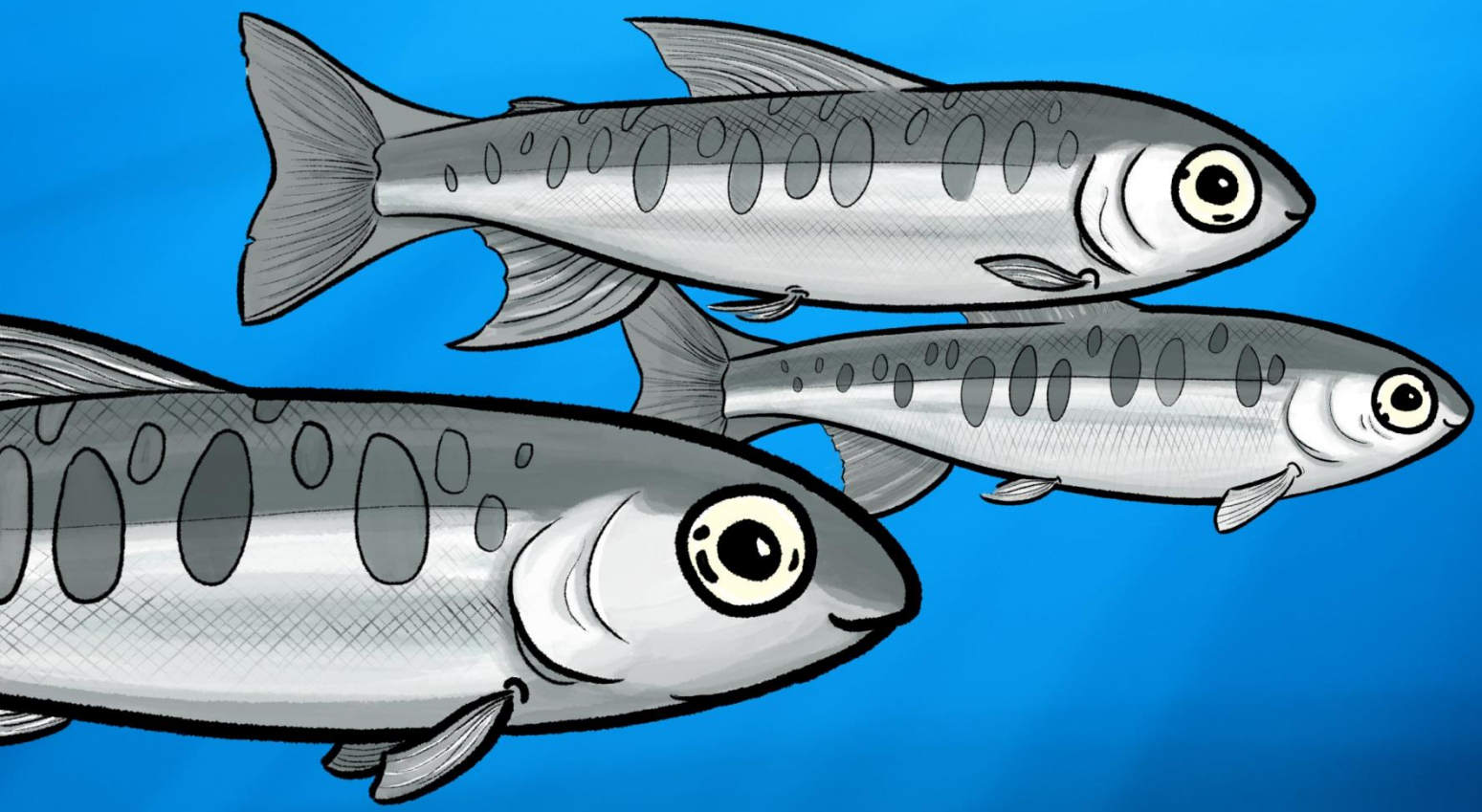
Bridging disciplines to solve today's challenges in resource management

JUNEAU, AK • OCT. 20-24, 2014



American Fisheries Society, Alaska Chapter

American Water Resources Association, Alaska Section

Southeast Alaska Fish Habitat Partnership

PROGRAM INFORMATION

The full program which includes abstracts may be downloaded at the Alaska Chapter AFS website http://www.afs-alaska.org/

Wi-Fi is available at Centennial for free using the password “fisheries2014”.

Cover Art

The cover art was done by Pat Race who is a filmmaker and illustrator from Juneau. His whimsical illustrations of trees, squids, and bears can be found at Alaska Robotics Gallery or online at http://alaskarobotics.com

American Fisheries Society (AFS)

What is the AFS?

The American Fisheries Society (AFS), founded in 1870, is the oldest and largest professional society representing fisheries scientists. AFS promotes scientific research and enlightened management of resources for optimum use and enjoyment by the public. It also encourages a comprehensive education for fisheries scientists and continuing on-the-job training.

The AFS publishes some of the world's leading fisheries research journals: the *Transactions of the American Fisheries Society,; North American Journal of Fisheries Management, North American Journal of Aquaculture, Journal of Aquatic Animal Health,* and *Fisheries.*

The AFS organizes meetings where new scientific research is reported and discussed. In addition to these primary activities, the Society has many other programs in areas such as professional certification, international affairs, public affairs, and public information.

AFS Mission Statement

The mission of the American Fisheries Society is to improve the conservation and sustainability of fishery resources and aquatic ecosystems by advancing fisheries and aquatic science and promoting the development of fisheries professionals.

The Alaska Chapter of AFS

The Alaska Chapter is the local organization in Alaska for the American Fisheries Society. Major activities include our annual meeting, consisting of technical paper presentations, special guest lecturers, and continuing education courses for fisheries professionals. Through resolutions and letters to policy makers, the AK Chapter has supported continued conservation and stewardship of Alaska's fisheries.

Visit the Alaska Chapter AFS Website at: www.afs-alaska.org

American Water Resources Association (AWRA)

About the AWRA

The mission of the American Water Resources Association (AWRA) to promote an improved understanding of water resources and related issues by providing a multidisciplinary forum for information exchange, professional development, and education has not changed over the 50 years of its existence. The AWRA multidisciplinary emphasis has drawn membership and clientele from a wide variety of water-related disciplines in academia, government and private industry and has allowed AWRA programs to rapidly adapt to emerging issues, changes in technology and shifting needs of its members.

Since its founding AWRA has sponsored 120 meetings and symposia in the U. S. and abroad with over 30,000 attendees. *Impact* and the *Journal of the American Water Resources Association (JAWRA)* have emerged as the major AWRA publications with the impact factor for JAWRA currently ranking it in the upper third of peer-reviewed publications. AWRA also supports an extensive network of state sections and student chapters, annual awards and student scholarships to help fulfill its mission. Sixteen different AWRA state and regional sections and 14 separate AWRA student chapters have received awards for excellence in water resources programming during this period. In recognition of outstanding service and achievements in water resources, AWRA has given over 300 AWRA awards to individuals and organizations. Student education in water resources has also been promoted by AWRA with over 39 scholarships awarded to undergraduate and graduate students during this period.

Alaska Section

AMERICAN WATER RESOURCES ASSOCIATION

Alaska Section of AWRA

The Alaska Section represents the AWRA in Alaska. The mission of the Alaska Section of the AWRA is to advance multidisciplinary water resources education, management, and research in Alaska. The Alaska Section holds an annual scientific meeting, provides scholarships for graduate and undergraduate students and conducts continuing education courses for the Alaska hydrology community. The Alaska Section was named Outstanding AWRA State Section in 2001 and again in 2011.

Visit the Alaska Section AWRA website at: http://state.awra.org/alaska/

Southeast Alaska Fish Habitat Partnership (SEAKFHP)

What is the SEAKFHP?

The Southeast Alaska Fish Habitat Partnership (SEAKFHP, www.seakfhp.org) is made up of resource managers, scientists and professionals from different state, federal, tribal and non-governmental entities working together to conserve habitat for resident, anadromous, estuarine and marine dependent fishes in Southeast Alaska. Our partnership works to address stressors impacting fish habitats and has a strong interest in reversing declines in the quality and quantity of aquatic habitats to improve overall productivity and health of fish in this unique part of Alaska.

SOUTHEAST ALASKA
FISH HABITAT
PARTNERSHIP

SEAKFHP Mission Statement

SEAKFHP's mission is to support cooperative fish habitat conservation, restoration and management across Southeast Alaska with consideration of economic, social and cultural interests of local communities in its endeavors.

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ACKNOWLEDGEMENTS

A special thanks to those individuals who offered their knowledge, time, and expertise in planning and organizing the 2014 Alaska Chapter meeting

AFS Alaska Chapter Executive Committee

Mark Wipfli (Past President), Philip Loring (President), Jennifer Stahl (President-elect), Mary Beth Loewen (Vice-president), Nicky Szarzi (Secretary), Lee Ann Gardner (Treasurer), Emily Whitney (Student President)

Alaska Section of the American Water Resources Association

Terence Schwarz, Trey Simmons

Southeast Alaska Fish Habitat Partnership

Deborah Hart (SEAKFHP), Neil Stichert (US Fish and Wildlife Service), Sheila Jacobson (US Forest Service), Scott Harris (Sitka Conservation Society), Christine Woll (The Nature Conservancy)

Program Planning Committee

Jennifer Stahl (ADF&G), Deborah Hart (Southeast Alaska Fish Habitat Partnership), Trey Simmons (NPS), Terence Schwarz (Alaska Department of Natural Resources), Mark Wipfli (UAF), Anne Beaudreau (UAF, School of Fisheries), Benjamin Williams (UAF, School of Fisheries), Joel Webb (ADF&G)

Registration

Lee Ann Gardner (RWJ Consulting) and Donna Eidam (Juniperfish Services)

Student Presentation Judging Coordinator

Mary Beth Loewen (ADF&G)

Acknowledgements (cont.)

Technical Support

AK-AFS Student Subunits (UAF, UAA, & UAS) - Audio/ visual support; Audra Brase (ADF&G) - Website support; Hamachan Hamazaki (ADF&G) - List-server management; ADF&G IT

1st Annual Alaska Film Festival

Planning Committee: Mark Kaelke (Trout Unlimited), Katrina Mueller (USFWS), Bethany Goodrich (Sitka Conservation Society), & Deborah Hart (SEAKFHP)

Sponsors/Supporters: Erin Harrington, Miriam Roberts and Pat Race (Salmon Project, www.salmonproject.org); Dzantik'i Heeni Middle School Taku House Science Class (Logo creators); Jeff Nichols, Dave Love and Aaron Baldwin (ADF&G; middle school field support)

Banquet Entertainment

Travis Rummel (Felt Soul Media) – Banquet Speaker

Andy Piston (ADF&G) - Banquet Auctioneer

Plenary Speakers

Kim Elton, F. Stuart (Terry) Chapin, III (Institute of Arctic Biology, UAF), Dr. Lee Benda (Earth Systems Institute), James A. Fall (ADF&G, Subsistence Program)

Session Chairs

Fisheries-forestry sustainability: what progress have we made? Mark Wipfli and Doug Martin

Hydrologic and fish habitat modeling and characterization. Bill Rice and Christine Woll

Aquatic habitat restoration in Alaska: innovations, applications, successes and failures. Neil Stichert

Assessing the biotic and abiotic responses to fish habitat restoration actions. Scott Harris and Sheila Jacobson

Ecosystem linkages from icefield to ocean in coastal Alaska. Shad O'Neel, Jason Amundson and Allison Bidlack

Challenges and opportunities for long-term monitoring in Alaska. Michael Bower and Chris Sergeant

Use of mobile electronic devices for field data collection in Alaska. Ted Otis and Kathy Jones

Data management for hydrology and fisheries research. Jessie Cherry

Instream flow perspectives and issues in Alaska. Joe Klein and Cathy Flanagan

Groundwater hydrology. Melissa Hill

Alaska river hydrology. Robin Beebee

North slope hydrology. Anna Liljedahl

Fisheries and fish populations and their habitats of the North Slope of Alaska. Jeff Adams and Matthew Whitman

Climate modeling and hydrology. Uma Bhatt

Mining effects on hydrology and fisheries. Trey Simmons

Hydropower effects on hydrology and fisheries. Sue Walker

Habitat science to support fisheries management in Alaska marine ecosystems. Jodi Pirtle

Using genetics to address resource management challenges. Sara Gilk-Baumer

Salmon ecology. Joe Orsi

Life on the half-shell: biology, ecology, and management of Alaska's shellfish resources. Joel Webb

Bridging space and time: distribution and movement of fish in Alaska. Ben Williams and Julie Nielsen

Fisheries management. Jason Gasper

Advances in fisheries science & technology. Kristen Green and Jennifer Stahl

Invasive species. Tammy Davis

Alaska's State Wildlife Action Plan revision. Tim Viavant

Fishing communities and fisheries management. Courtney Lyons and Courtney Carothers

Small-scale Alaskan fisheries: a focus on sport and subsistence sectors. Anne Beaudreau and Maggie Chan

Climate change impacts on hydrology and fisheries. Hal Shepherd

Acknowledgements (Cont.)

Continuing Education Coordinators

Sara Miller (Alaska Department of Fish & Game), Kari Fenske (University of Alaska Fairbanks, School of Fisheries)

Continuing Education Instructors

Stock Synthesis: fisheries stock assessment software. Ian Taylor (NOAA fisheries)

A mesh is a mesh: basic net construction and repair workshop. Carl Schilt

Technical writing. Jim Hale

An introduction to ArcGIS with fisheries applications. Anupma Prakash (UAF Geophysical Institute), Robert McNabb (UAF Geophysical Institute), Christine Waigl (UAF Geophysical Institute)

Fish passage workshop. Bill Rice (USFWS), Gillian O'Doherty, (ADF&G), Neil Stichert (USFWS), Neil Stichert (Southeast Alaska Fish Habitat Partnership), Debbie Hart (Southeast Alaska Fish Habitat Partnership

AK hydro: a regional approach to NHD stewardship in Alaska. Kacy Krieger (Alaska hydrography database program coordinator) and Becci Anderson (USGS geospatial liaison for Alaska)

Unmanned aircraft systems & applications. Keith W. Cunningham (UAF)

An introduction to integrated hydrography with the NetMap digital landscape. Lee Benda (TerrainWorks), Daniel Miller (TerrainWorks), and David Albert (Nature Conservancy)

Meeting & Auction Sponsors

Special thanks to all those sponsors who supported the meeting, including but not limited to:

Hal Geiger, St. Hubert Research Group

Alaskan Brewery for donating refreshments to kick-off the welcome social!

Thanks to all businesses, artists, and others who donated auction items to benefit the Alaska AFS Student Travel Fund. Including but not limited to:

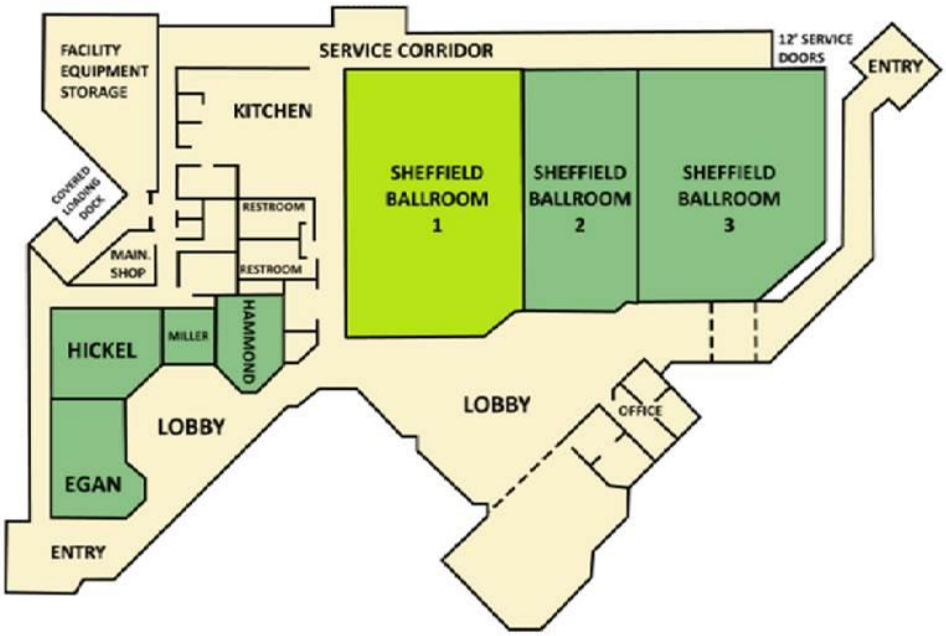
Able Ryan, artist of the engraved silver earrings, who can be found on Facebook.

Susan M. Smith, fisherman woodcarving, www.santacarving.net

Jim Brashear, ceramics professor, University of Alaska Fairbanks

MAPS AND DINING INFORMATION

Centennial Hall Map



Dining Information

On the following page is a dining guide to downtown Juneau. Please note some of the restaurants are seasonal, which is indicated in the description.

Additional options not in the guide include:

Pelmeni's – Open late & offers Russian dumplings (located in the Hangar Wharf Building)

Grumpy's Delicatessen & Juice Bar - (225 Front St., downtown in upstairs of Miner's Mercantile Building)

Sandpiper Café – Great breakfast and lunch (429 Willoughby Ave, block from Centennial Hall)

COPAA - Amazing ice cream, soups, coffee, and sandwiches (917 Glacier Ave, around corner from Federal Building)

Seong's Sushi Bar & Chinease – (740 W 9th St., across from Federal Building).

Little Tokyo - (next to SALT #16 on above map)

Kenny's Wok & Teriyaki Sushi Bar – (126 Front St, downtown)

IGA – Grocery store with deli (615 W Willoughy Ave, 5 min. walk from Centennial Hall)

Rainbow Foods – Health food Store with pizza, salad, soup, & hot items (224 E 4th St, downtown)

DINING IN DOWNTOWN JUNEAU

1. Alaskan Fudge Company
Open Mon – Sun
Treat yourself to the best aroma in Juneau! You can watch us make delicious fudge, brittles & candies.
195 S Franklin St • (907) 586-1478

2. The Bubble Room at the Westmark Baranof Hotel
D • Open Mon – Sun
Serving a wide range of select wines, creative martinis, and Alaskan beers on draft. Also offering fresh Alaskan seafood, appetizers, and local favorites.
127 N Franklin St • (907) 586-2662

3. Capital Café at the Westmark Baranof Hotel
B, L • Open Mon – Sun
Breakfast: creative skillets, scrambles & omelets, plus fresh baked breads from Silverbow Bakery. Lunch: Alaskan seafood, homemade soups, sandwiches & salads.
127 N Franklin St • (907) 586-2661

4. Coho's Bar & Grill
B, L, D • Open Mon – Sun
Restaurant and bar serving steak and seafood! Open for breakfast, lunch, and dinner.
51 Egan Dr. • (907) 586-240-8963

5. El Sombrero
L, D • Open Mon – Sat
One of Juneau's favorite dining establishments in the heart of downtown. Come in and let our friendly staff serve you our warm delicious Mexican favorites.
157 S Franklin St • (907) 586-6770

6. Front Street Café
L, D • Open Mon – Sun
Freshly made burgers, house made sausages, smoked meats, sandwiches, fried chicken & pub food in Juneau's oldest saloon, 11am to late night daily. WiFi for guests.
241 Front St • (907) 586-1968

7. The Gold Room at the Westmark Baranof Hotel
D • Open Mon – Sun
The Gold Room in the historic Baranof offers leisurely evening dining in an elegant setting, contemporary Northwest cuisine, fine wine. Private dining available.
127 N Franklin St • (907) 586-2660

8. Hangar on the Wharf
L, D • Open Mon – Sun
One of Juneau's waterfront restaurants, with SE Alaska's largest selection of micro-brews & great food in a pub & grill atmosphere. Reservations suggested.
#2 Marine Way, #106 • (907) 586-5018

9. Heritage Coffee Company & Café
B, L, D • Open Mon – Sun
Enjoy fresh roasted coffee with great sandwiches and pastries at any of our cafés or stop by our drive-thrus for a quick pick-me-up.
174 S Franklin St & 216 2nd St
(907) 586-1087

10. Lunch Box
B, L • Open Mon – Sun, May – Sept
Quick service restaurant. Sandwiches, wraps, grab-n-go, refreshments. Public restrooms, ATM.
495 South Franklin St • (907) 586-9521

11. Papa Rod's
L, D • Open Mon – Sun, May – Sept
Food service trailer serving seafood and chowder!
300 South Franklin St • (907) 321-3366

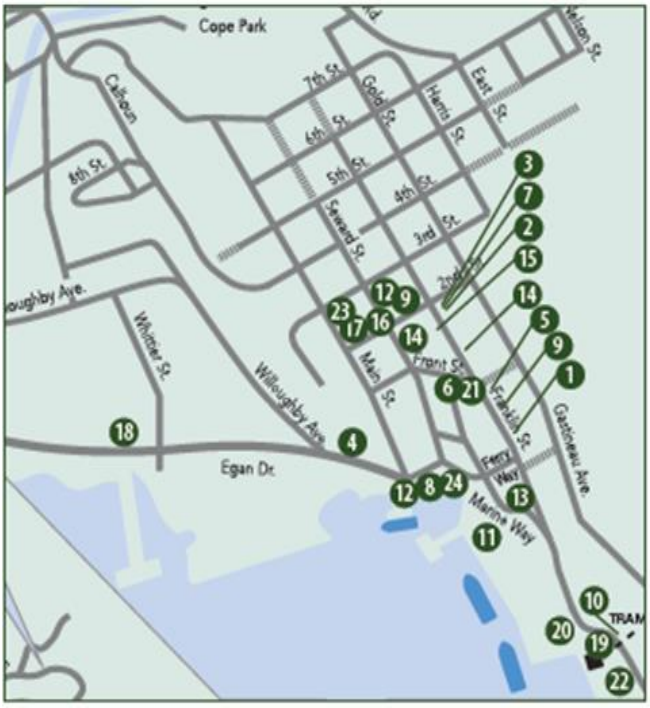
12. Pizzeria Roma
L, D • Open Mon – Sun
A local favorite for gourmet pies, oven baked sandwiches, and a variety of salads. Casual atmosphere offers impressive wine list, and tap and bottled beers.
#2 Marine Way, Ste 104 • (907) 463-5020

13. Red Dog Saloon
L, D • Open Mon – Sun
Great selection of burgers, sandwiches, pizza, fish baskets, chicken, and more all served in our iconic Alaskan saloon. Full bar & live summer entertainment.
278 S Franklin St • (907) 463-3658

14. The Rookery Cafe
B, L, D • Open Mon – Sat
Coffeehouse & bakery located in Historic Downtown Juneau serving breakfast & lunch Mon-Sat. Freshest house-made pastries & highest quality coffee available.
111 Seward St • (907) 463-3013

15. Saffron
L, D • Open Mon – Sat
Indian comfort cuisine. Everything made from scratch with all natural ingredients. Curries, Naan bread, chutneys, dahl, pakoras. Served in a warm, inviting, and traditional setting. Open lunch from 11 – 2pm & dinner from 4 – 10pm.
112 N. Franklin St • (907) 586-1036

16. SALT
D • Open Mon – Sun
Salt is a modern/casual cuisine experience specializing in steak and seafood. Open for dinner 4 – 10pm.
200 Seward St • (907) 780-2221



17. Silverbow Inn, Bakery, Catering, and Wine Bar
B, L, D • Open Mon – Sun
Enjoy our café for breakfast, lunch, or dinner. Sandwiches, salads, soups, and the best cookies in Alaska. Enjoy a beer or wine on our outdoor deck.
120 Second St • (907) 586-4146

18. T.K. Maguire's at the Prospector Hotel
B, L, D • Open Mon – Sun
T.K. Maguire's, a full service restaurant and lounge, is sure to please a variety of tastes. Famous for Alaskan seafood dishes and the best prime rib in Juneau.
375 Whittier St • (907) 586-3737

19. Timberline Bar & Grill at Mount Roberts Tramway
L, D • Open Mon – Sun, May – Sept
Featuring locally brewed Alaskan beers and Dungeness crab feed in season! A great meal with the best view in town! Wedding, meeting, & catering services.
490 S Franklin St • (907) 463-3412

20. Tracy's King Crab Shack
L, D • Open Mon – Sun, May – Sept
"Best Legs in Town!" Alaska's finest red king crab served by the leg. Award winning crab bisque, crab rolls & crab cakes. Beer & wine.
406 S Franklin St • (907) 723-1811

21. Triangle Club Bar
L, D • Open Mon – Sun, May – Sept
Full service bar with limited food, Internet, games and an ATM.
251 Front St • (907) 586-3140

22. Twisted Fish Co. – Alaskan Grill
L, D • Open Mon – Sun, May – Sept
In this part of the world, salmon is king. Alaska's salmon inspired the restaurant's upbeat wild fish decor & name. Reservations recommended.
550 S Franklin St • (907) 463-5033

23. V's Cellar Door
L, D • Open Mon – Sun
Mexican fusion restaurant. We mix different cultures and flavors together in a fusion cuisine!
222 Seward St • (907) 586-6870

24. Wings Airways/ Taku Glacier Lodge
B, L, D • Open Mon – Sun, May – Sept
Superb 5-glacier seaplane flight to Juneau's only king salmon feast! An elegantly rustic remote day lodge with bears! As seen in "Bon Appétit Magazine."
2 Marine Way, Ste 175 • (907) 586-6275

Produced by the Juneau Convention & Visitors Bureau
(907) 586-2201 • 888-581-2201
www.TravelJuneau.com

B=Breakfast • L=Lunch • D=Dinner

Times are subject to change. Please contact individual restaurants for more up-to-date information.

PLENARY SPEAKER BIOGRAPHIES

Kim Elton

Former State Senator, ptlouisa@gmail.com

After graduating from high school in Juneau, Kim helped finance college by working summers for the Alaska Department of Fish and Game walking streams for escapement counts in the‘60s. He later took a two-year sabbatical from a career in newspapers (city editor at the Fairbanks News-Miner and editor of the Juneau Empire) to hand troll out of Elfin Cove. Before entering the political realm in the ‘90s, he was the executive director of the Alaska Seafood Marketing Institute, a private/public partnership that marketed Alaska seafood in domestic and oversea markets.

Kim served 14 years in the Alaska State House and Senate where he served on the House Fisheries Committee, the Senate Resources Committee, and the Senate Finance Committee. He also was appointed to represent Alaska on the Pacific Fisheries Legislative Task Force—a group of four legislators each from Alaska, Washington, Oregon, California, and Idaho. He chaired the task force for a term.

In 2009, Kim accepted a presidential appointment and served as senior advisor to the Secretary of the Department of the Interior. Among other duties, he represented the Secretary in the Gulf during the Deepwater Horizon disaster and as a trustee on the Exxon Valdez Oil Spill Trustee Council. He also led a review of the federal subsistence program in Alaska and was closely involved in Fish and Wildlife reviews of the management plan for the Arctic National Wildlife Refuge and the BLM management protocols for the NPR-A.

Kim is now retired and living in Bend, Oregon, where he feeds his passion of photographing landscapes, wildlife and other special resources on federal, state and city public lands.

Plenary Speaker

F. Stuart (Terry) Chapin, III

Professor Emeritus of Ecology
Institute of Arctic Biology, University of Alaska Fairbanks, terry.chapin@alaska.edu

My research addresses the effects of changes in climate and wildfire on Alaskan ecology and rural communities. I explore ways that communities and agencies can develop options that increase sustainability of ecosystems and human communities over the long term despite rapid climatic and social changes. Through projections of future climate, ecology, and subsistence resources, my research helps people make more informed choices about options for long-term sustainability. My research in earth stewardship explores ways that society can proactively shape changes toward a more sustainable future through actions that enhance ecosystem resilience and human well-being. I pursue this internationally through the Resilience Alliance, nationally through the Ecological Society of America, and in Alaska through a community partnership that links the sustainability visions of rural indigenous communities with university research expertise to implement those visions.

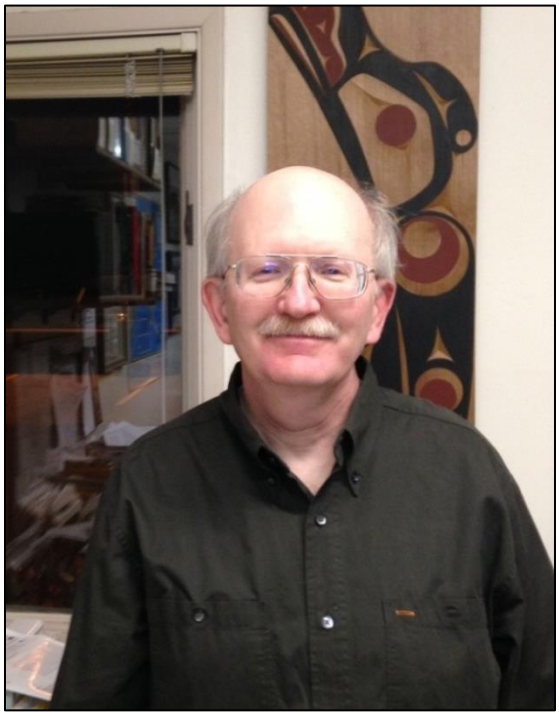
Plenary Speaker

Dr. Lee Benda

Earth Systems Institute, leebenda@terrainworks.com

Dr. Lee Benda's research has focused on understanding how spatial patterns of landscape disturbances (fires, storms, landslides, debris flows, and floods) are organized by interactions among climate, topography, river network geometry and spatial scale, beginning his work in the 1990s with Tom Dunne. Lee's related interests involved developing general principles about how the stochastic nature of erosion and sediment supply (and in-stream wood supply) influence fluvial geomorphology and formation of aquatic and riparian habitats. In the last decade, Lee, along with colleagues, has focused on building a community based landscape analysis system (NetMap) designed to strengthen resource management and conservation planning in agencies, NGOs, universities and the private sector across the Pacific Northwest Region and beyond.

Plenary Speaker



James A. Fall

Alaska Department of Fish and Game, Subsistence Program Manager, jim.fall@alaska.gov

Jim Fall serves as the research director for the Division of Subsistence of the Alaska Department of Fish and Game. He holds degrees in cultural anthropology from the University of Pennsylvania and the University of Wisconsin-Madison. Since the early 1980s, Jim has conducted research on contemporary subsistence hunting and fishing in Alaska and has authored or co-authored over 70 reports for the division's Technical Paper Series.

1ST ANNUAL ALASKA FILM FESTIVAL

Sponsored by SEAKFHP

Over 20 short films will be featured at the first annual Alaska Fish Film Festival that focus on the connections between people and salmon, the unique life cycle and habitat needs of different species, how ordinary people are helping conserve fish and their habitats, and more. The films are from a variety of perspectives—from fishermen to subsistence users, researchers, volunteers, landowners, and the fish themselves. The festival seeks to inspire fisheries conservation, grow appreciation for and awareness of Alaska's fisheries and the many ways in which we're connected to fish and all the goods and services they provide, and grow a collection of short films that can be shared with Alaskans and beyond.

BANQUET PROGRAM

Banquet Speaker

Travis Rummel of Felt Soul Media

Over the past ten years Travis has honed his filmmaking craft from the ground up. Partnering with Ben Knight in 2004, the two became known for their award-winning short films within the tiny genre of fly fishing. In 2007, Red Gold, their first feature documentary, was released to critical acclaim and helped create awareness of the proposed Pebble Mine in Alaska's Bristol Bay. Firm believers in the power of film to effect positive change, Travis and Ben continue to gravitate towards environmental storytelling. Travis was born in New Jersey and received his B.A. from Colorado College. He lives with his wife Melissa in Denver, Colorado.

Live Auction

Auctioneer - Andy Piston

Awards

25-Year National AFS Members

Steven J. Klein, Mark J. Lisac, David G Parker, Mary A. Price, Tim Sands, Trent M. Sutton, Thomas T. Taube

1st Annual Alaska Fish Film Festival Logo Contest Winner

AK AFS Cultural Diversity Travel Award

Molly McCarthy – Master's student at the UAA studying Kenai River sockeye salmon populations over the past 200 years.

AK AFS - Molly Ahlgren Scholarship Award

Sky Brandt – UAF fisheries undergraduate. Sky works for the ADF&G and is interested in a career in fisheries management or research in the Yukon River Area and has experience living and working as a fisherman.

Lauren Bailey – UAF fisheries undergraduate. Lauren's first introduction to fish and fisheries was handed down by her dad. Her volunteer work on sculpin

phytogeography and internship work on Arctic grayling ecology furthered her interest in conducting research with sport fish. She is currently the Vice-President of the UAF AFS student subunit.

AWRA Alaska Section Graduate Student Scholarship Award

Christopher Kasanke - UAF. "Remediation of sulfolane contaminated groundwater in above ground aerobic bioreactors via nutrient stimulation".

Jon Allen. UAA. "Modeling water quality on the Yukon-Kuskokwim Delta under current and future climatic scenarios and predicting the effects of water-quality changes relevant to medium- and long-term wildlife biology and civil infrastructure"

Johnse Ostman, APU. "Modeling the well-constrained impacts of recent extreme weather events on water delivery to downstream users in a glaciated Alaskan watershed"

Haley Huff, UAA. "Trace element fluxes from a high-latitude island arc watershed".

AWRA Alaska Section Student Travel Grants

Anna Iverson, UAF. "Assessing the fate of fresh crude oil through an arctic coastline, based on sediment structure and wave action".

Priyamvada Sharma, UAF. "Crude oil biodegradation in Arctic sea shore sediments".

Chas Jones, UAF. "Mapping hazardous ice conditions with high-resolution satellite imagery".

SCHEDULE

MONDAY OCTOBER 20, 2014

8:30–5:00	Fish Passage Workshop (Baranof, Treadwell)
9:00–5:00	Stock Synthesis (Centennial Hall, Egan); An Introduction to ArcGIS with Fisheries Applications (Centennial Hall, Hickel); Technical Writing Workshop (Baranof, Gastineau)

TUESDAY OCTOBER 21, 2014

8:00–12:00	National Hydrography Stewardship in Alaska (Baranof, AJ)
8:30–5:00	Fish Passage Workshop (Baranof, Treadwell)
9:00–5:00	Stock Synthesis (Centennial Hall, Egan); An Introduction to ArcGIS with Fisheries Applications (Centennial Hall, Hickel)
12:00–5:30	Field Trip 12:00 Leave from Centennial Hall; 12:15–2:00 Mendenhall Glacier Visitor Center; 2:15–4:00 NOAA Fisheries, Lena Point Laboratory; 4:15–5:15 Alaskan Brewery; 5:30 Return Centennial Hall
1:00– 4:00	An Introduction to Integrated Hydrography with NetMap Digital Landscape (UAS GIS lab)
1:00–5:00	Unmanned Aircraft Systems & Applications (Baranof, Douglas)
12:00–7:00	Registration (Centennial Hall Lobby in Front of Egan Room)
6:00–10:00	Welcome Social/Film Festival (Rockwell, Upstairs) 6:00–8:30pm – Appetizers & Bar, 8:30–10:00pm – Film Festival & Bar

WEDNESDAY OCTOBER 22, 2014

7:30–5:00	Registration (Centennial Hall Lobby in Front of Egan Room)
7:30–8:15	Light Breakfast (Ballroom 1)
8:15–8:30	Opening Remarks (Ballroom 1 & 2)
8:30–10:30	Plenary Speakers (Ballroom 1 & 2) 8:30 – Kim Elton, 9:00 – Terry Chapin, 9:30 –Lee Benda, 10:00 – Jim Fall
10:30–11:00	Break

11:00–12:00	Fisheries & Forestry Interactions (Ballroom 2); Marine Habitat (Ballroom 3); Fishing Communities and Fisheries Management (Hickel)
12:00–1:30	Lunch
12:00–1:30	Student- Mentor Lunch (Egan)
12:30–1:30	Fisheries Outreach/In-reach Discussion & Network Building (Ballroom 2)
1:30–3:00	Fisheries & Forestry Interactions (cont.) (Ballroom 2); Marine Habitat (cont.) & Genetics (Ballroom 3); Fishing Communities & Fisheries Management (cont.) & Small-scale AK Fisheries (Hickel)
3:00–3:30	Break
3:30–5:00	Fisheries & Forestry Interactions (cont.) & Hydrologic & Fish Habitat Modeling (Ballroom 2); Genetics (Ballroom 3); Small-scale AK Fisheries (Hickel); & Climate change Impacts to Hydrology (Egan)
5:00–6:00	AK AFS Business Meeting (Hickel)
5:00–6:00	Poster Set-up (Ballroom 3)
6:00–9:00	Poster Session (Ballroom 3) 6:00 Bar Opens/Heavy Appetizers Served, 6:30–7:30 Authors by Posters

THURSDAY OCTOBER 23, 2014

7:30–5:00	Registration (Centennial Hall Lobby in Front of Egan Room)
7:30–8:00	Light Breakfast (Ballroom 1)
8:00–5:00	Registration (Hammond)
8:00–10:00	Hydrologic & Fish Habitat Modeling (cont.); Habitat Restoration (Ballroom 2); Mobile Electronic Devices (Hickel); Salmon Ecology (Ballroom 3); Longterm Monitoring (8:15 in Egan)
10:00–10:15	Break
10:15–12:00	Habitat Restoration (cont.) (Ballroom 2); Longterm Monitoring (cont.) & Instream Flow (Egan); Mobile Electronic Devices (cont.) & Biology/Ecology Shellfish (Hickel); Salmon Ecology (cont.) (Ballroom 3)
12:00–1:30	(Lunch)
12:30–1:30	Word Press/Making a Simple Website (Ballroom 2)
1:30–3:00	Habitat Restoration (cont.) & Biotic & Abiotic Responses to Restoration (Ballroom 2);

	Instream Flow (cont.) (Egan); Biology/Ecology Shellfish (cont.) &Invasive Species (Hickel); Bridging Space & Time: Distribution & Movement of Fish (Ballroom 3)
3:00–3:30	Break
3:30–5:00	Biotic & Abiotic Responses to Restoration (cont.) & Panel Discussion (Ballroom 2); Groundwater Hydrology (Egan); Invasive Species (cont.) & Alaska's State Wildlife Action Plan Revision (Hickel); Bridging Space & Time: Distribution & Movement of Fish (Ballroom 3)
6:00–11:00	Banquet (Ballroom 1 & 2)
	6:00 Bar Opens, 7:00 Dinner Buffet; 7:30 Speaker; 8:30 Awards/Live Auction; 9:30 Music

FRIDAY OCTOBER 24, 2014

7:30–12:00	Registration (Centennial Hall Lobby in Front of Egan room)
7:30–8:00	Light Breakfast (Ballroom 1)
8:00–10:00	Ecosystem Linkages from Icefield to Ocean (Ballroom 2); Alaska River Hydrology & North Slope Hydrology (Hickel); Fisheries Management (Ballroom 3)
10:00–10:15	Break
10:15–12:00	Ecosystem Linkages from Icefield to Ocean (cont.) (Ballroom 2); North Slope Hydrology (cont.) & North Slope Fisheries & Habitats (Hickel); Fisheries Management (cont.) (Ballroom 3)
12:00–1:30	Lunch
12:00–1:00	AWRA Alaska Section Business Lunch (Egan); AK AFS Past-President Lunch (Miller)
12:30–1:30	All Alaska Fish Habitat Partnership (FHP) Membership Lunch (Hickel)
1:30–3:00	Mining Effects on Hydrology and Fisheries (Ballroom 2); Advances in Fisheries Science & Technology (Ballroom 3); North Slope Fisheries & Habitats (cont.) & Climate Modeling Hydrology (Hickel)
3:00–3:30	Break
3:30–4:45	Mining Effects on Hydrology & Fisheries (cont.); Hydropower Effects on Hydrology & Fisheries (Ballroom 2); Climate Modeling & Hydrology (cont.) (Hickel); Advances in Fisheries Science & Technology (cont.) & Data Management for Hydrology & Fisheries (Ballroom 3)
4:45–5:00	Closing/Student Awards (Ballroom 2)

SESSION SCHEDULE

WEDNESDAY 22, 2014

TIME	BALLROOM 2	BALLROOM 3	HICKEL	EGAN
8:15	Opening Remarks Followed by Plenaries Kim Elton Terry Chapin Lee Benda Jim Fall			
8:30				
9:00				
9:30				
10:00				
10:30	BREAK			
11:00	Fisheries and Forestry Interactions	Habitat Science	Fishing Communities and Fisheries Management	
11:15				
11:30				
11:45				
12:00	LUNCH			
1:30	Fisheries and Forestry Interactions	Habitat Science	Fishing Communities and Fisheries Management	
1:45				
2:00			Small-Scale Alaskan Fisheries	
2:15				
2:30		Genetics		
2:45				
3:00	BREAK			
3:30	Fisheries and Forestry Interactions	Genetics	Small-Scale Alaskan Fisheries	
3:45				Climate Change Impacts
4:00	Hydrologic and Fish Habitat Modeling			
4:15				
4:30				
4:45			Fisheries Career Development	

THURSDAY OCTOBER 23

TIME	BALLROOM 2	EGAN	HICKEL	BALLROOM 3
8:00	Hydrologic and Fish Habitat Modeling		Mobile Electronic Devices	Salmon Ecology
8:15		Longterm Monitoring		
8:30				
8:45				
9:00				
9:15				
9:30				
9:45	Habitat Restoration			
10:00	BREAK			
10:15	Habitat Restoration	Longterm Monitoring	Mobile Electronic Devices	Salmon Ecology
10:30				
10:45				
11:00			Biology and Ecology of Alaska Shellfish	
11:15		Instream flow		
11:30				
11:45				
12:00	LUNCH			
1:30	Habitat Restoration	Instream flow	Biology and Ecology of Alaska Shellfish	Distribution and Movement of Fish in Alaska
1:45				
2:00				
2:15	Biotic and Abiotic Responses to Restoration		Invasive Species	
2:30				
2:45				
3:00	BREAK			
3:30	Biotic and Abiotic Responses to Restoration	Groundwater Hydrology	Invasive Species	Distribution and Movement of Fish in Alaska
3:45				
4:00				
4:15				
4:30			Alaska's State Wildlife Action Plan Revision	
4:45				

FRIDAY, OCTOBER 24

TIME	BALLROOM 2	HICKEL	BALLROOM 3
8:00	Ecosystem Linkages	Alaska River Hydrology	Fisheries Management
8:15			
8:30			
8:45			
9:00			
9:15			
9:30			
9:45			
10:00	BREAK		
10:15	Ecosystem Linkages	North Slope Hydrology	Fisheries Management
10:30			
10:45			
11:00		North Slope Fisheries and Their Habitats	
11:15			
11:30			
11:45			
12:00	LUNCH		
1:30	Mining Effects on Hydrology and Fisheries	North Slope Fisheries and Their Habitats	Advances in Fisheries Science and Technology
1:45			
2:00		Climate Modeling and Hydrology	
2:15			
2:30			
2:45			
3:00	LUNCH		
3:30	Mining Effects on Hydrology and Fisheries	Climate Modeling and Hydrology	Advances in Fisheries Science and Technology
3:45	Hydropower Effects on Hydrology and Fisheries		
4:00			Data Management for Hydrology and Fisheries
4:15			
4:30			
4:45	Closing/Student Awards		

PLENARY PRESENTATIONS

WEDNESDAY OCTOBER 22, BALLROOM 2

8:30–9:00	Kim Elton	Science, Policy, and Politics
9:00–9:30	Terry Chapin	Strategizing for Resilient Fisheries and Livelihoods in a Rapidly Changing North
9:30–10:00	Lee Benda	Increasing Access to Watershed Science to Strengthen Resource Management and Conservation
10:00–10:30	Jim Fall	35 Years of Research on Subsistence Fisheries in Alaska

ORAL PRESENTATION SCHEDULE

WEDNESDAY OCTOBER 22, BALLROOM 2

FISHERIES-FORESTRY SUSTAINABILITY: WHAT PROGRESS HAVE WE MADE?

11:00–11:15	Mark Wipfli	Forests and fish feed one another: What are the resource management messages?
11:15–11:30	David D'Amore	Soil geomorphology influences stand differentiation in harvested riparian zones of southeast Alaska
11:30–11:45	Lee Benda	Southeast Alaska - NetMap: New analysis capabilities for evaluating forestry and fishery interactions
11:45–12:00	Robert Danehy	Influences to aquatic biological diversity by natural and anthropogenic disturbance in western Oregon
12:00–1:30	LUNCH	
1:30–1:45	Jared Ross	Geomorphic, riparian, and historical timber harvest influences on aquatic habitat in anadromous streams of southeastern Alaska
1:45–2:00	Megan Marie	Using complementary authorities of ADF&G and ADNR to provide greater habitat protection for anadromous fish
2:00–2:15	Steve Paustian	The evolution of riparian management in Tongass NF watersheds
2:15–2:30	Gordon Reeves	Management of riparian and aquatic ecosystems using variable width buffers
2:30–2:45	Jeffrey Falke	Fish, forests, and fire: vulnerability analysis for threatened salmonids under a changing climate
2:45–3:00	Matthew Sloat	The Alsea watershed study revisited: Examining the effects of contemporary forest practices on stream salmonids
3:00–3:30	BREAK	
3:30–3:45	Marty Welbourn Freeman	Evolution of the Alaska Forest Resources and Practices Act
3:45–4:00	Douglas Martin	Riparian management evaluation in Alaska coastal working forests

HYDROLOGIC AND FISH HABITAT MODELING AND CHARACTERIZATION

4:00–4:15	Jeffrey Davis	Juvenile salmon winter habitat in the Susitna River
4:15–4:30	Gordon Reeves	The ecology of coho salmon in ground water streams on the Copper River Delta
4:30–4:45	Steve Wondzell	Surface – groundwater interactions control egg-incubation temperature regimes on the Copper River Delta, Alaska
4:45–5:00	Sue Mauger	Cold water mapping and salmon habitat characterization guide land conservation and restoration in Cook Inlet watersheds

WEDNESDAY OCTOBER 22, BALLROOM 3

HABITAT SCIENCE TO SUPPORT FISHERIES MANAGEMENT IN ALASKA MARINE ECOSYSTEMS

11:00–11:15	Cindy Hartmann Moore	Alaska's ShoreZone dataset, the mother lode of nearshore marine habitat data
11:15–11:30	Mandy Lindeberg	Google it! Nearshore Fish Atlas of Alaska
11:30–11:45	JJ Vollenweider	Short term variation in arctic nearshore fish communities during the brief ice-free season
11:45–12:00	Susie Zagorski	Assessing habitat impacts of raised ground gear for the Eastern Bering Sea pollock fishery
12:00–1:30	LUNCH	
1:30–1:45	Jessica Glass	Benthic community structure helps inform essential fish habitat definitions for weathervane scallops (*Patinopecten caurinus*)
1:45–2:00	Aaron Baldwin	Use of benthic macroinvertebrates to characterize groundfish habitat
2:00–2:15	Mike Sigler	Coral habitat of the eastern Bering Sea slope
2:15–2:30	Jodi L. Pirtle	Habitat suitability models for groundfish in the Gulf of Alaska

USING GENETICS TO ADDRESS RESOURCE MANAGEMENT CHALLENGES

2:30–2:45	William Templin	Overview of current genetic methods: Bridging disciplines to solve today's challenges in resource management
2:45–3:00	Jeffrey Guyon	ATGUGA - the beginnings of a graphical application to evaluate Markov chain parameters estimating Hardy-Weinberg Equilibrium statistics of multi-allelic microsatellite markers
3:00–3:30	**BREAK**	
3:30–3:45	Kyle Shedd	Power analysis of parentage study for the Alaska Hatchery Research Program
3:45–4:00	Nick DeCovich	Yukon River salmon genetic population structure; exploration of two hypotheses to explain similarities between chum and Chinook
4:00–4:15	Ora Schlei	Mixed stock analysis of commercial harvest Bering Cisco (*Coregonus Laurettae*) from northwest Alaska
4:15–4:30	David Tallmon	Population genetic structure and mating system of red and blue king crab
4:30–4:45	Katie Shink	Improving our understanding of lamprey biology using evidence from genetics

Wednesday October 22, Hickel Room

FISHING COMMUNITIES AND FISHERIES MANAGEMENT

11:00–11:15	Emilie Springer	Creating understanding through public performance: The icon of salmon as a commonality for Alaska's physical and occupational communities
11:15–11:30	Courtney Lyons	Place-making as a framework for understanding development in fishing communities
11:30–11:45	Caroline Brown	Sociocultural dimensions of the Yukon River Chinook salmon fishery

11:45–12:00	Erin Wilson	Investigating the benefits and challenges of community fishing associations
12:00–1:30	**LUNCH**	
1:30–1:45	Marysia Szymkowiak	Examining the impacts of active participation mandates in the Alaskan Halibut IFQ Program
1:45–2:00	Elizabeth Figus	Monitoring in the commercial halibut fishery off Southeast Alaska: incorporating local knowledge

SMALL-SCALE ALASKAN FISHERIES: A FOCUS ON SPORT AND SUBSISTENCE SECTORS

2:00–2:15	Rosalie Grant	Salmon harvested for home use in southeast Alaska
2:15–2:30	Lauren Sill	Evaluating the subsistence harvest of Pacific herring spawn in Sitka Sound, Alaska
2:30–2:45	Daniel Monteith	Alaska natives social and economic interaction in the fisheries in southeast Alaska
2:45–3:00	Andrew A. Thomason	Ethnoichthyology of southern Alaska
3:00–3:30	**BREAK**	
3:30–3:45	Brad A. Ryan	A method for estimating Eulachon populations using a combination of subsistence fishermen and western science
3:45–4:00	Richard Yamada	Improving recreational fishing opportunities for Pacific halibut through cooperative research with Alaska's charter fleet
4:00–4:15	Anne Beaudreau	Temporal changes in target species portfolios in the Gulf of Alaska sport charter fishery
4:15–4:30	Maggie Chan	Effects of halibut regulations on charter fishing practices in Southeast Alaska

FISHERIES CAREER DEVELOPMENT

4:45–5:00	Joel Markis	Developing a fisheries workforce to meet the needs of an ever changing scientific and technical career field

Wednesday October 22, Egan Room

CLIMATE CHANGE IMPACTS ON HYDROLOGY AND FISHERIES

3:45–4:00	Chas Jones	Mapping hazardous ice conditions with high-resolution satellite imagery
4:00–4:15	Adelaide Johnson	Hydrology and sustainable indigenous populations
4:30–4:45	Hal Shepherd	The Norton Bay climate change adaption plan
4:15–4:30	Peter Westley	Evolutionary rescue and the persistence of fish populations
4:45–5:00	Hannah Johnson	Kenai River salmon harvest: trends and changes

THURSDAY OCTOBER 23, BALLROOM 2

HYDROLOGIC AND FISH HABITAT MODELING AND CHARACTERIZATION (CONTINUED)

8:00–8:15	Daniel Miller	Building accurate hydrography within a framework of analysis tools to strengthen resource management and conservation in the Matanuska-Susitna Watershed, Alaska
8:15–8:30	Matthew Sloat	Predicting the response of salmon spawning habitat to changing hydrologic regimes in the salmon forests of southeast Alaska
8:30–8:45	Wesley Daniel	Influence of catchment-scale landscape factors on fishes of southeast Alaska: determining condition of fluvial fish habitat for the National Fish Habitat Partnership 2015 assessment
8:45–9:00	Christine Woll	Salmon habitat mapping in the Nushagak and Kvichak Watersheds

9:00–9:15	Jessica Cherry	Airborne thermography for hydrology and aquatic ecology
9:15–9:30	Guy Wade	Preliminary habitat assessment for large projects in Alaska during the pre-design phase
9:30–9:45	Jonathon Gerken	Putting your money where the fish are

AQUATIC HABITAT RESTORATION IN ALASKA: INNOVATIONS, APPLICATIONS, SUCCESSES AND FAILURES

9:45–10:00	Julianne Thompson	Prioritizing watershed restoration in the Tongass National Forest
10:00–10:15	BREAK	
10:15–10:30	Heath Whitacre	Pinnacles & pitfalls of a large stream restoration project
10:30–10:45	Nate Catterson	The Colorado road restoration
10:45–11:00	Katherine (K.K.) Prussian	A glimpse of the past
11:00–11:15	William Rice	A decade of restoration achievements and challenges in the Mat-Su Basin
11:15–11:30	Kate Morse	Community partnerships for fish habitat restoration
11:30–11:45	John Hudson	Aquatic habitat restoration in Skagway: reversing 117 years of urban impacts on Pullen Creek
11:45–12:00	Meredith Pochardt	Upstream habitat assessment of fish passage barriers in Haines, Alaska
12:00–1:30	LUNCH	
1:30–1:45	Neil Stichert	Assessment, design, and improvement of fish passage through culverts: a case study at Cannery Creek, Haines, Alaska
1:45–2:00	Pete Schneider	Kanalku sockeye: a balance between wilderness and subsistence needs
2:00–2:15	Gary E. Whelan	Alaska's aquatic habitat options as viewed through the National Fish Habitat Partnership Assessment lens

ASSESSING THE BIOTIC AND ABIOTIC RESPONSES TO FISH HABITAT RESTORATION ACTIONS

2:15–2:45	Philip Roni	Designing effective monitoring and evaluation of stream and watershed restoration
2:45–3:00	Emil Tucker	Was it broken? Did we fix it? What are aquatic habitat surveys telling us about channel condition?
3:00–3:30	BREAK	
3:30–3:45	Gillian O'Doherty	Monitoring fish passage in the Mat-Su Borough
3:45–4:00	Sheila Jacobson	The complexities of monitoring multiple restoration actions at various scales within a watershed: A case study of Twelve mile Creek, Prince of Wales Island
4:00–4:15	Gordon Reeves	Effective monitoring of stream and watershed restoration efforts in Alaska: challenges and opportunities
4:15–5:00	Scott Harris	Facilitated panel discussion: Where do we go from here to better assess responses to restoration?

Thursday October 23, Ballroom 3

SALMON ECOLOGY

8:00–8:15	Natura Richardson	Feeding ecology of juvenile sockeye salmon and resource partitioning with threespine stickleback in Afognak Lake, Alaska
8:15–8:30	Brock M. Huntsman	Habitat selection in an Appalachian brook trout population explained by riverscape energetics
8:30–8:45	Suresh Andrew Sethi	Inference about size, growth, and age from juvenile salmon fork length data
8:45–9:00	Jim Boersma	Site fidelity and its implications for the survival of overwintering juvenile Chinook salmon in a south-central Alaskan system
9:00–9:15	Erik Schoen	Factors limiting freshwater growth of juvenile Chinook and coho salmon in a large, glacial watershed

9:15–9:30	Molly McCarthy	Climate effects on sockeye salmon production: are clearwater and glacial lakes in sync?
9:30–9:45	Stacy L. Vega	Reconstruction of ocean entry timing and growth rates of juvenile chum salmon in Alaskan Waters of the Chukchi and Northern Bering Seas
9:45–10:00	Melissa Prechtl	Juvenile chum (*Oncorhynchus keta*) and pink (*O. gorbuscha)* salmon growth and condition in warm and cool spring thermal regimes of the northeastern Bering Sea
10:00–10:15	BREAK	
10:15–10:30	Jim Murphy	Impact of size-selective mortality on juvenile life-history patterns in Yukon River Chinook salmon
10:30–10:45	Philip Joy	Marine versus freshwater factors for explaining relationships between pink salmon escapements and coho salmon brood returns
10:45–11:00	Joe Orsi	The use of ecosystem metrics for pre-season forecasts of pink salmon harvest in Southeast Alaska: What we have learned?
11:00–11:15	Adrian Celewycz	Ocean distribution and occurrence of Chinook salmon stocks listed under the Endangered Species Act (ESA) from Coded-Wire Tag (CWT) recoveries, 1981-2013

BRIDGING SPACE AND TIME: DISTRIBUTION AND MOVEMENT OF FISH IN ALASKA

1:30–1:45	Kevin M. Fraley	Seasonal movements of Rainbow Trout (*Oncorhynchus mykiss*) in the Susitna River Basin, Southcentral Alaska
1:45–2:00	Randy J. Brown	Spawning distribution of Bering Cisco in the Yukon River
2:00–2:15	Joshua Ashline	Migratory behaviors of rearing juvenile coho salmon in the Big Lake Watershed, Alaska
2:15–2:30	Kevin Foley	Abundance estimates and movement patterns of juvenile sockeye salmon emigrants from Meadow Creek, Alaska, 2013
2:30–2:45	Lisa Stuby	Spawning distribution and migratory timing of Kuskokwim River Inconnu

2:45–3:00	Emily Whitney	Community composition of nearshore fishes in Southeast Alaska estuaries
3:00–3:30	BREAK	
3:30–3:45	Benjamin Williams	Sampling design influences on estimates of walleye pollock maturity rates in the Gulf of Alaska
3:45–4:00	Dan Olsen	Core use areas of resident (fish eating) killer whales in Prince William Sound and Kenai Fjords, Alaska
4:00–4:15	Kari H Fenske	Incorporating sablefish movement in a spatial stock assessment model
4:15–4:30	Julie Nielsen	At home or on the range? Defining movement states for Pacific halibut in Glacier Bay, Alaska using both acoustic and archival tag data
4:30–4:45	Andrew C. Seitz	Will the Glacier Bay Marine Protected Area shield Pacific Halibut from commercial fishery harvest?

Thursday October 23, Egan Room

CHALLENGES AND OPPORTUNITIES FOR LONG-TERM MONITORING IN ALASKA

8:15–8:30	Sue Mauger & Marcus Geist	Where we are and where we need to be to understand regional water temperature trends: AKOATS and minimum data collecting standards.
8:30–8:45	Trey Simmons	Long-term monitoring of stream ecosystems in the Central Alaska Network
8:45–9:00	Carrie Eischens	North Pacific Research Board investments in long-term monitoring in Alaska marine systems
9:00–9:15	Crane Johnson	Innovative methods to extend the National Weather Service Real-time Stream Monitoring Network
9:15–9:30	Amber Bethe	Alaska monitoring and assessment program
9:30–9:45	Matt Piche	Potential for long-term monitoring of individual Copper River Chinook Salmon stocks using remote streambed RFID readers

9:45–10:00	Scott Harris	Partnering with communities to increase impact (and sample size) of long-term monitoring programs
10:00–10:15	BREAK	
10:15–10:30	Brad A. Ryan	A community based practitioner's perspective on monitoring water quality
10:30–10:45	Brian Vander Naald	Public perception of the benefits of long-term monitoring programs

INSTREAM FLOW PERSPECTIVES AND ISSUES IN ALASKA

11:15–11:30	Joe Klein	Overview of Instream Flow Issues in Alaska
11:30–11:45	Robert J. Henszey	Riparian plants need instream flows too
11:45–12:00	Brian Marston	Steelhead observations in the Situk River in relation to water conditions
12:00–1:30	LUNCH	
1:30–1:45	Robert Ruffner	Non-governmental organizations interest and application of instream flow
1:45–2:00	Mark Willette	Effects of water level fluctuations on ecological processes in subarctic lakes
2:00–2:15	Ed Neal	Fish kills in a coastal Alaska stream and why instream flow reservations can be important to water chemistry
2:15–2:30	Alan Peck	Recreation flows as an instream flow protection strategy
2:30–2:45	Terry Schwarz	Data needs for instream flow reservations

GROUNDWATER HYDROLOGY

3:30–3:45	Bill Mann	Guidelines on how to deploy and protect water level monitoring equipment in cold environments

3:45–4:00	Thomas Hanna	Installation of infiltration gallery at Greens Creek Mine Juneau, Alaska
4:00–4:15	Wayne Westberg	Thaw bulb well construction in arctic permafrost regions
4:15–4:30	Melissa E. Hill	The Alaska Hydrologic Survey's activities in the Matanuska-Susitna Valley and Anchorage Bowl Areas

Thursday October 23, Hickel Room

USE OF MOBILE ELECTRONIC DEVICES FOR FIELD DATA COLLECTION IN ALASKA

8:00–8:15	Jacob Van Baalen	HARM: Using mobile technologies to reduce halibut release mortality
8:15–8:30	Elisa Russ	Allegro-based electronic field data collection in ADF&G Central Region
8:30–8:45	Scott Johnson	An integrated environment for developing mobile applications
8:45–9:00	Ric Shepard	Overview of electronic data collection tools in Westward Region
9:00–9:15	Anne Reynolds	Electronic data collection in commercial fishery sampling in Southeast Alaska
9:15–9:30	Jon Bonkoski	Alaska Logbook - a mobile tool for field data collection, organization, management, and reporting
9:30–9:45	Glenn Hollowell	Development and use of PDA-based software for collecting geo-referenced salmon aerial survey data
9:45–10:00	Matt Jones	Development and use of a tablet-based digital survey tool for conducting aerial herring surveys
10:00–10:15	BREAK	
10:15–10:30	Timothy R. Frawley	Electronic data collection tools of the Mark, Tag, and Age Laboratory

10:30–10:45	Terri Morganson & John Sharrard	Effectively using the ArcGIS platform for field data collection, communication, and decision making

LIFE ON THE HALF-SHELL: BIOLOGY, ECOLOGY, AND MANAGEMENT OF ALASKA'S SHELLFISH RESOURCES

11:00–11:15	Ginny L. Eckert	Sea otter foraging on commercially important shellfish in southern Southeast Alaska
11:15–11:30	Charlotte R.-Whitefield	Seasonal patterns in nutrient utilization and storage by the California sea cucumber (*Parastichopus californicus*) from Southeastern Alaska
11:30–11:45	Cynthia Pring-Ham	A look at bivalve shellfish aquatic farming in Alaska
11:45–12:00	Asia Beder	Dietary lipids improve the nutrition and condition of red king crab larvae (*Paralithodes camtschaticus*)
12:00–1:30	**LUNCH**	
1:30–1:45	L. Michelle Ridgway	Locally-based investigations of king crab habitat ecology in the Pribilof Domain
1:45–2:00	Joel Webb	Feasibility of direct age determination in commercially important crustaceans in Alaska

INVASIVE SPECIES

2:15–2:30	Scott A Miller	Implications of the invasive tunicate *D. vexillum* on the subsistence herring fishery in Sitka Sound
2:30–2:45	Joshua Ream	Human-amphibian interactions in the North: a detriment or an opportunity for Alaska's native species?
2:45–3:00	Morgan Sparks	Is Whirling Disease driving salmonid community shifts in Blackfoot River Basin, Montana?

3:00–3:30	**BREAK**	
3:30–3:45	Dona Eidam	Alaska Blackfish--successful invaders of Cook Inlet Basin
3:45–4:00	Hugo Villavicencio	Stable isotope and diet analysis of food web structure in Lake Atitlan, Guatemala
4:00–4:15	David Rutz	Invasive Northern Pike suppression in Alexander Creek
4:15–4:30	Robert Massengill	Invasive Northern Pike detection using environmental DNA

ALASKA'S STATE WILDLIFE ACTION PLAN REVISION

4:30–5:00	Tim Viavant	Alaska's State Wildlife Action Plan revision

Friday October 23, Ballroom 2

ECOSYSTEM LINKAGES FROM ICEFIELD TO OCEAN IN COASTAL ALASKA

8:00–8:15	Shad O'Neel	Icefield-to-ocean linkages across the northern Pacific coastal temperate rainforest ecosystem
8:15–8:30	Jeremy Littell	Of snow and hemlock: maritime treeline and snow interactions in Alaska
8:30–8:45	Louis Sass	Quantifying the variability of snow accumulation on glaciers around the Gulf of Alaska
8:45–9:00	Jason Fellman	Temporal variability in stream physical characteristics influences potential habitat suitability for Pacific salmon in two coastal watersheds of southeast Alaska
9:00–9:15	Sonia Nagorski	Contrasting mercury dynamics and uptake in three adjacent watersheds near Gustavus, southeast Alaska
9:15–9:30	Dennis Landwehr	Riparian area mapping pilot
9:30–9:45	Kristin Rine	Patterns of energy flow in salmonid food webs within a large glacial Alaskan river

9:45–10:00	Daniel Rinella	Exotic earthworms as a trophic subsidy to native salmonids
10:00–10:15	BREAK	
10:15–10:30	Jason Amundson	Subglacial discharge from tidewater glaciers
10:30–10:45	Roman Motyka	Glacier-ocean and glacier-lake interactions: feedbacks and relevance for habitat
10:45–11:00	Robert McNabb	Variations in Alaska tidewater glacier frontal ablation, 1985-2013
11:00–11:15	Rob Campbell	Ice sheets to oceans: linkages between the Copper River and the northern Gulf of Alaska
11:15–11:30	Melissa Rhodes-Reese	Glacier Fed: Investigating marine iron within Berners Bay
11:30–11:45	Mayumi Arimitsu	Influence of meltwater on marine ecosystem structure of glacial fjords in the Gulf of Alaska

MINING EFFECTS ON HYDROLOGY AND FISHERIES

1:30–1:45	Kyle Moselle	Coordinating the mine permitting process in Alaska and Canada
1:45–2:00	Charles F. Cobb	Overview of the Alaska Dam Safety Program
2:00–2:15	David Chambers	Long term risk of tailings dam failure
2:15–2:30	Gordon Willson-Naranjo	Aquatic biomonitoring at Southeast large mines
2:30–2:45	Parker Bradley	Aquatic bio-monitoring of the Red Dog and Fort Knox Hard Rock Mines in Alaska
2:45–3:00	Carol Ann Woody	Coho salmon biodiversity, distribution, and density in a proposed mining area, Bristol Bay, Alaska
3:00–3:30	**BREAK**	
3:30–3:45	Will	Water quality report for the Greens Creek Mine

	Collingwood	

HYDROPOWER EFFECTS ON HYDROLOGY AND FISHERIES

3:45–4:00	Sarah O'Neal	Costs and benefits of large hydropower mitigation
4:00–4:15	Corinne Smith	Indicators of Hydrologic Alteration (IHA): A tool for understanding hydrologic changes in ecologically-relevant terms
4:15–4:30	Joseph L Miller	Ecological risk assessment of large-scale hydropower on Pacific salmon populations within the Susitna River
4:30–4:45	Duff Mitchell	Sweetheart Lake Hydroelectric Project. Developing SE Alaska hydropower for compatibility with fishery resources

Friday October 23, Ballroom 3

FISHERIES MANAGEMENT

8:00–8:15	Milo Adkison	Are Alaska crab hatcheries a good idea?
8:15–8:30	Ginny L. Eckert	Crab raised in hatchery provide opportunities for understanding lack of recovery of king crab in Alaska
8:30–8:45	Daniel Michrowski	The swimming dead: addressing the uncertainty of discard mortality using the example of skates (Rajidae) in the North Pacific
8:45–9:00	Thomas J. Farrugia	Development of the first stock assessment for skates in Alaska, using Stock Synthesis
9:00–9:15	Dean Courtney	Risk analysis of plausible incidental exploitation rates for Pacific sleeper sharks: a data poor species in the Gulf of Alaska
9:15–9:30	Julie Scheurer	Cross-sector transfers of commercial halibut fishing quota: a review of Alaska's new Guided Angler Fish program
9:30–9:45	Megan J. Peterson	Managing Pacific halibut bycatch in the Bering Sea and Aleutian Islands

9:45–10:00	Toshihide "Hamachan" Hamazaki	Historical run size reconstruction of Yukon River Chinook salmon by stock
10:00–10:15	BREAK	
10:15–10:30	Ken Harper	Near term Chinook salmon run size expectations for the Kwethluk River. Ricker projections vs reality.
10:30–10:45	Bryce Mecum	Prediction of stock-specific upriver migratory timing for Yukon River Chinook salmon
10:45–11:00	Andrew Piston	The Alaska harvest of Skeena River sockeye salmon: perception versus reality
11:00–11:15	Nicole Portley	Limit reference points for Pacific salmon fisheries
11:15–11:30	Ben Staton	Stock assessment in data-limited situations: an integrated run reconstruction with stock-recruitment analysis on Kuskokwim River Chinook salmon
11:30–11:45	Mark Stopha	Trends in hatchery salmon value in Alaska and implications for future hatchery production

ADVANCES IN FISHERIES SCIENCE & TECHNOLOGY

1:30–1:45	Joe Orsi	Underwater observations and paired surface trawling comparisons to see if a Marine Mammal Exclusion Device (MMED) affects juvenile salmon catch
1:45–2:00	Nyssa Baechler	Chignik River DIDSON post-weir escapement enumeration
2:00–2:15	Heather Finkle	Assessment of Kodiak Island salmon lakes using an autonomous underwater vehicle
2:15–2:30	Carl Burger	Graduated-field fish guidance technology: a conservation tool to help solve resource management challenges and aid salmon escapement monitoring in Alaska
2:30–2:45	Carl Burger	Innovative technology for deterrence and conservation of marine mammals

		using non-lethal electric gradients: updated results of field trials
2:45–3:00	Lauren T. Bailey	Development and calibration of bioelectric impedance analysis as a measure of energetic status of Arctic grayling (*Thymallus arcticus*)
3:00–3:30	BREAK	
3:30–3:45	Jim Bowker	Efficacy and safety data to support approval of AQUI-S20 to sedate freshwater finfish to handleable
3:45–4:00	Priyamvada Sharma	Crude oil biodegradation in arctic sea shore sediments

DATA MANAGEMENT FOR HYDROLOGY AND FISHERIES RESEARCH

4:00–4:15	Bradley E. Dunker	The role of fisheries management and hydrology data in oil spill preparedness and response
4:15–4:30	Jessica Cherry	Imiq: a hydroclimate database and data portal for Alaska
4:30–4:45	Kacy Krieger	Statewide hydrography stewardship: the Alaska Hydrography Database

Friday October 23, Hickel Room

ALASKA RIVER HYDROLOGY

8:00–8:15	Jeff Conaway	Status of the U.S. Geological Survey stream gaging program in Alaska
8:15–8:30	Janet Curran	Alaska streamflow statistics update
8:30–8:45	Chas Jones	Modeling how changes in flooding affects the driftwood harvest from the Yukon River
8:45–9:00	Paul Schauer	Hydraulics of tidally-influenced streamflow at bridges in Alaska
9:00–9:15	Janet Curran	Flooding and channel change in a glacial stream near the Exit Glacier access road, Kenai Fjords National Park, Alaska

9:15–9:30	Robin Beebee	Channel changes on the Copper River near Bridge 339, 2011–2014

NORTH SLOPE HYDROLOGY

10:15–10:30	Joshua Koch	Unique hydrology and ecology of partially-drained arctic thaw lakes
10:30–10:45	Ronald Daanen	Hydrogeology on the North Slope of Alaska
10:45–11:00	Anna Iverson	Assessing the fate of fresh crude oil through an arctic coastline, based on sediment structure and wave action

FISHERIES AND FISH POPULATIONS AND THEIR HABITATS OF THE NORTH SLOPE OF ALASKA

11:00–11:15	John Seigle	An overview of the Colville River Delta Arctic cisco fall fishery
11:15–11:30	Parker Bradley	Fish and aquatic habitat surveying on the North Slope
11:30–11:45	Kurt Heim	Body size and condition influence migration timing of juvenile arctic grayling on the Arctic Coastal Plain
11:45–12:00	Stephen Klobucar	Understanding how lake populations of arctic char are structured and function with special consideration of the potential effects of climate change: a multi-faceted approach
12:00–1:30	BREAK	
1:30–1:45	Sarah Laske	Fish community structure is influenced by local and regional landscape attributes on the North Slope, Alaska
1:45–2:00	Jason Leppi	Modeling landscape influences on winter dissolved oxygen concentrations in Arctic tundra lakes

CLIMATE MODELING AND HYDROLOGY

2:00–2:15	Rick Lader	An evaluation of reanalysis products for Alaska to facilitate climate impact studies

2:15–2:30	Anna Liljedahl	Climate data needs for Alaska's hydrologic studies
2:30–2:45	Peter Bieniek	Dynamical downscaling for Alaska
2:45–3:00	Gabriel Wolken	Future glacier and runoff changes in the upper Susitna drainage basin, Alaska
3:00–3:30	BREAK	
3:30–3:45	Michael Pirhalla	Evaluation of particulate matter emissions from cruise ships in Glacier Bay using the WRF/Chem Model
3:45–4:00	Uma S. Bhatt	Changing seasonality of tundra vegetation in relationship to climatic variables
4:00–4:30	Stephanie McAfee	The PDO: A useful planning tool for Alaska or not?

ORAL PRESENTATION ABSTRACTS

Fisheries-Forestry Sustainability: What Progress Have We Made?

Session chairs: Mark Wipfli[1] and Doug Martin[2]
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[2] Doug Martin, Martin Environmental, doug@martinenv.com

The effects of forest management on aquatic ecosystems and the sustainability of salmon populations are a continuing concern to land owners, resource managers, resource users (sport, commercial, and subsistence fisheries), conservationists, and the general public. These concerns along with new scientific knowledge have motivated major revisions to the forest practices rules on public and private timberlands of Southeast Alaska. Adaptive management programs have improved our understanding of forest and fish interactions, but questions remain concerning the effectiveness of contemporary forest management and the sustainability of salmonid populations. Also, there are emerging questions about the effectiveness of riparian silviculture and restoration as management transitions from harvesting of old-growth to young-growth management.

SESSION: Fisheries-forestry sustainability: What progress have we made?

Forests and fish feed one another: What are the resource management messages?

Mark Wipfli
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Linkages among ecosystems have proven crucial in supporting the biota inhabiting aquatic and terrestrial systems. Resource subsidies of nutrients, detritus, and prey from one ecosystem or habitat to another often have tremendous influences on recipient food webs. For example, marine biomass (nutrients, energy) from adult salmon returns often dramatically affects biofilms, invertebrates, and fishes in streams and lakes, and terrestrial plants and consumers. In Alaska and throughout much of the Pacific Northwest, forests provide a crucial subsidy of terrestrial invertebrate prey to streams, greatly supplementing food supplies for fish that are seemingly food-limited. The composition of riparian vegetation along streams plays an important role in shaping those food supplies, hence forest management proximal to fish habitats can have a large, unseen influence on fish production, through controlling the flow of prey and detritus to streams. Furthermore, biomass from spawned salmon often fertilizes riparian forests, which in turn supply plant matter and terrestrial invertebrates to riparian and aquatic consumers (e.g., birds, fish). What we've learned over the last decade about interactions between forests and fishes can be used to better manage forest ecosystems, to benefit forests, fishes, and the other biota forests and fresh waters support.

Soil geomorphology influences stand differentiation in harvested riparian zones of southeast Alaska

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Riparian zones comprise a small proportion of total watershed area, but these zones are disproportionately important in controlling stream function. Managing and restoring riparian zones is a high priority for land stewards but there are few tools in southeast Alaska to evaluate the impact of riparian forest management on the full array of stream functions. Regenerating riparian forest stands are thinned to enhance forest stand recovery to achieve a desired condition that provides for the acceleration of old-growth conditions including increase and diversification of understory plant communities, expansion of woody debris recruitment and enhancement of nutrient cycling. However, the trajectory of stand growth and differentiation among various soil landscape components of the terrestrial ecosystem adjacent to the stream channel is currently uncertain. We have created a soil geomorphic model and used this as a framework for advancing the understanding of riparian stand dynamics under both natural and managed conditions. The soil landscape model was applied to several stream reaches in two watersheds. The model included information on soil type, geomorphic surface, and stream channel type. The key feature of each site was the stand structural attributes determined by size and density of the trees. The ratio of size to density was determined for each site to determine how these ratios compared to comparable sites in unharvested riparian zones. Riparian areas have distinctive size and densities with larger diameter trees spaced more widely apart than upland stands. Thinning can enhance growth in riparian stands, but is most effective under conditions of conifer overstocking. Disturbance in many natural and managed riparian stands promotes mixed conifer-alder stands that do not respond to thinning as well. These mixed stands have the characteristic size and density of the future desired condition and grow on a preferred trajectory with little manipulation. The stand size and density provides a metric for the long-term monitoring of recovery in stands located on specific soil landscape units.

SESSION: Fisheries-forestry sustainability: What progress have we made?

Southeast Alaska - NetMap: New analysis capabilities for evaluating forestry and fishery interactions

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The Tongass National Forest commissioned NetMap watershed datasets, coupled to analysis tools, across the majority of southeast Alaska in 2012/2013 using a proprietary 20 m DEM. NetMap was also applied to Sealaska lands using a 5 m DEM. NetMap datasets will be updated with IfSAR 5 m DEMs when they are available from the Alaska Statewide Digital Mapping Initiative. This is providing the forestry sector in southeast Alaska with new analysis and planning capabilities: (1) Fish habitat modeling - NetMap's channel attributes and associated tools, in conjunction with additional field data and numerical models, could be used to predict the distribution and relative quality of fish habitats, including salmon across southeast Alaska. This could be used to refine streamside protection strategies, prioritize stream monitoring and plan restoration activities. (2) Road analyses - tools are used to estimate road density (watershed to stream reach scale), road hydrologic connectivity, road surface erosion, sediment delivery to streams, road stability, roads in floodplains, and habitat length above all road crossings. Road analyses could be used to prioritize road maintenance, road restoration or road abandonment. (3) Riparian Management - more site specific strategies could take advantage of information about erosion risk (slope stability, surface erosion), thermal loading and in-stream wood recruitment. For example, riparian management in second growth forests could be informed by estimating effects of thinning on wood recruitment and the proportion of thinned trees that would need to be tipped into streams to offset losses of in-stream wood.

Influences to aquatic biological diversity by natural and anthropogenic disturbance in western Oregon

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We examined aquatic biological diversity in forested streams in western Oregon USA using published work from comprehensive databases and three other data sets. Two comprehensive aquatic insects studies in W Oregon are available, with richness values of 325 taxa at one site and the second with beta diversity (6400 ha watershed) of 425 taxa. We use these values as the likely upper end of richness in ecoregion. We examined two disturbance types: natural - debris flows, and anthropogenic - canopy removal across three studies (6, 11, and 19 sites). Overall study richness was 159, 165, and 192 taxa, with site alpha richness 34 to 80 taxa. Each study had similar levels of taxonomic resolution with the inclusion of Chironomidae to genus or species. Rare species contributed to richness as 20-30 % of taxa were found at only one site within each study. We paired eight disturbed sites with a less disturbed neighboring site. In all pairs, disturbed sites had higher overall taxa and Chironomidae taxa richness. EPT taxa richness was higher at disturbed sites in all but one pair. Taxa with rapid turnover life history respond to changed riparian state and other local conditions. Since alpha richness was a fifth to a half of beta/gamma richness in each study, measuring full landscape aquatic richness, even when only targeting small streams, needs to be both intensive and extensive. Within a landscape, site assemblage drivers (e.g., primary production, substrate conditions) are altered by disturbance of local conditions.

SESSION: Fisheries-forestry sustainability: What progress have we made?

Geomorphic, riparian, and historical timber harvest influences on aquatic habitat in anadromous streams of southeastern Alaska

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Early clear-cut logging is known to have negatively affected stream habitat and biota in the Pacific Northwest and Alaska. Altered hydrology and connectivity, unstable banks, increased erosion, sedimentation of stream beds, and simplified channels have resulted from logging. As timber management is widely accepted as having the potential to alter stream habitat, understanding the influence of natural controls is likewise important in defining habitat potential for streams that have experienced historical human influences. The goal of this study was to compare geomorphic, riparian, and timber harvest-related influences on aquatic habitat in streams of Southeast Alaska with riparian zones harvested between 1980 and 1990 (i.e., the period of initial regulations in SE Alaska) to better account for natural controls vs. the legacy of human impacts to the region's streams. Results show that aquatic habitat in sampled streams is related to both natural and anthropogenic land uses. Pool, substrate, and large wood characteristics were related with geomorphic factors including bankfull width, channel gradient, and channel confinement, while pools formed by wood and large wood density were also related to riparian composition. In this study, size of substrates was found to be related to historical timber management practices; harvested streams were found to have smaller median particle sizes than substrate in unharvested streams. These findings suggest that riparian and geomorphic factors strongly influence fluvial habitat at the reach scale in streams draining previously logged watersheds and reinforce the importance of understanding natural controls on aquatic habitat to effectively manage streams in Southeast Alaska.

SESSION: Fisheries-forestry sustainability: What progress have we made?

Using complementary authorities of ADF&G and ADNR to provide greater habitat protection for anadromous fish

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Historical forestry practices often harvested timber adjacent to streams, with well-documented deleterious riparian and stream habitat impacts throughout the literature. As a result, the Alaska Forest Resources and Practices Act (FRPA) requires a 66-foot riparian retention area along anadromous waters. The Alaska Department of Fish and Game (ADF&G) is required by statute to specify waters important to anadromous fish; ADF&G does so by maintaining the Catalog of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes and its companion Atlas (AWC). Yet, the same ADF&G statute limits jurisdiction of habitat protections to below ordinary high water (OHW). The purpose of this study was to sample waters on Afognak and Kodiak islands for the presence of anadromous fish in advance of timber harvest activity. The information gathered has been used to submit official nominations for inclusion in the AWC, thus invoking the complementary authorities of ADF&G (below OHW) and FRPA (66-foot riparian area) to provide greater protection for anadromous fish habitat. During the three year sampling period (2012 -2014), fish presence surveys resulted in 99 nominations to the AWC in 2012, 59 nominations to the AWC in 2013, and 95 nominations to the AWC in 2014. To date, about 77 km of anadromous fish habitat has been added to the AWC, with additional habitat being approved for the June 2015 revision. Riparian areas in all newly documented anadromous fish habitats have been maintained through FRPA.

SESSION: Fisheries-forestry sustainability: What progress have we made?

The evolution of riparian management in Tongass NF watersheds

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Riparian management practices on the Tongass National Forest have changed significantly over the past 50+ years. During the 1960's and 1970's industrial scale logging along major salmon producing streams and rivers resulted in long lasting impacts to over 70 watersheds (6th code Hydrologic Units). Over the next two decades Tongass riparian management transitioned to an emphasis on resource protection and stewardship with the passage of the 1990 Tongass Timber Reform Act and the adoption of the 1997 Forest Plan. Beginning around 2000 the Tongass riparian management strategy incorporated a major watershed restoration component to address watershed health issues associated with early logging and land management activities. The Forest has made great strides over the last two decades in developing robust riparian protection measures and initiating an integrated watershed restoration and stewardship program. However, a strong commitment to future research and monitoring is needed to clearly demonstrate the long-term effectiveness of the Tongass riparian management strategy.

SESSION: Fisheries-forestry sustainability: What progress have we made?

Management of riparian and aquatic ecosystems using variable width buffers

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Management of aquatic and riparian ecosystems is constrained because of the reliance on "off-the-shelf" and one-size-fits-all concepts and designs, rather than considering specific features and capabilities of the location of interest. As a result, use of fixed widths buffers that generally depend on stream size is the most common approach. This is easy to administer and apply, and along with lack of guidance for developing buffers and uncertainty about results of using variable width buffers, development and application of a variable approach to management of riparian and aquatic ecosystems has been limited. However, new analysis tools, such as NetMap, and practices, such as tree tipping, and a growing understanding of how key ecological processes occur within a watershed allows for development of viable and practical alternative approaches to the fixed width approach that are ecologically beneficial and cost- effective while providing potential opportunities for other management objectives. We developed an approach that recognizes the inherent variation in where ecological processes occur within a watershed as well as the capacity to provide productive habitat to establish the size of riparian buffers and the type, extent, and objectives of management activities at a particular location. More productive and ecologically important locations receive the largest buffer in which management is directed to solely achieving ecological goals. Locations that are less productive and more immune to management impacts have less area devoted to solely achieving ecological goals and more area for managing for ecological and other goals. We provide an example of the application of this approach on federally managed lands in western Oregon.

SESSION: Fisheries-forestry sustainability: What progress have we made?

Fish, forests, and fire: vulnerability analysis for threatened salmonids under a changing climate

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Linked atmospheric and wildfire changes will complicate future management of native coldwater fishes in fire-prone landscapes and new approaches to management that incorporate uncertainty are needed to address this challenge. We used a Bayesian network (BN) approach to evaluate population vulnerability of Bull Trout (*Salvelinus confluentus*) and spring Chinook Salmon (*Oncorhynchus tshawytscha*) in the Wenatchee River basin, Washington, USA under current and future climate and fire scenarios. The BN was based on modeled estimates of wildfire, along with stream temperature, wood, and sediment dynamics, prior to, and following, simulated fires throughout the basin. This approach allowed us to estimate the population-level, and in the case of Chinook Salmon life-stage specific, response to current and future climate and fire scenarios. We found that for Bull Trout, population vulnerability depended on the extent to which climate effects can be at least partially offset by managing factors such as habitat connectivity and fire size. Moreover, our analysis showed that local management can significantly reduce the vulnerability of Bull Trout to wildfire and climate change given appropriate management actions. The response of three life stages of Chinook Salmon (egg, juvenile, and spawning adult) varied across the riverscape with both positive and negative effects depending on the spatial context and specific set of physical conditions to which life stages were exposed pre- and post-fire. Overall, the BN offered a powerful approach to identify areas where forest management has the greatest potential to effect population-scale resilience of threatened salmonids in fire-prone ecosystems.

SESSION: Fisheries-forestry sustainability: What progress have we made?

The Alsea watershed study revisited: Examining the effects of contemporary forest practices on stream salmonids

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The Alsea Watershed Study (AWS), initiated in 1959, was a landmark study that investigated the effect of timber harvest practices on aquatic biota and an array of hydrologic and water quality parameters in headwater streams in western Oregon. Results from the AWS played an important role in forever changing Oregon's forest harvest practices. Fifty years later, we returned to the same watershed to compare the effects of modern forest practices with those of historic practices. Flynn Creek and Needle Branch drain small headwater basins of the Alsea watershed. Flynn Creek served as an unlogged reference stream in the original AWS and in our study. Needle Branch was clearcut, burned, and cleaned of instream wood in the original AWS. Needle Branch was harvested again in 2009 according to Oregon Forest Practice guidelines, which require retention of a riparian forest buffer adjacent to fish bearing streams. The response of coastal cutthroat trout (*Oncorhynchus clarkii clarkii*) to forest harvest in the original AWS was a dramatic decrease in population abundance, particularly of age-1+ fish. Following contemporary timber harvest the abundance and biomass of age-1+ cutthroat trout in Needle Branch significantly increased relative to Flynn Creek following forest harvest. The retention of riparian forest buffers, absence of stream cleaning, and improved logging technology under contemporary forest management practices likely contribute to differences between the two studies.

SESSION: Fisheries-forestry sustainability: What progress have we made?

Evolution of the Alaska Forest Resources and Practices Act

Marty Welbourn Freeman
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Effective protection of fish habitat and water quality in a manner that allows economical timber management is the core of the Alaska Forest Resources and Practices Act (FRPA). Since 1978, FRPA has governed timber harvesting, forest roads, and reforestation across Alaska. In the 1980s, forest landowners, environmental and fishing groups, timber industry representatives, and state agencies joined to propose major changes to the Act. The proposal, designed to balance economic concerns for timber management with protection of fish habitat and water quality, was adopted without opposition in 1990. To ensure that the Act is working, and to keep up with new information on forestry and fisheries, FRPA requires annual assessments. Each year, the resource agencies and the Board of Forestry review monitoring results and assess FRPA's effectiveness. When assessments identify concerns, the State addresses the issues with in-depth science and technical reviews and stakeholder involvement. This presentation will review the process used to evaluate and update FRPA and the resulting changes to the Act and regulations.

SESSION: Fisheries-forestry sustainability: What progress have we made?

Riparian management evaluation in Alaska coastal working forests

Douglas Martin
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Trends in fish habitat condition were monitored over an 18-year period in watersheds managed for timber harvest as permitted under the Forest Resources and Practices Act. Habitat was characterized with standard measures of pools, large wood, and substrate composition. Collectively, there were no consistent changes (trends positive or negative) in fish habitat over the monitoring period nor is there any indication of significant or persistent habitat degradation that could be related to timber harvest. The study findings represent the effectiveness of the forest practices rules, as implemented, in moderate-sized streams with variable width buffers and basin timber harvest levels that were similar to conditions in the study basins. Further, the effectiveness of AK's forest practices (FP) rules to maintain fish habitat is a function of both the specific buffer BMPs and how the BMPs are implemented at a given location. Consequently, the study results are not a measure of the effectiveness of the standard 20-m wide buffer alone, but rather indicates riparian BMP effectiveness as influenced and constrained by the FP rules, physical setting, and harvest economics. Given these conditions, the monitoring results suggest that current forest practices BMPs are generally maintaining fish habitat and protecting riparian areas from the significant adverse effects of timber harvest. However, the results also show that under certain conditions the BMPs may not be sufficient to minimize logging associated disturbances (e.g., windthrow and landslides) and that additional attention in harvest unit design is warranted.

HYDROLOGIC AND FISH HABITAT MODELING AND CHARACTERIZATION

Session chairs: Bill Rice[1] and Christine Woll[2]
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Session Summary: Decision-making around land use and resource development in Alaska requires information across large scales and in areas lacking field data. New remotely-derived data products and site-specific field studies offer opportunities to model hydrologic and freshwater habitat conditions, as well as fish distribution and abundance. This session highlights past, present and future research across the state and its applications in fisheries management, resource development, conservation, and restoration.

SESSION: Hydrologic and fish habitat modeling and characterization

Juvenile salmon winter habitat in the Susitna River

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This presentation describes the second year of studies conducted to investigate juvenile salmon overwinter habitat in the Susitna and Talkeetna Rivers. During the winter of 2013/2014, sampling was conducted in 9 locations representing 3 replicate tributary mouths, side sloughs, and upland sloughs, in January and February. Juvenile salmon were captured using 10 baited minnow traps fished for 20-24 hours within 100 m sampling sites. Measures of water temperature, dissolved oxygen, conductivity, pH, water depth, ice thickness, water velocity, and woody debris were collected at each trap location. We tested for relationships between habitat characteristics at each trap site and number of juvenile salmon in each trap (CPUT). We then looked to see if these same relationships could be used to predict coho salmon relative abundance at larger spatial scales, sites and macrohabitat classification types. Juvenile coho salmon were the dominate species captured. Juvenile coho salmon CPUT was positively related to site measures of woody debris, water velocity, and dissolved oxygen; however, these local characteristics were not good predictors of average site or macrohabitat CPUT. Mainstem ice development had a large influence on water velocities within sampling locations, and we hypothesize that short term increases in water velocity during mainstem ice development may have precluded juvenile salmon use of side sloughs as overwintering habitat even though habitat characteristics were favorable.

SESSION: Hydrologic and fish habitat modeling and characterization

The ecology of coho salmon in ground water streams on the Copper River Delta

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[6]US Forest Service, Cordova, AK

Coho salmon on the Copper River Delta appear to be uniquely adapted to physical characteristics of groundwater streams. Water temperatures are relatively cool and uniform throughout the year, reflecting mean annual air temperature. Spawning is 4-8 weeks later in these streams than in surface or glacial water. However, emergence in the different streams occurs about the same time. This is because groundwater streams are actually warmer during incubation and accumulate degree days more quickly than other stream types. Upon emergence, fry move to off-channel habitats, which tend to be warmer than the main channel. They exploit abundant Chironomids populations. They also exhibit diel movements with fish moving into the mainstem at dark to feed on a different assemblage of aquatic invertebrates and returning to off-channel areas presumably because warmer water provides for greater metabolic efficiency. 1+ fish are scarce in groundwater streams because of the lack of available off-channel habitat and cooler temperatures, which limits metabolic efficiency and growth, in the mainstem. As a result, the adult population is dominated individuals that spend a single year in freshwater before smolting. This contrasts with surface water streams where 1+ fish are abundant in the main channel and the majority of returning adults spent 2+ years in freshwater before smolting. The signal of climate change in groundwater streams will be more gradual and subtle than in surface water streams. However, coho salmon populations may be strongly challenged by even small changes in temperatures, and flows, if they are constrained by their current ecological capacity.

SESSION: Hydrologic and fish habitat modeling and characterization

Surface – groundwater interactions control egg-incubation temperature regimes on the Copper River Delta, Alaska

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Egg incubation and emergence timing of salmonids are closely linked to over-winter temperature regimes in the redd. Global climate models project warmer future climates, with relatively more warming occurring in northern latitudes and during the winter. Thus, climate change could significantly affect duration of incubation and emergence timing of salmonids on the Copper River Delta. As a baseline for understanding future changes, we are examining spatial heterogeneity in water temperature of shallow groundwater across the Copper River Delta. We are monitoring temperature in streams and in shallow groundwater "wells" approximately 50 cm below the streambed at 14 sites. We found surprising spatial heterogeneity in water temperatures. At some sites, water temperatures were stable at ~4 oC throughout the winter, indicating locations of regional groundwater discharge. Other sites appeared to reflect the local ambient environment, cooling to near ~0 oC early in the winter although short warming periods were observed at these sites in response to warm winter storms. Accumulated degree-days predict that these differences in water temperature could change emergence timing by as much as 6 to 10 weeks. However, the water source also controlled the oxygen environment to which incubating eggs were exposed. Discharging deeper groundwater appears well oxygenated whereas shallow soil water from stream-adjacent wetlands is anoxic. Hyporheic water had variable DO concentrations but appeared to provide sufficient oxygen to the shallow streambed so that salmon can successfully spawn in reaches dominated by discharge of shallow soil water.

SESSION: Hydrologic and fish habitat modeling and characterization

Cold water mapping and salmon habitat characterization guide land conservation and restoration in Cook Inlet watersheds

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As stream temperatures rise in the years ahead, cold water refuges – areas within a stream which are persistently colder than adjacent areas during the summer – will be critical to the survival and persistence of salmonids and other fish species. Recent advances in remote sensing techniques allow researchers to map cold water variation within stream channels using thermal infrared sensors. These high resolution maps can then be integrated with reach-scale salmon habitat and density information to create a picture of current fish use as well as potential future fish use. In numerous Cook Inlet watersheds, we are using these tools to assist land managers as they seek to conserve and/or restore land for the benefit of salmon. On the lower Kenai Peninsula, we have identified 55 key cold-water habitats to guide parcel-level prioritization for Kachemak Heritage Land Trust based on thermal imagery and output from the Anchor River RIPPLE model. On the Ninilchik River, we have identified one key habitat needing restoration. In the Big Lake basin, results from juvenile salmon studies by USWFS will be integrated with thermal imagery interpretation to assist Great Land Trust in salmon habitat protection decision making. By linking remotely-derived data and field studies for conservation planning, we aim to improve landscape-scale resilience for salmon in Southcentral Alaska.

SESSION: Hydrologic and fish habitat modeling and characterization

Building accurate hydrography within a framework of analysis tools to strengthen resource management and conservation in the Matanuska-Susitna Watershed, Alaska

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The advent of high-resolution digital elevation data for Alaska provides an opportunity to synthesize information over watershed scales, while maintaining detail at the channel reach and site scale. The goal of our project is to develop a replicable approach to use these data to update standard hydrographic datasets within a framework of fully integrated watershed mapping and planning tools. In the Matanuska-Susitna watershed, we are combining the best elevation data sources: 1-m bare-earth LiDAR DEMs, 5-m IfSAR DEMs, and 90-m NED DEMs. Using these, a key component is creation of a synthetic stream network guided and verified by detailed field mapping and photo interpretation for its eventual incorporation into the NHD. The synthetic river network, explicitly tied to all landscape locations via inferred surface and subsurface flow paths in a "digital hydroscape", supports analysis of physical and biological processes, and human interactions. The LiDAR data resolve both flood-plain detail and human infrastructure (roads, dams), so these features can be integrated into analyses and planning. Terrestrial and aquatic environments are tightly integrated in a GIS environment, enabling use of other data sources and models to identify process interactions, to delineate specific environments, and to drive a variety of analyses. We describe components of the Mat Su hydroscape and show how they are employed in NetMap, a suite of tools designed for watershed assessments. The Mat Su project is based on a stakeholder community approach that can be applied to other areas of Alaska.

SESSION: Hydrologic and fish habitat modeling and characterization

Predicting the response of salmon spawning habitat to changing hydrologic regimes in the salmon forests of southeast Alaska

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Pacific salmon (*Oncorhynchus* spp.) are an integral ecological, economic, and cultural component the Tongass National Forest (TNF) in southeast Alaska. They are ecological keystone species that influence terrestrial and aquatic ecosystems. They form the basis for commercial, subsistence, and recreational fisheries. Species and populations are currently well distributed across TNF and most are generally productive and healthy. However, because of potential impacts of climate change (increasing temperatures and altered precipitation patterns and hydrographs) the continued health and productivity of these populations is uncertain. How will critical habitats that support salmon respond to changing temperature, precipitation, and hydrologic regimes within the region? Here, we assess potential responses of salmon spawning habitat to changing climatic and hydrologic regimes in southeast Alaska. We use a series of physical models that link climate change, streamflow, and channel morphology to conduct a spatially-explicit analysis of stream channel response potential within the region, including the potential for increased streambed scour and consequent risk to salmonid embryos. We predict a median increase in bankfull flood magnitude of 18% by 2040 and 28% by 2080. This increase is associated with a median potential loss of spawning habitat of ~15% by 2040, and ~20% by 2080 in TNF watersheds due to a combination of streambed coarsening and increased substrate scour. Predicted spawning habitat loss was highly spatially variable, ranging from 0 – 50% among TNF watersheds. This variability reflects an overriding importance of considering local geomorphic context when estimating the potential effects of changing hydrology on salmon spawning habitat.

SESSION: Hydrologic and fish habitat modeling and characterization

Influence of catchment-scale landscape factors on fishes of Southeast Alaska: Determining condition of fluvial fish habitat for the National Fish Habitat Partnership 2015 Assessment

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The National Fish Habitat Partnership (NFHP, www.fishhabitat.org) represents a coalition of governmental and non-governmental groups voluntarily applying habitat conservation actions to protect, restore, and enhance fish habitats throughout the United States. In 2010, NFHP supported completion of the Nation's first assessments of inland and coastal systems in the conterminous United States, Hawaii, and Alaska to provide information in support of its mission. While inland assessments for Hawaii and the conterminous U.S. were based on a spatial framework including summaries of catchment information for all stream reaches in study regions, summaries of landscape factors in Alaska were limited within 12-digit hydrologic units (HUC-12s) which are typically larger than local catchments of stream reaches. To provide finer-resolution information for the upcoming 2015 NFHP assessment, we delineated local and network catchments for rivers in a large portion of Southeast Alaska. Further, in preparation, we have obtained freshwater fish community data from the Alaska Department of Fish and Game, along with new natural and anthropogenic landscape data summarized within stream catchments. In this presentation, we highlight these new data sources and our proposed analytical approach for conducting the 2015 assessment for Southeast Alaska which will evaluate relationships between stream fishes and landscape factors to identify both natural and anthropogenic influences on fish. We emphasize the value of developing a similar spatial framework for all of Alaska which will aid natural resource managers and decision-makers working to restore and protect freshwater habitats from stressors including human land use and climate change.

SESSION: Hydrologic and fish habitat modeling and characterization

Salmon habitat mapping in the Nushagak and Kvichak Watersheds

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In order to evaluate the cumulative impacts of land-use decision making on the health of the Bristol Bay ecosystem, economy, and culture, a better understanding of the relative contributions and diversity of salmon productivity by species and lifestage to certain portions of the Nushagak and Kvichak watersheds is sought. In order to accomplish this, we sought to improve mapping of both salmon habitat and likely salmon abundance patterns in these two watersheds. By surveying known information about salmon-habitat relationships, both across their range and locally, we identified important reach-scale salmon habitat characteristics for mapping. Using high resolution multispectral satellite imagery, we were able to map important salmon habitat features, including springbrooks and shallow shore habitats; we found that these habitats, as well as known salmon spawning locations, correlated well with metrics that could be calculated from digital elevation and hydrography data, including floodplain width, node density, and floodplain confinement. We also found that we could accurately estimate other habitat characteristics including stream order, elevation, reach slope, glacial influence, distance upstream, lake influence, migration barriers, flow accumulation, mean annual precipitation, mean annual flow, channel width, channel depth, and substrate size, across the entirety of both drainages. Modelled habitat characteristics, combined with spatially explicit information on salmon abundance, ultimately provided multi-scale, spatially explicit estimates of overall salmon habitat abundance and diversity. Results from these efforts showcase the abundance and diversity of critical habitats for salmon in the Nushagak and Kvichak watersheds, and provide a template for spatially explicit land-use planning.

SESSION: Hydrologic and fish habitat modeling and characterization

Airborne thermography for hydrology and aquatic ecology

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This talk reviews the technology of airborne remote sensing for optical and thermal properties of aquatic and wetland targets. Results from hydrologic and ecological applications in Alaska are discussed, as well as integration of *in situ* measurements. Conclusions suggest that a combination of *in situ*, airborne, and satellite techniques lead to reduced field costs, more effective in-stream monitoring and research/management. New upgrades to the authors' airborne remote sensing platforms and data processing workflows will highlight future capabilities for thermographic inventory and monitoring efforts.

SESSION: Hydrologic and fish habitat modeling and characterization

Preliminary habitat assessment for large projects in Alaska during the pre-design phase

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Large development projects in Alaska, such as transportation, pipelines, and utility corridors can traverse long distances, bisect multiple ecoregions, and cross numerous fish-bearing streams along their alignment. During the design phase, an understanding of how the extant fish assemblage uses the available habitat within the zone of influence is important for guiding a variety of alignment considerations to effectively avoid and minimize environmental impacts. Often these data are not readily available, and preliminary fish and habitat studies may be required for many streams over a vast geographic range. The diversity of life histories present in Alaska's freshwaters along with logistical and budgetary constraints may not allow for conducting fish surveys at optimal times to directly observe seasonal fish assemblages. Projects of this size may have to rely on habitat assessments to define those variables relevant to understanding ecological function and fish-habitat associations. Meso-habitat and sometimes micro-habitat mapping is required in the most-impacted area of the stream, primarily in the immediate vicinity of the crossing and downstream within the area of potential impact. In many cases, these surveys can be conducted along with a hydrologist to streamline the overall field effort; much of the same information is required by both disciplines. With direct, site-specific habitat characteristic observations, institutional knowledge of fish-habitat associations across Alaska can be used to better understand how each observed habitat unit within the zone of influence may be used. Through this effort, recommendations for project alignment, crossing mode, and construction timing can be developed.

SESSION: Hydrologic and fish habitat modeling and characterization

Putting Your Money Where the Fish Are

Jonathon Gerken[1], Suresh Sethi[2], and Joshua Ashline[3]
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Approximately 70% of the over 400 culverts surveyed in the Matanuska-Susitna drainages were some type of juvenile salmon *Oncorhynchus spp.* barrier at certain flows. Restoration activities to improve fish passage have been ongoing for the past 15 years and have resulted in over 60 culverts replaced or removed; however, replacement project are expensive, warranting a prioritization scheme for the remaining mitigation projects that considers both implementation costs and predicted benefit to fish. The AFWFO Fisheries branch has been collecting information on migration and habitat use of coho salmon *O.nerka* within the Big Lake drainage since 2009. These data will be used to assess culvert utilization and migration behavior amongst habitat types in this drainage, providing biological input to an objective decision making optimization model to prioritize culvert replacement under a limited mitigation budget, and taking into account the network-structure of stream systems. Biological information on juvenile rearing habitat, overwintering, and migration in conjunction with information on adult spawning habitat will be used to objectively rank all waterways of the Big Lake drainage in terms of their relative importance to coho salmon. The rank of biological importance will be coupled with estimates of mitigation project costs to identify sets of culverts which if restored maximize benefit to coho salmon while satisfying a budget limit. This method has been used with success in the lower 48 continental U.S

AQUATIC HABITAT RESTORATION IN ALASKA: INNOVATIONS, APPLICATIONS, SUCCESSES AND FAILURES

Session chair: Neil Stichert
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Across Alaska, multiple entities are implementing on-the-ground projects to improve aquatic habitat through restoration or mitigation activities. This session offers the opportunity for interdisciplinary project biologists, hydrologists, and engineers to demonstrate the efficacy and applications of their work in the region. Innovative case studies derived from in-stream, fish passage, riparian and streambank, and wetland projects are encouraged.

SESSION: Aquatic habitat restoration in Alaska: innovations, applications, successes and failures

Prioritizing Watershed Restoration in the Tongass National Forest

Julianne Thompson
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The Tongass National Forest completed a Forest-wide assessment of over 900 6th level HUC watersheds following national protocols. Twelve core watershed condition indicators were evaluated and ranked. Cumulative scores were used to establish condition classes in terms of geomorphic, hydrologic and biotic integrity relative to potential natural condition. About seventy watersheds have been impacted by past land management practices and need restoration. Overall condition ratings, along with aquatic values, were used to develop a short list of candidate "Priority Watersheds" for restoration planning. Action plans were completed to identify essential restoration projects and facilitate an integrated program of work. Essential restoration work has been completed in the Harris River and Twelvemile Creek. Restoration is nearly completed in Saginaw Creek, Sitkoh River, and Sitkoh Creek. Restoration is underway in Staney Creek, Eagle-Luck Creek and Iris-Shelikof Creek. In 2015 we will repeat the Forest-wide assessment and solicit stakeholder support to identify new Priority Watersheds for restoration in the Tongass National Forest.

SESSION: Aquatic habitat restoration in Alaska: innovations, applications, successes and failures

Pinnacles & Pitfalls of a Large Stream Restoration Project

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Large-scale stream restoration projects are complex and often take years to complete. A recent restoration project on Kuiu Island near Petersburg, Alaska was completed in summer 2014 following approximately 6 years of planning and process. This presentation highlights some of the lessons learned - from planning and contracting to wood collection and instream construction of large wood structures.

SESSION: Aquatic habitat restoration in Alaska: innovations, applications, successes and failures

The Colorado Road Restoration

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In the late 1960's, oil and gas exploration activities created a two mile trench across wetlands in the Lost and Situk River Watersheds near Yakutat Alaska. This trench persisted as a hydrologic feature capturing ground water and surface flow and dewatering segments of over twenty small wetland channels. We used two techniques to restore portions of the original network of stream channels. In the first, small dams were built from jut matting, burlap sandbags, and coir logs, and installed in the trench to direct surface flow back down the original channels. Second, a mini excavator was used to dredge out the vegetation and sediment that had built up in the degraded channels over the previous twenty years. Here we present methods, quantify benefits, and review the lessons learned during the project.

SESSION: Aquatic habitat restoration in Alaska: innovations, applications, successes and failures

A Glimpse of the Past

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Habitat restoration has been occurring for many years in Southeast Alaska. While some projects are generally well known, others have been filed and forgotten. A Glimpse of the Past is an annotated bibliography of several projects related to habitat restoration in Southeast Alaska including large wood removal, large wood additions, and changes in stream morphology.

SESSION: Aquatic habitat restoration in Alaska: innovations, applications, successes and failures

A Decade of Restoration Achievements and Challenges in the Mat-Su Basin

William Rice
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While restoration activities occurred in the Matanuska-Susitna Borough (Borough) prior to 2004, the last 10 years has seen a significant surge in both awareness of aquatic habitat loss and activities to reduce it through the members of the Mat-Su Basin Salmon Habitat Partnership. These restoration activities primarily benefit salmon species on anadromous steams and most of the impacts occur on private lands in urbanizing rural areas. Types of restoration projects implemented over time and where they were mainly installed are discussed as well as their relative success. A select set of bioengineered projects are highlighted and evaluated through visual and measured observation, streams returned to natural function discussed, and fish passage projects monitored over the last 10 years analyzed. Besides basic evaluation, some recommended changes to current practices are discussed, including use of alder plantings, alternative methods besides coir log and brushlayering, and rootwads and how they can be designed for conditions smaller than large river systems. Natural stream construction methods and stream types to best implement it are proposed and observations of fish passage project success with various widths beyond bankfull are evaluated. This talk includes a mix of good projects as well as projects that had problems we all can learn from; illustrating what makes the restoration world an exciting yet inexact science.

SESSION: Aquatic habitat restoration in Alaska: innovations, applications, successes and failures

Community Partnerships for Fish Habitat Restoration

Kate Morse
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Since 2009 the Copper River Watershed Project has worked with diverse community partners to assess and restore Odiak watershed, a small aquatic system in the heart of Cordova, AK that supports coho salmon. Middle school students assisted with water quality and salmon population monitoring and successfully nominated Odiak Pond and stream into the Anadromous Waters Catalog in 2010. Since then, five grants were received that resulted in on-the-ground results for fish passage and improvement of water quality, including a comprehensive hydrologic assessment of the watershed that models pollutant loading and prioritizes restoration projects within the watershed. To date two projects have been completed, including the creation of a demonstration bioswale for filtering stormwater run-off from the community hospital parking lot and the removal of an old wooden culvert from the Copper River/Pacific Northwest railroad and re-establishment of an open stream channel between the pond and upstream spawning habitat. In addition to local students, project partners have included the City of Cordova, Cordova Community Medical Center, Native Village of Eyak, U.S. Forest Service, U.S. Fish & Wildlife Service, and Alaska Department of Fish & Game. Partners contributed staff time, expertise, equipment, and supplies to help with the successful implementation of these restoration efforts. The benefits extend beyond improved habitat conditions for coho salmon and include enhanced working relationships between partners, increased awareness for the impact of the local community on surrounding salmon habitat, and an enriched field-based learning experience for local school students.

SESSION: Aquatic habitat restoration in Alaska: innovations, applications, successes and failures

Aquatic habitat restoration in Skagway: reversing 117 years of urban impacts on Pullen Creek

John Hudson
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Pullen Creek in Skagway is one of the most densely developed salmon watersheds in Alaska. The entire stream, including two miles of fish habitat, lies within an urban and light-industrial setting. Large-scale land development around Pullen Creek began during the Klondike Gold Rush of the late 1890s when Skagway was the largest city in Alaska (pop. 10,000). Today residents number less than 800 and more than 900,000 tourists visit the community each year. Pullen Creek flows through a landscape that has been completely altered, with seventeen miles of roads and city streets traversing an area of 1.7 square miles. Thirty-two culverts have been placed in the channel and most of the stream has been channelized. More than 50 stormwater catch basins deliver sediment and other pollutants to the stream channel and streambed sediments are contaminated with heavy metals. The riparian zone has been highly altered or greatly reduced in size. Finally, a hydroelectric outfall discharges water to the stream from another basin, seasonally increasing flow and turbidity levels and decreasing water temperatures in the lower third of the stream. Despite these impacts, Pullen Creek supports populations of pink and coho salmon and Dolly Varden char, and water quality in portions of the stream are quite high. Guided by the Pullen Creek Action Plan developed by the Taiya Inlet Watershed Council, the U.S. Fish and Widlife Service has worked with the Municipality of Skagway, White Pass Yukon Route Railroad, and other partners to restore and enhance aquatic habitat in Pullen Creek since 2002. This presentation provides an overview of past and ongoing efforts to improve water quality, restore and protect riparian habitat, remove fish barriers, and increase public awareness of human impacts, restoration techniques, and the benefits of an urban salmon stream.

SESSION: Aquatic habitat restoration in Alaska: innovations, applications, successes and failures

Upstream Habitat Assessment of Fish Passage Barriers in Haines, Alaska

Meredith Pochardt[1], Dan Schultz[1], and Brad Ryan[1], and Neil Stichert[2]
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The primary anthropogenic impediments to fish passage on small anadromous streams in Southeast Alaska exist at road crossings where culverts and bridges have been improperly installed or damaged. Restoring fish passage at these crossings is desirable to maintain healthy anadromous fish populations. However, the possibility of restoring all of these deficient structures is limited by the amount of restoration and mitigation funding available. This creates a need to prioritize these crossings to maximize the gain in habitat in light of limited monetary resources. To address this issue, in 2008 the Takshanuk Watershed Council (TWC) with assistance from the USFWS conducted a culvert inventory of 37 culverts in the Haines, Borough. The inventory identified 28 culverts that were potentially impeding fish passage. In 2013 TWC initiated a study with assistance from the USFWS to prioritize the replacement of the 28 culverts based on a modified Upstream Habitat Assessment Protocol and Biological Significance Index developed by the Tongass National Forest. The culminations of these efforts are an upstream habitat assessment of the stream above the culverts represented by a Biological Significance Index (BSI) score and mapping products for culvert replacements in selected portions of the Haines Borough. Additionally, an interactive Google Earth .KMZ file was created to allow agencies and the general public to view potential projects and background information.

SESSION: Aquatic habitat restoration in Alaska: innovations, applications, successes and failures

Assessment, Design, and Improvement of Fish Passage through Culverts: A Case Study at Cannery Creek, Haines, Alaska

Neil Stichert
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Maintaining and improving aquatic habitat connectivity through road/stream crossings is a fundamental habitat management approach to ensure persistence of fish populations in small streams. In Alaska, agencies and NGOs have completed various inventories of culverts at road/stream crossings Federal, State, local government, corporate, and private lands and assessed the degree of passage for selected 'design' fish. These assessments are now being used to prioritize culverts for removal or replacement with structures to modern fish passage design guidelines. This presentation offers an in-depth case study in fish passage improvement at a site with a unique location at the upper intertidal zone, seasonally low flow conditions, and deep road fill above the crossing posing specific challenges to project success. The author illustrates the watershed characteristics, barrier assessment procedure, design considerations, and implementation aspects of a culvert replacement in Cannery Creek near Haines.

SESSION: Aquatic habitat restoration in Alaska: innovations, applications, successes and failures

Kanalku sockeye: a balance between Wilderness and Subsistence needs

Pete Schneider
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Kanalku Creek is located 8 miles east of Angoon on Admiralty Island. The system supports a small, but consistent run of sockeye salmon which provides subsistence opportunities for local residents. This run appeared in jeopardy after consecutive seasons with low escapement. The system has a significant set of falls located halfway between salt water and the lake which affects sockeye passage success. A 25 percent passage rate (% fish successfully passing the falls) was reported in 2008. A joint effort to address solutions to improve escapement was made by the US Forest Service and Alaska Department of Fish and Game (ADF&G). Given the site is located in wilderness and considered a small but important resource for local residents created additional challenges. The Forest Service proposed to enhance the run by drilling and blasting a new jump pool at the base of the falls. The idea was to increase escapement by improving the jump success rate. This would allow a greater number of fish to successfully navigate the falls at a wider range of flows. The challenge was to accomplish the task without jeopardizing the small run, but also preserve the wilderness character. The work was completed in 2013 and preliminary reports from ADF&G indicate the 2014 passage success rate was greater than 60 percent. This work between cooperating agencies was completed with minimal visual impacts to the site, involved the community in the decision-making process, and achieved increased sockeye passage without impacting the integrity of the existing run.

SESSION: Aquatic habitat restoration in Alaska: innovations, applications, successes and failures

Alaska's aquatic habitat options as viewed through the National Fish Habitat Partnership Assessment lens

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Alaska is viewed by many people as a nearly unspoiled landscape. While 12,000 years of human habitation is evident across the state, the residence time of humans has been generally short and this has allowed systems to recover. This has not been the case in the rest of the U.S., where much higher human population densities and permanent human residence times have completely altered the landscape. Using the National Fish Habitat Partnership (NFHP) and other data sources, the amount of aquatic resource damage to the U.S. is at minimum $2.6 trillion dollars using estimates for 4 of the 6 NFHP system processes. While Alaska has some resource damage, the current intact status for many of its systems that has resulted in self-sustaining fisheries provides unique opportunities for resource protection and avoidance of the high cost of rehabilitating degraded systems. A key goal of NFHP is protecting intact functioning systems, and is the focus of all four of the Alaskan Fish Habitat Partnerships (Matanuska-Susitna Basin Salmon Habitat, Kenai Peninsula Fish Habitat, Southwest Alaska Salmon Habitat, and Southeast Alaska Fish Habitat Partnerships). While protection is politically sensitive, it has by far has the highest return on investment, particularly when you contrast the opportunities in Alaska to the lost opportunities and resulting huge investments needed to rehabilitate degraded aquatic systems elsewhere. This paper will describe damage to aquatic systems in the U.S. and provide insights on protecting remaining intact systems using voluntary action-orientated mechanisms such as those provided by NFHP, particularly in Alaska.

ASSESSING THE BIOTIC AND ABIOTIC RESPONSES TO FISH HABITAT RESTORATION ACTIONS

Session chairs: Scott Harris[1] and Sheila Jacobson[2]
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As fish habitat restoration becomes a greater focus of resource managers, partner organizations, and the public, there is an increasing need to assess and communicate the effectiveness of restoration actions intended to restore stream and fish habitat, and better understand how fish and other biota respond.

This session focuses on methods and case studies of assessing the biotic and/or abiotic responses to freshwater fish habitat restoration actions. At this session, active practitioners in restoration work hope to gain an understanding of successful strategies that they can employ on their projects, and an understanding of the challenges of assessing responses across appropriate spatial and temporal scales.

SESSION: Assessing the biotic and abiotic responses to fish habitat restoration actions

Designing effective monitoring and evaluation of stream and watershed restoration

Philip Roni
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Despite investment of more than a billion dollars a year on river restoration in the United States, less than 10% of projects receive any type of monitoring and evaluation (M&E). This is in part due limited funding for monitoring, but also due to the challenge of designing effective and robust M&E programs. Here I describe the key steps and challenges for designing effective M&E at both reach (project) and watershed scale and provide key examples based on experience in the Pacific Northwest and elsewhere. Designing effective restoration include several key steps including: determining goals and objectives, hypotheses, monitoring design, parameters, replication, sampling scheme, as well as implementing the monitoring program and reporting the results. Defining clear, testable hypotheses that succinctly outline the scale, study design and parameters to be measured is absolutely essential. Monitoring parameters should be chosen judiciously to focus on those that respond to the restoration action and address the questions outlined in the hypotheses. Spatial and temporal replication (sample size) should be estimated to optimize study design and refine the list of monitoring parameters. In addition to these technical aspects, successful implementation and completion of monitoring depends on many non-technical issues: the importance of good project management should not be overlooked. Furthermore, design of M&E should occur during initial restoration design or as early in the design process as possible. These and other factors are critical for a successful M&E program and improving future restoration design and effectiveness. However, not all restoration projects lend themselves to thorough M&E and funding limits the scope of what is practical or possible. I close with a discussion of cost-effective approaches and when monitoring may or may not be warranted.

SESSION: Assessing the biotic and abiotic responses to fish habitat restoration actions

Was it broken? Did we fix it? What are aquatic habitat surveys telling us about channel condition?

Emil Tucker
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The Tongass National Forest uses descriptive statistics derived from reach-scale aquatic habitat surveys to evaluate physical habitat condition in stream channels potentially affected by land management activities as well as to evaluate channel response to restoration activities. Data from channels under evaluation are compared to statistics from channels in reference condition. While this comparative approach and the variables used are well-grounded in scientific literature, analytical conclusions are complicated by a high degree of natural variation in the landscape, differential channel response to land management, and sampling bias inherent to the methods and variables. This presentation is an overview of the Forest Service survey methodology, response variables and analytical toolset.

SESSION: Assessing the biotic and abiotic responses to fish habitat restoration actions

Monitoring Fish Passage in the Mat-Su Borough

Gillian O'Doherty
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Over the past 10 years approximately 80 fish passage projects have been carried out in the Mat-Su Borough in an effort to protect fish populations; however project monitoring has been limited primarily to construction inspections and as built surveys. In this project we directly monitor passage rates by implanting PIT tags in juvenile fish and recording their movements using tracking devices (PIT tag antennae) located upstream and downstream of the culvert. Passage through the existing and new culverts will be related to stream discharge and the range of flows over which passage occurs will be compared. The culvert will be replaced in June of 2015. Here we discuss the results of the pre-project monitoring (July 2013 through October 2014).

SESSION: Assessing the biotic and abiotic responses to fish habitat restoration actions

The complexities of monitoring multiple restoration actions at various scales within a watershed: A case study of Twelve mile Creek, Prince of Wales Island

Sheila Jacobson
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Twelvemile Creek was identified as a "watershed of interest" because of extensive timber harvest, floodplain road construction impacts, and stream cleaning activities beginning as early as 1960, resulting in altered stream reaches, disrupted water flow patterns, barriers to fish movement, and reduced supply of large in-stream wood. Restoration efforts were completed within the watershed over a period of years with the intent to stabilize and improve the condition of these habitats and promote their succession toward natural conditions. We recognize monitoring is a crucial component of the adaptive management process and a necessity for testing hypotheses about abiotic and biotic responses to these restoration efforts. The Twelvemile project monitoring focuses not only on channel morphology and aquatic habitat feature evaluation at a reach scale, it also incorporates an evaluation of the salmonid response at both a reach and watershed scale. These monitoring efforts to date have not been without challenges and the ability to detect a biotic response solely due to restoration actions remains uncertain. This presentation describes the monitoring efforts and challenges faced.

SESSION: Assessing the biotic and abiotic responses to fish habitat restoration actions

Effective Monitoring of Stream and Watershed Restoration Efforts in Alaska: Challenges and Opportunities

Gordon Reeves
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An increasing number of streams and watershed restoration projects are done each year throughout Alaska. There is a concurrent call to determine the effectiveness of these efforts to justify the expenditure of funds and to see if the stated goals are met. However, very few are monitored for reasons similar to restoration projects in other areas, lack of funding and expertise and the long time period needed to see results. Additionally, costs of monitoring efforts in Alaska are high because of the remote location of many sites. Meeting these challenges will be essential to justify future restoration efforts and requires development of effective and practical monitoring efforts. This could include a program that has implementation and effectiveness components. The former would include an assessment of whether the project was done as planned. It would be important that any changes that occurred be documented in order to improve the design and implementation of future projects. This is relatively easy to do and could be done for every project. Effectiveness monitoring is more expensive and requires longer time periods to obtain an answer so it is not practical that every project, or even a subset of them, be monitored. The best option may be to establish a set of watersheds distributed throughout different areas of Alaska where there is a concerted effort to assess the effects of restoration. Lessons learned could be conveyed to help improve future efforts.

SESSION: Assessing the biotic and abiotic responses to fish habitat restoration actions

Facilitated Panel Discussion: Where do we go from here to better assess responses to restoration?

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No chance to ask your burning questions during the presentations? Now you can! This session concludes with a panel discussion where we will have the opportunity to synthesize key points of the presentations and discuss our capacities and challenges to conducting meaningful restoration monitoring. Session presenters will be available to answer questions. In order to keep the discussion on track, it will be organized by the following 4 topic areas with time limits for each topic: 1) Why is it so hard to count fish - the challenges of monitoring fish response, 2) increasing effectiveness through partnerships and coordinating between agencies and stakeholders, 3) what is the most important metric, at what scale, and what are the tradeoffs, 4) open question session.

ECOSYSTEM LINKAGES FROM ICEFIELD TO OCEAN IN COASTAL ALASKA

Session chairs: Shad O'Neel[1], Jason Amundson[2] and Allison Bidlack[3]
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Terrestrial and aquatic ecosystems are linked in multiple ways, from hydrologic functioning to nutrient exchange mediated by biological processes, and the spatial and temporal variability of these interactions is integral to the ecology of organisms living within the system. In coastal Alaska in particular, glaciers are rapidly changing, and these changes are transmitted physically and chemically through streams and rivers to downstream components of the ecosystem. These ecosystem linkages include surface- and groundwater flow dynamics and temperature regimes, transport of organic matter from terrestrial to aquatic habitats, microbial processing of dissolved organic matter in streams and estuaries, and glacier meltwater inputs of carbon, iron and phosphorous to freshwater and marine systems. Such connections have profound direct and trophic impacts on freshwater and marine ecosystems, affecting fish and wildlife populations, recreation opportunities, sea level rise, and the overall sustainability of fisheries and the communities that rely on them. This session will explore icefield to ocean linkages in the face of climate change and resource development. Comprehensive consideration of time- and spatial scales, biophysical feedbacks, and twice-removed ecosystem components is needed to enhance our understanding of the complex processes ongoing in the unique coastal regions of Alaska.

SESSION: Ecosystem linkages from icefield to ocean in coastal Alaska

Icefield-to-ocean linkages across the northern Pacific coastal temperate rainforest ecosystem

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Rates of glacier mass loss in the northern Pacific coastal temperate rainforest (PCTR) are among the highest on Earth, and changes in glacier volume and extent will impact the flow regime and chemistry of coastal rivers, as well as the nearshore marine ecosystem of the Gulf of Alaska. Here we synthesize physical, chemical and biological linkages that characterize the northern PCTR ecosystem, with particular emphasis on the potential impacts of glacier change in the coastal mountain ranges on the surface-water hydrology, biogeochemistry, coastal oceanography and aquatic ecology. We also evaluate the relative importance and interplay between interannual variability and long-term trends in key physical drivers and ecological responses. To advance our knowledge of the northern PCTR, we advocate for cross-disciplinary research bridging the icefield-to-ocean ecosystem that can be paired with long-term scientific records and designed to inform decision makers.

SESSION: Ecosystem linkages from icefield to ocean in coastal Alaska

Of snow and hemlock: maritime treeline and snow interactions in Alaska

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Much like tree growth, treeline above maritime forests in Alaska is affected by climate (including temperature, snowpack, and wind) as well as microsite feedbacks that affect local manifestation of regional climate. In this talk, I describe ongoing research on the local-to-regional climatic controls on treeline position and seedling establishment in the mountain hemlock (Tsuga mertensiana) zone of the Chugach Mountains. I also highlight recent results from work on the likely changes in snow climate (snow and snow day fraction) likely to occur in the coming decades and their possible effects on the dyanmics of the icefield-to-ocean continuum in the mountainous regions of Southcentral and Southeast Alaska. First-order treeline and snowpack changes are probably dependent on regional climate change, but local patterns and feedbacks make prediction more difficult than might first be expected from simple models.

SESSION: Ecosystem linkages from icefield to ocean in coastal Alaska

Quantifying the variability of snow accumulation on glaciers around the Gulf of Alaska

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Glacier runoff accounts for approximately half of the annual freshwater discharge into the Gulf of Alaska (GoA). Glaciers function as reservoirs on both seasonal and interannual time-scales, accumulating snow in winter, and producing runoff through ablation of snow and ice. Direct measurements of these processes are typically limited to a small number of point measurements on a few glaciers in the region. In spring of 2013 we amassed a previously unachievable quantity of accumulation data distributed across seven glaciers around the GoA by utilizing an off-the-shelf, user friendly, ground-penetrating radar system. We converted radar travel time to snow thickness and density with probe and snow-pit measurements, and then developed multi-variable regression models to predict snow water equivalence (SWE) based on topographic variables. Regionally, we find a given glacier's total SWE was controlled by the distance from the coastal moisture source, and that the SWE gradient with respect to elevation also decreased with distance from the coast. On smaller scales the pattern of accumulation was much more complicated. On individual glaciers elevation was the primary control on accumulation, and wind exposure/shelter was the most frequent secondary variable. The importance of these variables, and the statistical significance of other variables (such as sun exposure, slope, and aspect), changed significantly across the suite of glaciers. Furthermore, on several of the glaciers some large portion of the spatial variability was unexplained by any combination of topographic variables, underscoring the continued need for direct measurements.

SESSION: Ecosystem linkages from icefield to ocean in coastal Alaska

Temporal variability in stream physical characteristics influences potential habitat suitability for Pacific salmon in two coastal watersheds of southeast Alaska

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Climate warming has raised concern about potential habitat suitability for societal important fish species such as Pacific salmon. We examined the seasonal variability in stream temperature, discharge and dissolved oxygen (DO) and their interaction in a low-gradient, forested stream and a glacial-fed stream in coastal southeast Alaska to assess how these key physical parameters influence potential habitat suitability for salmon. Mean daily stream temperature ranged from 1.1 to 16.4 ºC in non-glacial Peterson Creek and 1.0 to 8.8 ºC in glacial fed Cowee Creek reflecting the strong moderating influence glacier meltwater has on stream temperature. Peterson Creek had mean daily DO concentrations ranging from 3.8 to 14.1 mg L^{-1} across the study period, values suggesting that future changes in climate that result in an even greater seasonal depletion in DO could cause sub-lethal and potentially lethal impacts to aquatic species. Multiple linear regression models showed that air temperature and discharge were strong predictors of mean monthly stream temperature in both streams. Mean daily stream temperature strongly controlled mean daily DO in both Peterson (R^2=0.82; $p<0.001$) and Cowee Creeks (R^2=0.93; $p<0.001$) across the study period. However, DO in Peterson Creek was poorly related to stream temperature and strongly influenced by discharge (R^2=0.46; $p<0.001$) on days when DO was <10 mg L^{-1}. Overall, our results demonstrate the complexity of stream temperature and DO regimes in coastal forested watersheds and highlight the need for watershed managers to move towards multi-factor risk assessment of potential salmon habitat quality rather than single factor assessments alone.

SESSION: Ecosystem linkages from icefield to ocean in coastal Alaska

Contrasting mercury dynamics and uptake in three adjacent watersheds near Gustavus, southeast Alaska

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Glacier Bay National Park and Preserve (GBNPP), Alaska, like many high latitude areas, is exposed to long range, atmospherically derived contaminants such as mercury (Hg). Although the harmful effects of Hg are well established, information on this contaminant in southeast Alaska is scarce. Here, we assess the levels of Hg in water, sediments, and biota within 3 watersheds in GBNPP. Twenty sampling events conducted over 2 years revealed that total and methylmercury concentrations in water varied with watershed landcover. Total and methyl-Hg concentrations were highest in Rink Creek, a peatland dominated stream, intermediate in Salmon River, which drains a mixture of peatlands and forests, and lowest in Good River, which drains forest and herbaceous wet meadows. Concentrations of Hg in benthic macroinvertebrates, suspended particulates, and streambed sediments, as well as the % Hg in the methylated form within biota, followed a similar pattern, with Rink>Salmon>Good. Differences in Hg concentrations between watersheds were substantial; for example, median streamwater total Hg concentrations in Rink Creek were twice as high as in Salmon River, and 5 fold higher than in Good River. Juvenile salmon followed similar spatial trends in Hg concentrations although not as consistently, possibly due to life stage differences in fish among streams. These results suggest that peatlands, which are a ubiquitous feature of the landscape in southeast Alaska, are important for facilitating methylmercury production. As a result, watershed landcover in this region plays an important role in mediating the biological uptake of Hg as well as its transport to downstream nearshore ecosystems.

Riparian Area Mapping Pilot

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On the Tongass National Forest the fluvial soils characteristic of unconfined low gradient riparian areas require large woody debris for channel and floodplain stability. Prior to timber harvest the large spruce and hemlock trees common to the well-drained coarse textured fluvial soils provided stability to the channel and floodplain. The trees were products of survival in a landscape that experiences frequent flood events. To effectively manage young-growth in riparian areas and conduct riparian area restoration the Forest Service needs to know the extent of the riparian area and the current and historic disturbance regime of the riparian area. Using soils, vegetation and topographic surveys we created a refined riparian area map that delineates the active and inactive portions of floodplains and alluvial fans, thus identifying areas where vegetation treatments will have the highest chance of success. The results of this mapping effort can be used to guide decision making regarding vegetation treatments designed to restore ecological functions to each site.

SESSION: Ecosystem linkages from icefield to ocean in coastal Alaska

Patterns of energy flow in salmonid food webs within a large glacial Alaskan river

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Riverine landscapes consist of a mosaic of habitats that receive food resource subsidies from terrestrial, riverine, and marine environments. The contributions of these resources to salmonid food webs in streams can shift over large spatial and temporal gradients, altering the energy pathways that limit fish production. Despite the need for understanding regulators of salmonid production, most riverine food web research has been done on small scales and has not accounted for the broader heterogeneous nature of river networks. The objective of our ongoing study is to determine river network scale patterns in the contributions of terrestrial, riverine, and marine food subsidies to juvenile salmonid food webs in a large, glacially-influenced Alaskan watershed. We quantified food web variation (1) among habitat types, (2) along an upstream to downstream continuum, and (3) across seasons using stable isotope and gut content analysis of juvenile salmon. Preliminary mixing model results using stable isotope and gut content samples from the 2013 field season showed that the relative contribution of marine-derived nutrients to both juvenile Chinook and coho salmon increased from June to October with increasing availability of spawning salmon eggs in rearing habitats. Mixing models also showed that terrestrial food resources were relatively more important to juvenile coho in comparison to juvenile Chinook salmon across all habitat types studied. Understanding broad patterns and dynamics of food resource contributions to rearing juvenile stream salmonids can assist in improved management decisions of stream salmonid populations, habitats, and the ecosystems from which their food subsidies originate.

Exotic earthworms as a trophic subsidy to native salmonids

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We tracked the diet of juvenile coho salmon (*Oncorhynchus kisutch*) wintering in an off-channel pond adjacent to the lower Anchor River (Kenai Peninsula, Alaska). Coho salmon gorged on exotic earthworms (*Lumbricus* sp. and *Eiseniella tetradera*) during May of both years examined, during which earthworms were found in 73% of coho stomachs and comprised >97% (by dry mass) of all prey consumed. Earthworms were a smaller diet component during October, when they were found in 10% of coho stomachs and comprised 59% of prey biomass, and were absent from samples collected during March and April. Coho stomachs with earthworms contained, on average, a 50-fold higher prey biomass than those that lacked earthworms (i.e., 100 vs 2 mg dry mass). Length-mass relationships indicate that by May coho salmon had regained the body mass lost over the winter, and our diet data suggest that this growth may have been fueled largely by exotic earthworms; an ongoing bioenergetics analysis will simulate the enhanced growth associated with earthworm subsidies. Samples from two additional sites upstream in the Anchor River watershed indicate that earthworm subsidies are not confined to the lower river or to coho salmon. This work shows that exotic earthworms can be a substantial cross-boundary subsidy to native salmon, primarily in spring when salmon are rebuilding energy stores in preparation for their transition to the marine environment, but more work is required to understand the geographic extent and ecological ramifications of this phenomenon.

SESSION: Ecosystem linkages from icefield to ocean in coastal Alaska

Subglacial discharge from tidewater glaciers

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Subglacial discharge from the termini of tidewater glaciers drives submarine terminus melting, influences fjord circulation, erodes and redeposits subglacial sediment, and is a central component of proglacial marine ecosystems. The timing and variability of subglacial discharge also influences the dynamics of tidewater glaciers through changes in basal motion. However, a lack of observations of subglacial discharge from tidewater glaciers hinders progress in understanding these processes and contributes to some of the largest uncertainties in sea level rise projections. Here, we use background seismic noise to generate the first continuous time series of subglacial discharge variations from tidewater or lake-terminating glaciers. We show that these glaciers experience hourly-to-seasonal variations in subglacial discharge and that drainage efficiency increases during summer. This variability occurs despite minimum water pressure constraints, as well as fast basal motion that could destroy or otherwise prevent the formation of subglacial conduits. Moreover, our results offer verifiable proof of the long-standing prediction that fluid flow through glaciers generates quantifiable seismic tremor. Consequently, seismic recordings of glacio-hydraulic tremor provide a mechanism for further insights into glacier hydrology, ice-ocean interactions, and related seismic, oceanographic, geologic, and ecological disciplines.

SESSION: Ecosystem linkages from icefield to ocean in coastal Alaska

Glacier-ocean and glacier-lake interactions: feedbacks and relevance for habitat

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Over fifty glaciers exit into tidewater along coastal Alaska and numerous others calve into proglacial lakes. These systems create unique environments in both aqueous settings. In the case of tidewater glaciers, subglacial freshwater discharge draws in warm ambient seawater (6 - 10°C), entraining it in a turbulent upwelling flow along the submarine face that melts glacier ice. In fact, submarine melting of glacier ice can account for a substantial portion and sometimes most of frontal ablation at tidewater glaciers. This buoyant discharge drives a two-layer estuarine circulation in the proglacial fjord. The late-summer outflow plume is typically 30 to 50 m in thickness and composed of a mixture of subglacial freshwater discharge, submarine glacier meltwater, and seawater. The plume is typically turbid, with suspended sediments derived from the subglacial discharge. The plume overlies a column of inflowing warmer, more saline water. The turbid upwelling near the glacier face attracts numerous birds that feed on amphipods and fish driven to the surface by the turbulent currents. In contrast to fjords, proglacial lakes with no source of heat other than solar typically remain quite cold, < 2°C, significantly below the freshwater density maximum of 4°C. While subglacial discharge can be similar in magnitude to tidewater glaciers, the discharged water is not necessarily buoyant so does not generate upwelling circulation. The lack of density driven circulation together with the relatively cold water leads to very small sub-aqueous melt rates. Similar to tidewater proglacial fjords, proglacial lakes are also typically quite turbid.

SESSION: Ecosystem linkages from icefield to ocean in coastal Alaska

Variations in Alaska tidewater glacier frontal ablation, 1985-2013

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Mass loss from marine-terminating fronts of tidewater glaciers (frontal ablation) can a major source of freshwater input to fjord and coastal environments, but is generally difficult to measure directly; observations of frontal ablation outside of the ice sheets are generally sparse, both temporally and spatially. We present a 28 year record of surface velocity and frontal ablation for 27 Alaska tidewater glaciers (representing 96% of the total tidewater glacier area in the region), derived using an offset tracking algorithm, cloud-free Landsat 5 and 7 scenes, and estimates of glacier ice thickness derived from an inversion of surface topography. We account for cross-sectional ice thickness variation, long-term thickness changes, mass lost between the flux gate and the terminus, and mass change due to changes in terminus position. The total mean rate of frontal ablation for these 27 glaciers over the period 1985-2013 is 15.11±3.63 Gt/yr. Two glaciers, Hubbard and Columbia, account for approximately 50% of the frontal ablation signal of the set of 27 glaciers. Frontal ablation varies significantly on seasonal timescales, with winter measurements being closest to the annual mean values. The regional total has decreased at a rate of 0.14 Gt/yr over this time period, likely due to stabilization of many of the tidewater glaciers in the region. We compare several commonly-used approximations of frontal ablation to quantify the differences introduced through these approximations, finding that neglecting cross-sectional thickness variations severely underestimates frontal ablation.

SESSION: Ecosystem linkages from icefield to ocean in coastal Alaska

Ice sheets to oceans: linkages between the Copper River and the northern Gulf of Alaska

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The Copper River is the largest point source of freshwater to the northern Gulf of Alaska, and the coastal ocean is connected hydrologically and biogeochemically with the upriver systems of the watershed. The Copper River watershed (and much of southcentral Alaska) is heavily glaciated, and is experiencing very high loss rates of ice mass, among the highest in the world. Those losses have resulted in biogeochemical changes in the upper watershed that are cascading throughout the watershed into the coastal ocean. Since 2010, a coordinated watershed level program has observed terrestrial-aquatic material fluxes in the watershed, aerosol fluxes from land to sea, and conducted numerous oceanographic surveys of the Copper River plume; we will present an overview of the project, and summarize the most important results from the various subcomponents.

SESSION: Ecosystem linkages from icefield to ocean in coastal Alaska

Glacier Fed: Investigating marine iron within Berners Bay

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Marine iron is generally considered a limiting nutrient, especially within the Gulf of Alaska. While it is known that glaciers in Southeast Alaska contribute essential nutrients to the marine environment, there is little information regarding fluxes and bioavailability of iron transported from glacial rivers to coastal waters in the region. Berners Bay, north of Juneau, is a tidal estuary that is substantially influenced by three converging glacial rivers. The goal of this research is to gain an understanding of total dissolved iron within Berners Bay and ascertain a potential gradient in iron concentrations from the estuary into Lynn Canal while evaluating other oceanographic parameters such as chlorophyll-α. Water samples were collected during the summer of 2014 at eight stations along two separate transects throughout Berners Bay. Iron concentrations were determined at the University of Alaska Southeast using Chelex-100 resin and graphite furnace atomic absorption spectrometry. While the results are forthcoming this study has the potential to determine baseline marine nutrient values and support future nutrient work within these dynamic glacial systems.

SESSION: Ecosystem linkages from icefield to ocean in coastal Alaska

Influence of meltwater on marine ecosystem structure of glacial fjords in the Gulf of Alaska

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Rates of tidewater glacier volume loss through melting and calving in coastal Alaska are among the highest in the world, but little is known about the role of glacier processes in nearshore marine ecosystems. To better understand the influence of tidewater glaciers on fjord ecosystems and the consequences of glacier retreat, we sampled oceanography, nutrients, zooplankton, forage fish, and predators (seabirds and marine mammals) within four fjords from south-central to southeast Alaska. We used linear and non-linear models to compare among fjords the response of depth-integrated chlorophyll *a* concentration, zooplankton biomass, fish catch per unit effort, and predator density to selected physical, chemical and biotic predictor variables. Glacier-induced physical gradients, nutrient availability, and among-fjord differences explained 75% of the variation in phytoplankton abundance, which in turn underpins ecosystem structure at higher trophic levels. Zooplankton community structure differed between protected vs. oceanic sites, and biomass was related to temperature gradients. Fish catch per unit effort and predator density were related to food availability, environmental gradients and topography. This ecosystem approach to understanding drivers of trophic linkages in rapidly changing glacial environments will enhance the ability of marine resource managers to distinguish between human versus natural impacts on higher vertebrate populations in the face of predicted climate change.

CHALLENGES AND OPPORTUNITIES FOR LONG-TERM MONITORING IN ALASKA

Session chairs: Michael Bower[1] and Chris Sergeant[2]
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Society continually wrestles with understanding complex and dynamic environmental conditions. In response to this complexity, scientists and resource managers are increasingly relying on long-term monitoring to accurately assess resource trends and the effectiveness of management actions. Alaska is a challenging yet vibrant place to conduct monitoring, and many examples of mature and evolving programs exist. Speakers in this session represent a diverse cross-section of monitoring practitioners. Presentations will discuss monitoring successes, lessons learned, and advice for the future.

Session: Challenges and opportunities for long-term monitoring in Alaska

Where we are and where we need to be to understand regional water temperature trends: AKOATS and minimum data collecting standards.

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As Alaskans continue to feel the impacts of a changing climate, the need for resource managers to understand how these changes will alter aquatic systems and fisheries resources grows. Water temperature data collection has increased in recent years to begin to fill our gaps in knowledge about current thermal profiles. Many entities are collecting temperature data for a variety of purposes to meet project or agency specific goals. AKOATS, the Alaska Online Aquatic Temperature Site, is a comprehensive statewide inventory of existing (n=413) and historic (n=398) continuous monitoring locations for stream and lake temperature using a common set of attributes. Data were gathered from fish biologists, hydrologists, water resource managers, ecologists, and engineers. The inventory is fully accessible via an online, interactive map or it can be viewed directly within commercial GIS software.

Statewide interest in thermal patterns and increasing data collection efforts provides Alaska's scientific and resource managing community an opportunity to meet broader regional-scale data needs. A basic set of stream temperature monitoring standards are needed for Alaskans to begin building robust datasets suitable for regional analyses. By identifying minimum data standards, our objective is to encourage rapid, but structured, growth in comparable stream temperature monitoring efforts in Alaska that will be used to understand current and future trends in thermal regimes. These trends will inform efforts to develop strategies for maintaining ecosystem resilience. This work is supported through a grant from the US Fish and Wildlife Service on behalf of the Western Alaska Landscape Conservation Cooperative (WALCC).

Session: Challenges and opportunities for long-term monitoring in Alaska

Long-term monitoring of stream ecosystems in the Central Alaska Network

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The Central Alaska Network, consisting of Denali National Park & Preserve, Wrangell-St. Elias National Park & Preserve, and Yukon-Charley Rivers National Preserve, is a part of the National Park Service's Inventory and Monitoring Program, and is tasked with assessing the status of, and detecting long-term trends in, the condition of ecosystems and wildlife populations in Network Parks. The Network's stream monitoring program is responsible for monitoring the condition of over 34,000 miles of largely remote streams, which presents a unique set of challenges given the program's limited budget. The initially ambitious goals of the program, which were to monitor biodiversity, fish distribution and abundance, water quality, geomorphology and hydrology across all 23 million acres of the Network, as well as the methods employed to address those goals, have both undergone significant changes in the 8 years since the inception of the program. I will discuss lessons learned in this initial phase of long-term monitoring, and outline how the program has evolved to take advantage of emerging technology. This includes the use of a tiered survey design to maximize our ability to detect change and to infer conditions at unsampled sites, the development of empirical predictive models of aquatic invertebrate communities to assess changes in stream ecosystem condition, the development of environmental DNA analysis methods to assess fish communities, and the use of high-resolution photogrammetry to quantify geomorphological change in river channels.

Session: Challenges and opportunities for long-term monitoring in Alaska

North Pacific Research Board investments in long-term monitoring in Alaska marine systems

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Understanding complex and dynamic marine environments and processes that drive them requires data that extends over long time frames. Long-term monitoring programs provide a useful tool to better understand system processes, assess resource trends, and evaluate effectiveness of management actions. The North Pacific Research Board (NPRB) has funded programs that support long-term monitoring, process studies, and retrospective analyses through its annual Request for Proposals and Integrated Ecosystem Research Programs in the Bering Sea and Gulf of Alaska. In 2014 NPRB launched a new program dedicated specifically to long-term monitoring. The goal is to support new or existing time-series that contribute to understanding ecosystem variability and the effect of that variability on subsistence or commercial marine resources. Research is intended to be interdisciplinary, involve multiple trophic levels, and evaluate ecosystem responses to changing ocean conditions. NPRB is currently supporting: (1) a North Pacific Continuous Plankton Recorder Survey that uses commercial ships to collect data on plankton and the physical environment along an east-west transect through the Aleutian Islands and southern Bering Sea and a north-south transect between Washington and Alaska; (2) oceanographic observations and seabird and marine mammal surveys along the Seward Line in the Gulf of Alaska; and (3) a subsurface ecosystem mooring in the Chukchi Sea that measures physical, chemical and biological data in the Arctic throughout the year. We discuss how long-term monitoring advances the NPRB mission. We also highlight research in the programs that are continuations of existing monitoring and describe how that data has been applied.

Session: Challenges and opportunities for long-term monitoring in Alaska

Innovative Methods to Extend the National Weather Service Real-time Stream Monitoring Network

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The National Weather Service (NWS) has the mission of providing hydrologic forecasts and warnings for the United States. To accomplish this task the Alaska Pacific River Forecast Center (APRFC) maintains a real-time hydrometeorological database and a suite of hydrologic modeling tools to assist with flood forecasting. The central core of this hydrometeorological database consists of observations from the statewide network of United States Geologic Survey (USGS) streamflow gages that provide high quality discharge data. In the US (49 states) there is, on average, one real-time USGS river gage for every 339 square miles. In Alaska the number is much higher with an average of one real-time USGS gage for every 6,085 square miles.

To increase the number of real-time observations, the APRFC has developed several programs that increase the number of river monitoring sites from 109 (USGS) to our current total of 229 gages. This brings the number of real-time river gages down to one gage for every 2500 square miles in Alaska. While these gages and their accompanying rating curves do not meet the strict quality control of the USGS, they do provide valuable data for many parts of the state. These additional gages include real-time data from cooperating partners; NWS operated river stage gages with GOES telemetry; volunteer river observers and more recently a low cost portable river stage gage. In 2014 this low cost, portable gage was developed and deployed at twenty sites throughout the State. These gages have proven to be efficient in both the amount of time to deploy and overall cost. They do have limitations which include where they can be installed and the accuracy of the measurements. A second project that that the APRFC is working on is a low cost laser based river stage sensor. This type of non-contact sensor might work well on larger rivers where using an acoustic sensor is not feasible and real-time data is not currently available.

Session: Challenges and opportunities for long-term monitoring in Alaska

Alaska Monitoring and Assessment Program

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The Alaska Department of Environmental Conservation has the responsibility to report and identify causes and sources of water quality impairment by "characterizing all the waters in Alaska". One way this is accomplished is through the Alaska Monitoring and Assessment Program (AKMAP), which is responsible for implementing statistical surveys to assess water quality on a regional basis. AKMAP has surveyed coastal and fresh waters since 2002, no similar probabilistic sampling surveys currently provide regional, ecological information on such a large scale within Alaska. Surveys are completed through partnerships with other federal, state, and local agencies and organizations.

Survey goals are to estimate current status and trends, establish associations between indicators of natural and anthropogenic stresses, and determine indicators of the condition of aquatic ecological resources. A combination of random and targeted sites are surveyed to ensure data is collected across a range of environmental conditions. Indicators to be sampled are assessed and prioritized with project partners, allowing sampling across a suite of water quality, sediment, biological and habitat parameters.

Surveys report on the status of Alaska's water with a known statistical confidence, allowing resource managers, elected officials and the public to understand the "big picture" of Alaska's water resources. AKMAP currently conducting a five-year cycle of surveys in the arctic coastal plain that includes wetland, lake, stream, estuary and coastal projects.

This talk will cover a brief history of the AKMAP program, review a completed freshwater and coastal survey, and discuss lessons learned from many years of aquatic surveys in Alaska.

Session: Challenges and opportunities for long-term monitoring in Alaska

Potential for long-term monitoring of individual Copper River Chinook Salmon stocks using remote streambed RFID readers

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Management of Copper River salmon is complex due to inter-annual variation in the size and timing of stocks, fisheries that target a mixture of stocks, and difficulties in estimating abundance due to physical characteristics of the drainage. Copper River Chinook salmon escapement is calculated using abundance data obtained by Native Village of Eyak's (NVE) Chinook salmon Escapement Monitoring Program (CEM). The CEM program applies external TBA-PIT tags to 5-10% of the total Chinook salmon run entering the lower Copper River. Through NVE's FRMP funded study 10-500, the feasibility of remote streambed RFID readers for TBA-PIT tag detection efficacy and efficiency was validated. The study provided data on lower river run timing, arrival timing to spawning grounds and travel time through the Copper River. With low re-occurring costs and minimal required maintenance this stand-alone system can provide a cost effective and reliable method for long-term monitoring salmon populations in remote, glacially occluded rivers, where visual surveys are not feasible. Development of a streambed array network in major spawning tributaries of the Copper River would provide the first long-term spawning distribution dataset and individual stock run timing for Copper River Chinook salmon stocks.

Session: Challenges and opportunities for long-term monitoring in Alaska

Partnering with communities to increase impact (and sample size) of long-term monitoring programs

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The Southeast Alaska Monitoring Network (SALMoN) is a little program with the presumptuous name. SALMoN strives to engage community members in meaningful ecological monitoring that will inform adaptive management and natural resource decision making. In this presentation I will discuss some successful case studies of how our community-based monitoring has informed decision-making. I will also discuss some of the capacity challenges that exist for our program, such as funding, quality control, and access to professional networks; and the potential of community-based monitoring to play a meaningful role in existing professional-level monitoring programs. SALMoN operates under the assumption that communities can best achieve ecological, economic, and social resiliency when management decisions are made in a collaborative setting that includes an informed, knowledgeable, and engaged public, and participating in ecological monitoring is an effective means to achieve that end.

A community based practitioner's perspective on monitoring water quality

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Water quality is essential to the quality of life for residents of Southeast Alaska. However, as a community based organization it can be difficult to even know where to begin. Some examples of questions that might help you make those decisions are; should you let your kids swim at the local swimming beach near the borough sewer plant outfall, how will the proposed copper mine effect your fish populations, or how is climate change effecting stream health. Then once a community or group has decided on what question they want to answer how do they get the appropriate skills and expertise to answer these questions and what do you do with the results. This talk will provide examples of how the Southeast Alaska Watershed Coalition works with community based watershed groups, tribes, and local governments to help answer these questions and more.

Public Perception of the Benefits of Long-Term Monitoring Programs

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Many government agencies and other organizations with science agendas are implementing long-term monitoring programs with the objective of producing hard data on the status and trends of natural resources. Recent work has identified the optimal allocation of resources between targeted monitoring programs and less targeted long-term monitoring programs, but fewer studies exist examining how the public – whose tax dollars are being spent on these programs – value long-term monitoring programs (LTMs). We are developing a survey to estimate the value placed on LTMs by the public. In particular, we will ask respondents to rank order directly observed final ecosystem goods and services such as whales and salmon, and unobserved intermediate ecosystem goods and services such as oceanographic conditions and water quality to get a sense of how highly they value the measurement of these very different goods. Our intended sample includes tourists, residents, and policy-makers. Expected results include a range of likely values placed on long-term monitoring projects examining final and intermediate ecosystem services.

USE OF MOBILE ELECTRONIC DEVICES FOR FIELD DATA COLLECTION IN ALASKA

Session chairs: Ted Otis[1] and Kathy Jones[2]
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The means by which biologists collect field data has evolved rapidly in the past 20 years. A wide variety of small, relatively inexpensive electronic devices are now available to supplement the field biologist's old reliable Rite-in-the-Rain notebook and pencil. Collecting field data electronically offers several advantages over its analog counterpart: it is often faster, both in the field and during post-processing, because it saves the step of having to transcribe field data into a spreadsheet or database; and is more accurate because it precludes transcription errors and data entry programs can be customized to identify quantities outside the expected range of values as they're being entered, minimizing data entry errors. Many electronic devices also offer wireless connectivity to peripheral tools like GPS so the spatial context of your data can be captured while sampling. This session will highlight some of the innovative ways that biologists around Alaska have begun using electronic devices for field data collection. In keeping with the inter-disciplinary theme of this meeting, we've invited speakers from the Analyst Programmer (AP) and Information Technology (IT) fields in hopes that they can help expedite the continued evolution of electronic field data collection in Alaska.

Session: Use of mobile electronic devices for field data collection in Alaska

HARM: Using mobile technologies to reduce halibut release mortality

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Halibut caught in the sport charter fishery in Alaska are often brought on board the vessel only to be released shortly after. This is believed to increase the risk of mortality post release. This study focused on determining the potential of using mobile technologies to estimate the total length of a halibut, and thereby reducing the amount of halibut being unnecessarily brought onboard a vessel. Data, in the form of halibut head images as well as size and location information, was collected from IPHC port samplers and charter captains around Southeast and south central Alaska by means of several custom iOS applications. This data was analyzed to determine the distance between which two points on the halibuts head, if any, had a high enough correlation to overall length to be used in the development of a mobile measurement application. The data revealed there was a high correlation between the distance from eye to distinctive notch on the operculum, and the overall length of the halibut. A simple function, resulting from one set of the data, was created and incorporated in an Android application to estimate the overall length of the halibut from an image taken using the smart phone's camera. Mobile technology was a powerful tool in this study. It aided the creating distributable and uniform mode of data collection, and the potential to make the findings of the study available to the public in a practical and useful manner.

Session: Use of mobile electronic devices for field data collection in Alaska

Allegro-based electronic field data collection in ADF&G Central Region

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After years of waterproof paper blowing in the wind, pencil marks smudging in wet conditions, and the frustration of indecipherable penmanship, implementation of electronic data collection devices has greatly improved efficiency and accuracy of fisheries field data acquisition. Biological sampling is conducted dockside and aboard vessels by Alaska Department of Fish and Game (ADF&G) staff in the Central Region. The waterproof, handheld Juniper® Systems Allegro rugged Field PC loaded with DataPlus® Professional software is utilized, which allows programming of customized applications, including setting acceptable value ranges and auto-filling certain fields to reduce data entry mistakes. Automatic data collection peripheral accessories, such as electronic fish measuring boards, calipers, and scales, can be interfaced with the Allegro using wireless or direct connection. Transcription errors are effectively eliminated through direct download of data into spreadsheet software on a computer and, following error-checking, data is transferred into a database. The goal is to have the local database regularly uploaded into the OceanAK data warehouse. OceanAK houses databases from many different projects, is maintained by statewide ADF&G Information Technology staff, and is accessible through a password-protected interface with a personalized dashboard. Electronic data collection has its limitations, and operators must be diligent to ensure accuracy. Maintenance is critical to reduce problems in the field and there remains the possibility of reduced battery life or equipment failure due to prolonged use, particularly in extreme weather conditions.

Session: Use of mobile electronic devices for field data collection in Alaska

An integrated environment for developing mobile applications

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The need for mobile data capture applications within the Alaska Department of Fish & Game continues to increase. In Southeast Alaska, we are in the early phase of developing mobile applications. The potential list of new applications include: port sampling commercial fishery landings, at-sea research surveys, aerial surveys, and sampling at remote field camps. As more applications are developed, the management of devices, users, and data becomes more difficult. To address these issues, we are using Oracle Database Mobile Server (ODMS) from Oracle Corporation.

ODMS is an integrated suite of tools for managing all aspects of mobile applications. The three main components of ODMS are the Mobile Server, Mobile Client, and Mobile Development Kit.

The Mobile Server includes a bi-directional data synchronization engine and the Mobile Manager, a browser-based administration console. With the Mobile Manager, you can manage users, deploy applications and databases to mobile devices, and monitor data synchronization activity.

The Mobile Client resides on devices and includes a database and tools for initiating data synchronization events. It supports many client operating systems, including Windows, Android, and iOS.

The Mobile Development Kit is a tool for designing synchronized databases, and includes a packaging wizard for bundling all application components (database, executables, libraries, etc.) into a single file that is uploaded to the Mobile Server. From there, the package can be deployed to devices.

With ODMS, the management of users, devices, applications, and data is more efficient and reliable, and results in increased quality and timeliness of the data collected.

Session: Use of mobile electronic devices for field data collection in Alaska

Overview of electronic data collection tools in Westward Region

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Westward Region staff employ various types of electronic instruments and data capture strategies in the routine collection of the data needed for successful fisheries management and associated research. Ranging in size from rugged hand-held devices, used in the field collection of salmon ASL data, up to the Alaska CamSled, a 1600 pound towed benthic imaging platform, Westward staff have successfully incorporated a diverse mix of electronic devices into their data collection and recording activities. This presentation presents a brief overview of some of the electronic tools currently used for Westward Region projects.

Session: Use of mobile electronic devices for field data collection in Alaska

Electronic data collection in commercial fishery sampling in Southeast Alaska

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In 2006 the Division of Commercial Fisheries of the Alaska Department of Fish and Game (ADF&G) instituted an Electronic Sampling application named CWT Mobile for the purposes of reducing paper form data capture of commercial fishery samples. In most ports of call ADF&G commercial port samplers in Southeast Alaska enter all sampling information into a hand held data logger. The data is transmitted over the internet to servers at the ADF&G Mark, Tag, and Age Lab (MTA Lab), validated and moved into the centralized database nightly. This approach, speeds up sampling, reduces errors, and provides managers with very accurate and current data.

In 2010 it was determined that the escalating presence of adipose fin clipped Chinook salmon that did not have a CWT harvested in Southeast Alaska fisheries led to a decrease in CWT sample rates, an increase in sampling time, shipping costs, tag detection/decoding time, and loss of revenue to seafood processors and direct marketers. To mitigate these issues handheld electronic tag detection wands were instituted in almost all ports in Southeast Alaska. These wands are used to examine adipose clipped Chinook salmon harvested in the Southeast Alaska troll fisheries to determine if valid CWTs are present before CWT processing protocols are invoked.

Modifications to the CWT mobile data collection program were made to incorporate the use of electronic tag detection wands leading to an increase in CWT sampling rates, a decrease in shipping and processing costs of fish heads, and increased value to seafood processors and direct marketers.

Session: Use of mobile electronic devices for field data collection in Alaska

Alaska Logbook - a mobile tool for field data collection, organization, management, and reporting

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Collecting field data in Alaska is hard enough with the logistical challenges and expense of working in the backcountry, so managing your data and creating regulatory reports should be as simple as possible. With an easy-to-use platform aimed at streamlining regulatory compliance, Alaska Logbook is a mobile application and website developed to collect, organize, manage, and report field data. It was developed to be a simple tool that provides process efficiencies. Our intention is to make the regulatory compliance aspects of fieldwork effortless. Logbook is built on free and open source platform called Formhub. This software was developed to work all over the world and can handle the lack of reliable technological infrastructure at the data collection site. This allows us to create easily deployable surveys that can work on mobile devices or through a desktop web browser. Alaska Logbook is free and open-access for all users. We have kept adaptability and accessibility as part of our core principles and we are using an agile development process with frequent feedback cycles to ensure users remain the focus. From the start, Alaska Logbook has been shaped by user need and feedback. The initial phase of Alaska Logbook has focused on Fisheries Resource Permit compliance and Anadromous Waters Catalog nominations; however, additional survey modules are in development, including Water Quality Monitoring and customizable research surveys. We are also exploring data sharing and networking features to foster collaboration within the research community.

Session: Use of mobile electronic devices for field data collection in Alaska

Development and use of PDA-based software for collecting geo-referenced salmon aerial survey data

Glenn Hollowell

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Historically, salmon escapement data in Alaska have been collected using aerial or ground surveys. For the most part, georeferencing of these data has only occurred to the level of the observed stream, river or bay. A software application for use on handheld PDAs was written in 2006 for use on salmon aerial surveys to document GPS coordinates of individual observations made during a survey. These observations were stored by the application in a SQL database on the device for downloading at the conclusion of the survey. In 2011, an ArcGIS routine was created to parse these data sets after the survey into specific geographic polygons for use in statistical analyses. In 2012, salmon ground surveyors began using the software to document individual counts made while conducting foot surveys of anadromous streams.

Session: Use of mobile electronic devices for field data collection in Alaska

Development and use of a tablet-based digital survey tool for conducting aerial herring surveys

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The Alaska Department of Fish and Game relies heavily on aerial surveys to estimate Pacific Herring (*Clupea pallasii*) comprising the Togiak Herring population of western Bristol Bay. Powerful GIS software and computer tablet hardware have allowed for great progress in the way biological resources, such as herring populations, are monitored. A Windows-based tablet computer using ESRI ArcPad software to document herring biomass and spawn has improved measurement accuracy, reduced math error and data entry time, and increased the utility of the data through GIS software applications. Analyses of GIS survey data shows great promise in improving poorly understood western Bristol Bay Pacific herring movement, spawning, and schooling behavior. Similar GIS programs could improve monitoring of nearly all habitats and their respective inhabitants.

Session: Use of mobile electronic devices for field data collection in Alaska

Electronic data collection tools of the Mark, Tag, and Age Laboratory

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Handheld computers, used for electronic data collection, have increased the quality of data collected and the speed at which it is transmitted to the Mark, Tag, and Age Laboratory. For the past eight years, the pros and cons of supporting the costs of handheld computers and application development, maintenance and support have been assessed to determine their future in our data collection protocols. On the negative side, the mobile units are expensive. Each unit and its peripherals cost approximately $1800 with 40 units in service throughout Southeast Alaska. The life expectancy of each unit is approximately four years. Currently, funding for the purchase and replacement of these mobile devices comes entirely from federal sources. Given these logistics, combined with the relatively low life expectancy of mobile computing devices in harsh environments, the continued support of mobile data collection will be costly. On the plus side, electronic sampling leads to faster data delivery, increased data quality, immediate feedback to samplers improving their understanding of business rules, portability into the field and reliability in data protection from failover. The potential to use these devices for additional projects may increase their value to the organization. The benefits of this system to a multi-million dollar fishing industry in Alaska far out-weigh the costs. Given the importance of these mobile devices and the transient nature of federal funding, a more stable source of support is necessary to ensure the future of mobile electronic data collection.

Session: Use of mobile electronic devices for field data collection in Alaska

Effectively using the ArcGIS platform for field data collection, communication, and decision making

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Your ArcGIS Online subscription includes pre-built applications ready for you to deploy immediately. One of those is the Collector for ArcGIS application. Esri staff will step through mobile GIS workflows supported by this app. Collector for ArcGIS improves your productivity with intuitive data collection. It's designed specifically for iPhone and Android smartphones. We will touch on other available applications and tools such as the WebApp Builder for ArcGIS.

- Capture, update, and report spatial and tabular information directly from your Android or Apple device.
- Improve your data quality with data-driven forms.
- Capture photos and video.
- Integrate information into your organization's GIS.
- Configure the app to fit your organization's workflow.

DATA MANAGEMENT FOR HYDROLOGY AND FISHERIES RESEARCH

Session chair: Jessie Cherry
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This session will focus on challenges and solutions for managing disparate datasets in Alaska and the surrounding region. Submissions are encouraged from a variety of research and management communities.

Session: Data Management for Hydrology and Fisheries Research

The Role of Fisheries Management and Hydrology Data in Oil Spill Preparedness and Response

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The Exxon Valdez Oil Spill (EVOS) and the subsequent passage of the Oil Spill Pollution Act of 1990 (OPA 90) integrated oil spill response with a variety of disciplines including fisheries management and hydrology. OPA 90 requires states to develop Subarea Contingency Plans that, among other things, identify natural resources present in the subarea and provide information on environmentally sensitive areas, fish and wildlife populations, and their habitat. Fisheries management data play an important role in oil spill preparedness planning by providing information such as locations of frequently used fishing grounds, quantities of catch or escapement from different areas or different fisheries, and trends in run strength or population that may help determine the impact of a spill on a fishery. Hydrology data can be used to inform the decision-making process of whether to use non-mechanical countermeasures such as dispersants and in-situ burning near a river mouth to helping responders identify places of slower water where oil may be captured and removed from a flowing river system. As science and technology improve our understanding of fish populations and hydrology in Alaska, oil spill preparedness planners and spill responders use that information to better prioritize sensitive areas and wildlife populations for protection from oiling and determine the impact of a spill on those areas and populations if one should occur. This presentation will outline how fishery management and hydrology data are used in preparing for oil spills and discuss the importance of these data in guiding oil spill response operations and assessing natural resource damage.

Session: Data Management for Hydrology and Fisheries Research

Imiq: a hydroclimate database and data portal for Alaska

Jessica Cherry[1, 2] and Amy Jacobs[1]
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[2] Geographic Information Network of Alaska, University of Alaska Fairbanks

This talk describes our efforts to identify, catalogue, acquire, and curate a large data repository for hydrologic, climatologic, and soils data for Alaska. This database, called *Imiq*, is the result of a five-year long effort, which has culminated in a standalone collection of some 400 million data points as well as an online data portal serving value added products and access to individual data streams. The authors will show potential end users what type of products are available in Imiq to support their own research, as well as how to contribute data to the database. Finally, examples of research results using the database will be shown.

Session: Data Management for Hydrology and Fisheries Research

Statewide Hydrography Stewardship: the Alaska Hydrography Database

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The Alaska Hydrography Database project, or AK Hydro, is a regional collaborative stewardship model used to generate hydrography updates for the National Hydrography Database (NHD) and store local attributes. In 2013, the Alaska Hydrography Technical Working Group, a committee consisting of representatives from federal and state agencies concerned with surface water mapping, recognized the AK Hydro stewardship model as the best solution to address hydrography needs in Alaska and adopted it to update hydrography throughout the state. In this collaborative approach, AK Hydro partners use a simple workflow and familiar GIS tools to edit and maintain hydrography data in an AK Hydro formatted database and enrich the data with relevant attributes in the regions where their jurisdiction or interests are. Following the completion of edits and updates, and undergoing quality assurance/quality control, feature geometries in AK Hydro are transferred to the NHD using robust tools while agency specific attributes remain linked to the NHD in the AK Hydro database. This unique relationship between the two databases meets local agency needs and updates the NHD. The workflow makes maintaining hydrography data possible for a diverse group of GIS users in Alaska that may not have access or resources to work with existing NHD editing tools. AK Hydro is a shared effort between agencies developed with the goal to update and maintain the NHD and hydrography across a large and diverse state.

INSTREAM FLOW PERSPECTIVES AND ISSUES IN ALASKA

Session chairs: Joe Klein[1] and Cathy Flanagan[2]
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Instream flows are defined as the amount of stream flow or lake levels necessary to maintain or restore ecological functions and values important for healthy ecosystems. This session is intended to broaden the dialogue on instream flows, current state of knowledge and practice, and explore how instream flows can be incorporated into river management practices.

SESSION: Instream Flow Perspectives and Issues in Alaska

Overview of Instream Flow Issues in Alaska

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Water of sufficient quality and quantity is needed to maintain ecological functions and values in rivers and lakes. The experience of other states shows that it is prudent to protect instream flows as early as possible to avoid water use conflicts and costly restoration measures. An overview of instream flow issues in Alaska, and the importance and status of reserving water for protecting these functions and values will be presented.

SESSION: Instream Flow Perspectives and Issues in Alaska

Riparian Plants Need Instream Flows Too

Robert J. Henszey
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In contrast to fish, the need to manage instream flows for riparian vegetation is less widely recognized and the science is less well developed. Flows are needed to establish, maintain, and rejuvenate riparian plant communities. Establishment and rejuvenation flows tend to be episodic and are often associated with overbank flooding events, which are relatively easy to document and develop prescriptive flows. Maintenance flows, however, are often associated with groundwater linked to streamflow, which is more difficult to document and thus develop prescriptive flows. Plant communities are composed of individual species, each responding independently to environmental gradients such as the timing, duration, and frequency of surface- and ground-water levels. Most techniques describing plant response to environmental gradients rely upon general terms such as low to high elevation, and xeric to mesic. While ecologists understand these imprecise scales, managers responsible for making decisions affecting these gradients need more precise information. A technique using non-linear models fitting plant frequency response to preserve the measurement units of a water-level gradient ranging from shallow ground water to standing water is presented. Non-linear models, unlike polynomials, have coefficients that can be interpreted with a biological meaning such as population peak, optimum gradient position, and ecological amplitude. These plant response curves are the first step toward predicting how plants requiring maintenance flows might respond to river management.

SESSION: Instream Flow Perspectives and Issues in Alaska

Steelhead observations in the Situk River in relation to water conditions

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Water conditions affect fish and fisheries in many ways. Water quantity, flow duration, and water quality, alone and in combination, have direct effects on fish survival, as well as indirect effects on harvest availability and fishery management. The effects of water conditions on fish are often variable depending on the geographic position of the watershed in relation to the distribution of a particular species, as well as the other species found in that drainage. This presentation will discuss generalized water issues important to fish survival, and as an example, will exhibit data from steelhead studies on the Situk River of SE Alaska in relation to observed water conditions. The examples originate from an ongoing steelhead monitoring project near Yakutat. The Situk River weir has been used to count and sample steelhead kelts emigrating from the Situk River since 1995. The Situk River hosts the largest steelhead fishery in Alaska. The Situk drainage is ~ 60 km long and contains 3 lakes, 2 significant tributaries and encompasses 15,500 hectares. The main stem drainage is largely flat, but the headwater tributaries reach up to 600 meters in elevation, and steelhead have been recorded spawning at 97 meters elevation, down to tidal influence. The drainage is located in coastal Southeast Alaska near the northern limit of steelhead distribution. The habitat in the area is largely unaltered, and regulatory water reservations for fish and wildlife are in effect for the majority of the drainage.

SESSION: Instream Flow Perspectives and Issues in Alaska

Non-Governmental Organizations interest and application of Instream Flow

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Non-governmental organizations (NGOs) are often interested in stream flow. What does it take for a NGO to capitalize on these interests? How do NGOs use and/or collect stream flow data to meet their study objectives? This session will discuss how these NGOs have used flow data and the challenges they have met. To show the NGOs interest in instream flow, case studies will be used from the Kenai Peninsula.

SESSION: Instream Flow Perspectives and Issues in Alaska

Effects of Water Level Fluctuations on Ecological Processes in Subarctic Lakes

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This presentation will review studies related to effects of water-level fluctuations on ecological processes in subarctic lakes. In general, natural water level fluctuations are greater in lakes that are small relative to the area of their drainage basin. The effects of water level fluctuations in the littoral zone are greatest in lakes with shallow shoreline gradients. Species diversity in littoral macroinvertebrate communities is reduced in lakes where water levels are regulated. Low water levels in winter have caused dramatic reductions in littoral mussel populations that are an important food source for waterfowl. In shallow lakes, low water levels often lead to increases in benthic macrophytes creating a refugia for juvenile fishes. But in deep lakes, low water levels may lead to increased water temperatures in the epilimnion, prolonged stratification, and decreased nutrient replenishment to the epilimnion reducing phytoplankton and zooplankton densities. If extended for long periods, oxygen may become depleted in the hypolimnion reducing overwinter refugia for fishes. High water levels may have the opposite effects on nutrient cycling and productivity, but high water can also lead to release of phosphate from the littoral zone further increasing primary productivity. In semi-glacial lakes, high water levels are associated with increased turbidity due to glacial runoff, decreased light penetration, and reduced phytoplankton and zooplankton production leading to reduced juvenile sockeye salmon growth and survival.

SESSION: Instream Flow Perspectives and Issues in Alaska

Fish kills in a coastal Alaska stream and why instream flow reservations can be important to water chemistry

Ed Neal
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In August of 2013 low streamflow combined with warm water temperatures and large pink salmon returns resulted in a large fish die-off on the Indian River near Sitka, Alaska. Employees of the National Park Service recorded mortality of large numbers of pre-spawn pink salmon as well as Dolly Varden, char, and possibly cutthroat trout. Environmental conditions leading up to the die-off were examined. This data includes: time series record of streamflow, water temperature, and dissolved oxygen. Data indicate that fish mortality likely resulted from low concentrations of dissolved oxygen due to increased biological oxygen demand from large numbers of decaying pink salmon. Streamflow during the die-off was considerably less than the Alaska Department of Fish and Game instream flow reservation of 61 cubic feet per second.

SESSION: Instream Flow Perspectives and Issues in Alaska

Recreation Flows as an Instream Flow Protection Strategy

Alan Peck
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Instream flow requirements represent a merging of resource values and hydrology. Recreation is one of the important river resource values that depends on flow and is recognized as a purpose in Alaska instream flow reservations. What are possible approaches and methods to consider when identifying recreation as a purpose in reserving flows? How can multiple resource purposes with varying flow requirements be accommodated in one reservation? This presentation will look at recreation as part of a flow protection strategy.

SESSION: Instream Flow Perspectives and Issues in Alaska

Data Needs for Instream Flow Reservations

Terry Schwarz [1], Jason Hass[2], Kim Sager[3], and Jarrod Sowa[4]
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Under Alaska Statute 46.15.145 "Reservation of Water", the Department of Natural Resources (DNR) has the responsibility and authority to issue Instream Flow Reservations (IFR) on inland water bodies. The purpose of a reservation is to "maintain a specified instream flow or level of water at a specified point on a stream or body of water, or in a specified part of a stream throughout a year or for specified times, for 1) protection of fish and wildlife habitat, migration and propagation 2) recreation and park purposes 3) navigation and transportation purposes and 4) sanitary and water quality purposes". DNR requires that the applicant provide sufficient hydrologic and needs (fish, wildlife, recreation, navigation, or water quality) data specific to the location and purpose of the reservation application to support the requested flows or water levels. Because a majority of the IFR applications to date in Alaska are for the protection of fish, this presentation will focus on fisheries data needs. Hydrologic data requirements consist of stream gage or lake level data sufficient to calculate the mean annual and monthly flows as well as flow duration curves. Required fisheries data includes spatial and temporal distribution of fish within the water body as well as the utilization of life stages for each fish species for which the reservation is being requested. The combination of these data sets defines the spatial and temporal extent over which the appropriate quantity of water is needed to protect the fisheries resource within that water body.

GROUNDWATER HYDROLOGY

Session chair: Melissa Hill
DNR, Melissa.hill@alaska.gov

This session focuses on groundwater studies conducted in arctic or subarctic areas of the state. Topics for discussion include groundwater availability, groundwater quality, integrated surface-groundwater studies, and applications of new tools or methods for collecting or evaluating hydrologic data in either remote or densely populated areas of Alaska.

SESSION: Groundwater Hydrology

Guidelines on How to Deploy and Protect Water Level Monitoring Equipment in Cold Environments

Bill Mann
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Cold climates and wintery conditions present environmental technicians with unique challenges. They need to protect themselves against the cold with appropriate clothing and shelter. They also need to protect valuable water level monitoring equipment from cold weather and water. In this presentation, we will discuss practical guidelines from environmental technicians who brave the ice and snow to collect important water level data. You will learn how to prepare equipment in the office; how to equilibrate equipment at the initial deployment; and how to protect the pressure diaphragm and prevent ice from rupturing the diaphragm. Learn how to install pressure transducers and communication cable and prevent damage during ice break-up in the spring. Find out how scientists are monitoring an Antarctic ice shelf in near-freezing water.

SESSION: Groundwater Hydrology

Installation of Infiltration Gallery at Greens Creek Mine

Juneau, Alaska

Thomas Hanna[1], Eric Sundberg[2], and Gabriel Hayden[3]
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The Greens Creek Mine is located on Admiralty Island, near Juneau Alaska. It is one of the nation's largest silver producers, with a projected 10-year mine life. Bedrock in the vicinity of the mine consists of relatively impermeable agillites and the only reliable water source for the mine and milling operations are the alluvium along the narrow stream bed of Greens Creek. The original source water for the mine consisted of three wells competed within the bed of Greens Creek alluvium. However, the wells were too shallow and became ineffective in providing an adequate water supply due to freezing of the streambed into the stream bed in the winter and sediment production at times when the creek was experiencing high run off. In 2008 the wells were replaced with an infiltration gallery completed in the stream bed that would not be affected by the bedload movement and freezing that would damage the intakes and reducing capacity in the winter months. A Johnson Screens, Muni-pak screen was selected as the intake to address problems that might occur with excessive stream bed erosion that occurs during large storm events and provide filtration during periods of high flow and turbidity. The main challenge during the construction phase was to maintain the 700 gpm flow to the mine and mill operations while decommissioning the old well system and installing the new infiltration gallery. Estimates of the production from a bed mounted infiltration gallery were used to determine that a screen length approximately 20 feet would be required to provide the 700 gpm. Greens Creek was diverted and the infiltration gallery connected to the existing stilling well. The new system has been operational for about 2 years without problems at a peak capacity of 700 gpm with minimal drawdown in the stilling well.

SESSION: Groundwater Hydrology

Thaw Bulb Well Construction in Arctic Permafrost Regions

Wayne Westberg
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Wayne Westberg, M-W Drilling, will describe his water well drilling and construction experiences in Arctic permafrost regions over the last 46 years. The presentation will center around the use of slant well and directional drilling methods to reach thaw bulbs and complete screened wells in them.

SESSION: Groundwater Hydrology

The Alaska Hydrologic Survey's Activities in the Matanuska-Susitna Valley and Anchorage Bowl Areas

Melissa E. Hill[1] and Collin Macheel[2]

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The Alaska Hydrologic Survey provides data necessary to manage Alaska's waters as described in the Alaska Water Use Act. Progress updates on instrumenting former U.S. Geological Survey stations in the Matanuska-Susitna Valley and efforts to quantify both groundwater use and the development of a three-dimensional hydrogeologic framework model for the Anchorage Bowl are presented. The data collected in these ongoing studies, though modest, provide the technical foundation for managing water resources and provide a start to part of the large data requirements for developing steady-state/transient numerical groundwater flow models needed for developing data sets to run predictive scenarios for large (subdivision-scale) water right adjudications.

ALASKA RIVER HYDROLOGY

Session chair: Robin Beebee
USGS, rbeebee@usgs.gov

This series of talks explores a variety of studies of surface hydrology and hydraulics, from long-term monitoring networks that form the backbone of our knowledge of regional streamflow, to flooding and flood risks owing to local influences such as tidal influence, sediment deposition, and channel change.

Status of the U.S. Geological Survey stream gaging program in Alaska

Jeff Conaway
U.S. Geological Survey, jconaway@usgs.gov

The U.S. Geological Survey Alaska Science Center operated a network of 110 streamflow gages and 40 crest-stage gages in Alaska during the 2014 water year. The network is dynamic and fluctuates annually based on cooperator data needs and federal funding levels. The overall number of active streamflow gages has decreased in the last two years: 11 gages were discontinued and six gages were added. Funding for the network is split between federally appropriated dollars and funding from 16 different federal, state, borough, and native corporations. Additional funding that was received in 2014 from the USGS National Streamflow Information Program was used to reactivate the Kobuk River gage, add a new gage on the Salmon River in Gustavus, and add real-time water temperature data collection to 17 existing gages. The length of record for gages in Alaska ranges from a single open-water season to 95 years with the average being 13 years of daily discharge data. Traditionally, streamflow data collected over a water year have been published annually after a thorough check and review process. Beginning in water year 2014, the USGS has migrated to a continuous web only publication process that no longer is based on the water year. The USGS commitment to providing quality, timely data remains unchanged and the discontinuation of annual data publication is a logical step to meeting real-time data needs. Real-time and historic data are now all accessible through the USGS NWISWeb page and data will continuously transition from provisional to approved as the real-time records are updated and reviewed. Many of the statistical and data summaries available in the annual publication have already been incorporated into NWISWeb and allow users to generate summaries at any time scale rather than only being available in a water-year period.

SESSION: Alaska river hydrology

Alaska Streamflow Statistics Update

Janet Curran[1], Nancy Barth[2], and Andrea Veilleux[3]
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Streamflow statistics and equations are a common basis for hydrologic analysis for engineering design, instream flow, fish passage, flood hazard planning and mitigation, and ecological assessment. The USGS is updating flood and mean annual flow statistics at gaging stations in Alaska and regional regression equations used for estimating these statistics at ungaged basins in Alaska. The updates incorporate 13 years of new peak-streamflow data collected since the last update was published in 2003 and adopt new flood frequency analysis techniques, including the Expected Moments Algorithm and the multiple Grubbs-Beck test. A companion regional skew update being conducted by the USGS Office of Surface Water employs Bayesian Least Squares techniques to assess skew patterns within a region. Regional skew will be developed only for areas where gaging density is highest, in particular an area in central and southcentral Alaska, and in southeast Alaska. The new flood frequency techniques and regional skew, coupled with a review of gaging station data, can improve accuracy of flood statistics even for sites with no new record. StreamStats, an online GIS application, is being developed from the National Hydrography Dataset (NHD) for the Cook Inlet Basin. This pilot Cook Inlet Basin StreamStats will streamline drainage basin delineation and computation of streamflow statistics for the Cook Inlet Basin.

SESSION: Alaska river hydrology

Modeling how changes in flooding affects the driftwood harvest from the Yukon River

Chas Jones[1], Knut Kielland[2], and Larry Hinzman[3],

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The integration of local knowledge and science represents an opportunity to enhance the understanding of interrelations among climate, hydrology, and social-economic systems while providing mutual benefits to scientists and rural communities. In this project, insight from rural Alaskans helped to identify a social-ecological threshold used to model potential driftwood harvest from the Yukon River during flooding. Information from residents of Tanana, Alaska was combined with scientific data to model harvest rates of driftwood. We estimate that between 1980 and 2010 hydrologic factors were responsible for a 29% decrease in the wood harvest, which approximately balanced a 23% reduction in wood demand related to fewer village households. The community's installation of wood-fired boilers in 2007 created a threshold increase (76%) in wood demand that is not met by driftwood harvest. Modeling analyses of climate scenarios illustrates that increases in hydrologic variability decreases the reliability of future driftwood harvest. Economic analyses demonstrate that increased climatic variability could have serious economic consequences for subsistence users, while demanding more of their time. Lost time is very important because it reduces the time available for other subsistence activities and the time required to learn to adapt to climate-related challenges that are affecting people across the Arctic. This research benefits communities by providing an approach for predicting the timing and duration of driftwood runs. This project also illustrates the potential for regional-scale adaptations to limit the social-ecological impacts of extreme events, while encouraging economic growth and energy independence that decreases their vulnerability to climatic extremes.

SESSION: Alaska river hydrology

Hydraulics of Tidally-Influenced Streamflow at Bridges in Alaska

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The Alaska Department of Transportation and Public Facilities and the USGS undertook a cooperative study of streambed scour at 41 tidally-affected bridges in Alaska from 2009 to 2012. The hydraulics of channels within the tidal zone can be more complex than purely riverine channels because of flow reversals and upstream storage, thus standardized techniques do not exist for evaluating scour at tidally-affected bridges. The extent of tidal influence was determined by collecting stage data at 33 sites during a full tidal cycle and correlating it to the nearest tidal gage. The tidal influence on the hydraulics at each bridge was determined from the relationship between the mean tide elevations and the streambed elevation. Asymmetrical hydrographs during the tidal exchange indicated that 10 bridges stored water upstream of the bridge during the high tide because the bridge opening created a constriction. These conditions produced the greatest scour potential during the tidal exchange and were selected for a more in-depth assessment. An ADCP (acoustic Doppler current profiler) was used to record the velocities during an ebb tide. The measured tidal velocities were compared to the maximum riverine velocity at low tide and the critical velocity needed to move the streambed sediment. Of the 10 bridges with measured tidal velocities, only one site had tidal velocities higher than the measured velocities during riverine conditions. Tidal velocities were high enough to pose a high potential scour risk at 3 bridges and upstream storage presented a high potential scour risk at 11 sites.

SESSION: Alaska river hydrology

Flooding and Channel Change in a Glacial Stream near the Exit Glacier Access Road, Kenai Fjords National Park, Alaska

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Streamflow from Exit Creek has overtopped the Exit Glacier access road in Kenai Fjords National Park, Alaska one to three times per year since 2009, resulting in costly road closures and repairs. Floods have occurred in mid-summer and fall during periods associated with rainfall, glacier melt, or both. We attribute flooding to geomorphic, hydrologic, and glacial processes in Exit Creek, which parallels the road; in Paradise Creek, which historically merged with Exit Creek; and in Exit Glacier, which covers 65 percent of the 50 km^2 Exit Creek basin. The upper two-thirds of the 3 km long braided Exit Creek flow through several moraines and former outwash channels both associated with glacier retreat since a Little Ice Age (LIA) highstand in the early 1800s. LIDAR topographic data reveals an alluvial fan emerging from the LIA moraine, the right and topographically higher side of which is occupied by Exit Creek. The access road in the center of the fan and older channels on the left part of the fan are situated below the braid plain, a configuration that equates to a high likelihood of persistent flooding or migration of the braid plain toward the road. Comparison of 2008 and 2012 digital elevation models of the fan indicate deposition across the braid plain on the order of 1 m over that 4 year period, exacerbating the spilling of flow from the braid plain. Exit Creek appears to have established a long-term pattern of fan construction that will likely pose an ongoing threat to the existing road alignment.

SESSION: Alaska river hydrology

Channel Changes on the Copper River near Bridge 339, 2011-2014

Robin Beebee[1], Jeff Conaway[2], and Paul Schauer[3]
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Over the last several decades geomorphic changes in the Copper River Delta have caused the majority of the flow to migrate from channels on the west side of the delta to channels on the east side of the delta. The shift in the flow distribution has created maintenance and stability issues at several bridges on the Copper River Highway. The Copper River Highway has been closed at Mile 36 (Bridge 339) since August 19, 2011, when flows in excess of four times the design discharge scoured the streambed at the bridge up to 67 feet below the original level. This reduced the lateral stability of the piers to the extent that the bridge was no longer structurally sound. In the spring of 2012, the eastern road approach washed out during breakup and the channel rapidly widened toward the east. Bridge 339 remains standing, and the USGS, in cooperation with the Alaska Department of Transportation and Public Facilities, has continued to monitor channel changes using pier-mounted sonars, bathymetry surveys, and time-lapse cameras. Sonar data have shown continuing cycles of fill and scour around one of the piers, although scour hasn't reached the levels seen before the channel widened. Repeat bathymetric surveys in the reach immediately surrounding the bridge have shown up to 50 feet of both scour and fill between 2011 and 2013. The channel has widened from 400 feet, the width of Bridge 339, in 2012 to about 1,500 feet in 2014. The future of Bridge 339 and the eastern end of the Copper River Highway remain uncertain in light of the engineering challenges presented by the changing nature of the Copper River Delta.

NORTH SLOPE HYDROLOGY

Session chair: Anna Liljedahl
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SESSION: North slope hydrology

Unique hydrology and ecology of partially-drained arctic thaw lakes

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Drained lake basins (DLBs) are ubiquitous features of coastal plains across the Arctic and may represent important biogeochemical hot spots in an otherwise oligotrophic environment. Our study on the Arctic Coastal Plain (ACP) of Alaska used GIS-based mapping, repeat photography, and physical and chemical data to quantify the unique characteristics of DLBs and to better understand their importance to ecosystems relative to stable lakes. All lakes within our 7 km2 study site refilled to some extent during spring snowmelt in 2011 through 2014 and then drained over the following weeks. Stable lakes lost as little as 4% of their water volume, while DLBs lost up to 90%. After the spring flush, DLBs continued to lose water relative to stable lakes due to evapotranspiration caused by the greater abundance of aqueous and shoreline macrophytes. In DLBs, drained extent, nutrients, and chlorophyll-a were directly related. These warm, nutrient-rich lakes may fertilize downstream lakes and rivers, and produce important plant and invertebrate food resources for birds and fish. We found four fish species in one DLB, which may migrate here to take advantage of invertebrate resources, and protection afforded by decreased water clarity and dense emergent plants. Climate change may increase the number of DLBs on the ACP, but may also decrease water volumes related to greater evaporative fluxes and drainage network development. Understanding gleaned from this work provides the physical and chemical information necessary to evaluate the potential effects of these changes on the ACP ecosystem.

SESSION: North slope hydrology

Hydrogeology on the North Slope of Alaska

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Few large scale hydrological studies have been pursued to understand groundwater behavior on the North Slope of Alaska. At the same time, oil exploration is continuing and methods for recovering oil are becoming much more refined. Directional drilling technology has developed to the point that only few new surface disturbances need to be made to reach oil that was previously unreachable. Hydraulic fracturing ('fracking') often follows directional drilling to increase the flow within the oil bearing formations. Hydraulic fracturing requires, on average, 5 million gallons of water per well in order to develop sufficient flow for oil. Other uses of water in the industry include construction of ice roads, human consumption in camps, cooling, and chemical processes.

To the casual observer the North Slope seems to have an abundance of liquid water, but due to permafrost there is virtually no recharge of long term below-ground storage. The use of surface water from deeper lakes is recommended in order to prevent negative ecological effects of water use in those lakes. Sub- and intra-permafrost groundwater has received little attention as a resource that can be used for the industry. Due to the lack of research in this area it is difficult to predict the effects of large scale pumping from those deeper aquifers on the groundwater system.

New research undertaken by the Alaska Division of Geological & Geophysical Surveys is aimed to improve our understanding of groundwater resources on the North Slope of Alaska. The primary focus is to address the potential impacts of groundwater pumping as well as injection of large quantities of water for and from industrial use.

SESSION: North slope hydrology

Assessing the fate of fresh crude oil through an arctic coastline, based on sediment structure and wave action

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Offshore oil production along Alaska's arctic coast is expected to increase in coming years. While this is expected to create large economic benefits for the state, crude oil spills may occur. An oil spill may reach the shoreline, where it could create adverse short and long-term ecological effects. Mass transfer processes play an important role in determining the fate of crude oil along shorelines. These processes (diffusion, dispersion, viscosity) are strongly temperature dependent. Nutrients, commonly added to stimulate bioremediation, may be washed out with waves and tides. It is therefore necessary to study how factors such as the beach matrix and temperature affect hydrocarbon and nutrient distribution.

Laboratory experiments were implemented to help better understand how the soil composition and tidal action will affect the oil's movement through the shoreline sediments. Experiments were ran at two different grain sizes (sand/gravel) using material obtained from Barrow and 2 different temperatures (20° and 3° Celsius). A microcosm study using a PVC pipe set-up was to simulate a more in-depth look at the transport of oil through the soil profile, based on the rise and fall of the tidal zone. Data shows that crude oil concentrations were highest in the middle of the soil profile showing that oil was pooling in the system, and not being washed out. Future experiments will use a wave tank as a scale model of an actual shore environment to investigate the effect of wave action on contaminant movement.

FISHERIES AND FISH POPULATIONS AND THEIR HABITATS OF THE NORTH SLOPE OF ALASKA

Session chairs: Jeff Adams[1] and Matthew Whitman[2]
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The combination of climate change and increased oil and gas development will undoubtedly have effects on North Slope fish populations, their habitats, and the fisheries they support. These two factors will alter the physical aspects of the environment at varying scales and likely cause changes in population behavior, habitat quality, and harvest patterns. To prepare for future scenarios, managers and researchers must first recognize the current and historical status of these populations, their habitats, and their fisheries. This session focuses on projects and activities that will lead to a better understanding of the factors that drive North Slope fish ecology and how these factors may affect future uses of these populations.

SESSION: Fisheries and fish populations and their habitats of the North Slope of Alaska

An Overview of the Colville River Delta Arctic Cisco Fall Fishery

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Each fall, the residents of Nuiqsut, Alaska, a small village on the Colville River delta, deploy subsistence gill nets under the frozen river ice to harvest overwintering Arctic Cisco (*Coregonus autumnalis*). Known as *Qaaktaq* in Iñupiaq, these fish are a staple in the diet of Nuiqsut residents and are traded widely with other northern Alaska communities. Over the years, concerns have been raised that oil and gas exploration and development in the nearshore marine environment and on the Colville River delta could adversely affect local fish populations. To help address these concerns, ConocoPhillips Alaska, Inc., (CPAI) and its predecessors began funding annual harvest monitoring in the 1980s. One goal of the harvest monitoring program is to provide estimates of the total fishing effort and catch of Arctic Cisco and other species. This presentation will provide an historical overview of the Arctic Cisco fishery and monitoring program on the Colville River delta and will highlight the successful partnership between subsistence fishers, agency managers, industry and other stakeholders.

SESSION: Fisheries and fish populations and their habitats of the North Slope of Alaska

Fish and Aquatic Habitat Surveying on the North Slope

Parker Bradley[1] and Brad Wendling[2]

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Spawning and overwintering habitats are critical for fish. For fall and winter spawning fish on Alaska's North Slope, these habitats are limited because the majority of water present during the open-water season freezes solid and most rivers and streams cease to flow. Identifying these limited yet critical habitats is important for the conservation of these fish as development (e.g. oil and gas) has potential to encroach on these previously undisturbed drainages. Our research included a radio telemetry study on burbot (*Lota lota*) in the Kuk River drainage and broad whitefish (*Coregonus nasus*) in the Topagoruk River drainage. In 2012, we radio tagged 29 burbot in the Kuk River and conducted telemetry flights later that winter. Twenty six of the 29 burbot were relocated, some of which made extensive movements upstream and into other drainages. To further our understanding of burbot movement in this system and overwintering locations, we radio tagged 50 more burbot in 2014 and have been conducting monthly radio telemetry flights. In June 2013, we radio tagged 62 broad whitefish in the Topagoruk River. Radio tracking that occurred later that year in early October relocated 45 of those fish, many of which made extensive movements to the Inaru, Meade, Chipp, Oumalik, Ikpikpuk rivers. More frequent flights will occur this fall and winter to better understand their movements and critical habitats.

SESSION: Fisheries and fish populations and their habitats of the North Slope of Alaska

Body size and condition influence migration timing of juvenile arctic grayling on the Arctic Coastal Plain

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Freshwater fishes utilizing seasonally available habitats within annual migratory circuits time movements out of such habitats with changing environmental conditions, though individual fish attributes may also mediate the migratory response to seasonal environmental change. We tagged juvenile Arctic grayling in a seasonally flowing beaded stream on the Arctic Coastal Plain of Alaska in 2012 and 2013 and recorded migration timing as fish left the study area towards overwintering habitats. We examined the relationship between an individual's migration date and its fork length and body condition index (BCI) for fish tagged in June, July, and August in three separate models. All models indicated that larger fish tended to migrate earlier, however only the model including fish tagged in August suggested a significant a relationship with BCI. In this model, 42% of variability in exit timing was explained by body size and condition, and indicated that fish in better condition were more likely to migrate earlier. Stepwise addition of variables to this model indicated the majority of variability (33%) was captured by body size alone with an additional 9% attributable to BCI. These results are interpreted in the context of size and state-specific risk of overwintering starvation and mortality, which may influence individuals at greater risk to extend summer foraging in a risky, yet prey-rich, habitat. Our results provide further evidence that heterogeneity among individuals within a population can influence migratory behavior, and identifies potential risks to late season migrants in Arctic beaded stream habitats influenced by climate change and petroleum development.

SESSION: Fisheries and fish populations and their habitats of the North Slope of Alaska

Understanding how lake populations of arctic char are structured and function with special consideration of the potential effects of climate change: a multi-faceted approach

Phaedra Budy[1] and **Stephen Klobucar**[2]

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We explored patterns among empirical vital rates, population structure, abundance and trend, and predicted the effects of climate change on populations of arctic char (*Salvelinus alpinus)* in two lakes. Both populations cycle dramatically between dominance by small (≤ 300 mm) and large (> 300 mm) char. Apparent survival (Φ) and specific growth rates (SGR) were relatively high (40-96%; SGR range 0.03 – 1.5%) and comparable to conspecifics at lower latitudes. Climate change scenarios mimicked observed patterns of warming and resulted in temperatures closer to optimal for char growth (15.15 °C) and a longer growing season. An increase in consumption rates (28-34%) under climate change scenarios led to much greater growth rates (23-34%). Higher growth rates predicted under climate change resulted in an even greater predicted amplitude of cycles in population structure as well as an increase in R_o (reproductive output) and decrease in G_o (generation time). Collectively, these results indicate arctic char populations (not just individuals) are extremely sensitive to small changes in the number of ice-free days. We hypothesize years with a longer growing season, predicted to occur more often under climate change, produce elevated growth rates of small char and act in a manner similar to a "resource pulse", allowing a sub-set of small char to "break though", thus setting the cycle in population structure. Lastly, we introduce up coming whole lake warming experiments planned for the new future.

SESSION: Fisheries and fish populations and their habitats of the North Slope of Alaska

Fish community structure is influenced by local and regional landscape attributes on the North Slope, Alaska

Sarah Laske[1], Trevor Haynes[1], Amanda Rosenberger[2], Christian Zimmerman[3], Joshua Koch[3], and Mark Wipfli[4]

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Fish communities on the Arctic Coastal Plain, Alaska, are structured by the combined influence of local and regional factors. Hydrologic variables, in particular, appear to impart large influence on fish communities. For example, surface water connectivity among lakes and with the Arctic coast enhances the colonization potential of most fish species into lakes. We found that fish species richness was greater in lakes with a surface water connection to other lakes and streams, and that richness decreased with distance from the coast. Also, fish species richness and composition were closely related; lakes with a richness of one always contained Ninespine Stickleback (*Pungitius pungitius*) while lakes with higher richness (five to nine species) regularly contained Arctic Grayling (*Thymallus arcticus*). Given that richness and species composition are tied to hydrologic characteristics suggests that these hydrologic properties influence trophic structure as well. As the climate changes on the North Slope we anticipate an accompanied shift in hydrologic regimes, this will undoubtedly alter fish species richness and composition in lakes. Therefore, we expect, under different scenarios of wetter versus drier climate, to either increase or decrease local richness, thus altering fish species composition and food availability for piscivorous fish and birds.

SESSION: Fisheries and fish populations and their habitats of the North Slope of Alaska

Modeling landscape influences on winter dissolved oxygen concentrations in Arctic tundra lakes

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Overwintering habitat for Arctic fish is essential, such that understanding the distribution of winter habitat quality and availability at the landscape-scale is warranted. Adequate dissolved oxygen concentrations (DO) are a major factor limiting habitat quality for regions with ice-covered lakes, which is particularly true in the Arctic where lakes are ice-covered for about 8 months each year. The high abundance and morphometric diversity of lakes across many Arctic landscapes suggests that predicting DO is needed to identify how overwintering fish habitat is distributed. Here we use a mixed-effect model to assess the significance of landscape attributes (i.e. lake depth, geology) from 28 lakes across northern Alaska. Preliminary results suggest that a majority of the variation in late winter DO can be explained by lake depth, lake area, lake connection, littoral area and surficial geology. Our analysis identifies landscape features that relate to late winter DO regimes in Arctic lakes that can aid in predicting which lakes are most likely to experience winter hypoxic conditions. These results will help managers predict which lakes provide optimum DO for overwintering habitat and thus may be more resilient to winter water withdrawals. Conversely, lakes predicted to have marginal winter DO levels may be vulnerable to disturbances that could lower DO below critical thresholds to support fish. In regions where lakes are also used by humans for industrial winter water supply, such as ice-road construction for oil and gas development that is anticipated to expand in northern Alaska, these finding will be vital for the management of resources and protection of Arctic fish.

CLIMATE MODELING AND HYDROLOGY

Session chair: Uma Bhatt
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The objective of the presentations in the *Climate Modeling and Hydrology* session is to provide information that can lead to better informed applications of climate and weather data to water resources analysis in Alaska. The session will begin with talks focused on Alaska: an evaluation of atmospheric reanalysis data(R. Lader), hydrological modeling data needs (A. Liljedahl), and a new dynamically downscaled data set (P. Bieniek). Two modeling studies will follow the data presentations. The first speaker will discuss an application of downscaled data to glacier studies (G. Wolken) and this will be followed by a regional atmospheric model study of air quality in Glacier Bay (M. Pirhalla). The final two presentations focus on the role of large-scale climate variations on Alaska climate. The first talk will discuss the links between the large-scale climate and tundra vegetation greening (U. Bhatt). The final speaker (invited) will present new insights into the link between the Pacific Decadal Oscillation and Alaska Climate (S. McAfee).

SESSION: Climate modeling and hydrology

An Evaluation of Reanalysis Products for Alaska to Facilitate Climate Impact Studies

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Alaska is experiencing effects of global climate change due, in large part, to the positive feedback mechanisms associated with polar amplification. The major risk factors include loss of sea ice, glaciers, thawing permafrost, increased wildfires, and ocean acidification. Reanalyses, which are weather forecast models that assimilate observations, are integral to understanding mechanisms of Alaska's past climate and to help calibrate future modeling efforts. This study evaluates five reanalyses using monthly gridded datasets of temperature, precipitation, as well as daily station data of maximum and minimum temperature, and precipitation, across six climate regions in Alaska, and at six stations from 1979-2009. Cross correlations between the monthly gridded and daily station time series are computed to provide a measure of confidence that data users can assume when selecting reanalysis data in a region without many surface observations. The reanalyses evaluated in this study include the: NCEP-NCAR Reanalysis (NCEP- R1), North American Regional Reanalysis (NARR), Climate Forecast System Reanalysis (CFSR), ERA-Interim, and Modern-Era Retrospective Analysis for Research and Applications (MERRA). MERRA was the top-performing reanalysis for the station-based assessment, and has the lowest statewide precipitation bias. NARR and ERA-Interim have the lowest near-surface air temperature biases across Alaska. The quality of reanalysis data varies by region, season, and variable. This study provides guidance for reanalysis users to make informed decisions.

SESSION: Climate modeling and hydrology

Climate data needs for Alaska's hydrologic studies

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Alaska's water resource information needs often entail short-term flood forecasting, estimating flood frequency and determining seasonal variability in flow regimes. These hydrologic analyses are only as effective as the field measurements that are supporting them. One of the greatest challenges to short-term flood forecasting in Alaska is real time precipitation (and river runoff) information. A recent intensity-duration-frequency exercise of observed precipitation showed for example that a) although density and spatial coverage of meteorological stations have increased, large areas in northern and western Alaska are still without gauge coverage and b) the number of gauges at higher elevations is insufficient, although growing. Further, freely available gridded climate products lack the combined spatial and temporal resolutions that are necessary to provide effective input for long-term hydrologic modeling addressing flood frequency, seasonal variability in flows etc. Spatial resolutions of gridded climate products are 2 km at their finest, but then their temporal resolutions are constrained to monthly time steps, while sub-daily climate datasets are only resolved at the 38 km (2.5 deg.) scale. In order to meet the needs of the state regarding applied water resource problems, effective climate information (e.g. supported by field measurements) would need to be at the sub-daily to daily and <5 km resolution. Such products have been produced for selected portions of the state via individual research projects. However, it is just recently that attempts have been made to calibrate such fine-resolution climate simulations with field measurements, which may improve the representation of extreme events that are otherwise often muted by climate models. Faced by a sparse monitoring network and climate change, Alaska has some serious climate data needs to address in order to support effective hydrologic studies.

SESSION: Climate modeling and hydrology

Dynamical Downscaling for Alaska

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The climate of Alaska is experiencing dramatic changes that have been enhanced by Arctic amplification. Understanding the mechanisms of change is necessary to better assess potential impacts. Due to sparse station observations in the vast state, dynamical downscaling of coarse resolution reanalysis/global climate model data using a regional climate model may be especially valuable to better understand the local climate. In this study we downscaled the ERA – Interim reanalysis data set 1979-2013 using the Weather Research and Forecasting (WRF) model to a 20km grid centered on Alaska. The results of the downscaling were compared to the original reanalysis to determine the value added by downscaling temperature and precipitation.

Owing to the complex topography of Alaska, the more realistic topography of WRF compared with the more smoothed topography of ERA – Interim allows for a better representation of the effect of terrain on the local climate. Preliminary results indicate warmer temperatures over higher elevations in winter relative to the reanalysis with cooler temperatures in summer. Lower elevations also tended to be cooler in winter in the downscaling. The downscaling tended to be wetter when compared to the original reanalysis. When compared locally with station data, the Fairbanks downscaling was warmer than observations while the Juneau downscaling, being in more complex terrain, tended to follow the station observations more closely than the reanalysis. This demonstrates that, with the added detail of topography and mesoscale processes, dynamical downscaling enhances the local information of temperature and precipitation in Alaska.

SESSION: Climate modeling and hydrology

Future glacier and runoff changes in the upper Susitna drainage basin, Alaska

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The Alaska Energy Authority (AEA) has been authorized by the State of Alaska to develop the Susitna-Watana Hydroelectric Project on the Susitna River to serve the region's energy needs. Critical to any hydroelectric development is a firm understanding of the basin-wide contributions to river runoff and how these might change over time to influence the quantity and seasonality of flow into a hydroelectric reservoir. Although only about 4% of the upper Susitna watershed area (13,279 km²) is glacierized, these glaciers provide a significant portion of the total runoff in the upper Susitna drainage basin, and it is well documented that these glaciers, like most Alaskan glaciers, are retreating. Changes in glacier extent and volume, in response to climate warming and/or altered precipitation regimes, have the potential to substantially alter the quantity and seasonality of runoff. It is crucial, therefore, to simulate future changes in glaciers and the quantity and seasonality of runoff in order to properly evaluate the hydroelectric project's operational longevity and to assess potential protection, mitigation and enhancement measures. This study combines field measurements and computational modeling to provide estimates of future runoff into the proposed 81 km^2 and 63 km-long reservoir of the Susitna-Watana Hydroelectric Project. We run Water Flow and Balance Simulation Model (WaSiM), a physically-based hydrological model, to project 21st century river discharge from the upper Susitna basin. Climate inputs come from a CCSM CMIP5 RCP6.0 scenario downscaled to a 20km-5km nested grid using the Weather Research and Forecasting (WRF) Model. Here we present historic and recently acquired hydrometeorologic field data, and initial glacier melt and hydrological model simulations.

SESSION: Climate modeling and hydrology

Evaluation of Particulate Matter Emissions from Cruise Ships in Glacier Bay Using the WRF/Chem Model

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Simulations from the Weather Research and Forecasting Model, inline coupled with atmospheric chemistry (WRF/Chem), were used to examine the fate of particulate matter with a diameter of 10 µm or less (PM_{10}) in Glacier Bay, Alaska during the 2008 tourist season. The robustness of the model was evaluated through an extensive network of surface and radiosonde meteorological observations. The model simulations demonstrated that mesoscale and synoptic scale weather systems affected the residence time of PM_{10}, the magnitude of concentrations, and its transport in and out of Glacier Bay. Strong inversions exceeding 2 K $(100\ m)^{-1}$ caused notable trapping of pollutants from cruise-ship emissions, increasing PM_{10} concentrations up to 43%, compared to days with cruise-ship visits and no inversions. Inversions occurred locally in Glacier Bay approximately 42% of days during the 124-day tourist season, with an average lifetime of 9 h. Pollutants occasionally originated from outside of the National Park when southerly winds advected pollutants from ship traffic in Icy Strait. The model also simulated orographically forced lifting over the Fairweather Mountains, which occasionally transported pollutants into Glacier Bay from the Gulf of Alaska. While hourly (daily) PM_{10} concentrations reached up to 44 $\mu g\ m^{-3}$ (22 $\mu g\ m^{-3}$) in some areas, overall seasonal average PM_{10} concentrations were below 2 $\mu g\ m^{-3}$. The results show that, despite up to two cruise ship visits per day, Glacier Bay still has pristine air quality overall.

SESSION: Climate modeling and hydrology

Changing seasonality of tundra vegetation in relationship to climatic variables

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This study documents changes in the seasonality of tundra vegetation productivity and its associated climate variables using long-term data sets. An overall increase of Pan-Arctic tundra vegetation greenness corresponds to increased land surface temperatures and declining sea ice concentrations. While sea ice has continued to decline, summer land surface temperature and vegetation productivity increases have stalled during the last decade in parts of the Arctic. To understand the processes behind these features we investigate snow cover and ocean heat content in addition to vegetation productivity, land surface temperatures and sea ice cover.

This study employs remotely sensed weekly 25-km sea ice concentration, weekly surface temperature, and bi-weekly NDVI from 1982 to 2013. Maximum NDVI (MaxNDVI, Maximum Normalized Difference Vegetation Index), Time Integrated NDVI (TI-NDVI), Summer Warmth Index (SWI), and ocean heat content (PIOMAS). We present analysis for 1982-2013 and subperiods.

MaxNDVI has increased from 1982-2013 over most of the Arctic but has declined from 1999 to 2013 over western Eurasia, northern Canada, and southwest Alaska. TI-NDVI has trends that are similar to those for MaxNDVI for the full period but displays widespread declines over the 1999-2013 period. Therefore, as the MaxNDVI has continued to increase overall for the Arctic, TI-NDVI has been declining since 1999. Weekly snow water equivalent over Arctic tundra has declined over most seasons but shows slight increases in spring in North America and during fall over Eurasia. The spatial patterns of NDVI trends can be likely attributed to changing Arctic moisture.

SESSION: Climate modeling and hydrology

The PDO: A Useful Planning Tool for Alaska or not?

Stephanie McAfee
University of Nevada, Reno

There is great need for and interest in understanding likely weather patterns over the coming season and through the next several years. A common way to make informed prognoses about weather over these time frames is to investigate current and developing conditions in the tropical and northern Pacific Ocean and use statistical relationships to local and regional climate to understand whether it is likely to be warm, cool, wet or dry. In Alaska, the Pacific Decadal Oscillation or PDO is commonly understood to impact weather and climate over much of the state. However, statistical relationships linking the PDO to Alaskan climate were developed over a short period of time relative to variability in the state of the PDO. These relationships were developed using, in essence, one positive phase of the PDO (mid -1970s through the late 1980s or early 1990s) and one negative phase (mid-1940s through mid-1970s). Since the mid-1970s, there have been a number of other changes, such as reductions in sea ice, that might not be related to the PDO but that likely also influence Alaska's climate, complicating the analysis of PDO teleconnections. The passage of time and development of new data products provide the opportunity to revisit PDO teleconnections and determine how stable they are over time. Results suggest that Alaska's climate may not track the PDO as closely as previously believed and so the PDO should be used with caution in planning and management decisions.

MINING EFFECTS ON HYDROLOGY AND FISHERIES

Session chair: Trey Simmons
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SESSION: Mining effects on hydrology and fisheries

Coordinating the Mine Permitting Process in Alaska and Canada

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Alaska uses a coordinated approach to reviewing and approving major permits for large mines. The approach incorporates a team of subject experts from State regulatory agencies referred to as the Large Mine Permitting Team or LMPT. The team approach strives to improve the review and approval process by adding a level of efficiency and completeness as well as improving the interactions with the public during the review process. These improvements are more difficult to achieve when agencies work independently. Applicants pay the full cost for this coordinated review, thereby reducing the cost of mine permitting to the state. The LMPT is managed by a project coordinator. The State has three large mine coordinators who are part of the Department of Natural Resources. For Canadian mine projects that are situated in watersheds that drain into Alaskan waters, or support anadromous fish that migrate through Alaskan waters, the LMPT participates in Canada's environmental review processes as members of technical working groups that review all components of a proposed mine. The LMPT typically works directly with, and comments directly to, the British Columbia Environmental Assessment Office and the Canadian Environmental Assessment Agency for such mining projects to ensure Alaskan interests are fully considered as part of Canada's environmental review processes.

SESSION: Mining effects on hydrology and fisheries

Overview of the Alaska Dam Safety Program

Charles F. Cobb
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The Dam Safety and Construction Unit within the Water Resources Section of the Division of Mining, Land and Water, in the Alaska Department of Natural Resources (ADNR) administers the Alaska Dam Safety Program under the authority of AS 46.17 to "supervise the safety" of approximately 77 dams currently identified under state regulatory jurisdiction. The mission of the Alaska Dam Safety Program is to protect life and property in Alaska through the effective collection, evaluation, understanding and sharing of the information necessary to identify, estimate and mitigate the risks created by dams. ADNR issues Certificates of Approval to Construct, Repair, Modify, Operate, Remove, or Abandon a Dam after detailed technical reviews are completed on engineering submittals. The Alaska Dam Safety Program reviews periodic safety inspection reports, design drawings, engineering evaluations, detailed design reports, construction plans, quality assurance plans and more. The Alaska Dam Safety Program is administered as a cooperative effort between the ADNR and the various persons, businesses, agencies, and other interests that are involved in the design, construction, and operation of dams. To foster cooperation, communication between these parties must be effective and efficient. By anticipating the scope of the communication, all of the entities involved will better understand the level of commitment necessary to accomplish the objectives of a particular project. Safe dams are the ultimate objectives of the Alaska Dam Safety Program. If cooperative relationships can be established between all of the parties involved, the entire community will benefit.

SESSION: Mining effects on hydrology and fisheries

Long Term Risk of Tailings Dam Failure

David Chambers
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Large tailings dams, which are built to contain mining waste and are among the largest dams and structures in the world, must stand in perpetuity. Experience shows that a catastrophic release of tailings can lead to long-term environmental damage with huge cleanup costs. The failure rate of tailings dams is also significantly higher than that of water supply reservoir dams. The difference probably reflects two factors: (1) the ability to use construction types for tailings dams that are more susceptible to failure; and, (2) the fact that tailings dams are most often constructed in sequential "lifts" over several years, making quality control more challenging than for water supply dams that are constructed all at once. There is a well understood tendency to make assumptions that favor short-term economic situations, and to assume that present technology can and will minimize the long-term risks associated with the design, operation, and long-term closure of tailings facilities. Technology and science have limits, and care must be exercised not to allow the significant economic incentives associated with present day decisions about risk to bias our estimates of the magnitude of these risks to be less, rather than more, conservative.

SESSION: Mining effects on hydrology and fisheries

Aquatic Biomonitoring at Southeast Large Mines

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Coeur Alaska, Inc. and Hecla Greens Creek Mining Company contract the Alaska Department of Fish and Game (ADF&G) Division of Habitat to conduct the aquatic biomonitoring at the Kensington and Greens Creek Mines in southeast Alaska.

The Kensington Mine, an underground gold mine near Berners Bay north of Juneau, began production in 2010. Mill and camp facilities are located adjacent to Johnson Creek, and effluent from mine water treatment is discharged to Sherman and Slate Creeks. ADF&G began sampling periphyton, benthic macroinvertebrates, fish, and sediment in Johnson, Sherman, and Slate Creeks in 2010, and conducting habitability studies in the tailings treatment facility in 2013.

The Greens Creek Mine, a polymetallic underground mine on Admiralty Island west of Juneau, began production in 1989. Greens Creek flows adjacent to the upper mine site and access road, and Tributary Creek originates downstream of the tailings disposal facility. Treated mine water effluent is discharged to Hawk Inlet. ADF&G began sampling periphyton, benthic macroinvertebrates, and fish in Greens and Tributary Creeks in 2001.

These biomonitoring contracts provide ADF&G the opportunity to the visit the mine sites regularly to observe development and operations as we collect data in freshwater systems upstream, adjacent to, and downstream of both mines. We use the information we collect to identify, assess and resolve issues at the mines as they arise.

SESSION: Mining effects on hydrology and fisheries

Aquatic Bio-Monitoring of the Red Dog and Fort Knox Hard Rock Mines in Alaska

Bill Morris[1] and **Parker Bradley[2]**

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This presentation will outline some of the key components included in ADF&G aquatic bio-monitoring programs associated with some of Alaska's largest and longest operating mines. Current programs focus on monitoring the aquatic food chain or particular components of the food chain. We will discuss important factors to consider when designing an aquatic bio-monitoring program including the importance of ensuring programs are site specific, contain some simple, cost effective methods and also provide the ability to detect changes in aquatic organisms and/or habitats over time. The bio-monitoring program, in its current form since the mid-1990's, at the Red Dog Mine will be discussed and results presented. Similarly, results from nearly 20 years of fish sampling at the Fort Knox Mine will be presented.

SESSION: Mining effects on hydrology and fisheries

Coho salmon biodiversity, distribution, and density in a proposed mining area, Bristol Bay, Alaska

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Increasing global demand for metals accelerated mineral interest in remote Alaska. Several porphyry-copper deposits are now under exploration in Bristol Bay, including Big Chunk and Pebble. Bristol Bay's rivers produce the world's most valuable ($1.5 billion) all-wild salmon runs, averaging 38.7 million fish (1991-2010). If mining proceeds, then baseline data are needed to guide salmon conservation efforts. Coho salmon (*Oncorhynchus nerka*) are a valuable component of Bristol Bay's salmon runs. The species is more vulnerable to localized habitat loss compared to other salmon due to their reliance on small often-unprotected headwater streams. We present the first studies on coho salmon in mine claims that examines genotypic and phenotypic traits as well as information on distribution and density. Genotypic analyses (8 microsatellites) of five Bristol Bay coho populations, including two from mine claims, indicate all populations differed significantly (n=5; Fst 0.026; 95% CI:0.017-0.036), suggesting unique stocks. Age and size at maturity, adaptive heritable traits influenced by natal environments, also differed significantly between spawning populations within mine claims (male age: $\chi 2$ = 12.0969, df = 3, p = 0.007; female size; p <0.0001). Distributional surveys (n=96) documented fish in 97% of survey sites and coho salmon in 71% of survey sites. Density surveys (n=12) showed sculpin (*Cottus* sp.) occurred at highest frequencies and densities, followed by coho salmon, then Dolly Varden (*Salvelinus malma*). Results are discussed relative to future long-term monitoring goals for potential mining and inevitable climate change.

SESSION: Mining effects on hydrology and fisheries

Water Quality Report for the Greens Creek Mine

Will Collingwood[1] and Allan Nakanishi[2]

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State regulations require that mining operations be designed and operated to "fully protect the existing uses" of the watershed. This provision is met, in part, by a permitting process that places limits on mine effluent, institutes a monitoring and reporting program, and regulates the disposal of waste. For large hard-rock mines, these permits are specific to the facility, site conditions, and the receiving water.

This presentation will focus on the Greens Creek Mine, an underground hard-rock mine located on Admiralty Island, approximately 18 miles southwest of Juneau. The Greens Creek Mine is a mature operation that has been subject to State oversight since its inception. Extensive baseline water quality and biological data is available to allow for comparisons between pre-mining and post-mining conditions. An overview of the Greens Creek Mine and the Department of Environmental Conservation's role in regulating the mine will be presented. The results of the water quality monitoring and bio-monitoring for this site will be summarized and interpreted. The presentation will conclude with a discussion of the mine's impact on the watershed.

HYDROPOWER EFFECTS ON HYDROLOGY AND FISHERIES

Session chair: Sue Walker
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SESSION: Hydropower effects on hydrology and fisheries

Costs And Benefits Of Large Hydropower Mitigation

Sarah O'Neal
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Although the era of widespread dam building ended decades ago, impacts of large dams to Pacific salmon remain one of the major impediments to their recovery in the Lower 48. This presentation will review major impacts of large-scale hydroelectric dams to salmon, strategies to mitigate those impacts, and documented costs and effectiveness of mitigation measures. Impacts from large dams to streamflows, temperatures, water chemistry, accessibility to spawning and rearing habitat, and increased predation from native and non-native species are well documented in the literature. Mitigation efforts including fish passage facilities, predator control, transportation, flow manipulation, and hatcheries have all been subject to significant research which has documented their strengths and drawbacks. By and large, mitigation measures are limited to impacts incurred at and above large dams, as opposed to downstream impacts. While the overall cost of mitigation is difficult to accurately estimate, at least hundreds of thousands of dollars are spent annually in the Columbia River basin alone. Effectiveness metrics tend to focus on individual mitigation strategies rather than overall population recovery. However, in light of the billions of dollars spent on salmon recovery, no stock of Pacific salmon has been removed from the Endangered Species List to date. In recent years, dam removal has become a more common mitigation tool, and has proven effective with surprising efficiency.

SESSION: Hydropower effects on hydrology and fisheries

Indicators of Hydrologic Alteration (IHA): A Tool for Understanding Hydrologic Changes in Ecologically-Relevant Terms

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The Indicators of Hydrologic Alteration (IHA) is a software program that provides useful information for those trying to understand the hydrologic impacts of human activities or trying to develop environmental flow recommendations for water managers. Nearly 2,000 water resource managers, hydrologists, ecologists, researchers and policy makers from around the world have used this program to assess how rivers, lakes, and groundwater basins have been affected by human activities over time, or to evaluate future water management scenarios. This program was developed by scientists at the Nature Conservancy to facilitate hydrologic analysis in an ecologically-meaningful manner. This software program assesses 67 ecologically-relevant statistics derived from daily hydrologic data. For instance, the IHA software can calculate the timing and maximum flow of each year's largest flood or lowest flows, then calculates the mean and variance of these values over some period of time. IHA can analyze hydrologic data available either from existing measurements (such as stream gauges or wells) or model-generated data. Comparative analysis can then help statistically describe how these patterns will change for a particular river or lake, due to abrupt impacts such as dam construction, or more gradual trends associated with land- and water-use changes. The full range of natural intra- and inter-annual variation in hydrologic regimes, and associated characteristics of timing, duration, frequency, and rate of change, are critical in sustaining the full native biodiversity and integrity of aquatic ecosystems.

SESSION: Hydropower effects on hydrology and fisheries

Ecological Risk Assessment of Large-Scale Hydropower on Pacific Salmon Populations within the Susitna River

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An environmental risk assessment (ERA) is being conducted to consider the effects of the proposed Susitna-Watana hydroelectric project on Pacific salmon populations within the Susitna River Watershed. Specifically, the ERA will examine how project construction and operations affect biological and physical processes that shape habitat attributes and, ultimately, influence the abundance, productivity, diversity, and spatial structure of salmon populations. The ERA will also consider different hypothetical operational scenarios and consider the effects of climate change. The presentation focuses on the basic framework and key information that will inform the ERA as well as assumptions and uncertainties that will be addressed in the future analysis phase of the ERA.

SESSION: Hydropower effects on hydrology and fisheries

Sweetheart Lake Hydroelectric Project. Developing SE Alaska hydropower for compatibility with fishery resources

Duff Mitchell
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A hydropower developer perspective to develop and operate a Federal Energy Regulatory Commission (FERC) licensed Southeast Alaska hydropower project while striving to enhance fisheries and avoid and minimize effects on fishery resources. Development of hydropower resources either competes or synergizes with, in varying degrees, the water resource (timing, quantity, and quality) utilized by aquatic life and fishery resources. This is challenging but the strategies and steps a developer implements in the hydropower development process can help obtain compatibility with a goal of harmonization with fishery resources. These strategies affect the design, efficiency of the hydropower resource, and project costs but ultimately determines the success of a hydropower project.

HABITAT SCIENCE TO SUPPORT FISHERIES MANAGEMENT IN ALASKA MARINE ECOSYSTEMS

Session chair: Jodi Pirtle
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Recent advances in habitat science have improved fisheries assessment and management. This session will highlight research that advances habitat science in support of fisheries management in Alaska marine ecosystems. Featured topics include habitat-based assessment of harvested species and protected resources, habitat suitability modeling for marine species, habitat conservation engineering, and updates on improved access to marine spatial data for Alaska.

SESSION: Habitat science to support fisheries management in Alaska marine ecosystems

Alaska's ShoreZone Dataset, the Mother Lode of Nearshore Marine Habitat Data

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ShoreZone is a mapping and classification system that specializes in the collection and interpretation of low-altitude aerial imagery of the coastal environment. Its objective is to produce an integrated, searchable inventory of geomorphic and biological features of the intertidal and nearshore zones which can be used as a tool for science, education, management, environmental hazard planning, and other uses. ShoreZone imagery is available for approximately eighty-six percent (~67,939 km) of Alaska's shoreline and mapping is completed or in progress for approximately seventy-eight percent (~61,401 km) of Alaska's shoreline. An overview of ShoreZone will be provided in this presentation as well as information on how to access the dataset. ShoreZone products from Alaska will be highlighted including the ShoreZone website (open access dataset), the ShoreZone coastal vulnerability module, Alaska ShoreZone bioareas, and additional ShoreZone applications.

SESSION: Habitat science to support fisheries management in Alaska marine ecosystems

Google it! Nearshore Fish Atlas of Alaska

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Over the years, NOAA Fisheries' Alaska Regional Office and Auke Bay Laboratories have collaborated to provide coastal habitat and nearshore fish data online to the public. This data portal hosted by the Alaska Regional Office is known as the Alaska ShoreZone Flex Mapping Website. Included is the nearshore fish atlas of Alaska containing over a 1,000 beach seine hauls which can be queried by species (currently 121 different species), species group, habitat type, region, and site. This data set is a rare resource for juvenile fish species throughout Alaska's nearshore. A surprising variety of users give this portal a workout from grad students, researchers, resource managers, and curious weekenders. The speaker will give a brief overview of the nearshore fish atlas along with a tour of the portal and its capabilities to get you jump started.

SESSION: Habitat science to support fisheries management in Alaska marine ecosystems

Short Term Variation in Arctic Nearshore Fish Communities During the Brief Ice-Free Season

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The nearshore in the high arctic is a sensitive region, being particularly susceptible to climate change and anthropogenic changes such as development and possible oil spills. We investigated the fish communities inhabiting various nearshore waterbodies, including Elson Lagoon, and the Chukchi and Beaufort Seas. In the brackish lagoon, capelin were one of the most abundant species, while Pacific sand lance were more characteristic in the marine water bodies. Sculpin were abundant in all regions. Regardless of waterbody, nearshore areas were predominantly utilized by juvenile fish. Weekly beach seine catches throughout the relatively short ice-free summer season revealed weekly variation in species composition and abundance. Similarly, energetic content of fish changed significantly throughout the summer. Of the approximately 15 species of fish analyzed, juvenile arctic cod were the most energy dense. Nearshore fish communities in the high arctic have a relatively short ice-free summer season for growth and energy acquisition prior to the onset of winter. Interannual differences in fish catches are likely related to physical and oceanographic conditions.

SESSION: Habitat science to support fisheries management in Alaska marine ecosystems

Assessing habitat impacts of raised groundgear for the Eastern Bering Sea pollock fishery

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U.S. fisheries are required to minimize adverse impacts on Essential Fish Habitat, while maintaining viable catch efficiencies. The Alaska pollock fishery, the nation's largest single species fishery, is further constrained by increased fuel costs, strict regulations and avoidance of bycatch. Through collaboration with the Alaska pollock industry and science professionals, a modified, low impact pelagic trawl footrope is being developed. Our goal is to optimize near seafloor pollock capture with minimal benthic habitat impacts. We tested seven footrope configurations by systematically varying footrope material, raised element spacing and seafloor clearance. Each gear configuration was towed twice within the eight square nautical mile study site for a total of fourteen experimental trawl tows and approximately 28 nautical miles of tracks for evaluation. After trawl tracks were established and the seafloor settled, we completed 10 perpendicular transects with tube cameras and DIDSON sonar. Imagery analysis and the Swept Area model will be used to calculate habitat impacts of each configuration to the component specific level. This will be used to support a quantitative evaluation of the new pollock trawl designs within the context of a fishery habitat impacts assessment. We expect that this tool will aid managers in the evaluation of implementing raised groundgear in the Alaska pollock fishery and be a model for management of other fisheries.

SESSION: Habitat science to support fisheries management in Alaska marine ecosystems

Benthic community structure helps inform essential fish habitat definitions for weathervane scallops (*Patinopecten caurinus*)

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We conducted an analysis of benthic communities in areas targeted by the commercial weathervane scallop (*Patinopecten caurinus*) fishery on the continental shelf off Alaska. Some bycatch species taken in this fishery are commercially valuable, including Tanner crab (*Chionoecetes bairdi*). Using bycatch data collected by onboard observers during 1996-2012, we explored whether spatiotemporal differences in benthic communities could be related to environmental variables (sediment type, depth, bottom temperature, and freshwater discharge) and anthropogenic variables (trawling and dredging effort). Statistically significant ($P < 0.05$) differences in benthic community structure were observed at the scale of state fishery registration districts, as well as among individual scallop beds. Spatial differences were most strongly correlated with sediment, depth, and dredging effort. Changes over time were also detected, and were weakly yet significantly correlated with freshwater discharge and dredging effort. Weathervane scallop catch per unit effort has generally been stable over time, suggesting that scallop populations in Alaska are robust to recent levels of fishing mortality since 1996. Other benthic species exhibited varying abundance levels, and temporal changes tended to be location-dependent. Results from this study inform our understanding of the extent to which benthic community composition in Alaska has changed over the past two decades with repeated disturbance, and will serve as a baseline against which to compare future changes. Advancements in habitat mapping techniques will contribute to improving essential fish habitat definitions for scallops and their associated benthic organisms, specifically related to habitat requirements and connectivity, given relationships among certain taxa and sediment type.

SESSION: Habitat science to support fisheries management in Alaska marine ecosystems

Use of benthic macroinvertebrates to characterize groundfish habitat

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Characterization of groundfish habitat is an important component of survey design and fisheries management; when substrate identification is not possible via direct observation macroinvertebrates can often be used to infer substrate type. Substrate identification from video recorded during surveys is often difficult due to silt, low light, and cover such as algae or hydroids. The proper identification of habitat-specific invertebrates is a valuable tool for characterization of groundfish habitats. We are currently investigating this method during habitat analyses from video collected during remote operated vehicle surveys to assess yelloweye rockfish stocks. Substrate is typically classified by direct observation of video; however, in some cases positive identification of substrate is not possible. Consequently, invertebrates were used to assist in the identification of substrate. For example, a section of the benthos was obscured by dense hydroid growth; however, rocky substrate could be inferred by the presence of a species of sea cucumber that is exclusively associated with rock. Another application for this type of substrate classification is for surveys that occur in deep water, such as the Southeast Alaska sablefish pot survey. In the pot survey substrate type is important for prevention of gear entanglement and to assess fish size or density variance in habitat utilization. Careful assessment of invertebrate bycatch on sablefish gear could provide greater resolution of benthic substrate to optimize set locations. This multi-disciplinary approach could be used for a wide variety of studies for which habitat information is difficult to assess or is in need of independent confirmation.

SESSION: Habitat science to support fisheries management in Alaska marine ecosystems

Coral habitat of the eastern Bering Sea slope

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Some of the largest submarine canyons in the world incise the eastern Bering Sea shelf break. In this presentation, we examine coral habitat for five large canyons (Bering, Pribilof, Zhemchug, Pervenets and Navarin) within the eastern Bering Sea, as well as the areas lying between these five canyons. We compiled data from the eastern Bering Sea that included trawl survey data on fish and invertebrate distributions and observations of ocean conditions and benthic habitat. Based on multivariate techniques, one notable feature of these canyons is that about one quarter of the coral habitat predicted for the eastern Bering Sea slope occurs in Pribilof Canyon, an area that comprises only about 10% of the total slope area. The predicted coral habitat also extends westward along the adjacent slope, indicating that this coral habitat concentration is not unique to Pribilof Canyon but rather the general area (Pribilof Canyon and westward). During 9 August-5 September 2014, we also conducted a drop camera survey of the eastern Bering Sea shelf break and upper slope. The purpose was to groundtruth the locations of coral habitat based on the trawl survey data. A total of 252 camera drops were completed. Complete analysis of the camera drop images will take several months. However we anticipate that presence-absence screening for coral will be complete by early October, which we will report in this presentation.

SESSION: Habitat science to support fisheries management in Alaska marine ecosystems

Habitat Suitability Models for Groundfish in the Gulf of Alaska

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Estimating annual reproductive success for groundfish populations is a daunting process primarily due to limited critical early life stage data and knowledge gaps of the processes that influence recruitment during these stages. Habitat-based predictors that may improve estimates of groundfish reproductive success, include habitat suitability at the end of the critical period and the influence of encountering preferred habitat on early life survival. In this case study, we characterize preferred habitat for a set of groundfish species and their early life stages in the Gulf of Alaska (GOA) and explore the most appropriate use for this information as a final step to determine early life survival. This project is part of a larger integrated ecosystem research program (GOA IERP) with the main objective to identify and quantify the major ecosystem processes that regulate recruitment strength of five commercial and ecologically valuable groundfish species. To that end, we generated gridded bathymetry and sediment surfaces from datasets that were previously developed for this research program. Multi-scale terrain analysis was then performed on these surfaces to develop a suite of benthic predictor variables to evaluate species-specific habitat suitability. Given the paucity of observations for these early life stages, we developed presence-only habitat suitability models using maximum entropy modeling for each species. We plan to incorporate this habitat suitability information into the population ecosystem assessment for these groundfish species to help inform recruitment indices for fisheries management.

USING GENETICS TO ADDRESS RESOURCE MANAGEMENT CHALLENGES

Session Chair: Sara Gilk-Baumer
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In Alaska, much of the work in genetics research and application has been on species such as salmon, groundfish, and shellfish. Resource management challenges for these species are heavily weighted towards the effects of harvest. However, challenges exist for the breadth of aquatic species in Alaska, from small localized populations to widespread keystone species. For example, genetic research presented at the last several years of Alaska Chapter AFS meetings included exploited and unexploited freshwater species and narrowly and broadly distributed fishes. Harvest concerns may not exist for all of these species, but all face challenges from climate change, human-induced activities, and natural forces. Genetics is a powerful and highly valuable tool for addressing increasingly complicated resource management questions regardless of the source of inquiry. The focus of this symposium is broad and will highlight recent and future applications of genetic data to issues related to aquaculture, fishery management, and conservation.

SESSION: Using Genetics to Address Resource Management Challenges

Overview of current genetic methods: Bridging disciplines to solve today's challenges in resource management

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Recent advances in genetic technologies have augmented methods well suited to help solve today's challenges in resource management. Genetic methods can be used for species identification, population genetics, mixed-stock analysis, individual assignment, and parentage analysis. These methods can inform questions in the disciplines of ecology, fishery management, and fish culture. This presentation will walk through methods currently available, provide examples of how these methods are being be applied for resource management in Alaska, and review variables to consider when identifying the most appropriate methodologies.

ATGUGA - the beginnings of a graphical application to evaluate Markov chain parameters estimating Hardy-Weinberg Equilibrium statistics of multi-allelic microsatellite markers

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Hardy-Weinberg equilibrium (HWE) determinations are central in population genetics statistics. HWE evaluations of multi-allelic microsatellite markers are often determined using the Markov chain algorithm of Guo and Thompson (1992). Based on their original C code, a graphical C++ program is being constructed to help visualize the impacts of chain switches on the resulting estimated p-value. The goal of the program is to help users evaluate the most reliable Markov chain parameters for multi-allelic markers.

Power analysis of parentage study for the Alaska Hatchery Research Program

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The Alaska Department of Fish and Game conceived the Alaska Hatchery Research Program (AHRP) to address questions regarding the impact of large-scale hatchery releases on the productivity and sustainability of natural stocks. One of the primary questions of the AHRP regards the impact of straying of hatchery pink and chum salmon on fitness (productivity) of natural pink and chum salmon stocks in Prince William Sound and Southeast Alaska. To address this question, the Gene Conservation Laboratory (GCL) is using genetic parentage analysis to reconstruct the pedigrees of naturally-spawning salmon in order to determine the relative reproductive success (RRS) of hatchery-origin to natural-origin fish. However, due to limitations of working in these systems, not all parents or offspring can be sampled under the current sampling plan. We performed a power analysis on simulated genetic data to assess our ability to detect differences in RRS based on two different hatchery stray rates, six sampling levels of spawners, six sampling levels of recruits, and four effect sizes (true RRS of hatchery-origin to natural origin fish). Our findings demonstrate a clear need to sample a high proportion (0.5 or greater) of both spawners and recruits to reliably detect fitness differences between hatchery-origin and natural-origin fish, especially for systems with low stray rates and when fitness differences are less than 50%.

Yukon River salmon genetic population structure; exploration of two hypotheses to explain similarities between chum and Chinook

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Chum salmon (*Oncorhynchus keta*), and Chinook salmon (*O. tshawytscha*), exhibit similar patterns of broad-scale genetic population structure in the Yukon River drainage. Each species has distinct upper and lower river groups separated by a longitudinal divide that occurs in interior Alaska. We explore two hypotheses to explain this phenomenon; extant population structure is the result of population expansion from 1) a single refugium (Beringia), or 2) two refugia (Beringia and Upper Yukon). While not conclusive, evidence provided by genetic baselines for each species favors the two-refugia hypothesis. Here we present map-based, graphical depictions of baseline for both species, and our rationale for favoring the two-refugia model.

Mixed Stock Analysis of Commercial Harvest Bering Cisco (Coregonus Laurettae) From Northwest Alaska

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Bering cisco Coregonus laurettae are anadromous salmonids with known spawning populations only in the Yukon, Kuskokwim, and Susitna rivers in Alaska. Bering cisco are actively harvested at the mouth of the Yukon River in a commercial coregonid fishery targeting Bering cisco for a market in New York City. Rearing Bering cisco are broadly distributed in coastal habitats and the commercial harvest was hypothesized to be a mix of Yukon and Kuskokwim River fish due to their proximity. The primary objective of this investigation was to estimate the population composition of the annual commercial harvest at the mouth of Yukon River using genetics methods to help direct future population monitoring activities. To accomplish this objective, we developed microsatellite baselines and quantified genetic diversity among the three known spawning populations. Baseline tissue samples were analyzed from the Yukon (n = 273), Kuskokwim (n = 266), and Susitna (n = 211) River spawning populations during 2009, 2010, and 2011. Mixed stock analysis was conducted on samples from the Yukon commercial harvest during 2010 (n = 731), 2011 (n = 565), and 2012 (n = 466) with results indicating the Yukon River population was the main contributor to the commercial harvest across all three years. The 95% confidence intervals for the proportion of Yukon River fish in the samples included 1.0, and for the proportion of Kuskokwim River fish in the samples included 0.0. These data indicate that the fishery is comprised of Yukon River fish with negligible or no contribution of Kuskokwim fish.

SESSION: Using Genetics to Address Resource Management Challenges

Population Genetic Structure and Mating System of Red and Blue King Crab

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Red king crab (Paralithodes camtschaticus) and blue king crab (P. platypus) are species of considerable economic and ecological interest, but both have checkered histories of boom and bust. To increase our understanding of these species, we examined their population genetic structure and mating system using microsatellite genetic markers. Red and blue king crab show similar genetic patterns that likely reflect shared life history characteristics and distributions. For example, they show similar levels of overall population genetic divergence, and Southeast Alaska populations are the most divergent in both species. Each species shows changes in allele frequencies over time indicative of possible population bottlenecks in some parts of their ranges. Red king crab show signals of past population bottlenecks in Bristol Bay, Deadman's Reach, and Gambier Bay. Blue king crab samples collected over time from the Pribilof and St. Matthew Islands imply that genetic drift has influenced allele frequencies in these populations, as well. Genotypes of multiple red and blue king crab females and their sampled broods indicate single paternity is the dominant mating system in both species.

Improving our understanding of lamprey biology using evidence from genetics

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The Arctic Lamprey (*Lethenteron camtschaticum*) is broadly distributed in the North Pacific and surrounding lands. It shares with other species of lamprey a complex life history that involves major anatomical and physiological changes in the transition between the larval endobenthic filter feeding stage and the juvenile/adult free-swimming stage. Following metamorphosis, lampreys may undertake extensive migrations to the ocean to feed or they may bypass the marine stage to migrate to spawning grounds to complete the semelparous life cycle that is characteristic of all lampreys. We are currently using a suite of genetic techniques to improve our understanding of Arctic lamprey populations in Alaska. We tested the validity of the Alaskan brook lamprey as a species by examining mitochondrial genetic variability in a broad sample of larval and adult lamprey. Comparative analysis of these DNA sequences suggests that the endemic 'brook' lamprey of Alaska is a genetically indistinguishable life history variant of the wide-ranging Arctic lamprey. This finding is in line with results of other studies of non-migratory species of lamprey and it highlights an intriguing form of phenotypic plasticity. We are now using microsatellite genotypes to characterize the genetic structure of Arctic lamprey populations across a range of geographic scales. Finally, genetic tools will add a novel perspective on the diet of Arctic lampreys during the marine phase. The DNA sequence-based identification of the species composition of gut contents will complement existing diet composition information generated from analysis of lamprey-scarred fish in commercial fish catches.

SALMON ECOLOGY

Session Chair: Joe Orsi
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This session will focus on the ecological interactions and migrations of salmonids over a variety of aquatic and marine habitats. The salmonid species showcased will include: Chinook salmon, sockeye salmon, coho salmon, chum salmon, pink salmon, and brook trout.

Topics covered will include: freshwater resource portioning, energetics modeling, the effects of climate change on live history strategies, interspecific interactions, salmon forecasting, and ocean distribution patterns of ESA stocks.

SESSION: Salmon ecology

Feeding ecology of juvenile sockeye salmon and resource partitioning with threespine stickleback in Afognak Lake, Alaska

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The freshwater rearing phase for sockeye salmon, *Oncohynchus nerka*, is a critical period of growth for juveniles before they migrate to sea. Freshwater sockeye growth is dependent on a suite of variable biotic and abiotic factors such as temperature, food quality and quantity, and density of competitors. Afognak Lake near Kodiak, Alaska, is relatively shallow and oligotrophic, and has historically been described as "food limited" for juvenile sockeye. The Alaska Department of Fish and Game has been monitoring adult sockeye salmon returns, smolt outmigration, and limnological conditions in Afognak Lake; however, little is known about the feeding ecology of Afognak sockeye salmon. We collected stomach contents of juvenile sockeye salmon (N=221) in Afognak Lake during productive summer months. Our objective was to quantify the diets and characterize temporal and ontogenetic variation in juvenile sockeye diet composition. Because considerable spatial and temporal overlap has been observed in both habitat and prey of juvenile sockeye salmon and threespine stickleback, *Gasterosteus aculeatus*, in other sockeye nursery lakes, we also examined diets of threespine stickleback (N=203). Juvenile sockeye salmon diets consisted mostly of dipterans and other insects and stickleback diets consisted of a large variety of benthic invertebrates. We used the multivariate analysis tools of NMDS and ANOSIM to describe differences in their diets and resource partitioning. Results from this study help contribute to a better understanding of juvenile sockeye salmon foraging behaviors, intra and interspecies interactions, and food web dynamics within sockeye nursery lakes.

SESSION: Salmon ecology

Habitat selection in an Appalachian brook trout population explained by riverscape energetics

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Growth potential, distributions, and habitat selection have often been modeled by energetics in stream fishes. However, decisions on habitat selection by stream fishes must also consider the relative risks associated with movement and exploitation of new habitat. We used bioenergetics software with stream temperature models, seasonal mark-recapture growth data, and seasonal foraging data to explain brook trout habitat selection within the Shavers Fork watershed, WV. We found brook trout growth was maximized when using main stem habitat during cold years, while the average tributary foraging position supported better growth than most main stem habitats in hotter years. Main stem temperatures were often outside the optimal brook trout growth ranges in summer, providing growth advantages to tributary dwelling fish. In fall, growth was greatest in the main stem than tributaries, likely due to spawning. Our results confirm the main stem as important brook trout foraging habitat, by providing higher quality prey and reducing density-dependent effects from crowded tributaries. Our results along with climate change predictions of increased water temperature indicate main stem foraging by brook trout will be substantially reduced. This could prove detrimental to brook trout productivity on the riverscape, by confining higher numbers of brook trout to already food and space limited tributaries.

SESSION: Salmon ecology

Inference about size, growth, and age from juvenile salmon fork length data

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Juvenile salmon are challenging to sample given their vulnerability to physical harm during handling, and their difficulty to locate, particularly when repeated samples on individuals are required. Fork length data present a simple, relatively low-cost source of information on juvenile salmon, which can provide insight into growth, size, and age. We demonstrate methodology to use length frequency distributions and finite Gaussian mixture models to determine size at age at a given sample time and location, optimal age-discriminating fork lengths, and estimates of growth. We find the method to be feasible at relatively low sample sizes, with estimates most accurate when age cohorts are clearly separated by size. We present a case study on juvenile coho salmon from two waterways in the Big Lake drainage in Southcentral Alaska. Results indicate consistent differences in growth and size at age across the two small watersheds which are separated by only a few miles, suggesting fine scale variation in size and growth of juvenile coho salmon across the Big Lake landscape.

SESSION: Salmon ecology

Site fidelity and its implications for the survival of overwintering juvenile Chinook salmon in a south-central Alaskan system

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In order to investigate the effect of winter (October – April) movement on juvenile stream-type Chinook salmon (*Oncorhynchus tshawytscha*), we examined the difference in overwinter survival for individuals that had either emigrated from or had fidelity to a small tributary in south-central Alaska. Our study design and multistate modeling approach utilized passive integrated transponder (PIT) technology to consider both live recaptures of individuals during discrete sampling occasions and continuous data collected by monitoring movements of PIT-tagged fish. Parameter estimates from the best supported models provided strong evidence for size-dependence in both survival and fidelity. The lower survival and tributary fidelity rates for smaller juveniles suggests that intraspecific competition for limited food resources and space during winter may be a major mechanistic driver of overwinter survival.

SESSION: Salmon ecology

Factors limiting freshwater growth of juvenile Chinook and coho salmon in a large, glacial watershed

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Freshwater growth of juvenile salmon (*Oncorhynchus* spp.) can strongly influence their early marine survival, subsequent ocean growth, and overall stock productivity. The growth rates of salmon are physiologically controlled by temperature and the amount and quality of food they ingest, and these factors vary dramatically among and within watersheds. We sampled juvenile Chinook and coho salmon in glacially influenced mainstem and side channel habitats, sloughs, and clear-water tributaries in this ongoing study within the Susitna River watershed. We quantified diet composition with stomach content analysis and stable isotopes, and we determined growth rates using size frequency and scale analysis. We used bioenergetics models to determine how water temperature, food availability, and food quality influenced the growth of juvenile salmon. Salmon shifted from an invertebrate-based diet to primarily salmon eggs and fish when they reached larger sizes. Observed growth rates were similar to those described in prior decades in this system, despite record-breaking high air temperatures during summer 2013. Preliminary modeling for a subset of habitats indicated that growth was strongly limited by food intake, while temperature and food quality were less important. Future research will determine how feeding rates are influenced by invertebrate drift density, flow velocity, and turbidity using growth rate potential models. Understanding how environmental factors interact to provide a mosaic of growth opportunities within large, complex watersheds is important for managing fish stocks and their habitats in the face of environmental change.

SESSION: Salmon ecology

Climate effects on sockeye salmon production: are clearwater and glacial lakes in sync?

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The Kenai River's sockeye salmon runs are supported by production from both glacial and clearwater lakes, introducing a unique opportunity to explore how salmon population dynamics contrast in general, and how climatic drivers impact salmon residing in these distinctive habitat types. We hypothesize that productivity will be out of phase, with clearwater lakes being most productive during warm periods and glacial lakes being most productive during cool periods. Since warming impacts on glacial systems include increased suspended silt and decreased productivity, cooling periods would enhance euphotic volume and prey productivity. We constructed brood tables and calculated recruits per spawner (R/S) for the major clear-water (i.e., Russian River) and glacial (the remainder of the run) components of the Kenai sockeye run using escapement and harvest data from 1970-present. Surprisingly, R/S for the clearwater and glacial run components were closely synchronized and of similar magnitude, suggesting that ocean conditions may mask any differences in productivity due to varying habitat conditions in nursery lakes. Ongoing analyses will examine the influence of climate during the freshwater phase (i.e., air temperature, precipitation, discharge) and marine phase (near-shore sea surface temperatures, PDO) on the productivity of both run components.

SESSION: Salmon ecology

Reconstruction of Ocean Entry Timing and Growth Rates of Juvenile Chum Salmon in Alaskan Waters of the Chukchi and Northern Bering Seas

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Recent climate change is most pronounced in the Arctic, with many implications for shifts in juvenile salmon distributions and life-history patterns. This may include expansion of sub-Arctic species poleward, altered timing of runs, and timing and success of key life-history stages. Chum Salmon are the most widely distributed Pacific salmon; however, few studies have examined their early marine life history. The objectives of this study were to determine ocean entry timing of Chum Salmon in the Chukchi and northern Bering seas and increase our understanding of their early life history characteristics. Inductively coupled plasma-mass spectrometry (ICP-MS) was used to detect changes in strontium concentrations along a cross section of sagittal otoliths to show entry into the marine environment. Entry dates of Chum Salmon from summers of 2012 and 2013 were determined using daily otolith increments and compared to data collected in 2007 (a year of minimal sea ice) to make temporal and regional comparisons. Results show that entry dates ranged from mid-June to mid-July, with both regions exhibiting similar characteristics with respect to entry timing. Larger individuals from both regions enter earlier than smaller individuals, although Chukchi Sea individuals in 2013 had an earlier mean entry date than northern Bering Sea individuals the same year and in both regions in 2007 and 2012. Juvenile length-at-age growth did not significantly differ across regions and years. This look into early life history and growth of Chum Salmon can inform predictions of the effects of climate change on future distribution and production of stocks.

SESSION: Salmon ecology

Juvenile chum (*Oncorhynchus keta*) and pink (*O. gorbuscha)* salmon growth and condition in warm and cool spring thermal regimes of the northeastern Bering Sea

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The Bering Sea region has alternated between warm and cool spring thermal regimes and in recent years has remained in a "cool" state. Large-scale ocean processes clearly influence salmon populations, but the mechanisms connecting oceanography to salmon growth and condition remain elusive. We first used data collected in the northeastern Bering Sea (NEBS) from 2003 to 2013 to test for differences in juvenile chum and pink salmon size and condition (weight/length residuals and energy density) between thermal regimes. During cool years, pink salmon were shorter and chum salmon showed increased energy density, but no other aspects of size and condition differed significantly. Second, we explored relationships between size, condition, and growth of juvenile salmon and environmental conditions at the time of capture. For both species, longer individuals were caught over deeper bottom depths and in cooler temperatures. Weight/length residuals decreased with bottom depth, suggesting that as fish moved offshore they allocated energy to length rather than energy storage. Higher energy densities were correlated with cooler temperatures and shallower depths. Cooler temperatures facilitate fat storage in salmon and are associated with energy-dense prey. Insulin-like growth factor-1, an indicator of relative growth rate, increased from 2009 to 2012 and was positively correlated with temperature for chum salmon and depth and length for pink salmon. Our results suggest spring thermal regimes in the Bering Sea do not seem to characterize growth and condition of juvenile salmon. Future warming may not enhance growth and condition of juvenile chum and pink salmon within the NEBS.

SESSION: Salmon ecology

Impact of size-selective mortality on juvenile life-history patterns in Yukon River Chinook salmon

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A size-selective mortality model was applied to juvenile life-history types present in Yukon River Chinook salmon during 2011 to estimate the selective pressure against late outmigrating subyearling Chinook. Chinook salmon are known to either remain in freshwater for a full year and migrate to the ocean early in the summer growing season (yearlings), or smolt during the same year of hatching (sub-yearlings) and migrate to ocean later in the year than yearlings. The size-selective mortality model was constructed for Yukon River Chinook salmon in the northern Bering Sea based on size distributions of juveniles (2002-2007) and survivors. Survivor size distributions were estimated from scale growth histories of returning adults (2004-2011). Size-selective mortality was modeled with a generalized additive model fit to mortality probabilities at juvenile weight intervals. Juveniles had a lower average weight (141 g) and minimum weight (18 g) than the estimated size of survivors (average weight of 169 g and minimum weight of 62 g). This model was applied to juvenile life-history patterns during September, 2011, based on whole-body stable isotope signatures. Juvenile life-history type can be distinguished with stable isotopes as late outmigrating subyearling still retain freshwater isotope signature, whereas early outmigrants (yearlings) have full marine isotope signatures. Model estimates of size-selective mortality probability were lower for yearlings than subyearlings, indicating strong selective pressure exists against late outmigration and the expression of the sub-yearling life-history type in Yukon River Chinook salmon.

SESSION: Salmon ecology

Marine versus freshwater factors for explaining relationships between pink salmon escapements and coho salmon brood returns

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Several different correlations have been documented along the Pacific coast relating pink salmon (*Onchorynchus gorbuscha*) escapement levels and coho salmon (*O. kisutch*) brood returns. It has been hypothesized that these relationships result from either correlated responses to ocean conditions or from freshwater conditions related to marine-nutrient effects. In this study, simulated spawner-recruit models relating coho salmon returns to pink salmon population dynamics were used to examine how various correlations would manifest themselves relative to alternative hypotheses. Two spawning streams were used in the simulations: the North River in western Alaska and Ford Arm Creek in Southeast Alaska. Pink salmon escapement and coho salmon return data were simulated utilizing spawner-recruit models fit to the original data series. Freshwater effects were modeled by linking the coho salmon capacity parameter, β,, to pink salmon escapements in the years when coho salmon juveniles would be rearing in freshwater. Ocean effects were modeled by linking the error term, ε, in the coho salmon spawner-recruit model to the residual from the pink salmon spawner recruit model returning in the same year. 500 simulations were run for each parameter combination, and for each simulation four correlations were measured. Correlations interpreted as arising from marine-nutrient effects were most likely to be produced by freshwater effects whereas correlations associated with shared responses to marine conditions were only produced by ocean effects. Freshwater effects also demonstrated the highest probability of producing marine-nutrient correlations within the 90% confidence intervals of those measured in the true data series.

SESSION: Salmon ecology

The use of ecosystem metrics for pre-season forecasts of pink salmon harvest in Southeast Alaska: What have we learned?

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Research conducted by the Alaska Fisheries Science Center's Southeast Alaska Coastal Monitoring (SECM) project has provided "mostly accurate" pre-season forecasts of pink salmon harvest to the resource stakeholders of Southeast Alaska for over a decade. The SECM project collects biophysical data associated with seaward migrating juvenile salmon, from May to August, and uses this data along with larger basin scale indexes to forecast adult pink salmon returns to SEAK the ensuing year. Because pink salmon only spend one ocean winter at sea, they lack leading indicator information from sibling models which are available for most other salmon species. Consequently, forecasting pink salmon has often failed leaving managers and stakeholders with more questions than answers. A goal of this presentation is to provide a conceptual model of key factors that contribute to favorable conditions for high pink salmon production in the SEAK. Finally, an overview of the "track record" of the SECM forecasting will be shared, as well as an introduction to a newer forecast approach that incorporates a broader range of ecosystem indicators in a qualitative fashion.

SESSION: Salmon ecology

Ocean distribution and occurrence of Chinook salmon (*Oncorhynchus tshawytscha*) stocks listed under the Endangered Species Act (ESA) from Coded-Wire Tag (CWT) recoveries, 1981-2013

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At the Auke Bay Laboratories Coded-Wire Tag (CWT) Lab at the Ted Stevens Marine Research Institute (TSMRI), CWTs have been recovered from tagged salmon sampled in the bycatch of Federally-managed groundfish fisheries, as well as foreign and domestic research surveys in the Gulf of Alaska (GOA) and Bering Sea-Aleutian Islands (BSAI) since 1981. Historically, snouts have been collected from tagged salmon based on the visual detection of a missing adipose fin. In 2012 and 2013, however, several new programs were initiated to increase the sampling rate for CWTs by using electronic detection of CWTs to scan large numbers of fish. The higher sampling rate has resulted in the recovery of higher numbers of Chinook salmon (*Oncorhynchus tshawytscha*) originating from stocks listed as Threatened or Endangered under the Endangered Species Act (ESA).

The most prevalent ESA-listed stock recovered in Alaskan ocean trawl fisheries has historically been the Upper Willamette River (UWR) Evolutionarily-Significant Unit (ESU). The 20 recoveries of UWR Chinook salmon in 2012 and 2013 were the most since 2000-2001. Additionally in 2013, the first-ever Puget Sound (PS) Chinook salmon, the first Lower Columbia River (LCR) Chinook salmon since 2004, the first Snake River spring/summer (SRss) Chinook salmon since 1983, and the first CWT Upper Columbia River spring (UCRs) Chinook salmon since 1998 were all recovered in the GOA groundfish fisheries. The 8 CWT recoveries of Snake River fall (SRf) Chinook salmon in 2012 and 2013 were the first-ever recoveries from this ESU in the GOA. Historical distribution maps are shown.

LIFE ON THE HALF-SHELL: BIOLOGY, ECOLOGY, AND MANAGEMENT OF ALASKA'S SHELLFISH RESOURCES

Session chair: Joel Webb
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Crustaceans, mollusks, and echinoderms are ecologically important and support valuable commercial fishing and aquaculture industries in Alaska. Yet for many species knowledge of life history and factors affecting resilience is limited. This session will highlight research on shellfish biology, ecology, mariculture, and management in Alaska.
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Sea otter foraging on commercially important shellfish in southern Southeast Alaska

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The recolonization of sea otters in Southeast Alaska has resulted in direct competition with humans for shellfish. Sea otters were exterminated in Southeast Alaska during the 18th-19th century fur trade, and their shellfish prey flourished for the last 100-200 years in their absence. To quantify the direct impact of sea otters on commercially important invertebrate species, we investigated sea otter foraging in southern Southeast Alaska, the area of most intense conflict. We quantified how sea otter diet changes as a function of time of occupation and density using sea otter density data calculated on small spatial scales in southern SEAK from 1975-2011 and sea otter foraging observations from 2010-2012 (n=699 bouts, 6,117 foraging dives). Commercially important invertebrate prey species observed in sea otter diets include red sea urchins, Dungeness crab, California sea cucumbers, pinto abalone, geoduck clams, red king crab, Tanner crab and several species of shrimp. We found that diet diversity increased logarithmically as a function of the duration of sea otter occupation and that the fraction of commercially important invertebrates in the diet decreased with sea otter density and time of occupation. Several areas in the region showed evidence of sea otter sub-populations reaching or exceeding carrying capacity as preferred prey species were reduced; however in most regions, sea otters density increased without limitation. We expect that the sea otter population in southern Southeast Alaska will continue to expand until preferred resources are reduced across the region, with increasing conflict for commercial and subsistence shellfish fisheries.

Seasonal patterns in nutrient utilization and storage by the California sea cucumber (*Parastichopus californicus*) from Southeastern Alaska

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Parastichopus californicus is a profitable Alaskan fishery species; however, commercial divers are concerned about recent population declines. Causes are unknown, but diet shifts have been hypothesized to play a role. Previous aquaculture studies have demonstrated that limitations in fatty acids (e.g. EPA and DHA) can cause reduced growth rates and egg production. Many lipids and fatty acids metabolically required cannot be synthesized by marine animals, and must be acquired from primary producer derived foods and then stored in tissues for use throughout the year. Here, in-situ collections assessed how the type and amount of foods consumed, total lipid, and specific fatty acids varied with natural seasonal cycles of growth and reproduction in *P. californicus*. Eight collections were done near Ketchikan, AK, from April 2012 to August 2013. At each collection, females were dissected, and tissues separated for lipid extraction using dichloromethane accelerated solvent extraction. Fatty acid compositions of the lipid extracts were then quantified using gas chromatography with a flame ionization detector. Gut contents were also identified to demonstrate seasonal variations in food supply. Patterns in total lipid content reflected energy storage and allocation, while seasonal changes in the relative abundance of fatty acids in each tissue identified specific limiting nutrients essential for population health throughout the year. Results from this study have the potential to improve management of this lucrative Alaskan fishery by formulating baseline nutritional data on *P. californicus* that could suggest their potential resilience to future shifts in phytodetritus food supplies in light of changing oceanographic conditions.

SESSION: Life on the half-shell: biology and ecology of Alaska shellfish

A Look at Bivalve Shellfish Aquatic Farming in Alaska

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Alaska Department Fish and Game (ADF&G), in collaboration with Department of Natural Resources and Environmental Conservation, manages aquatic farm operations and their activities in Alaska. The agency's obligations dictate that 1) operations be conducted in a manner that causes no significant alteration to established use of fish and wildlife resources and does not adversely impact their habitat and 2) operations demonstrate continued improvement in production above what would occur in natural conditions using managed cultivation methods. The bivalve shellfish aquatic farm industry consists mostly of "mom and pop" operations and some partnerships and tribal corporations. Production has been pretty steady over the years, but a recent surge in Pacific oyster production topped 1.2 million oysters cultured and sold this year, totaling $712,365 in farm gate value, an increase of 35%. For many years, the bivalve shellfish aquatic farm industry growth and maturity has been hampered by seed quality and quantity, labor, capital, and controversy over wildstock harvest. Increased number of seed suppliers, improvements on husbandry practices to increase throughput and lower labor costs, new experimental culture of mussels and intertidal geoduck clams, and regulatory changes, all promise to further increase production in bivalves and workforce development for rural communities of Alaska. This talk will discuss the review and permitting process, status of the industry, challenges, and development potential of this industry.

Dietary lipids improve the nutrition and condition of red king crab larvae (*Paralithodes camtschaticus*)

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Diets supplemented with essential fatty acids improve red king crab (*Paralithodes camtschaticus*) larval nutrition and condition. Larvae were fed *Artemia* nauplii enriched with lipid emulsions varying in the following essential fatty acids: 1) high docosahexaenoic acid (DHA), 2) high DHA and eicosapentaenoic acid (EPA), 3) high DHA and arachidonic acid (AA), and 4) a control lipid (equal in total lipid but low essential fatty acids). Larval condition, assessed by viewing size and number of lipid droplets, was not significantly different among the four diet treatments during the zoeal stages. However, during the glaucothoe stage, larvae that were fed diets enriched with high DHA and EPA and high DHA and AA had more and larger lipid droplets than larvae that received either the DHA or control diets. Biochemical analyses showed that proportions of essential fatty acids were significantly different in crabs from all dietary treatments during both the fourth zoeal and glaucothoe stages. During the crucial glaucothoe stage the total fatty acids per wet weight (mg/g) was significantly lower in crabs fed the control diet (low essential fatty acids). Further, during a stress test, that measured response time after exposure to freshwater, glaucothoe previously fed the control lipid diet recovered significantly slower than individuals previously fed high essential fatty acid diets, suggesting that essential fatty acids can improve performance during stress. These results will improve larval nutrition and assist with assessing the feasibility of rehabilitating king crab stocks that crashed in the early 1980's throughout Alaska.

SESSION: Life on the half-shell: biology and ecology of Alaska shellfish

Locally-based investigations of king crab habitat ecology in the Pribilof Domain

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Characterizing current patterns of wild king crab habitat use, species interactions and early life history are vitally important for understanding potential bottlenecks in survival and recovery of king crab stocks in Pribilof Domain. Exploratory ecological investigations on king crab ecology from 2007-2014 inside and outside the Pribilof Island Habitat Conservation Zone (PIHCZ) have yielded insights into benthic nursery habitat distribution, adult habitat selection, halibut predation patterns, and larval distribution.

Multibeam sonar imagery and in situ observations confirm that essential shellhash habitat for juvenile rearing is still distributed within Pribilof Domain shallows, while adults occupy shelf and deep canyon habitats within and beyond the PIHCZ. A cooperative study with Pribilof area fishermen indicated that halibut in the region continue to have a higher frequency of Chionocetes and other invertebrates in their diets than king crab species. Across thirteen spring and summer zooplankton sampling events, aggregations of red and blue king crab larvae (late stage zoea) were observed in single year, mid-summer, in waters about 20 km offshore from St. Paul Island. Fine scale current structure influencing larval retention in gyres, gelatinous zooplankton predation and highly episodic spawning events by patchily distributed adults were examined as potential factors controlling distribution and survival of king crab larvae in Pribilof Domain.

Feasibility of direct age determination in commercially important crustaceans in Alaska

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Management of commercially important crab and shrimp stocks in Alaska has been hindered by the inability to directly determine individual age. A lack of comprehensive age information leads to poor understanding of life history schedules, difficulty in estimation of parameters necessary for modeling population dynamics, and uncertainty in the determination of appropriate harvest levels. This study evaluated the feasibility of applying a novel direct age determination method based on band counts to red king crab (*Paralithodes camtschaticus*), Tanner crab (*Chionoecetes bairdi*), and spot shrimp (*Pandalus platyceros*). Molting in captivity confirmed that the gastric mill of red king and Tanner crab were retained through ecdysis. The endocuticle region of the cuticle, where bands are formed, was identified in gastric mill of the crabs and eyestalks of both crab and shrimps by histological staining. Gastric mills of crab and eyestalks of shrimp were processed by standard techniques similar to age determination in fish. Bands were present in these structures and mean band counts increased with increasing body size in all species. Controlled experiments and application of this technique to known-age individuals will be necessary to further develop and validate band counts as indicators of chronological age.

BRIDGING SPACE AND TIME: DISTRIBUTION AND MOVEMENT OF FISH IN ALASKA

Session chairs: Ben Williams[1] and Julie Nielsen[2]
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To manage fisheries appropriately, information on the spatial distribution of fish populations and knowledge of how their distributions change over time is critical. Studies that provide information on fish spatial distributions (e.g., from systematic surveys or spatial trends in CPUE) provide an overall view of population distribution and habitat associations. However, movement studies that feature tagging of individual animals can provide insights into the mechanisms underlying population spatial structure. Spatial distribution and movement studies together provide opportunities for greater understanding of the spatial and temporal dynamics that may inform us of fish population responses to climate change or different management options. This session will feature talks ranging from movement of individual fish (e.g., tagging studies) to spatial and seasonal distribution of fishes (e.g., survey studies) to examples of benefits to fishery management that may occur when both types of information are available.

SESSION: Bridging space and time: distribution and movement of fish in Alaska

Seasonal movements of Rainbow Trout (*Oncorhynchus mykiss*) in the Susitna River Basin, Southcentral Alaska

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Anthropogenic development and climate change threaten fishes and their habitats, even in relatively pristine watersheds such as those in Alaska. As such, a better understanding of seasonal movements across multiple spatial scales will assist managers in monitoring, protecting, and rehabilitating native fish populations. Little is known about potamodromous Rainbow Trout movements, so we used a combination of aerial and on-the-ground radio telemetry tracking to characterize seasonal movements and habitat use across a complex Southcentral Alaska riverscape. Seven monthly aerial surveys of trout tagged in 2013 (N = 20) and 2014 (N = 28) indicated fish utilized slow-moving areas of the Susitna River near tributary mouths as overwintering habitat from November-April, then ascended clearwater tributaries to spawn in upper reaches in May and June. Post-spawning, fish moved downstream to lower tributary reaches to feed. Soon after the arrival of spawning salmon in midsummer, trout were concentrated upstream near areas of high salmon spawning activity. After the peak salmon spawning period, and when water temperatures dropped at the onset of autumn, tagged fish slowly descended to lower reaches of tributaries. Our future work will include investigating whether movements of Susitna Basin trout vary by sex, and modeling trout resource selection at the habitat unit, stream reach, and valley segment scales. Results of this work could be applied to trout populations found in similar drainages in Alaska to identify critical habitats and movement corridors, which will be useful for prioritizing habitat protection efforts in light of anticipated future land use and climate change.

SESSION: Bridging space and time: distribution and movement of fish in Alaska

Spawning Distribution of Bering Cisco in the Yukon River

Randy J. Brown and David W. Daum (retired)
U.S. Fish and Wildlife Service, 101 12th Ave, Room 110, Fairbanks, AK, 99701

Bering Cisco *Coregonus laurettae* are anadromous salmonids with known spawning populations only in the Yukon, Kuskokwim, and Susitna rivers in Alaska. The spawning area for Bering Cisco in the Susitna River was delineated in the early 1980s during an intensive period of fisheries research associated with potential hydroelectric development in the drainage. A radio telemetry project is currently underway in the Kuskokwim River to delineate Bering Cisco spawning areas there. Fall sampling studies in the upper Yukon Flats during the late 1990s identified spawning Bering Cisco in the area but did not delineate the upstream and downstream extent of the spawning area. This study was designed to delineate the geographic spawning distribution of Bering Cisco in the Yukon River. One hundred radio transmitters per year in 2012 and 2013 were deployed in pre-spawning Bering Cisco between late June and early August. A total of 160 fish survived fish wheel capture and tagging, avoided harvest and predation after tagging, and continued migrating upstream to spawning destinations. Approximately 79% migrated to spawn in the upper Yukon Flats, upstream from the mouth of the Porcupine River, and 21% migrated to spawn in the lower Yukon Flats. The proportional distribution between upper and lower Yukon Flats was statistically similar among years. These data indicate that the upper Yukon Flats is the spawning destination of most Bering Cisco in the Yukon River.

SESSION: Bridging space and time: distribution and movement of fish in Alaska

Migratory Behaviors of Rearing Juvenile Coho Salmon in the Big Lake Watershed, Alaska

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The freshwater life histories of juvenile coho salmon (*Oncorhynchus kisutch*) within the Big Lake watershed are diverse. Individuals have been observed rearing in freshwater habitats for one to four years before migrating to the Knik Arm as smolts. During freshwater residency, individuals utilize different seasonal habitats in an attempt to maximize fitness. Seasonal habitats are rarely the same; thus seasonal migrations between habitats are undertaken, often at a great cost to the individuals. This study seeks to understand and describe seasonal migratory behaviors and patterns of age 0 vs age 1+ juvenile coho during a single seasonal migration – the "winter redistribution" – which is the migration from summer rearing habitats to overwintering habitats. Over 6,000 juvenile coho were tagged during the summers of 2011/12 and subsequently tracked for the duration of their freshwater residencies using passive integrated transponder technologies. Specific winter redistribution behaviors described include: directional movement, overwintering habitat type selected and date of arrival, and linear distance traveled. Understanding seasonal freshwater migrations within a wetland watershed located within a highly populated area, such as the Big Lake watershed, is necessary to make informed decisions on fish passage restoration, design, and development, as maintaining habitat connectivity between summer rearing areas and overwintering areas is paramount for juvenile salmon population survival.

SESSION: Bridging space and time: distribution and movement of fish in Alaska

Abundance Estimates and Movement Patterns of Juvenile Sockeye Salmon Emigrants from Meadow Creek, Alaska, 2013

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Sockeye salmon *Oncorhynchus nerka* require diverse habitat types for completion of their freshwater life stages. Maintaining connectivity to sensitive habitats is of vital importance for the long-term stewardship of the species within the Matanuska-Susitna basin. At present, approximately 75 culvert road crossings exist within the Meadow Creek drainage, with 80% assessed as impediments to juvenile salmonid migration. Restoration activities to improve fish passage have been ongoing for the past 15 years; however, current fish passage engineering targets juvenile coho salmon *O. kisutch*. This study seeks to address questions related to movements of juvenile sockeye salmon from Meadow Creek to Big Lake. Study objectives focused on juvenile sockeye salmon movements within the Big Lake drainage, differential movements by cohort, and time of emigration. A total of 8,184 juvenile sockeye salmon were captured in the fyke net with fry comprising 89% of the total sockeye salmon catch. Two distinct size classes, cohorts, of juvenile sockeye salmon were observed; 29–54 mm and 69–124 mm. The low (<0.001%) capture proportion of sockeye salmon smolt suggests that Meadow Creek and its tributaries does not support significant numbers of summer stream rearing forms of sockeye salmon or smolt production. Fish passage design of restoration activities in the Meadow Creek drainage are adequate for sockeye salmon and design changes are not warranted at this time.

SESSION: Bridging space and time: distribution and movement of fish in Alaska

Spawning Distribution and Migratory Timing of Kuskokwim River Inconnu

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A multiple-year study utilizing radiotelemetry techniques was initiated in 2007 to expand our understanding of inconnu *Stenodus leucichthys* in the Kuskokwim River drainage. Management of the inconnu population for long-term sustainability requires a greater understanding of their life history. The primary purpose of this study has been to identify locations of spawning aggregations. So far, four spawning areas have been identified and examined in the upper reaches of the Kuskokwim River drainage: ≈ 20km section of Big River, ≈ 15km section of the South Fork Kuskokwim River, ≈2km section of the Middle Fork Kuskokwim River, and ≈ 15km section of the Tonzona River. Efforts were made during mid to late September 2010, 2012, and 2013 to capture and deploy radio transmitters into inconnu that may spawn at or near Highpower Creek, which was documented as a spawning area in 1972. However, no radio-tagged inconnu were captured or detected during aerial tracking flights at or near the mouth of Highpower Creek. Inconnu arrived at their spawning areas during late July through mid-September and spawned during late September through early October. Post-spawning outmigration occurred during a 1 to 1.5 week period in mid-October. Habitat characteristics of the sheefish spawning areas were similar with respect to spawning substrate, temperature, pH, conductivity, dissolved oxygen, and turbidity. Information gathered from this study can be used to design future studies to investigate the population dynamics of specific spawning stocks and stock abundance.

SESSION: Bridging space and time: distribution and movement of fish in Alaska

Community Composition of Nearshore Fishes in Southeast Alaska Estuaries

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Estuaries are highly productive and dynamic environments. In Southeast Alaska, glacially influenced estuaries could be impacted by rapidly receding glaciers and changes in rainfall. To assess broad-scale patterns of change in estuaries, it is important to first understand the variability in community composition across time and space. Nearshore fish communities were sampled by beach seine at three Juneau estuaries, along a gradient of glacial-influence, between April and September 2014. Our objective was to characterize composition and spatial and temporal variation of the nearshore fish communities in these estuaries. We hypothesized community composition, measured through biodiversity and relative abundance, would vary by sampling month and site based on differences in watershed characteristics. Fish assemblage, species richness, and relative abundance data were collected. A total of 8070 fish from 32 taxonomic groups were caught in 79 hauls over shallow sloping, sandy substrate. Pacific staghorn sculpin (Leptocottus armatus) and starry flounder (Platichthys stellatus) comprised 52% of the total catch. Other abundant fishes included juvenile salmonids (Oncorhynchus spp.), Dolly Varden (Salvelinus malma), and young of the year flatfishes (Pleuronectiformes spp.). Analysis of similarity and nonmetric multidimensional scaling were used to examine community composition between sites and months. The greatest variation in composition was observed between months with the greatest diversity of species observed during mid-summer. This work complements other research in Southeast Alaska that establishes baseline data on nearshore fish communities that can be used to assess impacts of changing climate conditions.

SESSION: Bridging space and time: distribution and movement of fish in Alaska

Sampling design influences on estimates of walleye pollock maturity rates in the Gulf of Alaska

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Walleye pollock (*Gadus chalcogrammus*) is the dominant species in the groundfish fishery off Alaska. Catch quotas for pollock and other groundfish are set by applying harvest control rules to annual estimates of spawning stock biomass (SSB) from age-structured stock assessments. Stock assessments often assume that the spawning season is constant among years; however, environmental conditions and population abundance influence the seasonal timing and location of maturation and spawning. Further, the sampling design for evaluating maturity can have implications for observed maturity rates. Adult abundance and stage of reproductive maturity have been monitored in early spring in Shelikof Strait in the western Gulf of Alaska for almost three decades. The maturity sampling structure has been largely directed by opportunistic sampling during hydroacoustic surveys. Utilizing these data we developed generalized additive models to examine spatial patterns in pollock maturation sampling and the influence that such spatial structure has on SSB estimates. Current stock assessments estimate SSB using annual estimates of numbers and weight-at-age and estimates of mean maturity-at-age from 1983-2013. This strategy appears to be generally conservative as it tends to underestimate SSB when compared to our estimates of SSB based upon mean maturity-at-age (all years combined) that accounts for spatial structure. However, the current strategy occasionally overestimates SSB when compared to estimates that incorporate spatially-structured annual maturity rates. Spatially explicit information of pollock maturity has implications for estimates of stock productivity and therefore the harvest control used to manage this valuable fishery.

SESSION: Bridging space and time: distribution and movement of fish in Alaska

Core use areas of Resident (fish eating) Killer Whales in Prince William Sound and Kenai Fjords, Alaska

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The assessment of habitat use is of critical importance to understanding the ecology of a species and its prey, which in turn is necessary to properly apply management decisions. Resident (fish eating) killer whales (*Orcinus Orca*) are a key predator in the ecology of various commercial fish species, and their use of habitat will lead to further understanding of the overall ecology of the region. Baseline habitat use is also necessary to determine the effects of anthropogenic impacts. The detrimental effects of the 1989 Exxon Valdez Oil Spill caused the decline of two groups of killer whales (Matkin et. al., 2008). Prior survey efforts existed before the spill, allowing assessment of the disaster on killer whale population trends in the area. In the event of further anthropogenic impacts, oil spills, ocean acidification, or oceanic warming trends, a deeper understanding of habitat use is warranted. Recent advances in satellite telemetry provide us a better understanding of movements and use of habitat. This study includes location data from 25 satellite tags from 2006 to 2013 deployed on RKW in Prince William Sound and Kenai Fjords, Alaska. Movement based kernel density estimators will be used to describe the core use areas of important habitat from these satellite tags. Subsequently, behavior data from research vessel surveys during these same years will be utilized to investigate patterns of movement and use in these core areas.

SESSION: Bridging space and time: distribution and movement of fish in Alaska

Incorporating sablefish movement in a spatial stock assessment model

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Sablefish (Anaplopoma fimbria) are a highly mobile groundfish in Alaska, and more than three decades of tag-recapture data have been collected to estimate age- and length-based movement rates. Using age-based estimates of sablefish movement rates from mark-recapture analysis, we developed a spatially-explicit stock assessment model that examines sablefish abundance in three regions: the Bering Sea/Aleutian Islands/Western Gulf of Alaska, the Central Gulf of Alaska, and the Eastern Gulf of Alaska. We investigated the sensitivity of the assessment model results to uncertainties in movement rates and spatially disaggregated data and compared sablefish abundance from the spatial model to a single area model that ignores movement. We discuss our results in the context of ongoing work on the relationship of movement to sablefish management and apportionment.

SESSION: Bridging space and time: distribution and movement of fish in Alaska

At home or on the range? Defining movement states for Pacific halibut in Glacier Bay, Alaska using both acoustic and archival tag data

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As part of a study to determine seasonal migration of Pacific halibut (*Hippoglossus stenolepis*) in Glacier Bay National Park, a Marine Protected Area, fifteen adult halibut were double-tagged with both acoustic transmitters and pop-up satellite archival tags (PSATs) during July 2013. To characterize short-term dispersal patterns during summer, fish were tracked every other week for two months in 2013 and for one month in 2014. To understand longer-term inter-seasonal dispersal patterns, PSATs recorded depth, temperature, light intensity, magnetic field intensity (3 dimensions), and acceleration (3 dimensions). Based on locations and sensor data from acoustic and PSAT tags, two general movement states were inferred. The home range movement state was characterized by limited horizontal movements and a large range in daily depths. For this movement state, most activity occurred in conjunction with regular excursions to deeper depths at dusk and a return to shallow water home ranges the following dawn. In contrast, a migratory movement state was characterized by a much smaller range of daily depths and was related to tide stage and range rather than diurnal movements. Our results 1) expand our understanding of home range and site fidelity for adult female halibut during summer, 2) suggest tidal stream transport during migratory periods, and 3) provide information on the timing of seasonal spawning migrations. The ability to classify archival tag records into different movement states may improve our ability to reconstruct large-scale movement pathways and answer practical management questions such as whether or not fish remain in Marine Protected Areas.

SESSION: Bridging space and time: distribution and movement of fish in Alaska

Will the Glacier Bay Marine Protected Area shield Pacific Halibut from commercial fishery harvest?

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To assess whether the Glacier Bay National Park Marine Protected Area (MPA) will lead to changes in Pacific halibut (Hippoglossus stenolepis) abundance and/or size-structure after commercial fishing ceases in the future, it is necessary to determine the degree to which the MPA shields this species from commercial fishery harvest in adjacent areas. To do this, the seasonal movement of individual fish was examined in relation to the boundaries of the MPA and the timing of the commercial fishing season. Specifically, locations and movement inferred from 25 adult Pacific halibut that were electronic-tagged during the summer were used to evaluate whether the fish remained within the boundaries of the MPA for up to a year, or whether they exited the MPA while the commercial fishery was open from March to November. Electronic tagging data suggest that a majority of fish demonstrated year-round residence within the MPA. In contrast, a small proportion of fish demonstrated either interannual site fidelity to the MPA following winter migrations to locations outside the fjord, or potentially exited the MPA permanently. Of the tagged fish that exited the MPA, most were outside of the boundaries while the commercial fishing season was closed, although a small proportion was outside of the MPA while fishing was occurring, with at least one recapture in the commercial fishery. These results suggest that after commercial fishing in the MPA ceases in the future, the MPA will shield most Pacific halibut that feed there during the summer from commercial harvest, while a small proportion of fish might be vulnerable to capture in the commercial fishery adjacent to the MPA. This relatively high level of protection from commercial harvest that occurs outside the MPA may lead to changes in Pacific halibut abundance and/or size structure within the MPA.

FISHERIES MANAGEMENT

Session chair: Jason Gasper
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SESSION: Fisheries Management

Are Alaska crab hatcheries a good idea?

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The Alaska King Crab Research, Rehabilitation and Biology Program (AKCRRAB) is a large research effort investigating the potential of hatcheries to restore long-depressed red and blue king crab fisheries to their former high catch levels. Much of this research has focused on whether larval and early juvenile stage crab can be successfully cultivated in the laboratory and, once cultivated, whether they can survive in the wild. Less attention has been paid to more important questions, such as whether adding more juvenile crab would increase catches, or what effects release of large numbers of hatchery juveniles might have on wild abundance, stock structure, or local adaptation. Lessons can be drawn from the checkered history of salmon hatcheries, including the more successful salmon programs in Alaska. Features of crab biology – they don't home and are difficult to permanently mark – may make them less suitable to a well-monitored enhancement program capable of measuring success or failure. We propose different research priorities, such as investigation of factors limiting wild stocks, the potential effects of hatchery-reared juveniles on wild stocks, and the potential for mark-selective fisheries, release of sterile crabs, and closed-system cultivation.

SESSION: Fisheries Management

Crab raised in hatchery provide opportunities for understanding lack of recovery of king crab in Alaska

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The Alaska King Crab Research, Rehabilitation, and Biology program has the mission to understand the large-scale culturing needs of wild red and blue king crab stocks and to perfect strategies for hatching and rearing king crab to a stage where they can be released into the wild and contribute to reversing low wild stock abundance in Alaska. Acquiring this knowledge base will aid policymakers in making informed decisions about whether to one day pursue active rehabilitation of depressed wild king crab stocks through hatchery enhancement. Such efforts may be needed in locations where stocks crashed after overharvesting and have not recovered in the absence of fishing for over 30 years. Salmon hatcheries have a very different goal to enhance existing fisheries for perpetuity. AKCRRAB research over the last 7 years has produced 26 publications in peer-reviewed journals and revealed key features of juvenile king crab growth, habitat, juvenile behavior, interaction with predators, population genetic structure, responses to increased temperature and ocean acidification; all factors that lead to a greater understanding of the lack of recovery of king crab in Alaska.

SESSION: Fisheries Management

The swimming dead: addressing the uncertainty of discard mortality using the example of skates (Rajidae) in the North Pacific

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Discard, or release, mortality is a pressing management issue faced by most fisheries. Both target and by-catch species are released after capture for a multitude of reasons, including those of regulatory and market origins. The difficulties in determining the fate of such discards often requires managers to make assumptions of discard mortality based on little to no data, leading to uncertainty in stock assessment models. The repercussions of this uncertainty can be far ranging, with implications on stock rebuilding, access to target species, and ecosystem health. One such case in the North Pacific is that of the skate complex (family: Rajidae), which are caught incidentally in large numbers in many fisheries and across most gear-types. Our current research has focused on estimating the discard mortality of skates after longline capture, as this gear-type is responsible for the majority of the catch in the region. The initial studies have described and codified the injuries sustained by these skates as a result of capture, as well as the effects of handling on injury severity. Further studies are underway to establish both injury-class specific mortality rates as well as a general discard mortality rate to be made available to fisheries managers. Our goal with these efforts are to reduce the uncertainty of management models as well as the potential for effects of incidental catch rates on those of target species.

SESSION: Fisheries Management

Development of the First Stock Assessment for Skates in Alaska, Using Stock Synthesis

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Skates are in growing demand worldwide, specifically in European and Asian markets. Big (*Beringraja binoculata*) and longnose (*Raja rhina*) skates are the most commonly landed skates in Alaska and currently, these species are harvested as non-target catch, partly because of a lack of information and formal stock assessments. Because skates are long-lived, slow-growing and late-maturing, they are vulnerable to overfishing, and management is unlikely to allow more skate landings until skate populations are shown to be capable of sustaining increased harvest pressures. Recently, more species-specific information on skates has made it possible to develop full stock assessments.

Through cooperation with the National Marine Fisheries Service (NMFS), we developed a preliminary stock assessment for big skates in Alaska, using Stock Synthesis (SS3), a powerful software package flexible enough to handle data-poor assessments. The current version is a single-sex model that divides the fishery into longline and trawl gears, and incorporates two survey data sets. The model shows that the big skate population in the Gulf of Alaska has declined since 2004 when retention of skates became more prevalent, and suggests that skate landings cannot be substantially increased without jeopardizing the sustainability of the stock. We now need to refine the big skate model, and create a parallel model for longnose skates in the Gulf of Alaska. These models will be shared with NMFS, and used to evaluate the feasibility of expanding harvest opportunities and prosecuting directed fisheries for skates.

SESSION: Fisheries Management

Risk Analysis of Plausible Incidental Exploitation Rates for Pacific Sleeper Sharks: A Data Poor Species in the Gulf of Alaska

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There are only limited data available to assess the status of shark populations in U.S. federal waters of the Gulf of Alaska. This study used risk analysis to investigate the sustainability of plausible incidental exploitation rates for Pacific sleeper sharks in the Gulf of Alaska under status quo fisheries management—namely, limiting targeted shark catches, followed by the estimation and monitoring of incidental shark discards—. Risk analysis was used to determine the proportion of simulation runs (bootstrap replicates) associated with a particular set of assumed parameter values (model configurations) that ended in an unsustainable condition after 100 years of simulated exploitation, based on a plausible range in exploitation rates. Sustainability was defined by comparing the distribution of spawning stock biomass obtained from bootstrap simulations to approximate values (proxies) developed for the spawning biomass level that would be obtained at maximum sustainable yield. Examples are provided from the range of simulation results. The risk analysis results were most sensitive to the range in parameter values evaluated for exploitation rate and were less sensitive to the range in parameter values evaluated for maximum age, the size of sharks at capture, and the productivity of the stock recruitment relationship.

Cross-sector transfers of commercial halibut fishing quota: a review of Alaska's new Guided Angler Fish program

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Since 2007, the guided sport halibut fishery in parts of Alaska has been managed under more restrictive harvest limits than the unguided sport fishery. In 2014, NOAA Fisheries implemented the Guided Angler Fish (GAF) program. The GAF program allows limited annual transfers of commercial halibut individual fishing quota (IFQ) to qualified charter businesses in Southeast and Southcentral Alaska so that they may offer greater harvest opportunities to their clients. Additionally, the GAF program gives commercial halibut quota share holders greater flexibility in how they use their annual IFQ. As of September 15, 2014, more than 100 GAF permits were issued, representing transfers of more than 40,000 lb of IFQ to the guided sport halibut fishery. These transfers allowed the harvest of more than 2000 fish of unrestricted size in the guided sport halibut fishery. An overview of the GAF program will be presented, along with summary statistics by management area for the first year of implementation including average cost per pound of IFQ transferred, average lengths of halibut harvested under the program, and the spatial distribution of GAF use.

SESSION: Fisheries Management

Managing Pacific Halibut Bycatch in the Bering Sea and Aleutian Islands

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The management of Pacific halibut (*Hippoglossus stenolopis*) in the Bering Sea and Aleutian Islands (BSAI) epitomizes a number of policy challenges. Major policy issues relate to regional and international co-management, bycatch mitigation, and uncertainty in the stock assessment and area catch limit setting process. Significant declines in halibut exploitable biomass, beginning in the mid-1990s, have raised concerns about halibut bycatch levels in BSAI groundfish fisheries. In 2013, estimated halibut bycatch in the BSAI represented over 55% of the total halibut catch. This presentation will: 1) address recent Council actions to mitigate Pacific halibut bycatch in the BSAI, 2) explore trends in halibut mortality in non-directed fisheries from 2008-2013, and 3) discuss options for reducing halibut bycatch across groundfish sectors. In June 2014 the North Pacific Fishery Management Council passed a motion calling for voluntary reductions to halibut bycatch and regulatory reductions to halibut Protected Species Catch (PSC) limits in the BSAI. The main sectors impacted by this motion include the American Fisheries Act pollock fleet, the groundfish bottom trawl sector, Community Development Quota groups, and the freezer longline Pacific cod sector. Halibut bycatch rates and mortality vary by sector and target fishery; however, the bottom trawl sector uses most of the halibut PSC in the BSAI. Potential measures for reducing halibut bycatch within the identified sectors include deck sorting and best handling procedures to minimize halibut discard mortality, halibut excluder devices, hot spot avoidance, and sector-specific incentive programs.

SESSION: Fisheries Management

Historical Run Size Reconstruction of Yukon River Chinook Salmon by Stock

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I present the first reconstruction of Yukon River Chinook salmon from 1981 to 2012, separated by Lower, Middle, and Canada stocks using maximum likelihood method. In this, scalar of escapement for each stock was separately from various escapement indices for each stock (11: Canada, 5: Middle, 7: Lower). Assuming that estimates of harvest by stock is accurate, run size of each stocks was a sum of escapement and harvest, which was adjusted by observed stock-wise run size estimated by genetic mark-recapture technique (2005-2012). ADMB was used for estimation of model parameters.

The reconstructed run showed that Yukon River Chinook salmon run increased from 1981 (300,000) to 1997 (450,000), sharply declined to 150,000 in 2000, recovered to 300,000 in 2002-2005, but declined since 2006. At stock level, the proportion of Canada stock declined from 50% to 35%, while that of Lower and Middle stocks increased, 30% to 40% and 20% to 25%, respectively.

SESSION: Fisheries Management

Near term Chinook salmon run size expectations for the Kwethluk River. Ricker projections vs reality

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The Ricker recruitment curve for the Kwethluk River suggests that since 2010 the Chinook salmon returns should be producing near maximum returns/spawner. However the current disconnect between predictions based upon the Ricker recruitment curve and observed returns per spawner suggests density dependence may not be the primary driver of recent escapements. Current conditions and low escapements experienced since 2010 suggest that returns to the Kwethluk River will continue to produce subpar escapements for the next several years.

SESSION: Fisheries Management

Prediction of Stock-Specific Upriver Migratory Timing for Yukon River Chinook Salmon

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The Yukon River Chinook Salmon fishery is considered a gauntlet fishery, where salmon are harvested throughout the main stem of the river and its tributaries in multiple, sequential fisheries. Fish traveling farther upriver are potentially subjected to greater levels of fishing pressure as they migrate through a greater number of fishing districts than their lower-river counterparts. Fishing effort in both subsistence and commercial fisheries is typically controlled through a series of time and area closures as well as gear restrictions. Due to this indirect method of controlling catch, it is crucial for fisheries managers to be able to predict both the run timing and relative abundance of salmon throughout the river so that fishing effort can be spread evenly across sub-stocks. The current study extended an existing model of arrival timing by incorporating genetic stock identification and radio telemetry data to produce stock-specific forecasts of upriver migration timing along the main stem of the Yukon River. An exploratory tool was then developed to produce data to aid managers in scheduling subsistence and commercial fishing openers. This research has the potential to help fisheries managers better control harvest rates on Chinook salmon as well as provide more fishing opportunities for other fish species when harvest of Chinook salmon is not the desired management objective.

SESSION: Fisheries Management

The Alaska Harvest of Skeena River Sockeye Salmon: Perception Versus Reality

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Skeena River sockeye salmon are harvested in a variety of Canadian marine and inriver fisheries, as well as commercial fisheries in Alaska. The harvest of Skeena River sockeye salmon by Alaska is closely monitored and managed, and the harvest is subject to provisions of the Pacific Salmon Treaty. The sockeye salmon harvest in the District 4 purse seine fishery on the outer coast of southern Southeast Alaska, the location of the highest Alaska harvest of Skeena River sockeye salmon, is limited through late July to 2.45% of the combined Skeena and Nass River annual allowable harvest, as specified by the Treaty. Harvests of these fish in Alaska are closely monitored through an extensive fishery sampling program and genetic stock identification. In 2013, the Skeena River sockeye salmon run was extremely weak which resulted in closures to Canadian commercial, sport, and First Nation's fisheries. As the season developed a series of reports emerged in the Canadian media suggesting Alaska fisheries were harvesting excessive numbers of Skeena River fish. Alaska currently has an underage of over 100,000 sockeye salmon in this fishery. Preliminary results from 2013 suggest the Alaska harvest of Skeena River sockeye salmon was very low and close to or below the amount allowed under the Treaty. The total Alaska harvest in all fisheries, as a proportion of the total Skeena River run, has dropped in the last two decades and averaged only 8% annually over the most recent ten years, and less than 5% in the last five years.

SESSION: Fisheries Management

Limit Reference Points for Pacific Salmon Fisheries

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"Limit reference points" define a state at which fishery management has reached overfishing, overfished stock status, or some other regulatory or conservation point of concern. In many Pacific salmon Oncorhynchus spp. fishery jurisdictions, management only uses "target reference points"—the specific numerical management objective intended to bring about some fishery benefit. There are several reasons to adopt limit reference points, and jurisdictions without previously defined limit reference points could adopt them in order to align better with the Magnuson–Stevens Act (American fisheries) or, more importantly, to facilitate cross-jurisdiction sustainability assessments, which are increasingly needed for certifications of sustainability. In actual practice, the stock size of 0.5 times a target reference point has been used as a limit reference point for some Pacific salmon fisheries, or at least as a proxy for a limit reference point. We term this point the "minimum stock size threshold," following a convention already in use, and we note that limit reference points defined this way are increasingly being accepted as a standard either because of justification based on simulation and fishery principles or for purely pragmatic reasons.

SESSION: Fisheries Management

Stock assessment in data-limited situations: an integrated run reconstruction with stock-recruitment analysis on Kuskokwim River Chinook salmon

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Reliable estimates of run abundance, productivity, and the temporal trends surrounding them are necessary in scientifically defensible salmon management. However, such estimates are often impeded by spatially and temporally incomplete sampling of escapement. Bayesian state-space models are becoming increasingly popular in Alaskan salmon stock assessments to cope with data-limitations and uncertainty. These models have the benefit of incorporating several different types of data and sources of uncertainty, including both measurement error and process variation. We present the application of this approach to the Kuskokwim River Chinook salmon stock. This specific model functions by reconstructing the historical time-series of drainage-wide run abundance based on 38 years of harvest and incomplete escapement sampling while simultaneously estimating stock recruitment parameters. The model is fit in the Bayesian framework using Markov Chain Monte Carlo methods to estimate the joint posterior probability distribution of unknown parameters. Emphasis is placed on how the model reconstructs the historical time-series of run abundance based on observation-level data and stochastic processes and how uncertainty of the estimates is included implicitly in the model fitting. We provide comparisons to point estimates and their confidence bounds from a non-Bayesian version of the model, and present future plans for the assessment of the sensitivity of the model to prior distributions and different model structures.

SESSION: Fisheries Management

Trends in hatchery salmon value in Alaska and implications for future hatchery production

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Alaska manages wild salmon populations to meet spawning needs. Salmon harvest is arguably at its maximum, given the imprecisions of population estimation and fisheries management. Further increases to wild salmon production include habitat restoration or alteration to provide access to spawning or rearing waters; improving management precision; and supplementing wild harvests with hatchery production.

Alaska hatcheries provide a large supplement to natural spawning production. Hatcheries collect gametes, incubate fertilized eggs, and release juveniles to the ocean. Unlike fish farming, hatcheries neither raise fish to market size nor selectively breed salmon for market demands or hatchery conditions. Hatcheries use local stocks to minimize genetic impacts from straying, and improve egg to juvenile survival by protecting eggs from predators and natural events.

Alaska produced nearly half of the world salmon supply in 1980. Today that contribution is less than 15% of world supply, as most salmon are now farmed. Year-round farmed salmon production has expanded the demand for all salmon worldwide, resulting in strong prices for the niche market for Alaska salmon, with prices paid to fishermen increasing 250% from 2002 to 2013 despite large fluctuations in Alaska's annual harvest volume and record return in 2013. New processing plants have been built across the state, with buyers returning to recently dormant western Alaska fisheries.

The commercial salmon industry is encouraging increased hatchery production to meet rising demand and strong prices. The state has embarked on several ambitious projects to study the interaction between hatchery and naturally-spawning populations prior to expanding production.

ADVANCES IN FISHERIES SCIENCE & TECHNOLOGY

Session chairs: Kristen Green[1] and Jennifer Stahl[2]
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Advances in fisheries science and technology provide improved methods for data collection and innovative ways to aid in species protection and habitat conservation. Topics include enumeration of species using video cameras and DIDSON technology; collection of habitat data using an Autonomous Underwater Vehicle; and use of electrical pulses to collect biological data on fish condition, to guide salmon migration, and to deter marine mammals. In addition, improved fish sedatives and methods for degradation of oil will be discussed.

SESSION: Advances in Fisheries Science & Technology

Underwater observations and paired surface trawling comparisons to see if a Marine Mammal Exclusion Device (MMED) affects juvenile salmon catch

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Paired trawl comparisons and underwater video observations were conducted to determine if the use of a Marine Mammal Exclusion Device (MMED) inside a research surface trawl would affect catches of juvenile salmon. Catch rates of juvenile, immature, and adult salmon were compared between a Nordic 264 rope trawl fished with and without a MMED. In total, 10 paired comparisons were conducted in August of 2013, and 5 paired comparisons were conducted in both June and July of 2014. Results from these comparisons and underwater video footage will be presented. Although the use of a MMED is not currently mandated for research operations in Alaska, it is in other west coast regions, so this pilot study was done to see if catch differences of the targeted juvenile salmon species would occur with a MMED. This study is a proactive step to help minimize the incidental and unintended bycatch of sea otters, porpoise, sea lions, or large sharks during research trawl operations, and may provide a "calibration" for the targeted focal species to extend existing time series on juvenile salmon currently used for long-term salmon forecasting.

Chignik River DIDSON post-weir escapement enumeration

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The Chignik River watershed supports large and healthy sockeye and coho salmon populations that are important to commercial and subsistence users. Current salmon escapement is monitored at the Chignik weir from late May through August 31st, after which a statistical model has traditionally been used to estimate September sockeye salmon escapement based on extrapolation from August escapement counts. Fixed-location, side-looking hydroacoustic techniques have been established in riverine systems throughout the world as a non-invasive, cost-effective means to enumerate upstream migrating fishes. Beginning in 2012, in order to better characterize the late-season escapement of sockeye and coho salmon, the Alaska Department of Fish and Game has used two dual-frequency identification sonars (DIDSON) to enumerate late-run sockeye, *Onchorynchus nerka*, and coho salmon, *Onchorhynchus kisutch*, after the removal of the Chignik River weir. This project enumerates salmon traveling upstream using DIDSON software, apportions the escapement of late-run sockeye and coho salmon by gillnetting and beach seining in the Chignik Lagoon, collects age, sex, and length data of both species, and uses this information to evaluate current models of September escapement. These data help fisheries managers maintain the sustainability of these important subsistence runs and accurately characterize the run magnitude and timing of sockeye and coho salmon in September.

Assessment of Kodiak Island salmon lakes using an autonomous underwater vehicle

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Since 2009, the Alaska Department of Fish & Game has used a free-swimming Autonomous Underwater Vehicle (AUV) to create high-resolution suites of limnological data to improve assessments of Kodiak salmon stocks as sufficient descriptive biological data remain limited. Specifically, catch and escapement data are often the only available data, yet they also often lack contrast and fail to fit well with standard spawner-recruit or sibling relationship models. Thus, limnological data have become extremely useful for identifying rearing limitations, preparing escapement goal recommendations, estimating stocking levels, and forecasting adult returns of Kodiak Island salmon stocks. Traditional methods of limnological data collection using hand-held meters, although well established, are limited in their ability to describe trends in rearing habitats because they are often confined to one or two stationary sampling locations. Run concurrently with traditional sampling events, monthly AUV missions between May and September in five Kodiak Island lakes collected geo-referenced temperature, dissolved oxygen, chlorophyll, pH, turbidity, depth, and fish presence data. With these data, we were able to create accurate bathymetric maps and definitively identify and assess the variability of physical conditions across each lake. Ultimately, the AUV has allowed rapid mapping of whole-lake conditions and modernized our sampling methods while improving data quality. The AUV has also provided data allowing us to recalculate lake rearing capacities, increasing our understanding of conditions that affect salmon survival.

Graduated-Field Fish Guidance Technology: A Conservation Tool to Help Solve Resource Management Challenges and Aid Salmon Escapement Monitoring in Alaska

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Mild fields of pulsed-DC electric gradients have been used worldwide to influence and direct the riverine behavior and upstream movements of fish for improved conservation and management. Over the past two decades, natural resource managers have successfully used this technology in over 65 applications to influence and guide fish behavior throughout North America and in Europe. Examples include graduated guidance arrays to protect and deter fish from entering hydropower tailraces and water intake canals, deployments that limit range expansion by invasive species, and applications that guide salmon to Pacific NW fish ladders. The innovative, graduated-field design typically uses electrode output levels ranging from 0.2 to 1.2 V/cm (DC gradients *significantly lower* than those used in routine electrofishing surveys). This design allows fish to detect and avoid the increasing gradients and to instead locate intended passage areas (where the electric field is not present), to continue migratory behavior. Designs include permanent installations as well as temporary angled, bottom-mounted cable arrays that can be staked to streambeds for seasonal usage (all of which are unaffected by floating debris and do not affect boats or occupants). We discuss the key elements of the technology and how it works. We provide examples (from peer-reviewed published literature) of installations that have met specific fish management needs, including guidance from river tributaries into bypass return channels at National Fish Hatcheries in the Pacific NW. This graduated-field fish guidance technology has direct application for salmon managers in Alaska for stream and river escapement monitoring and management.

SESSION: Advances in Fisheries Science & Technology

Innovative Technology for Deterrence and Conservation of Marine Mammals Using Non-Lethal Electric Gradients: Updated Results of Field Trials

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In "the Lower 48," marine mammal population expansions have led to a growing number of conflicts and issues among entities that manage marinas and agencies that manage fisheries. For harbormasters, issues include damage to marina infrastructure and human use conflicts. For resource managers, issues frequently involve predation on sensitive fish stocks. We present results from over 8 years of field trials to deter marine mammals in various environments (and highlight our knowledge and experience to inform resource managers about how this technology can address pinniped conflicts in human-use areas). We describe an innovative approach to deter California sea lions and Pacific harbor seals using non-lethal fields of pulsed DC. It evolved from three decades of research on graduated-field fish guidance technology and uses low-energy electric gradients that irritate, but do not harm animals. We summarize deterrence trials conducted on harbor seals in British Columbia, Canada (2007), in-water trials on captive California sea lions in the U.S. (2008), and dock deterrence successes on wild sea lion aggregations in California (2012 and 2014). Short video clips highlight typical responses recorded while observing animals trying to repopulate energized docks and deterrence areas. The goal is to update attendees and resource managers about a non-lethal deterrence technology having the potential to address marine mammal interactions and conflicts in both fisheries applications and public use settings.

Development and calibration of bioelectric impedance analysis as a measure of energetic status of Arctic grayling (*Thymallus arcticus*)

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The energetic status of fish is represented by the energy stored as protein and lipids and reflects an individual's ability to reproduce, migrate, and transition through life stages, and ultimately influences survival. Currently, little information exists on how the energetic status of individuals varies across seasons and life stages. Traditional methods, such as proximate analysis, while highly accurate, can be time consuming, expensive, and lethal. Nonlethal methods, like condition factor, are often imprecise. We used bioelectrical impedance analysis (BIA) to characterize the energetic status of Arctic grayling (*Thymallus arcticus*), and provide researchers a non-lethal method of accurately assessing condition. As a first step, we developed statistical models specific to Arctic grayling that describe the relationship between BIA readings and estimates of energy content based on proximate analysis (e.g., percent dry mass and lipids). We collected 160 grayling (range 142-435 mm FL) from four interior Alaska river basins during early summer and fall 2013 and used multiple regression and model selection to evaluate the efficacy of BIA readings to predict dry mass (%) estimated from proximate analysis. Our results indicated that BIA readings are a precise (RMSE = 1.5%) estimate of dry mass for Arctic grayling. Moreover, our analysis showed that fish energy density varied across seasons, basins, and sex; these results were not evident based solely on length-weight indices. Future work will investigate the relationship between BIA readings and total lipid contents. Overall, the BIA approach shows promise as a rapid, precise, and non-lethal measurement of energy density.

SESSION: Advances in Fisheries Science & Technology

Efficacy and safety data to support approval of AQUI-S20 to sedate freshwater finfish to handleable

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Fisheries professionals routinely handle fish during collection of morphometric data, spawning, sorting, or tagging/marking, and sedatives facilitate these activities. Currently, MS-222 products are the only sedatives approved by the U.S. Food and Drug Administration (FDA) for use on fish. However, legal use of MS-222 is restricted to four families of fish and requires a 21-day withdrawal period for fish which may enter the human food supply. Holding fish for a lengthy withdrawal period is not practical, particularly in field settings, and an approved immediate-release sedative is desperately needed. Efforts are underway to gain FDA approval of AQUI-S®20E (10% eugenol; developed by AQUI-S New Zealand, Ltd., Lower Hutt, New Zealand) as an immediate-release fish sedative. As part of the approval package required by FDA, studies were conducted to demonstrate that AQUI-S®20E is as effective as claimed and that various dose/duration combinations are safe to fish. A range of cold-, cool-, and warmwater taxa were all effectively sedated to handleable within 2-3 minutes, with water temperature and AQUI-S® 20E dose being the determining factors in the timing of sedation and recovery. Subsequent studies with representative cold-, cool, and warmwater species demonstrated that intended sedative doses and exposure times could be exceeded by a considerable margin without affecting fish survival, histopathology, or behavior. The results of these studies have fulfilled safety and effectiveness data requirements to support a claim to sedate all freshwater finfish to handleable. An initial approval for the use of this product as an immediate-release sedative is anticipated by 2017.

SESSION: Advances in Fisheries Science & Technology

Crude oil biodegradation in arctic sea shore sediments

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Oil is the most important energy source and an environment pollutant as well. Crude oil spill accidents along arctic shorelines might occur due to the expected increase in offshore oil production. To reduce adverse effects on the environment in the case of a spill, it is important to develop approaches to remove spilled oil.

Bioremediation with addition of nutrients has shown promising results in enhancing oil degradation rates. This research focuses on determining the effect of different environmental conditions on the rate of biodegradation in laboratory experiments, as a proxy for oil spills in cold seashores areas. Laboratory microcosms were set up containing beach sediments collected from Barrow, spiked with North Slope Crude. These microcosms were incubated at varying temperatures, salinities and crude oil concentrations, all with a standard concentration of nutrients. Measurements of respiration rates (breakdown of hydrocarbons to CO2), hydrocarbons remaining in the sediment (GC/FID), hydrocarbons volatilized and sorbed to activated carbon (GC/MS), hydrocarbon degrading microorganisms (MPN), and nutrient concentrations were performed. A study at 20ºC has shown higher respiration rates in microcosms with higher crude oil concentration and salinity. Lower temperature studies are currently being performed. This study will help to facilitate appropriate responses to oil spills along arctic coastlines.

INVASIVE SPECIES

Session chair: Tammy Davis
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Invasive species have been identified in terrestrial, freshwater, and marine ecosystems in Alaska, and are a growing concern globally. In addition to habitat loss, invasive species are identified as a main threat to the ecology and diversity of native species assemblages. Invasive species are non-indigenous organisms that have been introduced to areas outside their native range, generally by human intervention, whose establishment threatens to harm ecosystems, economies or human health. Thus, not all non-native species are invasive. Identifying the pathways by which invasive species are introduced and spread can assist in forecasting spread and informs management actions. An understanding of the risks non-native organisms pose to native species and habitats allows for strategizing response planning. When invasive species establishment occurs over broad geographic distribution the direct and indirect impacts become more complex, and control becomes more expensive and complicated. New technology may provide efficient means to evaluate control and eradication efforts and increase monitoring capabilities. This session will highlight a range of topics from evaluating the risks invasive species pose to native systems to assessing control efforts to revitalize native fisheries.

SESSION: Invasive Species

Implications of the Invasive Tunicate *D. vexillum* on the Subsistence Herring Fishery in Sitka Sound

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Didemnum vexillum is a species of global concern that has spread to sites throughout the world. It was first identified in Alaska in 2010 following an invasive species bioblitz. *D. vexillum* is of management concern because of its history of rapid expansion in some of the areas where it has been introduced. It is capable of overgrowing and potentially dominating the substrate, and can also overgrow sessile fauna. Like other ascidians, *D. vexillum* may have chemical defenses against predation and fouling which could prevent fish from using it as a spawning substrate or cause mortality to eggs that are laid on it. These characteristics raise the concern that *D. vexillum* could adversely affect important benthic spawning species such as Pacific herring (*Clupea pallasii)*. Subsistence fisheries for herring fish and roe have existed in Southeast Alaska for centuries. These fisheries typically occur in sheltered nearshore areas that could provide habitat for *D. vexillum* if it spread beyond its current location in Whiting Harbor, Sitka, Alaska. In this research, we use an analysis of potential habitat for *D. vexillum* in Sitka Sound to assess the possible impacts of *D. vexillum* spread on subsistence herring fisheries.

SESSION: Invasive Species

Human-Amphibian Interactions in the North: a Detriment or an Opportunity for Alaska's Native Species?

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Alaska is home to at least six native species of amphibians, one of which occurs relatively abundantly across much of the state. These species provide food resources for fish, birds, and mammals, and they can themselves consume large quantities of insect pests. Amphibians are defined as "fish" in Alaska, though few fish-related statutes apply to these species. Despite their unofficial designation as "nongame", recent research suggests that human-amphibian interactions in the state are frequent. Often, interactions have resulted in the introduction of non-native species, and the translocation of native species on local landscapes. These interactions may be stressing Alaska's native amphibian populations through the introduction of disease, competition, and predation. Furthermore, amphibian introductions can negatively impact species on which humans directly depend. Still, interactions with native species and captive pets provide opportunities for education, recreation and building an appreciation for herpetofauna. I report here on documented amphibian introductions and translocation events in Alaska, possible impacts on native amphibians and other native species, and promising solutions for curbing this activity.

SESSION: Invasive Species

Is Whirling Disease Driving Salmonid Community Shifts in Blackfoot River Basin, Montana?

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The exotic parasite *Myxobolus cerebralis*, better known as whirling disease, can be lethal to certain fish species and is an on-going threat to salmonid populations in certain regions of the United States. The parasite has had especially detrimental effects on populations in the genus *Oncorhynchus* (i.e. rainbow trout and westslope cutthroat trout) in some watersheds of western and central Montana, such as the Madison River and Rock Creek. In this talk, I will present the results of a study examining the potential effect of whirling disease on the composition of salmonid communities in the Blackfoot River Basin, Montana. Over the last two decades, Montana Fish, Wildlife and Parks has sampled the fish community and deployed sentinel cages to assess the presence and virulence of whirling disease in certain tributaries and main stem locations in the basin. We examined sites to evaluate the potential role of whirling disease as a driver of fish community shifts in tributaries. Using these data, we evaluated salmonid community trends in 11 streams within the Blackfoot basin with known records of either low or high whirling disease infection levels. We revealed that salmonid community composition changes did not appear to be strongly driven by whirling disease, but rather are shaped by the biotic or abiotic factors occurring across time and space within the basin.

SESSION: Invasive Species

Alaska Blackfish--Successful Invaders of Cook Inlet Basin

Dona Eidam
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The Alaska blackfish (Esocidae: *Dallia pectoralis*) is a small freshwater mudminnow endemic to Beringia. Alaska blackfish occur naturally on the Chukotka Peninsula of Eastern Russia, across Western Alaska, Central Alaska in the Yukon River drainage, and on the North Slope. Illegally released into a floatplane lake in Anchorage in the 1950s, Alaska blackfish have spread to most Cook Inlet Basin waters. Now a permanent invader in Southcentral Alaska, the species exhibits legendary hardiness due to an ability to breathe atmospheric air and survive freezing water. Blackfish ecology is poorly described, and fisheries managers express concern over predation of introduced blackfish on native salmonids as well as competition with native fishes for resources. I collected Alaska blackfish every month for a full year from a wetlands pond, stream, and lake in Cook Inlet Basin in order to describe their diet across season, sex, and size. Stomach contents were quantified and qualified by Index of Relative Importance to determine most significant prey categories. My results show that Alaska blackfish are opportunistic carnivores (sometimes omnivores) whose diet consists of primarily small benthic invertebrates. Piscivory on conspecifics and native fishes is rare (frequency = 9.3%), and fish consumed are mostly stickleback.

SESSION: Invasive Species

Stable Isotope and Diet Analysis of Food Web Structure in Lake Atitlan, Guatemala

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Lake Atitlan is the biggest and most important inland water body of Guatemala. More than 200,000 indigenous Mayans live around its watershed subsisting on its agriculture and its fisheries. During the last decade, the lake underwent an ecological collapse. It suffered from a cyanobacterial bloom of *Limnoraphis robusta* (2009) due to cultural eutrophication, a tropical storm (Agatha 2010) and the recent success of the invasive Asian carp (*Cyprinus carpio*). All this was added to the previous problems such as the agrochemical misuse and other invasive species like the Black Bass (*Micropterus salmoides*) that led the endemic Atitlan Grieve (*Podilymbus gigas*) to extinction. There have been many studies on the lake's Chemistry and Microbiology, but few efforts to determine its ecological interactions.

This study characterized the lake's food web structure using diet and stable isotope analysis (Carbon and Nitrogen). The food web is constituted in such way that the native aquatic invertebrates are being harvested by the invasive fish species. Carp contribute to the system's eutrophication by uprooting aquatic plants and resuspending nutrients in the benthos, and have no natural predator. Isotope signals revealed different habitat compositions in the bay areas compared to the main lake's area. The fisheries species structure was redefined, as three thought to be extinct native species in the lake were found again. A new fisheries guide was created and distributed to the local schools and institutions.

SESSION: Invasive Species

Invasive Northern Pike Suppression in Alexander Creek

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Northern Pike are invasive to the Alexander Creek drainage and established through a series of illegal introductions in the early 1960's. The Alexander Creek drainage is a large river basin encompassing thousands of square miles. This system is low velocity with numerous tributaries and encompasses several shallow lakes and ponds, thousands of acres of adjacent wetlands, and numerous side-slough and oxbow channels. Alexander Creek was once a very productive and popular Chinook salmon fishery. Today, northern pike have expanded throughout this drainage, and native fish populations and sport fishing opportunities have consequently eroded.

This is the fourth year of a long-term northern pike suppression project. The primary goal is to reduce the invasive northern pike population in Alexander Creek to replenish depleted anadromous and resident fish populations and restore sport fishing opportunities. Preliminary findings are encouraging. Since the project's inception in 2011, approximately 16,000 northern pike have been removed from side-slough channels of Alexander Creek. During 2013 and 2014, aerial escapement surveys of spawning Chinook salmon for Alexander Creek were the highest in a decade while other systems in the area were receiving average to below average returns. In the past two years, recolonization of Chinook salmon spawning areas in the upper reaches of Alexander Creek that had been devoid of spawning fish for years, were once again utilized by spawning Chinook salmon. Aerial indices and information from local anglers also indicate that other salmon species are rebounding as well. Juvenile salmon were captured in minnow traps and observed in stomachs of northern pike in areas of the creek that, only a few years earlier, did not contain them. Lastly, resident fish catches in gillnets have increased substantially since the projects inception indicating increases in their abundance.

SESSION: Invasive Species

Invasive Northern Pike Detection Using Environmental DNA

Robert Massengill[1], Kristine Dunker[2], Anton Antonovich[3], Jeff Olsen[4], Cara Lewis[5] and John Wenburg[6]

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Organisms release material containing their DNA into the environment called environmental DNA (eDNA). eDNA from aquatic organisms can be detected in water samples that can potentially serve to be a more sensitive and less intrusive survey tool than traditional methods. ADF&G and the USFWS have partnered to develop and test northern pike genetic markers and to select one for evaluating eDNA detection success under a variety of test conditions. Assay protocols for processing eDNA samples using quantitative polymerase chain reaction (qPCR) were refined and northern pike eDNA samples were collected from stocked aquaria, lake experiments and unmanipulated field settings. Objectives are to determine the quantity of water sample required for positive eDNA detection in aquaria trails, determine if a low density (~32 g/acre-foot) northern pike population can be detected in small lakes, evaluate how distance affects sample detection probability, determine eDNA persistence post-mortem, and assess whether eDNA detection results align with current northern pike distribution knowledge for Alexander Creek and Kenai Peninsula drainages. Although the project is ongoing, initial findings indicate northern pike eDNA is detectable in 1-liter samples up to 40 meters from caged pike held in a small lakes and that detection success appears inversely related to distance from the northern pike. eDNA detection success at Alexander Lake (Susitna River drainage), where a naturalized northern pike population resides, was 90%. ADFG will share how eDNA detection methodology will be used to help evaluate the effectiveness of current and past invasive northern pike removal projects on the Kenai Peninsula.

ALASKA'S STATE WILDLIFE ACTION PLAN REVISION

Session chair: Tim Viavant
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The US congress created the State and Tribal Wildlife Grant Program (SWG) in 2000 to assist states in the conservation or restoration of species considered at risk for population decline. The program promotes conservation efforts intended to prevent species from being listed or nominated under the Endangered Species Act. States were required to develop State Wildlife Action Plans (SWAP), which were first developed and approved in 2005, and their implementation is accomplished through the SWG program. The plans are based on eight criteria that are set out in the enabling legislation. At the core of each SWAP are what are called Species of Greatest Conservation Need. These species are identified based on abundance, trend, and degree of threat to populations. Over the past 10 years, SWG funds have been used in Alaska primarily for inventory work on the distribution and abundance of focus species, on habitat mapping and evaluation, and on public outreach to develop capacity for citizen science, conservation, and habitat protection and restoration. States must revise these plans at least every 10 years. These revisions must include coordination with Federal, State, local, and tribal agencies that manage land or water within the State, or administer programs that significantly affect the conservation of species or their habitats, as well as provisions for public participation in the revision and implementation. The Alaska Dept. of Fish and Game has just begun the process of revising Alaska's SWAP, which must be in final draft from by October 1, 2015. An initial draft of the plan is scheduled to be released by January, 2015, and input on the revision of the SWAP and on implementation of the revised plan is currently being sought from interested agencies, NGO's, and the general public.

FISHING COMMUNITIES AND FISHERIES MANAGEMENT

Session chairs: Courtney Lyons[1] and Courtney Carothers[2]
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In 1996, the Sustainable Fisheries Act mandated the inclusion of fishing communities in US fisheries management programs. Understanding fishing communities, however, is not a straightforward task. Researchers draw upon many theories and methodologies across diverse disciplines to better understand fishing communities and the ways in which fisheries management programs affect these communities. This session draws together research on fishing communities, highlighting the diverse relationships between people and fish across a range of coastal communities and cultures. Rather than attempting to consolidate these complex, multifarious relationships into simple metrics, papers in this session illuminate community studies from a variety of frameworks. Papers explore the role of power and place in shaping residents' relationships with fish resources, differences between urban and rural, Alaska Native and western fishing communities, challenges of representing and communicating sociocultural dimensions in fishery systems, among other topics. The panel aims to help advance ideas about how to best include community considerations in fisheries management processes.

SESSION: Fishing communities and fisheries management

Creating Understanding Through Public Performance: The Icon of Salmon as a Commonality for Alaska's Physical and Occupational Communities

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Salmon is a species with iconic significance across the state of Alaska with importance in subsistence, commercial and sport associations. Despite contemporary regional conflicts in policy transitions as a result of environmental concerns such as the decline of Chinook salmon, there IS commonality across all user groups regarding the significance of the animal as a cultural feature. This feature is difficult to address in management settings where personal testimony is more likely to address access logistics rather than subjective emotion.

My research is specifically related to oral history in the Copper River commercial salmon fisheries, I'm developing an unexpected finding of communication opportunities in public, theatrical performances of local stories related to history and memories of salmon. This venue removes the dialogue from a direct informant and allows me to make the story independent from the original teller. The words, in my voice, allow audience members to provide feedback or argument in post-performance discussion sessions that help bring out both differences and similarities in political issues without necessarily staging biased testimony.

Performance offers a mediated venue for discussion which could be useful in informing policy makers about combined community interests. The next task is to figure out how to provide these findings in a manner appropriate to management agencies.

SESSION: Fishing communities and fisheries management

Place-making as a framework for understanding development in fishing communities

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Social data, while becoming more common in fisheries management analyses, are typically restricted to quantitative measures. These data are limited, however, and cannot adequately summarize the dynamics within fishing communities. In contrast, detailed ethnographic research and the theoretical framework of place-making can provide a useful methodology through which to gather social data to understand how fisheries management policies affect fishing communities. Place-making is the process through which places are socially constructed and invested with social and cultural meaning. Place-making ideas and practices can therefore interact with economic development efforts to help create (or fail to create) sustainable communities. To examine how place-making and development efforts articulate in the Pribilof Islands, we conducted six months of ethnographic research in the communities of St. George and St. Paul, Alaska. We found that residents in both communities strategically embrace development, rejecting any development initiatives that might undermine local autonomy, in pursuit of creating and furthering a place-based, local economy. Furthermore, residents in St. Paul harnessed local development efforts in the pursuit of place-making efforts, successfully establishing a halibut day-fishery their community. In contrast, residents of St. George developed narratives of resistance to help gain control over local resources currently controlled by a third-party corporation tasked with representing the village. This research therefore supports previous research indicating that policies and development projects that increase local power and autonomy are the most successful in furthering community sustainability and wellbeing. Furthermore, our research demonstrates that place-making provides a useful framework to design fishing community policies.

SESSION: Fishing communities and fisheries management

Sociocultural Dimensions of the Yukon River Chinook Salmon fishery

Caroline Brown
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In recent years, Chinook salmon runs to the Yukon River have experienced severe declines, resulting in commercial and subsistence salmon fishing closures as well as economic disaster declarations in 2000 and again in 2009. While the "disaster" was a direct result of the number of salmon that returned to the river in 2009, the socioeconomic effects of the poor run were not isolated to 2009 only, but rather are informed by over a decade of below average or poor returns that have continued. While management processes consider a variety of factors related to salmon harvests throughout the river (such as species reliance, harvest timing, etc.), the primary means of describing Yukon River communities' involvement in salmon fisheries through harvest estimates. This research explores the social, economic, and cultural effects of declining runs through ethnographic exploration of the role of salmon within the totality of subsistence economies and attention to exchange networks. Building on these findings, we are beginning to explore the factors that drive community and household level harvests over time. Understanding these factors may allow community residents to more effectively contribute to management by representing their relationship to fish resources through a more complicated lens than just harvest estimates.

SESSION: Fishing communities and fisheries management

Investigating the Benefits and Challenges of Community Fishing Associations

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The Magnuson Stevens Act (MSA) 2007 added Limited Access Privilege Programs (LAPP) to provide assistance to fishing communities and community-based associations in order to receive quota allocation. Community fishing associations (CFAs) are a type of program that falls under the LAPP. The MSA emphasizes several eligibility criteria to qualify for this type of program, including being a defined fishing community and having a historical presence in the various fisheries. Many fishing communities have complied with these criteria, however they have yet to be federally recognized as an organization that can receive a part of the quota allocation. The purpose of this research is to investigate the benefits and obstacles of CFA implementation, further address the question of how to define a fishing community, and to analyze the overall applicability of these types of programs.

Ethnography and participant observation were used to obtain a variety of experiences and perceptions from members of CFAs and others who hold various roles in fishing communities and/or work with the fishing community, financial sectors and agencies. Results indicate the benefits of a CFA include diversifying a portfolio, business training, and sustainability and conservation practices in the various fisheries. Yet they also indicate that CFAs are not applicable to all fisheries, and reveal several fears and misunderstandings regarding the applicability. In addition, lack of funding, confusion in the language of what a CFA is and can offer, accountability, and agency involvement add hesitance to people considering establishing this type of LAPP. More research on, and defined guidelines about CFA creation, implementation, and quota allocation is needed.

SESSION: Fishing communities and fisheries management

Examining the Impacts of Active Participation Mandates in the Alaskan Halibut IFQ Program

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Catch shares are an increasingly popular tool used by fisheries managers to address the race for fish. Potentially adverse impacts of these policies include job losses in coastal communities, outmigration of fishing privileges, and prohibitive costs of entry. The Alaskan halibut and sablefish IFQ program includes provisions designed to keep quota in the hands of active, bona fide fishermen, including a prohibition on leasing and on the acquisition of quota by non initial-recipient corporations, and an owner-on-board mandate for second-generation shareholders. In Southeast Alaska, additional limitations on hired skipper use were implemented to maintain what had historically been an owner-operated fleet and to facilitate entry for second-generation shareholders. This study analyzes the impacts of these active participation mandates in the IFQ program, focusing on the differential impacts of the extra restriction on hired skipper use in Southeast. Data indicate that despite significantly lower hired skipper use in Southeast, metrics of facility of entry are on par with other regulatory areas. With significant differences in who participates and how between the regulatory areas, a counterfactual analysis is needed to estimate facility of entry and hired skipper use in Southeast without the hired skipper limitation. A framework for this counterfactual analysis, using conditions across other regulatory areas, will be presented.

SESSION: Fishing communities and fisheries management

Monitoring in the commercial halibut fishery off Southeast Alaska: incorporating local knowledge

Elizabeth Figus[1] and Keith Criddle[2]

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In 2013, the North Pacific Fishery Management Council extended the federal fisheries observer program to include vessels commercially fishing Pacific halibut (*Hippoglossus stenolepis).* Although monitoring is considered crucial in order to evaluate bycatch, onboard observers are costly and halibut fishermen have voiced negative opinions about program expansion. Thus there is interest in exploring alternative means of meeting management needs for accurate characterization of bycatch.

This talk will outline upcoming research plans to document bycatch trends over time in the directed halibut fishery off Southeast Alaska, as well as fishermen's perceptions of various methods of bycatch monitoring. Fishermen's personal experiences with monitoring systems, such as logbooks, human observers, and electronic monitoring, will be documented. Interviews will be conducted with fishermen in Juneau, Hoonah, Sitka, and Petersburg between January and May 2015, and analyzed using cultural consensus analysis. Results will then be compared with other sources of data (e.g., landings reports and stock assessment surveys) using multiple criteria decision analysis to assess potential effects of different types of monitoring on fleet composition. Results are expected to yield information about how managers might implement reliable monitoring with support from the fleet, potentially illuminating ways to reduce costs of monitoring to the fishing industry.

SMALL-SCALE ALASKAN FISHERIES: A FOCUS ON SPORT AND SUBSISTENCE SECTORS

Session chairs: Anne Beaudreau[1] and Maggie Chan[2]
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Sport and subsistence fisheries span urban to rural communities and marine waters to inland lakes across Alaska. These sectors contribute substantially to well-being, food security, local economies, and traditional ways of living. This session highlights social and ecological research on sport and subsistence fisheries in Alaska and provides interdisciplinary perspectives on conducting research in these sectors throughout the state.

SESSION: Small-scale Alaskan fisheries: a focus on sport and subsistence sectors

Salmon harvested for home use in southeast Alaska

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Subsistence, "personal use" and sport salmon harvest in Southeast Alaska: A contemporary look at salmon harvest for home use in southeast Alaska with an exploration of harvest trends, socioeconomic impact and cultural importance of salmon harvest in Southeast Alaska.

SESSION: Small-scale Alaskan fisheries: a focus on sport and subsistence sectors

Evaluating the subsistence harvest of Pacific herring spawn in Sitka Sound, Alaska

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In Sitka Sound, Pacific herring *Clupea pallasii* is a highly valuable resource to the ecosystem, to commercial harvesters of herring sac roe, and to subsistence harvesters of herring eggs. While the commercial harvest is a relatively recent activity with high value, the subsistence harvest has historically been nutritionally and culturally important to Alaska residents. The two fisheries share geographic and temporal components, creating challenges in assuring mutual access to the resource. As a result of a 2001 Board of Fisheries process to resolve some of the conflict that has underlain these fisheries, the Alaska Department of Fish and Game began a collaborative and ongoing subsistence herring egg harvest monitoring program with the Sitka Tribe of Alaska. The project generates data to calculate annual estimates of the subsistence harvest of herring eggs on various substrates from Sitka Sound. This research has shown that herring egg harvesting is a highly specialized activity in which a relatively small number of people harvest and distribute eggs widely. The giving and receiving of herring eggs is culturally important to Alaska residents. Besides collecting quantified data on the harvest and use of herring eggs from Sitka Sound, over the course of the project ethnographic research has also been conducted to better understand the complex social-ecological system within which the herring egg harvest operates.

SESSION: Small-scale Alaskan fisheries: a focus on sport and subsistence sectors

Alaska Natives Social and Economic Interaction in the Fisheries in Southeast Alaska

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Tlingit communities in Southeast Alaska have been resilient in the face of many social, economic, and political changes in the subsistence fisheries. While local ecological knowledge remains a constant, change in gear type, regulations, and climate can lead to diminishing marginal returns for many fishers. How communities are maintaining efficiency, sharing, and community stability will be explored.

SESSION: Small-scale Alaskan fisheries: a focus on sport and subsistence sectors

Ethnoichthyology of Southern Alaska

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Anthropological fieldwork was conducted in Juneau, Sitka, and Kodiak, Alaska in the study of human culture with regards to fish, known as Ethnoichthyology, through an undergraduate research program. The principle investigator conducted semi-structured interviews with regards to commercial fishing culture as experienced by commercial fishermen, amassing a collection of data from fifty interviews. Selection was made for commercial fishing experience of three seasons or more, as well as for consenting adults. Informed consent was both initially sought and periodically and conditionally reaffirmed; the interview had a 10% withdrawal rate. Through this process, data collected pertained to: demography, material/biophysical representation of fish and fishing, fishing practices, sociocultural norms and taboos of fishing, beliefs regarding influential behavior upon the environment, perspectives on fisheries regulation, and observations of changing/stable ecological paradigms. This work demonstrates the capacity for cooperative management of fisheries, and otherwise validates work conducted in cooperative management worldwide. The ethnobiological, transdisciplinary approach also verifies the close connection between the natural and social sciences, and the increasing demand for local perspectives and voices in management. Through anthropological methodology, such a novel management approach has clear and impressive implications as far as “on the ground” viewpoints and utility of syncretic ecological knowledge. Significant study into this application must be completed in order to further develop a means of routinely collecting individual and community perspectives and applying such perspectives in fisheries management.

SESSION: Small-scale Alaskan fisheries: a focus on sport and subsistence sectors

A method for estimating Eulachon populations using a combination of subsistence fishermen and western science

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The Chilkoot Indian Association (CIA) and the Takshanuk Watershed Council (TWC) initiated a study to estimate the spawning populations of Eulachon *Thaleichthys pacificus* in the Chilkoot River using a combination of western science and subsistence fisherman. The population was estimated using a mark recapture method {N=[(M+1)(C+1)/(R+1)]-1} where N= total population size, M=marked initially, C=total in second sample, and R=marked recaptures. The 95% confidence intervals were calculated using the equation N=+/-(1.96)(SE). The initial mark group was captured using a modified fyke net and the subsequent recaptures were collected from subsistence fishermen. Population estimates of eulachon returning to the Chilkoot River were 2.2 million (95% CI 1.7 to 2.7 million), 12.6 million (95% CI 11.5 to 12.6 million), and 7.1 million (95% CI 6.1 to 8.1 million) in 2010, 11, and 12 respectively. This method has proven an effective way to estimate the number of Eulachon returning to spawn in the Chilkoot River. However, it is a labor and fish handling intensive method. Therefore CIA and TWC are working to develop a population indexed by correlating the level of environmental DNA (eDNA) from Eulachon with the mark recapture data. The initial year of the eDNA study began in 2014 with a population estimate of 3.4 million (95% CI 2.9 to 3.9 million) and we are still waiting on the eDNA analysis.

SESSION: Small-scale Alaskan fisheries: a focus on sport and subsistence sectors

Improving Recreational Fishing Opportunities for Pacific Halibut through Cooperative Research with Alaska's Charter Fleet

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Recreational fishing brings many benefits to our nation. It provides the opportunity to share an enjoyable outdoor activity that is healthy, educational, and social. It also provides one of the few vanishing opportunities for people to reconnect with their source of food in its natural, unprocessed, state.

As our nation's population grows, so will the demand for recreational fishing. Pacific Halibut has been a sought after fish due to its delicate mild flavor and the trophy size opportunities that this species is known for. Reduced abundance and reduced size at age of Pacific Halibut now threaten one of Alaska's great economic drivers, the sport charter industry. With recent declines in funding for scientific research, cooperative efforts with the charter fishing community may provide a cost-effective means to achieve a better understanding of these issues and their potential solutions.

Examples of charter sector involvement in cooperative research projects will be the focus of this presentation. The CATCH (Catch Accountability Through Compensated Halibut) Project aims to provide the framework for a compensated transfer of halibut allocation between the commercial and recreational sectors. The HARM (Halibut Angler Release Mortality) Project aims at reducing halibut release mortality by using a Smartphone App to measure the size of a halibut without bringing the fish aboard the vessel. Project "Arroshimi" aims at understanding arrowtooth flounder as a prime competitor of Pacific Halibut for high nutrient food resources and as a potential suspect for the recent halibut's reduced size at age.

SESSION: Small-scale Alaskan fisheries: a focus on sport and subsistence sectors

Temporal changes in target species portfolios in the Gulf of Alaska sport charter fishery

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Fishers may respond to changes in regulations or the quality of their fishing experience by targeting alternative species. This has been shown for some subsistence harvesters in Alaska, who use a portfolio of terrestrial and aquatic resources and regularly adjust harvest strategies for one species based on their success at harvesting others. These adaptations are important for maintaining subsistence and recreational opportunities in the face of regulatory and environmental change, but can have unintended ecological consequences for non-target or secondary target species. For example, management measures implemented for one species can unintentionally shift fishing effort to other species and/or areas if resource users are seeking alternative opportunities. In this study, we are examining patterns of resource use by the halibut sport charter fleet in Southeast and South-central Alaska to evaluate whether the portfolio of targeted species has changed over a period of marked regulatory change. We hypothesize that increasing restrictions in allowable halibut harvest since the early 2000s may have led to increased retention of historically less-preferred species, such as rockfishes. Further, we expect that species preference and use patterns will differ between Southeast and South-central Alaska, which have been subject to different management measures for halibut and other marine species. We will present a preliminary analysis of temporal trends in the portfolio of species harvested on charter trips using two sources of information: interviews with charter operators and catch records from the Alaska Department of Fish and Game.

SESSION: Small-scale Alaskan fisheries: a focus on sport and subsistence sectors

Effects of halibut regulations on charter fishing practices in Southeast Alaska

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In recreational fisheries, regulations such as bag limits and size limits are often used to manage harvest and fishing effort. For the charter fishing industry in Southeast Alaska, effective adaptation to new fisheries regulations is crucial for maintaining successful businesses. Charter operators may respond to specific regulations through changes in fishing strategies; for example, changes to the size limit of halibut could affect the choice of fishing depth or location, resulting in different areas being fished over time.

This project aims to quantify spatial and temporal changes in charter fishing areas and identify drivers of changes to fishing locations. This talk will present preliminary findings based on interviews with charter operators in May 2014 in Sitka, AK. Respondents were asked to mark fishing locations for Pacific halibut (*Hippoglossus stenolepis*), salmon (*Oncorhynchus spp*.), sablefish (*Anoplopoma fimbria*), and rockfish (*Sebastes spp.*) over his or her charter fishing experience. Additional open-ended questions asked respondents to describe drivers of changes in where they fish. Maps were digitized in ArcGIS and changes in location and size of fishing areas were examined over time. Preliminary analyses suggest that charter operators have shifted areas in response to regulation changes. This ongoing research highlights the importance of understanding the spatial dynamics of fisher behavior, particularly in response to fisheries regulations.

FISHERIES CAREER DEVELOPMENT

Developing a fisheries workforce to meet the needs of an ever changing scientific and technical career field

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In Alaska, over 60,000 people earn their living in fisheries related jobs accounting for a direct economic impact of $4.6 billion. The professional fisheries workforce is aging and as entry level positions are vacated by more experienced workers, there is an opportunity for skilled Alaskans to acquire jobs. The next 10 years will see a large increase in the need for scientifically trained technicians, managers, and biologists to work in the fisheries industry. In many cases a technical certificate or degree will produce a graduate more suited to tackle the entry-level positions available in the fisheries industries.

The University of Alaska Southeast and UA branch campuses across the state have partnered with industry and regulatory agencies to develop a Fisheries Technology curriculum which can meet this growing need for a qualified workforce. Using innovative teaching techniques, hands on training, and internships, we provide students with the skills they need to be successful in this increasingly technical field. Current focuses include Alaska Salmon Enhancement and Fisheries Management Techniques. As industry helped develop the current curricula, we provide students with the skills and information needed to be successful in these careers. Graduates from these programs will be career ready with the technical training necessary to perform a wide variety of entry level fisheries positions and beyond. Together we can train the future fisheries workforce of Alaska to meet industry needs, provide careers for Alaskans, and ensure responsible and sustainable resource utilization and management.

CLIMATE CHANGE IMPACTS ON HYDROLOGY AND FISHERIES

Session chair: Hal Shepherd
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The changing weather patterns in Alaska are, already, having substantial impacts on Native Alaskan village and other communities. Increased stream temperatures combined with other climate change related impacts of high river flows, altered ice flows and stream bank erosion, in many cases combine with industrial development in watersheds to directly threaten the fishery and wildlife habitat upon which the Native Villages in the area (Villages) and other communities depend for their subsistence fishing and hunting. In addition, reduced water flows in rivers and streams caused by water diversions from development activity can be exacerbated by the effects of climate change. This can result in increased water temperatures and impair fish and wildlife habitat.

In addition, commercial and subsistence fishing in, which, in many areas, is already impacted by the effects of climate change including coastal erosion, flooding, extreme fluctuations in hydro-geomorphology, early spring break-up and disrupted access to traditional fishing and hunting sites. In early November 2013, for example, the Norton Sound area was hit by a series of severe storms causing flooding in the streets of the communities and damage to sewer and drinking water systems. This Session will address current management efforts to assist communities and government entities to mitigate and adapt to such impacts.

SESSION: Climate change impacts on hydrology and fisheries

Mapping hazardous ice conditions with high-resolution satellite imagery

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In interior Alaska, frozen river systems are important transportation corridors, due to the very limited road network. Long-time Alaskan residents report that winter travel conditions on Interior rivers have become more dangerous in recent memory. To address this concern, we used remote sensing to map dangerous ice conditions on the Tanana River in Interior Alaska. Unsupervised classification of high-resolution satellite imagery was used to identify and map open water and degraded ice conditions on the Tanana River. The classification system performed well for numerous Geoeye-1 and Worldview-2 satellite images. Ninety-five percent of the total river channel surface was classified as "safe" for river travel, while 4% of the channel was mapped as having degraded ice and 0.6% of the channel was classified as open water. An accuracy assessment indicated that snow, degraded ice, and open water were mapped with an overall accuracy of 73%. Over 95% of the classification errors were caused by shadowing of trees or topographic features in the snow. However, the errors associated with shadowing, are relatively easy to discern visually and avoided. This research demonstrates that the classification of high-resolution satellite images is useful for mapping hazardous ice conditions and show promise for a multitude of recreational, transportation, or industrial applications in northern climates.

SESSION: Climate change impacts on hydrology and fisheries

Hydrology and Sustainable Indigenous Populations

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SE Alaska extends across approximately 1,000 miles and Alaska Natives who live in the region's communities regularly access water use in a hydro-spatial context. SE Alaska is experiencing natural and human-related changes in water resources which vary in magnitude both temporally and spatially. Few summaries of potential impacts of climate change on Alaska Natives living in SE Alaska have been compiled. Potential biophysical changes include alteration of estuary area, shore zone erosion pattern, stream water quality and quantity, and stream flow timing. These changes, influencing food resource quantity and quality, require both major and minor resource use adjustments. By synthesizing data from sources including, but not limited to Bureau of Indian Affairs, Alaska State Department of Natural Resources, Sealaska Corporation, USGS gage records, Shorezone Coastal Habitat Mapping Program, USFS interviews, and Local Environmental Observers (LEO), we will document relevant water resources, review historic water use, describe changes in water use, and will document the influences of water change affecting subsistence lifestyles. In this study, we present our methodology for summarizing data and discuss implications of spatial pattern variation. Methods used for analysis will include classification and regression trees, a means of analyzing both quantitative and qualitative non-parametric data.

SESSION: Climate change impacts on hydrology and fisheries

The Norton Bay Climate Change Adaption Plan

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The Norton Bay Inter-Tribal Watershed Council (NBITWC), the Model Forest Policy Program (MFPP) and the Norton Bay Alaska Native Villages (Villages) have a shared vision to enhance the resiliency of our communities and watershed. In 2013, the NBITWC, in partnership with the Villages, took the leadership role to engage in the Climate Solution's University (CSU) Plan Development Program created by the Model Forest Policy Program. The goal of CSU is to empower rural, underserved communities to become leaders in climate resilience using a cost effective distance learning program. This Climate Change Adaption Plan for the Norton Bay Watershed (CCAP) is the result of a year of community team effort, bringing in an array of stakeholders and expertise, building partnerships, extensive information gathering, critical thinking, and engaged planning. The result is a localized, actionable plan that the Norton Bay community and supporters can implement in the coming years. The outcome will be a community that has strengthened capacity to be resilient to the inevitable impacts of climate change- a community with the awareness, shared vision, and partnerships to enable it to have the capacity to withstand the impacts of climate upon the natural resources, economy, and community. This presentation will summarize the Plan and discuss implementation of the Plan

SESSION: Climate change impacts on hydrology and fisheries

Evolutionary rescue and the persistence of fish populations

Peter Westley
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One of the great conservation questions of the modern era is, under what set of conditions will populations be able to adapt quickly enough in order to avoid extinction. Mounting evidence reveals that evolutionary and ecological processes interact on concomitant timescales, indicating the potential for evolution to influence the dynamics of populations. Environmental change can result in individuals being maladapted to new conditions and if the level of maladaptation is severe, the population growth rate may become negative and trend towards extinction. 'Evolutionary rescue' occurs when adaptive evolution restores positive growth to declining populations and extinction is avoided. In this talk I briefly review the hallmarks of evolutionary rescue and highlight several putative cases of evolutionary rescue in wild fish populations. Although the examples are suggestive of rescue, a key insight is that currently no definitive empirical examples of evolutionary rescue in fish or other taxa exist to my knowledge. I end with a call for a unifying framework for researchers in both natural and social sciences to explore the capacity and potential for adaptation of both humans and non-humans alike in a rapidly changing world.

SESSION: Climate change impacts on hydrology and fisheries

Kenai River Salmon Harvest: Trends and Changes

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This paper will be taking a contemporary look at salmon harvest trends on the Kenai Peninsula. An exploration of harvest trends over time and shifts in habit and habitat will be described from the perspective of those that have engaged with the Kenai River for decades or more. Potential impacts and causes of these shifts will also be touched upon.

POSTER ABSTRACTS

Alaska Hydrography Technical Working Group

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The Alaska Hydrography Technical Working Group, or AHTWG, is the committee focused on the coordination of current and future surface water hydrography mapping in Alaska. AHTWG is charted under the Alaska Climate Change Executive Roundtable, and is comprised of six federal agencies- U.S. Forest Service, U.S. Geological Survey, National Park Service, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, and Bureau of Land Management- and four State of Alaska entities- Department of Environmental Conservation, Department of Fish and Game, Department of Natural Resources and the University of Alaska. The group is currently Chaired by the USGS with a Vice-Chair from Alaska Department of Natural Resources. AHTWG currently has four Focus Groups comprised of AHTWG members working in special sessions on Hydrography Data Model Standards, Hydrography Data Editing Standards, NHDPlus Development and performing Outreach and Communications activities. AHTWG has adopted AK Hydro as the preferred path forward to support hydrography mapping updates in Alaska.

Do I need a permit to collect that? An overview of the Fish Resource Permit (FRP) process

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Do you want to set up an aquarium in your child's school, or try growing some tilapia in that pond in your back yard? You'd better stop and check the state's regulations first.

The Alaska Department of Fish and Game (ADF&G) is the steward of the fish resources of the state. A Fish Resource Permit (FRP) is required for scientific and educational collections of fish, invertebrates, amphibians, and marine aquatic plants not covered by existing regulations. The application process involves a thorough investigation by various department staff to ensure the study plan is sound and the resource can withstand collections without significant adverse effects. Permits indicate species and numbers allowed for collection, acceptable methods, and stipulations to be followed. Project results are submitted to ADF&G for review, and are available to the public.

FRPs also cover propagative research by accredited institutions of higher learning and cooperative governmental projects to test feasibility of various techniques of incubation, marking, rearing, and release involving fish and invertebrates. Propagative research is highly regulated to ensure that the resource can withstand any collections, and that all concerns of the genetic, pathological, or management nature are addressed. Releases from propagative research are considered common property.

FRPs expire annually and the applicant must be in good standing with compliance of their permit conditions before any subsequent permits can be issued.

By the way, you can probably get an aquarium permit with certain conditions, but production of exotic species like tilapia is not permitted in Alaska.

Anadromous Cataloging and Fish Inventory in Select Bristol Bay Drainages

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From July 28 to August 19, 2014, the Alaska Department of Fish and Game, Division of Sport Fish conducted an inventory of stream and lake fish assemblages and associated aquatic and riparian habitats in a 35,436 km2 study area spanning much the Nushagak, Wood, Mulchatna, and Kvichak river drainages (excluding conservation units). Using helicopters and floatplanes to access our study sites, we surveyed multiple streams each day ranging in size from wadeable headwaters to the mainstem Mulchatna River and lakes ranging in surface area from 0.14 to 2.21 km2. At each site, we collected data describing the site location, aquatic habitat, riparian vegetation, and fish assemblage composition. Fish were collected primarily using backpack and boat-mounted electrofishers and gillnets. Anadromous fish observations made during these surveys will be used to nominate water bodies to the State of Alaska's Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes, or to update fish life stage information for waters already in the catalog.

Genetic structure of sockeye salmon *Oncorhynchus nerka* in Auke Lake, Alaska

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Genetic markers were used to detect changes in genetic variation within and between years in a naturally spawning population of sockeye salmon. Tissue samples were collected from nearly all returning adults to Auke Lake in 2008, 2009 and 2011. DNA was extracted and analyzed at 12 microsatellite and 48 single nucleotide polymorphism (SNP) loci. Evidence of isolation by time was present in all three years, although variation in signal strength occurred between years. Individuals clustered within years into three groups according to principal component analysis (on a centered matrix of individual allele frequencies) and into two groups as identified by the program STRUCTURE. This insight into the fine-scale population structure of Auke Lake sockeye allows us to anticipate the potential responses of the population to future management decisions as well as environmental and climate change effects.

The influence of environmental factors on the migration timing of Auke Creek Dolly Varden

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Anadromous populations of Dolly Varden (*Salvelinus malma)* migrate to sea each spring, then return to freshwater systems in the fall to overwinter. Pacific salmon (*Oncorhynchus spp.*) provide seasonally abundant food to Dolly Varden in the form of fry in the spring and eggs in the fall. These food sources are thought to be in part responsible for the timing of Dolly Varden movements, but the exact environmental cues triggering migration are not fully understood. We use historic Auke Creek weir data to examine environmental factors that influence Dolly Varden migration and the extent to which the migrations of Dolly Varden and salmon are synchronized. Preliminary analyses show the synchrony between upstream Dolly Varden and salmon migration, as well as factors that influence Dolly Varden migration. We will use a linear mixed effects model to compare models of the factors that affect upstream and downstream Dolly Varden migration. This study will provide a better understanding of the migratory behaviors of an ecologically important species of salmonid and help refine predictions of how Dolly Varden behavior may change as environmental conditions shift in the future.

Beyond Stream Layers: Building Digital Hydroscapes that Integrate River with Terrestrial Environments

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Stream layers within a GIS must be supplemented with additional capabilities to increase our ability to answer key questions in resource management and conservation planning. In concept, a "digital hydroscape" is a virtual riverine-terrestrial environment that contains features and functions similar to real landscapes. In practice, a hydroscape is a numerical data structure designed to quantify physical and biological processes and human interactions over a range of scales. A hydroscape contains five benchmarks: (1) a digital representation of topography, a DEM of the highest resolution available; (2) a node-based, routed and attributed "synthetic" river network, derived from a DEM; (3) landform and process characterization that include, in addition to river networks, valley floors, floodplains, terraces, alluvial fans, and hillslope geometry, such as gradient and curvature; (4) Multi-scale landscape and land use discretization designed to isolate effects of fine scale landform and land use elements and to define interactions among them; and (5) Connectivity that utilizes down-slope, up-slope, across-slope, and downstream and upstream transfer of information, similar to a real landscape. Processes in a hydroscape that affect landforms or are affected by land uses can encompass stream flow, flooding, sediment transport, landsliding, thermal loading, habitat formation, wildfire, erosion and climate change, among others. Human activities that can be addressed include forestry, agriculture, deforestation, grazing, road and pipeline construction, river diking, hydropower, and urbanization, among others, including river restoration and conservation activities. Moving beyond stream layers, hydroscapes can broaden access to the watershed sciences and strengthen resource management and conservation.

Off-road vehicle stream crossing assessments in anadromous fish habitat, Matanuska-Susitna Borough, Alaska.

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The Matanuska and Susitna (Mat-Su) river watersheds meet freshwater life history needs of all five species of Pacific salmon *Oncorhynchus spp*. and support other salmonid populations such as rainbow trout *O. mykiss*, and Dolly Varden *Salvelinus malma*. The Mat-Su is one of the most rapidly developing areas in Alaska, and fisheries and land managers have concerns that intense recreational use in this area could impact salmon production. The objectives of the project were to map off-road vehicle (ORV) trails, develop a simple method to assess and rank degradation levels at stream crossings, and evaluate the effectiveness of this methodology and its potential to inform future habitat restoration projects. The spatial distribution of ORV trails was assessed using satellite imagery, photographic flights, and on-the-ground surveys. Seven attributes of the trail stream crossing were recorded and assigned a rank used to determine the relative level of degradation. Over 200 km of ORV trails were mapped, and thirteen ORV trail stream crossings were assessed for degradation level and ranked in 2012. All crossings were degraded to some degree and most ranked as "extremely degraded". This methodology provided a simple and efficient assessment of ORV trail impacts at simple (2 entry point) stream crossings, and may be applicable elsewhere in Alaska where ORV use has degraded fish habitat. The method will be further evaluated for application in complex (braided) trail systems. Continued investigations will provide information needed to determine how these stream crossing assessments may be applicable in effectively prioritizing future habitat restoration projects.

Spot Prawn Reproductive Study

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Spot prawns (*Pandalus platyceros)* are a highly valued commodity in Southeast Alaska for 1) the commercial fishing industry, 2) subsistence and recreational fisheries, and 3) foraging marine species within Alaskan ecosystems. Understanding recruitment processes of the spot prawn has been understudied but is important for management decisions and ecosystem processes. Our study goals were to describe life history reproductive traits of spot prawns from Southeast Alaska by determining whether females produced multiple clutches in the summer months or just one. Shrimp were collected near Juneau, Alaska in February, housed at the University of Alaska Southeast wet lab, and critically observed from April through August. Results indicated that each reproductive female was fertilized, extruded eggs and carried the eggs until hatching once per summer season. After hatching, females molted. In summary, we found that spot prawns reproduce one time during the spring and molt prior to fall and winter. Further observations are currently being made to identify fall and winter life history traits.

Graying of the Fleet: Alaska's Next Generation of Commercial Fishermen

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This study seeks to better define the problem of the "graying of the fleet," a pressing concern for the state of Alaska and its coastal communities, and to assess and develop alternatives that will help address this growing problem. Since the implementation of limited entry, the average age of permit holders in the state's commercial fisheries has increased from 40.9 years in 1980 to 49.7 years in 2013. This shift indicates that young members of fishing communities are no longer entering local fisheries at the rate that they did in previous decades. This ethnographic research project based in the vital commercial fishing regions of Bristol Bay and Kodiak will: 1) document and compare barriers to entry into, and upward mobility within, fisheries among youth and young fishery participants; 2) examine the factors influencing young people's attitudes towards, and level of participation in, Alaska fisheries; 3) identify models of successful pathways to establishing fishing careers among young residents; and 4) identify potential policy responses to address the graying of the fleet and develop specific recommendations consistent with state and federal legal frameworks. This is the first year of the project, and we are currently conducting interviews with community members in Bristol Bay and Kodiak that will inform the design of a survey to be distributed to school-age residents of both regions in early 2015.

Vertical migrations of juvenile sablefish (*Anoplopoma fimbria*) in coastal southeast Alaska

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Describing fine-scale movements of juvenile sablefish can provide insight into their mechanisms for survival in nearshore habitats. Juvenile sablefish have been found to eat benthic and pelagic prey, implying potential vertical migration off the bottom to forage, however little is known about their fine-scale movement. This study assessed the vertical movement patterns of juvenile sablefish in relation to daylight and tidal cycles using acoustic telemetry. Thirteen juvenile sablefish were implanted with acoustic transmitters and monitored by 2 hydrophone receivers from 5 Oct to 14 Nov 2003 within St. John Baptist Bay, Baranof Island, Alaska. The six fish that remained within range of the receivers spent the majority of time near the bottom, but made periodic vertical excursions. Generalized linear mixed models were used to determine the relationship between excursion frequency and environmental factors. Excursions were influenced by tide and diel conditions, with a higher excursion frequency at dawn and during slack and flood conditions and a lower excursion frequency at night. Flood and slack tide may create an influx of pelagic prey resources which could lead to the more frequent vertical movement of juvenile sablefish during these tide stages. Higher probability of excursions at dawn may be due to factors such as predator avoidance or increased prey movement at crepuscular periods. To date, this is the first study describing vertical migration of juvenile sablefish in the wild and reveals that environmental conditions have the potential to affect the fine-scale movements of juvenile sablefish within nearshore habitats.

Interactions between Didemnum vexillum and Pacific herring (*Clupea pallasii*) roe in natural and artificial egg deposition experiments

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Pacific herring (*Clupea pallasii*) sustain important commercial and subsistence fisheries in the North Pacific. Pacific herring deposit eggs on a variety of substrates including shallow rocky bottom. *Didemnum vexillum*, a globally-invasive colonial ascidian, has been found to rapidly overgrow its competitors on shallow rocky bottoms in some Atlantic and Pacific locations. Nonindigenous *D.vexillum* populations occur at multiple locations within the natural range of Pacific herring. The discovery of *D. vexillum* in Sitka, Alaska in 2010, raises serious concerns about interactions between this zealous invader and this economically and culturally important fish. In the present study, both natural and artificial egg deposition experiments were carried out in San Francisco examining *D. vexillum* as spawning substrate. We found that in natural deposition experiments with light to moderate spawn, very few eggs were deposited on flat parts of the *D. vexillum* tunic . This suggests that smoother parts of the colonies may be too slippery for roe to adhere. In artificial deposition experiments, eggs were placed on the tunic of *Didmnum vexillum* and observed during development. Both in the lab and in situ, *D. vexillum* was able to overgrow some eggs prior to hatching. In Sitka, Alaska in 2013, herring spawn occurred in an area infested with *D. vexillum*. Preliminary field observations suggested interactions similar to San Francisco experiments. If successful egg deposition is reduced by the presence of *D. vexillum* or if overgrowth of eggs occurs significantly in the wild, this highly invasive species could pose a serious concern for herring populations.

Diets of Pacific Staghorn Sculpin in Cowee Creek Estuary, Summer 2014

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Alaska's estuaries are important habitat for a diverse group of aquatic organisms. Notably, they are nurseries for many species, including some that are commercially important. One of the most common teleost residents of southeast Alaska's estuaries is the euryhaline generalist Pacific staghorn sculpin (Leptocottus armatus). The staghorn sculpin is an opportunistic consumer that is commonly found in estuarine systems from Alaska to California. Despite their prevalence, staghorn sculpin diets in the northern portion of their range are poorly described. Little is known about their impact in the estuarine food webs of southeast Alaska. This study seeks to begin filling that knowledge gap by examining staghorn sculpin diets at Cowee Creek estuary near Juneau, AK. We used a beach seine to collect 51 staghorn sculpins from April 2014 to July 2014. Stomachs were removed from the fish, preserved, and opened to identify contents to the lowest taxonomic level possible. Stomach contents were measured for weight, and when possible, length. The data indicated that staghorn sculpins live up to their generalist consumer reputation. By weight, polychaete worms represented the largest portion of staghorn diets in this sample. Teleosts were the second heaviest prey group. Identified fish prey included sculpins, pricklebacks, and flatfish. Gammarid amphipods, mysids, and isopods also made up a substantial percentage of the total diet despite low individual weights. Other notable prey items included bivalves, echiurans, insects, crangon shrimp, and egg bearing vegetation. Temporal variations in prey composition were also observed, with prey diversity increasing with the progression of summer.

Control and eradication of invasive northern pike in Southcentral Alaska

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Northern pike are an invasive species in Southcentral Alaska. Illegal introductions of northern pike began in the Upper Susitna drainage in the late 1950s. Subsequent expansion coupled with continued illegal introductions have resulted in the widespread distribution of northern pike from the Matanuska-Susitna Valley to the Kenai Peninsula. Northern pike are highly piscivorous and reduce ecologically and economically valuable salmonid populations throughout Southcentral Alaska.

The Alaska Department of Fish and Game has taken an adaptive management approach with northern pike control. Protocols chosen for control activities in a water body are dependent on its unique conditions. Northern pike control efforts have included liberalized harvest, increased outreach, fish passage barriers, gillnetting operations, and piscicide applications. Piscicide applications are conducted to eradicate northern pike populations, restore fisheries, and prevent northern pike from spreading. Recently, ADF&G began an annual large-scale gillnetting project to control northern pike in Alexander Creek, a tributary to the Susitna River, where some of the worst fishery losses have occurred. ADF&G also conducts research on northern pike movement patterns, diet and bioenergetics, effective control methods, and detection methods such as eDNA. All control, eradication, and research projects are directed by an Invasive Northern Pike Management Plan and prioritized through a strategic planning process.

Water mass property associations with juvenile Chinook salmon in the northern Bering Sea; a look at warm and cold years

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The oceanography and shelf dynamics of the southern eastern Bering Sea (EBS) have been well-studied, while less attention has been given to the northern EBS, although commercially important fisheries are present in both the south and the north. Sea ice extent and duration, and freshwater inputs from the Yukon River are substantially higher in the north compared to the south, resulting in large variations in oceanography between the northern and southern EBS and between localized areas within the northern EBS. Our goal is to find water mass characteristics that associate with juvenile Chinook salmon and compare those associations between warm and cold years in the northern EBS.

Exploitation of Pacific salmon (*Oncorhynchus* spp.) by three major predators

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Pacific salmon (Oncorhynchus spp.) are a seasonal resource that can provide a substantial amount of marine derived nutrients and biomass to freshwater ecosystems along the Pacific coast. Salmon carcasses and eggs are exploited by a host of predators during the spawning migration, and in Southeast Alaska three major consumers of Pacific salmon and salmon eggs are brown bears (Ursus arcots), glaucous-winged gulls (Larus glaucescens), and coastrange sculpin (Cottus aleuticus). Our study examines the impact that Pacific salmon have on the behavior and growth of these predators in Berners Bay, Alaska. We will test whether coastrange sculpin show compensatory growth when fed a temporally limited diet of salmon eggs in the field. We also will explore the potentially interacting effects of water temperature and food availability on sculpin growth rates in a controlled setting. In a set of observational studies, we will examine spatial and temporal use of Berners Bay by brown bears and glaucous-winged gulls during the salmon spawning migration. The distribution of glaucous-winged gulls and brown bears relative to spatially and temporally varying salmon runs in Berners Bay will be used to infer how these two predators track this food resource. This research will help us to understand and predict changes in the distribution and phenology of salmon consumers as salmon populations shift their migration timing in response to changing physical conditions.

Evaluation of Growth, Survival, and Recruitment of Chinook Salmon in Southeast Alaska Rivers

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The importance of freshwater and marine processes on female Chinook Salmon *Oncorhynchus tshawytscha* recruitment to reproductive age was examined in the Taku and Unuk rivers (southeastern Alaska) using long-term adult and smolt data sets. These evaluations will allow for the assessment of growth and survival on recruitment within individual stocks by following cohorts from freshwater through marine residence until they return to their natal river as reproductively mature adults. Abundance of adult female Chinook Salmon escapements ranged from 4,120 to 70,691 fish between 1973 and 2007 and 475 to 6,757 fish between 1986 and 2013 in the Taku and Unuk rivers, respectively. Between 1991 and 2006, Taku River smolt abundance ranged from 1,112,499 to 3,470,479 fish. Estimated smolt abundance in Unuk River ranged from 165,253 to 754,009 individuals between 1992 and 2007. Preliminary results indicate that smolt abundance has increased significantly in the Taku but not the Unuk River. For both systems, smolt abundance and marine survival were positive linear predictors of total adult returns. In the Unuk River, there was a significant negative relationship between smolt abundance and marine survival. Ricker stock-recruitment analysis indicated the number of spawners at maximum recruitment was 6,161 and 44,371 fish and the maximum number of recruits was 52,664 and 509,197 fish for the Unuk and Taku rivers, respectively. This evaluation will allow for the development of more accurate and reliable forecasts for making management decisions on Chinook Salmon stock status and escapement goals in southeastern Alaska rivers.

An intraspecific comparison of fish diets between regions of the northeastern Chukchi and western Beaufort seas

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Diet information for Arctic Cod (Boreogadus saida), Arctic Staghorn Sculpin (Gymnocanthus tricuspis), and Shorthorn Sculpin (Myoxocephalus scorpius) is limited, outdated, from distant regions, or nonexistent. We collected these species during ice-free months over three years in the northeastern Chukchi Sea (2010–2012) and one year in the western Beaufort Sea (2011). Diets were compared by three factors: seas, regions, and size classes. Diets of each of the three fish species differed between the northeastern Chukchi and western Beaufort seas and small and large fish fed differently. In general, Arctic Cod were mainly pelagic feeders in both seas, while Arctic Staghorn Sculpin fed benthically in both seas. Shorthorn Sculpin diet was more variable, with northeastern Chukchi Sea fish feeding more benthically and western Beaufort Sea fish more pelagically. Additional diet differences were indicated by regional analysis. While differences were apparent across all regions, all three species consumed more benthic prey in the northern region of the northeastern Chukchi Sea. Our analysis indicated there is flexibility in some fish species' diets across both seas. This flexibility is critical to the ability of a fish species to adapt as Arctic conditions change.

Landscape-Scale Analysis of the Relationship between Juvenile Chinook (Oncorhynchus tshawytscha) Size and Growth and Stream Temperature in Western Alaska

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This project seeks to understand the interaction between climate change and subsequent responses by Chinook, *Oncorhynchus tshawytscha*, populations during their juvenile freshwater life stages. Recently, Chinook salmon abundance has synchronously declined across many Alaskan stocks, resulting in cultural and socioeconomic hardship for user groups. Water temperature plays a critical role in the health of pre-smolt salmon life stages (hereafter "juvenile"), and changes in water temperature may be a strong driving factor on growth and survival of juvenile Chinook salmon. Furthermore, climate is expected to warm substantially in the coming decades in western Alaska, potentially affecting juvenile salmon condition in freshwater habitats.

In this project, we undertake a landscape-scale meta analysis using statistical modeling to infer juvenile Chinook size at age and annual growth from extant fork length data, which is available with substantial spatial and temporal coverage. We investigate whether there is a discernible relationship between climate and juvenile Chinook condition by examining the association between juvenile Chinook size or growth and patterns in stream temperature. To accomplish this, project objectives are to: 1) leverage ongoing data collection efforts in Alaska to synthesize extant fish length and temperature data, 2) implement mixture models to estimate Chinook size at age and annual growth from fork length data, and 3) analyze the association between stream temperature and growth or size at age of Chinook salmon across the western Alaska landscape.

Simulating Glacial Outburst Lake releases for Suicide Basin, Mendenhall Glacier, Juneau, Alaska

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Glacial Lake outbursts from Suicide Basin are recent phenomenon first characterized in 2011. The 2014 event resulted in record river stage and moderate flooding on the Mendenhall River in Juneau. Recognizing that these events have can adversely impact residential areas of Juneau's Mendenhall Valley, the Alaska-Pacific River Forecast Center developed a real-time modeling technique capable of forecasting the timing and magnitude of the flood-wave crest due to releases from Suicide Basin. The 2014 event was estimated at about 37,000 acre feet with water levels cresting within 36 hours from the time the flood wave hit Mendenhall Lake. Given the magnitude of possible impacts to the public, accurate hydrological forecasting is essential for public safety and Emergency Managers. However, the data needed to effectively forecast magnitudes of specific Jokulhlaup events are limited. Estimating this event as related to river stage depended upon three variables: 1) the timing of the lag between Suicide Basin water level declines and the related rise of Mendenhall Lake, 2) continuous monitoring of Mendenhall Lake water levels, and 3) estimating the total water volume stored in Suicide Basin. Real-time modeling of the event utilized a Time of Concentration hydrograph with independent power equations representing the rising and falling limbs of the hydrograph. The initial accuracy of the model — as forecasted about 24 hours prior to crest — resulted in an estimated crest within 0.5 feet of the actual with a timing error of about six hours later than the actual crest.

Enumeration and Speciation of Pacific Salmon in Eagle River, Joint-Base Elmendorf Richardson, in Support of Identifying Prey Species of the Threatened Cook Inlet Beluga Whale.

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From May through September, Pacific salmon (Oncorhynchus sp.), a prey species for the threatened Cook Inlet Beluga Whale (CIBW), are enumerated in Eagle River on Joint Base Elmendorf-Richardson. This study aims to establish fisheries resource estimates and correlate salmon run timing and population with seasonal CIBW populations in Eagle River and Eagle River Bay. A dual frequency identification sonar (DIDSON) is used to estimate salmon passage along with a fish wheel to document run timing and species identification. The study duration encompasses the majority of the run timing for all five salmon species found in Eagle River. Daily passage is estimated for each salmon species; however, significant data gaps occur for periods when high flow events suspend the DIDSON operation. Species are apportioned by daily fish wheel catch and the season's overall total catch. Apportionment numbers are useful to describe the run period and relative run strength of each species, however, the season totals likely represent minimum passage. The Chinook (O. tshawytscha) seasonally-apportioned daily passage is believed the most accurate of the estimates because there is little overlap with run timing from other species. Passage estimates for sockeye (O. nerka), pink (O. gorbuscha), and chum (O. keta) have been incomplete during the past (2012-2013) because of the removal of the DIDSON during high flow periods. Overlap in run timing also adds uncertainty to the species specific estimates. Estimates for coho (O. kisutch) are least reliable because of high water and flooding events that occur in August and September.

Community-Based Stream Habitat Mapping in Traditional Hydaburg Subsistence Use Areas

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For the past two years, The Nature Conservancy, the Hydaburg Cooperative Association, and Kai Environmental Consulting Services have partnered to improve stream habitat mapping in the traditional subsistence use areas of the residents of Hydaburg on Prince of Wales Island. In 2012 2013, and 2014 crew members from Hydaburg actively performed fish and fish habitat surveys on all fish-bearing freshwater habitats in the Hetta Lake, Eek Lake, Natzuhini Creek, Kasook, Keete, Hydaburg River, Nutkwa, Dunbar, Coffee Chuck, and Klekass Nephew watersheds. These watersheds represent areas traditionally used by Hydaburg residents for harvesting salmon and other subsistence uses. They also represent watersheds currently under documented in the state's anadromous waters catalog as well as areas that are unprotected from future timber harvest. Surveys were intended to protect these watersheds as anadromous waters but also to document baseline habitat quality and quantity in the event of future changes in habitat conditions or to direct possible restoration actions where conditions are already degraded. Between 2012 and 2014, more than 30 miles of streams have been surveyed, with over 10 miles submitted or eligible for submission as new anadromous water bodies. Partners hope to continue this work until all relevant watersheds in the area have been mapped as well as to expand these community survey and monitoring efforts to other communities on Prince of Wales Island.

Yukon River juvenile chum salmon in the eastern Bering Sea

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In western Alaska, chum salmon (*Oncorhynchus keta*) are critical for subsistence, commercial, and cultural reasons. Over the last couple of decades, declines in chum salmon returns in some western Alaskan drainages prompted various disaster declaration by state and federal agencies. The Yukon River is one of the largest producers of chum salmon in western Alaska. The two distinct chum salmon life-history types in this system spawn at different times and places within the river. The earlier and typically more abundant summer run spawns in the lower to middle reaches of the Yukon drainage, whereas the genetically distinct fall run generally spawns in spring-fed regions of the middle to upper reaches in Alaska and Canada. Juvenile chum salmon migrate from the Yukon River in the spring and are found in the pelagic waters on the eastern Bering Sea shelf during summer and fall months, but little is known about their survival during this time period in fresh or salt water environments. We genetically analyzed juvenile chum salmon caught on the eastern Bering Sea shelf off the mouth of the Yukon River during the 2003-2007 Bering-Aleutian Salmon International Surveys. The genetic stock distribution of juvenile chum salmon was compared across years, a relative abundance index of summer and fall Yukon River chum salmon was developed, and the potential to correlate juvenile relative abundances with adult returns for summer and fall Yukon River chum salmon was explored.

Potential management strategies for invasive Alaska blackfish (*Dallia pectoralis*) utilizing cardiac physiology

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The Alaska blackfish is native to the densely vegetated, oxygen-poor waters of western Alaska. However, it has been introduced to Anchorage lakes and ponds stocked with rainbow trout. The Alaska blackfish has proven to be a resilient competitor of rainbow trout for habitat and food given its ability to breathe air and withstand extreme winter temperatures. The objective of my research was to lend insight into whether the Alaska blackfish remains active, or enters a dormant state in the winter months to determine the amount of time it actively competes against rainbow trout. This objective was assessed using physiological measurements of cardiac contractility as a proxy for overall metabolic activity. The density of L-type Ca^{2+} current in ventricular cardiomyocytes isolated from fish acclimated to summer (15°C) and winter (5°C) conditions was measured using whole-cell patch-clamping. A 7.7-fold difference in L-type Ca^{2+} current density was observed between 5°C-acclimated fish (1.11±0.09 pA pF^{-1}) and 15°C-acclimated fish (-8.79±0.57 pA pF^{-1}). Additionally, the kinetics of L-type Ca^{2+} channel inactivation was significantly slowed with cold-acclimation. The results indicate that the Alaska blackfish may enter a dormant state during the winter months, which is advantageous when the water becomes oxygen-poor. In these cases, Alaska blackfish will have a better chance of survival than the notoriously hypoxia-sensitive rainbow trout. The overwintering strategies of these competing species should be considered in future management and stocking strategies of Anchorage lakes.

Yukon River Summer Chum Salmon Radio Telemetry

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Salmon on the Yukon River consistently support some of Alaska's largest subsistence and in-river commercial fisheries; however, these fisheries are in a state of change. Fishermen are increasingly targeting summer chum to supplement or, in most cases, replace Chinook salmon harvest. Due to declines in the Chinook salmon run, market conditions have improved for a productive summer chum salmon commercial fishery, which provides a much needed economic boost to one of the poorest areas of Alaska. Unfortunately, because of the immense size of the Yukon River drainage, numerous tributaries lack adequate assessment of summer chum salmon spawning escapement and spawning distribution is poorly understood. In addition, lack of information prevents managers from giving full consideration to timing and relative exploitation of individual stock components. In order to address these data gaps, ADF&G implemented a radio telemetry study in 2014. Over 1,200 summer chum salmon were radio tagged near the mouth of the Yukon River, and of these, 1,107 were successfully tracked upriver via remote tracking stations and aerial surveys to determine spawning distribution, run timing, migration patterns, and stock composition within the drainage. Summer chum salmon migrated up 13 major tributaries and the bulk of the tagged salmon traveled up the Anvik (21%), Koyukuk (19%), and Bonasila (10%) rivers. Preliminary mark-recapture estimates put the total run size at about 2.1 million salmon. These data will provide critical information for managers to address management issues resulting from increased exploitation and will help ensure the sustainability of the summer chum salmon fishery.

Westward Region Smolt Studies

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Throughout the Westward Region (Kodiak Archipelago and Alaska Peninsula), the Alaska Department of Fish and Game typically runs seven or more juvenile sockeye salmon enumeration projects each season. Methods of capture throughout the region include rotary screw traps, fyke nets, inclined plane traps, and beach seines. Chignik River and Karluk River are two sockeye salmon producing rivers located on the Alaska Peninsula (Chignik) and Kodiak Island (Karluk) where juvenile sockeye salmon studies are of particular interest. Both systems produce two commercially-important runs of sockeye salmon each season, have large lagoons that are thought to act as nursery areas for rearing salmon, and have been the subject of much research work. But the pattern of smolt production and survival, as well as research history, vary dramatically. Chignik has a long term, continuous dataset of juvenile enumeration stretching over 20 years. Smolt produced from the Chignik watershed are typically small (mean length 74mm in 2013), have poor marine survival rates, are predominantly age 1.x and 2.x, and outmigrating population estimates have ranged from 2.9 to 28 million smolt. In contrast, the Karluk watershed typically produces large (mean length 147 mm in 2013), age 2.x smolt with high marine survival rates, and population estimates are typically below 2 million outmigrating smolt. Research on Karluk River juveniles has been irregular and includes sonar enumeration, grab samples, and most recently, three years of mark-recapture population estimates using inclined-plane traps. This work presents an overview of the two systems within the region.

Nuclear Genetic Diversity in Threespine Stickleback (*Gasterosteus aculeatus*) from the North Pacific Basin

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How is the genetic diversity of a species distributed across its geographic range? We are examining the distribution of genetic variation across coastal resident freshwater populations of threespine stickleback (*Gasterosteus aculeatus*) in the North Pacific to gauge the degree of gene flow between populations in this region and to infer historic movement from source populations. We are focusing on variation in multiple nuclear genomic regions to complement recent studies that documented the distribution of two different mitochondrial genome (mtDNA) lineages among populations in this region. We hypothesize that variation in the nuclear genome will point to deep genetic divergence in parallel to that observed in mtDNA. In addition, the geographic distribution of these variants will help us identify similarities and differences in the role of geography in shaping population genetic diversity in the mitochondrial and nuclear genomes. To date, our results provide evidence that there is extensive variation that is largely structured by geography. Together, mtDNA and nuclear evidence show that genetic intergradation of ancient stickleback lineages along the north Pacific Coast is an ongoing and dynamic

Habitat potential for juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) in the Chena River basin, Alaska

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It is estimated that less than 50% of potential waterbodies (e.g., streams, rivers or lakes) in Alaska have been documented as supporting anadromous fishes. However, identification and protection of unsampled waterbodies will be critical in light of increasing threats to fish populations owing to climate change, fishing pressure, and land development. We used Netmap, an integrated collection of watershed-process tools to attribute a digital stream layer with physically- and ecologically-relevant characteristics representing juvenile Chinook Salmon rearing habitat potential across the Chena River basin, interior Alaska. Using these metrics, we fit an Intrinsic Potential (IP) model based on gradient (%), mean annual discharge (m3/s), and valley constraint (bank full:valley width) using preference curves from three previously published studies. The model classified 930.8 stream-km as having high (IP > 0.7) rearing habitat potential. We then divided the basin into 149 watersheds (> 20 km2 drainage area) and assigned each watershed to a category: high IP (≥ 0.7), but unsampled (N = 86 watersheds), low IP (< 0.7), unsampled (N = 31) and known to support rearing juvenile Chinook Salmon based on the State of Alaska's Anadromous Waters Catalog (N = 32). Ten watersheds from each category were randomly selected to calibrate and refine the IP based on empirical data. Presence and abundance of juvenile Chinook Salmon will be quantified within these watersheds using environmental DNA and calibrated snorkeling surveys during summer 2014 and 2015. Our results will help managers map critical rearing habitats, direct field research activities, and assist with prioritizing restoration actions.

Diadromy of Humpback Whitefish and Least Cisco from the Chatanika and Tanana River Drainages Using Otolith Microchemistry

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This research focuses on developing a better understanding of the frequency of diadromy in stocks of humpback whitefish *Coregonus pidschian* and least cisco *C. sardinella* in the Chatanika and Tanana rivers, Alaska. Otolith microchemistry techniques, specifically Inductively Coupled Plasma Mass Spectrometry (ICPMS), were used to detect otolith Strontium (Sr) and Calcium (Ca) ratios in the otoliths because elements acquired from the environment are accumulated and stored through time in these structures. The results of this study indicate that diadromy occurs but is not universal in these stocks. Four of 14 humpback whitefish from the Tanana River were classified as diadromous, while one of 29 least cisco and four of 29 humpback whitefish from the Chatanika River were classified as diadromous. For both species the age at which individuals first entered the marine environment occurred just prior to or at the expected age of sexual maturity (age 5 for humpback whitefish and age 3 for least cisco), and the duration that individuals remained in areas marine environments ranged from less than one year to approximately 11 years. The distance traveled by whitefish in this study from marine environments to the Chatanika and Tanana rivers were slightly greater than those reported for whitefishes within the Tanana River Drainage (1,300km), but not as far as those found in the Yukon (1,700km) or Koyukuk River (1,600km). While this study expands our understanding of whitefish movements within the Yukon River drainage, there is much to be studied before gaining a comprehensive knowledge of whitefish life-history dynamics.

The Incidence of Windthrow in Stream Buffers adjacent to Timber Harvest Units on the Tongass National Forest

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Windthrow is an important and naturally occuring phenomenon in southeast Alaska. It recycles forest stands while maintaining and renewing the forest ecosystem. However, timber harvest has the potential to exacerbate the rate of windthrow in adjacent forest stands, including riparian management areas, beyond that found within the natural range of variability. The vegetation inherent in riparian areas is recognized as an important controlling component in maintaining the natural range and frequency of aquatic habitat conditions. The incidence and characteristics of windthrow are monitored in riparian buffers of both fish streams and streams of water quality concern on the Tongass National Forest. The amount of windthrow compares the number of windthrown trees to the total number of originally standing trees in the buffer. The number of trees felled due to windthrow is documented and measured using low-altitude digital still aerial imagery. Repeated measurements of standing tree loss due to windthrow are obtained annually for the first five years after harvest and then again ten and fifteen years after harvest. The year 2014 was the fifteenth consecutive year of monitoring. Initial results have shown that post-harvest windthrow is present in 55 percent of the 262 buffers monitored. The cumulative windthrow mortality in the buffers is highly variable and ranges from zero to 85 percent. The mean amount of windthrow in the buffers is 6.7 percent, the median is 0.8 percent.

Alaska's ShoreZone Dataset, the Mother Lode of Nearshore Marine Habitat Data

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ShoreZone is a mapping and classification system that specializes in the collection and interpretation of low-altitude aerial imagery of the coastal environment. Its objective is to produce an integrated, searchable inventory of geomorphic and biological features of the intertidal and nearshore zones which can be used as a tool for science, education, management, environmental hazard planning, and other uses. ShoreZone imagery is available for approximately eighty-six percent (~67,939 km) of Alaska's shoreline and mapping is completed or in progress for approximately seventy-eight percent (~61,401 km) of Alaska's shoreline. An overview of ShoreZone will be provided in this presentation as well as information on how to access the dataset. ShoreZone products from Alaska will be highlighted including the ShoreZone website (open access dataset), the ShoreZone coastal vulnerability module, Alaska ShoreZone bioareas, and additional ShoreZone applications.

Salmon Blitz: Engaging Citizen Scientists in Documenting Salmon Habitat in the Copper River Watershed

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An understanding of Pacific salmon habitat use at all life stages is necessary to protect and sustain Alaska's wild salmon populations into the future. Alaska Department of Fish & Game's (ADF&G) *Anadromous Waters Catalog (AWC)* is used to document all known rearing and spawning habitat of anadromous fish. However, due to the vast number of streams in Alaska and limited resources, not all salmon streams are currently listed or have detailed information about their use (e.g., rearing and/or spawning). The Copper River Watershed Project has worked with ADF&G and other partners throughout the watershed to develop and implement Salmon Blitz, a citizen science program designed to engage community volunteers in field surveys to collect data needed to nominate additional habitats to the AWC, and provide more spatial and temporal detail for habitats currently listed in the catalog. This project provides important data to inform management of salmon as well as hands-on learning opportunities for participants. By connecting people with their surroundings and deepening their understanding of the resources on which they depend, we hope to instill a greater sense of engagement and responsibility for the long-term health of the region's salmon. During the first field season over 100 volunteers helped asses a total of 15 sites, resulting in 13 nominations that included 7.7 new stream kilometers, and 3.3 kilometers of upstream extent added. New species were nominated for 5.9 kilometers of cataloged streams and life stage designation was added for 6.7 kilometers of cataloged streams.

Impacts of fry stocking on scale growth of juvenile sockeye salmon (*Oncorhynchus nerka*) in Chilkat Lake, Alaska

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Sockeye salmon (*Oncorhynchus nerka*) populations in Chilkat Lake, Alaska have steadily declined over the last two decades. A study of Chilkat Lake conducted in the late 1980s concluded that although the lake was limited in available sockeye spawning habitat, it had a zooplankton population large enough to sustain additional sockeye salmon fry. In order to increase sockeye salmon production, the lake was stocked annually with sockeye salmon fry from Chilkat Lake broodstock from 1994 – 1997 and in 2001. Following the large-scale fry stocking events, smolt size decreased, zooplankton abundance and size decreased, zooplankton species composition shifted, and sockeye salmon smolt age composition shifted from predominantly age-1 smolts to predominantly age-2 smolts. Using a long-term data series (1972-2012) of scales taken from adult sockeye salmon returning to Chilkat Lake, this study evaluates changes in freshwater growth of juvenile sockeye salmon as a result of density-dependent factors, such as large-scale fry stocking, high adult returns, changes in prey, and effects of climate on the freshwater environment.

Effects of predator exclusion netting on the survival and growth of littleneck clams in Tokeen Bay Alaska.

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Optimizing the growth and survival of commercially valuable species is a high priority for aquatic farmers in Alaska. Performance enhancing technologies are frequently implemented but, are rarely empirically examined for efficacy. One such technology, often used in the mariculture of infaunal bivalves, is predator exclusion netting. This project manipulated three intertidal populations of littleneck clams in Tokeen Bay Alaska with juvenile clam seed and predator exclusion netting to explore the effect of protection on the survival and growth of littleneck clams. After four years of monitoring, it's clear that the installation of predator exclusion netting can enhance the survival and growth of littleneck clams. Areas constantly protected by netting maintained greater mean clam densities and larger mean clam sizes than unprotected areas. Incremental or short term, protection under predator netting did not significantly affect clam survival and growth. These results are frequently reported throughout North America but, are not thoroughly studied in Alaska. This project lends regional evidence to a continental pattern.

Length Changes in Auke Creek Salmon

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In recent years, a trend of decreasing body length has been observed in some Southeast Alaska salmonid populations. This study was undertaken to determine whether this pattern holds for Auke Creek salmon and, if so, what factors are contributing to this phenomenon. We analyzed 32 years of coho salmon (*Oncorhynchus kisutch*) length data from Auke Creek Weir in Juneau, Alaska. We found a decrease in coho length over time. The male coho have decreased in mean length by 11.22 mm over 32 years (R^2=0.21, p = 0.0045, n=3285). The female coho have decreased in mean length by 17.00 mm over 32 years (R^2=0.18, p = 0.0078, n=3263). There is also a great deal of fluctuation in length across the time series. Further analyses will examine factors that seem to influence this variation. Next, we will use a time-series of sockeye (*O. nerka*) and pink (*O. gorbuscha*) salmon length data and incorporate Auke Creek coded wire tag recoveries from Southeast Alaska commercial fisheries to expand our analyses and examine factors contributing to changes in salmon length.

Chinook Bycatch Proportions by Geographic Area

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Proportions of regional groupings of Chinook are presented by large geographic areas for bycatch in the mid water trawl of the Bering Sea for a year where abundant genetic samples allowed geographic reporting.

Improving Commercial Fisheries Management; Can Environmental and Biological Variables be Used to Predict Bristol Bay Sockeye Salmon Run Timing?

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Knowledge of preseason abundance and run timing of sockeye salmon *Oncorhynchus nerka* populations in Bristol Bay, Alaska is critical to successful management of the world's largest commercial salmon fishery. Alaska Department of Fish and Game (ADF&G) managers use preseason forecasts to determine harvest strategies early before more accurate inseason assessments are available. However, preseason forecasts of salmon returns and run timing are notoriously imprecise. This research aims to assist managers, processors, and fishermen by providing a set of environmentally and biologically based predictive models to (1) predict sockeye salmon run timing at the Port Moller test fishery and (2) inseason estimates of stock specific run timing and inshore arrival to the five major fishing districts (Naknek-Kvichak, Egegik, Ugashik, Nushagak, and Togiak). These models will include a diverse set of variables including age, sex, and length data, sea surface temperature, commercial harvest, escapement, and run timing from other fisheries as an index by which to estimate Bristol Bay returns and run timing. Results of this research will be made available to ADF&G managers and interested public. A better understanding of run timing, and thus a tool that provides an inseason projection of sockeye salmon run timing, would greatly benefit management, industry, and Bristol Bay communities by increasing the economic benefits from this fishery.

Oceanic dispersal and behavior of a Chinook Salmon in the Bering Sea

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To examine the oceanic ecology of Chinook salmon in the Bering Sea, about which little is known, we are conducting a proof-of-concept study in which large, immature Chinook salmon are tagged with pop-up satellite archival transmitting tags. While externally attached to the fish, the tags measure and record ambient light (for daily geoposition estimates), depth and temperature data. On a pre-programmed date, the tags release from the fish, float to the surface of the ocean and transmit the recorded data to overhead satellites which are then retrieved by project investigators. To date, seven tags have been deployed, of which one has reported to satellites. This tag was attached to an 85-cm fish near Dutch Harbor in December 2013 and reported to satellites from the central Gulf of Alaska in April 2014. Based on temperature and depth recorded by the tag, the fish demonstrated three distinct behavioral phases, including Bering Sea feeding, Gulf of Alaska feeding, and movement towards southern British Columbia or the U.S. Pacific Northwest. The data from each behavioral phase provide valuable information about regional oceanic ecology of Chinook salmon, which may be used in a variety of ways, such as for improving bioenergetics models, avoiding bycatch, and improving evaluation of salmon survey data.

Dispersal patterns and summer ocean distribution of adult Dolly Varden in the Beaufort Sea using satellite telemetry

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The number of Dolly Varden harvested for subsistence purposes is largely undocumented in northern Alaska, but it is known that Dolly Varden are highly valued as a subsistence fish and local residents harvest thousands of these fish each year. For example, in Kaktovik, fishers harvested 15,388 pounds of fish for subsistence from 2000–2002, of which 12,297 pounds (80%) was Dolly Varden. In contrast to the information that is available about North Slope Dolly Varden during their freshwater phase, biologists have little direct information about their summer ocean ecology and distribution. Developments in satellite telemetry now provide an opportunity to examine the movements of fish as well as their depth and temperature preferences while in saltwater without having to recapture the fish. Therefore, we attempted to use PSAT tags to study the oceanic habits, distribution and migration patterns of Dolly Varden that spend summers in the Beaufort Sea. In June and July 2014, we deployed 14 Microwave Telemetry E-tags in large Dolly Varden (nine in the Ivishak River, five in the marine waters near Kaktovik) to examine temperature, depth and ambient light data for daily geoposition estimates. Of these 14 tagged fish, five never left the Ivishak River and likely moved upstream to spawn, one was found in the Kongakut River, two were found in the Hulahula River, two sent brief transmissions but no fixed location was made, and three were never heard from again. Movement inferences as well as changes in sampling design for the 2015 season are discussed.

Fish distribution modeling in Western Alaska

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Fish distribution models provide an important tool for understanding species-environment relationships, predicting potential habitat in un-surveyed areas, and assessing the impacts of climate change on species distributions. In Alaska, distribution models are especially valuable given predicted changes in climate and difficulty accessing most regions of the State. For this project, we gathered field data on fish occurrences across our study area in Western Alaska to develop fish distribution models for Dolly Varden and northern pike using two analysis methods: classification trees and random forests. We developed a suite of climatic, topographic, and hydrologic predictor variables that could be easily calculated using data in GIS. The random forest models for both northern pike and Dolly Varden had much better prediction accuracy than the classification trees. The final model for Dolly Varden had a misclassification rate of 23.6% and a kappa of 0.53, indicating moderate model performance. The variable importance plot indicated that the most important predictors for Dolly Varden were mean watershed slope, stream elevation, percent waterbody, mean watershed precipitation, and mean watershed temperature. The final model for northern pike had a misclassification rate of 10.6% and a kappa of 0.76, indicating substantial model performance. The variable importance plots indicated that the most important predictors for northern pike were watershed area, stream elevation, percent waterbody, stream order, and mean watershed precipitation. The final distribution maps provide an important tool for land managers assessing impacts in remote areas and also allow for modeling changes in distribution using climate change scenarios for Alaska.

Natzuhini Watershed Fish Habitat Assessment

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The Natzuhini River on southern Prince of Wales Island, Alaska, was surveyed by the Hydaburg community using Alaska Department of Fish & Game andromous waters stream survey methods (Frenette et al. 2010). Fish habitat conditions were analyzed using the U.S. Forest Service statistical evaluation metrics of 262 comparable reaches in unmanaged watersheds in southeast Alaska, and reaches were ranked from poor to good (Tucker and Caouette 2008). This map was produced to visualize the final stream condition scores and discuss possible opportunities for watershed restoration.

Case History: Root Wad Restoration on Campbell Creek, Anchorage, Alaska

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The Department of Fish & Game (ADF&G) Sport Fish RTS Cost Share Program partnered with the Municipality of Anchorage Parks & Recreation (MOA) to restore a heavily utilized section of stream bank along Campbell Creek, Anchorage, Alaska.

Restoration techniques included the installation of root wads, native vegetative material and planting rooted alder and willow.

Use of Sr:Ca in inconnu otoliths from the Kuskokwim River as an aid in describing anadromy

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An on-going radiotelemetry study on inconnu (*Stenodus leucichthys*) from the Kuskokwim River has expanded our understanding of spawning locations, seasonal distribution, and movements throughout this drainage. This study has shown various degrees of anadromy in this population. Radiotelemetry data show that inconnu currently spawn in 4 upper Kuskokwim River locations during early fall.

Twenty-two otoliths were collected from inconnu at their spawning grounds on the Big River and Middle Fork of the Kuskokwim River in late September 2011 and 5 from the Tonzona River. Otolith Strontium:Calcium (Sr:Ca) levels were analyzed with a microprobe over thin-sectioned inconnu otoliths encompassing all of the annuli over the fishes lifetime prior to capture. Approximate Sr:Ca incorporation was examined for each otolith to ascertain the occurrence and degree of anadromy and to corroborate with the radiotelemetry data. Sr:Ca is positively correlated with salinity, with freshwater environments having significantly lower Sr:Ca values than marine systems.

The otolith Sr:Ca distributions of two otoliths showed clear evidence of anadromy. However, Sr:Ca levels in the others suggested limited exposure to salt water. Most of the radiotagged inconnu overwintered in the lower Kuskokwim River and perhaps the upper reaches of Kuskokwim Bay, which is a brackish environment. Soon after spring ice out many of these fish swam upriver and spent summers at the mouths of major tributaries. However, some inconnu spent the entire summer in the lower Kuskokwim River and others spent the entire winter in the middle and upper Kuskokwim River with year to year variations for individual inconnu.

Long-term variability in size at age of Pacific halibut

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Pacific halibut have been actively managed by the International Pacific Halibut Commission (IPHC) since the mid-1920's. Pacific halibut are managed as one stock that occupies a large geographic area in the north Pacific Ocean, from offshore Oregon to the Bering Sea. The IPHC has split the stock into twelve regulatory areas for management; however, the boundaries of these regulatory areas follow political and international boundaries and may not represent the true spatial variability of the stock. Since the early 1990s, the IPHC has observed steep declines in size at age (SAA) of Pacific halibut coastwide. These trends are complicated by two factors, long-term temporal and spatial variability in SAA. Though halibut SAA has dramatically decreased since the early 1990s, current SAA levels are similar to SAA levels observed in the 1920s. Halibut SAA increased steadily from the 1920s, peaked in the 1980s, and declined rapidly to present. Furthermore, declines in SAA are primarily driven by two regulatory areas in the central and western Gulf of Alaska, areas 3A and 3B. Size at age of halibut has remained relatively constant and has even increases in other areas. I will describe trends in spatial and temporal variability in SAA, and the relevance of this research to identifying potential drivers of variability in SAA and to the management of Pacific halibut.

Ballast-borne Marine Invasive Species: Exploring the Risk to Coastal Alaska

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Marine invasive species have the potential to cause significant harm in Alaska's relatively un-invaded coastal waters by impacting habitat, species diversity, and even commercial fisheries. Currently, ballast water exchange 200 nautical miles from shore is the primary method of controlling introductions via ballast water. However, exemptions from management requirements and increased vessel traffic to the region leave substantial room for invasion risk. To assess the risk of ballast-borne invasive species to Alaska during an era of ballast water policy changes (2005 – 2012), we reviewed reported vessel route and ballast water management (BWM) patterns through time. Data from the National Ballast Information Clearinghouse revealed that a total of 3,773 arrivals reported discharging nearly 75 million metric tons of ballast water during the 8-year period. The majority of these arrivals (72%) arrived from coastwise routes, often from highly-invaded ports in California, Oregon and Washington or from other Alaskan ports. Ballast water was most commonly discharged in the ports of Valdez, Nikiski, Red Dog, and Seward, largely by tankers and bulk carriers (88% and 11% by volume, respectively). Due to exemptions from BWM requirements from 2005 through 2008, mid-ocean exchange rates averaged only 14% during that time period. However, from 2009 – 2012, average mid-ocean exchange rates increased to only 17%, reaching a high of 19% in 2012. We identify relative risk of invasion in Alaskan ports using a vector-based risk assessment framework incorporating factors known to influence the likelihood of invasion success.

Helicopter versus Heavy Equipment – Considerations for Large Stream Restoration Projects

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Large stream restoration projects use both helicopter and heavy equipment for constructing instream structures with large wood. A recent restoration project on Kuiu Island near Petersburg, Alaska used a combination of both methods during implementation. This presentation compares the two methods and highlights tradeoffs and considerations for their use on large-scale stream restoration projects.

Potential photochemical and biological degradation of dissolved organic carbon in coastal watersheds of southeast Alaska

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Dissolved organic carbon (DOC) mediates a variety of physical and biological processes such as light penetration and heterotrophic metabolism. Dissolved organic carbon in aquatic ecosystems has two primary degradation pathways: photolytic reactions mediated by ultraviolet light, and the second is through microbial mitigated biological degradation. The significance of each of these processes is largely determined by stream environmental conditions and the chemical quality of DOC. This study investigates the effect that stream origin and landcover have on these processes by sampling across 5 general watershed types: bogs, forested wetlands, uplands, brownwater streams, and clearwater streams. For each of these ecosystem types, water was sampled from 4 different replicate sites, for a total sample size of 20 sites. Initially, streamwater from each watershed type was analyzed for DOC. A DOC concentration range 65 mg C L-1 to 26.18 mg C L-1 was found across all watershed types, with large variability seen in the bog and forested wetland sites. Photolytic degradation potential was determined using a solar simulator on 0.2µm-filtered samples, and showed an average DOC loss of 10%, ranging from 3.5% to 23.6%. Laboratory incubations were used to determine biologic degradation. Biologic degradation (% DOC loss) averaged 19% across all streams, with the most significant losses being observed in upland tributary streams. Additionally, to explore the interaction between these two processes, the two methods were combined to determine how photolysis influence biologic degradation. Average DOC loss associated with coupled photo- and bio-degradation was found to be 25% across all ecosystems with a range of 14.3% to 35.4%. These findings highlight the important role that photochemical and biological processes play in controlling organic carbon export from watersheds in the coastal temperate rainforest.

Multi-Disciplinary Stream Restoration on Old Harbor Airport

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The city of Old Harbor is extending the single north/south runway to increase economic development activities and support a proposed fish processing plant. As part of the project, 450 linear feet of Sculpin Creek (90 acre watershed), a stream that supports Pink and Coho Salmon as well as Dolly Varden, was diverted into the Big Creek Estuary. A team consisting of a Civil Engineer, Habitat Biologist, Environmental Scientist, Military Personnel, Community Leaders, Construction Specialists, Surveyors, Blasting Specialists, and Landscaper developed a plan for design and construction of a new channel to mimic the gradient and habitat features of the existing stream. Blasting and removal of about 22,000 cubic yards of bedrock was conducted in the fall of 2013 and channel construction completed in April and May of 2014. The new channel was constructed using local boulders, cobble and gravel. Cottonwood trees were placed in the channel with root balls to provide in-stream habitat. About 200 native trees and vegetation mats from wetland grasses, forbs and shrubs were harvested and placed on both sides of the new stream channel. Construction of the new stream channel included assistance from the United States Marine Corps and United States Army personnel to place new stream substrate and from local school children to assist with fish relocation. When flow was diverted into the new channel and fish screening removed, hundreds of out-migrating juvenile pink salmon were observed. A 3-year program to monitor habitat conditions and fish distribution will be completed by Shearwater.