



Western Alaska Landscape Conservation Cooperative

Changes in Freshwater Temperature & Its Impacts: 2014 Projects

The Western Alaska LCC has adopted a strategy of two-year programs focused on one of three rotating themes, Coastal Systems, Freshwater Systems, or Terrestrial Systems, with further refinement of focal topics within each theme. While the LCC recognizes the need to maintain some flexibility to respond to emergent priorities, maintaining a narrow focus for two-year intervals allows us to fund a suite of integrated activities that builds momentum, increases leveraging and data sharing, and promotes substantial progress on shared needs.

In fiscal years 2014 and 2015, the LCC is focused on *Changes in Freshwater Temperature and Its Impacts*, a focal topic within the Freshwater Systems theme. Guided by priority recommendations from the 2013 Alaska Stream and Lake Temperature Monitoring Workshop, the LCC is supporting a suite of well-integrated projects (p. 4-7). These projects not only address the potential impacts of stream and lake temperature change on important freshwater resources, but also advance regional-scale water temperature monitoring and analyses through the development of capacity to collaboratively collect, inventory and share stream and lake water temperature data. Ultimately our activities are designed to inform future decisions about fish, drinking water and other priority resources linked to freshwater.

Mission

The mission of the Western Alaska LCC is to promote coordination, dissemination, and development of applied science to inform landscape level conservation, including terrestrial-marine linkages, in the face of landscape scale stressors, focusing on climate change.

Previously Funded Freshwater Projects

Prior to the adoption of a thematic funding cycle, the LCC supported several projects related to Freshwater topics in 2011 (Figure 1). These projects have important links to current work undertaken by the LCC and its partners. For detailed descriptions of these 2011 projects, please visit:

<https://westernalaskalcc.org/projects/SitePages/freshwater.aspx>

Figure 1. Freshwater projects funded in 2011.

Broad-scale Lake and Permafrost Dynamics in the Western Alaska LCC Region

Led by Guido Grasse (Alfred Wegener Institute and University of Alaska Fairbanks), this project relates permafrost change to lake habitat changes in the major lake districts of western Alaska. Final products are expected in early 2015.

Project WA2011_02

Thermal Response of Western Alaska Lakes and Lagoons to Past, Present, and Future Changes in Climate

Led by Ben Jones (U.S. Geological Survey) and Chris Arp (University of Alaska Fairbanks), this project analyzed spatial and temporal patterns of lake surface temperatures from 1985 to 2100 using satellite and ground data. It was completed in 2014.

Project WA2011_03

Moored All-Season Vertical Temperature Arrays in Lakes of Southwest Alaska NWRs

Led by Bill Pyle (U.S. Fish and Wildlife Service), this project provided lake temperature monitoring instrumentation in support of sockeye salmon habitat analysis. Resulting data was also contributed to project WA2011_03. It was completed in 2013.

Project WA2011_04

Watershed Control of Hydrologic Sources and Thermal Conditions in SW Alaska Streams: A Framework for Forecasting Effects of Changing Climate

Led by Daniel Schindler and Peter Lisi (University of Washington), this project examines how watershed geomorphology affects stream thermal regime, and provides an initial assessment of future regimes. Final products are expected in late 2014.

Project WA2011_05

In 2013, the five LCCs in Alaska successfully competed for \$300,000 from the National LCC Network to 'address priority needs that transcend LCC boundaries'. Products and services generated by this collaborative project will benefit scientists and resource managers throughout the state (Figure 2).

Figure 2. Mult-LCC project funded in 2013 by the National LCC Network

NHD Stewardship in Alaska

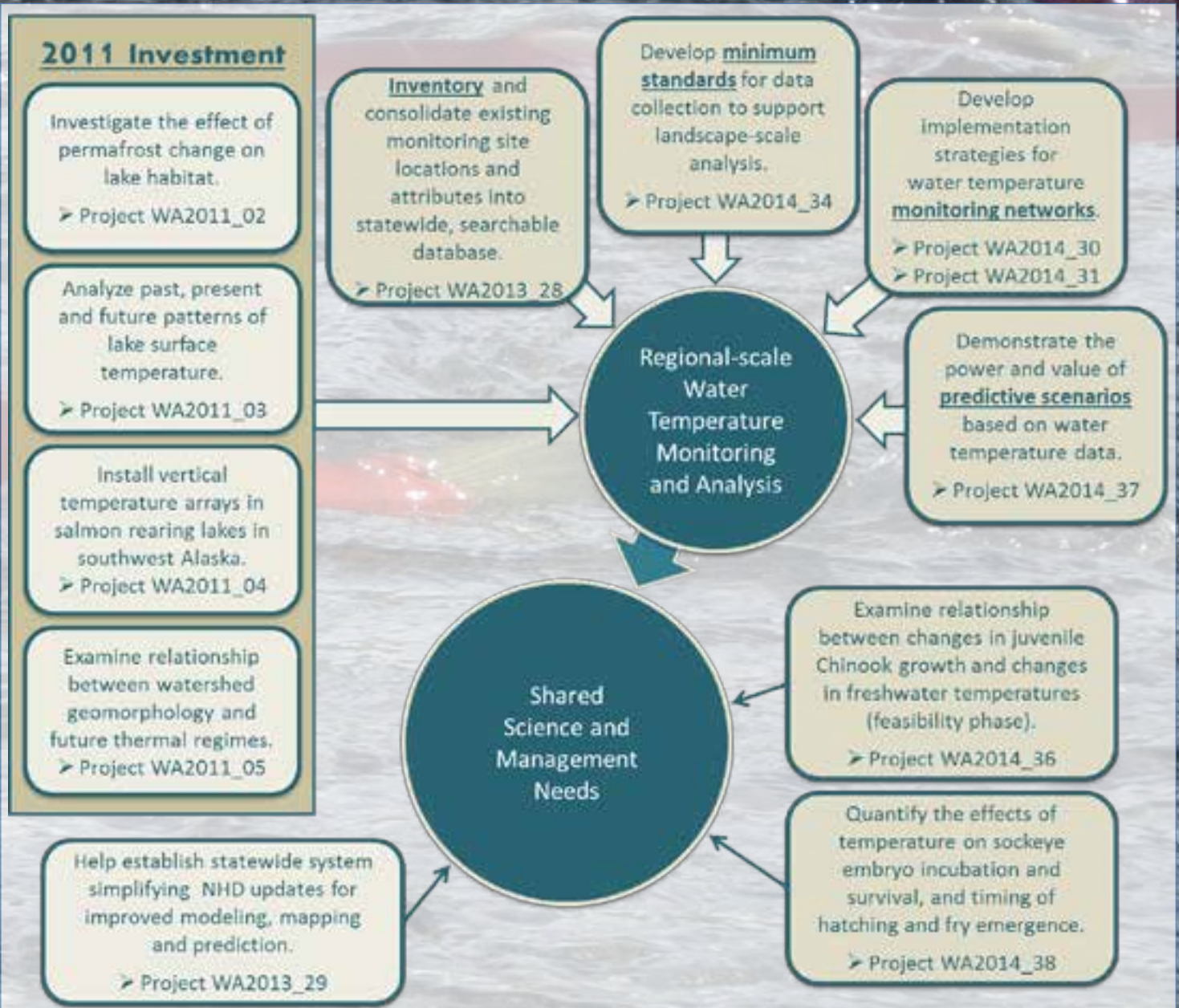
Becci Anderson (U.S. Geological Survey) and Kacy Krieger (University of Alaska Anchorage) are leading this project to help bring Alaska's National Hydrography Dataset (NHD) into the 21st century. Depicting streams, lakes and other water features, the NHD is essential for mapping and modeling, yet Alaska's NHD lags far behind the rest of the U.S. This project will update the NHD in priority areas of the Western Alaska and Arctic LCCs. More importantly, it will extend statewide the 'AK Hydrography' collaboration, providing tools and support to streamline NHD updating in Alaska, improving efficiency and avoiding duplication of effort. The LCC project will be completed in late 2015.

Project WA2013_29

How it All Fits Together

The suite of past (p. 2) and current (p. 4-7) projects promotes advancements in water temperature monitoring, as well as in understanding the connections between temperature change, other physical and hydrological processes, and biological resources (Figure 3).

Figure 3. Relationship between the LCC's goals and the freshwater projects it supports. For project details, please visit <https://westernalaskalcc.org/projects/SitePages/freshwater.aspx>



Current Freshwater Projects

1 Alaska Online Aquatic Temperature Site (AK-OATS)

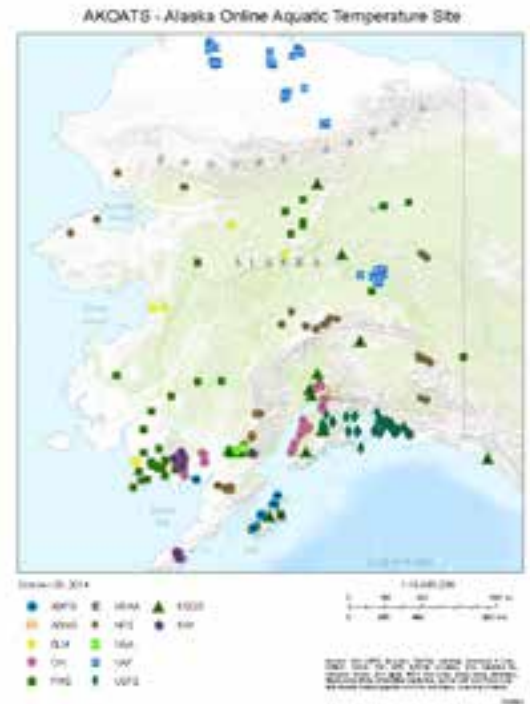
Project ID: WA2013_28

Lead Investigator: Jamie Trammell, University of Alaska Anchorage

Collaborators: Marcus Geist & Dan Bogan, University of Alaska Anchorage

Project Duration: 2013-2015

Funded in FY2013, this project represents the first step towards building the capacity for regional-scale water temperature and analysis. Because a coordinated network of monitoring data can help scientists and managers understand how aquatic systems are responding to climate change, conducting an inventory of past and present stream and lake temperature monitoring efforts was identified as a priority science need for Alaska. This project consolidates existing monitoring site locations and attributes into a statewide, spatially referenced 'project catalog', with an online interface that enables partners to add additional information. This database of monitoring projects is a first step in creating a voluntary monitoring network.



2 Water Temperature Monitoring Standards for Alaska

Project ID: WA2014_34

Lead Investigator: Jamie Trammell, University of Alaska Anchorage

Collaborators: Sue Mauger, Cook Inletkeeper; Rebecca Shaftel, Marcus Geist & Dan Bogan, University of Alaska Anchorage

Project Duration: 2014-2015

In order to inform resource management decisions related to fisheries, community water security and other resources, now and into the future, researchers have consistently prioritized the need to measure the status and trends of stream and lake temperatures across Alaska landscapes, and to compile those data for predictive modeling. This project identifies minimum data standards and recommends protocols to guide collection of water temperature data to use in landscape-level assessments. These clearly defined minimum standards will allow all partners collecting water temperature data, but especially the many smaller-scale non-agency efforts, to know that their data can contribute to regional-scale assessments.

Data Logger	Data Collection	Quality Assurance			Data Storage		
		Accuracy / Range	Sample Frequency / Duration	Accuracy Checks	Site Selection	Data Evaluation	File Format
Minimum sensor accuracy and operating range	Minimum sample frequency: 30 minutes, min. duration to collect data	Are their sensor accuracy check procedures, ice bath, field testing?	Is there guidance for sensor placement within stream or lake?	How are the data checked? Are the data corrected?	How are the data stored? Which format? Can they be exported in simple files	Does each site have distinct metadata regarding identifier, lat/lon coordinates, etc.?	Can the data be shared? Have the raw data been summarized into daily stats (mean, max, min)?

Current Freshwater Projects

3

Development of Voluntary Participation Water Temperature Network Implementation Plans for the Bristol Bay and Kodiak regions

Project ID: WA2014_30

Lead Investigator: Tim Troll, Bristol Bay Heritage Land Trust

Collaborators: Sue Flensburg, Bristol Bay Native Association; Sue Mauger, Cook Inletkeeper

Project Duration: 2014-2015

Project ID: WA2013_31

Lead Investigator: Bill Pyle, U.S. Fish and Wildlife Service

Collaborators: Alaska Department of Fish and Game, Kodiak Regional Aquaculture Association, Sun'aq Tribe

Project Duration: 2014-2015

The streams, rivers, and lakes of southwest Alaska provide essential spawning and rearing habitat for millions of Pacific salmon, collectively regarded as a foundation of the regional ecosystem and economy. Climate projections for the region indicate probable increases in annual and seasonal air temperature over the next 85 years. Corresponding increases in the temperature of freshwaters are expected, which may adversely influence the biology of salmon, the quality of salmon habitat, and the availability of salmon to support the ecosystem and economy.

These projects will develop Implementation Strategies for voluntary participation monitoring networks in two southwest Alaska sub-regions, Kodiak Archipelago and Bristol Bay. In each sub-region, the Implementation Strategies will identify issues inhibiting the partners' ability to contribute data to a regional monitoring network in support of regional analysis of freshwater temperature trends, including projection of expected future trends. The Bristol Bay plan is being co-developed with the Southwest Alaska Salmon Habitat Partnership.



4

Water Temperature Regimes in the Togiak NWR and Wood-Tikchik State Park



Project ID: WA2014_37

Lead Investigator: Daniel Schindler, University of Washington

Collaborators: Patrick Walsh, U.S. Fish and Wildlife Service

Project Duration: 2014-2016

This project will compile a database of existing stream, river and lake temperatures that is unmatched anywhere else in Alaska in terms of its spatial and temporal coverage. The data will be analyzed to characterize how the thermal regime of individual streams and lakes respond to changes in day length, precipitation and air temperature, providing an assessment of how thermal conditions have changed in response to changes in

climatological forcing. These results will be used to guide refinement of the monitoring plan developed to characterize thermal responses to ongoing climate change in the Wood-Tikchik State Park and the Togiak National Wildlife Refuge as well as development of scenarios of future stream thermal regimes across these landscape. The project will evaluate how both average change and spatial variation in stream thermal condition respond to changing climate.

This project will demonstrate the power of collecting, compiling, and synthesizing freshwater temperature data at the regional scale to better understand how our surface water systems have and may change. Ultimately, this project will demonstrate methods of analysis that can be applied to other regions of the LCC.

Current Freshwater Projects

5 Landscape-scale Analysis of the Relationship Between Juvenile Chinook Size and Growth and Stream Temperature in Western Alaska (Feasibility Phase)

Project ID: WA2013_36

Lead Investigator: Suresh Sethi, U.S. Fish and Wildlife Service

Collaborators: Brad Harris, Alaska Pacific University

Project Duration: 2014-2015

This project investigates the variability in size-at-age and annual growth for juvenile Chinook salmon across the western Alaska landscape, the association of juvenile Chinook size-at-age or annual growth with spatial or temporal stream temperature gradients, and whether expected water temperature changes in western Alaska will affect juvenile Chinook salmon habitat suitability and ultimately juvenile salmon condition. The LCC provided funding for a feasibility study in 2014 and will consider fully funding the project in 2015.



6 Temperature, Phenology, and Embryo Survival in Western Alaska Sockeye Salmon Populations: The Potential for Adaptation to a Warming World?



Project ID: WA2013_38

Lead Investigator: Jeffrey Falke, U.S. Geological Survey; Peter Westley, University of Alaska Fairbanks

Collaborators: Krista Bartz & Dan Young, National Park Service; Jennifer Griffiths, Stockholm University; Thomas Quinn, University of Washington

Project Duration: 2014-2016

This project's overarching goal is to understand how temperature might influence population-specific patterns of embryo incubation, timing of hatching and fry emergence, and sockeye salmon embryo survival. The project will combine analyses of data from two large lake systems in the Kvichak watershed, laboratory rearing experiments to elucidate functional relationships, and simulation modeling to quantify biological responses to changing freshwater temperature in this important species of western Alaska.

What's Next in Freshwater?

Pending availability of funds, in Winter 2014/2015 the LCC will make decisions regarding funding a number of additional projects in support of the theme of Changes in *Freshwater Temperature and Its Impacts*. Consideration will be given to the two Implementation Plans created under Project 3 and high ranking proposals received in response to our FY2014 RFP.

The Alaska Climate Science Center will be analyzing the geospatial database from Project 1 to develop recommendations for strategic expansion of monitoring locations statewide.

In addition, the LCC will continue working with the other Alaska LCCs and the Alaska Climate Science Center to help address the challenges of long-term management of hydrological data.

Other Major LCC Activities

While the majority of the 2014 project budget was devoted to promoting progress on Freshwater Systems topics, the LCC is engaged in the Coastal Systems and Terrestrial Systems topics in various ways.

Coastal Systems

As the Coastal Storms projects funded in 2012-2013 near completion, it is important to understand their impact in the context of other coastal change projects underway in western Alaska. Partner contributions provided support for an inventory of all current coastal change projects in the region. Conducted by the Alaska Center for Climate Assessment and Policy, this work will provide important information as the LCC considers the best way to move forward with Coastal topics in 2018-2019.

Terrestrial Systems

Addressing statewide concerns about invasive plants, partner contributions are supporting the development of a smartphone app to aid in identification and reporting of invasive plants in Alaska. Developed jointly by the University of Alaska Fairbanks and the University of Georgia, the app will be developed for both Android and iOS operating systems and will support integration of relevant reports into the Alaska Exotic Plants Information Clearinghouse (AKEPIC).

The LCC staff and Steering Committee are in the initial stages of selecting focal topics for the LCC's Terrestrial Systems program in 2016-2017.





Western Alaska Landscape Conservation Cooperative

Contact:

Steering Committee

<http://westernalaskalcc.org/governance/sitepages/steeringcommittee.aspx>

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More project information

<https://westernalaskalcc.org/projects/SitePages/allprojects.aspx>

westernalaskalcc.org

