S. Geological Survey</u> | Cordova, Kodiak, Seward, Valdez, Whittier Alaska | 2012 | 2015 |
| H11 | Human | subsistence | | Resilience and adaptation in Yakutat | Lauren Sill | Alaska Department of Fish and Game | Yakutat area, Icy Bay to Dry Bay | 2015 | 2017 |
| H12 | Human | subsistence | fish/shellfish | The Harvest and Use of Wild Resources in Nikiski, Seldovia, Nanwalek, and Port Graham, Alaska, 2014 | Brian Davis | Alaska Department of Fish and Game (ADF&G) | Seldovia, Port Graham, Nanwalek, Nikiski | 2013 | August 2016 |
| H13 | Human | subsistence | | EVOS update 2014 | James Fall | Alaska Department of Fish and Game (ADF&G) | Cordova, Tatitlek, and Chenega Bay | November 2014 | June 30, 2016 |
| H14 | Human | substance | | Coastal Subsistence Research | Linda Kruger | USFS Pacific Northwest Research Sta | Southeast Alaska | 2014 | ongoing |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------------------|--------------------|-------------------|--|--------------------|---|--------------------------------------|---------------------|-------------------|
| H15 | Human | subsistence | | Determine if climate change can affect the gathering calendar and natural resources | Dennis Nickerson | Organized Village of Kasaan | Prince of Whales Island | 8/15/2012 | 3/30/2014 |
| H16 | Human | local observation | fish/shellfish | Using local and traditional knowledge of fishers to assess long-term ecological change in coastal Alaska | Anne Beaudreau | University of Alaska Fairbanks, College of Fisheries and Ocean Sciences | Southeast and Southcentral Alaska | 2016 | 2018 |
| H17 | Human | local observation | fish/shellfish | Social and ecological consequences of regulatory change in the Alaska recreational halibut fishery | Anne Beaudreau | University of Alaska Fairbanks, College of Fisheries and Ocean Sciences | Southeast and Southcentral Alaska | 2014 | 2016 |
| H18 | Human | climate adaptation | vegetation | An Expert and Community Supported Decision Tool for Managing Marine Invasive Species | Jungho Baek | School of Management at University of Alaska Fairbanks | 10/1/2014 | 1/30/2017 | |
| H19 | Human | climate adaptation | subsistence | Coastal Geomorphologic Trends and Benthic Habitats: Implications for Sustainable Indigenous Populations | Adelaide Johnson | USDA, Pacific Northwest Research Station | Chugach and Tongass National Forests | 2014 | 2017 |
| LG1 | Landscape/Geo-physical | hydrologic | | Glacier Impacts on Current and Future Streamflow | Roland Viger | Alaska Climate Science Center, USGS | Alaska and Washington | 1-Jun-15 | 1-Jun-17 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------------------|------------------|--------------------|---|--------------------|---|---|---------------------|-------------------|
| LG2 | Landscape/Geo-physical | hydrologic | coastal/nears hore | Ice2O: Assessing the Sensitivity of Alaska's Coastal Rainforest Ecosystems to Changes in Glacier Runoff | Shad O'Neel | USGS Alaska Science Center | Gulf of Alaska drainage region | 1-Apr-15 | 1-Apr-17 |
| LG3 | Landscape/Geo-physical | mapping | coastal/nears hore | Habitat Mapping and Analysis Project | Teri Camery | City of Juneau | areas Juneau with anticipated future development | 2013 | 2015 |
| LG4 | Landscape/Geo-physical | climatological | coastal/nears hore | Tongass National Forest Climate Change Vulnerability Assessment | Todd Brinkman | University of Alaska Fairbanks, Scenarios Network for Alaska and Arctic Planning (SNAP) | Tongass National Forest | Jan-11 | Jun-12 |
| LG5 | Landscape/Geo-physical | hydrologic | fish/shellfish | Climate Change Sensitivity Index for Pacific Salmon Habitat in Southeast Alaska | Colin Shanley | The Nature Conservancy | Southeast Alaska | 2012 | 2014 |
| LG6 | Landscape/Geo-physical | hydrologic | fish/shellfish | Climate change implications in the northern coastal temperate rainforest of North America | Colin Shanley | The Nature Conservancy | Southeast Alaska and British Columbia Central Coast | 2012 | 2015 |
| LG7 | Landscape/Geo-physical | hydrologic | fish/shellfish | Impacts of climate change of Chinook habitat suitability | Gordie Reeves | University of Alaska Southeast, Alaska Coastal Rainforest Center | Copper River Watershed | 2012 | 2013 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------------------|------------------|-------------------|--|--------------------|--|--|---------------------|-------------------|
| LG8 | Landscape/Geo-physical | hydrologic | fish/shellfish | Winter Habitat Associations in Glacial Rivers | Jeffrey Davis | Aquatic Restoration & Research Institute | Susitna and Talkeetna Rivers located in Southcentral Alaska. | 2012 | 2013 |
| LG9 | Landscape/Geo-physical | climatological | local observation | Climate Change Vulnerability Assessment for the Chugach National Forest and the Kenai Peninsula | Greg Hayward | USDA Forest Service | Chugach National Forest and the Kenai Peninsula | 2012 | 2016 |
| LG10 | Landscape/Geo-physical | mapping | local observation | Coastal Impressions A Photographic Journey along Alaska's Gulf Coast | Susan Saupe | Cook Inlet Regional Citizens Advisory Council | Cook Inlet, SC GOA, SE Alaska | 2001 | Jan-12 |
| LG11 | Landscape/Geo-physical | hydrologic | fish/shellfish | Climate Change Sensitivity Index for Pacific Salmon Habitat in Southeast Alaska | Colin Shanley | The Nature Conservancy | Southeast Alaska | 2012 | 2014 |
| LG12 | Landscape/Geo-physical | hydrologic | vegetation | Habitat Degradation Due to Melting Glaciers: Effects of Glacial Discharge on Kelp Bed Community Recruitment and Succession in Kachemak Bay | Brenda Konar | University of Alaska Fairbanks, School of Fisheries and Ocean Sciences | Kachemak Bay, Lower Cook Inlet, Southcentral Alaska | 2/1/2014 | 1/31/2016 |
| LG13 | Landscape/Geo-physical | hydrologic | vegetation | Stream discharge, snow-cover, soil drainage and yellow-cedar decline in the NPLCC region of southeast Alaska. | Allison Bidlack | University of Alaska Southeast, Alaska Coastal Rainforest Center | David D'Amore | 2014 | 2015 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------------------|------------------|-------------------|---|--------------------|--|---|---------------------|-------------------|
| LG14 | Landscape/Geo-physical | bathymetry | | Marine Benthic Habitat Mapping of the West Arm, Glacier Bay National Park and Preserve, Alaska | Guy Cochrane | USGS | West Arm, Glacier Bay National Park and Preserve | 2010 | 2013 |
| LG15 | Landscape/Geo-physical | climatological | | Ongoing weather and climate monitoring | Michael Bower | National Park Service, Southeast Alaska Inventory and Monitoring Network | Glacier Bay NP and Klondike Gold Rush NHP | 2008 | ongoing |
| LG16 | Landscape/Geo-physical | climatological | | Flux and fate of carbon in terrestrial and aquatic ecosystems at the ocean margin of the Alaskan perhumid coastal temperate rainforest | Jason Fellman | UAS Alaska Coastal Rainforest Center | SE Alaska | 2014 | 2015 |
| LG17 | Landscape/Geo-physical | hydrologic | | Ongoing streamflow monitoring | Chris Sergeant | National Park Service, Southeast Alaska Network, Inventory and Monitoring Division | Glacier Bay NP, Klondike Gold Rush NHP, and Sitka NHP | 2010 | ongoing |
| LG18 | Landscape/Geo-physical | hydrologic | | Melting ice, habitat change and nutrient flux: Hydrological, biogeochemical and biological linkages between the Copper River watershed and the coastal Gulf of Alaska | John Crusius | <u>U.S. Geological Survey</u> | Copper River and Gulf of Alaska | 2010 | 2015 |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|------------------------|------------------|--------------------|--|--------------------|--|--|---------------------|-------------------|
| LG19 | Landscape/Geo-physical | hydrologic | | <u>Distribution and Flow of Water in Alaskan Coastal Forest Watersheds</u> | Scott Rupp | Alaska Climate Science Center | Southeast Alaska | 1-Aug-14 | 1-Aug-16 |
| LG20 | Landscape/Geo-physical | hydrologic | | Ongoing freshwater water quality monitoring | Chris Sergeant | National Park Service, Southeast Alaska Network, Inventory and Monitoring Division | Glacier Bay NP, Klondike Gold Rush NHP, and Sitka NHP | 2010 | ongoing |
| LG21 | Landscape/Geo-physical | mapping | | ShoreZone coastal Mapping and Imagery | Cindy Hartmann | NOAA | Southeast Alaska (approximately 1,100 km of unmapped shoreline in Glacier Bay), mapping survey is planned for the Barren Islands in the GOA April 2016 | 2004 | 2011 |
| LG22 | Landscape/Geo-physical | mapping | | SE AK Coastal GIS Module | David Albert | The Nature Conservancy | Southeast Alaska | 2008 | 2011 |
| O1 | Oceanographic | biophysical | climatologica l | NERRS System-wide Monitoring of Water Quality, Nutrients, and Weather | Angela Doroff | Kachemak Bay, National Estuarine Research Reserve | | 2001 | |
| O2 | Oceanographic | biophysical | coastal/nearshore | Oceanographic Conditions in Lower Cook Inlet and Kachemak Bay | Angela Doroff | Kachemak Bay, National Estuarine Research Reserve | Lower Cook Inlet and Kachemak Bay | 2011 | |

| Project ID | Category: | Primary keyword: | Secondary Keyword | Title: | Lead PI or contact | Institution: | Geographic scope | Project Start Date: | Project End Date: |
|------------|---------------|------------------|-------------------|---|--------------------|---|---|---------------------|-------------------|
| O3 | Oceanographic | biophysical | fish/shellfish | Ongoing marine contaminants monitoring | Chris Sergeant | National Park Service, Southeast Alaska Network, Inventory and Monitoring Division | Glacier Bay NP, Klondike Gold Rush NHP, and Sitka NHP | 2009 | ongoing |
| O4 | Oceanographic | biophysical | hydrologic | Assessing net community production in a glaciated Alaska fjord | Stacy Reisdorph | University of Alaska Fairbanks, Ocean Acidification Research Center | Gulf of Alaska, Glacier Bay | Jul-11 | Jul-12 |
| O5 | Oceanographic | biophysical | | A regression modeling approach for studying carbonate system variability in the northern Gulf of Alaska | Wiley Evans | University of Alaska Fairbanks, Ocean Acidification Research Center, School of Fisheries and Ocean Sciences | Northeast Pacific Global Ocean Ecosystems Dynamics (GLOBEC) Seward Line | Spring 2008 | Jun-13 |
| O6 | Oceanographic | biophysical | | Long term monitoring of oceanographic conditions in Prince William Sound | Robert Campbell | Prince William Sound Science Center | Prince William Sound | Feb 1 2012 | Jan 31 2017 |
| O7 | Oceanographic | biophysical | | Tidal and Sub-Tidal Circulation in Kachemak Bay from Drifting Buoys | Angela Doroff | Kachemak Bay, National Estuarine Research Reserve | Kachemak Bay | 2011 | ongoing |

Table 2.

Identified Research Gaps from Tillmann and Siemann (2011) and identified current coastal projects within the NPLCC meeting identified research needs. A full version of this database can be found at: https://accap.uaf.edu/NPLCC_CoastalChangeProjects.

| Gap Id | Subcategories for information gaps from Tillmann and Siemann 2011 | Current trend need identified for AK | Future prediction need identified for AK | Number of NLPCC projects addressing gap | Project IDs |
|--------|---|--------------------------------------|--|---|--|
| N | Altered food web dynamics | yes | yes | 9 | B15, B25, B3, B31, B5, H8, LG18, LG6, LG7 |
| R | Habitat loss, degradation, and conversion | yes | yes | 12 | B1, B2, B21, B3, B44, B8, B58, B59, H14, H7, LG21, LG3 |
| S | Shifts in species range and distribution | yes | yes | 18 | B12, B16, B20, B27, B28, B29, B34, B35, B38, B4, B41, B43, H15, H2, H6, H17, H19, LG8 |
| T | Altered phenology and development | yes | yes | 4 | B29, B37, LG11, LG5 |
| U | Shifts in community composition, competition, & survival | yes | yes | 19 | B15, B16, B26, B31, B34, B36, B38, B39, B4, B49, B53, B54, B55, B51, H16, H17, H15, H2, H6 |
| V | Altered interaction with non-native & invasive species | yes | yes | 4 | B48, B57, H14, H18 |
| W | Sea and shorebirds | no | yes | 6 | B1, B11, B15, B16, B45, B46 |
| Z | Pacific lamprey (<i>Lampetra tridentata</i>) | yes | yes | 1 | B14 |
| X | Shellfish | yes | yes | 8 | B26, B38, B43, B48, B5, B6, B59, O7 |

| Gap Id | Subcategories for information gaps from Tillmann and Siemann 2011 | Current trend need identified for AK | Future prediction need identified for AK | Number of NLPCC projects addressing gap | Project IDs |
|--------|---|--------------------------------------|--|---|--|
| Y | Pacific salmon (<i>Oncorhynchus spp.</i>) | yes | yes | 32 | B13, B14, B2, B20, B22, B23, B24, B28, B29, B34, B40, B41, B44, B50, B9, B51, B52, B56, H11, H12, H13, H2, H3, H4, H5, H6, H16, LG11, LG5, LG7, LG8, LG9 |
| AA | Eelgrass | yes | yes | 1 | LG21 |
| BB | Plankton | no | yes | 2 | B25, H8 |
| A | Carbon dioxide (CO2) concentrations | no | no | 1 | LG16 |
| B | Temperature | no | no | 2 | LG15, O1 |
| C | Precipitation | no | no | 1 | LG15 |
| F | Altered Hydrology | yes | yes | 14 | B49, B50, B8, B52, B56, LG1, LG11, LG19, LG2, LG5, LG6, LG7, LG9, O7 |
| L | Altered nutrient cycling | no | yes | 7 | B44, B52, B56, LG6, O2, O5, O6 |
| P | Altered patterns of coastal erosion and increased coastal squeeze | yes | yes | 3 | B42, H1, H14 |
| D | Ocean acidification | yes | yes | 2 | B6, LG20 |
| E | Increasing Sea Surface Temperature (SST) | yes | no | 5 | LG20, O1, O2, O5, O6 |
| G | Altered ocean currents | yes | yes | 0 | |

| Gap Id | Subcategories for information gaps from Tillmann and Siemann 2011 | Current trend need identified for AK | Future prediction need identified for AK | Number of NLPCC projects addressing gap | Project IDs |
|---------------|--|---|---|--|--------------------|
| H | Altered frequency and severity of storms | yes | yes | 1 | B6 |
| I | Sea level rise (SLR) | yes | no | 3 | B47, B58, H19 |
| J | Altered patterns of coastal upwelling | yes | yes | 1 | LG18 |
| M | Altered ocean productivity | yes | yes | 0 | |
| Q | Altered sedimentation patterns | yes | yes | 2 | B42, LG14 |
| K | Altered patterns of coastal hypoxia and anoxia | yes | yes | 0 | |
| O | Multiple stressors and thresholds | yes | yes | 0 | |

Appendix A.

Call for information sent out to coastal change project contacts



University of Alaska Fairbanks
930 Koyukuk Drive
PO Box 757245
Fairbanks, AK 99775-7245
907-474-7812 • accap.uaf.edu

To: Alaska Coastal Project Contact

From: Michaela Swanson

Date: December 18, 2016

Subject: Requesting information regarding coastal projects in Southeastern Alaska and Cook Inlet

My name is Michaela Swanson and I am graduate student at the University of Alaska Fairbanks working in collaboration with the North Pacific LCC and ACCAP on the project **Current Coastal Change Research/Management Projects and Priority Information Needs from Cook Inlet through Southeastern Alaska.**

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.

I am 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. You have been identified as an important contact through the North Pacific LCC. If you are involved in a coastal change project underway in the region, please contact me and I will add the project information to the database. Also, if you know of other projects in the region, please send me 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 drivers (storms, erosion, sea level rise, nearshore sea ice)
- projects in coastal communities that are looking at coastal change
- shoreline projects (e.g. mapping, stabilization surveys)
- coastal habitat or species response projects (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 bird species/populations
- fish projects at coastal sites

We are interested in all coastal projects from Cook Inlet through SE Alaska that are ongoing or have started or ended after October 31, 2010. Projects can be submitted at <http://goo.gl/forms/71J42axoEY>. If you would like to submit multiple projects in an excel format, please use the attached document: Coastal Change Project database template.

I can be reached at: m.swanson@alaska.edu or (907) 474-7955. Thank you for your time and help.

Sincerely,
Michaela Swanson

Appendix B.

List of coastal contact institutions

- ABR, Inc.
- Alaska Climate Science Center
- Alaska Department of Environmental Conservation (DEC)
- Alaska Department of Fish and Game (ADF&G)
- Alaska Native Tribal Health Consortium
- Alaska Ocean Observing System (AOOS)
- Alaska SeaLife Center
- Alaska Sustainable Salmon Fund (of ADF&G)
- Center for Alaskan Coastal Studies
- City of Juneau
- Coastal Research and Education Center
- Conservation Science Director
- Environmental Protection Agency (EPA)
- Greater Southeast Conservation Community
- Gulf Watch Alaska
- Kachemak Bay National Estuarine Research Reserve
- National Center for Ecological Analysis and Synthesis
- National Marine Mammal Lab
- National Oceanic and Atmospheric Administration (NOAA)
- National Park Service (NPS), Coastal Research Program
- Nature Conservancy (Alaska)
- Organized Village of Kasaan
- North Pacific Research Board
- Oceans Alaska
- Pacific Northwest Tribal Climate Change Project
- Pacific States Marine Fisheries Commission
- Prince William Sound Science Center
- Sealaska
- Seward Sealife Center
- Sitka Sound Science Center
- Sitka Tribe of Alaska
- Southeast Alaska Fish Habitat Partnership
- Sustainable Southeast
- Tyonek Tribal Conservation District
- U.S. Environmental Protection Agency (EPA)
- U.S. Fish and Wildlife Service (FWS)
- U.S. Forest Service (FS)
- U.S. Geological Survey (USGS)
- U.S. Natural Resources Conservation Service (NRCS)
- University of Alaska Anchorage
- University of Alaska Fairbanks, School of Fisheries and Ocean Sciences
- University of Alaska Southeast, Coastal Rainforest Center (ACRC)