Alaska Cooperative Fish and Wildlife Research Unit

Annual Research Report—2012

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Unit Roster 5
Federal Scientists 5
University Staff 5
Unit Students 5
Current 5
Graduated in CY 2012 5
Post-Doctoral Researchers 5
University Cooperators 6
Affiliated Students .....

Unit Roster

Federal Scientists

- Brad Griffith: Leader
- Jeff Falke: Assistant Leader-Fisheries (effective June 4, 2012)
- Dave McGuire: Assistant Leader-Ecology
- Abby Powell: Assistant Leader-Wildlife
- Mark Wipfli: Assistant Leader-Fisheries

University Staff

- Holly Neumeyer

University Cooperators

- Milo Adkison, School of Fisheries and Ocean Sciences (SFOS)-UAF
- Perry Barboza, Department of Biology and Wildlife(DBW) and Institute of Arctic Biology (IAB)-UAF
- F. Stuart Chapin, III, DBW and IAB
- Courtney Carothers, SFOS
- Eugénie Euskirchen, IAB
- Teresa Hollingsworth, Boreal Ecology Cooperative Research Unit (BECRU)-UAF
- Kris Hundertmark, DBW and IAB
- Christine Hunter, DBW and IAB
- Katrin Iken, SFOS
- Knut Kielland, IAB
- Mark Lindberg, DBW and IAB
- Andres Lopez, SFOS
- Sergey Marchenko, Geophysical Institute (GI)-UAF
- Kevin McCracken, DBW and IAB
- Anupma Prakash, GI and College of Natural Sciences and Mathematics
- James Reynolds, Emeritus UAF
- Vladimir Romanovsky, GI
- Amanda Rosenberger, University of Missouri
- Roger Ruess, DBW and IAB
- T. Scott Rupp, Scenarios Network for Alaska and Arctic Planning (SNAP)-UAF
- Trent Sutton, SFOS
- Dave Verbyla, SALRM
- Donald Walker, IAB

Affiliated Students

Current

- Matthew Albert, MS Fisheries (Sutton)
- Brittany Blain, MS Fisheries (Sutton)
- Tobey Carman, MS Computer Science (Euskirchen)
- Kevin Foley, MS Fisheries (Rosenberger)
- Sophie Gilbert, PhD Biological Sciences (Hundertmark)
- Elchin Jafarov, PhD Geophysics (Romanovsky)
- Tyler Lewis, PhD Biological Sciences (Lindberg)
- Jamie McKellar, MS Fisheries (Iken and Sutton)
- Stephanie Meggers, MS Fisheries (Seitz and Prakash)
- Dana Nossov, PhD Biological Sciences (Kielland)
- Daniel Rizzolo, PhD Biological Sciences (Lindberg)
- Heather Scannell, MS Fisheries (Sutton and Margraf)
- Matthew Smith, MS Wildlife Biology and Conservation (McCracken)
- Nicholas Smith, MS Fisheries (Sutton)
- Jason Stolarski, PhD Fisheries (Sutton and Prakash)
- Lindsey VanSomeren, MS Wildlife Biology and Conservation (Barboza)
- Mark Winterstein, MS Biology (Walker and Hollingsworth)

Graduated in CY 2012

- Katie Moerlein, MS Fisheries (Carothers)

Affiliated Post-Doctoral Researchers

- Amy Breen (Rupp)
- Mark Miller (Lindberg)
- Reginald Muskett (Romanovsky)
- Ken Tape (Ruess)

Cooperators

- Brian Barnes–Director, Institute of Arctic Biology, University of Alaska Fairbanks
- Cora Campbell–Commissioner, Alaska Department of Fish and Game
- Geoff Haskett–Director, Region 7, US Fish and Wildlife Service
- F. Joseph Margraf–Unit Supervisor, Cooperative Research Units, US Geological Survey
- Chris Smith–Western Field Representative, Wildlife Management Institute

This is the Annual Report for the Alaska Cooperative Fish and Wildlife Research Unit, highlighting activities for calendar year 2012. The Unit engages in research on living natural resources for a variety of State and Federal agencies. As an unbiased research organization, the Unit provides information requested and funded by these agencies. When studies are completed, the agencies use the information to assist in their natural resource management efforts. Most of the research is conducted by graduate students, many of whom go on to work for the agencies upon graduation.

In June 2012, Dr. Jeffrey (Jeff) Falke arrived in Alaska and started his position as the new Assistant Unit Leader-Fisheries. Jeff comes to the CRU program from Oregon State University where he was a Postdoctoral Research Associate in the Department of Fisheries and Wildlife. Jeff's research and expertise have focused on freshwater fish issues throughout the Midwest and Pacific Northwest. He has recently conducted research on models to predict the distribution and abundance of steelhead redds in eastern Oregon, an assessment of the vulnerability of threatened salmonids and their habitats to wildfire, and integrated habitat suitability-occupancy models. Jeff is originally from Missouri and has a BS from the University of Missouri, MS from Kansas State University, and PhD from Colorado State University. Contact info: jeffrey.falke@alaska.edu, 907-474-6044.

The Alaska Unit was established in 1950, providing over half a century of research dedicated to helping conserve and enhance the living natural resources of the State and the Arctic Region. The Unit is part of a larger and even older program, the U.S. Department of the Interior's Cooperative Research Unit Program. Established in 1935, Cooperative Research Units were created to fill the vacuum of wildlife management information and the shortage of trained wildlife biologists. In 1960, the Unit Program was formally sanctioned by Congress with the enactment of the Cooperative Units Act. Each unit is a partnership among the Ecosystems Discipline of the U.S. Geological Survey, a State fish and game agency, a host university, and the Wildlife Management Institute. Staffed by Federal personnel,

populations. Wildlife research will focus on the ecology of northern birds and mammals and their habitats. Unit research will also be directed at integrated studies of fish and wildlife at the ecosystem level.

Unit Cost-Benefit Statements

In-Kind Support

In-kind support, usually operational support of field activities, is critical to the success of the Alaska Cooperative Fish and Wildlife Research Unit. Although the monetary value of this support is not known, a listing of the assistance is provided for each project in this report.

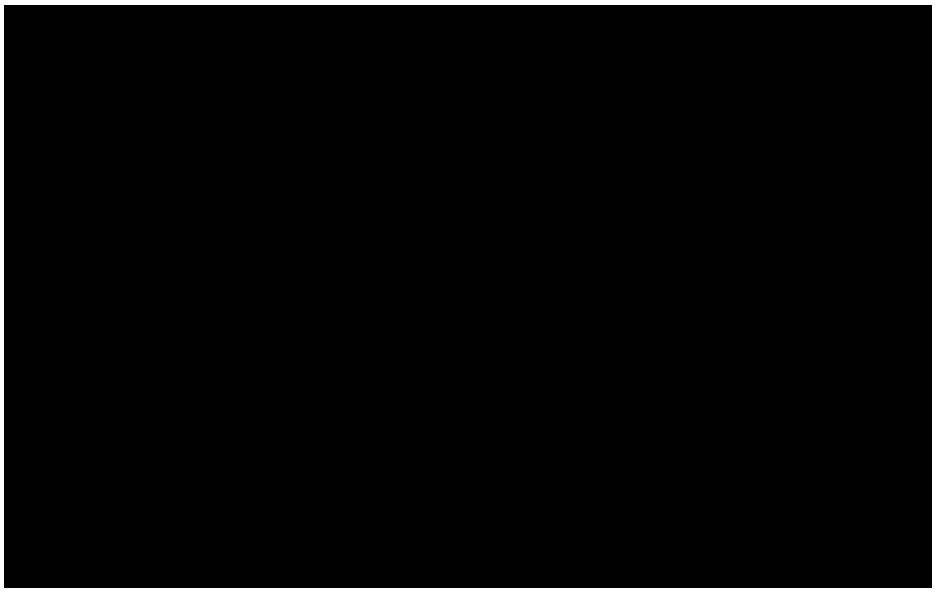
Benefits

Students Graduated: 3
Presentations: 38
Scientific and Technical Publications: 23

Courses Taught

Honors and Awards

- Twenty-Year Length-of-Service Awards from the U.S. Government were presented to Dave McGuire, Mark Wipfli, and Abby Powell



- Dave McGuire:
  * AAAS Fellow awarded by the American Association for the Advancement of Science
  * 2012 Performance Award awarded by the Cooperative Research Unit Program
- Abby Powell: American Ornithologists' Union Fellow awarded by the American Ornithologists' Union
- Heather Craig, MS Wildlife Conservation candidate advised by Abby Powell, received a
  * CNSM Student Travel Grant Award from the UAF College of Natural Science and Mathematics to attend the North American Ornithological Conference in Vancouver, BC, August 2012
  * travel award from the Alaska Bird Conference Organizing Committee to attend the Alaska Bird Conference in Anchorage, AK, October 2012
- Christopher Harwood, MS Wildlife Conservation candidate advised by Abby Powell, received the 2012 Angus Gavin Memorial Migratory Bird Research Grant awarded by the University of Alaska Foundation. He received the $15,000 award for his project, "Breeding Ecology of Whimbrels in Interior Alaska," which focuses on understanding factors effecting breeding populations of whimbrels (a species of curlew) in subarctic habitats.
  * He also received a UAF Institute of Arctic Biology (IAB) Director's Travel Award to attend the Alaska Bird Conference, Anchorage, AK, October 2012
- Kurt Heim, MS Fisheries candidate advised by Mark Wipfli, received an IAB Director's Travel Grant Award to attend the American Fisheries Society Alaska Chapter Annual Meeting in Kodiak, October 2012
- Philip Joy, PhD Fisheries candidate advised by Mark Wipfli, received an IAB Director's Travel Grant Award to attend the American Fisheries Society Alaska Chapter Annual Meeting in Kodiak, October 2012

- Jason McFarland, MS Biological Sciences candidate advised by Mark Wipfli, received an IAB Director's Travel Grant Award to attend the American Fisheries Society Alaska Chapter Annual Meeting in Kodiak, October 2012
- Jason Neuswanger, PhD Biological Sciences candidate advised by Mark Wipfli, won the best student paper award for an oral presentation at the annual national meeting of the American Fisheries Society in Minneapolis, MN.

Papers Presented

Churchwell, R. and A.N. Powell. October 2012. Impacts of feeding shorebirds on the invertebrate community of an arctic mudflat. 15th Annual Alaska Bird Conference, Anchorage, AK. (Contributed Oral)

Craig, H., A. Powell, S. Kendall, and T. Wild. August 2012. Annual survival of Smith's Longspurs in Alaska. 5th North American Ornithological Conference, Vancouver, B.C. (Contributed Poster)

Craig, H., A.N. Powell, S. Kendall, and T. Wild. October 2012. Effects of sex and age on survival of Smith's Longspurs in northern Alaska. 15th Annual Alaska Bird Conference, Anchorage, AK. (Contributed Oral)

Euskirchen, E.S., T.B. Carman, and A.D. McGuire. December 2012. Modeling leaf phenology variation by groupings within and across ecosystems in northern Alaska. American Geophysical Union 45th Annual Fall Meeting, San Francisco, CA. (Contributed Poster)

Falke, J.A. and D.J. Isaak. October 2012. Overview and applications of stream water temperature predictive models for fish conservation and management. Alaska Chapter of the American Fisheries Society 39th Annual Meeting, Kodiak, AK. (Invited Oral)

Falke, J., K. McNyset, B. Flitcroft, G. Reeves, C. Jordan, and J. Dunham. August 2012. Application of a riverscape water temperature model for conservation and management of threatened salmonids in the Pacific Northwest. American Fisheries Society Annual Meeting, St. Paul, MN. (Invited Oral)

Genet, H., K.M. Barrett, J.F. Johnstone, A.D. McGuire, F. Yuan, E.S., Euskirchen, E.S. Kasischke, S.T. Rupp, and M.R. Turetsky. December 2012. Modeling the effects of fire sl3v615de0094 e0094 e'4( )464(r)3u0-4(( )10-49nc)-2N5g(y)c 5.01oN5g(y)c 1dy

Roach, J.K. and B. Griffith. December 2012. Heterogeneity in high latitude lake area trends and relationship to landscape characteristics. American Geophysical Union 45th Annual Fall Meeting, San Francisco, CA. American Geophysical Union 45th Annual Fall Meeting, San Francisco, CA. (Contributed Poster)

Schädel, C., A.D. McGuire, J. G. Canadell, J. W. Harden, P. Kuhry, V. E. Romanovsky, M. R. Turetsky, and E.A.G. Schuur. June 2012. Vulnerability of permafrost carbon research coordination network. Tenth International Conference on Permafrost. Salekhard, Russia. (Contributed Poster)

Schädel, C., E.A.G. Schuur, A.D. McGuire, J. Canadell, J. Harden, P. Kuhry, V. Romanovsky, and M. Turetsky. April 2012. Vulnerability of permafrost carbon research coordination network. Annual Meeting of the European Geophysical Union, Vienna, Austria. (Contributed Poster)

Sexson, M.G., M.R. Petersen, and A.N. Powell. October 2012. Spatiotemporal distribution of Spectacled Eiders throughout the annual cycle. 15th Annual Alaska Bird Conference, Anchorage, AK. (Contributed Poster)

Sloan, V.L., C. Iversen, J. Childs, E.S. Euskirchen, A.D. McGuire, and R.J. Norby. December 2012. Linking vegetation composition to geomorphic units in a polygonal tundra landscape: A framework for improving estimates of plant L..functional type cove Annual Fall Meeting, San Francisco, CA. (Contributed Poster)

Tauzer, L. and A. Powell. August 2012. Ecosystem shift in an Alaskan boreal forest: Is there evidence of change in avian communities? 5th North American Ornithological Conference, Vancouver, B.C. (Contributed Poster)

Tauzer, L., A.N. Powell, and S. Sharbaugh. October 2012. Ecosystem shift in an Alaskan boreal forest: Evidence that succession drives avian population change. 15th Annual Alaska Bird Conference, Anchorage, AK. (Contributed Oral)

Waldrop, M.P., J. McFarland, E.S. Euskirchen, M.R. Turetsky, J.W. Harden, K. Manies, M. Jones, and A.D. McGuire. December 2012. Carbon balance and greenhouse gas fluxes in a thermokarst bog in interior Alaska: Positive and negative feedbacks from permafrost thaw. American Geophysical Union 45th Annual Fall Meeting, San Francisco, CA. (Contributed Oral)

Wild, T., S. Kendall, and A.N. Powell. October 2012. How many Smith's Longspurs are in Alaska's Brooks Range?: Estimating breeding density of a polygynandrous species. 15th Annual Alaska Bird Conference, Anchorage, AK. (Contributed Oral)

Zhang, Y. A.D. McGuire, H. Genet, W.R. Bolton, V.E. Romanovsky, G. Grosse, M.T. Jorgenson. December 2012. Modeling thermokarst dynamics in Alaska ecosystems. American Geophysical Union 45th Annual Fall Meeting, San Francisco, CA. (Contributed Poster)

Zhuang, Q., X. Zhu, C. Prigent, J.M. Melillo, A.D. McGuire, R.G. Prinn, and D.W. Kicklighter. December 2012. Influence of changes in wetland inundation extent on net fluxes of carbon dioxide and methane in northern latitudes from 1993 to 2004. American Geophysical Union 45th Annual Fall Meeting, San Francisco, CA. (Contributed Oral)

Scientific Publications

Benson, E.R., M.S. Wipfli, J.E. Clapcott, and N.F. Hughes. 2012. Relationships between ecosystem metabolism, benthic macroinvertebrate densities, and environmental variables in a sub-arctic Alaskan river. Hydrobiologia DOI 10.1007/s10750-012-1272-0

Bentzen, R. and A.N. Powell. 2012. Population dynamics of king eiders breeding in Alaska. Journal of Wildlife Management 76(5):1011-1020, DOI:10.1002/jwmg.335

Callaghan, T.V., M. Johansson, O. Anisimov, H.H. Christiansen, A. Instanes, V. Romanovsky, S. Smith, and contributing authors (including A.D. McGuire). 2012. Changing permafrost and its impacts. Chapter 5 in Snow, Water, Ice, and Permafrost in the Arctic (SWIPA). Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway, pp. 5-1 to 5-22.

Falke, J.A., L.L. Bailey, K.R. Bestgen, and K.D. Fausch. 2012. Colonization and extinction in dynamic habitats: an occupancy approach for an assemblage of fishes in a Great Plains river. Ecology 93:858-867.

Harden, J.W., C.D. Koven, C.-Lu Ping, G. Hugelius, A.D. McGuire, P. Camill, T. Jorgenson, P. Kuhry, G.J. Michaelson, J.A. O'Donnell, E.A.G. Schuur, C.

O'Donnell, J.A., M.T. Jorgenson, J.W. Harden, A.D. McGuire, M.Z. Kanevskiy, and

Ongoing Aquatic Studies

Growth and Reproductive Status of Razor Clams (

Marine-Derived Nutrient Effects on Chinook and Coho Salmon Productivity

Student Investigator: Philip Joy, PhD Fisheries
Advisor: Mark Wipfli
Funding Agencies: Alaska Sustainable Salmon Fund (AKSSF): Sport Fish Division, ADFG; Norton Sound Economic Development Corporation (NSEDC)

Marine nutrients imported to freshwater systems by migrating salmon, or marine-derived nutrients (MDN), have been identified as a significant variable affecting growth and survival of juvenile salmon. The effects on stock productivity, however, have not been assessed directly. Given that larger smolt are associated with higher marine survival, understanding the impacts of MDN on juvenile growth, size, and abundance may ultimately improve managers' ability to forecast return rates of adult salmon. The objectives of this study are to identify the degree and route of MDN assimilation in rearing Chinook and coho salmon and determine the effect on growth and size. Two-thousand twelve (2012) was the second year of a three-year project. Chinook and coho salmon smolt productivity is being examined with mark-recapture experiments on migrating smolt. MDN assimilation and growth are being assessed

Seasonal Movements of Arctic Grayling ( ) in a Small Beaded Stream on the Arctic Coastal Plain, Alaska

Student Investigator: Kurt Heim, MS Fisheries
Advisor: Mark Wipfli
Funding Agencies: USFWS (RWO 168) and Bureau of Land Management (BLM) (RWO 179)
In-Kind Support: Field logistics provided by BLM

The Arctic Coastal Plain is a unique landscape with a mosaic pattern of seasonally interconnected lakes and streams that support abounding populations of Arctic grayling; however, we know little about their habitat needs and migrations. Oil and gas development of this area has the potential to alter hydrology; thus, understanding local grayling ecology is a management need. The objective of this study is to track grayling movements in a representative beaded stream habitat and develop models to relate these movements to environmental variability and individual level attributes. We implanted Passive Integrated Transponder (PIT) tags into 575 grayling and tracked their movements within Crea Creek using an array of radio-frequency identification antennae. Grayling immigrated into Crea Creek in June shortly after the breakup of ice, when stream discharge peaked. As flows receded to low summer levels in July, many of these fish emigrated from the system. These emigrants were primarily adults, while the group that remained in the system was primarily juveniles. These movements and the presence of young-of-the-year grayling in the headwaters indicate that adults are making a spawning run into Crea Creek. Monitoring throughout the summer indicates that grayling continue to immigrate into Crea Creek; however, immigrants during the low-flow period display short residence times and limited upstream travel compared to June immigrants. Our study demonstrates the importance of beaded stream habitats to grayling and the need for continuous unobstructed access during the entire ice-free period.

Development and Calibration of Bioelectrical Impedance Analysis as a M

thermal regimes in the state. Spatio-temporal variability in water temperature metrics will be assessed using existing temperature data and a subset collected during this project. Water and air temperature data were collected in summer 2012 from 54 sites in the Reese River and Stewart Creek, Nye County, Nevada. Analyses are in progress. Current numeric criteria for mainstem habitats exist, but sources are poorly documented. Smaller streams are currently classified by water quality, and within each category a single criterion is applied across the year. New thermal criteria for Nevada's coldwater fishes are needed that are clear, consistent, supportable, and easily measurable.

Distribution Patterns and Habitat Associations of Juvenile Coho Salmon in High Gradient Headwater Tributaries of the Little Susitna River, Alaska

Student Investigator: Kevin Foley, MS Fisheries Science
Advisor: Amanda Rosenberger
Funding Agency: Anchorage Field Office, USFWS (RWO 174)
In-Kind Support: USFWS provided technical assistance and equipment

The upper Little Susitna River provides habitat for Pacific salmon runs faced with increased watershed development and fishing pressure. We lack a full understanding of juvenile rearing habitat and factors that limit Pacific salmon within the region. Conservation practices in the form of culvert pipe replacement are currently underway within the upper Little Susitna River watershed. These efforts are prioritized with little consideration to the capacity of these areas to bear and support salmon populations. My primary objective was to determine how habitat characteristics affected sampling efficiency of juvenile coho salmon and to validate low-effort backpack electrofisher sampling. We conducted closed population mark-recapture events as a baseline measure of fish abundance and detailed habitat measurements to determine how the efficiency of single-pass backpack electrofisher was influenced by stream habitat characteristics. We found that habitat characteristics had no measurable effect on sampling efficiency along the range of conditions within these headwater systems. Single-pass catch of mark-recapture reaches explained 94.8% of the observed variation within predictive models of abundance estimates. Absolute errors of abundance estimates based upon single-pass catch numbers were off on average by 110 fish, whereas relative errors of predicted abundance estimates were off by an absolute percentage of 24%. Results from this project will allow for a more strategic management of these populations, helping managers improve accuracy and establish reliable and unbiased population estimates. In turn, these estimates may be coupled with detailed measures of habitat to help prioritize replacement of culvert pipes within systems throughout the region.

Winter Movement Patterns and Habitat Use of Kotzebue Region Inconnu

Student Investigator: Nicholas Smith, MS Fisheries
Advisor: Trent Sutton
Funding Agency: Office of Subsistence Management, USFWS (RWO 177)
In-Kind Support: Field camp logistics and equipment during field season provided by Fairbanks Fish and Wildlife Field Office and Selawik National Wildlife Refuge, USFWS; Equipment during field season provided by ADFG

Inconnu of the Selawik and Kobuk River drainages are considered separate stocks. However, the two stocks overwinter as a mixed stock within Hotham Inlet and Selawik Lake, and to date no evaluation of inconnu migration and distribution during the wintering period relative to physico-chemical attributes within these drainages has been conducted. Inconnu provide an important subsistence food resource for this region of Alaska. To effectively manage the inconnu of this region, winter movement and habitat use need to be identified. The primary objectives of this study are to examine the distribution patterns of inconnu in the Selawik and Kobuk River drainages during the wintering period and determine whether water depth, temperature, or salinity influence winter habitat selection. These objectives were accomplished using acoustically tagged inconnu and automated submersible receivers

Completed Wildlife Studies

regarding the distribution and habitats used by Spectacled Eiders will help managers identify potential threats to the species away from breeding areas. This information is also needed to improve industrial development plans in the Chukchi and Beaufort seas, and to understand population level effects resulting from ecosystem changes. The primary objective of our study is to assess the distribution, migratory patterns, and habitat use of Spectacled Eiders at sea. We implanted satellite transmitters in Spectacled Eiders to collect location data from each individual over a 2-year period. Data were summarized to describe spatiotemporal patterns in distribution and migration. Data will also be incorporated into habitat use models and accompany a population genetics study. We marked 129 Spectacled Eiders at breeding sites in northern and western Alaska over 4 years (2008-2011). In spring and fall, eiders were located in distinct areas of the Bering, Chukchi, Beaufort, and East Siberian seas. In winter, all eiders used an area in the northern Bering Sea. Site fidelity among females was higher than males. Information regarding the spatiotemporal patterns of Spectacled Eiders at sea is valuable to conservation and recovery efforts. In addition, this information is necessary when planning the development of offshore natural resources in the Chukchi and Beaufort seas, mitigating for commercial and research vessel traffic in the Arctic, and understanding potential effects of changing prey regimes and habitat components such as sea ice.

Breeding Ecology of Whimbrels ( ) in Interior Alaska

Student Investigator: Christopher M. Harwood, MS Wildlife Biology
Advisor: Abby Powell
Funding Agency: Kanuti National Wildlife Refuge, USFWS; UA Foundation (Angus Gavin Bird Research); IAB Student Travel Award
In-Kind Support: Equipment used during field season provided by AKCFWRU

Studies of Whimbrel breeding ecology are limited in North America, despite suspected population declines and an official designation as a species of conservation concern in both the U.S. and Canada, as well as Alaska specifically. The ecology and distribution of the species in interior Alaska have

suggests a species with a patchy distribution and a metapopulation structure in the

Completed Ecological Studies

Partitioning of Soil Respiration along Moisture Gradients in Alaskan Landscapes

Student Investigator: Nicole McConnell, MS Biology
Advisor: A. David McGuire
Funding Agency: Geologic Division, USGS (RWO 178)

Permafrost and thick organic soil layers are common to most wetlands in interior Alaska, where wetlands regionally have functioned as important long-term soil carbon sinks. Boreal wetlands are diverse in both vegetation and nutrient cycling characteristics, which together serve as important controls on carbon cycling. Graduate student Nicole McConnell analyzed 5 years of growing season soil CO_2 fluxes along a gradient of vegetation and permafrost extent in a boreal wetland complex. In general, the communities underlain by surface permafrost had colder and drier surface soils and also tended to have lower ecosystem respiration (ER) relative to communities without surface permafrost. While there were few relationships between soil temperature, water table position, and thaw depth on instantaneous ER within communities, mean monthly ER increased exponentially

less than they increase carbon inputs via production. However, after 2061 the rate of SOC sequestration will be weakened and, as a result, the rich fen will likely become a carbon source to the atmosphere between 2062 and 2099. During this period, the effects of projected warming increase respiration so that it is greater than carbon inputs via production. Although changes in precipitation alone had relatively little effect on the dynamics of SOC, changes in precipitation did interact with warming to influence SOC dynamics for some climate scenarios.

A Total Environment of Change: Exploring Social-Ecological Shifts in Subsistence Fisheries in Noatak and Selawik, Alaska

Student Investigator: Katie Moerlein, MS Fisheries
Advisor: Courtney Carothers
Funding Agency: Office of Subsistence Management, USFWS (RWO 182)

Note: Katie Moerlein graduated from the University of Alaska Fairbanks in May 2012. Her thesis abstract follows:

Arctic ecosystems are undergoing rapid changes as a result of global climate change, with significant implications for the livelihoods of Arctic peoples. In this thesis, I use ethnographic research methods to detail prominent environmental changes observed and experienced over the past few decades and to document the impact of these changes on subsistence fishing practices in the Iñupiaq communities of Noatak and Selawik in northwestern Alaska. Using in-depth key informant interviews, participant observation, and cultural consensus analysis, I explore local knowledge and perceptions of climate change and other pronounced changes facing the communities of Noatak and Selawik. I find consistent agreement about a range of perceived environmental changes affecting subsistence fisheries in this region, including lower river water levels, decreasing abundances of particular fish species, increasingly unpredictable weather conditions, and increasing presence of beaver, which affect local waterways and fisheries. These observations of environmental changes are not perceived as isolated phenomena, but are experienced in the context of accompanying social changes that are continually reshaping rural Alaska communities and subsistence economies. Consequently, in order to properly assess and understand the impacts of climate change on the subsistence practices in Arctic communities, we must also consider the total environment of change that is dramatically shaping the relationship between people, communities, and their surrounding environments.

Ongoing Ecological Studies

Identifying Indicators of State Change and Forecasting Future Vulnerability in Alaskan Boreal Ecosystems

Postdoctoral Researcher: Héléne Genet
Faculty: A. David McGuire
Funding Agency: Department of Defense (DoD)

communicating within and outside the network in order to more efficiently keep members informed and able to input ideas.

Development and Application of an Integrated Ecosystem Model for Alaska

Postdoctoral Researchers: Amy Breen, Héléne Genet, Reginald Muskett, and Yujin Zhang
Student Investigators: Tobey Carman (MS Computer Science) and Elchin Javarov

Collaborative Research on Characterizing Post-Fire Successional Trajectories in Tundra Ecosystems

Postdoctoral Researcher: Amy Breen
Principal Investigator: Scott Rupp
Co-Principal Investigator: Teresa Hollingsworth
Funding Agency: Alaska Science Center, USGS (RWO 195)
In-Kind Support: Housing while in the field in Kotzebue, AK, provided by BLM and NPS

Changes in fire regime are predicted to increase the extent and frequency of

Geophysical measurements indicate physical changes occurring within the permafrost zones. Using ground-based and satellite-based geodetic measurements we are assessing the elements of water equivalent mass changes. Water equivalent mass (WEM) change is the cumulative sum of surface (including changes of snow water equivalent mass, discharge, and lake storage), and groundwater after removal of the atmospheric water equivalent mass and solid body mass changes. We utilize the Gravity Recovery and Climate Experiment (GRACE, satellites) and Global Positioning System (ground-based network) relative to the International Terrestrial Reference Frame. We quantify (R)-12Oiteerttlr71(lWE)5(M)2())8ne 1(t)4(w(a)1(m)5l)514

2013 to determine winter browse use by moose in these strata. Results will include estimates of browse quantity per burn (reported as shrub density/ha) and quality per burn (evaluated by measuring %C and N). Additionally, we will determine browse use by moose as a percentage of the total browse biomass available per burn. We will integrate our findings with knowledge of subsistence resource demand and harvest for four communities adjacent to Kanuti NWR. The results of this study will be useful in guiding land management decisions related to moose management objectives on the Kanuti NWR as burn scars age and progress through post-fire vegetative succession.

Implications of Climate Change for Biodiversity in Yukon River Basin Wetlands: Yukon Flats National Wildlife Refuge as a Test Case

Postdoctoral Researcher: Jennifer Roach
Faculty: Brad Griffith
Funding Agencies: USFWS; USGS (RWO 172)

Recent studies have identified net regional-scale declines in lake area in the Arctic and sub-Arctic that have been coincident with climate warming. Lakes are important breeding grounds for global migratory waterfowl populations, and the effect of lake area decline on avian species biodiversity, habitat, and aquatic food sources is unknown. The objectives of this study are to (1) build spatially explicit models of lake-specific biodiversity of four major taxa (birds, small mammals, vegetation, and aquatic invertebrates) based on broadly mapped landscape characteristics such as lake size, elevation, distance to rivers, land cover type, and surrounding habitat matrix, and (2) use these models to spatially and temporally project changes in biodiversity as a result of climate-induced changes in lake size, and (3) identify field-measured characteristics such as water chemistry and lake bathymetry that explain the residuals from these predictive models. Models will be built using estimates of avian, invertebrate, small mammal and vegetation biodiversity along with a suite of potential explanatory variables from a randomly spatially distributed sample of ~120 lakes in the Yukon Flats National Wildlife Refuge. Data collection is complete and waterfowl richness data analysis is in progress. Preliminary results suggest that lake waterfowl species richness is positively related to lake size, proportion of wetland vegetation surrounding the lake perimeter, proximity to rivers, and maximum lake size within 5 km. This information will provide land managers with spatially explicit projections of climate-induced changes on species biodiversity and will enable land managers to target specific habitats and species in conservation efforts.

Modeling Interactions between Climate Change, Lake Change, and Boreal Ecosystem Dynamics in the Yukon Flats National Wildlife Refuge

Student Investigator: Vijay Patil, PhD Biological Sciences
Co-Advisors: Brad Griffith and Eugénie Euskirchen

obscure the ecological significance of lake drying. Our objective is to estimate the influence of drying and flooding regimes on terrestrial ecosystem dynamics in the Yukon Flats National Wildlife Refuge. We will meet this objective using a combination of remote sensing, field surveys, and modeling exercises. Between 2010 and 2012, we surveyed vegetation at 130 lakes. We also sampled aboveground net primary productivity (ANPP) and soil characteristics (moisture, carbon, and nitrogen) at a subset of 16 lakes. Two-thirds of soil and productivity samples have been analyzed, and results were presented at the 2012 American Geophysical Union meeting. Increasing lakes had the highest ANPP but the lowest pH levels, while flooding lakes had reduced shrub biomass and soil nitrate availability relative to other sites. Peat depth was not influenced by lake history. These findings are helping us to incorporate the effects of lake history into a process-based model that will be used to simulate the carbon dynamics of Alaskan peatlands in a changing climate. We are also using our survey data to inform models of current and future spatial patterns of vegetation in highly valuable habitats for waterfowl and other wildlife.

Changing Habitat and Seasonality in Arctic Alaska and Impacts to Migrating Caribou and Birds

Postdoctoral Researcher: Ken Tape
Faculty: Roger Ruess
Funding Agency: Alaska Science Center, USGS (RWO 196)

Warming in Arctic Alaska has led to accelerated coastal erosion and earlier seasonal disappearance of snow, among other things. There is a need to understand these changes and their effects on caribou and migratory birds so that land managers can better understand and predict the impacts of ongoing changes on those animals. Caribou and geese are integral subsistence and personal use 4(e)-3(r3(p)1(e)2(gur)5(s)3l)7( )6(1(h

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Investigating Recent Change in Habitat and Avian Communities at Creamer's Refuge, Fairbanks, AK

Student Investigator: Lila Tauzer, MS Biology and Wildlife Conservation
Advisor: Abby Powell
Funding Agencies: Alaska Space Grant, NASA; Angus Gavin Memorial Bird Research Grant, UAF; IAB Summer Fellowship; AKCFWRU, Calvin J. Lensink Graduate Fellowship
In-Kind Support: Alaska Bird Observatory

Changes in vegetation and birds have been documented worldwide and correlated with recent warming trends. Little baseline data exists in Alaska where change is predicted to be the most drastic. Our understanding of the extent and consequences of ecosystem change in boreal forest is insufficient. Land stewards are finding it increasingly difficult to effectively manage with the limited data available. My specific objectives were twofold: (1) to quantify habitat change in the last 35 years at Creamer's Refuge, and (2) to relate these finding to changes observed in the local avian community. First, I quantified change in vegetation structure using remote-sensing data and archived field data from the 1970's. Second, I assessed the simultaneous habitat-specific change in avian communities. Marked changes in both vegetation and birds have occurred during the last 35 years. While direction and magnitude of this change varied with habitat type, there has been an overall decrease in shrub habitat and increase in forest. Change in bird abundances reflected this successional shift and additionally suggest a drying trend. This study gives an indication of the spatial and temporal scale needed to accurately document environmental change in a boreal wetland ecosystem. Information gathered provides habitat-

Annual Research Report

However, it is likely that hydrologic regimes will be altered, impacting aquatic communities and food web dynamics. The role of biotic and abiotic controls on Arctic lake food web structure will be investigated by addressing the following hypotheses: (1) lake community composition and food web structure differ with the degree of surface water connectivity; (2) fish predation and number of consumer levels affect food web structure; (3) the effect of a fish species in structuring lake food webs depends on its relative position within the food web; and (4) fish diet composition and trophic position differ with the assemblage of sympatric fish species. We sampled fish and invertebrates from 16 waterbodies of four treatment types: disconnected fishless ponds, low-connectivity ponds containing fish, disconnected lakes containing fish, and well-connected lakes containing fish. Degree of surface water connectivity influenced fish community composition. Well-connected lakes had greater fish species richness (6 spp.) than lakes with poor or no connectivity (1 sp.). Preliminary investigation of invertebrate taxa richness suggests that waterbodies with fish contain greater invertebrate richness (16–17 taxa) than those without fish (9–10 taxa). The results of this study will help guide management of Arctic species and provide necessary baseline ecological information for freshwater ecosystems on the Arctic Coastal Plain.

Feeding Ecology of Arctic Grayling ( ) in a Small Tundra Stream on the Arctic Coastal Plain, Alaska

Student Investigator: Jason J. McFarland, MS Biological Sciences
Advisor: Mark Wipfli
Funding Agency: Bureau of Land Management (BLM) (RWO 179)
In-Kind Support: Field camp logistics and equipment provided by BLM; Teaching Assistantship provided by Department of Biology and Wildlife

Climate change and increased oil and gas activities on Alaska's North Slope pose probable threats to ecological processes in aquatic ecosystems. The

August. Preliminary results suggest large differences in terrestrial invertebrate prey inputs among different riparian vegetation types and that aquatic invertebrates are more important food items to Arctic grayling than are terrestrial prey. Arctic grayling are not commonly known to be piscivorous, although we consistently found large amounts of ninespine stickleback (*Pungitius pungitius*) in their guts, especially larger grayling, suggesting that these fish rely heavily on piscivory.

Interactions of Fire and Thermokarst Affecting Ecological Change in Alaska

Student Investigator: Dana Nossov, PhD Biological Sciences
Co-Advisors: Knut Kielland and Torre Jorgenson
Funding Agency: USGS (RWO 189)
In-Kind Support: BNZ-LTER, DoD

Permafrost underlies ~70% of the landscape of Alaskan boreal region and is vulnerable to thawing from climate warming. Wildfire is a widespread disturbance that can trigger rapid permafrost degradation. The vulnerability of permafrost to degradation and the ecological effects can vary widely within a region. Permafrost strongly influences ecosystem processes, vegetation, and hydrology, and the pattern of its degradation has important implications from local to global scales. A better understanding of the interactions between fire and permafrost in the context of a heterogeneous environment is needed to be able to predict and plan for future ecological changes. The initial objective of this study is to assess the response of permafrost and vegetation to fire across different landscape types in interior Alaska. We are addressing this objective by (1) determining rates of vegetation change and

Climate Change and

strongly correlated to a gradient of soil moisture from current lake shore to historic lake shore. Total carbon and nitrogen are inversely correlated to distance from current lake shore. The results from this study will provide baseline data for the greater scientific community for the modeling of ecosystem processes, services, and wildlife habitat.

List of Abbreviations

ADFG	Alaska Department of Fish and Game
AKCFWRU	Alaska Cooperative Fish and Wildlife Research Unit
AKSSF	Alaska Sustainable Salmon Fund
AYKSSI	Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative
BLM	U.S. Bureau of Land Management
BOEM	U.S. Bureau of Ocean Energy Management
DBW	Department of Biology and Wildlife, UAF
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
GI	Geophysical Institute, UAF
GIS	Geographical Information System
IAB	Institute of Arctic Biology, UAF
NASA	U.S. nTJ 0aA13(14.4-2(EM)]TJ 0 Tc 2.226 0 Td (58(e)3(rdf2(e)3(F)]TRd [(De)3(p)2(7s)2(k)