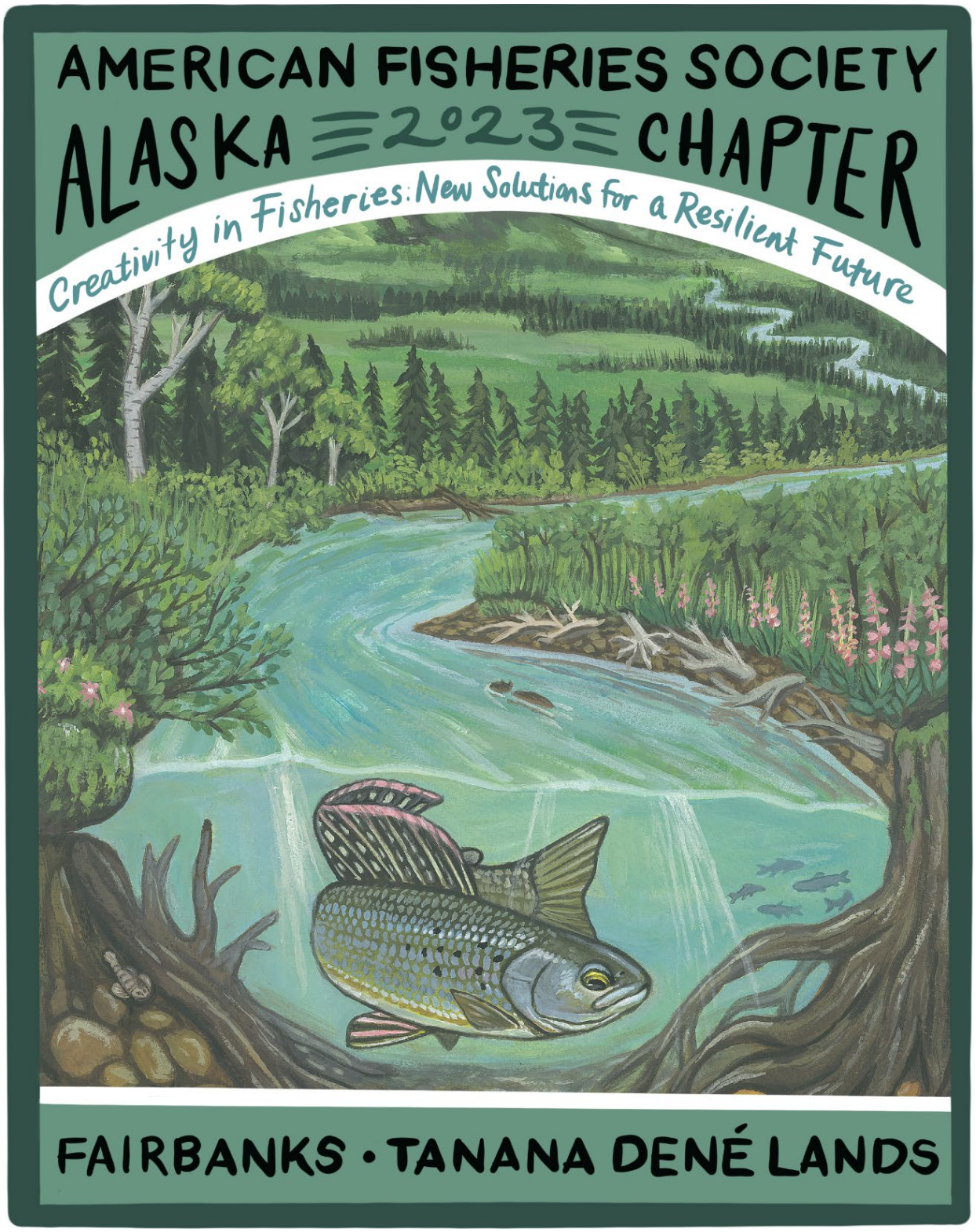
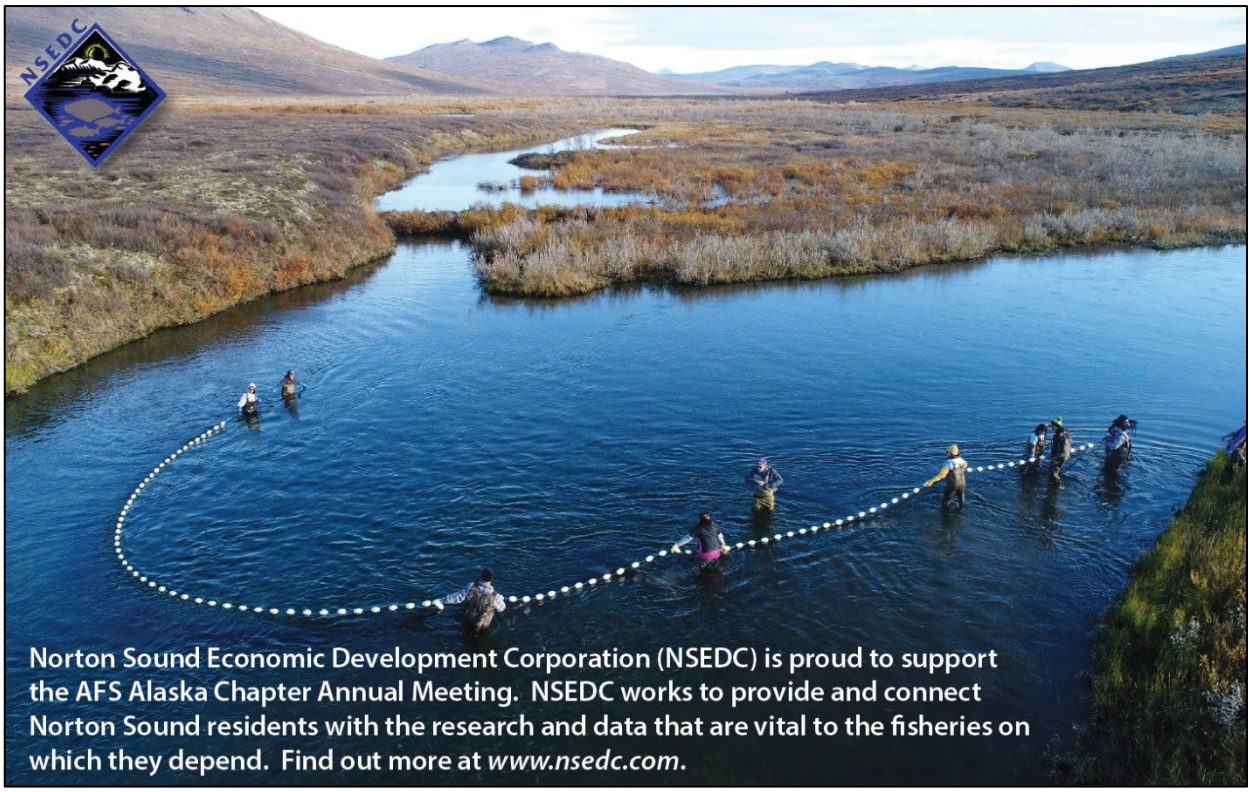


49th Annual Hybrid Meeting
March 27 – 31, 2023

Many Thanks to our Sponsors!


NORTH PACIFIC RESEARCH BOARD

International
Arctic Research
Center



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Arctic-Yukon-Kuskokwim Tribal Consortium

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Cover Art by **Taylor Cubbage**

Taylor grew up fishing and drawing inspiration from the saltmarshes of southern Texas, and this fascination with aquatic ecosystems led to her bachelor's in Marine Biology from Texas A&M University and master's in Fisheries Science from the University of Alaska Fairbanks. Her budding career in fisheries has become deeply intertwined with a passion for art, growing from elaborate class notes and dissection diagrams to visual summaries of her MS research and illustrations of fish species for identification purposes. This combination of art and science has fostered skills such as a strong attention to detail and distillation of complex ideas into understandable media, whether that be a publication or a painting. Skiing along scraggly black spruce trails, tripping on riparian muskeg for berries, and fly casting into boreal streams in search of Arctic Grayling, Taylor's time in interior Alaska has provided no shortage of inspiration for ecological questions and artistic endeavors. She enjoys painting from the trail, carving birch wood fishes, and experimenting with digital art, and hopes her artwork for the Alaska Chapter of AFS annual meeting encourages meaningful collaboration to protect our aquatic resources.

Website: https://drawntofish.weebly.com/
Email: drawntofish@gmail.com

Table of Contents

Letter of Welcome

Greetings!

Welcome to the 49th Annual Meeting of the Alaska Chapter of the American Fisheries Society. We meet at a critical time. Our climate and ecosystems are in flux, creating challenges and opportunities for sustainable management, conservation, and food security across the state. Cultural changes are rippling through our profession as well, offering chances to build resiliency within our ranks and strengthen our field. It is now as important as ever to support our communities and each other while maintaining high standards for the fisheries profession. This year's meeting theme is **Creativity in Fisheries: New Solutions for a Resilient Future**, reflecting both the big responsibilities and exciting discoveries that we experience as part of the Alaska fisheries community. We are happy to have you here.

It has been four years since our last in-person meeting in Sitka, and so many of us are ready to be back together! You really stepped up this year to contribute 105 talks and posters, as well as workshops, films, plenaries, symposia, and nearly a dozen activities focused on diversity, equity, and inclusion. And let's not forget the socials, spawning run, and banquet and awards ceremony. We have even heard a rumor that a certain auctioneer may make an appearance in his goat-skin vest. It all adds up to our biggest meeting in years and, we hope, one of the most rewarding and fun. While you attend the meeting, please make a point of welcoming our students, who have not had the kind of in-person networking opportunities many of us had early in our careers. Check out their fantastic talks and posters, join the Mentorship Mixer, and introduce yourself during a break or social. If you are attending remotely, a positive email or chat message can feel so good for a student or first-time attendee who just presented their work.

Many thanks to the volunteers who helped put this meeting together, including the hard-working and creative planning committee. We truly appreciate our meeting sponsors: Alaska Sea Grant, North Pacific Research Board, Alaska Department of Fish and Game, Norton Sound Economic Development Corporation, the University of Alaska Fairbanks' International Arctic Research Center and College of Fisheries and Ocean Sciences, Sealaska, Alaska Seafood Marketing Institute, Arctic-Yukon-Kuskokwim Tribal Consortium, North Pacific Fishery Management Council, Southeast Fish Habitat Partnership, and the Alaska Fisheries Development Foundation. These organizations helped us shoulder the added financial burden of a hybrid meeting and made it possible for a large contingent of students to attend from around the state. Don't forget to check out the Silent Auction, a long-standing tradition to benefit student travel.

Thanks for being a part of our Chapter, and we look forward to seeing you at the meeting.

Sincerely,

Megan McPhee
President
Alaska Chapter AFS

Erik Schoen
President Elect
Alaska Chapter AFS

AFS Meeting Code of Conduct

All participants, including but not limited to attendees, speakers, volunteers, and others, must abide by the American Fisheries Society Meetings Code of Conduct (below). Please use this anonymous form to report any violation(s) to the Alaska Chapter AFS' Diversity, Equity, and Inclusion Committee (DEIC). You may also contact the Executive Committee (president@afs-alaska.org) and/or DEIC (deic@afs-alaska.org) directly.

The Code of Conduct was written for in-person meetings; however, the sentiment captured here carries into the virtual space. We request that you read the guidelines before joining the meeting.

AK AFS Anonymous Reporting Form

Purpose:

American Fisheries Society (AFS) meetings are among the most respected scientific meetings of fisheries professionals in the natural resource scientific community. AFS values the diversity of views, expertise, opinions, backgrounds, and experiences reflected among all attendees, and is committed to providing a safe, productive, and welcoming environment for all meeting participants and AFS staff. All participants, including, but not limited to, attendees, speakers, volunteers, exhibitors, staff, service providers, and others, are expected to abide by this Meetings Code of Conduct. This Code of Conduct applies to all AFS meeting-related events, including those sponsored by organizations other than AFS but held in conjunction with AFS events, in public or private facilities.

Expected Behaviors:

- Treat all participants, attendees, staff, and vendors with respect and consideration, valuing a diversity of views and opinions, and critiquing ideas rather than individuals.
- Refrain from demeaning, discriminatory, or harassing behavior and speech directed toward other attendees, participants, staff, and suppliers/vendors.
- Be mindful of your surroundings and of your fellow participants. Alert AFS staff or venue event staff if you notice a dangerous situation or someone in distress.
- Respect the rules and policies of the meeting venue, hotels, AFS-contracted facility, or any other venue.
- To foster a welcoming environment, assist AFS members with impaired physical or cognitive abilities, if necessary.

Unacceptable Behaviors:

- Harassment, intimidation, or discrimination in any form is unacceptable. Harassment includes speech or behavior that is not welcome or is personally offensive. Behavior that is acceptable to one person may not be acceptable to another, so use discretion to be sure respect is communicated. Harassment intended in a joking manner still constitutes unacceptable behavior. Regardless of your intent, if you are advised directly or by another party that some aspect of your speech or behavior at an AFS meeting is harassment, you are expected to stop engaging in such speech or behavior.

- Do not physically or verbally abuse any attendee, speaker, volunteer, exhibitor, AFS staff member, service provider, or other meeting guest.
- Examples of unacceptable behavior include, but are not limited to, unwelcome or offensive verbal comments related to age, appearance, or body size, employment or military status, ethnicity, gender identity and expression, individual lifestyle, marital status, national origin, physical or cognitive ability, political affiliation, sexual orientation, race, or religion. Harassment can also include the use of sexual and/or discriminatory images in public spaces or in presentations; deliberate intimidation; stalking; following; harassing photography or recording; sustained disruption of talks or other events; bullying behavior; inappropriate physical contact; and unwanted sexual attention.
- Appropriate and responsible personal use of photographs or posts to social media of another individual's oral presentation, poster, or likeness is acceptable unless permission is specifically denied by the individual.
- Do not disrupt talks at oral or poster session or activities in the exhibit hall or at other events organized by AFS at the meeting venue, hotels, or other AFS -contracted facilities.
- Any retaliation against participants for reporting unacceptable behavior is unacceptable. Like harassment or discrimination, retaliation against reporting poor behavior will be subject to consequences.

Reporting Unacceptable Behavior:

- Anyone experiencing or witnessing behavior that constitutes an immediate or serious threat to public safety at any time should contact local law enforcement (by calling 911) and immediately notifying facility security without delay.
- If you are not in immediate danger but feel that you are the subject of unacceptable behavior, you are encouraged to contact ana AFS Alaska Executive Committee officer, (p.5) representative of the Cultural Diversity Committee (p. 6), and/or file a formal complaint to the AFS National Ethics and Professional Conduct Committee (Parent Society) which will then be forwarded to the Ethics and Professional Conduct Committee for assessment.

Consequences:

- Anyone requested to stop unacceptable behavior is expected to comply immediately.
- Consequences to unacceptable behavior will be determined by the AFS Ethics and Professional Conduct Committee in conjunction with AFS officers and the AFS Executive Director.
- Consequences may include one or more of the following actions:
    - Dismissal from the meeting without refund
    - Reporting to your agency
    - Exclusion from any future AFS (subunit/chapter/division) meetings for five years
    - Revoke of AFS membership without the opportunity for renewal for five years
    - If the offense is criminal, local law enforcement will be contacted.

2022-2023 Alaska Chapter AFS Executive Committee Members

Megan McPhee
President

Erik Schoen
President-Elect

Sue Mauger
Past President

Donnie Arthur
Vice President

Scott Ayers
Secretary

Jonah Bacon
Student Representative

Trent Dodson
Treasurer

2023 Annual Meeting Planning Committee


Donnie Arthur


Jonah Bacon


Cheryl Barnes


Morag Clinton


Katie Drew


Jeff Falke


Nicole Farnham


Kevin Fraley


Jessica Glass


Deborah Hart


Jason McFarland


Sara Miller


Jeff Muehlbauer


Jesse Pfeffer


Erik Schoen


Lisa Stuby


Marguerite Tibbles


Lauren Yancy

Alaska Chapter AFS Committees

Awards:

- Jeff Falke, *Chair*
    - Meritorious Service Award
    - Best Student Oral and Poster Presentation Awards
    - Chapter Service Award
- Ray Hander
    - Molly Ahlgren Scholarship
- Milo Adkison
    - Wally Noerenberg Award

Diversity, Equity, and Inclusion Committee (DEIC):

- Cheryl Barnes (she | they), *Chair*
- Sara Gilk-Baumer (she | her)
- Katie Russell (she | her)
- Keenan Sanderson (he | him)

The DEIC is soliciting new members! Email deic@afs-alaska.org for more info.

Electronic Communications Committee:

- Joel Markis, *Website*
- Toshihide “Hamachan” Hamazaki*, ListServ Manager*

Environmental Concerns Committee:

- Joel Markis, *Co-Chair*
- Sue Mauger, *Co-Chair*

Fisheries and Environmental Education Committee:

- Katrina Liebich, *Chair*

Financial Assets Oversight Committee:

- Ray Hander, *Chair*

Professional Development Committee:

- Sarah Miller, *ChairL*

Resolutions and Bylaws Committee:

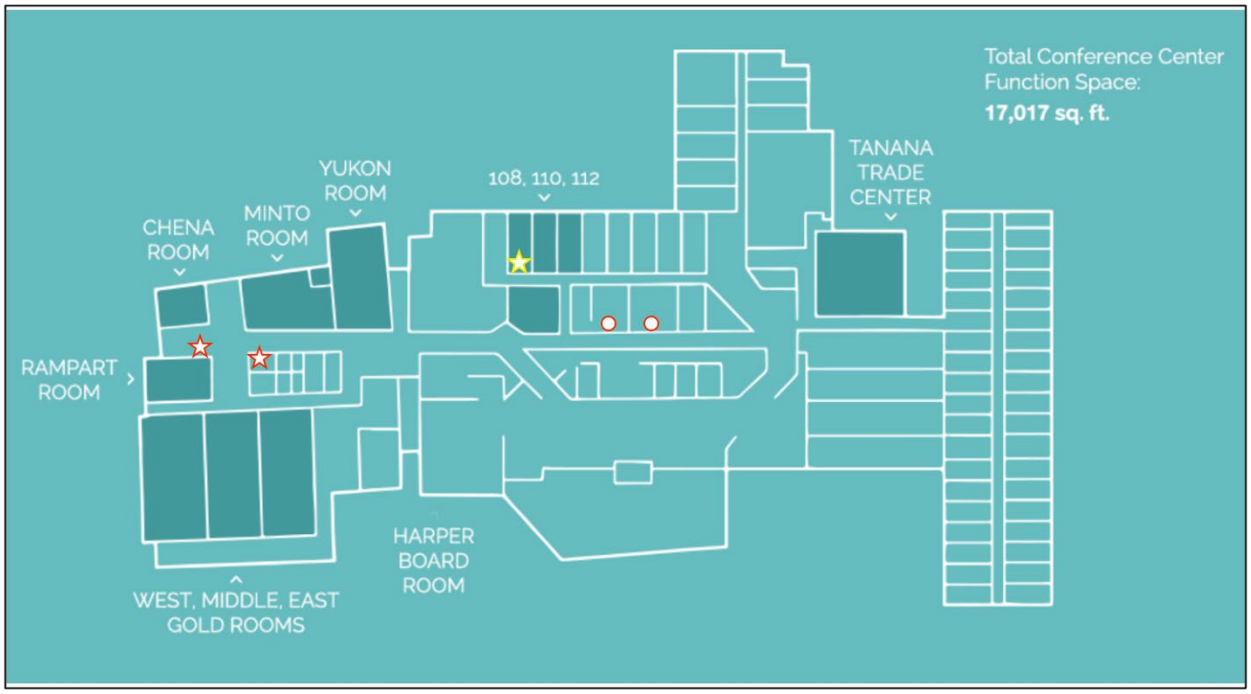
- Toshihide “Hamachan” Hamazaki, *Chair*

Student Sub-Committee

- Garrett Dunne, *President*
- Lilian Hart, *Vice President*
- Sam Rosenbaum, *Secretary*
- Linnaea Doerner, *Treasurer*
- Madeline (Maddy) Lee, *DEI Liaison*

Venue

Westmark Fairbanks Hotel and Conference Center



813 Noble Street, Fairbanks, Alaska 99701

Transportation: Westmark Hotel does not offer ground transportation. Airlink shuttle service is available at 907-452-3337 to schedule airport pickup and drop-off times.

☆ Gender-inclusive restrooms ◯ Restrooms shared with the main hotel

☆ Private restroom

Accessibility

Presentations: Subtitles will be auto-generated for all presentations and shown live on the big screen. The front row of seating is reserved for those who will benefit most from real-time captioning (e.g., attendees who are deaf or hard of hearing, people with learning disabilities, or those for whom English is a second language). If you have feedback on improving captioning for future meetings, please bring your thoughts to the Business Meeting or share with a member of the DEIC.

Restrooms: The restrooms nearest the conference rooms (i.e., red stars) will be designated as gender-inclusive for conference attendees. Another main set of restrooms are just down the hall to the east (i.e., red circles) that are shared with the main hotel. Meeting attendees will also have access to a private restroom in Room 108 (i.e., yellow star). Please check posted signage during the meeting or ask a DEIC member if you have trouble locating a nonbinary restroom.

Food: Vegetarian, vegan, and gluten-free options will be available whenever food is provided at the conference venue. We will make every effort to mark these options. If you have dietary restrictions that are not met, please let us know so that we can be more inclusive at future meetings.

Affinity Group Mixers: Affinity group mixers are designed to help members from underrepresented groups gather, build community, and bolster a sense of belonging within WSN. BIPOC, LGBTQIA2S+, First Generation College Students (Past and Present), and Disability groups can be found on the schedule. Please note that you must identify as a member of the group that you intend to join.

2023 AK AFS Member Survey

- Anonymous and confidential
- Inform us about the AK AFS memebership
- Track changes through time
- Improve diversity, equity, and inclusion

Schedule at a Glance

Date/Time	Activity/Event	Location
Sunday, March 26		
9:30 AM – 4:00 PM	Introduction to R (Day 1)	Yukon Room
Monday, March 27		
8:00 AM – 4:30 PM	Collaborative Approaches to DEI in Fisheries Workshop	UAF: Akasofu Building Room 501 (Off-Site)
9:30 AM – 4:00 PM	Introduction to R (Day 2)	Yukon Room
10:00 AM – 5:00 PM	Science Communication	Minto Room
2:00 PM – 4:30 PM	Introduction Fly-Tying	Rampart Room
6:00 – 9:00 PM	Welcome Social and Film Festival	Morrison Thompson Cultural & Visitors Center (Off-Site)
Tuesday, March 28		
8:00 AM – 9:15 AM	Conference Welcome and Plenary Session	Gold Room
9:15 AM – 10:00 AM	BIPOC Affinity Group	Harper Board Room
	Coffee Break	East Gold Room
10:00 AM – 12:00 PM	Human Dimensions	Gold Room
	Failure and Innovation	Minto Room
12:00 PM – 1:30 PM	Mentorship Mixer	Northern Latitudes
1:30 PM – 3:00 PM	Genomics	Gold Room
	Fisheries Management	Minto Room
3:00 PM – 3:45 PM	LGBTQIA2S+ Affinity Group	Harper Board Room
	Affinity Group for Remote Attendees	Zoom (see Whova for link)
	Coffee Break	East Gold Room
3:45 PM – 5:00 PM	Genomics	Gold Room
	Age, Growth, and Development	Minto Room
7:00 PM – 10:00 PM	Evening Social	Goldies (Off-Site)
Wednesday, March 29		
8:00 AM – 9:15 AM	Message from AFS Parent Society and Plenary Session	Gold Room
9:15 AM – 10:00 AM	Disability Affinity Group	Harper Board Room

	Coffee Break	East Gold Room
10:00 AM – 12:00 PM	Poster Session and Tradeshow	Gold Room
12:00 PM – 1:30 PM	AFS Past Presidents Lunch	Harper Board Room
1:30 PM – 3:00 PM	Hatcheries 2.0	Gold Room
	Climate Effects on Alaskan Ecosystems	Minto Room
3:00 PM – 3:45 PM	First Generation College Student Affinity Group	Harper Board Room
	Coffee Break	East Gold Room
3:45 PM – 5:00 PM	Hatcheries 2.0	Gold Room
	Wildfire Effects on Alaskan Ecosystems	Minto Room
5:30 PM – 6:30 PM	Spawning 5K Fun Run/Walk	Start/Finish at Westmark
7:00 PM – 11:00 PM	Trivia Night	The Basement (Off-Site)
Thursday, March 30		
8:00 AM – 9:15 PM	Message from AFS Western Division and Plenary Session	Gold Room
9:15 AM – 10:00 AM	Dependent Caregivers Affinity Group	Harper Board Room
	Coffee Break	East Gold Room
10:00 AM – 12:00 PM	Tamamta (All of us): A Racial Equity Dialogue	Gold Room
12:00 PM – 1:30 PM	AK AFS Chapter Business Luncheon	Gold Room
1:30 PM – 3:00 PM	Nutrients and Food Webs	Gold Room
	Behavior and Distribution	Minto Room
3:00 PM – 3:45 PM	Women and Underrepresented Genders Affinity Group	Minto Room
	Coffee Break	East Gold Room
3:45 PM – 5:00 PM	Nutrients and Food Webs	Gold Room
	Hard Rock Mining	Minto Room
5:00 PM – 6:00 PM	Environmental Concerns Committee Meeting	Minto Room
6:30 PM – 10:00 PM	Banquet and Awards	Gold Room
Friday, March 31		
8:30 AM – 10:00 AM	Allyship Discussion	Gold Room
9:00 AM – 4:00 PM	Field Trips	Off-Site

*for the most current information, please check the meeting website

Professional Development Workshops

An Introduction to R for Fishery Students and Researchers

Course Date: Sunday/Monday, March 26-27, 2023; 9:30 AM – 4:00 PM with a 1.5-hour lunch break

Course Location: In-person (Westmark Yukon Room) and virtual

Instructors: Isaac Nyameke, Ph.D. student; UAF; inyameke@alaska.edu
Nabahel Rex-Oneal, M.S. student; UAF

Cost: $80 for students; $100 for AFS members; $120 for non-AFS members

Capacity: Minimum attendance is 5; maximum capacity is 20 students.

Description: R is one of the most used tools in the fisheries sector for data analysis. Getting the fundament knowledge would be useful for your research as a student or a researcher. However, it is often hard to learn at the beginning because of the errors you may encounter. It is for this reason that this workshop is organized to share some of the tips you need to avoid the errors such as basic R commands, what to do in each stage, performing basic statistical analysis, and data visualizations. We will use “tidyverse” techniques, do plotting with ggplot, date setting, and read file among others. I do encourage undergraduate students to take this workshop. This course does not require any prior R experience as well as knowledge of statistics. It is recommended that participants bring their own laptop.

Instructor Isaac Nyameke is a Ph.D. Fisheries and Blue Economy student and Teaching Assistant at the University of Alaska, Fairbank (USA) and a scholar at Tamamta (All of Us-Indigenous student empowerment) Program. His research interest focuses on why African marine fisheries production differ per country and what fishing mechanism can be adopted to ensure sustainable fisheries in Africa for food security and poverty alleviation. Isaac is working under the supervision of Dr. Courtney Carothers and Dr. Peter Westley. His educational background spans from Ghana, Netherlands, USA, South Korea and Canada with double master’s degree. Isaac has a wide range of working experience in fisheries in Africa, Europe, Asia and Northern America as a consultant for African Union, UNDP, ECOWAS, World Bank, FARA and as a collaborator with a number of ocean research institutions and groups.

If you have any questions about whether this course would be beneficial or a good fit for you, please email the instructor.

Science Communication – Tips from a Former Journalist Turned Scientist

Course Date: Monday, March 27, 2023; 10:00 AM – 5 PM with a 1-hour lunch break

Course Location: In-person (Westmark Minto Room) and virtual

Instructor: Kelly Ireland, Ph.D. candidate; UAA/UAF; ksireland@alaska.edu

Cost: $50 for students; $60 for AFS members; $75 for non-AFS members

Capacity: Minimum attendance is 10 people; maximum capacity is 25 students

Description: Science means nothing if scientists cannot communicate it to the masses. This course will give scientists tips and tricks for making their science more accessible to the general public and scientists alike. The course will discuss how to simplify complex ideas, know your audience, and story structure in scientific writing. Participants will put their new knowledge to work while workshopping their own abstracts or other short writing sample throughout the day. The course will then go over examples of successful scientific communication to the general public and then brainstorm ideas to best share your work. Kelly will also share online tools for making quick and easy graphics. Finally, the course will cover interacting with news media to share your science – from contacting the news for coverage to answering news interview questions like a pro.

Instructor Kelly Ireland has a double B.A. in Biological Sciences and Journalism and Public Communications and M.S. in Biological Sciences and is currently pursuing her Ph.D. in biology. Kelly spent seven years in the news and communications world before pursuing science full time and hopes to share her insights on successful communication with participants during this course.

If you have any questions about whether this course would be beneficial or a good fit for you, please email the instructor.

Introduction to Fly-Tying

Course Date: Monday, March 27, 2023; 2:00 PM – 4:30 PM

Course Location: In-person (Westmark Rampart Room)

Instructor: Stian Stensland, Associate professor; Norwegian University of Life Sciences/UAF; stian.stensland@nmbu.no

Co-Instructors: Joe Spencer, Kevin Fitzgerald, Ben Rich, and Will Samuel, Graduate Students; UAF

Cost: $15 for students; $25 for AFS members; $30 for non-AFS members

Capacity: Minimum attendance is 4 people; maximum capacity is 20 students

Description: Learn the basics of fly-tying and tie flies proven to catch fish in Alaska. Fly-tying is an exciting activity that strengthens your angling experience and a deepens the connection to what lives under water. We will go through techniques for easy to tie wet fly, nymph, dry fly and streamer patterns for freshwater fishing. Equipment and materials provided.

Instructor Stian Stensland is an associate professor at the Norwegian University of Life Sciences, and a visiting research scholar at CFOS UAF. His research focuses on the Human dimensions of fisheries, wildlife, and nature-based tourism. Stensland and his fellow co-instructors have many years of experience with fly-tying and fly-fishing in Alaska and other places.

If you have any questions about whether this course would be beneficial or a good fit for you, please email the instructor.

Collaborative Approaches to DEI in Fisheries

Course Date: Monday, March 27, 2023; 8:00 AM – 4:30 PM

Course Location: University of Alaska Fairbanks Campus, Akasofu Building, Room 501

Instructor: Facilitated Discussion

Cost: $0 for students; $0 for AFS members; $0 for non-AFS members

Capacity: *Space is limited! Applications are due by February 24, 2023.*

Description: This workshop will focus on recruitment, retention, and promotion processes for Alaska fisheries professions. Here, we will provide an opportunity for people from around the state to discuss efforts that are and are not working in terms of advancing DEI. A major goal of the workshop is to promote collaboration among institutions and strengthen agency-specific efforts to increase access to fisheries professions across Alaska. Discussions will be professionally facilitated by G2 Diversified Services. Financial support from Alaska Sea Grant allows us to offer this workshop free of charge!

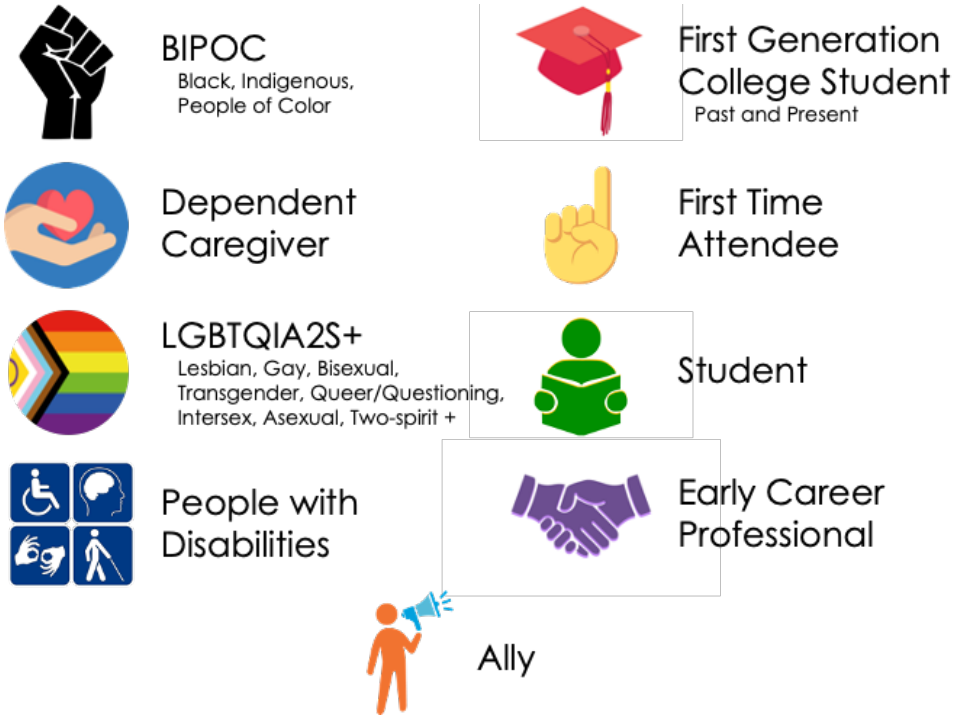
Affinity Groups

Affinity groups provide safe spaces for people who identify with underrepresented and/or historically marginalized groups to gather, build community, and bolster a sense of belonging. ***Note: You must identify as a member to any affinity group that you intend to join.***

- Tue AM Coffee Break | BIPOC (Black, Indigenous, People of Color)
- Tue PM Coffee Break | LGBTQIA2S+
  (Lesbian, Gay, Bisexual, Transgender, Queer/Questioning, Intersex, Asexual, Two-spirit+)
- Tue PM Coffee Break | **REMOTE OPTION** – All affinity groups listed.
  Contact deic@afs-alaska.org for the link!
- Wed AM Coffee Break | People with Disabilities
  (including physical conditions, neurodivergence, mood disorders, and chronic illness)
- Wed PM Coffee Break | First Generation College Students (Past & Present)
- Thu AM Coffee Break | Dependent Caregivers
- Thu PM Coffee Break | Women and Underrepresented Genders

Affinity Stickers

Available at the DEIC table. Many of these stickers are used to help those with underrepresented identities build community within the AK Chapter of AFS. Others identify first-time attendees, students, and early career professionals so that long-time AFS members can help them network!



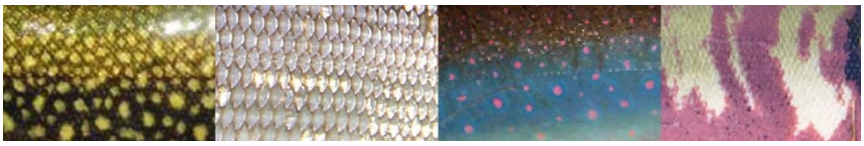
Monday, March 27

Welcome Social and Film Festival

6:00 PM – 9:00 PM, Morris Thompson Cultural and Visitors Center (101 Dunkel St.)

Mingle over food and drinks with your peers and reconnect after a long hiatus from in-person meetings. Heavy appetizers will be served. There will be a cash bar with cocktails and mocktails. Purchase a reusable AK-AFS tumbler or bring your own from a past AK-AFS meeting to get free drink tickets when you check in at registration.

Film Festival



7:00 PM – 8:30 PM

Sharing what we are learning through the use of film continues to be an exceptional way to communicate advances in science and fisheries management, showcase ways communities are engaging in local fisheries and stewardship efforts, and capture the beauty and diversity of fish across Alaska. To accompany this year's AFS Alaska Chapter meeting we are hosting a film festival inspired by this year's meeting title Creativity in Fisheries: "New Solutions for a Resilient Future." In addition to films that highlight the work of our membership, we will share films that capture the lives and experiences of Alaska Native elders, indigenous Inclusion in Alaska's Fisheries, Yukon and Interior Alaska salmon issues, and activities supporting a blue economy.

Films Include:

Legacy of our Elders

Contributed by: Rachel Saylor, Executive Director of Communications, Tanana Chiefs Conference, rachel.saylor@tananachiefs.org
Brief film description: Examples from the Legacy of Our Elders project, which documents the lives of Alaska Native elders throughout the Tanana Chiefs Conference region. These short films capture their stories of true strength and perseverance; what they went through, what they learned, and their advice for future generations.
Video length: 20 min
URL for online viewing: https://www.tananachiefs.org/legacy-of-our-elders/

Yukon River Chinook Salmon Project

Contributed by: Courtney Weiss, Yukon Delta Fisheries Development Association, cweiss@ydfda.org

Brief film description: Along the Yukon River, NOAA, Alaska DF&G, the Yukon Delta Fisheries Development Association, and local fishermen have collaborated to study Chinook salmon for years. In 2020, the pandemic shut down these efforts, so the local communities initiated a citizen science project to fill the gap. There is also a web-story that goes along with this: https://www.fisheries.noaa.gov/feature-story/community-steps-continue-yukon-river-salmon-research-during-pandemic
Video length: 4:17 min
URL for online viewing:
https://videos.fisheries.noaa.gov/detail/video/6254648895001/yukon-river-chinook-salmon-project

Understanding the Interactions of Fish with Renewable Energy in Alaska Rivers

Contributed by: Amanda Byrd, Chief Storyteller, Alaska Center for Energy and Power
agbyrd@alaska.edu
Brief Film Description: Researchers from the University of Alaska Fairbanks and the Pacific Northwest National Laboratory are working together to better understand the collision risk of in-river, or hydrokinetic, energy turbines on fishes in Alaska. PNNL's Garrett Staines is working with UAF's Andy Seitz and the team at the Alaska Center for Energy and Power's Tanana River Test Site to better understand the probability of fish interacting with turbines. This work is part of the Triton Initiative - the largest hydrokinetic and marine energy research project sponsored by the U.S. Department of Energy Water Power Technologies Office. Triton researches the potential environmental impacts of these renewable energy systems on marine and riverine environments.
Video Length: 5:01min
URL for online viewing: https://youtu.be/J3HftT--di8

ACEP's Hydrokinetic Energy Fisheries Research

Contributed by: Amanda Byrd, Chief Storyteller, Alaska Center for Energy and Power
agbyrd@alaska.edu
Brief Film Description: Lake Iliamna is vitally important for sockeye salmon in Alaska. How does capturing energy from the mouth of Lake Iliamna's Kvichak River affect the animal that sustains the community? Alaska has approximately 40% of the total river energy, approximately 90% of the total tidal energy and approximately 60% of the total wave energy in the U.S. Because of the high cost of power in Alaska, many communities are considering whether accessing these hydrokinetic energy resources to generate electric power is economically feasible and environmentally sustainable.
Video Length: 2:34 min
URL for online viewing: https://youtu.be/lANhN3xTwR0

Igiugig - Food, Water, Energy Connections

Contributed by: Amanda Byrd, Chief Storyteller, Alaska Center for Energy and Power
agbyrd@alaska.edu
Brief Film Description: How can an in-river energy device co-exist with a world famous and vitally important salmon population? Igiugig, located on Alaska's largest lake, Lake Iliamna, is the site of the first commercial in-river hydrokinetic

energy generator. The community has made strategic steps towards food, water, and now energy security. Salmon and clean water are most important to this remote community, and generating their own power. Funding for this film was made possible by the National Science Foundation.
Video Length: 8:01 min
URL for online viewing: https://youtu.be/pMzxHf-VBfs

Cordova Food, Energy, Water Connections

Contributed by: Amanda Byrd, Chief Storyteller, Alaska Center for Energy and Power agbyrd@alaska.edu
Brief Film Description: The community of Cordova is home to one of Alaska's strongest salmon fisheries. It lies in a remote area of Southcentral Alaska, accessible by only air or boat. Food and water security are vitally important to this remote Southcentral Alaska community, and energy security ensures the salmon harvests can find their market around the world. This film looks at the importance of water on the salmon returning to the sea and generating renewable power for the community. Funding for this film was made possible by the National Science Foundation.
Video Length: 6min
URL for online viewing: https://youtu.be/hhOpyZcuCyk

Drone Footage of a Unique Fall Chum Salmon Spawning Location in Northeast Alaska

Contributed by: Brian McKenna
Brief Film Description: Drone footage of a unique fall chum salmon spawning location in northeast Alaska
Video Length: 1:34min
URL for online viewing: https://vimeo.com/manage/videos/288630270

Five Years Before the Mast: Sights, Sounds, and Smells from Alaska Hatchery Research Fieldwork

Contributed by: Benjamin Americus, Alaska Fisheries Development Foundation, bamericus@afdf.org
Brief Film Description: Every spring, hundreds of millions of juvenile pink Salmon migrate from estuaries in Prince William Sound to marine waters. Some of these fish come from wild streams and others from hatcheries. A year and a half later, millions of fish return to estuaries in Prince William Sound as adults, however not all of these fish return to their site of origin. Some, whether by mistake or intention, travel up unknown streams to spawn in a phenomenon known as straying. In 2013, the Prince William Sound Science Center, contracted by the Alaska Department of Fish and Game, began collecting salmon carcasses for a decade-long study into the extent and effects of straying hatchery salmon. This film takes us to spawning grounds in Prince William Sound for the first five years of this work. You will experience the sights, sounds, and smells of Alaska's pink salmon runs and meet some of the rugged individuals who collected tissue samples from over 250,000 salmon carcasses in the remote, perilous corners of Prince William Sound.
Video Length: 5 min
URL for online viewing: TBD

Tuesday, March 28

Welcome & Announcements

8:00 – 8:15 AM, Westmark Gold Room

- Land Acknowledgement and AFS Meetings Code of Conduct
  Erik Schoen, Megan McPhee, and Cheryl Barnes

Plenary

8:15 AM – 9:15 AM, Westmark Gold Room

Dr. Jessica Black

University of Alaska Fairbanks

Title: Indigenizing Salmon Science and Governance: Moving from Theory to Action

Dr. Jessica Black, Gwich'in, is from Gwichyaa Zhee (Ft. Yukon), but also grew up in the village of Toghotthele (Nenana), Alaska. Dr. Black currently serves as an Associate Professor in the Department of Alaska Native Studies and Rural Development at the University of Alaska Fairbanks. Dr. Black received her bachelor's degree in Social Work (BSW) at UAF and her master's and Ph.D. in Social Work at Washington University in St. Louis. Her dissertation and current research examine the relationship between governance and well-being among Alaska Native peoples, especially regarding Tribal Stewardship and Cultural Connectivity.

See abstract on page 53

Tuesday, March 28

Mentorship Mixer

12:00 PM – 1:30 PM, Westmark Northern Latitudes Room

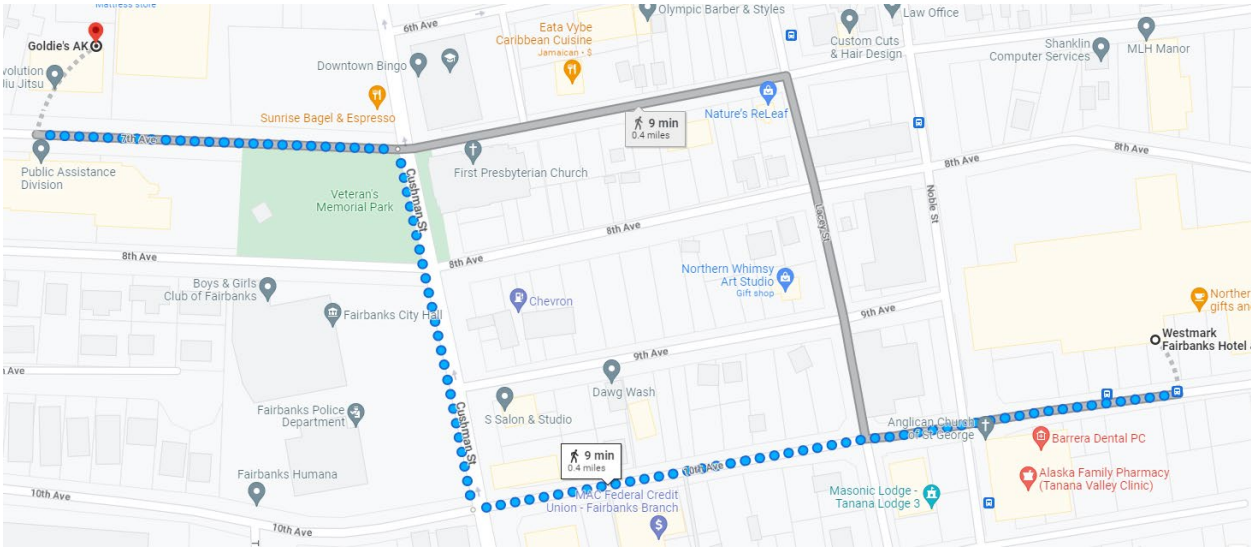
This lunch-time event, co-hosted by the AK AFS DEI Committee and Student Subunit, will provide an opportunity for attendees to discuss a number of topics. Mentorship benefits people at every career stage, so all participants are encouraged to both share their experiences and learn from others. Informal conversations may center around professional development, career advancement, and(or) belonging in STEM. The organizers will provide prompts, but participants are encouraged to discuss anything that is of interest to them.

Interested in year-round mentorship? Sign up today!

Evening Social

7:00 PM – 10:00 PM, Goldies (659 5th Ave)

Hang out and play party games with your peers at Goldies, a Fairbanks favorite. There will be a cash bar with cocktails and mocktails. Note: there will not be food at this event.



Wednesday, March 29

Announcements

8:00 – 8:15 AM, Westmark Gold Room

- Message from AFS Parent Society

  Cecil Jennings

Plenary

8:15 AM – 9:15 AM, Westmark Gold Room

Dr. Schery Umanzor

University of Alaska Fairbanks

Angela Bowers

University of Alaska Southeast

Title: The Alaska Mariculture Initiative and Opportunities to Leverage Salmon Hatchery Infrastructure

Dr. Schery Umanzor is UAF's College of Fisheries and Ocean Sciences mariculture faculty. Her expertise includes macroalgal ecology, ecophysiology, and cultivation. Some of her current projects include developing low-cost tools and methods for adequate site selection for kelp farms in Alaska, developing cultivation protocols for red seaweeds, and establishing a pinto abalone cultivation program for Alaska. Dr. Umanzor obtained her doctorate in Marine Ecology in Nov 2017. Shortly after, she joined the Seaweed Biotechnology Lab at the University of Connecticut, where she focused on the selective breeding of sugar kelp. She joined UAF in 2020.

Angela Bowers has been an Assistant Professor of fisheries and aquaculture in the Applied Fisheries program at the University of Alaska Southeast in Sitka since the fall of 2018. Prior to that, she worked for 13 years in salmon enhancement aquaculture in roles from fish technician to aquaculture director. In her current role she has developed a hands-on intensive training program for students in Aquaculture and mariculture, outplanting kelp near salmon net pens with students for the past 4 years. She earned degrees in Biology and Spanish at the University of Wisconsin-Eau Claire and a Professional Science Masters in Fisheries Management from Oregon State University. When she's not working, she spends her time on the water and in the woods with her daughter and two rescue dogs.

See abstract on page 53

Wednesday, March 29

Poster Session and Tradeshow

10:00 AM – 12:00 PM, Westmark East Gold Room

Poster Title	Author (*Student)
Stream-specific declines in chum salmon body size from 2013-2022 in southeastern Alaska	Alexandra McCarrel
Comparing microsatellite and reduced representation sequencing for population genetics: an Arctic grayling (Thymallus arcticus) case study	Anna Rix
How much aged carbon is used by Arctic fishes?	Ashley Stanek
Development of three quantitative polymerase chain reaction assays for Yessotoxin producing dinoflagellates	Brandi Kamermans
Under-ice fish assemblages in the Colville River Delta	Caitlin Forster
A comparison of fishery-independent and fishery-dependent data with regard to stock analysis of Rougheye and Blackspotted rockfish in the Aleutian Islands.	Cara Hesselbach*
Ages and Spawning Times of Berryteuthis magister Squid in Southeast Alaska	Charlotte Springer*
Prospective Students: New Opportunities with the Integrated Marine Fisheries Lab at OSU	Cheryl Barnes
Federal Subsistence Management Program	Cory Graham
Using Two Decades of PST Testing and Regional Weather Patterns to Uncover Patterns of Toxicity in Alaska's Commercial Geoduck Clam Fishery	Courtney Hart*
Exploring the Population Dynamics of Invasive Signal Crayfish in the Buskin Watershed, Kodiak Island, Alaska	Daniel Smith*
Seasonal increase in size and maturity of Armhook squid, Berryteuthis magister, in Southeast Alaska	Emma Roloff*
Advancing the Data-Limited Stock Assessments for Pacific Sleeper Shark (Somniosus pacificus) and Pacific Spiny Dogfish (Squalus suckleyi)	Garrett Dunne*
Applying an integrated population model to understand marine processes affecting Western Alaskan Chum salmon productivity	Genoa Sullaway*
mtDNA on Pacific Herring in the Eastern Bering Sea	Isabelle Nicolier*
Woody debris export to large rivers following wildfire	Jeffrey D. Muehlbauer

Wednesday, March 29

Poster Session and Tradeshow, Cont'd

10:00 AM – 12:00 PM, Westmark East Gold Room

Poster Title	Author (*Student)
Novel passive eDNA devices enable cost-effective aquatic biodiversity monitoring	George Deal*
Fine-scale Prediction of Freshwater Habitat Potential for Chinook Salmon (Oncorhynchus tshawytscha) across the Yukon and Kuskokwim River Basins, Alaska	Josh Paul
Learning Through Experience at the Salish Sea Research Center	Justice Black-Williams*
Using environmental DNA to assess Arctic grayling and Chinook salmon distribution in the Chena River	Kristen Reece*
Nearshore seascape complexity influence on fish assemblages in southern Southeast Alaska	Lia Domke*
eDNA metabarcoding to monitor the impact of climate change on estuarine communities in the Gulf of Alaska	Maris Goodwin*
Ability of Northern Pike in Southcentral Alaska to use marine habitats revealed using strontium isotope analyses of otoliths	Matthew Wooller
Patterns of aquatic insect emergence in cold and warm urban streams in Anchorage	Molly Legg*
Juvenile Coho Salmon growth patterns track biennial Pink Salmon spawning abundance fluctuations in a southeast Alaska watershed	Naomi Muehleck*
Arctic Grayling reintroduction in Michigan: A New Hope	Nicole Watson*
Do Lake Trout foraging habits affect mercury biomagnification?	Sarah Laske
Population Genomics of Pacific Herring in the Eastern Bering Sea	Sydney Almgren*
Trophic resource use by Arctic fishes across Beaufort Sea coastal lagoons	Sydney Wilkinson*
Pioneering proven technology in a new field: Can image analysis improve salmon escapement indices?	Teresa Margaret Fish
How a Levee Impacted Water Quality and Fish in Piledriver Slough: A Ten-Year Study	Teslin Brannan*
Validating morphometrics as a non-lethal tool to determine Arctic grayling sex	William Samuel*

Wednesday, March 29

AK Chapter AFS Past Presidents Lunch

12:00 PM – 1:30 PM, Harper Board Room

Spawning Fun 5K Run/Walk

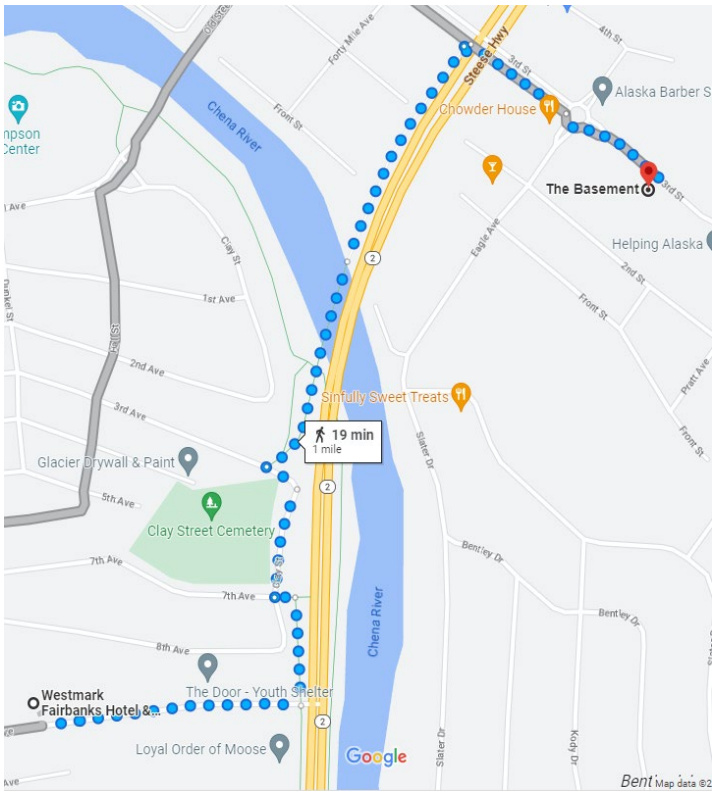
5:30 PM, Westmark Hotel

Join us in shuffling through frozen Fairbanks and experiencing the wonders of winter in the North on foot. By signing up for the event, you'll get a sweet sticker designed by our event artist, Taylor Cubbage, and the chance to win a prize announced at the Banquet on Thursday night! Please make sure that you registered ahead of time! **Cost is $15.00 per person.**

Trivia

7:00 PM – 11:00 PM, The Basement (541 3rd Ave)

Test your knowledge of marine and freshwater fishes with a chance to win prizes at one of Fairbanks' newest downtown venues. Pizza, beer, and non-alcoholic beverages will be provided.



Thursday, March 30

Announcements

8:00 – 8:15 AM, Westmark Gold Room

- Message from AFS Western Division

  Dan Brauch

Plenary

8:15 AM – 9:15 AM, Westmark Gold Room

Dr. Katie Howard

Alaska Department of Fish and Game

Dr. Vanessa von Biela

U.S.G.S. Alaska Science Center

Title: Fables for Fisheries: Creative Lessons for Strategic Approaches to Crisis

Dr. Katie Howard is a fisheries scientist and lead of the Salmon Ocean Ecology Program at Alaska Department of Fish and Game. She completed her undergraduate degree at the University of Idaho before moving on to her masters and Ph.D. at the University of Hawai'i-Mānoa. There, she took a deep dive (literally and figuratively) into the world of parrotfishes, which are immensely important to coral reef ecology, artisanal commercial fisheries, subsistence use, and in Native Hawaiian culture. Her first non-academic job was as a research biologist for Chinook and chum salmon on the Yukon River, cementing her passion for salmon and the people who depend on them. Since then, Katie has held a series of positions that melded her marine ecology background with salmon fisheries and population dynamics. Katie lives in Anchorage on Dena'ina land alongside her husband, son, and rambunctious puppy.

Dr. Vanessa von Biela is a Research Fish Biologist with the U.S. Geological Survey's Alaska Science Center in Anchorage, Alaska, USA. She earned her PhD in Fisheries from the University of Alaska Fairbanks, M.Sc. in Biological Sciences from the University of Alaska Anchorage, and B.Sc. in Zoology from the University of California Santa Barbara. Her work addresses

Thursday, March 30

Plenary (cont'd)

8:15 AM – 9:15 AM, Westmark Gold Room

research information needs for the management of fish, wildlife, and lands. Vanessa's research focuses on understanding the response of fish as individuals and at the population level to climate drivers. Vanessa enjoys sharing Alaska's vibrant ecosystems and culture with her young three kids and husband. Vanessa lives and works in Anchorage on Dena'ina land.

See abstract on page 54

Tamamta (All of Us): A Racial Equity Dialogue to Advance Justice in Fisheries Education, Research, and Governance.

10:00 AM – 12:00 PM, Westmark Gold Room

Thursday, March 30

49th Annual Alaska Chapter AFS Business Luncheon

12:00 PM – 1:30 PM, Westmark Gold Room

Agenda

1. Call to Order
2. Determination of a quorum
3. Approval of agenda
4. Approval of 2022 annual business meeting minutes (see 2023 Program Book pg. 48)
5. AFS Western Division report – Dan Brauch, WDAFS President
6. April 2022 - February 2023 Chapter review:
    - Treasurer's Report – Trenten Dodson
    - Secretary's Report – Scott Ayers
    - Student Representative's Report – Jonah Bacon
    - Past President's Report – Sue Mauger
        - Bylaws & Procedures Manual
    - Vice President's Report – Donnie Arthur
        - Membership update
        - 2024 AFS-Alaska Annual Meeting
    - President-Elect – Erik Schoen
        - 2023 Annual Meeting program review
    - Standing Committees
        - Finance Assets Oversight – Ray Hander
        - Molly Ahlgren Scholarship – Ray Hander
        - Awards – Jeff Falke
            - Meritorious Service Awards
        - Environmental Concerns – Joel Markis
        - Diversity, Equity & Inclusion – Cheryl Barnes
        - Professional Development – Sara Miller
    - President's Report – Megan McPhee
        - Student Endowment
        - ExComm Retreat Report
7. Farewell remarks from outgoing President – Megan McPhee
8. Remarks from the new President – Erik Schoen
9. New Business:
    - Appointment of new Executive Committee officers
10. Open forum
11. Adjourn

Thursday, March 30

Environmental Concerns Committee

5:00 PM – 6:00 PM, Westmark Minto Room

Concluding Banquet

6:00 PM – 10:00 PM, Westmark Gold Room

Here, we will enjoy a delicious catered dinner while celebrating the closing of another successful meeting! We will also recognize excellent research being conducted by the next generation of fisheries scientists as we present winners of the student poster and oral presentations. There will also be a live auction and a variety of exciting local and technical products on display. Be sure to bid in support of future meetings and student travel. You won't want to miss this event!

Friday, March 31

Allyship Discussion

8:30 AM – 10:00 AM, Westmark Gold Room

Want to keep refining your skills as an ally? Join us for an informal discussion about how we can work together to more effectively support those with underrepresented and/or historically marginalized identities in fisheries. Everyone is welcome (and encouraged) to attend! Coffee and snacks will be provided!

Please note that these discussions are not intended to serve as a professional training. This is simply an opportunity for participants to learn from each other.

Friday, March 31

Chena Hot Springs Resort Trip

Date: Friday, March 31st 9:00 AM – 3:00 PM

Place: Pick up at the Westmark Hotel

Cost: $130/person for roundtrip transportation. A day pass to the pool is $20 for adults, $18 for seniors, and $17 for children.

Description: Food and beverages not included, so participants are encouraged to bring their own or purchase at the resort.

Participants: Participants should schedule transportation directly through the resort at: https://chenahotsprings.com/chena-shuttle/

Ice Fishing Trip

Date: Friday, March 31st 10:00 AM – 4:00 PM

Place: Lake or river near Fairbanks. Van departs from Westmark Lobby.

Cost: $20/per person

Capacity: 15 participants who require transportation, unlimited participants who arrange their own transportation.

Description: Fish for various species through the ice in Fairbanks. There will be a big fish and small fish competition, so bring your good luck charms and skills for a chance to reel in a winner. Limited numbers of fishing rods and gear will be provided, so participants are encouraged to bring their own. All licenses and food/water will be the responsibility of participants.

Participants: Van departure from Westmark Hotel at 10am and returning at 4 pm. Other pickup/dropoff locations within Fairbanks are possible, contact organizers to discuss. Participants with their own transportation are welcome to come and go as they please.

Technical Session Schedule – Tuesday AM

	Human Dimensions of Fishery Management and Fishing Tourism	Failure and Innovation in Fisheries Science: Presenting Past Challenges for a Better Future
	Gold Room	**Minto Room**
10:00 AM	Local views of competition and integration between commercial fishing, subsistence, and tourism in Southeast Alaska **Ryan Naylor* (Virtual)**	Wild, Natural, Sustainable...or Hatchery? **Benjamin Van Alen (Virtual)**
10:15 AM	Angler's perceptions, experiences, and attitudes towards fisheries management in three NC lakes **Kathryn Jewell (Virtual)**	Swimming Upstream: Innovations of Undergrads and Educators for Salmon and STEM Learning **Christina Buffington**
10:30 AM	The social-ecological system of the Kenai River Fishery (Alaska, USA) **Chase Lamborn (Virtual)**	Videos from the sea: the fish and the wrecks **Erica Ebert**
10:45 AM	A Delphi-study approach to future participation in recreational angling and fishing tourism **Stian Stensland**	Future Directions in Optical Remote Sensing of Fisheries **Michael Roddewig**
11:00 AM	Indigenizing Salmon Science and Management: From Theory to Practice **Brooke Woods**	Pacific Cod in Southeast Alaska: Challenges of Managing a Data Limited Fishery **Laura Coleman**
11:15 AM	Tamamta (All of Us): Transforming Western and Indigenous Fisheries and Marine Sciences Together **Courtney Carothers**	Estimating Groundfish Abundance by Combining the Data from Multiple Fishery-Independent Surveys **Tristan Sebens***
11:30 AM	Kahtnu Fisheries: A Focus for Dena'ina Representation **Nicholas Jacuk***	When beavers get burned, do fish get fried? Assessing beaver effects on fish in a fire-dominated ecosystem using and eDNA **William Samuel***
11:45 AM	The Story of a Slough: Engaging (and Managing) Young Scientists and Stewards, a Ten-Year Project **Tori Brannan**	Comparison of eDNA primers for aquatic invertebrate diversity in Interior Alaska streams **Jeffrey D. Muehlbauer**

*student

Technical Session Schedule – Tuesday PM

	Crafting Creative Solutions for Fisheries Using Genomics	Contributed talks: Fisheries Management
	Gold Room	**Minto Room**
1:30 PM	Improving genetic tools for research and management of western Alaska salmon **Elizabeth Lee**	A look inside federal fisheries management in Alaska, exploring the diverse jobs within NOAA Sustainable Fisheries Division **Maggie Chan**
1:45 PM	Developing genomic resources for analyzing fisheries bycatch of Black-footed Albatross (Phoebastria nigripes) **Diana Baetscher (Virtual)**	Using selectivity ratio to evaluate bottom trawl survey and longline fishery selectivity **Sean Rohan**
2:00 PM	Population genomics of sablefish throughout the North Pacific **Laura E. Timm (Virtual)**	Boats 'N Cohos: 2022 Alaska Freshwater Fish Inventory Surveys and Nominations to the Anadromous Waters Catalog **Nate Cathcart**
2:15 PM	Genotyping at sea informs in-season fisheries management in real-time. **Heather A. Hoyt**	Climate-informed models benefit hindcasting but present challenges when forecasting species-habitat associations **Cheryl Barnes**
2:30 PM	Using quantitative PCR to estimate Chum Salmon (Oncorhynchus keta) abundance with environmental DNA on the Chena River **Maggie Harings***	Incorporating dynamic fleet structure in stock assessment models: Accounting for a rapidly developing pot fishery for Alaska sablefish (Anoplopoma fimbria) **Matt Cheng***
2:45 PM	Population genomics of rockfish species across the West Coast: chaos reigns supreme **Laura E. Timm (Virtual)**	Forests, Fish, & People: Quantifying Alaska National Forest Contributions to Subsistence, Sport, and Personal-Use Salmon Harvest **Emily Whitney**
3:00 PM	***BREAK***	

*student

Technical Session Schedule – Tuesday PM (cont'd)

	Crafting Creative Solutions for Fisheries Using Genomics (cont'd)	Contributed Talks: Age, Growth, and Development
	Gold Room	**Minto Room**
3:45 PM	Genomic evidence for hatchery-induced domestication selection in Chinook salmon, Oncorhynchus tshawytscha **Natasha Howe* (Virtual)**	Declines in body size of Bristol Bay sockeye salmon associated with increased competition in the ocean **Bert Lewis**
4:00 PM	Optimizing trans-generational genetic mark-recapture (tGMR) for improved enumeration of Pacific salmon **Sam Rosenbaum***	Hindcasted bioenergetics modeling of juvenile Chinook salmon (Oncorhynchus tschawyscha) and Dolly Varden (Salvelinus malma) within the Kenai River system to inform future climate projections **Peyton Thomas**
4:15 PM	Quantifying impacts of hatchery-origin salmon strays to wild population recruitment and resilience using quantitative genetic models **Samuel May**	Heritability of length and age at maturity in a captive population of Chinook salmon **Megan McPhee**
4:30 PM	Pink Salmon in the North American Arctic: Natural expansions from the Pacific or invasions from the Atlantic? **Sara Gilk-Baumer**	Developmental toxicity of microbial phenanthrene-biodegradation metabolites to larval threespine stickleback **Kelly Ireland***
4:45 PM	Detecting Longfin Smelt with eDNA in Bellingham Bay, WA. **John Rombold**	Life in the fast lane: squid fishery species in Southeast Alaska **Michael Navarro**

*student

Technical Session Schedule – Wednesday PM

	Salmon Hatcheries 2.0: Opportunities for Mariculture, Economic Development, and Ecosystem Services	**Contributed Talks: Climate Effects on Alaskan Ecosystems**
	Gold Room	**Minto Room**
1:30 PM	Salmon Hatcheries 2.0: Setting the Stage **Tommy Sheridan**	Drivers and diversity of Chinook salmon productivity in the Arctic-Yukon-Kuskokwim region **Megan Feddern (Virtual)**
1:45 PM	Integrating Mariculture into Alaska's salmon aquaculture: A resource for Alaska's Aquaculture and mariculture industries and a unique learning opportunity for students in Southeast Alaska **Angela Bowers**	Modeling stream temperature and flow from gridded climate datasets in Alaska's Yukon and Kuskokwim basins **Rebecca Shaftel***
2:00 PM	Indoor cultivation protocols for the Rhodophytes, Devaleraea mollis and Palmaria hecatensis from Alaska **Muriel Dittrich***	Investigating factors associated with heat stress responses of two adjacent populations of subarctic Chinook salmon in Alaska: the role of site-specific temperature, body size, and hatchery vs. wild origins on HSP70 expression **Madeline Lee***
2:15 PM	Mapping marine invasive species in Alaska to raise awareness in the mariculture industry **Suzie O'Neill***	Fluvial export of nutrients and multiple forms of carbon from a temperate forested watershed in southeast Alaska **Claire Delbecq***
2:30 PM	Sustainability certification of Alaskan fisheries **Benjamin Americus**	A Southeast Alaska community-based stream temperature monitoring network provides insights into salmon resilience to climate change **Rebecca Bellmore**
2:45 PM	Imprinting salmon to targeted locations using natural odor cues: a new imprinting paradigm for hatchery programs? **Andrew Dittman (Virtual)**	AKTEMP: Presenting a fully functional stream and lake temperature database for Alaska **Marcus Geist**
3:00 PM	***BREAK***	

*student

Technical Session Schedule – Wednesday PM (cont'd)

	Salmon Hatcheries 2.0: Opportunities for Mariculture, Economic Development, and Ecosystem Services	**Contributed Talks: Wildfire Effects on Alaskan Ecosystems**
	Gold Room	**Minto Room**
3:45 PM	**Panel Discussion**	Does Riparian Vegetation Buffer Aquatic Habitats from Direct Wildfire Impacts in Interior Alaska Boreal Stream Networks? **Jeff Falke**
4:00 PM		Hydrologic regime characterization for wildfire- impacted streams in changing boreal ecosystems **Deanna Strohm**
4:15 PM		Arctic Grayling (Thymallus arcticus) physiology and movement behavior across a fire-impacted boreal riverscape **Elizabeth Hinkle***
4:30 PM		How do wildfires affect Chinook salmon? Evidence from small streams, big rivers, and satellites **Erik Schoen**
4:45 PM		

*student

Technical Session Schedule – Thursday PM

	Contributed Talks: Nutrients and Food Webs	Contributed Talks: Behavior and Distribution
	Gold Room	**Minto Room**
1:30 PM	Assessing the effects of sea otters on depth distributions of Dungeness crab in Southeast Alaska **Carter Johnson***	Assessing Spawning Behavior at the Northern Extreme of Pacific Halibut **Austin Flanigan***
1:45 PM	Paralytic Shellfish Poisoning (PSP) in Alaska: Past Studies and Ways Forward **Andrea James**	Seaward migration and overwintering habits of Dolly Varden in northwestern Alaska analyzed using otolith microchemistry **Joe Spencer***
2:00 PM	Combining predator diet and survey data to understand spatial and temporal patterns of forage fish in Alaska **Lindsay Turner***	An Examination of Burbot Life History Strategies Through Use of Radiotelemetry **Lisa Stuby**
2:15 PM	Analyzing stable isotopes within eye lenses to determine ontogenetic trophic dynamics of whitefish species from the central Beaufort Sea **Jonah Bacon***	Testing the Efficacy of Mark Report Satellite Tags (mrPAT) to Examine Movements of Large Male Snow Crab (Chionoecetes opilio) in the Eastern Bering Sea **Concepcion Melovidov***
2:30 PM	Patterns in predation: understanding climate mediated predation impacts of a novel subarctic predator **Benjamin Rich***	Species distribution models estimate juvenile salmon habitat and time-varying distributions in the northern and southeastern Bering Sea **Lilian Hart***
2:45 PM	Food webs in hydrologically diverse riverscapes: contributions to salmon production and population stability **J. Ryan Bellmore**	Insights into the ecology of Chinook Salmon in the North Pacific Ocean, gleaned from pop-up satellite tags **Andy Seitz**
3:00 PM	***BREAK***	

*student

Technical Session Schedule – Thursday PM (cont'd)

	Contributed Talks: Nutrients and Food Webs (cont'd)	Hard Rock Mining in Alaska – How Could and Should the Alaska Chapter AFS be Engaged?
	Gold Room	**Minto Room**
3:45 PM	Stream hydrology and a salmon pulse subsidy shape juvenile salmonid foraging patterns in a southeast Alaska watershed **Kevin Fitzgerald***	Overview of Alaska's mining past, present and future; implications for fisheries and watersheds; and ways for the Alaska Chapter AFS to engage **Sue Mauger**
4:00 PM	Using "Big Data" and Ecological Stoichiometry to Inform Fisheries Research **Erin Larson**	Brief overview of Heavy Metal Mining and Effects on Alaskan Streams **Katie Wedemeyer**
4:15 PM	Linking permafrost characteristics to fish in Arctic headwater streams **Michael Carey**	Aquatic Biomonitoring at Hard Rock Mine Projects in Alaska **Chelsea Clawson**
4:30 PM		**Panel Discussion**
4:45 PM		

*student

Symposia Descriptions - Tuesday

Human Dimensions of Fishery Management and Fishing Tourism

Organizer: Stian Stensland
Location: Westmark Gold Room
Time: 10:00 AM – 12:00 PM

Description: Fisheries are managed for use and conservation of stocks and their habitat, but research on the human dimension of fisheries are often limited. In the era of the Anthropocene, it is clear that that fisheries must be seen as socio-ecological systems with important feedback loops between the two subsystems – society and nature. Resilient fisheries are dependent on understanding both these systems and how they interact. In Alaska sport, commercial, subsistence and personal use are all important fisheries to e.g., local communities, tribal groups, locals, visitors, and fishing tourism businesses. Despite the socio-cultural, economic, and ecological impact of these fisheries few "human" studies have gone beyond ADF&G's annual catch and effort surveys. We invite presentations with a human dimension/social science perspective on these fisheries. Presentations do not need to be about Alaska, but we welcome presentations addressing how the results can be relevant for an Alaskan setting. Some examples of topics are different stakeholders' view on fishery management issues, actors' involvement in habitat restoration and conservation, governance of fisheries, fishers' motivation and behavior, economic value of fisheries, invasive species management, firms and anglers in fishing tourism.

Failure and innovation in fisheries science, presenting past challenges for a better future.

Organizer(s): Will Samuel, Joe Spencer
Location: Westmark Minto Room
Time: 10:00 AM – 12:00 PM

Description: Publications and presentations are often biased towards projects with successful or statistically significant results, however, we can still learn a lot from the "unsuccessful" studies, or studies that didn't turn out as we expected. Not only can we learn what to avoid in future research, but often "unsuccessful" projects lead to ideas that are interesting or important. We can also learn from past mishaps in management, and other fisheries issues like mine and environmental catastrophes. This symposium embraces the idea that failure is part of the process of science, and that we should hear about all the challenges in research and management so we can improve on them next time around. Come present your failures, surprises, innovations, and unexpected discoveries.

Symposia Descriptions - Tuesday Cont'd

Crafting Creative Solutions for Fisheries Using Genomics

Organizer(s): Jessica Glass, Samuel May
Location: Westmark Gold Room
Time: 1:30 PM – 3:30 PM; 3:45 PM – 5:00 PM

Description: Genomic techniques have advanced rapidly over the past several decades. New tools are needed to provide creative solutions to fisheries management challenges while better integrating genomic and evolutionary applications into existing management and conservation frameworks. The aim of this symposium is to showcase the advancement and innovation of genomic tools in Alaska for fisheries applications such as whole genome sequencing, environmental DNA, transcriptomics, population genomics and phylogeography. We invite speakers whose research integrates genomic tools across Alaska, whether freshwater or marine, Arctic or temperate rainforest, and encourage talks offering creative ideas that will push the boundaries of the field of genomics as applied to fisheries.

Symposia Descriptions - Wednesday

Salmon Hatcheries 2.0: Opportunities for Mariculture, Economic Development, and Ecosystem Services

Organizer: Tommy Sheridan
Location: Westmark Minto Room
Time: 1:30 PM – 3:00 PM; 3:45 PM – 5:00 PM

Description: Originally designed in the early-1970s to enhance fisheries at a time when salmon returns were at historically low levels, Alaska's salmon hatchery program has been successful by many metrics, with recent hatchery returns accounting for over 25% of all Alaskan salmon harvests, oftentimes accounting for greater than 25% of the state's total salmon fishery value. Alaska's salmon hatcheries have also served to diversify economic opportunities in coastal Alaskan communities to include some of the state's largest recreational fisheries, and have supported maritime-related workforce development programs while contributing to cutting edge scientific research. As the State of Alaska grapples with issues relating to food, energy, and water security, stakeholders are exploring how this program could be leveraged to generate broader benefit. This symposium seeks to highlight a few areas where these opportunities may exist, including mariculture development, energy innovation, and climate change mitigation.

Symposia Descriptions - Thursday

Hard Rock Mining in Alaska – How Could and Should the Alaska Chapter AFS Be Engaged?

Organizer(s): Sue Mauger, Joel Markis
Location: Westmark Minto Room
Time: 3:45 PM – 5:00 PM

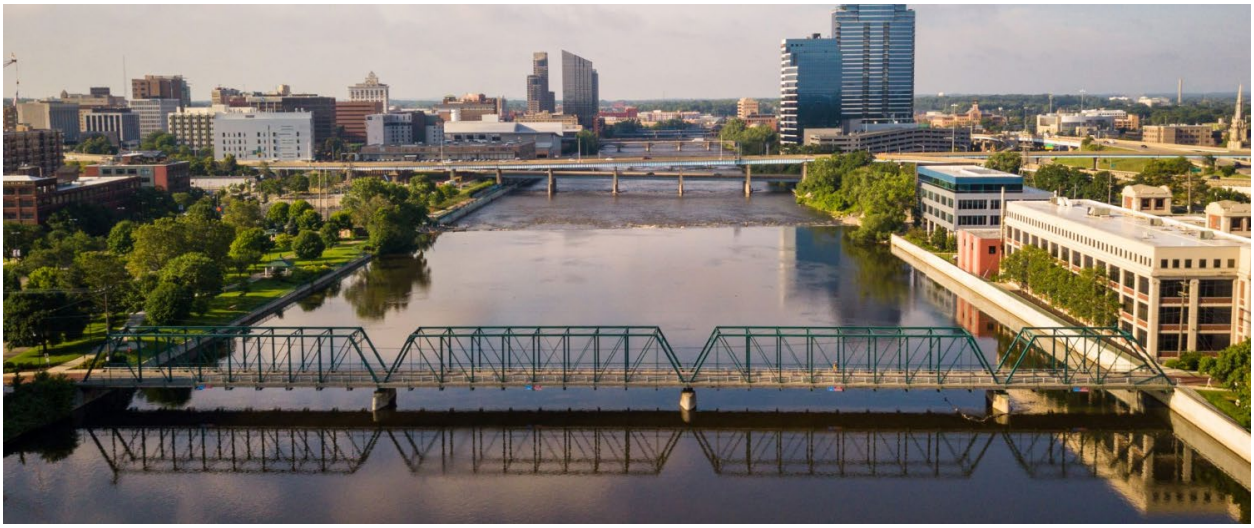
Description: Proposals for new hard rock mining projects are anticipated to increase in the coming years to meet the demands for the renewable energy transition. We want to create space for a mining and fisheries discussion. We invite presentations that provide a state or regional view of current and anticipated mining activity, how geology and landscape result in fish habitat and fisheries concerns, issues the chapter should be aware of and/or do something about, and examples of positive outcomes from implemented Best Management Practices.

2023 National AFS Meeting

Join us this year at the National AFS Meeting!

AMERICAN FISHERIES SOCIETY
153rd Annual Meeting
AUGUST 20-24, 2023 | GRAND RAPIDS, MICHIGAN

The American Fisheries Society, President April Croxton, and the Michigan Chapter are excited to host the 153rd AFS Annual Meeting, August 20-24, 2023. Home to the iconic Blue Bridge and Grant River, AFS is thrilled to return to the city of Grand Rapids following a successful Join Aquatic Sciences Meeting held earlier this year. As we continue to address the various stressors impacting fisheries and their ecosystems, we hope that this year's theme, "Adaptive approaches to understand and manage changes in fisheries," will stimulate a wide range of sessions as we bring together professionals from across North American and countries throughout the world.



For more information, visit:
https://afsannualmeeting.fisheries.org/

2022 Alaska Chapter AFS Meeting Minutes

48th Annual Alaska Chapter AFS Business Meeting

Mar 2, 2022 12:15 PM to 1:30 PM

Agenda

1. Call to Order: 12:16 PM
2. Determination of a quorum
    - 23 members present at the start, meeting a quorum. (35 members participated as the meeting continued)
3. Approval of agenda
    - Motion by Erik Schoen, seconded by Toshihide (Hamachan) Hamazaki. Motion carried
4. Approval of 2021 annual business meeting minutes
    - Motion by Erik Schoen, seconded by Megan McPhee . Motion carried
5. AFS Western Division report – Dan Brauch, WDAFS President

    -Dan provided a Western Division (WD) AFS update slideshow that covered the WD mission, member benefits of being a part of the WD including travel and small project grants, scholarships, and Service awards. He also spoke about the August 2022 Spokane meeting, the first WD meeting that will be in person in the past few years. They are looking for volunteers for the meeting, more of which will be in the upcoming Tributary newsletter. He also noted that they welcome interest in their committees and anyone interested in running for office for WD roles.
6. April 2021 - February 2022 Chapter review:
    - Treasurer's Report – Trenten Dodson

        -Trent unable to attend today's meeting. Sue presented the treasurer's report in his absence. She noted that the biggest change has been the passing of the treasurer torch from Lee Ann Gardner to Trent Dodson after the many years of her service to the Chapter. (Treasurer report document is in the Annual Meetings 2022 folder). Total Chapter assets are nearly identical to this time last year. The virtual meetings are less expensive than in-person meetings and have been good to our bottom line. This year's meeting platform (Whova) is less expensive than what we used last year (Cvent), and the Chapter is going to request feedback from the membership at the conclusion of this Annual meeting to see what they thought about the experience.

        -There was a question from Kate Wedemeyer, who asked about extra Chapter funds and whether past policy to hold extra seminars with those funds was still taking place. Sue noted that she wasn't aware of any profits being turned over to anything other than our general funds. Stephanie Quinn-Davidson spoke to the various items that the Chapter has been funding by request, but that there was nothing specifically outlined about what to do with excess funds. She also noted that the Chapter takes into account that some

meetings make money while others lose money and the extra funds provide a buffer.

- Secretary's Report – Scott Ayers

  Scott is happy to be continuing in this role.

- Student Representative's Report – Taylor Cubbage

  -Taylor has really enjoyed her time working with the Executive Committee over the past year, and the new skills that she picked up along the way. This past year the student subunit partnered with another organization at UAF to develop a mentoring program. They are planning an in-person retreat in Homer this April. There has also been a Burbot research project by the student subunit for the past few years in the Fairbanks area and a paper from those research efforts is currently in review. She's excited to help the new student representative get up to speed.

- Past President's Report – Stephanie Quinn-Davidson
  - -Election winners: New vice president will be Donnie Arthur. The student representative will be Jonah Bacon.
  - -Bylaws & Procedures Manual: Although Stephanie is formally exiting the executive committee, she'll be informally helping for a few more months to continue working on the Chapter's Bylaws and Procedures Manual. The Procedures Manual is a living document of how the Chapter functions and she's still working on final updates to it.
  - -Stephanie shared the proposed updates to the Chapter Bylaws, walking through each change and the rationale behind them. This included changes to how the Student Representative was listed, how succession works in the event of a vacancy on the Executive Committee, redefining how long committee chairs serve and how they are selected, making sure our Bylaws conform to Parent Society rules, and other small changes for clarity.
  - **-Motion: By Scott Ayers to adopt the Alaska Chapter Bylaws as presented by Stephanie Quinn-Davidson, seconded by Kate Wedemeyer. Hamachan Hamazaki spoke about concerns that the voting section wording is perhaps not concise enough. Suggested changing language in Section 3 to updated language "shall be elected from ballots distributed to all Chapter members via a manner deemed appropriate by the Executive Committee".**
  - **Jeff Falke asked to ensure that flexibility in changes in administration when we're holding virtual meetings. He asked about clarifying the language allowing for multiple terms for both the Treasurer and Secretary positions. Stephanie made changes allowing for multiple terms.**
  - **Motion passed as amended to update language in Section 3 for both elections (Hamazaki) and allowing multiple terms for Treasurer and Secretary (Falke). There were no objections.**
  - -Stephanie will accept the originally presented changes and the modifications suggested in the motion. The final version will then be sent to the Parent society for their review to ensure compliance, after which it will be posted to the Alaska Chapter website.

- Vice President's Report – Erik Schoen
  - -Membership update: Erik presented a figure on membership trends showing a long-term decline in membership, which hasn't changed much in the past few years. The number of regular and early professional members has increased recently.
  - -2023 AFS-Alaska Annual Meeting: Last week of March 2023! Avoids all spring breaks across the state and is a great time to visit Fairbanks. The Westmark Fairbanks Hotel and Conference Center has been reserved. Erik will be recruiting an organizing committee soon - please consider signing up. He also asked folks to consider symposia that they might want to host.
  - -Ray Hander recalled the difficulty of getting the Chapter's deposit back the last time we had a meeting scheduled at this site (due to Covid) and suggested that Erik thoroughly review the contract section related to refunds before signing.
  - -Katie Russell asked whether there will be the option for hybrid functionality at the meeting next year. Erik will be working through this with the input of the Chapter and the Program Committee.
- President-Elect – Megan McPhee
  - -2022 Annual Meeting program review: It looks like we will make about the same amount of money this year as last year. She shared a big thanks to the organizing committee, Taylor Cubbage, Cheryl Barnes, Jeff Falke, and others for the hard work that they have put into the meeting.
- Standing Committees
  - -Finance Assets Oversight - Ray Hander: They have continued meeting quarterly with Wells Fargo Advisors. We now have four endowments as a Chapter. The Chapter is invested in a moderately conservative strategy that helps us weather the bumps in the market. The Chapter tries to keep roughly 30K in our Fund A as working capital for annual meetings and other Chapter expenses. The committee membership has been long standing and works well together.
  - -Molly Ahlgren Scholarship - Ray Hander: Committee now has new members; the Student Representative to the Executive Committee and a member of the Diversity, Equity, and Inclusion Committee. There were two deserving awardees this year.
  - Awards - Jeff Falke
    - Meritorious Service Award: Jeff provided a quick slideshow with all the opportunities to recognize peers via the Chapter, all of which have descriptions on the Chapter website. Not all awards are given out annually, but the Chapter as a whole has been doing a good job of submitting nominations. He thanked all the students that are presenting and all that are helping with the reviews. The Chapter has awarded the Meritorious Service Award this year to Jodi Estrada (ADF&G Gene Conservation Laboratory). Heather Hoyt provided an overview of the nomination for Jodi's award. Congratulations Jodi!
  - -Environmental Concerns - Joel Markis was unable to attend, and Sue (as co-chair) presented. The two of them have been trying to find ways to

comment more and also provide opportunities for the Chapter membership to learn more about environmental concerns through a part of the Oncorhynchus newsletter. They are going to come up with a listserv for these issues to create more of a culture and community to get engaged in these discussions.

- -Diversity, Equity & Inclusion Committee (DEIC) - Cheryl Barnes: DEIC has two folks that are stepping down this year and there will be room for new members on the committee if anyone is interested. They are looking for folks across the career spectrum. They are excited that a member of the Executive Committee attended the DEIC meetings this past year and will continue to do so moving forward. There are now DEIC members also participating on some of the other committees. Additionally, some of the Chapter's DEIC members serve on the WD and National committees. Cheryl is hopeful that the DEI travel award, which hasn't been awarded the past two years, will be awarded this next year. She also noted that there are lots of great DEI events at the Chapter's annual meeting this year. Lastly, the committee has put together a demographic survey for the Chapter to understand who are the members now and where the Chapter is missing folks, and hope to use this information to identify ways to help fill in those gaps.
- -Continuing Education - Sara Miller: The Chapter has put on a few workshops this year with good participation. There were 47 participants at the GitHub workshop last week. Introduction to R had 18 participants. Wetland workshop had 15 attendees. We also had a science communication with 13 participants, which may be extended from a half-day to a full-day workshop at the next meeting. Great participation this time around!

- President's Report – Sue Mauger
  - -Student Travel Endowment Fund (STEF): A new fund to support student travel and networking activities has been established. The AFS Alaska Chapter will contribute a minimum of $500 to the STEF each fiscal year for the following 10 years, for a minimum contribution of $5,500. There has been indication that there are donors who are going to contribute now that the endowment has been set up. The endowment will start paying out annually once it reaches a $85k mark, with payments for travel consisting of a specified percentage of the fund each year.
  - -ExComm Retreat Report: This annual meeting covers items that there isn't time to discuss during the monthly one-hour Executive Committee meetings. Many good ideas were discussed. Sue noted how nice it will be to do this in person next year.

7. Farewell remarks from outgoing President – Sue Mauger: Sue noted that it has been a pleasure to be President this year. At a time when we are dealing with such significant change, this is an important group and platform for working together. She handed (virtually) the gavel over to Megan.
8. Remarks from the new President – Megan McPhee: Megan thanked Sue for the work she's done this past year and for pioneering virtual annual meetings this past year. She looks forward to focusing on reminding the members that the Chapter belongs to them, and the formation of short-term ad hoc committees to further engage the Chapter membership.

9. New Business:
    - Appointment of new Executive Committee officers
        1. New Vice President: Donald (Donnie) Arthur
        2. New Student Representative: Jonah Bacon
        3. The outgoing 2021-2022 officers are as follows: Stephanie Quinn-Davison (immediate past-president), Sue Mauger (president), Megan McPhee (president-elect), Erik Schoen (vice president), Trent Dodson (treasurer), and Scott Ayers (secretary)
        4. The incoming 2022-2023 officers are as follows: Sue Mauger (immediate past-president), Megan McPhee (president), Erik Schoen (president-elect), Donald (Donnie) Arthur (vice president), Trent Dodson (treasurer), and Scott Ayers (secretary)
        5. The outgoing (2021-2022) student representative to the Executive Committee is Taylor Cubbage, and the incoming (2022-2023) representative is Jonah Bacon.
10. Open forum
11. Adjourn: 1:38 PM
    - Motion by Scott Ayers

Plenary Abstracts

Indigenizing Salmon Science and Governance: Moving from Theory to Action

Jessica Black[1]
[1]University of Alaska Fairbanks

Inequities in Fisheries persist. Alaska Native peoples and knowledge systems - despite their 10,000 years of documented stewardship- have largely been made invisible and excluded from fisheries education and governance systems in the State of Alaska. These inequities result in systems that are vastly out of balance, decreased Alaska Native persistence in programs such as fisheries, and an overall lack of well-being for [Alaska Native] peoples and varied fisheries, lands, and water systems. This talk will highlight the importance of meaningful inclusion of Alaska Native peoples and knowledge systems in fisheries governance and education, providing two examples from Dr. Black's research that aims to advance equity and inclusion. Best practices will be highlighted.

The Alaska Mariculture and Opportunities to Leverage Salmon Hatchery Infrastructure

Schery Umanzor[1] and Angela Bowers[2]
[1]University of Alaska Fairbanks
[2]University of Alaska Southeast

Alaska aims to grow a $100 million mariculture industry in 20 years. Actions towards this goal started in 2014, spearheaded by the Alaska Fisheries Development Foundation (AFDF), with today's success reflecting the collaborative effort between multiple private, state, and federal agencies. The Alaska Mariculture Initiative summarizes accomplishments and milestones over the past nine years. Although the industry has come a long way, seafood production through mariculture has a significant opportunity for growth by leveraging salmon hatchery infrastructure while simultaneously providing potential positive impacts on both the kelp grow-out systems and the rearing salmon. Alaska's private non-profit salmon hatcheries were started in response to historically low salmon abundance in the early 1970s and now contribute nearly 25% of commercially harvested salmon, with 26 hatcheries releasing around 1.7 billion fish each year. Merging hatchery release sites and mariculture

operations could utilize existing tidelands leases, reducing the need for site prospecting, as many hatcheries are located in remote bays with excess nutrients and organic waste, potentially suitable for various types of mariculture.

Fables for Fisheries: Creative lessons for strategic approaches to crisis

Katie Howard[1] and Vanessa von Biela [2]
[1]Alaska Department of Fish and Game
[2]USGS Alaska Science Center

Fables are short stories with animals as characters that are used to convey bigger lessons. Drs. Howard and von Biela have been working to understand changing productivity and population decline in Yukon River Chinook salmon and found several 'fables' along the way. In this talk, they'll present recent work on Yukon River Chinook salmon through a series of short stories that illustrated bigger lessons that are applicable to researchers focused on other species and ecosystems. These stories include: "What came first, the spawner or the egg?", "Are means meaningful?", "Don't cry wolf" and "It Takes a Village".

Oral Abstracts

Sustainability certification of Alaskan fisheries

Americus, Benjamin E. Alaska Fisheries Development Foundation*
Wilson, Hannah M. Alaska Fisheries Development Foundation
Sheridan, Thomas M. Alaska Blue Economy Center
Decker, Julie K. Alaska Fisheries Development Foundation

Seafood sustainability certifications are used to inform consumers of environmentally friendly options. The most widely recognized certification comes from the Marine Stewardship Council (MSC) and appears as a blue check mark on packaging. MSC has certified over 400 fisheries globally, including Alaskan salmon, the second fishery in the world to be certified. In Alaska, Responsible Fisheries Management (RFM) is an alternative sustainability auditor that certifies Alaskan salmon as well as flatfish, pollock, crab and cod. Since 2010, major retailers in the United States and Europe including Costco, Walmart, and Whole Foods have transitioned to purchasing certified sustainable seafood, making MSC/RFM certification is increasingly important to Alaskan fisheries. MSC and RFM recertification occurs on a five-year cycle. During recertification, the "client group" representing the fishery, facilitates meetings between MCS and RFM assessment teams and management biologists. Since 2019, the Alaskan Fisheries Development Foundation (AFDF) has served as the client group for Alaska salmon. In past years, MSC has certified Alaskan salmon with conditions to be addressed on the sustainability of pink and chum hatchery

programs and the possibility for murrelet bycatch in gillnets. To address these conditions for the 2024 reassessment, AFDF collaborated with state and federal biologists to 1.) prepare a synthesis of results from the Alaska Hatchery Research Project, and 2.) perform an Ecological Risk Assessment on seabird bycatch. AFDF also serve as the client group for MSC and RFM certification of Pacific cod, and RFM certification of halibut and sablefish. Sustainability certification, whether by MSC, RFM, or other agencies, incentivizes fisheries research and adds value to Alaskan seafood. AFDF fills a necessary role in this process.

Analyzing stable isotopes within eye lenses to determine ontogenetic trophic dynamics of whitefish species from the central Beaufort Sea

Bacon, Jonah. Department of Fisheries, University of Alaska Fairbanks, Fairbanks, AK, USA
Barst, Benjamin. Water and Environmental Research Center, University of Alaska Fairbanks, Fairbanks, AK, USA
Glass, Jessica. Department of Fisheries, University of Alaska Fairbanks, Fairbanks, AK, USA
Wooller, Matthew J. Alaska Stable Isotope Facility, University of Alaska Fairbanks, Fairbanks, AK, USA.
Sutton, Trent. Department of Fisheries, University of Alaska Fairbanks, Fairbanks, AK, USA

Climate change is rapidly accelerating in the Arctic, causing dramatic changes in environmental conditions of nearshore marine habitats that directly impact the diet of Arctic fishes. We aimed to determine differences in the trophic ecology of four whitefish species (Arctic Cisco Coregonus autumnalis, Least Cisco Coregonus sardinella, Broad Whitefish Coregonus nasus, Humpback Whitefish Coregonus pidschian) that coexist in the central Beaufort Sea. We analyzed bulk and compound-specific nitrogen stable isotopes within the layers of eye lenses from these whitefish species to compare changes in trophic position across species, accounting for ontogeny. Preliminary results indicate that Least Cisco, Broad Whitefish and Humpback Whitefish increase their trophic position on average by 1.3, 1.0, and 1.2, respectively, across their entire life span. A consistent difference in trophic level exists between these three species, accounting for ontogeny, where Broad Whitefish occupies a lower trophic position than Humpback Whitefish which occupies a lower trophic position than Least Cisco. Within each species, a large amount of variation exists in the timing and magnitude of dietary shifts, potentially due to differences in migration timing, frequency, or other tenets of life history. Results will be expanded to include data from Arctic Cisco. Overall, this study indicates that there are species-level differences in trophic position dynamics among three closely-related whitefish species in the Beaufort Sea. Measuring trophic isotope ratios within eye lenses gives an indication of trophic dynamics and trophic position changes across the ontogenetic timeline of four whitefish species.

Developing genomic resources for analyzing fisheries bycatch of Black-footed Albatross (Phoebastria nigripes)

Baetscher, Diana S. NOAA Alaska Fisheries Science Center*
Edwards, Scott. Harvard University, Department of Organismic and Evolutionary Biology
Sin, Simon. University of Hong Kong, School of Biological Sciences
Hayes, Kenneth A. Bishop Museum, Pacific Center for Molecular Biodiversity
Beck, Jessie. Oikonos Ecosystem Knowledge & University of California, Santa Cruz

Black-footed Albatross (Phoebastria nigripes) overlap with fisheries across the North Pacific from the Northwestern Hawaiian Islands to Japan, and California to Alaska. Fisheries bycatch is the primary documented source of mortality for the species, although breeding colonies on islands in

the central Pacific are increasingly inundated with storm surges and threatened by sea-level rise. The majority of the 64,200 breeding pairs are found throughout the Hawaiian archipelago and on the island of Torishima off the coast of Japan. Prior genetic studies provided evidence of differentiation between Hawaiian and Japanese colonies, but had limited resolution for characterizing adaptation or identifying patterns of genome-wide variation to support conservation efforts. To understand how fisheries may be impacting specific colonies, we used low-coverage whole genome resequencing (lcWGS) to identify genetic differences among colonies and then designed a set of markers targeting these differences for genotyping bycatch samples obtained from fisheries observers. Bycatch samples can then be assigned to breeding colonies using genetic stock identification. For the reference samples, we prepared 137 lcWGS libraries from breeding colonies on five Hawaiian islands and Torishima (Japan), with the following number of samples per breeding colony: Torishima (48), Tern (30), Kure (23), Midway (23), Laysan (8), Whale-Skate (3), and Lehua (2). Libraries were sequenced on one Illumina NovaSeq lane and analyzed using genotype-likelihoods. Initially, PCR primers were designed for 344 markers, but the number of primer sets was reduced to 262 after multiple iterations of experimental optimization. In addition to generating genomic resources for the Black-footed Albatross, this project highlights one method for leveraging whole-genome data to genotype hundreds of additional samples.

Videos from the sea: the fish and the wrecks

Bargas, Madison ADFG
Ebert, Erica ADFG

Assessing and managing the stock for yelloweye rockfish (Sebastes ruberrimus) presents many challenges due to the biology and life history of the species. Yelloweye are mostly found between 300 to 600 feet in rocky terrain. When yelloweye rockfish are brought to the surface, they often suffer from barotrauma making released survival rates very low. On top of this low survival rate, yelloweye rockfish are a long-lived and late-maturating species, which slow population recovery. Due to these factors, a nonlethal, habitat-based underwater survey was developed using a submersible in 1990. Since 2012, a remote-operated vehicle (ROV) survey has been developed and used by the State to manage the stock of yelloweye rockfish. These surveys take place in the Southeast Outside subdistrict which encompasses the management areas: East Yakutat (EYKT), Central Southeast Outside (CSEO), Southern Southeast Outside (SSEO), and Northern Southeast Outside (NSEO). These areas are surveyed once every two to four years. Transects are determined randomly within yelloweye rockfish habitat. The video obtain from the ROV dives are later reviewed in the office to enumerate species observed. The data gathered is used as part of the stock assessment for demersal shelf rockfish (DSR) and for calculating yelloweye biomass estimate for each given area. The challenges that face the remote-operated vehicle range from rough weather conditions to maneuvering over rocky boulders and surging through strong currents. There is an established quality review process to account for these conditions that may affect the quality of the dive videos. Here we take a look at the challenges of operating a camera up to 140 feet below the ocean surface in search of the brightly colored, charismatic yelloweye rockfish.

Climate-informed models benefit hindcasting but present challenges when forecasting species-habitat associations

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Pirtle, Jodi P. Alaska Regional Office | National Marine Fisheries Service
Rooper, Christopher N. Fisheries and Oceans Canada
Laman, Edward A. Alaska Fisheries Science Center | National Marine Fisheries Service
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Aydin, Kerim Y. Alaska Fisheries Science Center | National Marine Fisheries Service
Thorson, James T. Alaska Fisheries Science Center | National Marine Fisheries Service

Although species distribution models (SDMs) are commonly used to hindcast fine-scale population metrics, there remains a paucity of information about how well these models predict future responses to climate. Many conventional SDMs rely on spatially-explicit but time-invariant conditions to quantify species distributions and densities. We compared these status quo ‘static' models with more climate-informed 'dynamic' SDMs to assess whether the addition of time-varying processes would improve hindcast performance and/or forecast skill. Here, we present two groundfish case studies from the Bering Sea – a high latitude system that has recently undergone considerable warming. We relied on conventional statistics (R2, % deviance explained, UBRE or GCV) to evaluate hindcast performance for presence–absence, numerical abundance and biomass of arrowtooth flounder Atheresthes stomias and walleye pollock Gadus chalcogrammus. We then used retrospective skill testing to evaluate near-term forecast skill. Retrospective skill testing enables direct comparisons between forecasts and observations through a process of fitting and forecasting nested submodels within a given time series. We found that the inclusion of time-varying covariates improved hindcasts. However, dynamic models either did not improve or decreased forecast skill relative to static SDMs. This is likely a result of rapidly changing temperatures within the ecosystem, which required models to predict species responses to environmental conditions that were outside the range of observed values. Until additional model development allows for fully dynamic predictions, static model forecasts (or persistence forecasts from dynamic models) may serve as reliable placeholders, especially when anomalous conditions are anticipated. Nonetheless, our findings demonstrate support for the use of retrospective skill testing rather than selecting forecast models a priori based on their ability to quantify species–habitat associations in the past.

Food webs in hydrologically diverse riverscapes: contributions to salmon production and population stability

Bellmore, J. Ryan, US Forest Service*
Dunkle, Matthew, University of Wyoming
Fellman, Jason, University of Alaska Southeast
Whitney, Emily, University of Alaska Southeast
Caudill, Chris, University of Idaho

Watersheds are often composed of multiple tributaries with distinct hydrologic, temperature, and biogeochemical regimes. This heterogeneity can provide a template for food webs that vary in structure and phenology, and which are spatially connected via organism movement and organic matter transport. Theory suggests that these so-called “meta-food-webs” can contribute to ecological stability, but few studies have evaluated meta-food-webs in riverscapes. We examined the structure and seasonal dynamics of food webs that support salmon in glacier, snow-, and rain-fed streams in southeast Alaska. We found that these stream types have distinct food webs that exhibit: (1) seasonal asynchronies in the timing of resource availability, and (2) variation in the strength of energy flow pathways supporting aquatic invertebrate and fish production. In turn, model analyses suggest that salmon can benefit by moving between glacier-, snowmelt-, and rain-fed streams, tracking asynchronous peaks in resource availability, and spatially coupling

different energy flow pathways. However, as glaciers diminish and precipitation shifts from snow to rain, the physical and chemical characteristics that make glacial or snowmelt streams distinct from rain-fed streams will fade. Among the unforeseen consequences of this hydrologic homogenization could be the loss of unique food webs that promote salmon productivity and resilience.

A Southeast Alaska community-based stream temperature monitoring network provides insights into salmon resilience to climate change

Bellmore, Rebecca A. Southeast Alaska Watershed Coalition*
Hood, Eran. University of Alaska Southeast Tucker, Emil. US Forest Service
Winfree, Michael. US Fish and Wildlife Service

Water temperature is an important environmental parameter in aquatic ecosystems, affecting a wide range of processes, including dissolved oxygen solubility, nutrient cycling rates, and organisms' metabolism and growth. Water temperatures have a cumulative effect on the growth and survival of salmon, and can result in acute impacts, for example, when temperatures exceed tolerance thresholds or contribute to hypoxia. Warming air temperatures and changing precipitation patterns will alter stream temperatures, and identifying places that will continue to be hospitable to salmon in the coming decades is important for prioritizing conservation and restoration activities. In Southeast Alaska, a network of Tribes, community groups, and agencies are monitoring stream temperature in over 70 locations to characterize existing conditions and inform climate change research. While a few sites have decades of data, most were established in 2014 or later. Now that multiple years of continuous, year-round data have been collected at 50 sites, we are able to quantify the interannual variability in water temperature metrics relative to variability in regional weather patterns. Our results provide insights into the types and locations of watersheds that have optimal thermal regimes to continue to support productive salmon populations in the coming decades.

Tamamta (All of Us): Transforming Western and Indigenous Fisheries and Marine Sciences Together

Black, Jessica, University of Alaska Fairbanks
Carothers, Courtney, University of Alaska Fairbanks
Ibarra, Sonia, University of Alaska Fairbanks
Ringer, Danielle, University of Alaska Fairbanks
Stern, Charlene, University of Alaska Fairbanks
Westley, Peter, University of Alaska Fairbanks

Motivated by deep inequities, Indigenous erasure, racism, and continued violence against Alaska Native peoples, Tribal sovereignty, Indigenous values, governance practices, and knowledge systems, the Tamamta program seeks to transform education, research, governance systems in Alaska and beyond. We envision a future where Indigenous Peoples and our/their knowledge and governance systems steward land, fish, and animal relations. Our program supports three cohorts of Indigenous and allied students to pursue their graduate degrees in western and Indigenous fisheries and marine sciences. We are working to decolonize and Indigenize our curriculum, programs, and institutions. We are hosting difficult dialogues, providing short courses, and cultural exchanges for state and federal partner agencies to join this collective transformation. In this work, we center deep relational work based on reciprocity, respect, and redistribution. We will share our origin story, the work of our two years, and some opportunities and challenges along the way.

Indigenizing Salmon Science and Management: From Theory to Practice

Black, Jessica, University of Alaska Fairbanks
Woods, Brooke, Rampart Tribal Member and Woodwell Climate Research Center
Samuelson, Jonathan, Kuskokwim River Inter-Tribal Fish Commission
Carothers, Courtney, University of Alaska Fairbanks
Donkersloot, Rachel, Coastal Cultures Research
Esquible, Janessa, University of Alaska Fairbanks
Hautala, Kendrick, University of Alaska Fairbanks
Ringer, Danielle, University of Alaska Fairbanks
Chya, Dehrich, The Alutiiq Museum
Stevens, Carrie, University of Alaska Fairbanks

Inequities in salmon science and management in Alaska persist. These equities reveal themselves in a multitude of ways, including limited and inequitable access to fisheries management decisions by Tribal governments in Alaska; limited and inequitable access to Indigenous knowledge at educational institutions, including universities; and a general erasure of Indigenous history and lessons of stewardship of salmon and other plant, animal, and fish relatives more broadly. These inequities have also resulted in declining fish populations (e.g., chinook and chum salmon), narrow focus not sufficient addressing for complex problems, and overall negative impacts to well-being for Alaska Native peoples and the whole system. This project documents the breadth and depth of Indigenous Knowledge as it pertains to fisheries management in Alaska and uses that knowledge to suggest improvements for the overall system, decision-making, and co-stewardship of the land, waters, and plant, animal, and fish relatives. This presentation will highlight preliminary findings from the project and offer practical and policy solutions moving forward to center equity and sustainability of fishery systems for the well-being of all.

Integrating Mariculture into Alaska's salmon aquaculture: A resource for Alaska's Aquaculture and mariculture industries and a unique learning opportunity for students in Southeast Alaska

Bowers, Angie, J. University of Alaska Southeast Sitka

Harvesting salmon and other food from the ocean is an integral part of the culture and economy in the State of Alaska. A large contributor to the state's commercial salmon harvest is its private non-profit (PNP) salmon hatcheries. This program started in the early 1070's and now contributes as much as 1/3 of commercially caught salmon, with 26 hatcheries releasing 1.7 billion salmon each year. These fish are reared each spring in ocean net-pens for a few months before their release, providing the space, nutrients, and infrastructure to integrate lower trophic level species such as seaweed. For the last three winters students and faculty from the University of Alaska Southeast have outplanted Sugar kelp (Saccharina latissima) and Ribbon kelp (Alaria marginata) near rearing chum (Oncorhynchus keta) and pink (Oncorhynchus gorbuscha) salmon to help determine the feasibility and measurable benefits of this form of Integrated Multi-Trophic Aquaculture (IMTA). Kelp growth, nitrite, nitrate, ammonia and dissolved phosphorous as well as dissolved oxygen and salinity are measured bi-weekly. As part of this work students not only learn about the kelp life cycle and sustainable aquaculture but they also gain skills using oceanographic

equipment, operate small vessels and work closely with industry professionals. Future work will support aquaculture workforce development, increase the sustainability of salmon enhancement aquaculture in Alaska, improve food security and provide industry with a proof of concept important for demonstrating the potential economic and environmental benefits for IMTA in Alaska.

The Story of a Slough: Engaging (and Managing) Young Scientists and Stewards, a Ten-Year Project

Brannan, Tori L. Salcha Elementary School Principal (retired)*
Jonas, Jenna Tanana Valley Watershed Association
Brannan, Teslin R. Ben Eielson/BEST High School
Buffington, Christina University of Alaska Fairbanks

When a multi-million dollar bridge and levee project on the Tanana River cut off the head of Piledriver Slough, the rural community of Salcha grew concerned about its health and fish populations. An authentic, ten-year scientific study began when the local K-6 elementary school partnered with the Tanana Valley Watershed Association to study the impact of the new infrastructure on the slough, a local food source for Arctic grayling, salmon, and burbot. Staff, students, partners, and community members came together to train in water quality and fish survey protocols, map curriculum, and develop programmatic and structural supports for this hands-on, school-wide STEM opportunity. Partnerships, training, and immersion into citizen and community science empowered students by having them at the forefront of data collection, review, and presentation of findings, further growing into additional grant and scientific opportunities for our school and students. Students and staff have told the story of the slough through the local media, school and regional science fairs, state-wide art contests, regional student research symposiums, scientific publications, and even the 2022 American Geophysical Union Fall Meeting. This session will present insights and methods of engaging young scientists and the importance of their voice and stewardship to the lands and waters as a generation of young people who are invested in science and their community.

Swimming Upstream: Innovations of Undergrads and Educators for Salmon and STEM Learning

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In 2022, while few Yukon River salmon returned to their spawning habitats, two innovations in Fairbanks impacted undergraduate students, educators and (hopefully for the future) chum salmon Oncorhynchus keta and Chinook salmon O.tshawytscha. Motivated by the Arctic and Earth STEM Integrating GLOBE and NASA project and its partners, both innovations involved

GLOBE, a world-wide environmental observing and education program. Global Learning and Observations to Benefit the Environment (GLOBE) includes water quality, macroinvertebrate and land cover protocols and App data entry. Starting in the spring semester, two undergraduate students working with the Fresh Eyes on Ice project snowshoed down the steep banks of Cripple Creek Drain near the UAF Troth Yeddha' campus. They wanted to find out what caused a failed diversion into the original Cripple Creek channel. Drilling through the ice and documenting their sites with the GLOBE Observer App, the undergrads encountered weekly challenges. Persistence led to answers. The U.S. Fish and Wildlife Service and its many partners used the students' fact-finding to inform design work for restoration on the channel. During fall, three weeks after rerouting flow to the original stream channel, one of the students conducted baseline monitoring of macroinvertebrates. A second innovation in 2022 involved a one-day gathering of formal and informal educators eager to learn culturally sustaining approaches to educate youth about salmon and water quality. The Association of Interior Native Educators presented the "When Will the Salmon Come?" curriculum kit produced by Yukon River Drainage Fisheries Association. Through activities grounded in diverse learning styles and Elder observations, educators compared environmental indicators of salmon returning along the lower Yukon River. Participants also tested water quality with GLOBE hydrosphere protocols. In this presentation, we share opportunities for undergraduate students, educators and partners who go against the current for salmon and STEM learning.

Linking permafrost characteristics to fish in Arctic headwater streams

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Permafrost characteristics can dramatically alter groundwater flow, river hydrology, and the availability of carbon and nutrients in headwater streams of the Arctic. While connections among permafrost landscapes, watershed hydrology, and biogeochemistry of headwater streams have been observed, there is little understanding of how permafrost characteristics influence fish in these ecosystems. We examined relationships among permafrost characteristics, the resulting changes in water temperature, discharge flashiness, and carbon and nutrients, with the abundance, biomass, and energy density of juvenile Dolly Varden (Salvelinus malma) and Arctic Grayling (Thymallus arcticus) across 11 headwater streams in northwestern Alaska. Streams spanned watersheds with varying extents of near-surface permafrost and contrasting soil texture of ice-poor bedrock versus ice-rich loess. Findings documented patterns between near-surface permafrost extent and fish responses with Dolly Varden abundance and biomass primarily related to water temperature, while Dolly Varden energy density decreased with flashiness of the headwater streams. In contrast, Arctic Grayling abundance and biomass was linked to bottom-up effects through the food web and energy density of Arctic Grayling was directly related to temperature differences. These relationships demonstrate the importance of near surface permafrost to fish and how impacts can differ between fish species. As permafrost thaw is one of the most dramatic changes occurring in the Arctic, increasing our understanding of what drivers are important, helps anticipate how changing permafrost states will alter fish populations.

Boats 'N Cohos: 2022 Alaska Freshwater Fish Inventory Surveys and Nominations to the Anadromous Waters Catalog

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Alaska state law mandates the Alaska Department of Fish & Game (ADF&G) to define waterbodies with anadromous fish habitat throughout the state. To be listed, habitats must have direct, unambiguous observations and documentation by a qualified observer. These habitats gain protections regulating land use policies such as those directing stream crossings requiring bridges to allow fish passage or the timing of construction to not coincide with sensitive spawning or juvenile rearing periods. To provide this knowledge of habitats, the ADF&G curates the "Catalog of Waters Important for the Spawning Rearing or Migration of Anadromous Fishes," known by its colloquial title as the Anadromous Waters Catalog, or AWC. To inform the AWC, ADF&G established the Alaska Freshwater Fish Inventory (AFFI) in 2002. The AFFI program represents the state's primary annual effort to revise the AWC. In 2022, the AFFI program surveyed Prince William Sound (PWS), the Tanana River, the upper Koyukuk and Kobuk rivers, the Fortymile River, and Bering Land Bridge National Preserve while assisting on minor projects in the Susitna River basin. Surveys contributed more than 80 nominations to the AWC totaling over 440 km of new habitat across >100 waterbodies. In 2023, AFFI will finish four projects and begin a few new efforts. First, a collaborative effort of AFFI staff with the ADF&G Subsistence Section will start to survey fishes of the Pastolik and Pastoliak rivers. Then, a landscape-level study of the Copper and Bering river basins begins as part of AWC fish surveys tied to glacial melt. Last, AFFI and University of Alaska Fairbanks researchers will launch efforts to better define anadromous lamprey habitat.

A look inside federal fisheries management in Alaska, exploring the diverse jobs within NOAA Sustainable Fisheries Division

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What does an in-season manager do? How can your statistical and analytical skills apply in the fisheries policy world? Can you work in policy if you didn't study it? What skill sets do you need to work in fisheries management? How much on the job training is there? This talk will highlight the diversity of projects and positions within NOAA Fisheries, Alaska Regional Office, Sustainable Fisheries Division.

Incorporating dynamic fleet structure in stock assessment models: Accounting for a rapidly developing pot fishery for Alaska sablefish (Anoplopoma fimbria)

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Stock assessment models, which form the scientific basis of fisheries management decision-making, strive for realistic parameterizations of biological and fishery processes. A common complication encountered when parametrizing stock assessment models is addressing time-

varying fishery dynamics, which can occur due to regulatory changes or shifts in harvester behaviors. Allowing for time-varying fishery selectivity is widely utilized to address potential changes in fishery dynamics, but may not be adequate when such changes substantially alter the fishery fleet structure. We explore the implications for stock assessment models of accounting for, or ignoring complex temporal changes in fleet structure dynamics, including associated interactions with fishery selectivity patterns, by exploring alternate parametrizations of the Alaska sablefish (Anoplopoma fimbria) stock assessment model. Over the last five years, the sablefish fishery has undergone a rapid transition from hook-and-line to pot gear (i.e., pot gear has almost completely replaced hook-and-line gear). To address these changing fishery dynamics, we adapted the current assessment model to incorporate the developing pot fishery, while exploring alternate parametrizations of pot gear selectivity. Our findings demonstrate that the treatment of fleet structure did not greatly influence model estimates, but fishery selectivity assumptions had substantial impacts on recommended harvest levels. Furthermore, selectivity estimates for the pot fleet were influenced by the limited time series of age and length compositions, likely resulting in unrealistic doming in age-based selectivity patterns. Thus, we recommend that fleet structure and selectivity be carefully explored in tandem when strong shifts in fleet structure are observed. Additionally, model parametrizations should incorporate a priori considerations regarding expert knowledge and the biological dynamics of the fishery, to ensure adequate management advice. Moreover, our results indicate that parsimonious parametrizations (i.e., simply implementing a time block in selectivity) may be sufficient to address changes in fishery dynamics, particularly when transitions among gears are rapid.

Aquatic Biomonitoring at Hard Rock Mine Projects in Alaska

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The ADF&G Habitat Section conducts aquatic biomonitoring at a numerous large hard rock mines and exploration projects throughout the state of Alaska, including Red Dog, Fort Knox, Greens Creek, and Kensington mines. A “good” biomonitoring program is one that is site specific, simple and cost effective, adaptive, long term, and has at least several years of pre-mining baseline data collection. Each program is adapted to the unique characteristics of each mine site, but generally we annually assess water chemistry, periphyton, aquatic invertebrates, and fish. The goal is to develop a comprehensive picture of the aquatic food web both upstream and downstream of the mine (or future development) and provide a basis for assessing anthropogenic and natural change over time.

Pacific Cod in Southeast Alaska: Challenges of Managing a Data Limited Fishery

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Pacific cod are a commercially valuable species in the Western Gulf of Alaska and the Bering Sea, though are not as widely fished in Southeast Alaska due to limited markets, smaller fish size, and susceptibility to parasites. Pacific cod caught in Southeast Alaska are commonly sold for bait use in more valuable fish and crab fisheries, though they remain an important fish for human consumption. The state-managed directed Pacific cod fishery takes place in inside waters of Southeast Alaska and is fished primarily using longline gear with effort ranging from a high of 179

permits in 1987 to a low of 6 permits in 2022. The Pacific cod guideline harvest range of 750,000–1,250,000 round pounds was established in 1994, though harvests have remained below that range. The fishery is managed seasonally from July 1–June 30 of the following year, as fishermen target spawning aggregations from October–April. In recent years, Pacific cod in the Gulf of Alaska have experienced a period of reduced biomass, resulting in fishermen, researchers, and managers questioning stock status and what factors may be affecting their populations. The lack of a fishery independent survey in inside waters and the decline in harvest and participation in the directed Pacific cod fishery have presented data limitation challenges for managers. Our current understanding of Pacific cod in inside waters is limited to commercial fishery logbook and fish ticket data, as well as biological samples for length, weight, sex, maturity, and otoliths for aging obtained from the directed fishery. Here, we discuss the challenges of managing a data limited fishery and how we use the information we have to manage the fishery. We also explore fishery harvest trends and biological characteristics using catch-per-unit-effort and biological data from Pacific cod captured in inside waters of Southeast Alaska between 2000-2023.

Genotyping at sea informs in-season fisheries management in real-time

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Bristol Bay sockeye salmon are one of America's most valuable natural resources and define the economy, ecology, and culture of the region. The record 79 million sockeye salmon that returned to Bristol Bay in 2022 were worth a record $351M to fishermen and billions to the economy after accounting for multiplier effects. The large and temporally compressed run is managed to meet Alaska Department of Fish and Game (ADF&G) escapement goals for the nine major drainages of the bay. Mixed stock analysis (MSA) using 24 SNP markers is used to inform in-season management. MSA is conducted on samples from a test fishery that captures fish about seven days before they arrive in fishing districts. Historically, samples taken for genetic analysis were shipped from Port Moller to Anchorage where genotyping was performed at the ADF&G Gene Conservation Laboratory (GCL). The time and effort sailing to port to transport samples takes time away from fishing and increases costs. Here we describe a novel approach of genotyping at sea to circumvent lost time, costs, and weather delay issues. In 2021, samples were processed at sea in tandem with samples at the GCL to validate the approach. A comparison of 38,255 genotypes showed a 98.51% concordance rate between the two labs. The at sea lab was fully implemented and improved upon in 2022. We discuss improvements to the timeline of results, how well at sea estimates predicted inshore run, and potential improvements and other applications for the at sea lab.

Fluvial export of nutrients and multiple forms of carbon from a temperate forested watershed in southeast Alaska

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The coastal watersheds of Southeast Alaska have diverse hydrologic regimes driven by differences in the contribution of glacial, snow, and rainwater inputs to streamflow. However, a dramatically changing climate is shifting the dominant source of streamflow towards rainfall rather than snowmelt and increasing the likelihood of extreme hydrologic events. These changes to watershed hydrology have the potential to impact the source, processing, and export of materials from watersheds to the nearshore marine ecosystem. However, the impact of hydrologic variability, such as droughts and floods, on material transport is poorly understood. Our study evaluates how the sequence, magnitude, and timing of stream flows impacts the magnitude and composition of nutrients, particulate organic matter, and organisms (aquatic and terrestrial macroinvertebrates) exported from a predominantly rain-fed watershed in Juneau, Alaska. We collected stream drift and water samples at least twice per week from late April through October 2021, capturing peaks and troughs in stream flow during the main runoff season. We found that dissolved organic carbon (DOC) was the main form of watershed carbon export, but alkalinity was the dominant form of lateral carbon export during extended dry periods. Although other forms of organic carbon, such as particulate and coarse organic carbon, and invertebrates, comprised a proportionally small amount of the total carbon exported from the study watershed, these forms of organic matter have low carbon to nitrogen ratios that could render them more bioavailable to stream communities when compared to DOC. Our findings demonstrate that the seasonal dynamics and interactive effects that differing forms of carbon may have on the land-to-ocean biogeochemical processes have the potential to impact nearshore productivity and add to our understanding of the complex role of fluvial carbon export in watershed carbon budgets.

Imprinting salmon to targeted locations using natural odor cues: a new imprinting paradigm for hatchery programs?

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The need to rear salmon at large centralized hatcheries and then release them offsite to supplement specific populations or fisheries is a practical reality of artificial production. However, this practice can dramatically increase stray rates. Homing is governed by the olfactory discrimination of natal water and exposure to the home stream during appropriate juvenile stages is critical for olfactory imprinting and successful completion of the adult homing migration. In particular, the parr-smolt transformation has been demonstrated as a critical period for olfactory imprinting and most hatchery programs use this as a guiding principle for designing release strategies that will return fish to targeted locations. Smolt acclimation and imprinting facilities, costing hundreds of millions of dollars, have been developed as part of most hatchery supplementation programs in the Pacific Northwest. Here, we explore methods for achieving successful imprinting and homing fidelity to target spawning locations without moving fish from their central rearing hatchery prior to release. This new imprinting paradigm is based on the observation that most salmon species imprint to their natal sites during early development and we hypothesize that hatchery-reared adult salmon will seek their earliest detectable olfactory imprint as the appropriate location to terminate their spawning migration. Under this scenario, natural waters would be collected from targeted spawning areas and transported to a central rearing hatchery where embryos would be initially incubated in target waters during critical periods for imprinting. We describe initial experiments demonstrating that salmon embryos can learn and discriminate the olfactory signatures of natural waters and that stream waters can be collected,

transported and stored without compromising their olfactory integrity. We believe that if successful, this approach could be used to facilitate re-establishment of sustainable natural populations of upper Columbia River salmon without the need for expensive and logistically challenging acclimation facilities.

Indoor cultivation protocols for the Rhodophytes, Devaleraea mollis and Palmaria hecatensis from Alaska

Dittrich, Muriel
Umanzor, Schery
Stekoll, Michael

With the mariculture industry expansion projected to exceed $100 million in revenue in the next decade, diversification is pivotal to increasing resiliency. Currently, no red seaweeds are commercially grown within the state, despite their high commercial value. Although wild harvest by Indigenous peoples has occurred from time immemorial. Our goal is to develop reliable cultivation methods to produce Palmaria hecatensis and Develeraea mollis in indoor systems, which would set path for cultivation at sea in Alaska. We are determining the most suitable combination of temperature, photoperiod, light intensity, and nutrient media to maximize growth at the lowest cost to achieve this goal. Preliminary results show that a 16L:8D photoperiod combined with 8 °C promotes growth for both species. Next and final steps include experiments to assess light intensity and media performance to finalize protocols.

Does Riparian Vegetation Buffer Aquatic Habitats from Direct Wildfire Impacts in Interior Alaska Boreal Stream Networks?

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Rupp, Scott
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Fire is the dominant ecological disturbance in boreal forests and a strong control on landscape characteristics that affect freshwater processes and aquatic habitats. Such disturbances contribute to the creation and maintenance of a mosaic of dynamic aquatic habitats that support resilient populations. However, fire characteristics are changing in this region as a result of climate and land use change. Here, we take a landscape perspective to explore interactions among wildfire severity, climate, vegetation, geomorphic conditions, and aquatic habitat suitability to investigate the ability of riparian forest and valley bottoms to buffer streams from fire. Our study area included four large stream networks within a 20,000 km2 region in interior Alaska that contain important habitats for Chinook Salmon; nearly one-quarter of the study area has burned since the early 1980s. We found that pre-fire vegetation composition differed between valley bottoms and hillslopes, the fire return interval in valley bottoms was twice that of hillslopes, and valleys were much less likely to experience high severity burns. To date, most stream reaches that contain high quality salmon spawning and rearing habitats are located outside burned areas; however, flammability is expected to increase 60% in the future and the overlap between critical habitats and fire may increase. Our current goal is to use output from a suite of integrated environmental models to identify climate, vegetation, and watershed drivers of fire in valley bottoms toward quantifying the resilience of aquatic species and habitats across this broad sub-Arctic ecosystem in a fiery future.

Drivers and diversity of Chinook salmon productivity in the Arctic-Yukon-Kuskokwim region

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Recent declines in the abundance of many Chinook salmon (Oncorhynchus tshawytscha) populations have caused severe hardship in the Arctic-Yukon-Kuskokwim region. Given the rapidly changing ecosystems in this region, it is important to understand how conditions in freshwater and marine environments impact Chinook salmon throughout their life cycle and ultimately influence the productivity of these highly-valued stocks. It is particularly important to determine whether populations are responding synchronously or asynchronously to conditions, and whether Chinook salmon across watersheds and river basins are affected by the same drivers. To address this problem, we quantified the effects of environmental and ecological drivers (both freshwater and marine) on the productivity of 26 Chinook salmon population units in the AYK using a hierarchical Bayesian Ricker model. The population units tested represented four population units from the Yukon River basin in Alaska, eight population units from the Yukon River basin in Canada, and fourteen population units from the Kuskokwim River basin. We tested regional scale drivers that have been associated with Chinook salmon abundance and productivity in previous studies, including body size, summer sea surface temperature, and others. In addition, we developed time series for precipitation and streamflow using downscaled climate models (DAYMET, GloFAS) for individual watersheds. Some drivers (i.e. maximum daily stream temperature during migration) were associated with the productivity of Yukon population units but not Kuskokwim population units. Other drivers, such as abundance of North Pacific chum (O. keta) and pink salmon (O. gorbuscha) and body size impacted the productivity of most population units similarly throughout the entire region. This work builds on previous research by offering a comprehensive analysis of environmental and ecological drivers across watersheds, spatial scales, and population units. Our results highlight the diversity in salmon-environment relationships across the AYK.

Stream hydrology and a salmon pulse subsidy shape juvenile salmonid foraging patterns in a southeast Alaska watershed

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Pulsed subsidy events create ephemeral fluxes of hyper-abundant resources that can shape annual patterns of consumption and growth for recipient consumers. However, environmental conditions strongly affect local resource availability for much of the year, and can heavily impact consumer foraging and growth patterns prior to pulsed subsidy events. Thus, a consumer's capacity to exploit pulse subsidy resources may be influenced by antecedent environmental conditions. We examined the importance of hydrologic variation and a salmon pulse subsidy on foraging patterns of two stream salmonids in a coastal southeast Alaska drainage. We then

explored effects of interannual hydrologic variation on Coho Salmon growth trajectories and sequential access to pulse subsidy resources (whether fish exceeded an egg consumption gape limit) in a bioenergetic simulation. Before salmon spawning began, Dolly Varden and Coho Salmon displayed distinct and significant non-linear flow-foraging relationships. In both species, consumption optima coincided with baseflow and the highest observed flow conditions, and consumption minima were seen at severe low-water and intermediate flow values. After salmon spawning began, consumption rates increased and were not significantly affected by flow in either species. Simulation results revealed that patterns of interannual hydrologic variation may shift Coho Salmon growth trajectories among years, potentially impacting access to pulse subsidies.

Assessing Spawning Behavior at the Northern Extreme of Pacific Halibut

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The Pacific halibut in the Northeastern Pacific is a well-studied fish with decades of historical data. As such, many aspects of its biology have previously been assessed, including reproductive behavior. Current knowledge suggests that individuals spawn annually as far north as Pribilof Canyon from December to March, during which the directed commercial fishing season is largely closed. However, as conditions in the Bering Sea continue to warm, the latitudinal extent of the species appears to be shifting northward, with Pacific halibut now extending into the Bering Strait region. Pacific halibut at this northern extreme are understudied, with their spawning locations and timing unknown. To assess this, pop-up satellite telemetry tags were deployed at two Northern Bering Sea tagging locations (NBS) on Pacific halibut that had a high probability of being mature females. Recorded depth data and transmitted pop-off locations were used to assess spawning timing and location, respectively. Preliminary results indicate that NBS Pacific halibut spawn later than their southern counterparts: from January to May rather than December to March. Spawning also appears to occur farther north than previously documented, reaching as far north as the Russian shelf edge. Additionally, a large proportion of individuals never occupied spawning habitat, suggesting the presence of skipped spawning that violates the current assumption of annual spawning frequency. These findings indicate the presence of additional spawning habitat and behavior that is not accounted for in current stock assessment practice, and the potential for commercial exploitation during spawning. As such, these results will aid in estimating annual spawning stock biomass in the NBS and in considering adaptations to current management practices, such as shifting the winter fishery closure in the NBS to better represent the spawning season.

Using quantitative PCR to estimate Chum Salmon (Oncorhynchus keta) abundance with environmental DNA on the Chena River

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The Chena River historically supported one of the largest Chum Salmon (Oncorhynchus keta) runs in the Yukon River Basin. Since 1986, the Alaska Department of Fish and Game (ADFG) has estimated run timing and abundance to guide in-season fishing regulation modifications, update spawner-recruit relationships, and inform biological escapement goals for this species. However, in recent years an increase in the frequency of high streamflow events has resulted in periodic gaps in salmon escapement estimates when increased water levels limit the ability to conduct visual counts and use sonar technology. Simultaneously, severe declines in Chum Salmon abundance have led to subsistence fishing closures, further highlighting the importance of continuous salmon count datasets to estimate annual escapement. In response, we are testing a complementary method to assess adult salmon abundance measuring the concentration of DNA shed by salmon into the environment. During the summer of 2021, ADFG personnel collected daily temperature and flow measurements as well as 202 filtered eDNA samples over 45 days. Using validated species-specific quantitative PCR assays, we are quantifying Chum Salmon DNA from filtrates of river water. While other studies in Alaska have demonstrated the ability to implement similar methodology, this study is the first to assess the feasibility of such efforts at counting tower and sonar sites in systems with relatively low salmon densities. This project is part of a larger initiative to analyze Chinook (O. keta) and Chum Salmon DNA in the East Fork Andreafsky River, Gisasa River, Henshaw Creek, and Salcha River whose salmon runs contribute significantly to Yukon River Basin salmon populations. Our long-term vision is to build capacity to support cost-effective monitoring of fish populations and enhance climate change resilience in salmon assessment and fisheries throughout Alaska.

Species distribution models estimate juvenile salmon habitat and time-varying distributions in the northern and southeastern Bering Sea

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Wild Pacific salmon (Oncorhynchus spp.) fisheries are integral to Alaska and Alaskans for economic opportunity, food, and sustaining traditional cultures. Alaska's fisheries management organizations invest significant time and effort towards maintaining sustainable and productive wild fisheries. However, the majority of past research effort has focused on adult life stages, and there remains a paucity of knowledge about juvenile salmon ecology during their first months after ocean entry. Information gathered in marine ecosystem surveys conducted by the NOAA Alaska Fisheries Science Center and Alaska Department of Fish and Game provide an opportunity to expand our understanding of juvenile salmon distribution and habitat during this important life history stage, and an opportunity to define Essential Fish Habitat for the early marine life stage of Alaskan salmon. The purpose of this study was to describe the distribution and relative abundance of juvenile Pacific salmon species in the Bering Sea. Our first objective was to quantify the temporal variation in core habitat areas occupied by juvenile salmon in the Bering Sea; specifically, whether core habitat areas persist or shift across time. Our second objective was to compare the performance of species distribution model (SDM) frameworks: generalized additive models (GAMs) and Vector Autoregressive Spatiotemporal (VAST) models. Maps of predicted juvenile salmon distributions showed the greatest densities in habitats between the 50-100m isobaths of the continental shelf. Predicted distributions differed among species independent of

the SDM used. The GAM and VAST models that estimated time-varying spatial distributions performed better than alternative models in terms of information theoretic metrics and percent deviance explained, suggesting that there is evidence for shifting species distributions through time. The predictions generated by the two model frameworks were generally in agreement with each other. VAST predictions identified finer-scale spatial variability but performed worse in terms of percent deviance explained.

Arctic Grayling (Thymallus arcticus) physiology and movement behavior across a fire-impacted boreal riverscape

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Wildfire is the most prominent natural disturbance in the interior Alaska boreal ecosystem. High severity fires can have strong impacts on aquatic ecosystems via altered water chemistry and temperature, nutrient availability, removal of riparian vegetation, and reorganization of stream channels. Such impacts may affect energy acquisition of stream fishes, particularly salmonids, through altered resource availability and shifts in fitness and maturity. In turn, fire effects may drive fish dispersal and promote colonization of newly suitable patches. Our overall goal was to track the movement patterns of Arctic Grayling, a ubiquitous potamodromous sub-Arctic salmonid that exhibit high lifelong site fidelity to rearing tributary habitats, across the Chena River basin, a riverscape affected by wildfire in interior Alaska. We created a strontium isoscape using spatial stream network models based on strontium isotope ratios (87Sr/86Sr) derived from Slimy Sculpin (Cottus cognatus) otoliths from 65 locations in 2020 and 2021. Over the same period, we collected biological and physiological metrics (lipid concentrations, size-at-age, and size-at-maturity) and fin-rays from 192 adult and juvenile Arctic Grayling in seven tributary streams with a range of fire histories (3 recently burned; 4 unburned). By matching patterns in 87Sr/86Sr concentrations from Arctic Grayling fin-ray transects mapped using laser ablation to the Sr isoscape, we recreated movement histories for individual fish and identified areas from which fish became extirpated or utilized as refugia during fire events. By comparing movement as a function of physiology, we can better characterize the impact of large-scale disturbance on stream communities. Knowledge of the behavioral and physiological responses of Arctic Grayling to wildfire is important information toward a better understanding of the resilience of freshwater fish to disturbances, especially in light of a potentially fiery future in Alaska boreal aquatic ecosystems.

Genomic evidence for hatchery-induced domestication selection in Chinook salmon, Oncorhynchus tshawytscha

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Salmon hatcheries are widely used across the Pacific Northwest to enhance fisheries and supplement declining wild populations. However, substantial evidence suggests that hatchery fish have reduced fitness compared to their wild counterparts. Domestication selection, or adaptation

to the hatchery environment, poses a potential risk to wild populations if introgression between hatchery and wild fish occurs. While few studies have investigated domestication selection on a genomic level, none have done so in parallel across multiple hatchery-wild population pairs. In this study, we examined three separate hatchery populations of Chinook salmon, Oncorhynchus tshawytscha, and their corresponding wild progenitor populations using low-coverage whole genome sequencing. We sequenced 192 individuals from populations across Southeast Alaska and estimated genotype likelihoods at over six million loci. Each hatchery population, which was reared in a hatchery for approximately seven generations, was then compared to its wild progenitor population using multiple metrics of genomic divergence. While evaluating population-level genomic differentiation (FST), we discovered numerous outlier peaks in each hatchery-wild pair, although no outliers were shared across the three comparisons. Further analyses indicated that these relatively small (5 – 10 kilobase) peaks are likely due to genetic hitchhiking on hatchery-selected alleles, though the effects of these peaks on fitness are unknown. Overall, our genome-wide analyses demonstrate that domestication selection is prevalent in all hatchery facilities, but the genetic pathways differ across populations, possibly due to a polygenic basis of fitness related traits. These results provide fine-scale genetic evidence for domestication and highlight the need to assess if certain management practices, such as integration of wild broodstock, can universally mitigate genetic risks despite multiple pathways of domestication.

Developmental toxicity of microbial phenanthrene-biodegradation metabolites to larval threespine stickleback

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Biodegradation is one of the main mechanisms for removal of spilled petroleum from the marine environment. While biodegradation of polycyclic aromatic hydrocarbons (PAHs), a main constituent of crude oil, can reduce toxicity to fish, it also has the potential to produce toxic intermediates. Studies on the toxicity of PAH breakdown products to fish have been mainly limited to zebrafish, which are inbred, tropical freshwater model fish. We explored the developmental toxicity of phenanthrene biodegradation products using threespine stickleback (Gasterosteus aculeatus) which are a ubiquitous freshwater, anadromous, and marine fish in the northern hemisphere. We first subjected phenanthrene to biodegradation for 0-, 3-, and 7-days using microbes capable of phenanthrene degradation that were previously isolated from stickleback guts. Then, we exposed fish either to the parent (non-degraded – 0, 3, or 7 days), degraded (0, 3, or 7 days), or no phenanthrene at 7 days post fertilization (dpf). At 14 dpf, we measured snout-vent length, eye diameter, swim bladder length and area and assessed craniofacial and spinal defects in the fish. None of the parameters measured, except for eye diameter, were significantly impacted by phenanthrene exposure, microbial biodegradation, or the amount of time of biodegradation prior to fish exposure. Eye diameter was significantly reduced in fish exposed to solutions (with or without phenanthrene) cultured with biodegrading microbes then centrifuged to remove cells ($p=0.0223$) suggesting that these microbial products have a negative effect on eye growth. However, there was a positive interaction effect of phenanthrene exposure and microbial biodegradation ($p=0.0439$) reversing the negative effect of microbial products alone on eye development. Phenanthrene or its degradation products likely interacted with the microbes or microbial products as phenanthrene alone had a nonsignificant negative effect on eye development. These results suggest that threespine stickleback are quite tolerant to phenanthrene exposure and to biodegradation intermediates of phenanthrene.

Kahtnu Fisheries: A Focus for Dena'ina Representation

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Kahtnuht'ana Dena'ina, are the Indigenous stewards to the land surrounding Kahtnu (Kenai River), where the salmon and people have been tied through a relationship essential to the cultural, spiritual, and physical well-being of Dena'ina identity. This relationship has assured the survival of fish and people for thousands of years and continues to the present day. In the span of one lifetime, this relationship has taken a new form amidst the presence of state and federal fisheries management, as well as the introduction of commercial, sport, and dipnet fisheries in the area. This research thesis draws on a mixed methods approach to address the historical and present dispossession of Dena'ina representation in Kahtnu fisheries management and access. This mixed methods approach will be broken into two specific methods through (1) circle discussions with Kahtnuht'ana Dena'ina elders and leaders, and (2) secondary source analysis of public forums and legal documents. The theoretical foundation of this project will utilize the framework of cultural hegemony to identify and acknowledge unequal power structures, and their consequences to Dena'ina well-being; secondly, this work will equip the framework of capabilities justice in the context of Indigenous mobilization, which advocates for Tribal sovereignty and Indigenous self-governance of resources. The goals of this research are not to perpetuate a damage-centered narrative, but to contribute to a growing area of research that identifies inequities experienced in Alaska Native communities in fisheries management and to promote Indigenous representation for the future.

Paralytic Shellfish Poisoning (PSP) in Alaska: Past Studies and Ways Forward

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In Alaska, paralytic shellfish poisoning (PSP) is caused by toxins (PSTs) produced by the dinoflagellate Alexandrium catenella. PSP is usually associated with consumption of toxin-containing bivalves, but PSTs can also be present in other biota during Alexandrium blooms, including species that do not feed on shellfish. Human consumption of foods containing these toxins can produce serious and life-threatening symptoms. The Knik Tribe has been studying PSP since 2006, beginning with sampling all along coastal Alaska, from Ketchikan to the end of the Aleutian Islands, and in the Bering Sea north to Norton Sound, using local samplers in an extensive community-based monitoring program. Here, we will review some of our most recent study findings and share the challenges and successes of using local technicians to collect, prepare and ship samples and to provide outreach and expertise in the community on the risks from PSP. Some of the more surprising results of past studies have prompted Knik Tribe to continue researching PSP with a broader focus on collecting, not just those species that directly feed on Alexandrium or shellfish, but also the organs of predatory fishes to investigate how toxins are stored in these fishes and to better understand how toxins flow through the food web. We will also share these latest efforts by Knik Tribe to sample and quantify PSP findings in different species throughout Southern Alaska.

Assessing the effects of sea otters on depth distributions of Dungeness crab in Southeast Alaska

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Sea otters (Enhydra lutris) consume large quantities of macroinvertebrate prey and have a well-documented history of disrupting fisheries throughout the North Pacific. The expansion of the sea otter population in Southeast Alaska from ~400 translocated individuals in the 1960s to over 25,000 individuals resulted in reductions to invertebrate fishery species, including sea cucumbers and sea urchins. However, the region continues to support a highly productive Dungeness crab (Metacarcinus magister) fishery, and it is unclear how this is possible. We are investigating the ecological conditions in Southeast Alaska that may allow commercial Dungeness crab catch to persist in proximity to sea otters. Here we test one hypothesis that Dungeness crab may utilize a depth refuge beyond the diving limits of sea otters to avoid predation. We set 130 crab pots at depths within and below the regular diving limits of sea otters in four bays in Southeast Alaska; two bays that were newly colonized by sea otters and two bays without sea otters. The depth distribution of Dungeness crab was similar among bays with and without sea otters, suggesting crabs are not shifting to deeper habitat. The presence of sea otters, however, was associated with a reduction in size of male Dungeness crab. Future studies could examine if crab seek a depth refuge in areas with long established sea otter populations. We plan to further investigate the spatial and temporal overlap of Dungeness crab and sea otters to better understand interactions between these two species.

The social-ecological system of the Kenai River Fishery (Alaska, USA)

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Fisheries are complex and dynamic systems comprised of both social and ecological components. Social-ecological systems frameworks can facilitate a holistic exploration of complex dynamics that play out within and across the social and ecological components of fisheries. However, these general frameworks lack the specificity to be applicable to specific social-ecological systems such as individual fisheries. In this research, we provide a method for developing inductively generated social-ecological models of individual fisheries, and present a collaboratively developed social-ecological model of the Kenai River Fishery. We developed the model through iterative interviews with stakeholders throughout the Kenai Peninsula using a novel participatory Fuzzy Cognitive Mapping process grounded in Ostrom's social-ecological systems framework. Individual social-ecological models, developed one-on-one with key stakeholders, were combined into a single aggregated model representing the Kenai Fishery's structure and function. We validated this aggregated model through subsequent interviews with stakeholders and focused literature reviews. The result is a model that can: 1) illustrate the breadth and interconnectedness of the Kenai River Fishery's social-ecological system; 2) be used to facilitate discussions around management of the fishery; and 3) be used to explore the components and

interactions that move the system toward or away from sustainability. Using the model, we identify how the nature of salmon (migratory) and their habitat (large and unpredictable) leads to uncertainty about effective management strategies. This uncertainty, in addition to a large and diverse set of resource users, creates conflicting management goals that ultimately limit the governance system in making decisions that might increase the sustainability of the fishery.

Using "Big Data" and Ecological Stoichiometry to Inform Fisheries Research

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Ecological stoichiometry is a theoretical framework that has applications for fisheries ecology and management. For example, the relative availability of different elements can influence food web structure and affect the production of important species, like salmon. Compiling ecological stoichiometry data into a centralized database allows both theoretical and applied questions to be answered about how the relative availability of different elements might affect fish ecology. The Ecological Stoichiometry Cooperative (ESC) aims to fill some of these gaps in organismal aquatic stoichiometry data with the creation of a novel database, Stoichiometric Traits of Organisms In Their Chemical Habitats (STOICH). The STOICH project has created an open source database of new and existing data from sources such as NEON, USGS, an expansive literature survey, and author contributions. This database will allow users to test broader predictions about the role of ecological stoichiometry across landscapes to better predict changes to freshwater habitats. Specific research aims utilizing the data from STOICH include exploring structure and function of aquatic food webs and illuminating macrosystem patterns in biogeochemistry. We will present the database structure, decision-making and creation process, research aims, and current progress of the STOICH project. The fisheries community is invited both to contribute data and to use the database for their own purposes.

Improving genetic tools for research and management of western Alaska salmon

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Dann, Tyler
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Pacific salmon (Oncorhynchus spp.) returns have decreased in many western Alaska rivers within the last decade, creating economic, food security, and cultural preservation issues for fishing communities throughout the region. In addition to the societal challenges this poses to western Alaska communities, these declines present challenges to fishery managers, biologists, and other stakeholders. With low returns, it is important to minimize uncertainties around estimates of stock-specific harvest, escapement, run reconstruction, and forecasts of future returns used in management decisions. Genetic stock identification is an effective method for identifying stock of origin among mixed-stock salmon catches, including marine-stage salmon maturing in the Bering

Sea and adult salmon returning to western Alaska rivers. However, the accuracy and precision of genetic stock composition estimates depend on the quality and resolution of the underlying genetic baseline used for analysis. Here, we present improved genetic baselines for western Alaska Chinook and coho salmon that can be used for fisheries management and research projects requiring reliable genetic stock estimates. New genotyping by sequencing methods and bioinformatic pipelines were used to efficiently genotype western Alaska populations with hundreds of genetic markers, which improved the characterization of underlying population structure for more accurate and precise genetic stock estimates. These genetic baselines will be important tools for salmon management and research priorities within western Alaska and the Bering Sea.

Pink Salmon in the North American Arctic: Natural expansions from the Pacific or invasions from the Atlantic?

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Climate and human induced shifts in Pink Salmon distribution have been documented across the Northern Hemisphere, including expansion into Arctic regions. An improved understanding of the origin of invading salmon populations will benefit research and management of the species. We present genetic observations of Pink Salmon (Oncorhynchus gorbuscha) expansions into the Alaskan and Canadian Arctic to shed light on the relative roles of climate and human influences on the distribution and establishment of these invading salmon. To do this, we genotyped baseline Pink Salmon collections from the natural range across the Pacific Rim, from Norwegian rivers that represent secondary colonizations from stocking operations in the White Sea, and from the Great Lakes that represent secondary colonizations from an accidental release. We then genotyped samples of invading Arctic Pink Salmon for evidence of: origin, deviation from the strict 2-year life history found in their natal range (but not in some introduced areas), and self-sustaining populations. For origin, we test the hypothesis that North American Arctic individuals originate from natural colonization from the Pacific Ocean, from the Russian stocking in the White Sea (1956-1979; 1985-1999) of Magadan region stocks, or from the Canadian accidental release into the Great Lakes (1955) of a British Columbia stock. We screened 298 amplicons in a genotyping-in-thousands by sequencing panel, to examine conformance to Hardy-Weinberg Equilibrium expectations, heterozygosity, and genetic relationships to baseline populations.

Investigating factors associated with heat stress responses of two adjacent populations of subarctic Chinook salmon in Alaska: the role

of site-specific temperature, body size, and hatchery vs. wild origins on HSP70 expression

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Temperatures are rapidly increasing in Alaska, making heat stress research a priority information need for culturally and economically vital Pacific salmon (genus Oncorhynchus). Heat shock protein 70 (HSP70) is a tool for research and monitoring of heat stress, but open questions remain about HSP70 expression in relationship to factors beyond water temperature. Here, we examined HSP70 expression from non-lethal muscle biopsies to describe and quantify the thermal stress response in two neighboring Chinook salmon (Oncorhynchus tshawytscha) populations and individuals that differed in recent water temperature experiences, rearing (wild or hatchery), and holding for broodstock. Water temperature experiences did exceed the 18°C threshold established by the U.S. Environmental Protection Agency for stress in migrating Pacific salmon. Our results confirmed that as river temperatures increased, so did HSP70 expression, having the strongest association with the maximum temperature over the two days prior to sampling. In addition, HSP70 expression was related to population, rearing (wild vs. hatchery), and holding associated with hatchery egg take protocols when controlled for recent water temperature. HSP70 expression was higher for Chinook salmon sampled in Crooked Creek compared to Ninilchik River, wild-reared compared to hatchery-reared, and those held for broodstock gamete collections compared to those sampled en route without holding. We detected no evidence that body size, day of year, or year affected HSP70. Results suggest hatchery egg take protocols can increase physiological stress.

Detecting Longfin Smelt with eDNA in Bellingham Bay, WA.

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Longfin Smelt (Spirinchus thaleichthys) is an anadromous forage fish that is sporadically distributed from San Francisco Bay, California, USA to Prince William Sound, Alaska. The Lummi People—who value this fish for subsistence and to maintain cultural practices—describe a decline of the Longfin Smelt spawning run in the Nooksack River near Bellingham, WA. This study uses a novel high-sensitivity species-specific TaqMan quantitative PCR (qPCR) assay to detect environmental DNA (eDNA) of Longfin Smelt in marine and freshwater. eDNA can be collected

by water filtering, providing a non-invasive technique to detect the species. We have used this assay to investigate the habitat use and spatiotemporal distribution of Longfin Smelt in Bellingham Bay, WA. Based on our results, we hypothesize that: 1) the species is present within Bellingham Bay throughout the year, with higher concentrations being found near the mouth of the river during spawning season, 2) the nearshore environments of Bellingham Bay are important for juvenile rearing, and 3) the lower reaches of the Nooksack River Delta could be important Longfin Smelt spawning habitat. This fishery is co-managed by tribal (Lummi Natural Resources) and State (Washington Department of Fish and Wildlife) entities. Information regarding Longfin Smelt spawning, rearing, and migration dynamics will help to inform management practices of this culturally important population.

Quantifying impacts of hatchery-origin salmon strays to wild population recruitment and resilience using quantitative genetic models

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It is increasingly evident that high-quality protein produced through aquaculture is an integral component of food security for the nearly 8 billion people on Earth. Given the need to maximize food production, aquaculture operations must not diminish the productivity of currently sustainable and well-managed wild capture fisheries, or the resilience of these wild populations to impending changes. However, empirical evidence from multiple species suggests that captive-bred salmon have a reduced reproductive performance when they stray into wild habitats, compared to natural-origin individuals. Yet, the biological mechanisms producing these reproductive differences remain unclear. Furthermore, empirical studies have also shown how fitness-linked traits such as return timing of hatchery-strays can differ from wild populations, with unknown effects on the evolution of phenological traits in the wild. The present study used a recently published quantitative genetic, individual-based model to examine first, possible mechanisms that could be driving differences in reproductive success between hatchery- and natural-origin fish; second, the effect of reduced reproductive success of hatchery fish on wild population recruitment; and third, the effect of phenotypic differences between hatchery- and natural-origin fish on portfolio effects and resilience on the metapopulation scale. We found that differences in reproductive timing between hatchery and natural-origin fish may play a significant role in driving differences in reproductive success. Despite these reproductive differences, more hatchery strays resulted in greater recruitment in wild populations but also decreased portfolio effects of wild metapopulations. We parameterize our models and discuss our findings in the context of well-studied empirical populations of pink salmon in Prince William Sound, Alaska, but recognize the broad implications of these results to many supportive breeding programs globally.

Overview of Alaska's mining past, present and future; implications for fisheries and watersheds; and ways for the Alaska Chapter AFS to engage

Mauger, Sue, Cook Inletkeeper

TBA

Heritability of length and age at maturity in a captive population of Chinook salmon

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Age and size declines in Chinook salmon across Alaska have stimulated research into the many possible reasons why Chinook salmon are tending to return smaller and younger than they have in earlier times. Hypotheses include size-selective fisheries, competition with hatchery salmon, rising temperatures in the North Pacific, and changes in late-stage marine mortality. Regardless of the cause, the ability of Chinook salmon to respond evolutionarily to changing selection regimes depends on the amount of additive genetic variation for age and size at maturity. In the mid-1980s NOAA researchers conducted a controlled mating experiment designed to estimate heritability of age and size at maturity in the hatchery population of Chinook salmon at the Little Port Walter research station in Southeast Alaska. Since the study was conducted, advances in generalized linear mixed models have allowed us to revisit these data in a more robust analytical framework. We used “animal models” to estimate additive genetic variance and narrow-sense heritability of age at maturity (conditioned on sex) and age-adjusted length at maturity. For narrow-sense heritability estimates, the 95% highest posterior density intervals were ~0.1-0.5 for age at maturity and ~0.03-0.2 for length. These values are within the range reported for other Chinook salmon populations and indicate considerable potential for these traits to evolve in response to natural and anthropogenic forcings. Given that selection reduces additive genetic variation, care should be taken to minimize anthropogenic loss of genetic diversity for important life history traits in Pacific salmon populations.

Testing the Efficacy of Mark Report Satellite Tags (mrPAT) to Examine Movements of Large Male Snow Crab (Chionoecetes opilio) in the Eastern Bering Sea

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Understanding movements of high-latitude marine species can help refine management strategies, especially in a changing climate. In 2021 and 2022, the National Marine Fisheries Service (NMFS) eastern Bering Sea (EBS) summer bottom trawl survey showed an alarming decline in the snow crab population, and researchers indicate it was likely a mass mortality event where immature snow crab failed to recruit to maturity. Further complicating matters, snow crab distributions have shifted northward in the EBS over the last several decades, and their movements may also be occurring in areas that are unsurveyed down the continental slope or out of the U.S. Exclusive Economic Zone. Currently, limited tagging research has been used to understand snow crab movements and distributions. This pilot study examines the efficacy of using mark report pop-up satellite tags for understanding the movements of mature male snow crab in the EBS. In 2022 we tagged 48 snow crab; 30 during the commercial fishery in April/May, and 18 during the NMFS survey in July. Of the 48 tags deployed, 37 tags (77%) popped up on or shortly after their scheduled pop-up date, and 40 tags (83%) provided location data. The 48 tags were at liberty for a minimum and maximum of 21 and 145 days, respectively. Tagged snow crab moved an average distance of 55.4 km (mean rate of 0.55 km/day) from their tag deployment location. These preliminary results indicate that these tags can be a promising method for examining movements of mature male snow crab, especially to address transboundary

management concerns. Further analyses of the tag data will help elucidate if crab sampled during the summer survey represent those in winter fisheries, if crab caught in the commercial harvest are represented in the summer survey, and if movement patterns are related to fluctuations in the Bering Sea thermal regime.

Comparison of eDNA primers for aquatic invertebrate diversity in Interior Alaska streams

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The advent of environmental DNA (eDNA) metabarcoding using next-generation sequencing methods holds exciting potential for broad-scale assessments of freshwater biodiversity. In this study, we use eDNA metabarcoding samples to assess wildfire influence on freshwater biodiversity at a regional scale within Interior Alaska. Study plans initially called for a freshwater invertebrate-specific set of DNA primers. Due to an unexpected mix-up, however, we also obtained result using a generic invertebrate primer set. This gave us two unique eDNA datasets, based on different primers, for comparison. In this presentation, we will compare and contrast the "species" (actually operational taxonomic unit, or OTU) richness and OTU-specific diversity found using each primer set. We will explore the extent to which a freshwater-specific invertebrate primer set amplifies DNA from more aquatic organisms relative to a generic primer, and potentially reduces the chance of non-detection. We will also compare taxonomic bias across primers in terms of the OTUs they return. Finally, we will discuss spatial patterns in OTU richness throughout the sampled streams in Interior Alaska, and comment on the viability of eDNA samples for species biodiversity assessment in this region.

Life in the fast lane: squid fishery species in Southeast Alaska

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Globally, cephalopods are estimated to have a biomass that is equal to that of all fish species combined (Clarke 1987). Squid are supported to have expanded as some fish competitors and predators have declined in abundance from the oceans (Caddy and Rodhouse 1998). Regionally, despite their recognized importance in nearshore food webs, marine ecosystem dynamics, and fisheries, inshore squid in Alaska remain understudied. To contribute toward filling this knowledge gap, we present recent findings on two squid fishery species in Southeast Alaska, the medium-sized gonatid squid, Berryteuthis magister and the small-sized loliginid squid, Doryteuthis opalescens. We found evidence that both B. magister and D. opalescens have plastic life cycles and growth patterns. However, since they occupy different ecological niches, they impact nearshore systems in unique ways. B. magister may use its plasticity to allow them to have episodic periods where its population size can be large when predators are lacking. D. opalescens may use its plasticity to inhabit neritic Alaskan waters as ocean warming increases into their optimal temperature window. These regional findings are supported to also occur with other species across the global scale. Almost every life stage for squid studied to date support their high phenotypic plasticity. Over the next 100 years, D. opalescens will experience ~100 generations and B. magister ~50 generations compared to long-lived fish species that will

experience only a few. All available evidence supports that these squid are on the fast track towards adapting to the changing climate conditions in Southeast Alaska. Examining these two species provides a holistic approach towards how inshore squid species may be increasing their impacts onto nearshore food webs, ecosystems, and fisheries in Alaska.

Local views of competition and integration between commercial fishing, subsistence, and tourism livelihoods in Southeast Alaska

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Rapid environmental change and the exponential growth of tourism have led to increased community instability in Southeast Alaskan coastal communities which have historically relied on their traditional fishing livelihoods. Livelihood sustainability in the region increasingly depends on how tourism can be integrated into commercial fishing and subsistence economies, consequently influencing community-level decision-making on how tourism can become a viable economic driver while retaining the cherished community identity and authenticity surrounding traditional fishing livelihoods. This presentation reports on the preliminary results of eight months of ethnographic data collection from May 2022 to January 2023 in three communities in Southeast Alaska that experience qualitatively different scales of cruise tourism development using the recently introduced theoretical lens of livelihood sovereignty. Livelihood sovereignty is defined as the enhanced levels of local resident control and influence over management institutions and decision-making regarding the persistence of valued traditional practices, how new production opportunities are integrated into local socio-economic systems, and how local community wellbeing is perpetuated over time. This research emphasizes decolonial methodologies by prioritizing community engagement through developing community advisory boards in each study site and using ethnographic methods to understand local residents' views of conflict and harmony between economic sectors. A particular stress is placed on how cruise tourism facilitates the growth of fishing tourism, access to and control of local fishing resources, the cultural acceptance of who gets to extract fish, and regulations at the intersection of commercial and fishing tourism. This presentation will benefit those interested in understanding processes of how tourism is integrated, or lack of, into existing fishing economies, their distinct impacts on a community's willingness to accept other forms of tourism, and institutional decision-making.

Mapping marine invasive species in Alaska to raise awareness in the mariculture industry

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Mariculture operations are a potential route for the spread of marine invasive species in Alaska. Aquatic farmers can unknowingly transport invasives on mariculture gear, in ballast water, on floating platforms, and on crops (e.g., oyster spat). Invasive species can disrupt native species populations and fisheries by altering habitat and food resources in the marine ecosystem, and can negatively impact the success of mariculture operations. The mariculture industry in Alaska is expanding rapidly, and without increased awareness among farmers, the distribution of invasive species could expand with it. This project seeks to raise awareness of invasive species among aquatic farmers through the addition of an invasive species layer to the Alaska Ocean Observing System (AOOS) Mariculture Map. The Mariculture Map is an online tool that helps prospective aquatic farmers plan and permit mariculture operations by providing map layers that shed light on various siting considerations. As a mariculture student at UAS Sitka, I discovered that there was

no invasive species information on the AOOS Mariculture Map. To address this information gap, I built an annotated distribution map in ArcGIS showing the locations of known marine invasive species populations in Alaska, including invasive tunicates and green crabs. The map layer itself is simple and user-friendly, while also connecting users to external sources with more detailed information about specific invasive species infestations in Alaskan waters. I am currently working with the data management team at AOOS to upload the map layer to the Mariculture Map platform, and it will be updated annually to maintain its usefulness. Once uploaded, the invasive species map layer will act as an educational tool for mariculture courses and a mechanism to raise awareness among aquatic farmers in Alaska.

Declines in body size of Bristol Bay sockeye salmon associated with increased competition in the ocean

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Declining body sizes have been documented for several species of Pacific salmon; however, whether size declines are caused mainly by ocean warming or other ecological factors, and whether they result primarily from trends in age at maturation or changing growth rates remain poorly understood. We quantified changes in mean body size and contributions from shifting size-at-age and age structure of mature sockeye salmon returning to Bristol Bay, Alaska, over the past 60 years. Mean length declined by 3%, corresponding to a 10% decline in mean body mass, since the early 1960s, though much of this decline occurred since the early 2000s. Changes in size-at-age were the dominant cause of body size declines and were more consistent than trends in age structure among the major rivers that flow into Bristol Bay. Annual variation in size-at-age was largely explained by competition among Bristol Bay sockeye salmon and interspecific competition with other salmon in the North Pacific Ocean. Warm winters were associated with better growth of sockeye salmon, whereas warm summers were associated with reduced growth. Our findings thus point to competition at sea as the main driver of sockeye salmon size declines, and emphasize the trade-off between fish abundance and body size.

Patterns in predation: understanding climate mediated predation impacts of a novel subarctic predator

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Schoen, Erik, UAF

Global climate change is impacting subarctic streams by altering temperature and flow regimes, affecting phenology of native fishes, and possibly their interactions with invasive predators. Climate mediated changes in temperature and flow regimes has the potential to alter predator prey interactions and increase the impact of introduced predators. We examined diet patterns of an introduced predator, Northern Pike (Esox lucius), in their introduced range in Alaska's Deshka River across 11 years. We used generalized linear models and generalized linear mixed models to understand factors effecting probability of Northern Pike predation on native fishes across

years. We found that individual Northern Pike consumption of juvenile Chinook Salmon and total Oncorhynchus species decreased across years, while consumption of juvenile Coho Salmon increased, and the number of total fish consumed remained constant. These finding suggest that Northern Pike may be switching to alternative fish prey as salmon become less available. Across models we found strong positive effects between increasing water level (stage) and the number of juvenile Chinook salmon and total Oncorhynchus in diets. We also found that smaller Northern Pike consumed more juvenile salmon then larger conspecifics. These findings suggest that in this system the impacts of Northern Pike on salmon have changed over time in response to climate and other factors. They also suggest more broadly that changing stream flow and temperature regimes will have very real implications for predation rates and impacts of Northern Pike and other introduced predators like them in the subarctic.

Angler's perceptions, experiences, and attitudes towards fisheries management in three NC lakes

Robinson, Kerrick
Loftis, Scott
Besler, Doug
Ruhlman, Carrie
Watkins, Cristina

Walleye populations in western North Carolina reservoirs have been negatively impacted by the introduction of invasive species such as River Herring and Spotted Bass. To offset this decline, the North Carolina Wildlife Resources Commission was considering a number of management actions, including regulation change or modifications to the stocking program. To evaluate which management action(s) would be the preferred by anglers, we developed a survey to assess their perceptions of these options. The questionnaire was open for four weeks, and 627 anglers who fished the three western North Carolina lakes responded. Anglers at all three lakes were very experienced, as the majority reported fishing these areas for over 20 years. The most popular target species for all three lakes were Smallmouth Bass, Largemouth Bass, and Spotted Bass, and anglers were at least moderately satisfied with fishing in those lakes. When presented with a hypothetical stocking scenario to make selections based on a number of tradeoffs, anglers across all three lakes chose to stock Smallmouth Bass, Brown Trout and Walleye. Anglers at two of the three lakes chose to stock a higher tonnage of Smallmouth Bass than Brown Trout or Walleye. However, Walleye anglers chose to stock more Walleye than the other anglers. Anglers in all three lakes were supportive and found reducing the Walleye creel limit from eight fish to four, and introducing a minimum length limit of 15 inches to be acceptable to limit the number of Walleye removed from reservoirs. Most anglers indicated that these changes would either positively impact, or have no impact on their fishing experience. The information provided by anglers may inform future stocking program or regulatory changes.

Future Directions in Optical Remote Sensing of Fisheries

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In this talk I will briefly review the use of optical remote sensing instruments for study of marine and inland aquatic ecosystems and then present future directions of innovation. I will cover both active and passive optical approaches to remotely count fish, profile and quantify planktonic biomass, and measure water quality and turbidity. I will present upcoming experiments this summer using both airborne lidar and passive polarimetric imagers for remote measurement of

plankton, CDOM, and TSS. I will also report on development of a hexacopter-borne version of an oceanic lidar, bringing this technique out of the academic lab and to the end-user community. Finally, I will discuss emerging lidar technologies that have the necessary resolution for profiling shallow lakes and streams.

Using selectivity ratio to evaluate bottom trawl survey and longline fishery selectivity

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Fisheries-independent surveys collect catch rate and catch-at-length data that are crucial for fisheries stock assessment. These data provide information about relative or absolute abundance and demographic structure of fish populations. In stock assessment models, assumptions about how these relative and absolute quantities are correlated affects biological reference points from stock assessment that provide information about the health of fish stocks and inform management decisions about harvest. One key assumption is the functional form of selectivity, that relates fish length/age to catch efficiency of the survey or commercial gears. In the eastern Bering Sea, there has been a long-standing hypothesis that bottom-trawl survey selectivity for Pacific cod is “dome-shaped,” meaning the survey misses a proportion of the large fish within the sampled area. Previous efforts to test this hypothesis through trawling experiments have not found evidence of dome-shaped selectivity and concluded the bottom-trawl survey likely has asymptotic selectivity (i.e., it is fully selective for large size classes). In this study, we use a different approach based on selectivity ratio to compare bottom trawl survey and the longline fishery selectivity of Pacific cod and test the hypothesis that the bottom-trawl survey has dome-shaped selectivity. In addition, we use a novel method of analyzing accelerometer data from archival tagged Pacific cod that were opportunistically captured by bottom trawl fisheries to evaluate a potential mechanism for non-asymptotic bottom-trawl survey selectivity. The results of this study may have implications for selectivity assumptions in the eastern Bering Sea Pacific cod stock assessment.

Optimizing trans-generational genetic mark-recapture (tGMR) for improved enumeration of Pacific salmon

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Estimating the number of spawning adult salmon (escapement) in a population is a fundamental but difficult task for fishery managers. Escapement monitoring of salmon typically requires intensive observation across the return migration, often in remote locations, and is subject to changing environmental conditions that can reduce data quality. Alternative methods that increase the efficiency, accuracy, and precision of escapement monitoring are desirable, particularly during times of shrinking budgets for fisheries management. With the advent of high-throughput genotyping, biologists can now combine pedigree information with life-history data to make inferences about the size of wild populations using trans-generational genetic mark-

recapture (tGMR). Multi-locus genotypes are used to mark returning adults and sampling the offspring of those individuals can be treated as 'recapturing' those focal individuals, provided that potential parents and offspring can be identified and standard mark-recapture assumptions about equal capture probability are met. Our project aims to help optimize tGMR for improved enumeration of Pacific salmon by comparing tGMR estimates to a traditional mark-recapture project for Chinook salmon from the Chilkat River in Southeast Alaska. We identified potential biases arising from violations of the equal probability of capture assumption using an individual-based model. Specifically, we simulated age-specific changes in reproductive success and sampling selectivity to determine their influences on tGMR estimates. Furthermore, we investigated how adult sampling location and date of capture can impact tGMR estimates by stratifying adult samples collected from the mainstem of the Chilkat River in June from samples collected in the upriver tributaries in August.

When beavers get burned, do fish get fried? Assessing beaver effects on fish in a fire-dominated ecosystem using and eDNA.

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Wildfire is a dominant natural disturbance process throughout boreal North America and fires are increasing in size, frequency, and severity. However, little is known about how wildfire affects boreal fish habitat and populations despite its substantial impacts on ecosystem processes, and even less is known about how fire effects may be mediated by species interactions. For example, North American beavers (Castor canadensis) are affected by, and can influence, wildfire dynamics which have complex effects on aquatic habitats. Therefore, beavers have the potential to mediate wildfire effects on aquatic systems and subsequently, fish populations. We used a combination of traditional in situ fish sampling (angling and electrofishing) and environmental DNA (eDNA) to assess the effects of beavers on Arctic Grayling (Thymallus arcticus) abundance and distribution in Interior Alaska during summer 2023. We sampled 10 sites multiple time (n=26) for Arctic Grayling abundance (catch per unit effort; CPUE) and eDNA concentration and collected environmental parameters during each sampling event. We found a moderate correlation (Multiple R2 = 0.53, Adjusted R2 = 0.33) between eDNA concentration and CPUE when fitting models that also included environmental parameters such as water temperature (□C), stream flow (m3/s), turbidity, and pH. Subsequently, we collected eDNA at an additional 56 sites (once each) throughout Interior Alaska to predict Arctic Grayling CPUE using multiple model structures, including our eDNA model. We believe that some of the unexplained variance in our linear model is due to eDNA accumulating as it moves downstream and traveling further than previous literature suggests. Next steps include finalizing CPUE—eDNA concentration model predictions and linking them to remotely-sensed beaver pond density and wildfire data. Overall, these results will build on previous work using eDNA to approximate fish abundance and distributions and describe the effects of beavers and wildfires on that distribution.

How do wildfires affect Chinook salmon? Evidence from small streams, big rivers, and satellites

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Wildfires are becoming more frequent, widespread, and severe in Alaska's boreal forest and tundra ecosystems, but their effects on river ecology and salmon populations are not well understood. Do wildfires increase water temperature and erosion over years or decades? Do burned watersheds supply juvenile salmon with better or worse invertebrate food supplies? How do these changes affect salmon growth rates, which can influence future marine survival? We are addressing these questions at multiple scales with field work, remote sensing, and mechanistic models. First, we compared water temperature, turbidity, invertebrate drift, and juvenile Chinook salmon growth between fire-influenced and reference reaches of the Chena River one year after a 17,000-acre fire bisected a core spawning and rearing area. We deployed novel technologies including a suction pump sampler for invertebrate drift. Turbidity was elevated in the burned reach, but temperature, invertebrate energy content, and salmon growth were similar, suggesting this salmon population was resilient to a wildfire of this size and intensity. Second, we measured large-scale effects of wildfires on land-surface temperature using 20 years of satellite data across the Chena drainage and three neighboring sub-basins in the Tanana Valley. Burn scars were 2-3˚C warmer on average than nearby reference areas in the year following a fire, with effects persisting up to 15 years. Next, we are modeling the interactive effects of climate change and wildfire on watersheds and Chinook salmon, from the 2000s to the 2070s, under alternative fire management scenarios. These findings provide insights into the small- and large-scale effects of wildfire on boreal forest watersheds and salmon populations in Alaska. We discuss potential applications of remote sensing to rapidly assess wildfire impacts on salmon habitat at a landscape scale and relevance to the unprecedented 2022 wildfires in Western Alaska.

Estimating Groundfish Abundance by Combining the Data from Multiple Fishery-Independent Surveys

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Cunningham, Curry J.

Fishery-independent Catch-Per-Unit-Effort (CPUE) data are a critical and cost-effective tool for stock assessment and sustainable fisheries management. However, these CPUE data have inherent limitations: Fishery-independent surveys are typically subject to government funding, the availability of which can fluctuate. This can result in spatial or temporal gaps in survey coverage as sample designs are adjusted to meet budgetary requirements. Additionally, choices in areas and depths sampled, or more importantly not sampled, can lead to non-representative subsamples of a stock. Size-specific gear-selectivity can produce both CPUE and age-composition data which is not fully representative of the stock. We may be able to compensate for these challenges through the intercalibration of observations from multiple surveys, wherein

the relative catch-efficiency and selectivity of multiple surveys are directly estimated from catch rate observations that overlap in time and space. By intercalibrating data from multiple-fishery independent surveys employing different (i.e. trawl vs. fixed) gears, that operate at different depths and with differing spatial footprints, and with different interannual frequencies we hope to develop a more robust understanding of trends in abundance for Alaskan groundfish species. Using data from three Alaskan surveys (The NMFS Bottom Trawl Survey, the AFSC Sablefish Longline Survey, and the IPHC Setline Survey), our analysis is conducted across four species-region case-studies: Pacific cod in the Gulf of Alaska, Arrowtooth Flounder in the Gulf of Alaska, Rougheye Rockfish in the Aleutian Islands, and Greenland Turbot on the Eastern Bering Sea Slope. In this analysis, we compare the performance of three classes of statistical models for intercalibrating fishery-independent survey data: Timeseries random-walk models, generalized additive models (GAMs), and vector-autoregressive spatiotemporal (VAST) models. These models were fit to CPUE data collected by three fishery-independent surveys conducted in the marine waters surrounding Alaska. Model performance is compared based on their goodness-of-fit to the CPUE data, and comparison to official published abundance estimates from the NOAA-NMFS Bottom Trawl Surveys. Through this analysis, we hope to gain a better understanding of the potential benefits of combining data from multiple fishery-independent surveys when developing indices of abundance to inform stock assessment, as compared to standard single-survey abundance indices, as well as the complexities that such approaches can present.

Insights into the ecology of Chinook Salmon in the North Pacific Ocean, gleaned from pop-up satellite tags

Seitz, Andrew
Courtney, Michael
Garcia, Sabrina

Chinook salmon (Oncorhynchus tshawytscha) is an iconic species found throughout the North Pacific Ocean and supports many valuable fisheries. While in the ocean, relatively little is known about the ecology of this species, despite the fact that individuals frequently reside there for the majority of their lives. Beginning in 2013, we began a series of research projects in which we attached pop-up satellite archival tags (PSATs) to Chinook salmon to study the migration patterns, natural mortality, and habitat occupancy of the large immature ocean phase of this species. From 2013 to 2022, we tagged 183 Chinook salmon ranging from 57 to 101 cm FL (75.7±7.7 cm FL; mean±SD), across a broad range of the Bering Sea and Gulf of Alaska. A total of 166 tags reported to satellites and four were recaptured in fisheries, providing over 8,000 days of data. In this presentation, we describe the movement patterns, occupied depth and temperatures, and the mechanisms and timing of natural mortality of tagged Chinook salmon. We also discuss the practical application of this information, including understanding the overlap between Chinook salmon, and U.S. Navy training exercises and groundfish fisheries.

Modeling stream temperature and flow from gridded climate datasets in Alaska's Yukon and Kuskokwim basins

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Stream temperature and streamflow are critical controls on freshwater habitat dynamics and are important for understanding climate impacts on freshwater resources. In Alaska, using empirical stream temperature and streamflow datasets for research poses several challenges: data are often unavailable for an area of interest, datasets are typically of short durations, and sites are managed independently across agencies and organizations. Fortunately, advances in gridded climate products and downscaled climate projections provide alternatives for quantifying freshwater habitat conditions in remote regions like Alaska. For this project, we reviewed products and validated models against in situ data to develop more complete historical time series of stream temperature and streamflow. Specifically, our objectives included: 1) developing a list of gridded or modeled products available for Alaska, 2) comparing products with a focus on streamflow and temperature, and 3) comparing three different stream temperature models. We validated alternative products representing streamflow and temperature using empirical datasets associated with a case study of Chinook Salmon habitat in the Yukon and Kuskokwim basins. Our results indicated that a global modeled streamflow product had a strong positive correlation to observed streamflow (mean r = 0.79 for 11 sites). Boosted regression tree models that included daily gridded air temperatures along with other covariates had the highest positive correlation to observed stream temperatures (r = 0.97 for 31 sites) compared to other commonly used models and good prediction accuracy (mean RMSE = 0.7℃). Overall, we found several products that could be used to develop accurate time series of freshwater habitat conditions in Alaska and utilized for fisheries research. Potential applications include predicting aquatic species distributions, spread of invasive species, food availability, fish growth potential, and generally informing fish responses to climate change for research and management.

AKTEMP: Presenting a fully functional stream and lake temperature database for Alaska

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AKTEMP is a cloud-based database platform for storing and accessing stream and lake temperature monitoring data across Alaska. The website allows users to upload, review, explore, and download data. Data can be uploaded either as a single file or as multiple files, which can be uploaded simultaneously as a single batch. Each data file can contain either discrete or continuous measurements collected at one or more sites as well as at one or more depths or depth categories to accommodate lake arrays, paired bottom/surface stream loggers, or other multi-depth scenarios. After uploading, an interactive QA/QC tool can be used to review and flag data representing erroneous or abnormal measurements (e.g., out of water). Users can explore available data at all sites statewide or within specific hydrologic basins (i.e. HUC4, 6, or 8) using spatial filters. Additionally, users can download both the raw and daily-aggregated timeseries at one or more sites along with the accompanying station metadata. The project team has developed instructional videos, decision tree flowcharts, and a user guide to aid data providers and public users. The system architecture for AKTEMP was based on the Spatial Hydro-Ecological Decision System (SHEDS) northeast stream temperature database, which was developed by Walker Environmental Research in collaboration with USGS and currently serves over 150 million measurements collected at approx. 8,400 monitoring stations by 92 agencies across ten northeastern US states. AKTEMP was released in early 2023 and currently serves stream and

lake data in more than twenty different Alaskan sub-basins (HUC8s). Use of AKTEMP is free and open and will continue to be supported by staff at UAA's Alaska Center for Conservation Science. We invite the community to take advantage of this database by uploading your own data, and/or exploring data uploaded by others to meet your needs.

Salmon Hatcheries 2.0: Setting the Stage

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Originally designed in the early-1970s to enhance fisheries at a time when salmon returns were at historically low levels, Alaska's salmon hatchery program has been successful by many metrics, with recent hatchery returns accounting for over 25% of all Alaskan salmon harvests, oftentimes accounting for greater than 25% of the state's total salmon fishery value. Alaska's salmon hatcheries have also served to diversify economic opportunities in coastal Alaskan communities to include some of the state's largest recreational fisheries, and have supported maritime-related workforce development programs while contributing to cutting edge scientific research. As the State of Alaska grapples with issues relating to food, energy, and water security, stakeholders are exploring how this program could be leveraged to generate broader benefit. This presentation will serve as an introduction to the symposium, and will highlight a few areas where these opportunities may exist, including mariculture development, energy innovation, and climate change mitigation. This presentation will build off similar outreach efforts elsewhere in recent years, and will set the stage for subsequent symposium participants, highlighting opportunities for Alaska Blue Economy Center (ABEC) to support their work.

Seaward migration and overwintering habits of Dolly Varden in northwestern Alaska analyzed using otolith microchemistry

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Diadromous migration is a strategy commonly used by fishes to access seasonally abundant resources; however, it can increase their exposure to human harvest and natural mortality. The Dolly Varden Salvelinus malma, an important subsistence fish in northwestern Alaska, displays a complex suite of movements and migratory strategies to utilize rich oceanic feeding grounds and to access freshwater habitats for spawning and overwintering. Dolly Varden are harvested in numerous commercial, subsistence, and sport fisheries while moving among these habitats, and provide a vital food source in remote, subsistence-reliant communities. Despite the need for a comprehensive understanding of migratory habits to properly assess population dynamics, exposure to harvest, and impacts of environmental change, considerable information gaps exist. Assessment of seaward migration frequency and overwintering-site fidelity has remained difficult due to the remoteness of the area and the high cost of tracking studies. To determine the migratory histories of Dolly Varden in this region, we measured the strontium (Sr) concentrations and 87Sr/86Sr isotope signatures in otoliths of 139 fish captured in major spawning areas. We used these microchemistry data to determine the age at first seaward migration, frequency of subsequent seaward migrations, and movements among overwintering locations. We intend to perform similar analyses with an additional 150 fish captured in commercial and subsistence fisheries. These data will be used to assess variation in life history strategies among Dolly Varden

populations in this region, identify life history strategies that are frequently encountered in regional fisheries, and elucidate the complex interchanges among overwintering and spawning areas that remain poorly understood. The results of this study will inform fisheries management and harvest practices in the region, and allow us to develop a descriptive baseline of life-history characteristics to monitor future changes in migratory habits brought about by a rapidly warming Arctic.

A Delphi-study approach to future participation in recreational angling and fishing tourism

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Regions like Alaska and the five Nordic countries of Denmark, Finland, Iceland, Norway, and Sweden are global angling hotspots with 14- 41% of the population angling per year and fishing being a central part of nature-based tourism. These regions might be where potential future changes in angling participation are felt the most, and the outcomes and the drivers behind it are therefore of interest to other regions as well. Our study used the Delphi method with 3 survey rounds to gather opinions from 93 experts across the five Nordic countries, We applied it to investigate possible future angling participation and the drivers behind for local and tourist anglers in the Nordics. An overall increase in local angler numbers was expected for the Nordics as a whole. The strongest increase was anticipated for ethnic minorities and women. Overall numbers were expected to drop for Norway and Finland who have the highest current participation rates, but increase in Sweden, Iceland, and Denmark where participation rates were expected to increase in every age cohort. For tourist anglers a growth was expected for both domestic and foreign tourist, with dominating foreign markets being neighboring countries. Drivers anticipated to have the largest positive or negative effect on future angler numbers both locals and tourist, were environmental (fish resources, nature, habitat) and technology (opportunities in social media, competition from screen-based leisure). For tourist anglers political/managerial drivers such as marketing efforts by governmental authorities, facilities/fishing tourism products and accessibility (sites, information) were seen as having a strong effect too. Contrary to other studies our experts did not assess increased urbanization as a strong driver. Scenarios about the future are uncertain and larger geopolitical events such as the war in Ukraine, the energy crisis, rising prices and COVID-pandemics were not on our experts' mind prior to their happening.

Hydrologic regime characterization for wildfire- impacted streams in changing boreal ecosystems

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Stream flow is a primary ecological driver of stream ecosystems that strongly influences biotic and abiotic processes, particularly in headwater streams that are tightly linked to the surrounding landscape, yet rarely monitored. As wildfires increase in frequency, intensity, and severity, boreal stream ecosystems, which span much of Alaska and western Canada, are changing rapidly, and shifts will likely be reflected in stream flow dynamics (e.g., timing, magnitude, duration). As small streams are highly prevalent and ecologically important to boreal stream ecosystem function, understanding interactions among wildfire, climate, and hydrologic patterns at multiple spatial scales (e.g., reach, catchment, and regional scales) is important for effective aquatic species management. In this study we: 1) used field observations to quantify and compare hydrologic regimes in a subsample of headwater streams (drainage basins ≤ 150 km^2) with different fire histories (no burn, historic burn, recent burn) in interior Alaska; and 2) used streamflow data from the Global Reach-Level Flood Reanalysis (GRFR) model to calculate the “Magnificent Seven” ecologically relevant hydrologic descriptors for 32,730 stream reaches (≥ 25km^2) across the Yukon and Kuskokwim basins and the Northwestern Boreal Ecosystem in Alaska and Yukon Territory, Canada. Next, we used a Bayesian mixture model to classify hydrologic regimes into distinct classes, which were further reduced into sub-classes based on relative class membership strength. We assessed time since burn and calculated the total length of stream (km) burned for each stream class based on the Arctic-Boreal Vulnerability Experiment (ABoVE) burn severity dataset. Our hydrologic regime characterization will provide a baseline for boreal streams that can be used to identify stream classes more susceptible to wildfire, detect potential regime shifts from continued climate warming and increased fire disturbance at multiple spatial scales, and provide valuable information toward management and conservation of important boreal aquatic species.

An Examination of Burbot Life History Strategies Through Use of Radiotelemetry

Stuby, Lisa

A radiotelemetry study of burbot (Lota lota) conducted during 2017-2019 in the Yukon River mainstem has expanded our understanding of their life history strategies. The primary objectives were to describe seasonal distributions and migration timing, identify probable spawning areas, and estimate mean travel distances. Overall, most radiotagged burbot did not travel far from their tagging locations, although approximately 18% travelled over 500 miles and 5 travelled over 1,000 miles. A statistically significantly linear relationship was noted between length and travel distance. River burbot spawn during late January/early February and the radiotagged fish spawned throughout most of the mainstem Yukon River. Spawning concentrations were especially noted between the Rampart Rapids above Tanana to Fort Yukon. Burbot showed the largest net upstream travel during the time of spawning. Radiotagged burbot began migrating to their spawning locations during late October-mid January (average 14 Dec) with post-spawning movement during April-May (average 8 May). Summer movement was noted, but not to the degree noted by pre-and-post spawning fish. Twenty-four burbot were captured at a spawning location near the Dalton Highway during early Feb 2020. Half of these had post-spawning characteristics and the other half had not spawned. Overall, Yukon River burbot showed varying fidelities to their spawning and oversummering areas and yearly travel distances and migration directions.

Hindcasted bioenergetics modeling of juvenile Chinook salmon (Oncorhynchus tschawyscha) and Dolly Varden (Salvelinus malma) within the Kenai River system to inform future climate projections

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The Arctic is one of the fastest warming regions on the planet, yet there is limited data capturing baseline environmental conditions to inform future projections. Likewise, there is limited information regarding the energetic condition and fitness of native fish species with both cultural and consumptive values to Indigenous communities. We used a river routing model (mizuRoute) and a river temperature model (RBM) forced by the Regional Arctic System Model (RASM) to simulate Kenai River flows and river temperature. The RASM produced meteorological forcing data optimized on streamflow and snowpack at a resolution of 4 km. The RBM was optimized using USGS gages for discharge and temperature. Using this hindcast river data and historical biometric data available through colleagues, literature, and publicly accessible databases for the Kenai Peninsula, we estimated historical growth rates during the open water period (May-September) for Age-0 Chinook salmon (Oncorhynchus tschawyscha) and juvenile (<200 mm) Dolly Varden (Salvelinus malma). The goal of these outputs is to use historical bioenergetic baseline data to estimate future changes in fish growth and survival under mid-century (2035-2065) climatic and hydrological conditions.

Population genomics of rockfish species across the West Coast: chaos reigns supreme

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Rockfish are a commercially important and diverse group of fishes that have been perplexing taxonomists and geneticists for decades. The overall goal of our work is to investigate the genetic stock structure of rockfish species caught in Alaska and leverage this information to improve fisheries management. We used low coverage whole genome resequencing to genotype tens to hundreds of individuals from nine rockfish species: rougheye, blackspotted, shortraker, yelloweye, dusky, northern, Pacific Ocean perch, black, and shortspine thornyhead. Patterns of population structure were highly variable, ranging from cryptic diversity and potentially new species (e.g., Pacific Ocean Perch), to high spatial structure (e.g., black), to no structure from the Bering Sea to the U.S. West Coast (shortspine thornyhead). Our findings indicate that some life history characteristics (e.g., nearshore vs offshore) may help to predict genetic structure but largely suggest that there is extremely high variation in patterns of population structure among

rockfish species. This finding stresses the importance of conducting thorough genetic analysis for all commercially important rockfish species.

Population genomics of sablefish throughout the North Pacific

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Sablefish (Anoplopoma fimbria) is a commercially important species in the North Pacific, valued at $112 million in 2021. Previous studies into genetic population structure across the northern range of sablefish have found a single population, suggesting panmixia. The overall aim of our research is to inform fisheries management of sablefish by characterizing the genetic stock structure of individuals caught in Alaska. Utilizing a low coverage whole genome resequencing approach, we genotyped over one hundred individuals spanning the western Aleutian Islands to the coast of Washington state, identifying millions of variable sites across the genome. Our results confirm a single population throughout the region. However, we also identified a small genomic region associated with sex-determination in the species, as well as two putative inversions which dominate an entire chromosome. Our research efforts stress the importance of conducting thorough, whole genome genetic analysis for commercially important species in Alaska.

Combining predator diet and survey data to understand spatial and temporal patterns of forage fish in Alaska

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Forage fish are energy rich species that play a crucial role in the diets of seabirds, marine mammals, and commercially important fish in Alaska. Understanding the spatial and temporal variability of forage species would help explain complex predator-prey interactions and assess potential trophic vulnerabilities to climate change within Alaska marine ecosystems. However, forage fish exhibit diverse life history strategies and are often patchily distributed, making consistent spatial and temporal sampling of forage fish abundance challenging. Additionally, many forage fish are not targeted by direct fisheries, so resources for forage fish assessment are often limited. In this study we compiled data from multiple sources, including trawls, beach seines, plankton surveys, and predator diets, in order to assess spatial and temporal variation in forage fish populations within Alaska. The expanded spatial and temporal scope from the resulting combined forage fish dataset will inform occurrence and abundance trends across space and time. We describe and visualize current data compilation efforts on forage fish abundance and distribution in terms of spatial and temporal availability. We present spatio-temporal models of key forage species (Pacific sand lance, Pacific herring, and Pacific capelin) distributions in the Gulf of Alaska, Aleutian Islands, and Bering Sea. This first step towards a large-scale understanding of forage fish distribution in Alaska will facilitate greater understanding of forage fish dynamics, trophic processes in marine ecosystems, and risk analysis in areas of oil and gas development.

Wild, Natural, Sustainable...or Hatchery?

Van Alen, Benjamin W.

What could possibly be wrong with letting 5.5 billion artificially incubated and reared hatchery babies swim wild each year? Hatcheries have been part of salmon management programs in Canada, Japan, Korea, Russia, and the United States for 150 years. We love to eat salmon, there are never enough salmon, we can easily alter their habitats and overfish salmon, and, if we just release more juveniles from hatcheries, we'd have rebuilding wild stocks and more adults. Right? Well, this is not the way Nature works and the North Pacific Ocean is Nature. The abundance of adult salmon, and all biota for that matter, is always limited more by the space, water, and food they need to grow and survive to reproduce than by the number reproduced. The biosphere can only carry so much biomass and there is always more than enough rearing biota competing to be carried. The ocean is already full of life. There is not, and will never be, an open niche for hatchery salmon. For a hatchery salmon to survive, wild fish must die. Lastly, in Nature, the environment's carrying capacity is sustained by the recycling of nutrients from dead and decaying biota. Deaths sustain life, not births. It is the marine-derived nutrients from the millions of wild salmon that spawn and die in thousands of natal streams that help sustain the productivity of the freshwater and early-marine habitats critical to the growth and survival of young salmon. Wild salmon are dying for more. Hatchery salmon grow big in the ocean like wild salmon do but since nearly all of them are caught, and should be, their tons of marine-derived nutrients are effectively removed from the marine-terrestrial-marine nutrient cycle. Hatchery salmon come to the ecosystem potluck without bringing a dish, and, in Nature, there is no free lunch.

Brief overview of Heavy Metal Mining and Effects on Alaskan Streams

Wedemeyer, Kate, Minerals Management Service

Geologically, metal deposits are primarily sulfides (sulfur attached to metal ions). Target metals often co-occur with other non-target sulfides. Mining separates minute proportions of metals from huge amounts of leftover rock tailings by pulverizing to maximize surface area and chemically separating (eg. flocculation). Tailings are forever (2,500 – 10,000+ years), usually piled in the most problematic location, valleys and streams, and left open to oxygen, iron, water, and runoff. It's difficult to separate effects of scouring, turbidity and heavy metals. Water, the universal solvent, can infiltrate and dissolve the HM's. The 'iron-eating' bacteria break sulfur-iron bonds for energy, creating acid, and increasing dissolved metals concentration by up to 1,000%. Biologically, Heavy metals (HM's) are especially toxic in streams because water dissolves metals into free ions. Ions cross permeable membranes causing toxicity. Toxic metal and metalloid ions substitute for biologically required bi-valent (calcium, magnesium, iron, sulfur) and uni-valent (potassium, sodium). Relative toxicity generally ranks: Mercury, Lead > > Copper, Cadmium, Silver > Zinc, Arsenic, Tin (metalloids) > Antimony, Selenium > > Magnesium, Iron. High pH, alkalinity, hardness and course particulate organics can reduce toxicity. My 80's Denali Preserve research near surface placer and underground antimony mine revealed HM's pollution is like taking a sledge hammer to the biota. Decreased total abundance appeared at all trophic levels including fish, macroinvertebrates, periphyton and moss. Macroinvertebrate abundance (mostly insects) decreased by 2 orders of magnitude. Chlorophyll A decreased by 1 order of magnitude. Both fish and moss were completely absent. Trophic relationships (relative abundance) were unaffected. Prevention includes preplanning to minimize forever-tailings, keep water, oxygen and bacteria away, exclude tailings from valleys/streams/tailings dams and cover tailings piles with clay, organics, or membranes. Treatment after the fact is exceedingly difficult. Acid and copper tolerant algae/bacteria, municipal sludge, calcium carbonate, zeolite, fly-ash have limited success.

Forests, Fish, & People: Quantifying Alaska National Forest Contributions to Subsistence, Sport, and Personal-Use Salmon Harvest

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Forest lands provide a number of ecosystem services. These services range from providing clean water, food, and cultural and recreational opportunities to providing habitat to support fish populations. Recognizing and quantifying these services adds value to the way we understand the functions of these areas. Here we quantify the number of salmon caught in personal-use, subsistence, and sport fisheries that originate from Alaska's Tongass and Chugach national forests. Using data from 2011-2020, the proportion of "forest fish" or salmon harvested in these fisheries that originated from streams and lakes within national forest boundaries was estimated by subtracting hatchery salmon and salmon originating from outside the national forest areas from the total catch. Total catch was estimated from the Alaska Sport Fishing Survey data and harvest reported by users in the state personal-use and subsistence fisheries, and from federal subsistence harvest reports. Earlier work examining the commercial fishery found that these "forest fish" represented 25% of Alaska's commercial salmon harvest between 2007-2016. The importance of the forest lands in supporting salmon production is only further emphasized with consideration of the salmon caught in personal-use, subsistence, and sport fisheries. Understanding the contribution of these national forest lands to these fisheries leads to a more comprehensive socioeconomic valuation of the services the forests provide. Further, this work can contribute to discussions of land management strategies and resources allocations.

Poster Abstracts

Population Genomics of Pacific Herring in the Eastern Bering Sea

Almgren, Sydney A.*
López, J. Andrés
Glass, Jessica R.

Pacific Herring (Clupea pallasii) is vital to the environment, economy, and culture of Alaska. Despite their importance, the genetic diversity and population structure of Pacific Herring in western Alaska are not well understood. Using modern genomic techniques, we are conducting the first fine-scale genetic assessment of herring aggregations throughout the eastern Bering Sea. Our large sample size (>1,400) is composed of NOAA trawl surveys and NMFS fisheries observers, along with historical samples from spawning aggregations from the Alaska Department of Fish and Game. This variety of samples will provide a robust assessment of the genetic composition of Pacific Herring throughout the eastern Bering Sea. A combination of RADseq and low coverage whole genome libraries will be constructed, sequenced, and analyzed with bioinformatic tools. SNP marker panels will be established throughout the Pacific Herring genome,

providing a foundation for future genetic monitoring. In addition to population structure analyses, low coverage whole genome sequencing will be used to identify and characterize genomic regions related to sex determination in Pacific Herring. The genome of Atlantic Herring (Clupea harengus) will provide context and serve as a reference for our Pacific Herring genomic analyses. Both projects will provide valuable baseline genomic information on Pacific Herring that will inform key decisions for the management of federal and state marine fisheries in the North Pacific.

Prospective Students: New Opportunities with the Integrated Marine Fisheries Lab at OSU

Barnes, Cheryl L. Coastal Oregon Marine Experiment Station | Department of Fisheries, Wildlife, and Conservation Sciences | Oregon State University

The main objective of the Integrated Marine Fisheries Lab is to conduct scientific research that informs marine resource management. Much of our work focuses on better understanding population and community dynamics of groundfishes in the North Pacific. To do so, we rely on field sampling, lab-based research, and statistical modeling techniques. We also place considerable value on collaborating with academic and agency scientists, resource managers, and fishery stakeholders because of its benefit to both process and product. Some common research themes include: evaluating effects of scale on ecological inferences, enhancing scientific lessons through multi-region comparisons, and using multiple metrics to improve our understanding about processes of interest. Student Opportunities: We are currently recruiting MS/PhD students who are interested in working on highly collaborative projects that are specifically designed to answer management-relevant questions. Topics may relate to marine spatial ecology, food web dynamics, impacts of climate change, and improving commonly-used statistical tools. We intentionally seek out and support diverse identities, backgrounds, and perspectives — doing so improves the quality of our work and enriches our daily lives. Thus, we strongly encourage those who identify with underrepresented and/or historically marginalized groups to apply. Please click here for a Diversity, Equity, and Inclusion Statement and here for a Code of Conduct that I helped create through different collaborative processes. I emphasize the ideas, values, and strategies identified therein in all aspects of my work.

Learning Through Experience at the Salish Sea Research Center

Black-Williams, Justice M. Northwest Indian College

As a student at Northwest Indian College, I have been exploring career paths in Native Environmental Science. I applied to be a student intern at the Salish Sea Research Center (SSRC) on campus to broaden my horizons in this field of work. I have gained valuable knowledge from the hands-on learning experience. The goal of the research done at SSRC is to maintain a sustainable way of life for the generations to come, specifically focusing on marine environments and access to traditional foods. I started off by sampling marine and freshwater sites in Lummi Bay and Bellingham Bay, assisting with research on harmful algae blooms that affect locally harvested shellfish. After filtering the samples, we tested various physical water quality parameters, such as microcystin, yessotoxin, paralytic shellfish toxins, chlorophyll A, domoic acid, and inorganic nutrients. After mastering water quality and toxin lab procedures, I was interested in new laboratory techniques and began working in the genetics lab. I learned how to collect eDNA samples at our marine sites in Bellingham Bay and Lummi Bay, as well as how to extract eDNA from filters using a Qiagen Kit and how to extract gDNA from Longfin Smelt liver tissue. I am learning so much from the hands-on education that I am constantly obtaining at SSRC and am

looking forward to learning new skills in the genetics lab: qPCR as well as the chemistry behind it. Although I have just started my bachelors in Native Environmental Science I feel as if I have already exceeded expectations, and that is thanks to the Salish Sea Research Center. Being part of something greater than myself is gratifying. This experience supports me as a scholar, tribal member, and in my professional advancement.

How a Levee Impacted Water Quality and Fish in Piledriver Slough: A Ten-Year Study

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A 188 million-dollar bridge and levee project on the Tanana River cut off the head of a slough in 2011, leaving it entirely groundwater-fed. The Tanana Valley Watershed Association partnered with the local Salcha Elementary School to involve its K-6 students as citizen scientists in monitoring fish passage, habitat, water quality, beaver activity, invasive plants, and riparian changes three times a year over ten years. Eight sites were visited, collecting over 1,200 data points using GLOBE (Global Learning and Observations to Benefit the Environment) and Chena River Fish Sampling protocols. The two student authors started with their kindergarten class at the beginning of the whole school project. They continued their work into high school: collecting samples, making observations, and analyzing data. They noticed changes in fish distribution, depth of pools with beaver dam removal, algae blooms, variability in conductivity, but most notably, a 6-degree Celsius increase in the eight-site averaged summer water temperature. This is an opportunity to talk with high school (scientifically published) authors who participated in a local project, practicing authentic science from an early age, including presenting at the 2022 American Geophysical Union Fall Meeting in Chicago and the impact it has had on them.

Novel passive eDNA devices enable cost-effective aquatic biodiversity monitoring

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The ability to monitor marine and freshwater biodiversity rapidly and cost-effectively is critical for detecting invasive species, tracking animals' range shifts, and for understanding the plants and animals that comprise and distinguish healthy versus disturbed ecosystems. One way to monitor biodiversity is by quantifying the species present in the environment by sequencing their DNA. As aquatic organisms inhabit or move through an aqueous medium, they shed skin and tissue cells and excrete waste. DNA from these cells remains suspended in the water and taxa can be identified using genomic techniques in a process called environmental DNA (eDNA) metabarcoding. Traditionally, eDNA studies involve manually collecting and filtering water. However, this process can be cumbersome, requires specialized equipment and risks sample contamination. A new collaboration between students and faculty in the University of Alaska Fairbanks' Departments of Fisheries and Mechanical Engineering has led to the design and

development of novel eDNA passive sampling technologies. These devices are designed and tested to align with ocean or riverine currents while suspended in the water column to maximize eDNA retention and contain modular components that also allow researchers to also collect sediment. The novel passive sampling devices can accommodate a variety of filter types and sizes and are designed to minimize contamination. Importantly, these devices are 3D printable and cost-effective (<$30). Our goal is to better enable citizen science engagement for rapid and affordable biodiversity monitoring using eDNA.

Nearshore seascape complexity influence on fish assemblages in southern Southeast Alaska

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Nearshore essential fish habitats are generally identified as a single habitat (e.g. eelgrass, kelp forest, or coral reef) that is important for commercial fishes; however, nearshore habitats are often mosaics of habitats creating seascapes. The composition, location, and quality of habitats can ameliorate nearshore functions (e.g. nurseries) and facilitate movement of materials and organisms among habitats. Southeast Alaska has over 30,000 km of shoreline composed of dynamic and complex habitats that provide important services for a variety of species, including critical refuge, migratory and residential habitat, and food. The heterogeneous nature of Southeast Alaska's coasts provides a unique location to test the role of spatial arrangement and composition of nearshore habitats on associated fish assemblages. We are using a multi-prong approach including aerial imagery and field sampling to quantify habitat composition and arrangement and associated nearshore fish assemblages. We present preliminary data and methods for a subset of sites comparing eelgrass associated fish assemblages across a gradient of habitat coverage from primarily eelgrass meadows to eelgrass adjacent to mixed habitats like canopy and understory kelp beds. Fish assemblages in primarily eelgrass meadows are numerically dominated by pipefish, crescent gunnels, and snake pricklebacks. Whereas in eelgrass habitats adjacent to other habitats, we find an increase in juvenile greenlings, juvenile lingcods, and rockfishes in addition to species found in expansive eelgrass meadows. We acknowledge that these habitats and fish assemblages do not occur in isolation, and thus we are taking a broader seascape approach to characterize fish communities and habitat utilization. Incorporating seascape dynamics in Southeast Alaska into our understanding of the complexity of nearshore ecosystems can better inform conservation efforts and advance ecosystem-based management.

Advancing the Data-Limited Stock Assessments for Pacific Sleeper Shark (Somniosus pacificus) and Pacific Spiny Dogfish (Squalus suckleyi)

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The sustainable management of fisheries is mandated by law in the United States, even for the most data-limited species. Two of the more data-limited stocks in Alaska are Pacific sleeper shark (Somniosus pacificus) and Pacific spiny dogfish (Squalus suckleyi). While neither species is targeted commercially in Alaska, both are impacted through incidental catch in longline and trawl fisheries. Due to the rate of bycatch, concerning abundance indices, the acute vulnerability of elasmobranchs, and their ecological role, a better understanding of population parameters is needed. The goal of my dissertation is to improve the stock assessments of both species of sharks in Alaska by refining the current harvest specification methods through the incorporation of novel information. To improve the Pacific sleeper shark assessment model, we will further our understanding of the species' life history and movement by first determining the female length-at-maturity through a meta-analysis of closely related species and through biological sampling of incidental mortalities from commercial vessels. Second, we will explore Pacific sleeper shark fisheries interactions from the perspective of movement, derived from a synthesis of historic and contemporary tagging data. For Pacific spiny dogfish we will focus on expanding our understanding of the population dynamics of Pacific spiny dogfish by incorporating novel information such as movement into a length-based model and contrasting this with the current assessment. Overall, this information will improve our understanding of both stocks' status in Alaska.

Pioneering proven technology in a new field: Can image analysis improve salmon escapement indices?

Fish, Teresa
Wolf, Nathan

Computer-aided image analyses have revolutionized the way we explore and quantify natural phenomena. Using large assemblies of images and leveraging deep neural networks has, in many cases, supplanted the need for challenging and potentially invasive studies based on direct observations. Further, these advanced technological methods have been shown to be more robust to bias than traditional human-based observation and enumeration. Salmon management is one area in which the use of computer-aided image analyses is both currently underutilized and ripe with opportunity. Wild salmon spawn in thousands of coastal streams in Southeast Alaska and support a robust commercial fishery. Escapement indices are used for in-season fishery management to support sustainable harvest. These indices are often based on a variety of manual counting methods and are highly prone to bias attributed to observation error. Observed counts are usually lower than the true population, especially at high population size, and significant annual variability has been documented for individual observers. Here, we propose pilot research designed to explore the use of computer-aided image analysis to improve traditional count-based escapement indices. We will pair a traditional mark-recapture study on a 1.7 km section of pink salmon spawning stream with a series of drone videos, as well as foot- and aerial-observation surveys. The videos will be compiled into a single image, each fish will be manually annotated, and the derived fish counts will be compared to the mark–recapture estimate. Additionally, annotated images may be used as training data for surveyors, as well as to explore the use of computer vision to generate salmon escapement counts. To our knowledge, this

represents the first investigation into the use of computer-aided image analysis to enumerate salmon.

Under-ice fish assemblages in the Colville River Delta

Forster, Caitlin E. ABR Inc.
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The annual under-ice gillnet fishery for Arctic Cisco (Coregonus autumnalis), or Qaaktaq in Iñupiaq, located in the Niġliq Channel of the Colville River Delta, Alaska is important to the food security of residents of the nearby village of Nuiqsut. Each fall after river freeze-up, the community of subsistence fishers deploy nets from October through November, typically harvesting tens of thousands of Qaaktaq, which is prized for its high fat content and quality of meat. These harvests of Qaaktaq and other species have been monitored since the mid-1980s to address local concerns that increasing oil and gas development would impact the migrations and feeding behavior of anadromous whitefish. However, because the under-ice fishery itself mainly targets one species using mostly 7.6-cm (3-in) mesh gillnets, the monitoring dataset is inherently selective to a specific size class of fish. Furthermore, subsistence fishing activity in the Colville River Delta is also spatially selective and focused mostly on the western-most channel (Niġliq Channel) near Nuiqsut. To better understand fall and early winter fish assemblages in other parts of the Colville River Delta, we conducted fishery-independent sampling in the East Channel of the Colville River delta in the fall of 2022. Sampling was conducted concurrent with the subsistence fishing activities in the Niġliq Channel in early November. We set multipanel test gillnets with mesh sizes of either 3.8-cm, 5.7-cm, 7.6-cm, or 11.4-cm (1.5-in, 2.25-in, 3.0-in, or 4.5-in). We caught a total of 6 species, all of which are harvested in the subsistence fishery. Notably, we documented very few fish in the 11.4-cm mesh net, and the presence of age-3 and age-4 Arctic Cisco in the 3.8-cm mesh net. Arctic Cisco do not typically recruit to the subsistence fishery until age 5. We compared these results to summertime sampling to determine seasonal differences in fish distribution and abundance.

Federal Subsistence Management Program

Graham, Cory J. Office of Subsistence Management

The Federal Subsistence Management Program is responsible for managing the harvest and use by rural Alaskan residents of land mammals taken on Federal public lands and fish taken from waters within and adjacent to Federal public lands. Public involvement is the cornerstone of the Federal Subsistence Management Program. The public plays a vital role in proposing changes to subsistence fishing, hunting, and trapping regulations and commenting on proposed changes to ensure regulations meet the needs of subsistence users while conserving healthy populations of fish and wildlife. This poster provides an overview of the Federal Subsistence Management Program and is intended to help those interested in Federal subsistence management to become more familiar with the program.

eDNA metabarcoding to monitor the impact of climate change on estuarine communities in the Gulf of Alaska

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As global climate change continues to rapidly reshape Arctic and sub-Arctic marine ecosystems, it is important for scientists to identify tools and approaches that will rigorously quantify changes in food-webs and biological communities. Genomic sequencing tools such as environmental DNA (eDNA) metabarcoding complement traditional fisheries approaches (e.g., netting) by providing in-depth, rapid, and non-invasive assessments of species composition. This project utilizes the capabilities and increasing affordability of eDNA technology to address this major challenge of biological monitoring: quantifying responses in nearshore biological communities caused by global climate change. As a component of the Alaska EPSCoR Fire & Ice project, we are using eDNA metabarcoding to measure nearshore community composition along five glacial gradients in two comparative regions of the Gulf of Alaska. Over 1400 eDNA samples were collected in 2021 and 2022, comprising the largest nearshore eDNA project in Alaska to-date. Our goals are to 1) compare eDNA fish detection results to traditional fisheries sampling methods (beach seining), 2) to characterize the biodiversity and phenology of nearshore fish, invertebrate, seabird, and mammal communities, and 3) to determine how environmental and spatiotemporal factors influence nearshore communities. This project comprises the first stage of a long-term monitoring program that will use eDNA metabarcoding and citizen scientists to quantify fine-scale (i.e., daily) changes of the coastal community ecology in Alaska. We will communicate results to potential project partners in subarctic and Arctic communities with the hope they will be interested in using eDNA technology year-round to complement local and Indigenous knowledge of species occurrences (e.g., bowhead whale migrations). Results will build on existing baseline data to document changes in a region heavily impacted by climate change through heat waves, receding glaciers, and invasive species.

Using Two Decades of PST Testing and Regional Weather Patterns to Uncover Patterns of Toxicity in Alaska's Commercial Geoduck Clam Fishery

Hart, Courtney
Eckert, Ginny

For thousands of years Alexandrium catenella has been a primary phytoplankton species that causes harmful algal blooms (HABs) and toxifies many species of shellfish in Southeast Alaska. A. catenella contains the compound saxitoxin which is ingested by filter feeding organisms and can accumulate in shellfish tissues; this potent neurotoxin causes paralytic shellfish poisoning (PSP) in humans that consume contaminated shellfish. Geoduck clams (Panopea generosa) are shellfish harvested commercially by divers in Southeast Alaska and mostly exported overseas to live fish markets in Asia. Federal mandates require the clams be screened for toxicity prior to opening the fishery to ensure clams are non-toxic. In recent years, the Southeast Alaska geoduck fishery has been hampered by clam toxicity that fluctuates well above (4904 µg) and below (26

µg) the regulatory limit of 80 µgSTX (all per 100g shellfish tissue). These erratic toxicity patterns result in economic loss to the geoduck fishery through increased sampling costs and delayed or closed harvests. Understanding what causes variation in clam toxicity from year to year and within harvest regions is fundamental to informing management actions that can mitigate impacts of PSP on this fishery. To disentangle the environmental conditions that trigger HABs and subsequent geoduck toxicity, we are analyzing 20 years of past testing results from weekly sampling made by the commercial fishery. Initial results show low levels of correlation between wintertime clam toxicity and individual environmental parameters. Recent studies from coastal Alaska and the Pacific Northwest suggest that combinations of environmental parameters are needed to enable HABs, but the spatial and temporal extent of blooms is regionally specific. We are comparing toxicity values from specific regions with summertime weather to determine if identifying a suite of environmental conditions will help managers anticipate PSP toxicity and influence the execution of the following year's geoduck clam fishery.

A comparison of fishery-independent and fishery-dependent data with regard to stock analysis of Rougheye and Blackspotted rockfish in the Aleutian Islands

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Despite on-going efforts by the commercial fleet to avoid rougheye and black-spotted rockfish (BS/RE) during the Atka Mackerel and Pacific Ocean Perch fisheries, the total allowable catch (TAC) of BS/RE has been exceeded annually from 2017-2021 in the Central and Western Aleutian Islands. Regulatory changes including temporary prohibited retention rules and reduced TACs for BS/RE have proven ineffective at reducing BS/RE bycatch. While input from local knowledge holders in the fishery, fishery observer program data, and the National Marine Fisheries Service bottom trawl survey data (fishery and survey, respectively) all indicate a substantial increase in abundance of small, young BS/RE in the Central and Western Aleutians, the incidental catch of young fish in the fishery is higher than expected. This research examines the timing and location of survey and fishery sampling events, environmental variables (bathymetry, slope, sediment, etc), and data collection methods towards identifying potential causes for survey and fishery catch size composition differences and identifying environmental and operational covariates for use in species distribution modeling. For example, voluntary shifts in fishery effort to shallower waters to avoid adult BS/RE may have inadvertently caused increases in the catch of younger fish. Results from this work will help elucidate the differences in the survey and fishery data sources, provide insights leading to improved BS/RE rockfish stock assessment and lead to more effective avoidance techniques to mitigate BS/RE by-catch in directed Atka Mackerel and Pacific Ocean Perch fisheries.

Development of three quantitative polymerase chain reaction assays for Yessotoxin producing dinoflagellates

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Peacock, Melissa
Kudela, Raphael

Phytoplankton that produce yessotoxins (YTX) are proposed to play a cursory role in shellfish die-offs. We aim to study how YTX producing algal communities affect shellfish from the coasts of both California and Washington State. Shellfish safety concerns have prompted implementation of monitoring strategies that quantify the impact from these events to safeguard the wealth of subsistence, spiritual, and commercial resources for Indigenous and non-native people alike. This study is guided by concerns proposed by Lummi community members. Lummi Nation has been harvesting shellfish in Northwest Washington since time immemorial, and algae events are common in the Pacific Northwest. Our study location is the Salish Sea in Northwestern Washington State, as well as shellfish from California, to test the reliability of regionally developed assays. Quantitative Polymerase Chain Reaction (qPCR) probe assays for algae that produce YTX along the west coast of the United States are in development, for the following species: (1) Protoceratium reticulatum, (2) Lingulodinium polyedrum, and (3) Gonyaulax spinifera, which have been implicated in the shellfish die-offs. The use of qPCR with environmental DNA samples from both marine waters and within shellfish tissue is a novel approach to detect and quantify YTX-producing algae.

Do Lake Trout foraging habits affect mercury biomagnification?

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Mercury (Hg) is a toxic contaminant that threatens the health of aquatic ecosystems and species. At high Hg concentrations ([Hg]), human consumption of fish can be harmful and safety advisories are issued for subsistence and sportfishing. In the long-lived, piscivorous Lake Trout (Salvelinus namaycush), [Hg] were among the highest measured in western U.S. National Parks, exceeding ecological (>90 ng/g wet weight (ww)) and human health benchmarks (>300 ng/g ww). Fish [Hg] across individuals and lakes varied widely, however, which may result from differences in foraging habits, growth rates, and age. In this ongoing study, we are sampling aquatic food web components (i.e., algae, zooplankton, benthic macroinvertebrates, prey fishes, and Lake Trout) from lakes in four of Alaska's National Parks and Preserves for dietary stable isotopes and [Hg] to reveal trophic pathways that may reduce or enhance Hg biomagnification (i.e., increasing [Hg] with successive trophic levels). Preliminary data from Lake Clark shows Lake Trout (–25 ± 3 ‰ delta13C) as integrators of pelagic (–30 ‰ delta13C) and littoral (–18 ‰ delta13C) food chains – indicating that Hg is transferred to top predators from both energy pools. The average [Hg] of Lake Trout was 390 ± 174 ng/g ww, a level that requires human consumers limit their consumption to < 1 serving per week. Mean Lake Trout [Hg] was 18x higher than the average pelagic prey fish and 7.5x higher than the average littoral prey fish; suggesting more Hg may be available from the littoral food chain. Further analyses will investigate food web contributions (e.g., proportions of dietary littoral carbon) and environmental correlates of Lake Trout [Hg]. Due to the wide variability in Lake Trout [Hg], we will also continue to explore potential methods of identifying which fish to avoid at harvest based on size, body morphology, or harvest location.

Patterns of aquatic insect emergence in cold and warm urban streams in Anchorage

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Aquatic insects are important food resources for juvenile salmon and have complex life cycles, including larval aquatic stages and adult terrestrial stages. Recent research suggests that land use and stream temperature may act jointly to influence the timing and duration of insect emergence during the summer months. As climate change and urbanization shift stream temperatures, insects may also shift their emergence timing, which could result in changes to food abundance and quality for juvenile salmon. This pilot study used floating emergence traps to collect emerging insects weekly in a cold stream (North Fork Campbell Creek) and a warm stream (South Fork Chester Creek) in Anchorage from June - October 2022. We predicted that in warmer streams, the timing of insect emergence would happen earlier in the season and the duration of emergence would last longer. Insects were identified to the family level and compared between streams. Timing and duration of emergence differed among insect families without a consistent pattern overall when comparing cold and warm streams. For example, Perlodidae, a stonefly family, reached its peak emergence nearly two months earlier in the warm stream, while also having a five week longer emergence duration compared to the cold stream. In contrast, Baetidae, a mayfly family, reached its peak emergence in the warm stream one month earlier than the cold, but in the cold stream the duration of emergence was six weeks longer than the warm. These samples will also be analyzed for metals content to determine the stoichiometric niche of contaminants from emergent aquatic insects to neighboring riparian food webs. Future studies could expand on this work to collect emergence data across land use and temperature gradients in the greater Cook Inlet region to better understand the phenology of salmon food resources in their freshwater habitats.

Stream-specific declines in chum salmon body size from 2013-2022 in southeastern Alaska

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Declines in the body size of chum salmon are widely reported by literature in Alaska, primarily centered on aggregated fisheries statistics. We verified temporal declines in Alaska by tracking the size of chum salmon returning to specific streams between 2013-2022 in southeastern Alaska. This project was part of a larger study by the Alaska Department Fish & Game on the effects of hatchery straying on the fitness of wild chum salmon. We examined the lengths of hatchery stray and wild origin post-spawned summer run female chum salmon in three northern southeast Alaskan streams; Fish Creek (AWC 111-50-10690), Sawmill Creek (AWC 115-20-10520), and Prospect Creek (AWC 111-33-10100). We found that hatchery origin females returned to spawn at a smaller length than wild females across all three streams. Streams differed in the rate at which fish of both origins decreased in size, with hatchery strays decreasing at the same or greater rate than wild chum salmon. Based on length-fecundity relationships, we estimated that age-4 females from Fish Creek are losing an average (± 1 SE) of 52 (± 23) eggs per year, Sawmill Creek are losing an average of 12 (± 22) eggs per year, and Prospect Creek are losing an average of 51 (± 23) eggs per year. Hatchery fish are released to the marine environment at a larger size than wild emigrating fish. This indicates that hatchery fish are growing slower than wild fish or that faster growing hatchery fish are selectively consumed in the marine environment. The impacts of reduced size on fecundity are potentially leading to an economic loss in southeast Alaska’s chum salmon sac roe industry.

Woody debris export to large rivers following wildfire

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Forest fires are known to contribute to the sediment and carbon budgets of freshwaters, with potentially large effects on their ecology. However, quantification of these effects is often limited to the effects of inorganic material (i.e., mudslides and fine particulate sediment export), and often to wadeable streams. Substantially less is known about the magnitude of large woody debris (i.e., downed trees) that can be exported by these same disturbances, especially into large rivers. Yet this large woody debris in large rivers can represent important flow refugia and habitat for juvenile and adult fishes and hotspots of production, as well as posing a potential danger to navigation and infrastructure such as bridges and fish wheels. In this poster, I describe a study I carried out in summer 2023 on the Chena River in and around Fairbanks, Alaska. Key findings are that large wood is surprising difficult to ascribe burned/unburned status once it has entered a river, due to blackening of wood in water with chemical reduction. Additionally, given the 100+ year residence time of large woody debris in large rivers, paired contrasts of burned/unburned watersheds lose meaning; all watersheds in the area surveyed have burned within the past century. Although it cannot differentiate burned from unburned wood, underwater channel feature mapping using SONAR was demonstrated to effectively identify submerged large woody debris and may be beneficial for fish habitat assessment moving forward.

Juvenile Coho Salmon growth patterns track biennial Pink Salmon spawning abundance fluctuations in a southeast Alaska watershed

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Watersheds that support Pacific Salmon (Oncorhynchus spp.) runs often experience acute pulses of marine derived resources (MDR) in the form of salmon eggs, which have been shown to positively impact the growth of stream-dwelling fish. In southeast Alaska, Pink Salmon (O. gorbuscha) are widely distributed and frequently exhibit biennial spawning abundance fluctuations, where odd years support larger spawning returns and supply larger MDR fluxes relative to even years. However, it is not well known whether Pink Salmon spawning abundance fluctuations confer disparate foraging and growth opportunities to stream-dwelling fish between years. We explored this hypothesis using a bioenergetic simulation paired with empirical field observations of juvenile Coho Salmon (O. kisutch) annual growth trends, collected across two years in a southeast Alaskan watershed that supports spawning Pink Salmon. Bioenergetic simulations showed that Pink Salmon spawning abundance fluctuations result in large differences in Coho Salmon growth between years, and empirical data support that this mechanism facilitated significant growth disparity of age-1 Coho Salmon between years. Our findings indicate that biennial Pink Salmon spawning abundance fluctuations may confer disparate growth outcomes for juvenile Coho Salmon between high- and low-abundance years, and highlight the potential importance of Pink Salmon life-history and spawning patterns to juvenile Coho Salmon growth in coastal drainages of southeast Alaska. Given recent shifts in coastal climatic conditions, and increasing Pink Salmon abundance in the Gulf of Alaska, improved understanding of this linkage

may aid in deciphering future shifts of Coho Salmon productivity across drainages of southeast Alaska.

mtDNA on Pacific Herring in the Eastern Bering Sea

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The genetic diversity and population structure of Clupea pallasii in the Eastern Bering Sea have not been observed. To identify populations and relationships between Eastern Bering Sea herring we will take a subsample from 85 hauls and test the mitochondrial DNA at the control region site in the herring sequence. Understanding the different population structures will better aid in fisheries management in Alaska and elsewhere. The more information on fisheries populations will lead to better conservation of this important species.

Fine-scale Prediction of Freshwater Habitat Potential for Chinook Salmon (Oncorhynchus tshawytscha) across the Yukon and Kuskokwim River Basins, Alaska

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Chinook Salmon (Oncorhynchus tshawytscha) are an important commercial, subsistence, and recreational fishery resource in Alaska, and recent declines in escapement have resulted in closures of some Chinook Salmon fisheries. Research into environmental factors involved in the decline of salmon stocks has exposed information gaps regarding fine-scale freshwater habitat quality known to influence Chinook Salmon productivity. We developed spatially-explicit intrinsic habitat potential models for Chinook Salmon freshwater spawning and rearing life-stages based on geomorphic stream network attributes (e.g., gradient, mean annual flow, valley bottom width). Model predictions were applied to individual stream reaches and summarized across synthetic stream networks derived from high-resolution (5-meter) digital elevation models covering the Yukon River drainage west of the US-Canada border and the entire Kuskokwim River drainage (total stream length ~667,000 km across 1.3 million km2 area). Approximately 87,500 and 39,500 stream km were predicted to represent moderate to high (index scores 0.6-1.0) Chinook Salmon rearing and spawning habitat suitability, respectively. We compared habitat suitability scores to the known distribution of rearing and spawning habitats from multiple data sources using area-under-the-curve (AUC) analysis. On average and by HUC8 hydrologic units, 69.3% +/- 3.1% SD (range 62.8-74.7%) of rearing reaches and 65.6% +/- 4.9% SD (range 55.1-73.9%) of spawning reaches with suitability > 0.6 overlapped the known distribution of fish habitat use. Our high-resolution, spatially explicit dataset provides many options for summarizing and visualizing habitat suitability across areal units (e.g., river basins, land management boundaries) and assessing the potential for high suitability habitats outside the known distribution of Chinook Salmon at scales useful for managers and the research community. Finally, we are developing a decision support tool based on input from stakeholders and tailored to the specific applications of this dataset to facilitate conservation and management of Chinook Salmon in the Yukon and Kuskokwim River basins.

Using environmental DNA to assess Arctic grayling and Chinook salmon distribution in the Chena River

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We are conducting environmental DNA (eDNA) analyses to assess spatiotemporal variation in Arctic Grayling (Thymallus arcticus) abundances at seven locations located above, within, and below Chinook Salmon (Oncorhynchus tshawytscha) spawning grounds on the Chena River throughout the period of adult salmon migration. The Chena R. Chinook Salmon population has been declining since the 2010's, with the lowest run on record reported in 2022. Whether and how this decline in Chinook abundance impacts the resident grayling is not well understood. Our work aims to provide insights on potential interactions between these species centered around the arrival of spawning Chinook adults. We tested and optimized an existing species-specific quantitative PCR (qPCR) assay to estimate changes in grayling abundance at seven Chena River sites visited three times in 2022. The collecting events took place before, during, and after Chinook spawning. This work leverages Chinook salmon count data produced during a Yukon River Basin salmon eDNA study collected in partnership with the Alaska Department of Fish and Game.

Comparing microsatellite and reduced representation sequencing for population genetics: an Arctic grayling (Thymallus arcticus) case study

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Different sources of data and analysis types frequently yield contrasting results in population and evolutionary genetics studies. For example, phylogenetic reconstructions derived from nuclear or mitochondrial DNA sequences may support conflicting tree topologies due to differences in patterns and processes underlying their evolution. In population genetics, microsatellite genotyping was established early as an efficient and effective method for obtaining genetic variability information from large sample sets. However, modern DNA sequencing technology now supports the rapid generation of genotype datasets of vastly larger scales. Here we present a comparison between microsatellite and reduced-representation sequencing approaches to examine genetic variability in grayling populations. Specifically, we examined genetic connectivity of Arctic Grayling (Thymallus arcticus) from several sampling locations using genotypes from 12 polymorphic tetranucleotide microsatellite loci designed specifically for Arctic grayling and using genotypes from thousands of anonymous single nucleotide polymorphic (SNP) loci generated through restriction site associated DNA sequencing (RAD-Seq). Both datasets were generated from the same set of individuals. Both approaches found little differentiation among fish sampled in rivers within the Chena River drainage, but strong genetic differences between a population from the Nome River compared to the Chena River drainage populations. However, there is a substantial difference in the fixation index value (Fst) between Nome and Chena R. fish calculated from the two datasets with the SNP dataset yielding a much larger estimate of differentiation. We

discuss this finding in the context of existing literature comparing these two genotyping approaches.

Seasonal increase in size and maturity of Armhook squid, Berryteuthis magister, in Southeast Alaska

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Coastal squid are commonly a keystone species serving as a vital link in marine food webs. Berryteuthis magister, the armhook squid, is a significant contributor to the coastal ecosystem of Southeast Alaska. Yet, research regarding early life stages, life history, ecology, and behavior remain data poor and relatively unknown in this region. In recent years, an increased abundance of B. magister has been reported by Juneau-based sportfishermen. We tested our hypotheses that squid from Southeast Alaska were similar in their size, weight, and maturity, compared to squid in areas from their range where they have been assessed. In 2022, we subsampled from the Juneau sport fishery catches in April, June, July, and August and measured size (mm), total wet weight (g), maturity stages, and gonadosomatic index (GSI) from 102 individual squid. Results indicated a 30% increase in size (increase of 59.2 mm) and 112% increase in total wet weight (increase of 393.7 g). We found evidence of a general increase in their maturity and GSI that supports that individuals matured from subadults in April to adults by August. Our results are consistent with that of prior studies (Katugin et al. 2013 and Arkhipkin et al. 1996) and suggest a peak spawning season in fall, where squid may obtain their largest sizes. Future research steps will include sampling of squid yearly and extending sampling seasons to create a comprehensive size and maturity spectrum for this species. These data will contribute towards the knowledge gap regarding an important coastal species and to inform fishery stakeholders.

Validating morphometrics as a non-lethal tool to determine Arctic grayling sex

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Graylings (Thymallus spp.) possess an elongated dorsal fin that can be sexually dimorphic as demonstrated in European Grayling (Thymallus thymallus). Arctic Grayling (T. arcticus) are assumed to follow these trends, but empirical evidence is lacking, especially in Alaska. We utilized computer imaging software to measure 23 morphometrics on 97 Arctic Grayling of known sex in Interior Alaska. We developed a set of binomial models that validated morphometrics as a reliable predictor of Arctic Grayling sex in Interior Alaska for fish >250 mm fork length. Dorsal fin length was a useful predictor of sex, although models containing additional morphometrics were more accurate.

Exploring the Population Dynamics of Invasive Signal Crayfish in the Buskin Watershed, Kodiak Island, Alaska

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Over the last 20+ years an invasive signal crayfish (Pacifastacus leniusculus) population has become established in the Buskin Watershed on Kodiak Island, Alaska posing a significant threat to native populations of pacific salmon and other freshwater-living species. Their invasive range largely overlaps with sockeye, pink, and coho salmon spawning grounds and may contribute to the noticeable declines in sockeye salmon returning to the watershed over the past twenty years. This has raised enormous concern among the Sun'aq Tribe of Kodiak (STK) as Buskin sockeye salmon are important cultural resources to tribal members contributing to their subsistence way of life. To pair with ongoing eradication efforts, research is being conducted by the STK Natural Resources Department investigating Buskin signal crayfish population dynamics and their impacts on the ecosystem. To investigate Buskin signal crayfish dietary preferences throughout the year, C and N stable isotope analysis is being performed focusing in on any significant changes in crayfish isotopic signatures from spring to fall when more energetically beneficial nutrients (e.g., salmon carcasses and salmon eggs) are accessible to them. Diurnal and seasonal crayfish movement over the course of their active season is being examined through acoustic telemetry to determine their migratory ability and periods of highest activity. Mark-recapture experiments are also being conducted to assess crayfish population abundance over time throughout the high-density areas of Buskin Lake. Ongoing single-species qPCR eDNA monitoring operations to detect signal crayfish presence within and outside of the Buskin Watershed are helping us better understand population range in under-surveyed areas and may greatly increase the chances of eradicating newly introduced populations in other Kodiak drainages if transported. Established invasive signal crayfish populations are difficult, if not impossible, to eradicate, but through continued research and ongoing eradication effort, we hope to learn about and minimize the effects that the signal crayfish have on the Buskin Watershed.

Ages and Spawning Times of Berryteuthis magister Squid in Southeast Alaska

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Berryteuthis magister is a gonatid squid ranging from Southeast Alaska to Japan that is important in coastal meso and epipelagic ecosystems and is of interest to sport fisheries. However, little is known about the Southeast Alaska subpopulation. An initial step to understanding this group is to acquire evidence for the periodicity of their life cycle and associated age structure. From squid captured in this region, we used statoliths to infer their age (statoliths = biogenic carbonate structures analogous to fish otoliths). We hypothesized that squid in Southeast Alaska have a broad spawning period evidenced by an intra-annual age structure. In our studies, we tested our hypotheses using standard age inference methods (Arkhipkin et al. 1996). Squid were collected by Juneau-based fishermen using jigs at depths that varied from 15 m to 200 m, three times in 2022 (April, June, and July). During this period, 27 squid were aged and cumulatively averaged 297 days ± 19 SE (standard error). Intra-annual differences in 2022 included squid ages in April averaging 284 days ± 24 SE (N = 10), June averaging 311 days ± 15 SE (N = 10), and July

averaging 296 days ± 18 SE (N = 7). These data support a nuanced intra-annual age structure, a broad spawning period, and are the first to examine the life cycle dynamics for this species within this region. Additionally, we demonstrate the utility of age inference methods to identify previously unknown spawning periods. Future research steps will include a statolith age validation study that can be used to establish a baseline of data for this species to inform future fishery management plans.

How much aged carbon is used by Arctic fishes?

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Climate change has generated interest in aged carbon as an increasingly important energy pathway in aquatic food webs as melting glaciers and thawing permafrost release older carbon. Fishes in the nearshore Beaufort Sea, Alaska, assimilate a variety of carbon sources as they feed across Arctic aquatic habitats from freshwater mountain streams, coastal plain lakes and streams, nearshore lagoons, and marine shelf. This work builds upon the 1977-1982 baseline radiocarbon data set produced by Schell (Science, 1982), prior to rapid climate warming. Radiocarbon content was measured in muscle tissue from 10 species and individual fish were classified by their primary organic matter source as terrestrial (OMterr), marine (OMmar), or a mixture (OMmix) based on stable isotope (δ13C and δ15N) mixing models. Radiocarbon content spanned a wide range, reflecting nearly modern to moderately aged carbon (2325 yBP). Fish that primarily used OMterr incorporated the oldest carbon but were also highly variable; individuals that primarily used OMmar incorporated the youngest carbon, while those that used a mixture had intermediate use of aged carbon. The entire range of aged carbon use occurred in diadromous Dolly Varden (Salvelinus malma, Iqalukpik in Iñupiaq) which used older carbon at smaller sizes following outmigration from freshwater rearing habitats, and younger carbon at larger sizes with marine feeding. Radiocarbon content in this study is similar to that of fish collected prior to rapid warming when accounting for temporal shifts in atmospheric bomb-spike carbon, suggesting that use of aged carbon has not dramatically changed in this part of the high Arctic.

Applying an integrated population model to understand marine processes affecting Western Alaskan Chum salmon productivity

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Western Alaska Chum Salmon typically monitored using the spawning populations of the Yukon, and Kuskokwim rivers, have experienced recent precipitous declines. These fish have immense cultural, ecological, and economic value. Stock-recruit models, while frequently used to quantify fish population productivity and guide harvest recommendations, often fail to incorporate important environmental processes due either to a lack of data or insufficient mechanistic

understanding. This results in a large amount of unexplained variance in estimates of abundance at the end of the juvenile stage, a time period known to determine future cohort strength and productivity in many species. To address this shortcoming, we will develop an integrated population model (IPM) that incorporates environmental information, such as in situ observations of lower trophic levels, into estimates of juvenile survival using Western Alaska Chum salmon. Importantly, this work will incorporate a novel prey index into productivity estimates and provide insight into processes that influence the juvenile life stage in Yukon and Kuskokwim Chum salmon in order to test hypotheses related to recent declines.

Arctic Grayling reintroduction in Michigan: A New Hope

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Arctic Grayling were extirpated from Michigan in 1936. Several factors led to their demise including over-fishing, habitat destruction from large-scale logging, and introductions of Brook Trout and Brown Trout. Subsequently, Brook and Brown trout have become the dominant salmonid species in Michigan streams. Past attempts to restore Grayling to their historic home waters in Michigan were unsuccessful. Recent advances in the understanding of Grayling have led to successful reintroductions in Montana. These successes have renewed interest in restoring naturally reproducing populations to Michigan, but many unknowns need to be addressed for such efforts to succeed. Predation and competition with resident trout may be two of the greatest challenges to overcome in re-establishing a self-sustaining population of Arctic Grayling in Michigan's cold and cool water streams. In this study, we seek to gain insight to these interactions between age-0 Grayling and young Brook and Brown trout. Grayling were incubated in East Lansing, MI from eyed eggs, provided by Ruth Burnett Sport Fish Hatchery in Fairbanks, Alaska. Using experimental laboratory streams, we employed an adaptive design to explore predation rates of age-1 Brook and Brown trout on newly hatched Grayling fry and two-month competition trials between age-0 Grayling, Brook and Brown trout. Preliminary results of this research indicate a two-fold impact of young Brown Trout on age-0 Grayling through high predation and strong competitive interactions. Age-1 Brook Trout will prey upon Grayling fry, albeit at a rate lower than that of Brown Trout, but growth of age-0 Grayling may not be inhibited by age-0 Brook Trout. Understanding early life survival rates and suitable fish communities will help better target suitable streams and estimate numbers of eggs required for future streamside rearing on chosen streams to increase the likelihood of establishing successful populations.

Trophic resource use by Arctic fishes across Beaufort Sea coastal lagoons

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The Arctic is heating up nearly four times faster than the rest of the planet as reflected by warming ocean and coastal waters, reduced sea ice extent, thawing permafrost, and eroding coastlines. These changes affect the availability of organic matter from various marine or terrestrial origins that form the base of coastal lagoon food webs. The consequences to nearshore food webs for fish are manifested through shifts in their species composition, abundance, growth, and reproduction. Such adjustments can differ regionally or by species. Here, we aim to determine trophic resource use in multiple marine and diadromous fish species from several Arctic Beaufort Sea coastal lagoons using short and long time-scale markers of diet. First, a short-term diet snapshot was determined from stomach contents of Arctic fishes (saffron cod, Arctic cisco, least cisco, fourhorn sculpin) from three regions (Utqiaġvik, Prudhoe Bay, Kaktovik). Analysis of diet composition revealed differences among species and by region. Secondly, trophic niche width, trophic position, and ultimate carbon sources of these four fish species at longer time scales (months) were determined by bulk carbon and nitrogen stable isotopic analysis, and compound-specific amino acid carbon stable isotope analysis. Long-term markers indicated that marine residents assimilated carbon at higher tropic levels with strong connections to marine primary producers. Conversely, diadromous species feed at lower trophic levels and source carbon from a wider variety of organic matter sources. Our findings provide a better understanding of the current trophic resource for fish species that are important ecologically and for local subsistence. This work demonstrates the diversity of carbon sources that are seasonally available to sustain coastal fish populations in the context of anticipated ecosystem disruptions associated with climate warming.

Ability of Northern Pike in Southcentral Alaska to use marine habitats revealed using strontium isotope analyses of otoliths

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Although Northern Pike are native north and west of the Alaska Range, they do not naturally occur in Southcentral Alaska. After their anthropogenic introduction to the southcentral region in the 1950's, they have spread rapidly to a variety of lake, stream, and river habitats. As an apex predator, they can greatly affect fish assemblages by preying on vulnerable natives species such as juvenile salmon. This can have devastating consequences on ecologically, culturally and economically important fisheries. Over the last decade, significant resources from multiple organizations have been allocated toward invasive Northern Pike eradication, suppression, research, monitoring, and outreach. A management plan for mitigating invasive Northern Pike in Southcentral Alaska, published in 2022, flagged a need for research on the dispersal and movement of Northern Pike in the region. Recently, Northern Pike have been discovered in several unexpected locations. We analyzed the strontium isotope composition (87Sr/86Sr and 88Sr concentration) in the otoliths of n=57 invasive Northern Pike to compare with a strontium isotope map we have initiated for the region to better understand the movement ecology of this predatory, freshwater fish. Our data indicate an alarming behavior for three individuals which appeared to briefly move through the marine habitats of upper Cook Inlet and disperse to new watersheds on the Kenai Peninsula and in Anchorage. While pike are known to live in brackish waters of the Baltic Sea, this behavior was unknown in Alaska. While Cook Inlet was thought to be a barrier to Northern Pike dispersal from the Susitna River, it appears many more habitats are vulnerable to invasion, particularly on the upper Kenai Peninsula and west Cook Inlet. There is

an urgent need to further understand the prevalence of this behavior as well as the dispersal and movement of Northern Pike in Southcentral Alaska.