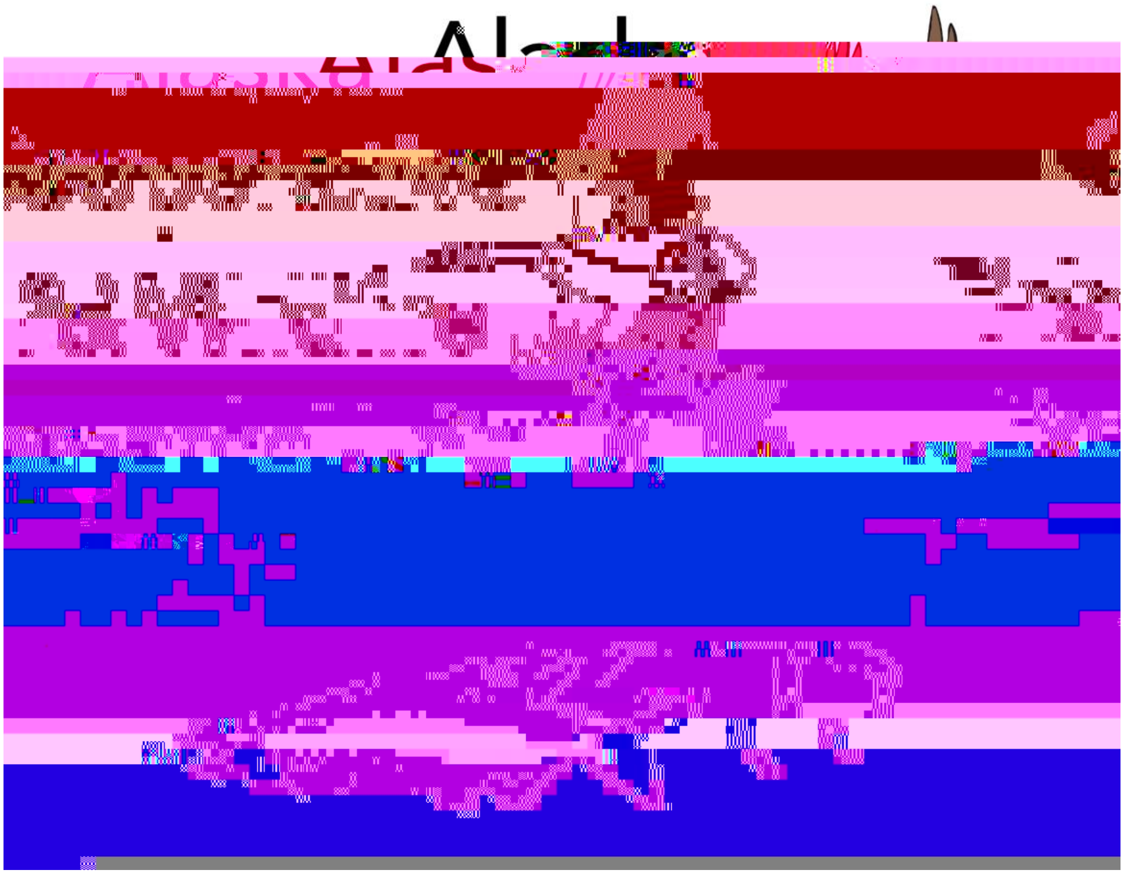
Alaska Cooperative Fish and Wildlife Research Unit

Annual Research Report—2019



Alaska Cooperative Fish and Wildlife Research Unit
P.O. Box 757020, University of Alaska Fairbanks
Fairbanks, AK 99775-7020
uaf-iab-akcfwru@alaska.edu
http://www.akcfwru.uaf.edu

Unit Roster

Federal Scientists

- Jeff Falke: Unit Leader
- Shawn Crimmins: Assistant Unit Leader-Wildlife (hired October 2019)
- Mark Wipfli: Assistant Unit Leader-Fisheries

University Staff

- Monica Armbruster: Fiscal Professional
- Deanna Klobucar: Research Professional
- Vacant: Administrative Generalist

Unit Students and Post-Doctoral Researchers

Current

- Donald Arthur, MS Fisheries Candidate (Falke)
- Olivia Edwards, MS Fisheries Candidate (Falke)
- Dan Govoni, PhD Biological Sciences Candidate (Wipfli)
- Jess Grunblatt, PhD Interdisciplinary Studies Candidate (Wipfli and Adams)
- Elizabeth Hinkle, PhD Fisheries Student (Falke)
- Jason Leppi, PhD Fisheries Candidate (Wipfli)
- Benjamin Meyer, MS Fisheries Candidate (Wipfli)
- Christopher Sergeant, PhD Fisheries Student (Falke)

Post-Doctoral Researchers

- Charlotte Gabrielsen (Griffith)
- Stephen Klobucar (Falke)

Graduated in CY 2018

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- Paul Layer, Vice President for Academics, Students, and Research (UA Statewide)
- Mark Lindberg, DBW, IAB
- Sergey Marchenko, GI
- A. David McGuire, IAB
- Megan McPhee, CFOS
- Anupma Prakash, CNSM and Provost UAF
- Vladimir Romanovsky, GI
- Roger Ruess, DBW, IAB
- T. Scott Rupp, IARC, SNAP
- Erik Schoen, IAB
- Diana Wolf, IAB

Affiliated Students and Post-Doctoral Researchers

Current

- Iris Cato, MS Biology Candidate (Ruess and Wolf)
- Matthew KynocM000912 0 612 792 reW*nBT/F3 12 Tf1 0 0 1 244.97 494.47 Tm0 g0 GsD0.00000912 0 612

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 (advised by Unit faculty)
Presentations: 17
Scientific and Technical Publications: 8

Courses Taught

Mark Wipfli: Aquatic Entomology (3 credits, Fall 2019)

Papers Presented

Arthur, D., Falke, J., Beaudreau, A., Sutton, T., and Blain-Roth, B. October 2019. Reproductive life history of Yelloweye Rockfish (Sebastes ruberrimus) in Prince William Sound and the northern Gulf of Alaska. 149th Annual Meeting of the American Fisheries Society, Reno, Nevada, 29 September - 3 October, 2019. (Contributed Oral)

Arthur, D., Falke, J., Beaudreau, A., Sutton, T., and Blain-Roth, B. March 2019. Reproductive life history and potential modeling for Yelloweye Rockfish (Sebastes ruberrimus) in Prince William Sound and the northern Gulf of Alaska. Alaska Chapter American Fisheries Society Annual Meeting, Sitka, Alaska, 19-22 March, 2019. (Contributed Oral)

Edwards, O., Falke, J., Savereide, J., and A. Seitz. March 2019. Juvenile Chinook Salmon

Alaska Chapter American Fisheries Society Annual Meeting, Sitka, Alaska, 19-21 March, 2019. (Contributed Poster)

Hinkle, E.G., and J.A. Falke. October 2019. Aquatic food web and community response to wildfire in interior Alaska boreal streams. American Fisheries Society and The Wildlife Society Joint Annual Conference, Reno, Nevada, 29 September to 3 October, 2019. (Invited Oral)

Klobucar, D.D., and J.A. Falke. March 2019. Gaging the importance: characterizing hydrologic regimes of headwater streams in changing boreal ecosystems. Alaska Chapter of the American Fisheries Society Annual Meeting, Sitka, Alaska, 19 – 21 March, 2019. (Contributed Poster)

Klobucar, D.D., and J.A. Falke. October 2019. Gaging the importance: hydrologic regime characterization for wildfire-

Falke, J.A., Bailey, L.T., Fraley, K.M., Lunde, M.J., and A.D. Gryska. 2019. Energetic status and bioelectrical impedance modeling of Arctic grayling in interior Alaska rivers. Environmental Biology of Fishes 102:1337-1349. https://doi.org/10.1007/s10641-019-00910-6.
Falke, J.A., Huntsman, B.M., and E. R. Schoen. 2019. Climatic variation drives growth potential of juvenile Chinook Salmon along a sub-Arctic boreal riverscape. Pages 57-82 in R. Hughes and D. Infante, editors. Advances in understanding landscape influences on freshwater habitats and biological assemblages. American Fisheries Society Symposium 90, Bethesda, MD.
Heim, K.C., McMahon, T.E., Calle, L., Wipfli, M.S., and J.A. Falke. 2019. Phenology of water as a life-history filter for fishes in temporary aquatic habitats. Fish and Fisheries 20:802-816. https://doi.org/10.1111/faf.12386.
Heim, K.C., Arp, C.D., Whitman, M.S., and M.S. Wipfli. 2019. The complimentary role of lentic and lotic habitats for Arctic Grayling in a complex stream-lake network in Arctic Alaska. Ecology of Freshwater Fish. 28: 209-221. https://doi.org/10.1111/eff.12444.
Huntsman, B.M., and J.A. Falke. 2019. Main stem and off-channel habitat use by juvenile Chinook salmon in a sub-Arctic riverscape. Freshwater Biology 64: 433-446. https://doi.org//10.1111/fwb.13232.
IPCC, 2019: Chapter 3: Arctic Regions. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Qq0.00000912 0 612 792 t8ecial (n)-4(466.3 503.47 Tm0 g0 G[( )] TJET

possibly adjust escapement goals (the number of spawners desired on the spawning grounds) to improve maximum-sustained yields (MSY).

Chena River Juvenile Chinook Salmon Large Wood Habitat Mapping

Student Investigator: NA, technicians only
Advisor: Jeff Falke
Funding Agency: USFWS Subsistence Fisheries Branch (RWO223)
In-Kind Support: USFWS Fisheries and Habitat Restoration Branch; Tanana Valley Watershed Association

Large woody debris (e.g., logjams, rootwads; LWD) within the channel provide important rearing habitat for fishes, and especially for juvenile Chinook Salmon in interior Alaska rivers, including the Chena River. For juvenile salmon, LWD provides cover from predation, refuge from high flow velocities, and high-quality habitat for invertebrate prey items. However, the distribution, abundance, and characteristics of LWD, particularly within stream reaches where juvenile Chinook Salmon are known to rear, have yet to be quantified in the Chena River basin. Our objectives were to (1) georeference and make simple measurements of LWD along the entire rearing distribution of juvenile Chinook Salmon in the upper Chena River, and potential rearing distribution in the lower river, during June 2017; (2) relate characteristics (e.g., size, location, composition) of LWD to use (i.e., presence) by juvenile Chinook Salmon for a subset of LWD habitats identified in Objective 1 during July and August 2017; and (3) communicate the importance of LWD as juvenile Chinook Salmon habitat to the public. We measured habitat attributes (e.g., submerged area, formative fluvial process, etc.) for all logjams (N=429) and conducted fish snorkel counts for a randomly-selected subset (N=189) of logjams within the known distribution (283 stream-km) of juvenile Chinook Salmon rearing in the Chena River basin, Alaska, during summer 2017. Logjam density and potential wood recruits (i.e., downed trees) declined downstream (33 recruits/km, 6 logjams/km; 6 recruits/km; 0.3 logjams/km, respectively), particularly below Moose Creek Dam, which is thought to intercept wood from the upper basin. Logjam size (submerged area; m^2

Ongoing Aquatic Studies

Broad Whitefish ( ) Ecology, Habitat Use and Potential Impacts of Climate Change in Arctic Alaska

Student Investigator: Jason Leppi, PhD Fisheries
Co-Advisors: Mark Wipfli and Dan Rinella (USFWS)NSF
Funding Agencies and Partners: USBLM; Alaska Science Center, USGS; The Wilderness Society; NSF-EPSCoR; and the State of Alaska
In-Kind Support: USFWS Fairbanks Field Office, Native Village of Nuiqsut

Subsistence fisheries provide an important f

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Post-doctoral Researcher: Stephen Klobucar (IAB)
Advisor: Jeff Falke
Funding Agency: Department of Defense (DoD) Strategic Environmental Research and Development Program (RWO 227)

With current and expected climate-driven shifts in Alaska fire regimes (e.g., increased frequency, severity), understanding future fire impacts on stream regulating processes are critical for managing fire, aquatic habitats, and fish populations. Because stream temperatures and habitat quality affect juvenile salmon

Boreal stream ecosystems, which span much of Alaska and western Canada, are changing rapidly; Alaska is warming faster than any other state in the U.S. Shorter winters, and warmer springs and summers have lengthened Alaska's fire season, increasing wildfire frequency, intensity, and severity. Understanding how climate change and wildfire influences hydrologic patterns (e.g., timing, magnitude) in boreal streams is important for effective aquatic habitat and species management under a rapidly changing climate. The objectives of this study are to use field observations to quantify and characterize hydrologic regimes in a subsample of headwater streams with different fire histories in interior Alaska, and use existing stream gage data to classify boreal streams and rivers based on statistics that describe the flow regime.

We installed stream gages to measure flow and water temperature in 9 tributaries with different fire histories (no burn, historic burn, recent burn) in interior Alaska. We also compiled existing stream gage data for statistical analysis. We estimated mean daily discharge (m^3/s) for the 2019 open water year for the gaged tributaries, and classified streams into three size classes and ten distinct subclasses based on streamflow characteristics. We found that historic and contemporary flow regimes have changed since the mid-1970's. Describing flow regimes in headwater tributaries will provide a benchmark with which to detect potential shifts that may result from continued climate warming and increased fire disturbance, and provide valuable information toward management and conservation of important boreal fish species.

Freshwater Habitat Potential for Chinook Salmon in the Yukon and Kuskokwim River Basins, Alaska

Post-doctoral Researcher: Stephen Klobucar (IAB)
Advisor: Jeff Falke
Funding Agency: U.S. Fish and Wildlife Service (RWO 230)

Chinook salmon ( ) are an important commercial, subsistence, and recreational fishery resource in Alaska. Knowledge of the distribution, amount, and relative importance of habitat features is critical for management of Chinook salmon stocks. Substantial declines in escapement from many Alaskan watersheds in recent years have resulted in closure of Chinook salmon fisheries in more imperiled drainages. The Yukon and Kuskokwim River basins are the largest in Alaska, and comprise 2 of 12 statewide indicator stocks. However, a lack of information on freshwater habitat in these two basins is a critical information gap. The overarching goal of this project is to develop spawning and rearing habitat potential estimates for the Yukon and Kuskokwim river basins in Alaska. To accomplish this goal we will compile georeferenced data on Chinook salmon juvenile and adult habitat use from ee0W/o(in)-4(o5 /0v1pas1 07q0.00

analysis tools, to facilitate classification of watershed attributes and aquatic environments for

In-Kind Support: Personnel and logistical support provided by Arctic NWR, USFWS

Pacific Common Eider populations decreased over 50% from the 1950s to 1990s. Although Pacific common eiders have declined throughout their range, those breeding on barrier islands in the Beaufort Sea are considered particularly vulnerable. Nest failure caused by predators or flooding may be an important limiting factor to common eider population recovery. Previous attempts to quantify causes of nest failure have been limited in geographic scale and/or have relied on methods that may induce bias. Our objectives are to quantify specific causes of nest failure and test the accuracy of two "evidence based" methods for determining nest predator species. In 2015-17, we surveyed barrier islands of Arctic NWR for common eider nests and placed small, time-lapse cameras at approximately 100 nests each year to record causes of nest failure. Glaucous gulls, polar bears, arctic foxes, and grizzly bears were the most common nest predators. Using a traditional method of evaluating nest site evidence, we correctly identified nest predators only 40% of the time. A quantitative method based on evidence left at nest sites only allowed us to accurately identify predator species 41% of the time. Neither the traditional method, nor quantitative method for assessing evidence at nest sites was effective for accurately assigning predator species or class.

Energetic Impacts of Storm Surges to Pacific Common Eiders along the Arctic Coastal Plain

Student Investigator: Elyssa Watford, MS Wildlife Biology and Conservation
Co-Advisors: Tuula Hollmén and Mark Lindberg
Funding Agencies: Arctic National Wildlife Refuge, USFWS (RWOs 215 and 228); National Fish and Wildlife Foundation; North Pacific R1 Tm0 (ci)-5(f)-3(i)6(c)-3(R1 Tm0 *nBT/F3 12 Tf1 0 0 1 197.93 386.23 Tr

In addition to widespread active layer deepening, ice rich permafrost can thaw laterally, often triggering abrupt thermokarst and subsidence of the ground surface. In boreal forest, thermokarst can lead to the development of collapse scar bogs, fens, or lakes inducing large changes in the hydrological regimes. With projected climate warming and change in precipitation regime, thermokarst disturbance may increase in frequency. The geomorphological changes associated with thermokarst disturbance will have local and regional impacts on a number of ecosystem services such as carbon dynamic, wildlife habitat, water availability, wildfire risks, infrastructure development. Developing a modeling framework to predict thermokarst disturbances and their ecological consequences will help guide management 00/cisio4(a)9(n)3(e7)6(t)-4(en)-6(i)10(n)trate and creal c

2.0244.9i-5(gr)10(ou)-7(n)5(d)-4( )-3(su)-3(r)9(f)-4(ace. In)5( )] TJETOq0.00000912 0 612 792 reW*nOq0.00(itP12 313.02 792 re

Natural resource managers and decision makers require an improved understanding of the potential response of ecosystems due to a changing climate in Alaska and northwest Canada. We created a modeling framework – the Integrated Ecosystem Model (IEM) for Alaska and Northwest Canada to meet this need. The IEM integrates the driving components for, and the interactions among, disturbance regimes, permafrost dynamics, hydrology, and vegetation succession and to provide an improved understanding of the potential response of ecosystems to a changing climate. Our study methods include: (1) coupling stand-alone models for specific regional areas of interest, and for the full IEM domain when computationally feasible, (2) developing input data sets for the study region, (3) providing model result summaries through an online data portal, and (3) phasing in additional capabilities as necessary. In 2019, we calibrated and validated model parameterizations for a new version of the model that includes a dynamic vegetation model. Our work is still in progress for select tundra regional analyses in Alaska (Utqiaġvik, Toolik Lake, Seward Peninsula, and Y-K Delta) for proof of concept. We anticipate completion of this phase of model coupling and manuscript prep by September 2020. The projections produced by the IEM are facilitating the integration of how landscapes may respond to climate change into resource management decisions.

Connectivity for Landscape Conservation Design and Adaptation Planning

Post-doctoral Researcher: Charlotte Gabrielsen (IAB)
Advisor: Brad Griffith
Funding Agency: U.S. Fish and Wildlife Service Region 7 (RWO 225)

observed a large degree of spatial overlap between historical and projected climate corridors. The majority of areas where climate connectivity remained intact into the future comprised locations with comparatively wider climate corridors, representative of areas with many alternative favorable pathways where climate gradients were gradual. Identifying climate connectivity corridors provides a useful framework for prioritizing areas to increase landscape connectivity in the face of climate change. By modeling corridors that will facilitate movement for species tracking suitable climate conditions into the future, this approach promotes proactive conservation. Given anticipated development throughout the study area, protecting connectivity while habitat is still intact can advance adaptive management and planning objectives. Furthermore, by identifying areas where climate corridors may be gained under future change, the approach can aid in identifying conservation priorities falling between existing protected areas.

Wetland Carbon Assessment for Alaska

Lead: Hélène Genet
Postdoctoral Researcher: Heather Greaves