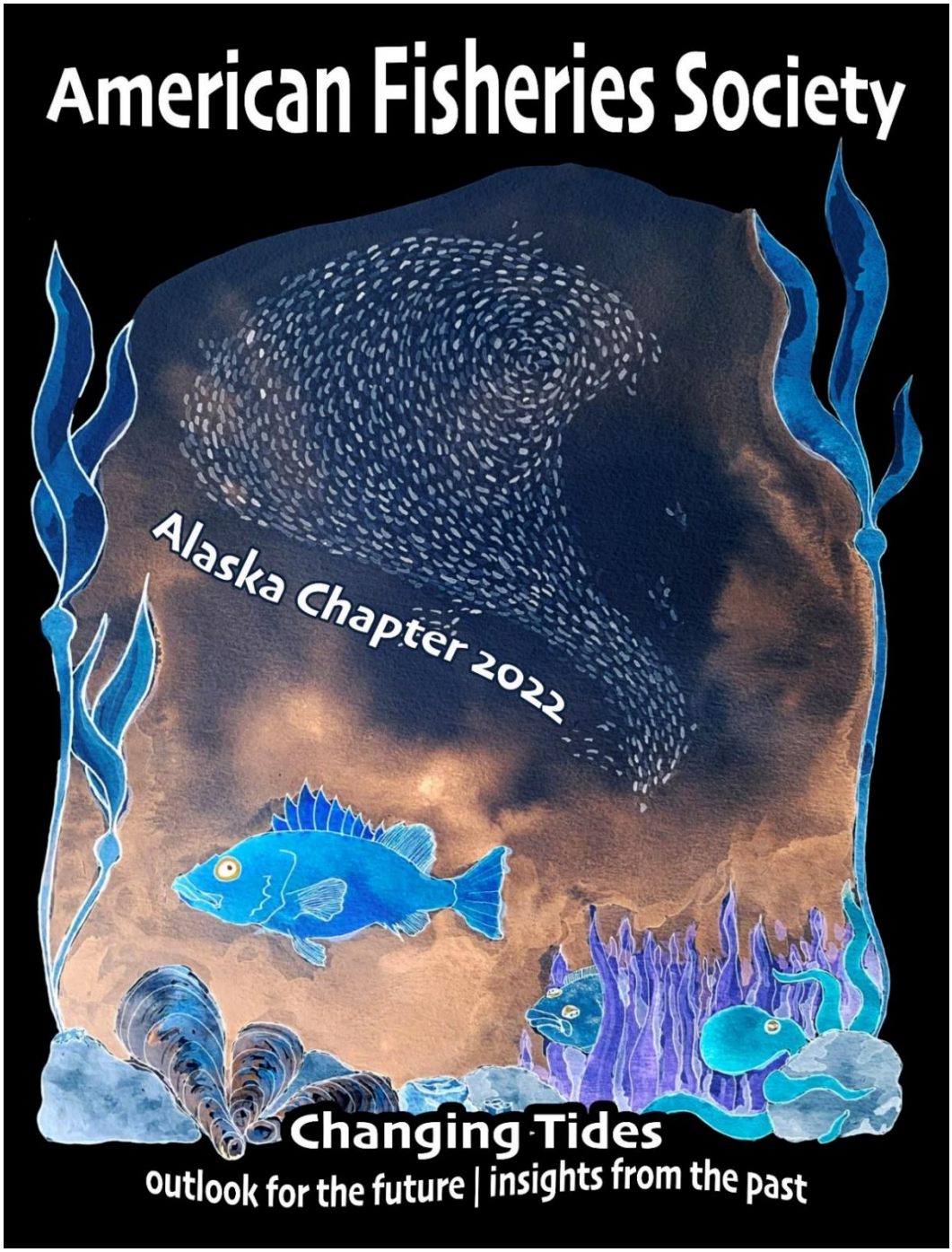

48th Annual Virtual Meeting

February 23 – March 4, 2022

Many Thanks to Our Sponsors!!

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Cover art by Celia Bower

Celia is an artist, snowboard enthusiast, and all around nature lover. She grew up commercial fishing in Southeast, Alaska which led to getting her Bachelor of Science in Marine Biology. After finishing her degree, she started to paint and draw after years of not engaging with art. She is self-taught in watercolor, acrylics, and pen illustrations. Additionally, Cecilia has a smidge of experience in graphic design work and incorporates that into some of her pieces. She derives most of her inspiration from the natural world although she finds it interesting to experiment with intense or different colors to convey a message or certain feel. She loves being creative and does her best to think outside the box by combining what she learned from her science training with art theory.

Website: celiabowerart.com
Instagram: @celiabowerart

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Letter of Welcome

Greetings!

Welcome to the 48th Annual Meeting of the Alaska Chapter of the American Fisheries Society. Our Chapter has been going strong for almost a half a century! Given that we have been working these past three years through the disruptions caused by the covid-19 pandemic, we are heartened by the amount of volunteer work our members have done to keep the Chapter vibrant, including pivoting (twice now) to a virtual meeting; weighing in on habitat issues affecting Alaska's fisheries; working to elevate justice, inclusion, and diversity in fisheries; and continuing to maintain high standards for the fisheries profession.

This year's meeting theme is **Changing Tides: Outlook for the Future | Insights from the Past**. It is safe to say that all of us are feeling pushed around by external forces beyond our control these past few years. But who better than fisheries folks to roll with change, from Indigenous Alaskans whose ancestors have lived here since time immemorial and have seen it all before, to fishermen who know they can never expect next year to be like the last, fisheries ecologists who recognize just how complex the concept of 'equilibrium' is, and fisheries students who are on the forefront of reenvisioning how we will work in the future.

A testament to our membership's ability to roll with change is this year's meeting: 85 submitted abstracts, nine submissions to the Film Festival, three plenary speakers, and six affinity groups hosted by the membership. Be sure to check out the Community Board to join coffee breaks (you'll find them at the "Meet-Ups and Virtual Meets" section), post a new discussion topic, and propose a new meet-up. And while you attend the meeting, please keep in mind our student members, who have not had the kind of in-person networking opportunities many of us had early in our careers. Check out their fantastic talks, join the Mentorship Mixer, drop in on some coffee breaks, and by all means keep those job postings coming!

We cannot thank enough the volunteers who helped put this meeting together. A special thanks goes out to our meeting sponsors: North Pacific Research Board, GCI, Sealaska, and the Southeast Fish Habitat Partnership. These organizations stood with us while we had to abandon our plans for a Juneau in-person meeting. Their contributions helped us keep registration costs very low and will allow us to direct more revenue towards supporting participation in in-person meetings in the future. Don't forget to check out the Silent Auction, a long-standing tradition.

Thanks for keeping our Chapter going and we look forward to seeing you at the meeting.

Sincerely,

Sue Mauger

President

Alaska Chapter AFS

Megan McPhee

President-Elect

Alaska Chapter AFS

AFS Meetings 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's 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.

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 an 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 Alaska Chapter Executive Committee

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Megan McPhee
President Elect

Stephanie Quinn-Davidson
Past President

Erik Schoen
Vice President

Scott Ayers
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Trent Dodson
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Cheryl Barnes, DEIC

Taylor Cubbage

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Heidi Ingram

Sara Miller

Keenan Sanderson

Erik Schoen

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Janessa Esquible
Sara Gilk-Baumer
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Ray Hander, Molly Ahlgren Scholarship
Vacant, Wally Noerenberg Award

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Joel Markis (Co-Chair)
Sue Mauger (Co-Chair)

Financial Assets Oversight Committee:
Ray Hander, Chair

Promotions:
Bill Bechtol, Newsletter Editor
Hamachan Hamazaki, ListServ Administrator

Meeting Schedule at a Glance

For the most current information, please check the meeting website:
https://whova.com/portal/webapp/acaam_202202/

Date/Time	Activity/Event
Wednesday Feb 23	
12:00 – 1:30pm	Github for fisheries scientists
Thursday Feb 24	
9:00 – 11:00 am	WESPAK-2.0 Orientation
Friday Feb 25	
9:00am – 5:00 pm	Intro to R Day 1
Monday Feb 28	
9:00 am – 5:00 pm	Intro to R Day 2
2:30 pm – 6:00 pm	Science Communication: Tips from a former journalist turned scientist
7:00 pm – 8:30 pm	Film Festival
Tuesday March 1	
8:00 am – 9:30 am	Plenary: Direct and indirect effects of ocean acidification on juvenile pink salmon physiology and biominerology
9:30 am – 10:00 am	Coffee Break
10:00 am – 12:00 pm	Morning Session: Hatchery-Wild Interactions
12:00 – 1:00 pm	Lunch Break
12:00 – 12:55 pm	Mentorship Mixer
1:00 pm – 3:00 pm	Afternoon Session: Hatchery-Wild Interactions
1:00 pm – 3:00 pm	Contributed Talks: Fish Organismal Biology & Ecology
3:00 pm – 4:00 pm	Coffee Break
3:15 pm – 4:00 pm	Affinity Group: Women and Underrepresented Genders
4:00 pm – 5:15 pm	Session: Big Swings in Salmon Production
5:15 pm – 6:00 pm	Affinity Group: BIPOC (Black, Indigenous, People of Color)
7:00 pm – 8:00 pm	Fish Trivia
Wednesday March 2	
8:30 am – 9:30 am	Plenary: Marine predators provide the first signals of a forage fish collapse and large-scale ecosystem disruption in the Northern Gulf of Alaska
9:30 am – 10:00 am	Coffee Break
10:00 am – 12:00 pm	Morning Session: Navigating the Future and Learning from the Past - Groundfish Management and Research
10:00 am – 12:10 pm	Contributed Talks: Fish-Freshwater Habitat Relationships
Date/Time	**Activity/Event**

12:00 pm – 1:00 pm	Lunch Break
12:15 pm – 1:30 pm	Annual Chapter Business Meeting
1:30 pm – 3:00 pm	Afternoon Session: Navigating the Future and Learning from the Past – Groundfish Management and Research
1:30 pm – 3:00 pm	Contributed Talks: Fish-Freshwater Habitat Relationships
3:00 pm – 4:00 pm	Coffee Break
3:15 pm – 4:00 pm	Affinity Group: People with Disabilities (including physical conditions, neurodivergence, mood disorders, and chronic illness)
4:00 pm – 5:10 pm	Contributed Talks: Marine Ecology
5:15 pm – 6:00 pm	Affinity Group: LGBTQIA2S+ (Lesbian, Gay, Bisexual, Transgender, Queer/Questioning, Intersex, Asexual, Two-spirit +)
7:00 pm – 8:00 pm	A Chat with Laine Welch
Thursday March 3	
8:30 am – 9:30 am	Plenary: Keynote Speaker Richard Chalyee Éesh Peterson
9:30 – 10:00 am	Coffee Break
10:00 am – 12:15 pm	Morning Session: Future Innovations in Fishery Data Captures and Analyses
10:00 am – 12:00 pm	Tamamta (All of Us): Transforming Western and Indigenous Fisheries and Marine Sciences Together
12:00 pm -1:00 pm	Lunch Break
12:15 pm – 1:00 pm	Affinity Group: Dependent Caregivers
1:00 pm – 2:00 pm	Contributed Talks - Human Dimensions/Pedagogical Issues
1:00 pm – 3:00 pm	Afternoon Session: Application of genomics tools for fisheries management in Alaska
3:00 pm – 4:00 pm	Coffee Break
3:15 pm – 4:00 pm	Affinity Group: First Generation College Students (Past & Present)
4:00 pm – 5:00 pm	Application of genomics tools for fisheries management in Alaska
Friday March 4	
10:00 am – 12:00 pm	Hosted Dialogue : Racial Equity in Fisheries Education, Research, and Governance in Alaska

Wednesday, February 23

Workshop: GitHub for Fishery Scientists

Course Time: 12:00 – 1:30 PM

Course Location: Virtual workshop

Instructors: Sara Miller, ADF&G Biometrician, sara.miller@alaska.gov

Justin Priest, ADF&G Fisheries Researcher; justin.priest@alaska.gov

Cost: Free! Minimum attendance is 5.

Description: GitHub is a website and software that can greatly assist scientific researchers. For those scientists that use R and RStudio, adding git and GitHub to their workflow has many benefits for collaboration and sharing results. The short presentation, demonstrations, and discussion will review the potential improvements and advantages of GitHub, while demonstrating its ease of use! The main impediment to not using GitHub is the initial startup and trying to figure out how to begin. We will demonstrate how to get started and how to use the RStudio features daily. This presentation will be highly valuable for researchers that collaborate on analyses and want to improve their data management practices.

Instructor Sara Miller is a salmon and herring Biometrician for ADF&G. Sara uses GitHub and other websites and software such as GitLab to collaborate and facilitate sharing code with her fellow colleagues and other fisheries researchers.

Instructor Justin Priest is the Southeast Alaska Coho Salmon Research Biologist for ADF&G. Justin specializes in using modern computing tools to help guide management and enjoys sharing this knowledge with others.

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

Justin Priest

Sara Miller

Thursday, February 24

Workshop: WESPAK-SE 2.0 Orientation

Course Time: 9 AM -11 AM

Course Location: Virtual workshop

Instructor: Khrystl Brouilette, SAWC/SEAKFHP Project Associate; khrystl@sawcak.org

Cost: Free! Minimum attendance is 5; no maximum

Description: The Wetlands Ecosystems Services Protocol for Southeast Alaska is a rapid assessment tool with a web mapping application designed to help answer ecosystem-based questions as posed in the WESPAK-SE office form. The original application was a product of collaboration between the Southeast Alaska Land Trust and the U.S. Fish and Wildlife Service, and was hosted by the Southeast Alaska GIS Library at the University of Alaska Southeast. The original application has been updated and is now hosted by the Southeast Alaska Fish Habitat Partnership in ArcGIS online. The new WESPAK-SE 2.0 is designed to be informative and user-friendly. This presentation will give an overview of the WESPAK-SE 2.0 application and will discuss how to access the tool, the layers available, and different use case scenarios for the tool. There will be time for a Q & A session so participants can ask specific questions they may have pertaining to the use of the application. WESPAK-SE 2.0 can be accessed here: https://psmfc.maps.arcgis.com/apps/webappviewer/index.html?id=c30e56d5e1514219ae1cfa7bb30b674f. For more information on this application, please contact khrystl@sawcak.org.

Instructor Khrystl Brouillette is SEAKFHP's Data Project Associate and has been working to rebuild the WESPAK-SE data archive and mapping application.

Khrystl Brouillette

Friday, February 25 & Monday February 28

An Introduction to R for Fishery Researchers

Course Time 9 AM – 5 PM (1.5 hr lunch)

Course Location: Virtual workshop

Instructor: Justin Priest, ADF&G Fisheries Researcher; justin.priest@alaska.gov

Cost: $70; Minimum attendance is 5; maximum 20 students

Description: Whether you have never opened R or are looking to brush up on your R skills, this course will provide helpful tools and tips to improve how you manage and analyze fisheries data. By the completion of the course, students will be able to recognize basic R commands, know the how and why of what code does, create a professional publication-level visualization, perform basic statistical analysis, and have a series of easily perusable resources for future reference. To incorporate different learning styles, we will go through presentations, show demonstrations of how / when to use the code in a fisheries context, use hands-on coding practice, and offer an interactive tutorial to walk students through coding knowledge. The latest (and simplest) coding practices will be taught so that students will have a cutting edge understanding of R. To this end, we will use "tidyverse" techniques and other modern tools. Plotting will be shown using ggplot2 to create beautiful graphics in a simple and fast way. Your instructor will work with each student to ensure that we overcome any obstacle and complete the course with a useful knowledge of R. Though this course does not require any prior R use and will start with no prerequisites, it is recommended that participants are very experienced with computer file / folder structure. Previous knowledge of statistics is very beneficial.

Instructor Justin Priest is the Southeast Alaska Coho Salmon Research Biologist for ADF&G. Justin specializes in quantitative ecology and using modern computing tools to help guide management. Despite these advanced uses, he still remembers his struggles of first learning R and put together this course to make R fun and straightforward for beginners.

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

Monday, February 28

Workshop: Science Communication – Tips from a Former Journalist Turned Scientist

Course Date: Monday, February 28, 2:30 PM – 6 PM

Course Location: Virtual workshop

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

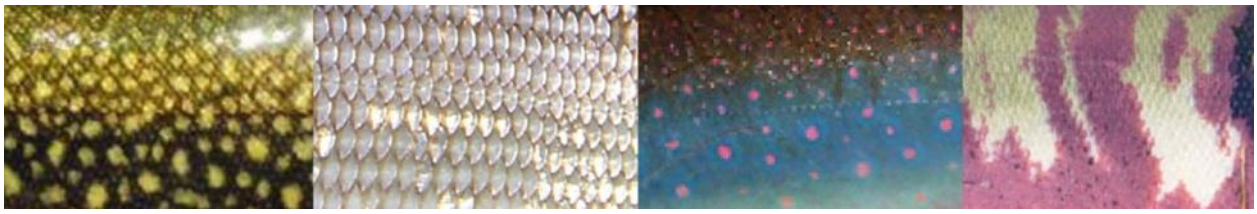
Cost: $40; Minimum attendance is 10 people; maximum 25 students

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 using participants' abstracts. The course will then go over examples of successful scientific communication to the general public and then brainstorm ideas to best share your work. 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 half-day course.

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

Monday, February 28
7:00 – 8:30 pm



Changing Tides: Outlook for the future | Insights from the past
AFS Alaska Chapter Film Festival

Date: Monday, February 28, 7:00 PM – 8:30 PM

Virtual Showing either thru WHOVA or directly on Zoom at this link:
https://zoom.us/j/98152312332?pwd=RVdFamdLY3pyS0ErMlJ6emh6MVNZZz09
Meeting ID: 981 5231 2332
Passcode: 196016

Host: Deborah Hart, Coordinator, Southeast Alaska Fish Habitat Partnership, coordinator@sealaskafishhabitat.org

Description: 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: Changing Tides – Outlook for the Future | Insights from the Past. In addition to films that highlight the work of our membership, we will share films that capture a historical perspective of fish use in Alaska and highlight advances made in learning from the past to advance how we expand knowledge of our fisheries resources and manage for a vibrant future.

Grab some popcorn, sit back, and enjoy!!!!

Films Include:

Science Through an Indigenous Lens
Contributed by: Court Pegus, AFS Alaska Student Member: ccpegus@alaska.edu (UAF College of Rural and Community Development, Kuskokwim Campus and Orutsararmiut Native Council)
Brief film description: Several authors report that teaching styles which frame Western learning concepts in a cultural context are an effective means to engage Indigenous students in a STEM (Science, Technology, Engineering, and Mathematics) focused educational curriculum. Native Hawaiian children and Alaska Native rural middle school students were observed to perform better on subjects in which teaching methods incorporated principles of cultural congruence. Alaska Native students are the smallest demographic of students enrolled in college and represent approximately 250,000 of the 19 million

college students attending schools in the United States and experience some of the highest dropout rates. This pattern prevails throughout all stages of the educational process (kindergarten-college) in almost all public schools in Alaska. Educational ceilings faced by Alaska Native youth hinder advancement to college and reduce opportunities to pursue research careers. The COVID-19 pandemic global outbreak has spread worldwide within the last two years creating observable changes to social practices including teaching customs within a relatively short time scale. In response to this deadly virus, many educational institutes have shifted teaching practices from face-to-face education to remote learning. While live-stream class sessions can be an efficient means of lecturing to large groups of widely dispersed students, this teaching style may not ensure adequate inclusion of physical or cultural activities to enhance the learning experience. It remains unclear how this new digitally-based format of teaching will be perceived by non-traditional and Indigenous students. As a collaborative effort, The Orutsararmiut Native Council and the University of Alaska Fairbanks hosted a science summer course to a diverse cohort of Native students. Course work focused on marine science and STEM education using teaching styles that included face-to-face education as well as remote learning (ZOOM classes). This short documentary presented captures teaching styles that contextualize STEM in a culturally relevant frame of reference and provide an outline and guide for other educators that teach in rural communities. A follow-up study from this effort will examine the instructor's perceptions of student's responses to the two forms of teaching styles as well as challenges associated with placing teaching activities in a cultural framework.
Video length: 18 min 46 sec
URL for online viewing: https://youtu.be/qZx_-ZIjuCs

Yukon River Chinook Salmon Project
Contributed by: Court Pegus, AFS Alaska Student Member: ccpegus@alaska.edu (UAF College of Rural and Community Development, Kuskokwim Campus and Orutsararmiut Native Council)
Brief film description: TBD (coming ASAP!)
Video length: 18 min 46 sec
URL for online viewing: (TBD)

Yukon River Chinook Salmon Project
Contributed by: Katharine Miller, NOAA, katharine.miller@noaa.gov, 907-523-8991
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 min 17 sec
URL for online viewing: https://videos.fisheries.noaa.gov/detail/video/6254648895001/yukon-river-chinook-salmon-project

Mosaic – The Salmon Wilderness of Bristol Bay, Alaska
Contributed by: Daniel Schindler, Jason Ching, and Chris Boatright; University of Washington – Alaska Salmon Program; cboat@uw.edu, 206-930-8979
Brief Film Description: The film highlights the connection between habitat and the long term stability of Bristol Bay's salmon populations and fisheries productivity.
Video Length: 10min 27sec
URL for online viewing: https://vimeo.com/637271167

***Alaska Ecosystem Status Report a Collaborative Approach to Inform Fishery Management**
Contributed by: Jonny Antoni, FeelReel Films: Jonantoni02@gmail.com, 909-605-3539
Brief Film Description: A look inside the development of Alaska's Ecosystem Status Report.
Video Length: 5 min
URL for online viewing: https://players.brightcove.net/659677166001/4b3c8a9e-7bf7-43dd-b693-2614cc1ed6b7_default/index.html?videoId=6287018070001

***2020 Gulf of Alaska Ecosystem Status Report**
Contributed by: Jonny Antoni, FeelReel Films: Jonantoni02@gmail.com, (909)605-3539
Brief Film Description: A video describing the Status of the Gulf of Alaska Ecosystem in 2020
Video Length: 8min 12 sec
URL for online viewing: https://www.fisheries.noaa.gov/media-release/noaa-fisheries-releases-new-video-looking-environmental-conditions-gulf-alaska-2020

*Both videos can be found on the Ecosystem Status Report webpage. This web page also contains the actual Ecosystem Status Reports and In Briefs for the three LME's of Alaska.

The Coast Between
Contributed by: Jonny Antoni, FeelReel Films: Jonantoni02@gmail.com, (909)605-3539
Brief Film Description: The Alaska coastal rainforest center teams up with organizations around the world to understand the incredible forest of and ecosystems of the Pacific Northwest.
Video Length: 5 min
URL for online viewing: https://youtu.be/fG1uhB3qCz0

Shoreline Wild Salmon
Contributed by: Jonny Antoni, FeelReel Films: Jonantoni02@gmail.com, (909)605-3539
Brief Film Description: A glimpse into the troll fishery.
Video Length: 3min 40sec
URL for online viewing: https://youtu.be/9OEcxinVXkg

Why Restoration? Fish. People. The Future.
Contributed by: Ian Johnson, Hoonah Native Forest Partnership: ian.johnson@hiatribe.org
Brief Film Description: Community Forests and locally driven workforce are the crux of the Hoonah Native Forest Partnership. This video dives into why stream restoration is needed and how its linked to maintaining healthy fish, people and communities.
Video Length: 11min 34sec
URL for online viewing: https://www.youtube.com/watch?v=nfff4CcHfIc&t=6s

On the Water with the Southeast Alaska Watershed Coalition and the Youth Conservation Corps in Cube Cove
Contributed by: Khrystl Brouillette, Southeast Alaska Watershed Coalition, khrystl@sawc.org
Brief Film Description: During the summer of 2021, a team from the Southeast Alaska Watershed Coalition (SAWC) worked with the Angoon Youth Conservation Corps (YCC) to remove a culvert from a remote area on Admiralty Island. This fantastic group of youths did a lot of work, alongside SAWC staff, to dig, carry, saw, and finally, remove a culvert that was blocking fish passage near Cube Cove. This project is part of a larger initiative to improve fish habitat across Admiralty Island.
Video Length: 3min 42sec
URL for online viewing: https://vimeo.com/629287158

Tuesday, March 1, 2022

8:30-9:30 AM

Plenary: Direct and indirect effects of ocean acidification on juvenile *Oncorhynchus gorbuscha* physiology and biominerology

Dr. Amanda Kelley (UAF)

Dr. Amanda Kelley's research program encompasses understanding organism-environment interactions in the context of ocean change. Dr. Kelley is keenly interested in characterizing environmental sensitivities and thresholds that exist for high-latitude coastal ecosystems in response to a changing environment. The focus of this work is two-fold. Her research is concerned with understanding the drivers of nearshore carbonate chemistry variability in high latitudes using *in situ* autonomous mooring arrays including pH, temperature, salinity, oxygen concentration, all factors associated with ocean change. These data are used to frame manipulative laboratory experiments aimed at determining the physiological thresholds of coastal species to ocean change, which brings a measure of ecological relevance to the results.

Tuesday, March 1, 2022

10:00 – 12:00 pm Hatchery-Wild Interactions

- 10:00 -10:15 Viability assessment for the use of otolith symmetry to distinguish hatchery and wild Chinook Salmon in Southeast Alaska **– Laura Coleman**
- 10:15-10:30 Using Saltwater to Mark Pink Salmon Otoliths **- Michael Wachter**
- 10:30-10:45 Nutrient Mining with Hatchery Salmon Releases **- Benjamin Van Alen**
- 10:45 – 11:00 Opportunistic evaluation of the impact of net pen tow release strategy on homing behavior of coho salmon **– Bobby Hsu**
- 11:00-11:15 Revealing stream attractiveness to hatchery-origin strays in a chum salmon metapopulation **– Molly Payne**
- Towards an understanding of site attractiveness to straying hatchery salmon: insights from the Columbia River Basin **– Peter Westley**
- 11:45-12:00 Ecological drivers and fitness consequences of dispersal in Sockeye Salmon; implications for hatchery impacts to natural populations **– Samuel May**

12:00-12:55 pm Mentorship Mixer

This lunch-time event provides an opportunity for attendees to discuss a variety of topics. Mentorship benefits people at every career stage, so all are encouraged to participate. Informal conversations may center around professional development, issues related to career advancement, and considerations of personal identity and belonging in STEM. The organizers will provide a suite of prompts, but participants are encouraged to discuss anything that is of interest to them.
Zoom - Meeting ID: 311 968 4907; Passcode: 875426
Questions and comments can be directed to deic@afs-alaska.org.

1:00-3:00 pm Hatchery-Wild Interactions

- 1:00 -:1:15 Assessing the effectiveness of transboundary Sockeye Salmon enhancement under the Pacific Salmon Treaty - **Megan McPhee**
- 1:15 - 1:30 Reduced relative fitness in hatchery-origin Pink Salmon across five streams in 2014 **-Kyle Shedd**
- 1:30 - 1:45 Heritability estimation using large-scale pedigree reconstruction in Pink Salmon spawning in the wild **– Kristen Gruenthal**
- 1:45 – 2:00 Phenotypic divergence between hatchery pink and coho salmon and their wild counterparts **– Alexandra Reich**
- 2:00 – 3:00 Hatchery -Wild Interactions Discussion

1:00-3:00 pm Contributed Talks: Fish Organismal Biology

- 1:00 – 1:15 The Pacific Lamprey Conservation Initiative in Alaska: A New Focus on an Old Fish **– Trent Sutton**
- 1:15 – 1:30 Evaluating the viability of the use of two tag types on adult Arctic Lamprey **-Mary Spanos**
- 1:30-1:45 Partitioning coho salmon landed in Norton Sound fisheries in the absence of convenient stock markers **-Luke Henslee**

- 1:45 – 2:00 Relative reproductive success of jack and regular male Coho Salmon **-Erika King**
- 2:00 – 2:15 Predation impacts of common merganser on Chinook salmon revealed using genetic analysis of scat **-Justin Hill**
- 2:15 – 2:30 Temporal and spatial patterns of predation on Juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) by a novel top predator, northern pike (*Esox lucius*) in a large Southcentral Alaska watershed**- Benjamin Rich**
- 2:30 – 2:45 Keeping Cool? Is heat stress influencing the success of sub-Arctic spawning Chinook salmon in Alaska? **-Madeline Lee**
- 2:45 – 2:50 Utilizing morphometrics to validate sexual dimorphism of Arctic Grayling in the Chatanika River **– Lauren Yancy**
- 2:50 – 2:55 Seaward migration and overwintering habits of Dolly Varden in northwestern Alaska analyzed using otolith microchemistry **– Joseph Spencer**
- 2:55 – 3:00 Lightening Talk Questions

3:15 – 4:00 pm Affinity Group: Women and Underrepresented Genders

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Questions and comments can be directed to deic@afs-alaska.org.

4:00 – 5:15 Big Swings in Salmon Production

- 4:00 – 4:15 Can a temporary productivity downturn cause a long-term shift in escapement goals? **– Milo Atkinson**
- 4:15 – 4:30 Synthesizing realized salmon escapements from AK to CA: How close are we to yield-based targets? **– James Cunningham**
- 4:30 – 4:45 Nutrient Cycling with Wild Salmon Spawners – Benjamin Van Alen
- 4:45 – 5:00 Adaptations to Change in Commercial Salmon Fisheries in Two Regions of the Gulf of Alaska **- Karen GrossKreutz**
- 4:50-4:55 Arctic Salmon: Patterns and Perceptions of Change **– Elizabeth Mik'aq Lindley**
- 4:55 – 5:00 Quantifying juvenile Chinook distribution and abundance under different climate regimes **– Lilian Hart**
- 5:00 – 5:05 Development of a Bayesian Framework for Yukon River Chinook Salmon In-season Abundance Projection **– Aaron Lambert**
- 5:05 – 5:15 Lightening talk/symposium questions

5:15 – 6:00 pm Affinity Group: BIPOC (Black Indigenous People of Color)

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7:00 – 8:00 pm Fish Trivia!

See how much you actually know about fishes, with some aquatic pop-culture questions mixed in! Fish Trivia will be hosted by Mason with Elephino Trivia

Wednesday, March 2, 2022

8:30-9:30 AM

Plenary: Marine predators provide the first signals of a forage fish collapse and large-scale ecosystem disruption in the Northern Gulf of Alaska

Dr. Mayumi Arimitsu (USGS)

Mayumi Arimitsu is a research ecologist with the USGS Alaska Science Center in Juneau, Alaska. She completed her undergraduate studies at University of California Santa Cruz and went earned her masters and PhD degrees in fisheries at University of Alaska Fairbanks. Her research interests focus broadly on seabird and forage fish ecology, detecting change in predator and prey populations, and understanding the impacts of climate change on marine food webs. She currently leads the Gulf Watch Alaska pelagic ecosystem component, which includes long-term monitoring projects for forage fish, marine birds, humpback whales, and killer whales. Her recent work has focused on the impacts of marine heatwaves on marine food webs in the Gulf of Alaska.

Wednesday, March 2, 2022

10:00 am – 12:00 pm Navigating the Future and Learning from the Past - Groundfish Management and Research

- 10:00 – 10:15 Understanding Pacific Halibut (*Hippoglossus stenolepis*) Spatial Dynamics in the Northern Bering Sea **– Austin Flanigan**
- 10:15 – 10:30 Integration of Fishery-Independent Survey Data with Variable Gear Types: A Comparison of Three Intercalibration Techniques **– Tristan Sebens**
- 10:30 – 10:45 Single echo detection hydroacoustics for black rockfish abundance estimation **– Philip Tschersich**
- 10:45 – 11:00 Utilizing remotely operated vehicles for yelloweye rockfish stock assessments in Southeast Alaska. **-Kellii Wood**
- 11:00 – 11:15 Model complexity has contrasting effects on hindcasting and forecasting species responses to climate change **– Cheryl Barnes**
- 11:15 – 11:30 Methods for assessing fisheries data and life history using black rockfish (*Sebastes melanops*) otoliths and bone **-Kevin McNeel**
- 11:30 -11:45 Alaska Department of Fish and Game's Statewide Rockfish Initiative **-Martin Schuster**
- 11:45 – 11:50 Development of Fishery-dependent Abundance Indices for Alaska Sablefish (*Anoplopoma fimbria*) **– Matt Cheng**
- 11:50 – 12:00 Lightening Talk Questions

10:00 am – 12:10 pm Contributed Talks - Fish-Freshwater Habitat Relationships

- 10:00 – 10:15 Hydrologic Variability Drives Riverine Materials Export from a Coastal Southeast Alaskan Catchment **– Claire Delbecq**
- 10:15 – 10:30 Understanding Impacts of Hydrologic Variability on Juvenile Salmon Growth in Gulf of Alaska Watersheds **– Kevin Fitzgerald**
- 10:30 – 10:45 Gaging the importance of headwater tributaries: hydrologic regime characterization for streams in changing boreal ecosystems **– Deanna Strohm**
- 10:45 – 11:00 Stream habitat and community assemblage response to wildfire in interior Alaska boreal **- Elizabeth Hinkle**
- 11:00 – 11:15 Seasonal stream physical and chemical regimes create distinct aquatic food web phenologies in meltwater and non-meltwater streams near the Juneau Icefield, Alaska **– Matthew R. Dunkle**
- 11:15 – 11:30 Stream thermal sensitivities in Southern Alaska **– Rebecca Shaftel**
- 11:30 – 11:45 The Fifth National Climate Assessment: opportunities for participation and engagement by the Alaska fisheries community in 2022 **-Jeff Falke**
- 11:45 – 11:50 A call for collaboration: Synthesizing juvenile salmon size data from across Alaska **– Erik Schoen**
- 11:50 – 12:00 Lightening talk questions/follow up

12:15 – 1:30 pm Annual Chapter Business Meeting

1:30 – 3:00 pm Navigating the Future and Learning from the Past - Groundfish Management and Research

- 1:30 – 1:45 Stock assessment of a valuable groundfish species, lingcod Ophiodon elongatus in Prince William Sound **– Katja Berghaus**
- 1:45 – 2:00 Comparison of age estimations in Lingcod otoliths and fin ray spines **– Chris Hinds**
- 2:00 – 2:15 Pacific Cod Commercial Fisheries in Central Region of Alaska **– Elisa Russ**
- 2:15 – 2:30 Food web structure in the eastern Gulf of Alaska **– Szymon Surma**
- 2:30 – 2:45 Reconstructing the past to inform the future: An estimate of historic rockfish harvest by a foreign fleet in the Gulf of Alaska **– Donald Arthur**
- 2:45 – 2:50 Pandemic Impacts on Biological Data Collection – Madison Bargas
- 2:50 – 3:00 Lightening talk questions/symposium discussion

1:30 – 3:00 Fish-Freshwater Habitat Relationships

- 1:30 – 1:45 When beavers get burned, do fish get fried? The role of beavers to mediate wildfire effects on freshwater fish habitat in boreal Alaska **– William Samuel**
- 1:45 – 2:00 Spawning Pacific salmon and dissolved oxygen dynamics in southeastern Alaska rivers **– Christopher Seargeant**
- 2:00 – 2:15 Factors affecting Northern Pike (Esox lucius) leaping ability: implications for barrier design in invaded systems **– Taylor L. Cubbage**
- 2:15 – 2:30 Crude Oil-Induced Impacts on Growth and Development in Threespine Stickleback and the Role of Microbial Community Composition **– Kelly Ireland**
- 2:30 – 2:45 A Review of Permitting Practices for Hardrock Mining In Alaska for Evidence of Fish-Friendly Provisions **– Randy Brown**
- 2:45 – 2:50 Expanding tribal fisheries research in the Matanuska River watershed **– Laura Pevan**
- 2:50 – 2:55 Piloting the Quantification of Large Woody Debris Inputs to Large Rivers following Wildfire **-Jeffrey D. Muehlbauer**
- 2:55 – 3:00 Lightening talk questions

3:15 – 4:00 pm Affinity Group: People with Disabilities (including physical conditions, neurological divergence, mood disorders, and chronic illness)

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Zoom - Meeting ID: 311 968 4907; Passcode: 875426
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4:00 – 5:10 pm Marine Ecology

- 4:00 – 4:15 Characterizing the interaction of shell developmental strategy and ocean acidification on larval Pacific razor clams (*Siliqua patula*) **– Marina Alcantar**

- 4:15 – 4:30 Monitoring spatial and temporal variation in forage fish densities using broad-scale aerial surveys in Prince William Sound **– Daniel Donnelly**
- 4:30 – 4:45 Habitats occupied by Chinook salmon in the Gulf of Alaska and in the U.S. Navy's Temporary Maritime Activities Area **– Michael Courtney**
- 4:45 – 4:50 Comparison of region ocean model with *in situ* zooplankton field data for the Eastern Bering Sea **-Genoa Sullaway**
- 4:50 – 4:55 Combining forage fish datasets to understand spatial and temporal patterns for management **- Lindsay Turner**
- 4:55 – 5:00 Unlearning the ropes: A student journey to conduct equitable abalone research with a tribal partner **-Ashley Bolwerk**
- 5:00 – 5:10 Lightening talk questions/session follow up

5:15 – 6:00 Affinity Group: LGBTQIA2S+ (Lesbian, Gay, Bisexual, Transgender, Queer/Questioning, Intersex, Asexual, Two-spirit +)

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7:00 – 8:00 pm A Chat with Laine Welch

Thursday, March 3, 2022
8:30-9:30 AM

Plenary: President Richard Chalyee Éesh Peterson (CCTHITA)

Richard (Chalyee Éesh) Peterson is Tlingit from the Kaagwaantaan clan. He grew up in Kasaan, Alaska and is a life long Alaska Native resident of Southeast Alaska. Prior to being elected as President of the Central Council of the Tlingit and Haida Indian Tribes of Alaska (Central Council) in 2014, Richard served as Chief Executive Officer of Prince of Wales Tribal Enterprise Consortium, LLC (POWTEC), president of the Organized Village of Kasaan (OVK), mayor/city council member for the City of Kasaan, and member of the Southeast Island School District Board of Education.

10:00 am – 12:15 pm Future Innovations in Fishery Data Captures and Analyses

- 10:00 - 10:15 Syncing the past with the future: Integrating advanced technologies into existing databases **– Andy Padilla**
- 10:15 – 10:30 Drone Applications for Fisheries Management in Norton Sound **-Justin Leon**
- 10:30 – 10:45 Using Unmanned Aerial Systems (UAS/drones) to conduct Chinook salmon redd surveys in the Salcha River **– Brian McKenna**
- 10:45 – 11:00 Automated Salmonid Counting Using Sonar Data **– Justin Kay and Erik Young**
- 11:00 – 11:15 Web based spawner-recruit and escapement goal analyses - **Toshihide Hamachan Hamazaki**
- 11:15 – 11:30 Life on the high seas: new insights into the marine distributions of Pacific salmon **– Joseph Langan**
- 11:30 – 11:45 Landscape-Level Extent of Resident Fish Occupancy in the Alexander Archipelago **- Bernard Romey**
- 11:45 – 11:50 Evaluating Environmental DNA as a Complementary Tool for Estimating Salmon Abundance in the Yukon River Basin **– Margaret (Maggie) Harings**
- 11:50 – 11:55 Ecological studies through a novel lens: stable isotope analyses of fisheye lens laminae as ontogenetic trophic markers **-Jonah Bacon**
- 11:55 – 12:15 Follow up and discussion

10:00 am – 12:00 pm Tamamta (All of Us): Transforming Western and Indigenous Fisheries and Marine Sciences Together

12:15 – 1:00 pm Affinity Group: Dependent Caregivers

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1:00 – 1:30 pm Human Dimensions/Pedagogical Issues

- 1:00 – 1:15 "To Zoom or Not To Zoom" A comparison of student's and instructor's attitudes on the use of different teaching pedagogies for marine science in rural Alaska **-Courtney Pegus**
- A Comparison of Perceptions About the Use of Two Different Teaching Pedagogies: Video Conferencing Platform (Zoom) and Experiential Hands-On Approaches to Teaching Marine Science in Bethel, AK **– Courtney Pegus**

1:00 – 3:00 pm Application of genomics tools for fisheries management in Alaska

- 1:00 – 1:15 Is structural variation necessary to create islands of divergence? A case study in sockeye salmon **– Wes Larson**
- 1:15 -1:30 Molecular and physiological thermotolerance traits of Broad Whitefish Coregonus nasus and Saffron Cod *Eleginus gracilis* – **Carolyn Hamman**
- 1:30 – 1:45 Fish Assemblages and Genetic Stock Determination of Salmon in Bering Land Bridge National Preserve **– Nate Cathcart**
- 1:45 – 2:00 Whole genome resequencing confirms and characterizes genetic population structure in the abundant rockfish species, Pacific ocean perch (*Sebastes alutus*) **– Laura E. Timm**
- 2:00 – 2:15 Population structure of lake trout from three river drainages in interior and southcentral Alaska **– Anna Rix**
- 2:15 – 2:30 Genotyping at sea for potential in-season salmon management use **-Jodi Estrada**
- 2:30 – 2:45 Leveraging multiple genomic approaches to investigate population structure and dynamics of Pacific halibut in the northeast Pacific Ocean **– Andrew Jasonowicz**
- 2:35 – 2:40 Understanding *Spirinchus thaleichthys*: local researchers searching for a declining population of a species valued by the Lhaq'temish in Bellingham Bay and the Nooksack River, WA **– Brandi Cron Kamermans**
- 2:45 – 3:00 Lightening talk questions and session discussion

3:15 – 4:00 pm Affinity Group: First Generation College Students (Past & Present)

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4:00 – 5:00 pm Application of genomics tools for fisheries management in Alaska

- 4:00 – 4:15 Measuring attenuation of eDNA in nearshore Southeast Alaska **– Diana Baetscher**
- 4:15 – 4:30 Linking Salmon Run Timing and endangered Cook Inlet beluga foraging patterns across Cook Inlet through eDNA **– Zachary Gold**
- 4:30 – 4:45 PoolSeq indicates multiple mechanisms associated with genomic islands of divergence between spawning Pacific cod from the Aleutian Islands and Bering Sea **– Ingrid Spies**
- 4:45 – 4:50 Seascape genomics in North Pacific forage fishes: opportunities and challenges **– Laura E. Timm**
- 4:50 – 4:55 A brief overview of a Broad Whitefish Coregonus nasus transcriptome **– Anna Rix**
- 4:55 – 5:00 Lightening talk questions

Friday, March 4, 2022

10:00 am – 12:00 pm Hosted Dialogue: Racial Equity in Fisheries Education, Research, and Governance in Alaska

Members of the Tamamta Program team will host a dialogue on racial equity using a model developed by First Alaskans Institute. This approach uses Indigenous methodologies for hosting difficult dialogues. First Alaskans Institute has led hundreds of transformative dialogues through their Alaska Native Dialogues on Racial Equity (ANDORE) project, which is "a statewide project that aims to initiate, foster, and grow racial healing by meaningfully engaging in conversations in communities across Alaska on race, racism, and racial equity; in order to move people into a place of understanding, healing and growth." The Tamamta project is motivated by deep inequities and Indigenous erasure that persists in education and resource management systems in Alaska. Through these racial equity dialogues, we hope to catalyze action towards racial equity, Indigenous representation and respectful inclusion of Indigenous knowledge systems in fisheries science, education, and management. Tamamta project team members were trained on specific strategies to host difficult dialogues with diverse groups of people, e.g., communities, fisheries management bodies, science colleagues. We will host a 2 hour dialogue as part of the American Fisheries Society, Alaska Chapter annual meeting. Participation is open and encouraged by all those who are working in support of Alaska's fisheries and people. We ask that participants join for the full session.

Save the Date!
Next Alaska Chapter Meeting in Fairbanks
March 27-31, 2023
Westmark Fairbanks Hotel and Conference Center


Photos: Explore Fairbanks

We are excited to host next year's Annual Meeting in Fairbanks. Late March is one of the best times of year in the Interior, when the daylight is back, temperatures are mild, ice fishing and snow sports are prime, and the aurora is shimmying. We are planning an in-person event full of the socials, networking opportunities, and field trips that we all have been missing. Save the dates, and we'll see you next year!



Photos (left to right): Explore Fairbanks, Alaska Department of Fish and Game, Red Photography

Abstracts

Milo Adkison: Can a temporary productivity downturn cause a long-term shift in escapement goals?

Stakeholders in Western Alaska sometimes express concern about lowering escapement goals when salmon stocks are doing poorly. They worry that these lower goals may become the new norm. Is it possible that once lowered, estimates of optimal escapement would remain low even when they are no longer appropriate. Is this a possibility? If so, how might it happen and what might prevent it? I use simulated salmon stocks and management strategy evaluation to examine these questions.

Marina Alcantar: Characterizing the interaction of shell developmental strategy and ocean acidification on larval Pacific razor clams (*Siliqua patula*)

Increases in anthropogenic carbon dioxide emissions are forcing chemical changes within the ocean, resulting in a long-term decrease in global oceanic pH, colloquially termed ocean acidification (OA). Previous studies have demonstrated that this decrease in pH can have negative physiological consequences on biocalcifying organisms, particularly during early life stages. Here, we examine the impact of ocean acidification (increased pCO2/reduced pH) on the larval Pacific razor clam, Siliqua patula. This study was conducted in July of 2018 at the Alutiiq Pride Marine Institute in Seward, Alaska. Larvae were spawned and cultured for one month under three different pCO2 treatments. The treatments included a static high pCO2 of 867 atm & 7.7 pH units, a variable pCO2 of 357 atm/8.0 pH units to 867 atm/7.7 pH units, and a current ambient pCO2 of 357 atm/8.0 pH units. The variable treatment fluctuated between the current ambient treatment condition and the high treatment condition on a diurnal cycle. As a precursor to the experiment, the first developmental time series was assembled for S. patula. Our experimental response variables include the analysis of shell composition, growth, and mineralization, as well as changes in gene expression for both HSP-70 and calmodulin. These are two genes identified as bioindicators of OA stress. In addition to assessing the impact of OA on S. patula development, this study also led to the discovery that S. patula utilizes a relatively unique shell developmental technique, more commonly found in gastropods, called a concretion. Understanding exactly how this unique shell developmental technique manifests in S. patula is critical to both assessing the response of S. patula to elevated pCO2 and informing management decisions in the future. Additionally, this study underscores the importance of comprehensive developmental assessment of a study species as a precursor to future climate change research.

Mayumi Arimitsu [Plenary]: Marine predators provide the first signals of a forage fish collapse and large-scale ecosystem disruption in the Northern Gulf of Alaska

Unprecedented mortality events, reproductive failures, and shifts in distribution by seabirds and other marine predators were among the first visible indicators of a major ecosystem disruption in the Gulf of Alaska during the 2014-2016 Pacific marine heatwave. From the wide-spread response of pelagic predators it was immediately clear that the marine ecosystem was undergoing unusual change during the heatwave. In this presentation I will summarize findings from situational response surveys and ongoing long-term monitoring efforts to document heatwave impacts to the marine ecosystem. Necropsies of beach-cast birds identified starvation as the primary cause of death, and further testing suggested that harmful algal blooms may have also been a stressor. It took several more years, however, to identify the underlying heatwave impacts to the food web. These impacts included a collapse of the forage fish portfolio, changes in age-structure, size, growth and energy content of key pelagic prey species. Although reduced biomass of cold-water euphausiid species and shifts in copepod communities towards smaller, warm water species point to bottom-up factors, observed shifts in size and age-structure of key forage species like capelin and sand lance suggest top-down pressures played a role as well. The ecosystem response lasted for at least 5 years after the onset of the heatwave, and while many taxa fell into the loser's circle, there were some winners too. For example, seabird diets provided early indications that conditions were favorable for a strong year class of herring in 2016, and age-0 sablefish growth index was above the long-term mean during the warm years between 2014 and 2019. A second marine heatwave occurred in summer 2019 but without extreme consequences to the marine food web, most likely due to the seasonality and shorter duration of the event. Continued monitoring of predator-prey interactions is essential to understanding ecosystem responses to future climate change.

Donald Arthur: Reconstructing the past to inform the future: An estimate of historic rockfish harvest by a foreign fleet in the Gulf of Alaska

Historical catch information is necessary for fisheries stock assessments. Catch history can provide insight into a stock's unfished biomass and its ability to respond to exploitation. Between 1961-1987, a large-scale foreign fishery occurred in the Gulf of Alaska (GOA) that was largely dominated by Japanese and Soviet Union vessels. This foreign fleet is estimated to have harvested over 4 million metric tons (mt) of groundfish. For the duration of the fishery, species-specific harvest is widely available for several targeted and/or regulated species such as Pacific Ocean Perch (Sebastes alutus) and Pacific Halibut (Hippoglossus stenolepis). However, at the beginning of the foreign fishery, data is lacking for numerous bycatch species including many rockfishes. Following the passage of the U.S. Fishery Conservation and Management Act of 1976 (FCMA), catch statistics for bycatch species improved. Currently, stock assessments for Black (Sebastes melanops) and Yelloweye Rockfish (Sebastes ruberrimus) are in development across the GOA by the Alaska Department of Fish and Game and reconstructing harvest of these two species was deemed a priority. Catch composition from the years leading up to and following the FCMA were used to reconstruct total rockfish harvest and the harvest of nearly 30 rockfish species for duration of the foreign fishery. To summarize the uncertainty around estimates, available catch compositions were bootstrap sampled and 95% bootstrap confidence intervals were reported. According

to the reconstruction, annual harvest by the foreign fleet of Black Rockfish peaked in 1965 at 34.9 mt (95% CI: 17.5, 55.4) and Yelloweye Rockfish harvest peaked in 1975 at 2104 mt (95% CI: 1673.8, 2542.4). Owing to the longevity of rockfish and the scale of the foreign fishery, incorporating historic harvest into a stock assessment will be important to produce more realistic estimates of stock status and sustainable yield that are necessary for management.

Cheryl Barnes, she | her: Model complexity has contrasting effects on hindcasting and forecasting species responses to climate change

Identifying and predicting species responses to climate change is a high priority in ecology. Species distribution models (SDMs) are commonly used to quantify environmental drivers of distributions and densities; however, we lack information about how well these models predict fine-scale population metrics under novel conditions. We compared the performance of a suite of SDMs when hindcasting species-habitat associations and forecasting responses to changing climates. We present two case studies from the Bering Sea, a system that has recently undergone considerable warming. Conventional statistics (R2, % Deviance Explained, UBRE or GCV) were used to assess the performance of in-sample predictions (i.e., hindcasts) for Arrowtooth Flounder (Atheresthes stomias) and Walleye Pollock (Gadus chalcogrammus). Retrospective skill testing was used to compare out-of-sample predictions (i.e., forecasts) with observed distributions or densities. The most complex models, which accounted for spatial, temporal, and spatiotemporal variation in addition to static and dynamic habitat covariates, outperformed all other models when hindcasting population metrics. Static models that relied on long-term mean environmental conditions, however, exhibited greater forecast skill. Decreased forecast skill for dynamic models likely resulted from predicting species responses to temperatures outside the range of those used in model fitting. Thus, dynamic SDMs better reflect the amount of spatiotemporal variation in natural systems, but static SDMs may prove more skillful when forecasting responses to novel environmental conditions. We also found that model performance and forecast skill were dependent upon the species and population metric of interest, suggesting a negative relationship with niche breadth. Expanding environment-only SDMs to include spatiotemporal variation in fishing pressure, trophic interactions, and other important context-specific drivers would likely improve forecast skill. Nonetheless, our results demonstrate support for the use of retrospective skill testing in model selection rather than identifying forecast models a priori based on their ability to quantify species-habitat associations from the past."

Jonah Bacon: Ecological studies through a novel lens: stable isotope analyses of fish eye lens laminae as ontogenetic trophic markers

Co-authors: Trent Sutton (University of Alaska Fairbanks, College of Fisheries and Ocean Sciences), Mat Wooller (Alaska Stable Isotope Facility, University of Alaska Fairbanks, Fairbanks, AK, USA; Department of Marine Biology, University of Alaska Fairbanks, Fairbanks, AK, USA)

Recent advances in fish ecology research include analyzing stable isotopes within proteinaceous layers of eye lenses from fish as a timeline of ontogenetic ecological changes. Eye lenses are produced through successive layers forming on top of previously formed layers, such that the lens becomes a spherical

tissue with distinct layers, much like an onion. Once individual layers (termed laminae) are formed, they become metabolically inert, meaning that the proteins making up each laminae are reflective of the biochemical building blocks present from the fish at the time of formation. These layers can be separated and subjected to stable isotope analysis to reveal ecological characteristics including changes in trophic position and location over time. In this study, lens stable isotope analysis will be used to examine trophic-position differences in sympatric whitefishes in the nearshore Beaufort Sea over their life history. For this project, eye lenses were sampled from adult whitefish Arctic Cisco Coregonus autumnalis, Least Cisco Coregonus sardinella, Humpback Whitefish Coregonus pidschian, and Broad Whitefish Coregonus nasus in summer 2021. Lens laminae were microdissected using forceps and a stereo-microscope to separate individual lens layers. Stomach contents were also removed for visual examination to determine diet composition and corroborate stable isotope results. Preliminary results indicated that variation exists in the number of laminae per lens (range 3-11, median 6). Lens laminae will be subjected to bulk (total organic) and compound-specific stable isotope analysis to track changes in individual trophic position or movement with fish age. Results from this study will offer a more holistic understanding of Arctic whitefish ecology which is critical in light of rapid climate change in the Arctic and the importance of Arctic whitefishes to coastal communities for subsistence harvest.

Diana Baetscher: Measuring attenuation of eDNA in nearshore Southeast Alaska

Co-authors: Pat Barry (UAF/NOAA), Jacek Maselko (NOAA), Johanna Page (NOAA), Wes Larson (NOAA)

Environmental DNA (eDNA) is increasingly used to track animals through diverse habitats. In marine environments, a variety of physical characteristics influence the distribution of eDNA and likelihood for species detection. Additionally, the taxonomic specificity of the genetic assay used; metabarcoding, qPCR, or species-specific primers; impacts detection. In this study, we make use of hatchery pens containing 46 million juvenile chum salmon (Oncorhynchus keta) in nearshore southeast Alaska and sample every 80 m along a 2 km transect to test the 1) attenuation of eDNA signal over surface distance and 2) role of water stratification between the surface and lower layers. Further, we evaluate how detection of chum salmon differs between qPCR, species-specific primers, and fish metabarcoding primers. Results from this study help clarify the role of physical attributes on the movement and detection of species from marine eDNA.

Madison Bargas: Pandemic Impacts on Biological Data Collection

Co-Author: Erica Ebert (ADF&G)

The Covid-19 pandemic has caused a global disruption impacting most aspects of daily life. Many have substantially altered their everyday work life; from how to perform basic job duties to some not being able to re-enter the workplace at all. In Alaska, fishery biologists and technicians have experienced a disruption in data collection as a result of the Covid-19 pandemic and ongoing efforts to minimize the spread of the virus. Beginning in 2020, for example, the Southeast Alaska Groundfish Project port sampling and research survey procedures adapted to adhere to social distancing and mitigation guidelines. Few port sampling staff were not allowed into some processing plants entirely, while other

port sampling staff were allowed to continue their biological sampling duties but under stringent rules such as limitations on number of samplers, restrictions on areas of access, and little to no ability to interview fishermen and permit holders. These factors impacted the number of biological samples collected and affected the quality of data. During research surveys, things like crew changes and quarantine guidelines were altered to ensure safety and comfortability of biologists on board. These experiences will allow us to better adapt to unforeseen challenges to be able to contribute to fisheries management and research.

Katja Berghaus: Stock assessment of a valuable groundfish species, lingcod Ophiodon elongatus in Prince William Sound

Lingcod are bottom-dwelling predatory fish inhabiting the West coast of the United States. Because of their large body size and palatable meat, they are coveted fishing targets. However, their long lifespan (up to 25 years) and life-history traits, such as aggressive nest guarding, make them susceptible to overfishing. In Prince William Sound, Alaska, declining numbers of landed fish and mean body sizes raise concerns over their stock status. The implementation of a stock assessment for lingcod is therefore highly desired to facilitate the effective management of this valued fish species. This study aims to improve the availability of biological information on important life history traits such as fecundity and length and age at maturity, as well as the precision of aging structures for lingcod in Prince William Sound that will form the basis for the implementation of a contemporary stock assessment. While preliminary results suggest that length and age at maturity remain similar to previous estimates for this region, fecundity may show more regional and temporal variation. In the 1960s fecundity estimates for lingcod from southern British Columbia ranged between 170,000 to 470,000 eggs. Our first estimates of lingcod fecundity for PWS lies within that range, but below the expected relative fecundity. This result is not surprising, given that fecundity is expected to decrease with increasing latitude. However, reduced fecundity implies reduced resilience and more fragile stock recruitment relationships warrant more conservative importance of further investigation into the reproductive biology of lingcod for stock recruitment relationships. In this talk we highlight preliminary results on the relationships of maturity and fecundity with weight, age and length and discuss future objectives and the implementation of a stock assessment."

Ashley Bolwerk: Unlearning the ropes: A student journey to conduct equitable abalone research with a tribal partner

At all levels of fisheries management, diversity and inclusion are becoming more and more common topics of discussion. Despite the popularity of these concepts, there is little training or direction provided for how to increase diversity and inclusion in our fisheries. In this presentation, I aim to share key obstacles and strategies that I have learned through my experiences working with the Hydaburg tribal association on abalone research. Much of what I have learned has been a result of the brave people who forged this path before it was popular. By sharing our experiences to overcome obstacles that stand in the way of diversity and inclusion, we can advance these initiatives more rapidly. If we do not share our experiences, we risk business as usual, which is no longer acceptable. Join me in a brief discussion of some tactics to get us to the future of fisheries research.

Randy Brown: A Review of Permitting Practices for Hardrock Mining In Alaska for Evidence of Fish-Friendly Provisions

Alaska has a long history with mining gold and other metals going back to the late 1800s. Until relatively recently, gold mining was predominantly focused on placer deposits with little or no attention to environmental concerns. Interest in hardrock mining for gold and other metals has seen a marked increase in recent decades with three big mines currently operating in Interior and NW Alaska, and another six in the planning or permitting process. This surging interest in hardrock metal mining in Alaska, along with the environmental damage that has been documented with similar mines in the lower 48 and Canada, got some of us in the Environmental Concerns Committee of the Alaska Chapter to consider whether the existing permitting processes in Alaska are sufficient to protect aquatic habitats that are critical to fishes. In this presentation I will review and compare some of the long-term environmental consequences of placer versus hardrock mining operations. I will then discuss the various regulatory programs that influence permitting and regulation of hardrock mine operations, reclamation, closure, and long-term monitoring, and consider whether these programs would provide a sufficiently robust level of environmental protection that could be considered “fish friendly".

Nate Cathcart: Fish Assemblages and Genetic Stock Determination of Salmon in Bering Land Bridge National Preserve

Salmon and non-salmon fish species play an essential role for subsistence residents living on the Seward Peninsula and near Bering Land Bridge National Preserve (BELA). Fish add diversity to local diets, contribute to regional food security, and are of significant cultural importance. Further, long-term changes in water temperature or other conditions may cause subsistence fisheries and their associated assemblages to respond by shifting distributions, migrations, and spawning times. However, these potential responses by fishes cannot be determined without accurate baseline information of species in affected areas. In 2021, we began a three-year study of fish assemblages and genetic stocks of salmon within major river systems of BELA. This project will be the first for BELA to establish baseline data on species presence, habitats critical for anadromous fishes (spawning, rearing, and feeding areas), and genetic stocks of chum and pink salmon in 4 rivers: the Serpentine, Nuluk, Arctic, and Nugnugaluktuk rivers. From the 4 target streams we documented 15 species of freshwater or anadromous fishes, verified or newly documented 43 anadromous fish-bearing waterbodies, and collected 25% of our needed genetic samples for chum and pink salmon. In 2022 and 2023, we plan to expand and continue fish surveys, visit and work with the Shishmaref community, and achieve our genetic sampling goal. Creating a baseline of knowledge can enable the detection of changes in presence, distribution, and population genetics of fishes and ultimately inform future conservation efforts as Arctic waters and coastal environments change.

Matt Cheng: Development of Fishery-dependent Abundance Indices for Alaska Sablefish (Anoplopoma fimbria)

Coauthors: Cara J. Rodgveller (NOAA AFSC), Curry J. Cunningham (UAF)

Sablefish in Alaska are a commercially important groundfish species, and accurate indices of sablefish biomass are imperative to informing management decisions. In recent years, sperm whale depredation of hook and line gear has prompted a regulation to allow the use of pot gear in the Gulf of Alaska. Over a short period, there has been a rapid shift towards the use of pot gear. Although fishery-dependent hook and line data are used in the assessment, pot gear are not integrated within the current stock assessment framework, despite its increasing use. The current stock assessment employs a statistical catch-at-age model fit to a variety of data sources, including the annual National Oceanic Atmospheric Administration longline survey and fishery-dependent catch-per-unit-effort (CPUE), which inform biomass estimates and projections for future stock status. Indices of abundance from fishery-dependent CPUE add value to the stock assessment in that they expand the spatiotemporal resolution of survey data and are often less costly to obtain. However, data from fishery CPUE are commonly confounded by a myriad of factors, including differences in reporting and preferential sampling, which may obscure abundance trends over time. Thus, fishery-dependent CPUE needs to be standardized using model-based methods, before they are incorporated within an assessment framework. Here, I will leverage fishery-dependent data from vessel logbooks and fishery observers, to develop a standardized index of abundance for the Alaska sablefish fishery that incorporates both hook and line and pot gear. I propose to explore different model-based methods to standardize fishery CPUE using: 1) Generalized Additive Models, 2) Machine Learning methods, and 3) Vector-Autoregressive Spatiotemporal models. Results will focus on an initial application of Generalized Additive Models for index standardization. Findings from this work will provide a framework for standardizing fishery CPUE and help better inform the stock status of Alaska sablefish.

Laura Coleman: Viability assessment for the use of otolith symmetry to distinguish hatchery and wild Chinook Salmon in Southeast Alaska

Differentiating hatchery and wild Chinook Salmon Oncorhynchus tshawytscha is critical for maintaining sustainable fisheries, ensuring fishing opportunity, and protecting wild Chinook Salmon runs, especially during periods of low productivity. Previous work has shown that asymmetry between otolith pairs (i.e., otolith fluctuating asymmetry) can be used to distinguish hatchery and wild Chinook Salmon. In the present study, we evaluated the symmetry of right and left otolith pairs among wild and hatchery Chinook Salmon captured in the spring troll fishery in Ketchikan, Alaska between 2019 - 2021 and wild Chinook salmon sampled during 2021 escapement surveys on the Taku and Unuk Rivers. Asymmetry between the right and left otoliths from wild and hatchery Chinook Salmon was evaluated using the average absolute difference. We then grouped the data by origin (i.e., hatchery and wild) and used a Wilcoxon signed-rank test to evaluate the statistical differences between the left and right otoliths by origin. Results showed that hatchery otoliths exhibited more asymmetry in all the otolith metrics than wild Chinook salmon, suggesting that these metrics may be useful when differentiating wild from hatchery Chinook Salmon. Together with Coded Wire Tags and Genetic Mixed Stock Analysis, these data

may illuminate our understanding of Chinook Salmon contributions to specific fisheries during distinct periods of time, potentially allowing more fishing opportunity while protecting wild salmon stocks.

Michael Courtney: Habitats occupied by Chinook salmon in the Gulf of Alaska and in the U.S. Navy's Temporary Maritime Activities Area

Co-authors: Andrew Seitz (UAF)

The U.S. Navy conducts training exercises in the Gulf of Alaska (GOA) Temporary Maritime Activities Area (TMAA). The Navy is interested in understanding the overlap of occurrence between populations of Chinook salmon and these training activities. To provide insights into Chinook salmon ocean ecology while occupying waters of the GOA, including the TMAA, we attached pop-up satellite archival tags (PSATs) to individuals near Chignik, AK (n = 20; August 2020), Kodiak, AK (n = 20; October 2020), and Yakutat, AK (n = 20; March 2021). Tissue samples were collected from the tagged fish to determine stock-of-origin of each tagged fish. Of the 60 PSATs deployed, 57 reported to satellites, providing over 3,700 days of data. Reporting locations of tags were widespread across the eastern North Pacific Ocean, ranging as far west as the Bering Sea to as far east as the U.S. Pacific Northwest. Fifteen tagged Chinook salmon were inferred to have occupied the TMAA, for an aggregated 252 fish-days. While occupying the TMAA, 58% of the estimated daily locations occurred over the continental shelf, while the remainder of the days occurred over the slope (22%) and the basin (20%). Genetic analyses suggest that all Chinook salmon originated from southern Southeast Alaska, British Columbia, Washington, and Oregon, making our results pertinent for many populations throughout North America. The information about Chinook salmon gained in this study may be used to provide insights into important management issues in the North Pacific Ocean, including overlap between Chinook salmon and Navy training exercises in the GOA.

Taylor Cubbage: Factors affecting Northern Pike (*Esox lucius*) leaping ability: implications for barrier design in invaded systems

The spread of invasive species has caused drastic ecological and economic consequences on a global scale, including the expansion of Northern Pike throughout Southcentral Alaska. Illegal introductions and the subsequent establishment of pike in the region threaten native fish populations along with the fisheries and ecosystems they support. The highly interconnected river and lake systems of Southcentral Alaska make eradication difficult; however, potential differences in pike and salmonid leaping abilities make selective vertical drop barriers a viable option. To determine the efficacy of barriers, we assessed pike leaping ability as a function of barrier height, pool depth, and flow rate, with individual pike size, growth rate, condition, and standard metabolic rate analyzed as covariates. Adult pike (N = 60) were collected from Fort Peck Reservoir, Montana, USA and used in leaping trials in an open channel flume system at the U.S. Fish and Wildlife Service Fish Technology Center in Bozeman, Montana during the summer of 2021. We estimated passage success with a Passive Integrated Transponder antennae array to detect pike presence above barriers, body condition via bioelectrical impedance analysis and proximate composition analysis, growth via cleithra increment analysis, and standard metabolic rate via heart, liver, and muscle tissue enzyme assays. Pike leaping behavior (e.g., explorations, attempts, and successes) was also observed via video recording. Likelihood of successful passage was affected by the interaction of

barrier height and pool depth, but did not differ under tested flow rates. Nearly all height x depth x flow treatments were explored and attempted by pike, although maximum successful leap height was limited to 42 cm when pool depth was 60 cm. These barrier parameters and insights into pike leaping behavior will help develop pike-selective barriers in Alaska and elsewhere pike are invasive to reduce predatory impacts of pike on native fish communities.

Curry James Cunningham: Synthesizing realized salmon escapements from AK to CA: How close are we to yield-based targets?

Despite the vast literature exploring the population dynamics and management of Pacific salmon, key questions remain about our baseline demographic assumptions and the efficacy of past and current management practices across species and regions. For example, how close have historical stock-specific escapements been to the spawning abundances expected to produce maximum sustainable yield (Smsy) under equilibrium conditions? And have advances in fisheries management narrowed the gaps between escapements and theoretical yield-based targets in recent years compared to the past? To address these questions at a coast-wide scale, I synthesized time series of salmon stock-recruitment data from 228 stocks of Sockeye, Pink, Coho, Chum, and Chinook Salmon from the Bering Sea to California using a Bayesian hierarchical Ricker-type stock-recruitment model. Results indicate that the proximity of realized salmon escapements to stock-specific Smsy targets are both species and region-specific. In some cases, recent fishery management outcomes are closer to theoretical yield-based targets than they were in the past. Stock-specific management will always be subject to mixed-stock constraints and socioeconomic considerations that result in actual management targets differing from those that may maximize yield, but this type of synthetic analysis provides the first step in assessing where salmon management stands relative to potential yield optimization. A useful byproduct of this research are reference priors suitable for Bayesian stock-recruitment analyses, which will be presented and may provide a starting point for future analysts.

Claire Delbecq: Hydrologic Variability Drives Riverine Materials Export from a Coastal Southeast Alaskan Catchment

The coastal watersheds of Southeast Alaska have diverse hydrologic regimes driven by differences in the contribution of glacial, snow, and rainwater inputs to streamflow. 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. Our results suggest that nutrient and particulate organic matter concentrations vary substantially with

season and discharge. Dissolved organic carbon (1.1-8.3 mg/L), dissolved nitrogen (0.03-0.13 mg/L) and alkalinity (6-33 mg/L) varied up to an order of magnitude. Stream water drift composition was dominated by terrestrial material (e.g., conifer needles, twigs), and appears to be linked to antecedent stream flow conditions. Our research will provide insight into the complex relationship between flow and material fluxes and aid in our understanding of how shifts in climate will impact materials export to nearshore ecosystems in Southeast Alaska.

Daniel Donnelly: Monitoring spatial and temporal variation in forage fish densities using broad-scale aerial surveys in Prince William Sound.

Despite their trophic importance in marine ecosystems, interannual variation in abundance and distribution of forage fish such as Pacific herring and Pacific sand is poorly known in the NE Pacific, partly because they are difficult to sample in a cost-effective manner. We used aerial surveys to quantify forage fish schools in nearshore areas of Prince William Sound (PWS) and gather data on Sound-wide distribution and relative abundance of forage fish over time. Aerial shoreline surveys were conducted during early summer 2010-2021, and we validated species and size classifications with boat-based sampling efforts whenever possible. Fish schools were identified to species by two observers, including an experienced commercial spotter pilot. Spotters recorded location and used a gridded sighting tube to estimate surface area of each school. Annual estimates of forage fish school area for each of 12 regions in PWS were standardized by effort (km shoreline surveyed) and adjusted for species-specific validation rates to provide a relative index of school density for comparison across years. Forage fish densities fluctuated over the course of the annual survey, but some regions of PWS showed consistently higher densities than others. Declines in school density coincided with a prolonged marine heat wave experienced in PWS from 2014-2016. Pacific Herring densities varied annually with several high recruitment years interspersed among years of low densities, but Pacific sand lance densities declined sharply after the beginning of the surveys and have only been observed consistently in a few discrete locations since 2013. These surveys demonstrate the efficacy of tracking forage fish populations over wide geographic areas by air and provide a means to better understand the ecology of forage fish by identifying patterns in their habitat selection.

Matthew R. Dunkle: Seasonal stream physical and chemical regimes create distinct aquatic food web phenologies in meltwater and non-meltwater streams near the Juneau Icefield, Alaska

Co-authors: J. Ryan Bellmore (USFS-PNW Juneau), Jason B. Fellman and Eran Hood (UAS), Christopher C. Caudill (U.Idaho)

On physically complex landscapes, such as streams in high latitude or elevation areas, biogeochemical regimes can vary between watersheds over relatively short distances with the potential to create a portfolio of food webs with asynchronous biomass dynamics. In the coastal temperate rainforest of Southeast Alaska, meltwater streams from glaciers, icefields, and seasonal snowpack occur in proximity to systems non-meltwater streams with distinct dynamics. We hypothesize that heterogeneity in abiotic

conditions provides a template for a diversity of unique food webs that exhibit asynchronous waves of resource availability that are important for sustaining fishes. This landscape is experiencing rapid loss of glacial coverage and trends from winter snow to winter rain with implications for food webs. As glaciers melt and precipitation shifts from winter snow to rain, the unique characteristics of glacial- and snow-fed watersheds may be lost, which in turn, could reduce the diversity of food webs and synchronize resource waves that support fishes. We analyzed the physico-chemical and biomass dynamics of the trophic base of the aquatic food webs, periphyton and aquatic invertebrates, in three streams representing relative end-member conditions of glacial, snowmelt, and rainfed hydrology as well as one stream with a mixed signature. We found that streams had distinct patterns of temperature, flow, and nutrient concentrations, which, in turn, created asynchronous biomass dynamics in the aquatic food web with implications for juvenile salmonids rearing on the landscape.

Jodi Estrada: Genotyping at sea for potential in-season salmon management use.

Co-Authors:Heather Hoyt (ADF&G), Tyler Dann (ADF&G), Michael Link (BBSRI).

Bristol Bay sockeye salmon are one of America's most valuable fish economic resources and define the economy, ecology, and culture of the region. The 66.1 million sockeye salmon that returned to Bristol Bay in 2021 were worth $246.8M 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 based upon 24 SNPs is used to inform in-season management. Historically, samples taken for genetic analysis on test fishing vessels were shipped from Port Moller to Anchorage where DNA extraction and genotyping was performed onsite at the ADF&G Gene Conservation Laboratory (GCL). The effort and time involved in sailing to port to ship samples to the GCL takes time away from fishing and increases costs. Here we describe a novel approach of performing DNA extraction and genotyping on-board one of the fishing vessels in an attempt to circumvent time, cost, and weather delay issues. To validate this approach, samples were processed on-board one of the fishing vessels in tandem with samples at the GCL in Anchorage. Results showed high concordance rates between the two labs. We review pros and cons of this project and whether it should be pursued in the future.

Jeff Falke: The Fifth National Climate Assessment: opportunities for participation and engagement by the Alaska fisheries community in 2022

The Fifth National Climate Assessment (NCA5), currently in development, will assess the science of climate change and its impacts across the United States and document climate change-related impacts and responses for various sectors and regions, with the goal of better informing public and private decision-making at all levels. The process is designed to be transparent and inclusive, offering multiple opportunities for public participation. The report will undergo an extensive, multi-phase process of internal and external review from federal agency experts, the general public, and external peer review by a panel of experts. This approach is designed to result in a report that is authoritative, timely, relevant, and policy neutral, valued by authors and users, accessible to the widest possible audience, and fully

compliant with applicable laws and policies. The NCA5 is organized into topical (e.g., climate trends, water, tribal and indigenous peoples, coastal systems) and regional chapters; Alaska is the only state to have its own chapter. To ensure that the assessment is informed by and useful to stakeholders, the NCA5 Alaska Chapter authors are currently soliciting feedback on key topics and issues of importance in Alaska, including fisheries. In this presentation I will provide an overview of the NCA5 Alaska Chapter, which focuses on the social and environmental circumstances specific to Alaska and the associated concerns related to vulnerability to climate change; both what is already occurring and what can be expected for the future. I will also highlight opportunities and resources for the Alaska fisheries community to engage with and provide input to the NCA5 Alaska Chapter.

Kevin Fitzgerald: Understanding Impacts of Hydrologic Variability on Juvenile Salmon Growth in Gulf of Alaska Watersheds

Climate change is altering hydrologic regimes in Gulf of Alaska watersheds, which collectively support one of the most productive salmon populations on Earth. It is expected that these coastal drainages will experience more severe low water events interspersed with larger, more frequent high flows. This raises the question: how will salmon respond? The timing and magnitude of stream flows influence juvenile salmon growth through effects on food availability, temperature, and foraging success. It is unknown how interactions among the timing, duration, and sequence of flow events may influence juvenile salmon growth. For example, high flows occurring after prolonged drought may transport large prey fluxes, possibly yielding growth conditions superior to those experienced at low flow, or during repeated high flows. Within this context, the goal of this research is to investigate how hydrologic patterns influence prey fluxes, and in turn, the proportion of juvenile Coho Salmon and Dolly Varden growth attributed to periods of high and low flow. We conducted a high temporal-resolution mechanistic study where we intensively sampled (e.g., hourly to weekly) invertebrate drift, fish diets, and fish growth from late April through October in a dynamic rain-fed watershed in Juneau, Alaska. Initial results indicate that fish growth is influenced by hydrologic conditions, and that flow regime plays a significant role in shaping annual growth trajectories of juvenile salmon. Our results will help parse out complex relationships among stream flows, prey fluxes, and fish growth, thus improving understanding of how shifting flow regimes may impact salmon productivity.

Austin Flanigan: Understanding Pacific Halibut (*Hippoglossus stenolepis*) Spatial Dynamics in the Northern Bering Sea

In recent years, the fish assemblage has been changing in the Northern Bering Sea (NBS), where rising water temperature has correlated with increases in abundance of sub-arctic fish species. One such species is the Pacific halibut, a commercially important flatfish that is a potentially valuable resource in the NBS. To optimize harvest opportunities of this increasingly available fish, informed management is important, which in part requires understanding halibut movements and spatial dynamics in the region. Currently, this information is scarce, and as such, the current management paradigm makes a number of assumptions generalizing Pacific halibut movements within NBS management areas. To obtain spatial dynamic information for Pacific halibut in this region to better inform management decisions, pop-up

satellite telemetry tags were attached to large, mature female Pacific halibut in two locations in the NBS. Data recovered from these tags was used to assess movement and habitat occupancy within the region. Preliminary findings indicate that tagged individuals remained within the NBS and Central Bering Sea, with Pacific halibut crossing multiple management boundaries, including the Russian maritime border. During the winter spawning season, Pacific halibut made long migrations to the shelf edge, ranging as far south as the Pribilof Islands. Additionally, some individuals returned to their tagging location the following year, an indication of inter-annual site fidelity to summer foraging areas. These findings are important to both local stakeholders and managers when making management decisions about this increasingly available resource.

Zachary Gold: Linking Salmon Run Timing and endangered Cook Inlet beluga foraging patterns across Cook Inlet through eDNA

Understanding the prey preferences of the endangered Cook Inlet beluga are critical for successful management and recovery of this culturally and ecologically important species. However, surveying both beluga prey species and tracking beluga foraging patterns are difficult in Cook Inlet given the highly dynamic marine environment and high glacially derived suspended sediment loads, severely limiting the application of visual surveys. Thus, novel methods for surveying prey fields and detecting beluga occurrences are needed. Here we designed and implemented an eDNA metabarcoding approach to capture fish prey species, and detect beluga occurrences at two key river mouths in upper Cook Inlet, in partnership with the Alaska Beluga Monitoring Partnership. We conducted monthly sampling in the Kenai River over a 12 month period (November 2020 - 2021 to better understand the relationship of beluga foraging patterns and seasonal dynamics in fish assemblages. High resolution eDNA sampling in conjunction with community science visual observations was conducted in Twentymile River before, during, and after the observation of Belugas (Aug.-Nov. 2021). We demonstrate the value of molecular genetic approaches to reveal changes in salmon and eulachon abundance and provide critical insights in the foraging ecology of Beluga in Cook Inlet rivers, directly informing management and recovery efforts. Our results lay the ground work for the application of eDNA approaches to monitor understudied fish communities and across Cook Inlet and Alaska broadly and provide a valuable tool to better resolve trophic ecologies and foraging patterns of marine top predators.

Karen Grosskreutz: Adaptations to Change in Commercial Salmon Fisheries in Two Regions of the Gulf of Alaska

In the Gulf of Alaska, effects from a changing climate impact Pacific salmon, and therefore salmon fishing livelihoods. We are conducting interviews with commercial salmon fishermen and representatives from institutions that support the salmon fisheries in two regions of Alaska. Interviews focus on long-term observations from commercial salmon fishermen regarding changes to the environment, target species, and strategies for adaptation to multiple stressors. Interviews with institutional representatives focus on perceptions of, and responses to stressors facing the commercial salmon fishery. Results will explore the adaptive strategies of fishermen and the role of local institutions in the resilience of the fisheries.

Kristen Gruenthal: Heritability estimation using large-scale pedigree reconstruction in Pink Salmon spawning in the wild

The Alaska Hatchery Research Project (AHRP) was developed to better understand how stray hatchery Pink (Oncorhynchus gorbuscha) and Chum (O. keta) Salmon interact with and impact wild populations. A portion of the AHRP has focused on estimating the reproductive success (RS) of stray hatchery- relative to natural-origin Pink Salmon spawning in streams. We performed genetic parentage analysis on tissue samples collected from thousands of post-spawning natural and hatchery Pink Salmon collected in five Prince William Sound (PWS) streams to reconstruct pedigrees in support of this goal. We then leveraged data from offspring assigned both parents (triads) in these large-scale Pink Salmon genetic pedigrees to estimate narrow-sense heritability (h2) of run timing (sample date) and body length (mid-eye to hypural plate). Triad data facilitated comparison among parental-origin cross types (natural-natural, hatchery-hatchery, or mixed-origin), which is important because differences between natural- and hatchery-origin Pink Salmon have been documented for all of these traits. We then used two methods to estimate h2 from linear regression of offspring trait values on parent or mid-parent data, including using the slope of the regression line and with an explicit animal model. Our results were estimated using single-generation data from the even lineage in five streams. Analyses of additional years are in progress. We found evidence of a heritable component to both sample date and body length. Moreover, because we are measuring heritability in the wild, our estimates are likely influenced (downward) by the many variables encountered in the wild. Therefore, interbreeding between natural and stray hatchery fish may carry the potential to change these natural population characteristics.

Toshihide Hamachan Hamazaki: Web based spawner-recruit and escapement goal analyses

Spawner-recruit and escapement goal analyses are fundamental of salmon fishery research and management that every fishery biologist studied in school. However, because it requires high statistical and programing skills, it is difficult for regular fishery biologist to conduct the analyses. Here, I introduce and demonstrate a web based Pacific salmon escapement goal analyses app. By uploading data and with few clicks, the app allows anyone to conduct Bayesian spawner-recruit and escapement goal analyses. The app is available at https://hamachan.shinyapps.io/Spawner_Recruit_Bayes/"

Carolyn Hamman: Molecular and physiological thermotolerance traits of Broad Whitefish Coregonus nasus and Saffron Cod *Eleginus gracilis*

Co-authors: Dr. Trent Sutton (UAF), Dr. Amanda Kelley (UAF), and Dr. Andrés López (UAF, Muesum of the North)

This study examined three interrelated thermotolerance parameters to increase our understanding of how Saffron Cod and Broad Whitefish may respond to differing thermal environments. The objectives were to determine if acclimating these fish to cold (5 C) or warm (15 C) temperatures affects thermotolerance between and among species, and if HSP70 concentrations and mRNA expression in

important tissue types would differ between acclimation temperatures, tissue-type, and species. Fish were collected from the Beaufort Sea and cold or warm acclimated in the laboratory where a thermal-ramping experiment was conducted until their critical thermal maximum (CTmax) was reached, a proxy for thermotolerance. Muscle, liver, and brain samples were collected for Western Blot analysis and RNAseq analysis to determine changes in HSP70 expression. The average CTmax for 15 C-acclimated fish (Broad Whitefish: 27.3 C; Saffron Cod: 25.7 C) was significantly higher ($p = 0.05$) than that of the 5 C-acclimated group (Broad Whitefish: 23.7 C; Saffron Cod: 23.2 C). At 15 C, Broad Whitefish had a significantly higher average CTmax (27.3 C) temperature than Saffron Cod (25.7 C). The results suggest that both species can generate a physiological response to differing temperatures and shift their thermotolerance as a result. The difference in CTmax values between Broad Whitefish and Saffron Cod at 15 C most likely reflects the fact that Saffron Cod is a more polar, marine species that briefly come in to the nearshore area while Broad Whitefish reside in this environment for an extended period of time. The positive relationship between acclimation temperature and CTmax reported here has been observed in other species such as the Lake Whitefish Coregonus clupeaformis. Additionally, the observed CTmax in Broad Whitefish is comparable to another reported values for this species acclimated at 9 C (23.3 C, n=2) . The data from this study provide insight in to the continued impact climate change will have on Arctic aquatic communities."

Margaret (Maggie) Harings: Evaluating Environmental DNA as a Complementary Tool for Estimating Salmon Abundance in the Yukon River Basin

Daily salmon abundance estimates guide critical in-season management decisions that impact subsistence fishing throughout the Yukon River Basin. In recent years, this region has observed a severe decline in Chinook and chum salmon abundance as well as an increase in high-flow events. At times, these high-flow events have rendered weirs, counting towers, and sonar stations temporarily inoperable, leading to inconsistent salmon counts and delayed management decisions. In response, we are testing a cost-effective method using concentrations of environmental DNA (eDNA) shed by Chinook and chum salmon to interpolate escapement data where gaps in salmon counts occurred. During the summer of 2021, agency personnel at the East Fork Andreafsky River, Chena River, Salcha River, and Henshaw Creek salmon escapement sites collected daily temperature and flow measurements and sampled eDNA over a period spanning between 32 and 45 days (average of 36 days of eDNA sampling per site). We will use species-specific quantitative PCR (qPCR) assays to determine the concentrations of DNA molecules from target species in filtrate DNA isolates. At present, we are confirming limits of detection and limits of quantification for species-specific assays, and we will begin quantifying filter eDNA during the winter of 2022. We predict that temporal variations observed in flow-corrected, species-specific eDNA concentrations will reflect those noted in salmon runs at corresponding escapement assessment sites. The long-term vision of this project is to build capacity to support cost-effective monitoring of fish populations and enhance climate change resilience in salmon assessment throughout Alaska."

Lilian Hart: Quantifying juvenile Chinook distribution and abundance under different climate regimes

Pacific salmon are integral to the wellbeing of many indigenous peoples, rural communities, and local economies throughout the state of Alaska. Global climate change has resulted in changes in both the distribution and condition of many species in marine environments, resulting in challenges for efficient and sustainable fisheries management. As the rate of climate change accelerates, fisheries managers face increasing pressure to develop novel planning methods that can account for unprecedented future conditions. This research explored whether changes in juvenile salmon distribution and abundance in the Bering and Chukchi seas could be explained by shifts in climate regimes. In the North Pacific, decadal-scale climate events have caused multi-year periods of warm and cold climate, termed climate stanzas. A nested set of generalized additive models were fit to spatiotemporal data collected from the Bering Arctic Subarctic Integrated Survey, trained with records from two warm climate stanzas (2002-2005, 2014-2016), and the other with records from a cold climate stanza (2007-2013). Spatial patterns in abundance and stanza effects were visualized to test hypotheses regarding shifts in species distribution during warmer climatic conditions. Parameter estimates were assessed to test the hypothesis that the overall abundance of juvenile Chinook salmon encountered decreased during warmer climatic conditions. The model that best described the data included covariates for both an overall climate stanza effect and for spatial variation by stanza. Distribution hotspots varied by stanza, and shifted from Bristol Bay (warm stanza) to the tip of the Alaska Peninsula (cold stanza). Estimates of overall abundance pointed to higher abundance during warm, rather than cold stanzas, for the 2002-2016 year period.

Luke Henslee: Partitioning coho salmon landed in Norton Sound fisheries in the absence of convenient stock markers

Co-authors: Ashley Dunker (NSEDC), Zach Liller (ADF&G), Peter Westley, and Andy Seitz (UAF).

In Alaskan salmon fisheries, partially-isolated populations that geographically co-occur are conceptualized as stocks for management purposes. Both the development of stock-specific harvest strategies and the metrics for judging their success depend on accurate estimation of recruitment abundance, which in turn is predicated on accurate stock identification in harvest. This is challenging in mixed fisheries which exploit multiple stocks as catches must be partitioned and allocated to their stock of origin. The nearshore waters of Norton Sound commercial fishing district is divided into subdistricts which, due to a lack of convenient stock markers, are each managed as terminal fisheries (i.e., all harvest is allocated to the subdistrict target stock). To test this assumption, 167 coho salmon from Shaktoolik subdistrict and 174 from Unalakleet subdistrict were fitted with acoustic transmiters in two consecutive return years and tracked to spawning destinations, allowing stock assignement. Models fit to data estimate that in Shaktoolik subdistrict 33% of commercial harvests were its target stock in project years and in Unalakleet subdistrict 87% of harvest was its target stock. Results suggest that stock-specific management reference points may be obscured by terminal fisheries strategies in some Norton Sound subdistricts.

Justin Hill: Predation impacts of common merganser on Chinook salmon revealed using genetic analysis of scat

Coauthors: Andrés López and Erik Schoen (UAF)

Piscivorous ducks such as the common merganser can be important predators of juvenile salmonids. Mergansers are regularly observed feeding near known Chinook salmon rearing areas in the Yukon River Basin. However, it is unclear whether merganser predation in these areas may be a contributing factor to ongoing Chinook salmon population declines. To assess potential predation impacts of mergansers on salmon populations, we 1) conducted piscivorous bird surveys along an approximately 90 km stretch of the Chena and Salcha rivers and 2) inferred the presence of Chinook salmon in merganser diets using species-specific genetic assays on merganser scat samples (n=64) collected from each river. The minimum post-breeding common merganser density was 0.78 birds/river km on the Chena River and 1.68 birds/river km on the Salcha River. Chinook salmon DNA was present in 19/32 of the Chena scat samples and 31/32 of the Salcha scat samples. Currently, we are using targeted next-generation sequencing on a subset of the scat samples to determine the presence of other potential prey species. Finally, we will describe a forthcoming bioenergetics assessment of whether mergansers at the densities we observed could potentially consume enough salmon parr to represent a meaningful source of mortality to Chinook salmon populations during periods of low abundance.

Chris Hinds: Comparison of age estimations in Lingcod otoliths and fin ray spines

Lingcod are an important food source for commercial, subsistence, and sport fisheries in Alaska. Two methods of age estimation for management are currently in use and this study aimed to substantiate both methods: the Alaska Department of Fish and Game commercial fisheries' Age Determination Unit (ADU) uses the otolith break and burn method and the Gulf of Alaska Bottom fish, Division of Sport Fish (GOAB) uses the fin ray spine resin and saw method. To assess potential differences between methods, both programs exchanged paired sagittal otoliths and fin ray spine collections. Agencies estimated ages without access to somatic or prior age data. Additionally, the ADU trained on GOAB methods without prior experience and spine ages were compared between labs. A total of 326 lingcod were sampled from the Northern Gulf of Alaska (NGAK), and the otoliths were aged by ADU while the paired spines were aged by GOAB. Secondly, a sample of 100 spines from fish caught in Southeast Alaska (SEAK) were prepared and aged by ADU using GOAB's methodology before being re-aged by GOAB. The paired otoliths from SEAK were also aged by ADU. For samples from the NGAK, the mean age was approximately 13 years, the average CV was 8.1%, and the agreement (+/- 2 years) was 82.5%. For samples from SEAK, the mean age was approximately 13 years, the average CV was 11.1% and agreement (+/- 2 years) was 68% across methods. Using the SEAK sample, the CV was 10.9% and the agreement (+/- 2 years) was 75% between fin spine ages between the labs. The average bias of all samples was approximately 0 and the average CV and percent agreement were comparable to reported production standards, suggesting that ages were comparable between methods and labs, and either structure is acceptable for age estimation."

Elizabeth Hinkle: Stream habitat and community assemblage response to wildfire in interior Alaska boreal

Wildfire is the primary natural disturbance in boreal forest stream ecosystems and fires are expected to continue to increase in duration and frequency owing to climate change. Wildfire has been shown to have positive (e.g., increased nutrients) and negative (e.g., increased sedimentation) impacts on stream ecosystems. Increased productivity as a result of recent fire may lead to more complex aquatic communities owing to higher food resource availability. As a result, fire may play a key role in determining macroinvertebrate and fish assemblages in boreal streams, but complex interactions make it challenging to quantify these effects. During summer 2019, we investigated community responses to wildfire at 26 spatially-balanced sites on wadeable streams in interior Alaska with varying time since fire disturbance (recent: 0-15 years, historic: 40-70, control: 80+). At each site, we measured physical habitat (e.g., substrate composition, riparian canopy cover, bank stability) and water chemistry, quantified macroinvertebrate and fish assemblage structure, determined fish mass-abundance relationships, and assessed aquatic food webs via stable isotope analysis. Fish community assemblages were relatively simple, with no more than five species detected per site. Macroinvertebrate and fish diversity and density were higher at recently burned sites relative to control or historic sites. Analysis of habitat characteristics revealed that recently burned sites had more in-channel wood, less fine sediment, lower canopy cover, more soluble reactive phosphorous, and warmer water temperatures relative to control and historic sites. Preliminary stable isotope data reveal that streams that recently experienced wildfire have a wider carbon breadth and longer food chain length than control streams. Knowledge of how aquatic community and food web structure relate to variables associated with fire disturbance may promote a better understanding of how climate change and fire interact to impact boreal stream ecosystems and provide insight into community-wide responses to wildfire.

Bobby Hsu: Opportunistic evaluation of the impact of net pen tow release strategy on homing behavior of coho salmon

Co-authors: Lorna Wilson (ADF&G), Chris Habicht (ADF&G), and Ben Adams (NSRAA)

Alaska salmon hatcheries release Pacific salmon smolts with the goal of benefiting the public through contribution to common property fisheries (commercial, sport, personal use, and subsistence). Homing behavior allows for the targeting of hatchery-origin fish by the fishers and the collection of broodstock for the hatchery, while reducing the interaction with wild stocks. Salmon originating from SEAK have steadily declined in survival since the 1990s, including coho salmon released at Kasnyku Bay. One possible cause for this poor survival is predation at the time of release from predators such as humpback whales and black cod. In response to this concern, hatchery operators have towed nets away from the imprinting site, before releasing smolts. However, little is known about the effect this treatment on homing behavior. The hatcheries differentially tag fish released under these two release treatments. However, simply assessing homing proportions of released and returning fish does not account for potential differences in survival between the treatments. Here we propose a novel method that accounts for mortality through adulthood to examine if homing behavior differs between these two treatments. Over six years of Coho salmon released at Kasnyku Bay, we found no evidence of differences in homing behavior between fish that were released at the imprinting site and fish released from towed net pens.

Kelly Ireland: Crude Oil-Induced Impacts on Growth and Development in Threespine Stickleback and the Role of Microbial Community Composition

Co-authors: Brandon Briggs (University of Alaska Anchorage), Kathryn Milligan-Myhre (University of Connecticut), Mary Beth Leigh (University of Alaska Fairbanks)

The microbiota plays a crucial role in host health and therefore toxicologists have begun examining how toxicants, like crude oil, impact the microbiota. Crude oil shifts the microbiota composition towards a greater abundance of known oil-degrading genera. These crude oil-induced community shifts could cause dysbiosis as important microbial functions for maintaining host health may be lost and oil-degrading genera may help detoxify or expose the host to more toxic intermediates. To examine how the microbiota impacts host response to crude oil, we exposed gnotobiotic threespine stickleback inoculated with either a putative hydrocarbon-degrading mock community, a conventional microbiota, or no microbes to water with oil and without oil. Fish from Westchester Lagoon were exposed to a 10 ppm water accommodated fraction of Alaska North Slope crude oil and microbes at 7 days post fertilization (dpf). We hypothesized that oil exposure would significantly reduce fish growth and increase defects and that greater microbial diversity and hydrocarbon-degrading microbes would aid in host detoxification, therefore the effects of oil would be least pronounced in conventional microbiota fish and most pronounced in germ-free fish. We found that crude oil significantly reduced eye diameter, swim bladder length, and area. Crude oil exposure also significantly increased craniofacial and spinal defects and edema. However, there was no significant effect of the microbiota alone or the interaction between treatment and microbiota on the fish. There was also no significant effect of oil alone on fish snout-vent length. While crude oil significantly impaired growth and development, the microbial community composition did not impact the fish's response to exposure, suggesting that crude oil's effect on the growth and development of threespine stickleback are not through indirect impacts like microbiota dysbiosis and that the microbiota does not play a protective role for the host following crude oil exposure at 7 dpf.

Andrew Jasonowicz: Leveraging multiple genomic approaches to investigate population structure and dynamics of Pacific halibut in the northeast Pacific Ocean

The Pacific halibut Hippoglossus stenolepis is a key flatfish species in the North Pacific Ocean ecosystem that supports important commercial, recreational and subsistence fisheries and that is managed as a single stock by the International Pacific Halibut Commission. The overarching goal of the present study is to advance our understanding of Pacific halibut population structure and dynamics in a changing climate through the use of genomic approaches to inform fishery management. In particular, we seek to improve our current understanding of stock structure among spawning groups of Pacific halibut in the northeast Pacific Ocean by conducting low coverage whole-genome resequencing, a method that allows the characterization of genomic variation at the highest resolution possible and with which we will establish a baseline of Pacific halibut genetic diversity. Subsequently, we will leverage the obtained genomic data to identify markers that display high differentiation among the different genetic baseline datasets. With approximately 500 of the identified genome-derived markers we will develop a high-throughput and

high-resolution genomic marker panel (GT-seq). Finally, we will test the utility of the GT-seq panel to address management and conservation issues in Pacific halibut by using it in two proof of concept applications: 1) to conduct a pilot mixed stock analysis to estimate the stock composition of commercial fishery landings from two different geographic areas in Alaska, and 2) to investigate distribution of Pacific halibut in the latitudinal extremes of the species' range in the northeast Pacific Ocean. The results from this study will inform on the delimitation of management units and provide preliminary information on stock composition in the Pacific halibut fishery, as well as provide a tool to monitor changes in distribution associated with climate change.

Justin Kay & Erik Young: Automated Salmonid Counting Using Sonar Data

Accurately measuring and counting the number of salmon and steelhead migrating upstream to spawn is essential in monitoring threatened populations, assessing the efficacy of recovery strategies, guiding fishing season regulations, and supporting the management of commercial and recreational fisheries. The success of these initiatives depends on accurate and fine-grained data collected in real-time on-site. While several different methods exist for counting freshwater fish, they often suffer from problems associated with mortality, measurement error, and high expense. Many key sites in the U.S. and Canada are using multi-beam SONAR cameras to count and measure salmon returning to their natal streams. This method eliminates mortality and reduces measurement error. However because the actual counting is done manually, requiring technicians to count fish by manually viewing in-stream SONAR video, it is expensive and can be slow. An automated system using visual recognition technology could accurately count and measure migrating salmonids around the clock and would lead to cost savings, improve counting accuracy, and reduce reporting times for river conservation and fisheries management initiatives, allowing these programs to scale to cover a broader range of locations and conservation goals. The Computational Vision Lab at California Institute of Technology (Caltech), in partnership with Trout Unlimited and with support from Amazon Web Services (AWS), is developing an automated system for fish counting and measurement. The approach is using state-of-the-art Machine Learning (ML) and Computer Vision (CV) algorithms to analyze multibeam imaging sonar video collected from SONAR cameras. The ultimate goal is to automatically detect, track, count, and measure migrating salmonids in real-time. We envision a system using on-site cameras and laptops with installed software designed to accurately estimate salmon and steelhead upstream migration 24 hours per day in-season, transmitting this data in real-time to fishery management personnel for making rapid, detailed, and cost-effective management decisions. Work on this project began in the Spring of 2019. A dataset of over 400,000 images has been collected and annotated for machine learning from SONAR cameras deployed on the Kenai, Elwha, and Nushagak rivers. An initial proof-of-concept algorithm has achieved promising results. As of October 2021 we have deployed in the cloud a prototype algorithm and automated counting system for testing by stakeholders at NMFS and ADF&G who were able to upload and analyze a sampler of their videos. Initial feedback has been positive. Future work will include: evaluating and improving generalization performance on new rivers and data sources; improving algorithms to reduce counting and measurement error; and deploying the algorithm on low-cost hardware on-site for real-time data analysis and reporting.

Brandi Cron Kamermans: Understanding *Spirinchus thaleichthys*: local researchers searching for a declining population of a species valued by the Lhaq'temish in Bellingham Bay and the Nooksack River, WA

We developed a species-specific quantitative PCR (qPCR) assay to detect Spirinchus thaleichthys (S. thaleichthys), from marine and freshwater environments. S. thaleichthys (also known as Longfin Smelt) are culturally important to the Lhaq'temish and Traditional Ecological Knowledge informs us that they are in decline. Researchers at Lummi Natural Resources and the Salish Sea Research Center teamed up to develop a set of sampling activities aimed at extending our knowledge of the abundance dynamics and movements of S. thaleichthys spawning assemblage in the Nooksack River. The ultimate goal is to help the local community monitor their valued resource. The Nooksack is home to a historically large and potentially genetically distinct annual spawning run of this anadromous species. However, the life history of S. thaleichthys is poorly characterized. We used traditional dipnet techniques, in addition to egg surveys and environmental DNA (eDNA) sampling to determine the spawning habitat and life cycle of S. thaleichthys in Bellingham Bay, WA. Our qPCR assay consistently and sensitively detects S. thaleichthys and differentiates them from the closely related Night Smelt, S. starski. We also confirmed the assay detects S. thaleichthys eDNA at times when the fish are present according to our catch records. The assay is capable of quantifying eDNA at concentrations as low as 8 molecules/uL. This is the first study to attempt to capture eDNA of forage fish in the Nooksack River and Bellingham Bay. No one knows where S. thaleichthys go in the months before and after spawning. The presentation will invoke discussion and collaborations about the use of eDNA and qPCR to observe anadromous fish. This work is important because detecting species using eDNA methods, rather than directly sampling the organisms, can reduce impacts on sensitive species while also filling life history data gaps."

Amanda Kelley [Plenary]: Direct and indirect effects of ocean acidification on juvenile pink salmon physiology and biominerology

Co-authors: Marina Washburn (UAF) and Shelby Bacus (UAF)

The ocean is currently experiencing a long-term decrease in pH, driven by an increase in anthropogenically produced carbon dioxide, a process known as ocean acidification (OA). OA can have direct and indirect effects on an organism's physiological function and potentially, overall fitness. Here, we conducted a fully factorial two-way experiment examining the direct effect of OA (elevated pCO2) and indirect effect of reduced food availability on juvenile pink salmon, Oncorhynchus gorbuscha. Newly osmocompetent juvenile pink salmon were exposed to ambient pCO2 (400 µatm)/ambient food availability, ambient pCO2/reduced food availability, elevated pCO2 (1,100 µatm)/ambient food availability, and elevated pCO2/reduced food availability for six weeks during the summer of 2021.This study found a significant, negative effect of pH on the conditional index and mass of juvenile pink salmon. In addition, there were significant differences in morphological features, presence of vaterite in otoliths, cortisol expression and other metrics, all a function of pH exposure. Differences in these parameters could have population-level impacts on pink salmon survival and fitness. This work highlights the need for OA exposure studies on salmon that extend beyond a few weeks, as previous OA research on this species lasted only two weeks postosmocompetency.

Erika King: Relative reproductive success of jack and regular male Coho Salmon

Despite the wealth of research on Pacific salmon life histories there is limited information on the lifetime reproductive success of precocial males (here referred to as jacks). Over half the returning male spawners can be jacks in some populations and some years, so it is crucial to understand their contribution to population productivity. We quantified adult-to-adult reproductive success (RS) of jacks (of which estimates are rare) and their relative reproductive success (RRS) compared to full-size males in a wild population of Coho Salmon in the Auke Creek watershed, Juneau, AK. We used genetic data from all individuals (~8,000) returning to spawn over a decade (2009-2019) to conduct parentage analysis and calculate RS of individuals. The average adult-to-adult RS of jacks (mean=0.7 & SD=1.9) was less than that of full-size males (mean=1.1 & SD=3.3). Jack RRS was consistently below 1 but ranged widely (0.23 to 0.96). Despite their lower average success, jacks contributed significantly to the population by fathering 23% of the total returning adult offspring (1033 out of 4456) produced between 2009-2015. These results demonstrate that jacks can affect evolutionary and population dynamics and they are relevant to the conservation and management of Pacific salmon.

Aaron Lambert: Development of a Bayesian Framework for Yukon River Chinook Salmon Inseason Abundance Projection

The Yukon River is the largest river in Alaska, stretching 1,980 miles from its headwaters in British Columbia, Canada to its terminus at the Bering Sea. Chinook salmon harvest in the U.S. portion of the Yukon River is managed by the Alaska Department of Fish & Game (ADF&G), who require robust in season predictions for the abundance of returning Canadian-origin Chinook salmon Oncorhynchus tshawytscha to comply with the Yukon River Salmon Agreement, between the countries of Canada and the United States. Chinook salmon returning to the Yukon River are an important subsistence, personal use, commercial, and sport resource for residents of the region. In recent years, little to no harvest opportunity has been available due to consistently low run sizes which have been further complicated by a high degree of uncertainty in annual run size predictions. Currently, ADF&G treats preseason run size predictions separately from inseason abundance projections based on information collected at the Pilot Station sonar project. ADF&G inseason projection methods may not account for the full uncertainty in the data or fully describe the increase in precision of inseason information as the season progresses. To address this issue, we have developed a Bayesian updating approach under which preseason forecasts are updated with inseason sonar abundance information to project the total end-of-season abundance of Canadian-origin Chinook salmon, while accounting for the uncertainty in preseason and inseason predictions. We hypothesize that this Bayesian approach is advantageous because data collected at different time points within the season and with differing levels of precision can easily be integrated to generate more robust predictions for end-of-season abundance while allowing probabilistic statements of forecast accuracy. Here we will describe preliminary results from the first iteration of this Bayesian abundance projection model and future directions for research and model development.

Joseph Langan: Life on the high seas: new insights into the marine distributions of Pacific salmon

"Co-authors: Curry J. Cunningham (UAF), Jordan T. Watson (NOAA), Skip McKinnell (Salmoforsk International Environmental Consulting)

Illegal, unreported, and unregulated (IUU) fishing presents a major challenge for global fisheries management, but increasingly available vessel tracking data primarily describe legal and legitimate activities. In vast ocean regions like the North Pacific, this makes the detection of IUU fishing difficult and leaves valuable species with uncertain distributions particularly vulnerable to exploitation. Pacific salmon spend a large part of their life cycle in the open ocean, where climatic and oceanographic conditions are thought to strongly influence habitat selection and survival. Although salmon as a group are abundant in the surface waters of the North Pacific, critical knowledge gaps regarding their ocean ecology and distributions persist. As a result, it is difficult to assess how high seas environmental conditions and IUU fishing impact the culturally and socioeconomically important fisheries salmon support throughout their range. To address this issue, we assembled a novel database of historic high seas survey data collected by Pacific Rim nations and fit species distribution models to: 1) describe the marine spatial distributions of six salmon species, 2) test for distribution shifts over time, and 3) evaluate species-specific environmental preferences that influence distribution. These results develop an enhanced understanding of salmon ocean distributions, providing a unique window into this often unobserved but crucial portion of the life cycle, and serve as a baseline for future investigations into the mechanisms influencing salmon ecology and vulnerability to harvest in the North Pacific.

Wes Larson: Is structural variation necessary to create islands of divergence? A case study in sockeye salmon

Co-Author: Kristen Gruenthal (ADF&G)

As more genomic data are accumulated in a wide variety of organisms, it is becoming increasingly clear that adaptive loci are often clustered in relatively few regions of the genome termed genomic islands of divergence. However, the mechanisms that create and maintain these islands of divergence are still relatively poorly understood. Here, we use sockeye salmon from Alaska as model to explore the mechanisms that underly islands of divergence. Sockeye salmon display extraordinary phenotypic diversity corresponding to unique spawning habitats, and it is hypothesized that this diversity evolved repeatedly as genetically similar ancestral populations colonized new systems and adaptively diverged. Previous research has illuminated multiple islands of divergence in sockeye salmon, with many shared among drainages, suggesting that islands of divergence may help to facilitate adaptive radiation in this species. We used whole genome resequencing to investigate the genetic mechanisms underlying islands of divergence in sockeye salmon from southwest Alaska. Most islands appear to be relatively small inversions (~50-100 kb), with one major exception on chromosome 13, which appears to be maintained by strong selection with no evidence of structural variation. Our findings indicate that structural variation is likely extremely important in facilitating adaptive divergence of sockeye salmon, but that structural variation is not required to create islands in all cases. These findings also illustrate the

importance of constructing management strategies that preserve adaptive diversity, as variation in islands of divergence is likely vital for ensuring the resiliency of sockeye salmon into the future.

Maddy Lee: Keeping Cool? Is heat stress influencing the success of sub-Arctic spawning Chinook salmon in Alaska?

Alaska is no longer the last frontier for salmon and the same challenges in the lower 48 are present on the Kenai Peninsula. With pressures of urbanization and climate change driving a rapid increase in water temperatures, wildfires, invasive species, and drought, the Kenai is a model system to explore whether Alaska's salmon will adapt to these obstacles. A major concern is the consistent warming of freshwater temperatures, surpassing salmon thermal limits (18 degC), which is contributing to en route mortality in adult migrating salmon before spawning (prespawn mortality) and weakened reproductive success. Recent work has revealed the heat shock protein 70 (HSP70) as a tool to assess thermal stress in Pacific salmon. There is still little known about how the release of HSP70 in Pacific salmon caused by warmer water temperatures differ by factors such as hatchery vs. wild origin and stream site origin. In my presentation, I compare the thermal experience of two nearby streams to understand whether there are patterns of natural variation of heat stress in a landscape. I have analyzed 135 HSP70 muscle biopsy samples as a response to variable temperatures in Chinook salmon on Crooked Creek and the Ninilchik River for the summer of 2020. Results suggest stream site plays a major role in varying HSP70 responses. The hatchery vs. wild variation did not appear to have a strong influence on HSP70 levels but will continue to be assessed once the 2021 HSP70 results are available. Overall, the 2020 HSP70 results for both streams were consistent with other HSP70 studies, showing as water temperatures increased, so did Chinook salmon HSP70. With current climate projections, I will try to understand the greater consequences of heightened thermal stress on salmon survival and spawning success.

Justin Leon: Drone Applications for Fisheries Management in Norton Sound

The Alaska Department of Fish and Game is tasked with managing fisheries in the best interest of the economy and the well-being of the people of the state. An important tool for fisheries managers is escapement data, which are total counts of fish species returning to their natal streams. Fisheries managers use aerial surveys to collect escapement data when on-the-ground counting projects are not an option. In Norton Sound, most aerial surveys are conducted by helicopter, which are expensive and can be difficult to schedule on short notice, when optimal viewing conditions are present. Drones were first considered as an alternative to aerial surveys in 2020, because the pandemic made helicopter time more restrictive. Therefore, a significant number of streams were not surveyed in 2020. Cost-benefit analysis showed investing in a drone may be worthwhile, and a drone (DJI Mavic 2 Zoom) was purchased. In 2021, the drone was used to inspect counting projects when staff had to leave due to safety concerns, such as high-water events, and to conduct aerial surveys of Salmon Lake to count sockeye salmon. Both applications were decided based on drone flight time and proximity to the road, allowing for less opportunities for drone error (e.g., run out of battery, loss of signal, etc.). Both applications proved successful, with the drone able to check and assess damage to counting projects and providing viable images for counting salmon. Counts from drone images and counts from an observer in a helicopter were

similar. Future plans include continuing survey assessments to validate using the drone on road-accessible systems.

Elizabeth Mik'aq Lindley: Arctic Salmon: Patterns and Perceptions of Change

The poleward redistribution of plants and animals is one of the strongest signals of warming global temperatures and is threatening to restructure ecosystems across the Arctic. As active ecosystem participants, Arctic residents are reporting an increasing presence and use of Pacific salmon (Oncorhynchus sp.), a change that is emblematic of a changing Arctic. The presence of salmon in the Arctic and what it means for socio-ecological systems is largely unknown and is concerning for many communities experiencing a plethora of environmental changes firsthand. In this talk I will briefly outline a methodological approach to synthesizing these changes in salmon occurrence across space over time through a novel holistic ecosystem functioning approach that considers salmon, people, and place as equal ecosystems participants.

Samuel May: Ecological drivers and fitness consequences of dispersal in Sockeye Salmon; implications for hatchery impacts to natural populations

Dispersal among populations is a fundamental process in ecology and evolutionary biology. Nevertheless, the ecological drivers and fitness consequences of dispersal in wild populations are relatively unknown, despite their significance for population distributions, gene flow, and recruitment. My recent Ph.D. work examined the effects of ecological processes on dispersal using 14 years of field surveys and full pedigrees of two stream-spawning populations of Sockeye salmon in Bristol Bay, Alaska (A and C Creeks). I found that predation, population density, and return timing to spawning sites were key factors influencing dispersal. Furthermore, I found differences in fitness and dispersal rates among the two streams, whereby C Creek had higher fitness and lower dispersal rate than A Creek. Finally, dispersers who moved from A Creek to C Creek increased their fitness, whereas individuals moving in the opposite direction decreased their fitness relative to non-dispersers in their respective natal streams. One likely explanation for these differences in fitness and dispersal rate is fine-scale differences in habitat quality among the two streams. These findings suggest that future changes to ecological processes or habitat qualities may affect rates of straying and gene flow between populations. Here, I discuss the relevance of these findings to the potential effects of hatcheries on wild population structure, recruitment, and resilience.

Brian McKenna: Using Unmanned Aerial Systems (UAS/drones) to conduct Chinook salmon redd surveys in the Salcha River

The Salcha River is the largest producer of Chinook salmon Onchorhynchus tshawytscha within the Alaska portion of the Yukon River basin. Chinook salmon spawning in the Salcha River have been monitored since as early as 1974. Previous monitoring methods have included boat-based redd surveys, manned-aircraft aerial surveys, counting tower, and sonar. This proof-of-concept study utilized a novel

methodology using UAS and photogrammetry to generate digital orthomosaics of Chinook salmon spawning habitats in the Salcha River. Orthomosaics were used to conduct a digital redd survey and to record a digital baseline of spawning habitats. Digital, orthomosaic baselines of spawning habitats allow researchers to analyze physical habitat changes as well as changes in habitat selection and usage through time. Digital redd surveys produce an index of abundance that can support current escapement monitoring methods. The information gained, and the outputs created through this project, compliment ongoing escapement efforts in the Salcha River, and provide researchers and managers with an innovative approach to monitoring salmon escapements."

Kevin McNeel: Methods for assessing fisheries data and life history using black rockfish (Sebastes melanops) otoliths and bone

Uncertainty around fisheries data and life history estimates can impact population assessments and management decisions. Analysis of structures such as otoliths and bone can be used to estimate, assess, or improve the quality of fisheries data. We've developed two methods using chronometric (ageable) structures to validate species identification and age at maturity for black rockfish (Sebastes melanops). Black rockfish are commercially important in Alaska, but the semblance to dusky (S. variabilis), and dark rockfish (S. ciliatus) can lead to misidentification. To address potential species identification errors, fish length and otolith weight at age models were used to identify and characterize species identification error. Identified errors were then assessed using species-specific otolith characteristics to corroborate model results. Also, maturation and reproductive life history traits can be difficult to estimate for this species because they are long-lived which can increase the likelihood of skipped and protracted spawning. To develop methods to estimate individual reproductive life histories, progesterone, estradiol, and cortisol concentrations were measured in annual opercula growth increments for two female black rockfish and normalized per individual to years of putatively immaturity (increment ages less than 5 years). Reproductive events were identified in growth increments where progesterone and estradiol were greater compared to years of assumed immaturity. Black rockfish species evaluations using otoliths found 12% of 6,861 putative black rockfish were potential errors, and 85% of those errors had otolith characteristics indicative of other species. Evaluation of hormone data of opercula indicated their concentrations varied annually, with initial peaks in estradiol at four and five years of age possibly indicating sexual maturity and/or reproductive events. These methods provide analytical frameworks for identifying errors in fishery data and for reconstructing reproductive life history events and show initial promise. Work is currently underway to expand results and validate these methods and results.

Megan McPhee: Assessing the effectiveness of transboundary Sockeye Salmon enhancement under the Pacific Salmon Treaty

Co-authors: Sara Gilk-Baumer and Chris Habicht (ADF&G), Pat Barry (UAF/NOAA), Scott Vulstek (NOAA), John Joyce (NOAA - retired), Bill Smoker and Tony Gharrett (UAF - emeriti)

The Pacific Salmon Treaty mandates that Alaska and Canada jointly enhance sockeye salmon populations in the transboundary Taku and Stikine drainages. This enhancement follows an integrated hatchery model: broodstock are taken from the wild return, eggs are fertilized in situ then transported to the

Snettisham Hatchery near Juneau for incubation, and resulting fry are stocked into recipient lakes to rear and emigrate alongside wild fish. Previous work compared fry growth and egg-to-smolt survival between hatchery and wild components in transboundary systems, finding variable effectiveness of enhancement in terms of juvenile survival. Until recently methodological constraints have prevented evaluating effectiveness in terms of returning adults per spawner. Here, we took advantage of the weir on Auke Lake, which allowed us to genetically sample all returning adult sockeye salmon, to evaluate hatchery and wild productivity (adult offspring/spawner). We calculated relative productivity over three brood years of experimental enhancement (2011-2013) by assigning returning adult offspring to individual hatchery or wild-spawning parents. Hatchery productivity greatly exceeded that of wild spawners, with annual relative productivity ranging from 6.0 to 48.9 in females and 8.9 to 58.7 in males. Enhancement had no detectable effect on genetic diversity, at least in the first generation. Hatchery and wild-born salmon had similar run timing and size at age, but hatchery-born fish tended to mature at a younger age. These results indicate that in systems where spawning and/or incubation habitat is limited, supplementation can be an effective way to provide a demographic boost to wild sockeye salmon populations. On the other hand, even a single generation of enhancement can cause undesirable phenotypic changes in the recipient population. Ongoing work will examine effects of the short-term experimental enhancement of Auke Lake sockeye salmon on relative reproductive success and life-history traits in the second generation.

Jeffrey Muehlbauer: Piloting the Quantification of Large Woody Debris Inputs to Large Rivers following Wildfire

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 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 presentation, I will describe plans for empirical quantification this summer in the Alaskan Interior of large woody debris import into large rivers following fire. This is a pilot study, and I welcome and am hoping for feedback on methods, site selection, and any interested collaborators or stakeholder groups.

Andy Padilla: Syncing the past with the future: Integrating advanced technologies into existing databases

Change often begins with the thought: There must be a better way; As technology advances in all aspects of our lives, from image recognition, ever-evolving smart phones to DIY coding, biologists have employed technologies to increase efficiency and accuracy of data workflows. Using ESRI and open-source products, the Alaska Department of Fish and Game (ADF&G) has developed apps for aerial salmon survey, subsistence survey and radio telemetry data, and tested image recognition of salmon using drone

imagery. The adaptation of these technologies has increased project efficiencies, the collection of enriched data, and opened the door to future possibilities.

Molly Payne: Revealing stream attractiveness to hatchery-origin strays in a chum salmon metapopulation

The straying of hatchery salmon produced in harvest enhancement programs results in lost yield to fishermen and mediates interactions between strays and wild fish on the spawning grounds. Previous work has revealed a strong influence of distance between release locations and sites where hatchery fish ultimately stray, but other evidence suggests additional features of recipient sites may similarly attract hatchery strays. In this talk, I review what is known and not known about site-specific attractiveness to hatchery salmon. I also present results from my research that further elucidate patterns of dispersal within Southeast Alaska chum salmon metapopulations. My research describes a modeling approach that considers collective movement ecology as well as site specific environmental variables while accounting for hydrological distances among sites. Understanding and identifying the biotic and abiotic factors shaping site specific attractiveness to strays with this model will allow for more accurate accounting of wild fish escapement and facilitate planning of release locations to avoid locations of highly attractive streams. Taken as a whole, this project seeks to support Alaska's intention to avoid interactions of hatchery and wild fish on the spawning grounds because of the well-known detrimental ecological and evolutionary impacts on wild fish.

Laura Pevan: Expanding tribal fisheries research in the Matanuska River watershed

With support from funding through the USFWS Tribal Wildlife Grant Program and BIA Subsistence Program, 2022 stands to be a busy year of increased focus on salmon information for the Matanuska Watershed, with a primary focus of increasing salmon presence and abundance information for Moose Creek, an anadromous tributary to the lower Matanuska River, through the installation and operation of a video monitoring system and weir. Understanding the fisheries resources that exist within traditional Ahtna Dene lands and waters is a high priority to Chickaloon Village Traditional Council in southcentral Alaska. Prioritizing knowledge about fisheries resources is a natural outcome from the Ahtna values of responsibility of land stewardship and resource conservation, and serves as a connection mechanism between cultural values and place-based history. Moose Creek has strong cultural and historical ties to the Chickaloon Village Tribal citizens, and oral histories document that at one time 5 species of Pacific salmon spawned in its waters. The upcoming 2022 fieldwork continues research into salmonid presence, abundance, and spatial extent in Moose Creek, following critical fish passage projects in 2005-2006, an extensive Chinook and Coho juvenile PIT Tagging study from 2017-2020, and ongoing surface water quality sampling due to the area's unique history of multiple coal mine sites. The 2022 summer field season will focus on designing, constructing, and installing a floating weir and video monitoring system for Moose Creek salmon; the first time a weir will be in use this water body. Information gained from operating a weir and video monitoring system for migrating salmon can help lead conservation decisions and funding priorities in the future. Recently collected spatial and temporal water quality and juvenile

PIT tagging information will also contribute to the future direction of fisheries priorities for Chickaloon Village Traditional Council.

Courtney Pegus: "To Zoom or Not To Zoom": A comparison of student's and instructor's attitudes on the use of different teaching pedagogies for marine science in rural Alaska

The 2019 novel coronavirus or COVID-19 pandemic significantly impacted educational systems worldwide causing abrupt shifts in teaching pedagogies from in-person lectures to virtual or digital forms of teaching. It remains unclear how this format of teaching will be perceived by non-traditional and Indigenous students. Compared to in-person experiential teaching pedagogies the virtually based pedagogies (e.g., Zoom) might exclude opportunities to establish connections with culturally meaningful knowledge. This study aims to compare the attitudes of students from rural villages in Alaska as well as teaching instructors who experienced the two types of teaching pedagogies during a science and culture class held in Bethel, Alaska in the summer 2021. A mixed-methods design will be used to evaluate the attitudes of a cohort of students and instructors that attended the summer classes. Classes and learning activities that students participated were digitally recorded as well as unprompted student monologues where students self-recorded in a private setting to describe their experiences of the two teaching pedagogies. Recordings will be analyzed for positive or negative attitudes to any of the teaching pedagogies as well as student's comments that compare the two teaching pedagogies. For the instructor's perceptions, a questionnaire designed to contrast and compare the two teaching pedagogies will be distributed to instructors and results evaluated. The expected outcomes from this effort will be a synopsis of perceptions that identifies features of each pedagogy that appealed to students and instructors.

Courtney Pegus: A Comparison of Perceptions About the Use of Two Different Teaching Pedagogies: Video Conferencing Platform (Zoom) and Experiential Hands-On Approaches to Teaching Marine Science in Bethel, AK

The 2019 novel coronavirus or COVID-19 pandemic continues to significantly impact and alter educational practices worldwide, causing abrupt shifts in teaching pedagogies to be more centered on virtual or digital forms of teaching. It remains unclear how this format of teaching marine science and other science, technology, engineering, and mathematics (STEM) courses will be perceived by students, especially individuals residing in low socio-economic rural communities. Compared to in-person experiential teaching pedagogies, virtually based pedagogies might increase levels of isolation by removing interpersonal and mentorship opportunities. To address this unknown we are examining perceptions and attitudes of a group that participated in a series of marine science classes held in Bethel, AK during summer 2021. The study will compare the attitudes and perceptions of individuals residing in rural villages in Alaska, as well as teaching instructors who were introduced to the two types of teaching pedagogies during a marine science-oriented summer course. Summer science classes were delivered virtually through Zoom; and in-person teaching, and subject materials were delivered by Elders and University professors. Classes included both lectures and hands-on experiential or laboratory activities. We will use a mixed-method design to incorporate results obtained from a questionnaire-based survey

completed by instructors as well as perceptions about learning experiences that were shared during the summer course. Results from this study will identify features of each teaching pedagogy that was appealing and meaningful to the class. The results from this effort will help guide future science classes directed to marine science and STEM education in rural communities. A visualization of teaching pedagogies used in the classes can be obtained from this link https://drive.google.com/file/d/1HSj0hss4kFwwI 7sPBokmAVv6_0vzYf7r/view?usp=sharing

Alexandra Reich: Phenotypic divergence between hatchery pink and coho salmon and their wild counterparts

The potential genetic risks to wild Pacific salmon stocks from hatchery salmon are an important consideration for fisheries management in Alaska. This project investigates the domestication of hatchery salmon resulting from the relaxation of natural and/or sexual selection in the hatchery environment. To accomplish this, we analyze hatchery and wild stocks of pink salmon (Oncorhynchus gorbuscha) and coho salmon (O. kisutch) for expected divergence in phenotypic characteristics associated with male sexual dimorphism and female gametes. Divergence in wild and hatchery salmon phenotypes due to domestication selection would suggest underlying genetic differences.

Benjamin Rich: Temporal and spatial patterns of predation on Juvenile Chinook Salmon (Oncorhynchus tshawytscha) by a novel top predator, northern pike (Esox lucius) in a large Southcentral, Alaska watershed

Despite substantial research in Southcentral Alaska demonstrating the impacts of invasive Northern Pike (Esox lucius) predation of salmonids we know little about how predation varies across time and space. This talk presents work that seeks to better understand the potential for site and season-dependent predation risk for juvenile Chinook salmon in the Deshka River watershed. Within 521 Northern Pike diet samples taken throughout the Deshka River in the summer of 2021, we quantified the presence and absence of Chinook salmon and used binomial generalized linear models and general additive models to assess the importance of space and time. Emerging patterns suggest that pike predation on Chinook was highest during late-June and late-July that likely correspond with juvenile Chinook migration, and that the predation risk to juvenile chinook by pike increased with river mile or distance from the mouth of the Deshka River. Although the analyses are on-going, these results are the first step towards understanding site-specific predation risk and seasons of impact that are expected to help inform future suppression efforts with the goal of protecting native fishes.

Anna Rix: Population structure of lake trout from three river drainages in interior and southcentral Alaska

The current distribution of lake trout (Salvelinus namaycush) largely mirrors the maximum extent of the Laurentide ice sheet. Modern populations of lake trout in interior and southcentral Alaska appear to be

descendants of lake trout that survived in glacial refugia in southern Beringia, while populations on the north slope contain a mix of northern and southern Beringia refugia lineages. Understanding genetic affinities between lake trout within river drainages and within close geographic proximity may help determine how lake trout arrived at their present distribution. This study examined Alaskan lake trout population genetics focusing on three river drainages with closely positioned upper reaches within the prehistoric lake Atna drainage with potential for stream capture and distance effects to shape population genetic patterns. The study examined contrasting hypotheses: (1) target populations are descendants of lake Atna fish, or (2) these populations have migrated into the area independently through the river systems. To characterize population structure and relatedness, Restriction site Associated DNA Sequencing (RAD-seq) was performed with 42 individuals from each sampling site. An average of 2.18 million high-quality paired end reads per individual was generated. 91,719 high quality single nucleotide polymorphisms (SNPs) loci were genotyped. For the unfiltered dataset, observed heterozygosity averaged 0.00036, expected heterozygosity averaged 0.00031, nucleotide diversity averaged 0.000315714, the inbreeding coefficient averaged -0.0000871, and genetic differentiation (FST) averaged 0.169. The fish resolved into seven distinct populations in STRUCTURE analyses. No gene flow appears to occur between lakes, suggesting that each lake contains a genetically distinct population. Both distance between lakes and river systems contribute to the modern population structure of lake trout providing little indication of a common lake Atna origin. Absence of gene flow between populations suggests these populations may have limited opportunities for natural 'genetic rescue' to serve as fuel for adaptation to environmental change.

Anna Rix: A brief overview of a Broad Whitefish Coregonus nasus transcriptome

Species of the genus Coregonus are among the most important fish for Alaskan subsistence fishers particularly in sub-Arctic and Arctic waters. Climate change has the potential to severely impact fish populations in the Arctic. We aim to use molecular techniques to further understand potential responses to differing thermal regimes in coregonids. Here, we report a coregonid transcriptome opportunistically assembled as part of a broader investigation of thermal tolerance in Arctic fishes. The broader study seeks to evaluate the ability of a specific coregonid, Broad Whitefish (C. nasus), to respond to climate change by determining the molecular mechanisms limiting thermal tolerance. Broad Whitefish were captured in the summer of 2018 and 2020 from four locations within the nearshore area of Prudhoe Bay, Alaska. A group of fish, acclimated to 5 oC (n=8) or 15 oC (n=9), was subjected to a thermal ramping experiment to reach the critical thermal maximum (CTMAX). RNA isolated from muscle and liver tissues from treatment and control groups was used to generate sequence datasets. An average of 27,883,393 raw reads were generated per tissue and individual. Transcriptome assembly was performed with and without trimmed reads and using SOAPdenovo2, Velvet, TransAbyss, and Trinity. The kmers were combined and run through EviGenes and BUSCO pipelines to characterize assembly quality. Orthologous genes to the human genome will be identified using kofamscan and EggNOG mapper. A preliminary analysis of transcription levels shows 1,321 upregulated and 766 downregulated genes in comparisons of muscle tissues from control and 5 oC acclimated fishes taken to their CTMAX. Improved annotation of the reference transcriptome specific to Broad Whitefish will support a more precise assessment of the gene expression response to differing temperature challenges in this species.

Bernard Romey: Landscape-Level Extent of Resident Fish Occupancy in the Alexander Archipelago "We used high resolution LiDAR-derived variable-length channel reaches and statistical tree-based modeling (Random Forest) to predict upper limit of occupancy (ULO) for resident salmonids (Cutthroat Trout Oncorhynchus clarkii clarkii and Dolly Varden Char Salvelinus malma) at a regional scale. The modeling used 13 spatially explicit landscape predictors, 4,490 field survey points, and 373 last fish observations (LFO) from streams on Prince of Wales and Chichagof islands in Southeast Alaska. The final model was configured to account for imbalanced datasets and had 0.992 AUC (indicator of model performance), 87.6% sensitivity (percentage of presence correctly classified), and 98.7% specificity (percentage of absence correctly classified); resulting in an absolute average error distance from the field LFO to the predicted ULO of 66 meters. Model validation with independent survey data confirmed that the model correctly classified 98% of the reaches. Analysis showed the most important predictors of relative reach occupancy to be: channel gradient, basin area, and elevation. This research demonstrates a strong linkage of resident salmonid occupancy to persistent reach-scale habitat conditions across the landscape. The mapping of predicted fish distributions show population boundaries that inform conservation, management, and restoration objectives.

Elisa Russ: Pacific Cod Commercial Fisheries in Central Region of Alaska

The history of Pacific cod commercial fisheries management in Central Region of the State of Alaska (SOA) is complex. There are multiple Pacific cod fisheries in the Gulf of Alaska (GOA), under both federal and state management. The SOA has been managing Pacific cod state-waters seasons in the GOA since 1997. These seasons were established by the Alaska Board of Fisheries and allocated a portion of the Acceptable Biological Catch (ABC) from corresponding federal GOA areas. In Central Region, Alaska Department of Fish and Game (ADF&G) biologists manage both the Prince William Sound Area and Cook Inlet Area state-waters seasons, and also open parallel seasons in state waters to run concurrently with federal seasons in adjacent areas.

William Samuel: When beavers get burned, do fish get fried? The role of beavers to mediate wildfire effects on freshwater fish habitat in boreal Alaska

Wildfire is a dominant natural disturbance process throughout boreal North America and fires are increasing in frequency, size, and severity. However, little is known about how wildfire affects fish habitat and populations despite the substantial impacts of fire 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, and they have complex effects on aquatic habitats. Therefore, beavers have the potential to mediate wildfire effects on aquatic systems and may magnify or reduce the effects of wildfire on fish populations. Here I investigate the role that beavers may play in mediating the effects of wildfire in Interior Alaska on a ubiquitous boreal fish species, Arctic Grayling (Thymallus arcticus). This study aims to: 1) quantify how the use of beaver ponds influences Arctic Grayling size, abundance, and body condition, and 2) examine the potential for beavers to act as a mechanism to amplify or dampen the effects of wildfire on boreal streams. These objectives

will be accomplished by conducting an empirical, field-based study paired with a broader remote sensing/geospatial analysis to understand beaver-fire-fish interactions at various spatial scales. This study is expected to make novel contributions to the fields of fisheries, aquatic ecology, wildlife biology, and fire ecology, and will provide a better understanding of the role of beavers in maintaining diverse and productive aquatic habitats in riverscapes under changing wildfire conditions.

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Erik Schoen: A call for collaboration: Synthesizing juvenile salmon size data from across Alaska

Many of Alaska's rivers, lakes, and streams provide important habitat for juvenile salmon. The body size that salmon attain in freshwater can affect their ability to survive in the ocean and return as adults. Each year, many people measure and weigh juvenile salmon as part of research, monitoring, and citizen science projects across Alaska, but these data are not currently available in one location. To better understand large-scale patterns of variation in juvenile salmon body size, we are assembling a database of juvenile salmon length and weight data from Alaskan freshwaters. The database currently contains over 190,000 fork length measurements and over 68,000 weights associated with a sampling location and date. To date, most data represent coho (Oncorhynchus kisutch) and Chinook salmon (O. tshawytscha); however, all five species are represented. We aim to solicit more data from fisheries researchers working in Alaska and publish a large, cleaned, publicly available dataset and an accompanying peer-reviewed data paper in the coming year, with all data contributors invited to be included as co-authors. We envision this dataset will be useful for a variety of purposes, including understanding how body size varies across space and time, putting local patterns into a broader context, and examining the effects of environmental change. We encourage researchers who wish to contribute juvenile salmon length or weight data or want to learn more to contact us.

Martin Schuster: Alaska Department of Fish and Game's Statewide Rockfish Initiative

Over 40 species of rockfish inhabit Alaska waters and are harvested in a variety of commercial and sport fisheries. Rockfish are extremely vulnerable to fishing pressure due to their slow growth, longevity, and

late maturation and overfishing of rockfish has occurred across the Pacific Northwest, resulting in conservative management actions through harvest restrictions and area closures to ensure population sustainability. With increased interest in sport and commercial rockfish fisheries in Alaska, addressing concerns over sustainable management have become a top priority for the Alaska Department of Fish and Game (ADF&G). Recently, ADF&G founded a Statewide Rockfish Initiative (SRI, 2017-present) focused on developing long-term management strategies for the two most heavily exploited species, black rockfish (Sebastes melanops) and yelloweye rockfish (S. ruberrimus). ADF&G manages commercial, sport, personal use, and subsistence fisheries for black and yelloweye rockfish in Gulf of Alaska waters, with management responsibility delegated to each region and division: Southeast, Southcentral, and Kodiak. SRI efforts are focused on creating statewide management standards and strategies, infrastructure, and knowledge that will support long-term adaptive management.

Tristan Sebens: Integration of Fishery-Independent Survey Data with Variable Gear Types: A Comparison of Three Intercalibration Techniques

Fishery-Independent Catch-Per-Unit-Effort (CPUE) data are a critical tool for sustainable fisheries management. However, these data have limitations as surveys are typically expensive to conduct and can be subject to fluctuating availability of funding, leading to temporal gaps in the data, reductions in the area surveyed, or other cost-saving adjustments to the sampling design. This in turn can be detrimental to the accuracy of, and confidence in, the stock assessments that utilize these data. Survey design may also introduce bias into the data, wherein choices in the areas or depths sampled can lead to unrepresentative sampling of stocks that inhabit unobserved depths or habitat and the type of survey gear employed can also vary in its ability to access specific habitats. For example, hook and line surveys are able to sample habitat with complex seafloor topography, a habitat type relatively inaccessible to trawl nets. Combining data from multiple surveys can address such issues by producing a dataset representative of a wider variety of habitats and size subsets of the stock, and with fewer spatial and/or temporal gaps. However, merging data from surveys employing different gear or spatiotemporal designs requires intercalibration, in which the relative efficiency and selectivity of multiple surveys are estimated and used to adjust observed CPUE. To better understand their relative strengths and we propose comparing three intercalibration techniques for combining data from fixed and trawl gear surveys for groundfish species in Alaska's marine waters: time series random-walk models, generalized additive models (GAMs), and vector-autoregressive spatiotemporal (VAST) models. These models will be fit to CPUE data of Pacific Cod in the Gulf of Alaska collected by three fishery independent surveys and compared based upon their goodness-of-fit to the data, the relative uncertainty in their abundance estimates, and their agreement with existing abundance indices.

Christopher Sergeant: Spawning Pacific salmon and dissolved oxygen dynamics in southeastern Alaska rivers

Adequate dissolved oxygen (DO) levels are critical for maintaining the health of aquatic organisms in high-latitude freshwater ecosystems. Since at least the mid-20th century, people in southern coastal Alaska have periodically documented adult salmon dying in streams before spawning due to low DO

(hypoxia) caused by low streamflow and/or warm water temperature. In the non-glacierized watersheds of this region, low streamflow often results from a lack of summer rainfall or below average snowpack that is available for runoff. While warm water can play an important role in hypoxia events, previous research has demonstrated that even under cool water temperatures, lethal DO levels can result from a combination of reduced reaeration rates due to low discharge and increased oxygen demand from abundant spawning salmon. This high spawner density can occur naturally (often due to pink salmon), or in some cases effects could be intensified by high percentages of hatchery stray salmon that enter natural streams. A recent study estimated that an order of 105 stray hatchery chum salmon entered 81 study streams in Southeast Alaska annually. Straying rates were especially high for watersheds within 25-50 km of hatchery release sites. Therefore, we hypothesized that lower gradient, warmer streams with high natural spawning densities and close to hatchery release sites are at the greatest risk for hypoxia events. Using a mechanistic model of DO dynamics, we estimated hypoxia risk at 49 stream sites in Southeast Alaska based on water temperature patterns, low-flow estimates, and channel hydraulics. We overlaid these risk predictions with proximity to current hatchery release sites across the region. The resulting maps have multiple uses, including 1) considering the potential implications of shifting summer streamflow patterns or increased straying in hypoxia-prone areas, and 2) prioritizing future ecological monitoring to determine whether predictions of frequent hypoxia come to fruition.

Rebecca Shaftel: Stream thermal sensitivities in Southern Alaska

Co-authors: Leslie Jones (Alaska Geospatial Office-ADNR), Will Atlas and Matt Sloat (Wild Salmon Center), Dustin Merrigan (Alaska Center for Conservation Science-UAA), Tim Cline (USGS), Luca Adelfio (USFS), Daniel Schindler (School of Aquatic and Fisheries Sciences-UW)

There remains considerable uncertainty about how future climate change will influence stream thermal regimes in southern Alaska. The reasons for this uncertainty are a lack of understanding regarding the influence of hydrology (derived from rainfall, snowfall and glacier melt), geomorphology, and landcover controls on stream temperature. These knowledge gaps are a barrier to understanding how salmon populations may be impacted by climate change. For this project, we aggregated stream temperature datasets from the Alaska Online Aquatic Temperature Site (AKOATS) across Bristol Bay, Kodiak, Cook Inlet, Prince William Sound, and the Copper River regions. Daily temperature data from 408 streams during 2001-2019 were used to characterize summer thermal regimes (i.e., magnitude, variability, timing, frequency, and duration of stream temperatures) and stream thermal sensitivities. Daily mean stream temperatures were combined with gridded air temperatures to calculate stream and year specific thermal sensitivities to air temperature change. Stream thermal sensitivities ranged from 0 to 0.8 and were generally lowest in the Bristol Bay and Prince William Sound regions. A predictive model of stream thermal sensitivities was also used to identify habitats that may be at a higher risk of warming and those that may have the capacity to mediate warming, thereby providing cold-water refugia. For all sites, we developed covariates at different hydrologic scales (e.g. reach and watershed) as predictors of stream thermal sensitivities. The covariates included an index of snow cover for each watershed and year; summer precipitation; stream gradient; distance to coast; watershed area, slope, aspect, and elevation; and watershed wetland, glacier, and lake cover. Relationships between stream thermal sensitivity and site characteristics indicated that watersheds with a late winter snowpack, high summer precipitation, glacier cover, large lakes, and high average watershed slope have the lowest thermal sensitivities."

Kyle Shedd: Reduced relative fitness in hatchery-origin Pink Salmon across five streams in 2014

Co-authors: Kristen Gruenthal and Chris Habicht (ADF&G)

Previous studies generally report that hatchery-origin Pacific Salmon (Oncorhynchus spp.) have lower relative reproductive success (RRS) than their natural-origin counterparts. We used genetic assignment of parentage to estimate the RRS of a single generation (2014) of stray hatchery-origin Pink Salmon (O. gorbuscha) for five streams in Prince William Sound (PWS), Alaska, using incomplete pedigrees. Reproductive success (RS), measured as sampled adult offspring that returned to their natal stream, was significantly lower for hatchery- versus natural-origin parents in both lineages, with RRS ranging from 0.34 to 0.88 for females and 0.29 to 0.96 for males. We then used generalized linear modeling to estimate the effect of origin on RS, after accounting for sample date (run timing), sample location within a stream (intertidal vs. upstream), and body length. After accounting for variation in RS due to stream, sample date, sample location, and body length, we find that the effect of hatchery-origin was highly significant with a modeled RRS of 0.52 (95% CI 0.44-0.60) for females and 0.50 (95% CI 0.42-0.60) for males. Our results build upon previous evidence from the AHRP to strongly suggest that hatchery-origin strays have lower fitness in the wild, even after controlling for covariates. The consequences of reduced RRS on wild productivity depend on whether the mechanisms underlying reduced RRS are environmentally driven, and likely ephemeral, or genetically driven, and likely persistent across generations.

Mary Spanos: Evaluating the viability of the use of two tag types on adult Arctic Lamprey

Co-authors: Trent Sutton, Katie Shink Drew, Curry Cunningham

Subsistence and commercial Arctic Lamprey (Lethenteron camtschaticum) fisheries in the lower Yukon River drainage rely on the ability to accurately track the species' return migratory run from the ocean to spawning grounds. In recent years, the late freezing of the Yukon River due to climate change has created new barriers for fisheries attempting to intercept the run, resulting in poor harvest. While Traditional Ecological Knowledge (TEK) provides valuable estimates for Arctic Lamprey upstream migratory timing in the Yukon River, little is currently known about Arctic Lamprey abundance, distribution, and life history. Telemetry and mark-recapture studies have the potential to be utilized for gathering information on Arctic lamprey migratory and dispersal patterns, population abundance, and spawning locations. The efficacy and retention of internal radio transmitters and external T-bar anchor tags was evaluated in a controlled laboratory setting. A sample size of 216 Arctic lamprey each received one of six treatments, including control, sham surgery, external T-bar anchor tag, and small, medium, and large internal transmitters. Surgical wound healing, survival, and tag retention was evaluated post-treatment. A subset of 60 Arctic lamprey was assessed for swim performance in a Brett-style swim-endurance chamber one day and 43 days after treatment. The results of this study will be used to determine if internal radio transmitters and external T-bar anchor tags are viable tools for tracking Arctic lamprey migratory run-timing and abundance, as well as determining the impact of harvest on resource sustainability."

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

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 during summer and freshwater habitats for spawning and overwintering. Dolly Varden are harvested in commercial, subsistence, and sport fisheries while moving among these habitats. Dolly Varden in this region display a unique pattern of anadromy in which annual feeding migrations at sea are foregone in the summer prior to spawning events, which may be a strategy to avoid the heightened mortality risks associated with feeding migrations. It is thought that Dolly Varden skip spawn, and during non-spawning years may display low fidelity to specific overwintering areas, resulting in frequent inter-drainage movements. Despite the need for a comprehensive understanding of migratory habits to properly assess population dynamics and exposure to harvest, 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. We intend to use the strontium (Sr) concentrations and 87Sr/86Sr isotope signatures of otoliths to determine age at first seaward migration, frequency of subsequent seaward migrations, and fidelity to specific overwintering locations. These data may help identify life history strategies of Dolly Varden that are captured in harvests and elucidate the complex interchanges between overwintering and spawning areas that are poorly understood. It will also allow us to develop a descriptive baseline of life-history characteristics to monitor future changes in population migratory habits brought about by a rapidly warming Arctic.

Ingrid Spies: PoolSeq indicates multiple mechanisms associated with genomic islands of divergence between spawning Pacific cod from the Aleutian Islands and Bering Sea

Genetic differentiation along the species continuum ranges from differentiated populations to reproductive isolation, and may eventually result in speciation, although the process is not necessary linear. Patterns of differentiation may include accumulation of genetic differentiation in particular regions, known as genomic islands of divergence, which may provide information on the mechanisms responsible for selection and adaptation. We used pooled whole genome sequencing to evaluate patterns of genomic differentiation and investigate mechanisms responsible for divergence among Pacific cod from the eastern Bering Sea, Aleutian Islands. Samples were taken from eight spawning locations, three of which were duplicated to test our ability to evaluate outlier loci. Correlation of F_{ST} among duplicated pools was highly significant. A kernel smoothing moving weighted average approach identified 15 F_{ST} outlier windows between the parapatric Aleutian Islands and Bering Sea samples. Further analysis provided evidence for elevated d_{XY} in eight of these regions, indicative of locally restricted gene flow. There was also evidence for linked selection and background selection in F_{ST} outlier regions subject to gene flow. Comparison with the allopatric Washington Coast provided contrast in the scale of divergence

and helped provide evidence for the time scale over which some islands of divergence evolved. There were five genes related to vision in SNPs found within islands of divergence among the Bering Sea and Aleutian Islands, suggestive of local adaptation that may be associated with differences in the physical environment and food habits.

Deanna Strohm: Gaging the importance of headwater tributaries: hydrologic regime characterization for streams in changing boreal ecosystems

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. 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); however, monitoring is limited in this region. As small streams are highly prevalent and ecologically important to boreal stream ecosystem function, understanding interactions among climate and hydrologic patterns at multiple spatial scales (e.g., regional, catchment, and reach scales) is important for effective aquatic species management. In this study we classified stream flow regimes based on the "Magnificent Seven" hydrologic descriptors for stream flow data collected: 1) in the field in six headwater streams (drainage basins ≤ 150 km2) in interior Alaska; 2) based on WRF-Hydro model-predicted mean daily discharge across a 20,000 km2 extent that included four large river basins; and 3) for 74 stream gages located throughout the Northwestern Boreal Ecosystem in Alaska and Yukon Territory, Canada. Field-collected headwater stream gage data from the 2019 and 2020 open water season captured a high and low water year and indicated small boreal streams respond rapidly to precipitation events. At the broad, regional scale, streams were classified by size (mean daily discharge; m/s3), and we found ten distinct flow regimes based on cluster analysis. Streamflow variability varied with stream size, and instances of extreme flow events differed seven-fold between two large-stream regime types. Our hydrologic regime characterization will provide a baseline for boreal streams that can be used to detect potential regime shifts from continued climate warming at multiple spatial scales, and provide valuable information toward management and conservation of important boreal aquatic species.

Genoa Sullaway: Comparison of region ocean model with in situ zooplankton field data for the Eastern Bering Sea

Ecosystem based fisheries management (EBFM) necessitates inclusion of environmental data and trophic links into fisheries modeling efforts. Recognizing these links is important as bottom-up processes can significantly impact fish population dynamics. In the Eastern Bering Sea (EBS), changes to zooplankton community dynamics can significantly shift fisheries productivity and changes in regional climate patterns are likely affecting zooplankton production. Currently the Regional Ocean Modeling System for nutrients, phytoplankton and zooplankton (ROMS-NPZ) estimates temporal and spatial variability in zooplankton biomass in the Eastern Bering Sea. The output of the ROMS-NPZ has yet to be compared with observational data. Model refinement can allow expanded use of ROMS-NPZ output in management decisions. We compare biomass predictions from the ROMS-NPZ Bering 10k model for an abundant copepod, Calanus spp., with a thirty-year time series of zooplankton field data collected by the NOAA Alaska Fisheries Science Center. We use Calanus spp. for this initial comparison as copepod species underpins the EBS food web as an important prey item for fish, marine mammals, and birds. Using a GAM

framework, we quantify the level of agreement between survey observations and ROMS-NPZ model predictions and include covariates to identify locations in space and time where discrepancies between the datasets may exist. Preliminary results indicate that the ROMS-NPZ and empirical data have higher agreement than expected and discrepancies were predictable when a spatial smoother was incorporated into the model. These comparisons are a first step in a data integration process to further bolster zooplankton data availability for use in EBFM efforts. Future work will expand the species included in this comparison to include other copepod species and euphausiids.

Szymon Surma: Food web structure in the eastern Gulf of Alaska

The Gulf of Alaska (GOA) is a large marine ecosystem hosting many federally protected species as well as locally, regionally, and nationally important fisheries, many of which were adversely impacted by a recent marine heatwave. The eastern Gulf of Alaska (EGOA) is distinguished from waters to the west (WGOA) by numerous key features of its oceanography, ecology, and fisheries. However, the EGOA has received comparatively less scientific attention than the WGOA. This study attempts to remedy this situation by developing a mass-balance model of the EGOA food web as it existed in the early 1990s. The study area includes federal and state waters extending over the continental shelf and upper slope (0-1000 m deep) from 54º40'N northwest to 147ºW, excluding Prince William Sound and the Inside Passage. The EGOA model represents ecosystem structure through a network of biomass pools and fluxes informed by field survey data, fisheries catches, and oceanographic (ROMS-NPZ) model outputs. The food web model contains 72 functional groups (i.e., species or groups thereof sharing similar ecological characteristics), including all trophic levels from primary producers and detritus to top predators and all size classes from phytoplankton to large whales. It also includes 19 commercial, subsistence, and recreational fishing fleets defined predominantly by gear and target species. Functional groups and fleets focus on key protected species and commercial fisheries. This model was developed at the College of Fisheries and Ocean Sciences, University of Alaska Fairbanks, in collaboration with the Gulf of Alaska Climate Integrated Modeling (GOA-CLIM), Gulf of Alaska Integrated Ecosystem Assessment (GOA IEA), and Sitka Integrated Ecosystem Assessment project teams at the NOAA Alaska Fisheries Science Center. It reveals the directions and strengths of predator-prey interactions in the EGOA, and will provide a simulation platform for hindcasts of ecosystem dynamics, projections of ecosystem states under various scenarios of climate change, and performance evaluations for multiple fisheries management strategies given these scenarios. It will also present an opportunity for multi-model inference in combination with a mass-balanced WGOA model, a GOA end-to-end (Atlantis) model, and a GOA multi-species (CEATTLE) model.

Trent M. Sutton: The Pacific Lamprey Conservation Initiative in Alaska: A New Focus on an Old Fish

Co-authors: Sabrina Garcia (ADF&G), Alicia Marrs (Pacific Lamprey Conservation Initiative), Nathan Cathcart (ADF&G), and Bruce Wright (Knik Tribe)

Lampreys have experienced wide-spread declines in abundance on a global scale primarily as a result of anthropogenic disturbances. Even though these ancestral fishes share many of the same habitats as

salmonids in freshwater ecosystems, native lampreys have received little management or research attention. This paucity of information limits the development of management and conservation plans for lamprey species in Alaska, which includes Pacific Lamprey Entosphenus tridentatus, a species of conservation concern throughout much of its historical distribution. The Pacific Lamprey Conservation Initiative (PLCI), a diverse group of indigenous tribal organizations, federal, state and local agencies, non-profit groups, universities, and other Pacific coast entities, uses collaborative research, conservation actions, and outreach to achieve long-term persistence of Pacific Lamprey populations and their habitats while concurrently supporting traditional cultural use. With their new fish habitat partnership (FHP) designation, PLCI is seeking ways to collaborate with other FHPs and partners throughout the historical range of Pacific Lamprey, especially those in Alaska, to increase awareness and understanding of the cultural and ecological importance of Pacific Lamprey, and to identify ways to leverage existing knowledge and resources to protect, restore, and enhance fish habitat for the benefit of all aquatic species and the communities they support. One of PLCI's primary goals is to strengthen its network of Alaskan partners and knowledge of Pacific Lamprey as well as other lamprey species. In this presentation, we will discuss the current state of knowledge on Pacific Lamprey in Alaska, describe ongoing and future research efforts on this lamprey species, and highlight opportunities for developing partnerships to foster a greater understanding on the distribution, abundance, habitat use, and life history of Pacific Lamprey in southcentral and southeastern Alaskan drainages.

Laura Timm: Whole genome resequencing confirms and characterizes genetic population structure in the abundant rockfish species, Pacific ocean perch (*Sebastes alutus*)

The Pacific ocean perch (POP), Sebastes alutus, is one of the most abundant rockfish species in the Gulf of Alaska, with over 55,000 tons landed in 2017 (the last year for which this data is available). However, the relationship between the spawning population size and the size of the resulting recruitment cohort is complex. Previous work utilizing reduced representation genomic data found distinct genetic population structure within POP pelagic larvae aggregates, however, the extent to which this structure is maintained in the adult population is unclear. To improve our understanding of population genetic structure in POP spawning populations despite sympatry during the pelagic larval stage, we undertook a population genomic study targeting low coverage whole genome resequencing data from over 150 adult POP spanning the Gulf of Alaska and the Aleutian Islands. By including a subset of larvae representing each of the populations described previously, we were able to confirm these populations with whole genome data and assign adult individuals to them. Our results reveal structuring of at least four genetically distinct POP populations within the Gulf of Alaska, evidenced by regions of high differentiation across the S. alutus genome. These findings reveal unique insight into POP biology and have important management implications within the Gulf of Alaska.

Laura Timm: Seascape genomics in North Pacific forage fishes: opportunities and challenges

Forage fishes are ecologically important taxa, serving as key trophic links and supporting economically valuable fisheries. In the highly productive North Pacific, these species are also contending with a rapidly warming climate and a litany of associated oceanographic changes (e.g., changes in salinity, dissolved oxygen, pH, primary production, etc). These changes can place substantial selective pressures on populations over space and time. Seascape genomics provides a powerful framework to evaluate the presence and strength of these pressures, as well as to forecast long term species stability under various climate change scenarios. While several population genomics studies have targeted forage fishes in the North Pacific, none have formally analyzed the interactions between genotype and environment. However, when population genomics studies provide collection location information and other critical data, it is possible to supplement a published genomic dataset with environmental data from existing public databases and perform post hoc seascape genomics analyses. Our research activities have focused on 1) surveying the literature for candidate studies, 2) supplementing data in a reproducible way to allow for seascape genomics analysis, and 3) identifying specific factors that may impede the application of seascape genomics methods in the region. Overall, our goal is to demonstrate – via case studies and literature review – the utility and importance of seascape genomics to address questions of interest to managers monitoring the long term health of forage fish species in the North Pacific.

Philip Tschersich: Single echo detection hydroacoustics for black rockfish abundance estimation

Recent increased fishing pressure from multiple angler groups on rockfish (Sebastes spp.) in Alaska has elevated concerns over sustainable management. Abundance estimates derived from hydroacoustics coupled with species identification data from underwater video offer a fishery-independent means to assess semi-pelagic rockfish stocks in untrawlable habitat, with the added benefits of being cost-effective and non-destructive. In an ongoing effort to better manage rockfish populations in the Kodiak Archipelago, the Alaska Department of Fish and Game conducts annual surveys for black rockfish (S. melanops) abundance using a single echo detection (SED) method to enumerate individual fish recorded in the echograms from a split beam hydroacoustic transducer. SED analysis requires a shoaling behavior in the target species that provides sufficient spatial separation between fish to allow algorithmic differentiation of individual animals, thus high density aggregations of small fish are not ideal candidates for SED analysis. Mature black rockfish have acoustically reflective swim bladders and only moderate density shoaling behavior making them good candidates for SED analysis. Our presentation provides examples of rockfish hydroacoustic echogram data and shows how individual echoes are grouped algorithmically to represent separate fish and how those data are subsequently used to calculate abundance estimates via a Horwitz-Thompson detection probability estimator.

Lindsay Turner: Combining forage fish datasets to understand spatial and temporal patterns for management

Forage fish are energy rich species that play a crucial role in the diets of seabirds, marine mammals, and commercially important fish. Understanding the spatial and temporal variability of forage species would help explain complex predator-prey interactions and assess potential trophic vulnerabilities within Alaska marine ecosystems. However, there are several factors that limit the availability of forage fish abundance data. Specifically, 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. While available data are limited, combined data from trawls, beach seines, plankton surveys, and predator diets can be utilized to better assess spatial and temporal variation in forage fish populations. As an alternative to traditional sampling methods, predator diets may present a novel method to index the abundance of forage fish stocks within Alaska waters. We describe and visualize current data compilation efforts on forage fish abundance and distribution in terms of spatial and temporal availability and identify intended analyses. Using seabird diet samples in conjunction with traditional survey methods could provide critical insight into what is driving the variability of forage fish within Alaska's nearshore communities."

Benjamin Van Alen: Nutrient Mining with Hatchery Salmon Releases

What could 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 are 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.

Benjamin Van Alen: Nutrient Cycling with Wild Salmon Spawners

Salmon harvests in Southeast Alaska reflects the boom and bust of overfishing prior to Statehood, then the boom of managing for spawners through the 1990s, and now the bust of managing for hatchery

releases. To sustain healthy salmon populations, we need to maintain the environment and maintain the spawners. Unfortunately, many are unaware of the ecological impacts that hatchery salmon have on both the environment and the spawners. Fortunately, salmon managers have control over how many salmon are harvested and how many are released from hatcheries. Managing where, when, and how many fish are harvested is critical to maintaining the natural spatial and temporal distribution of spawners needed to fill and sustain the carrying capacity. Harvest management efforts need to be supported by accurate assessments of the consequences of the management decisions. This involves getting timely and accurate estimates of harvests and escapements, by stock or population, and the appropriate use of these annual estimates in the ongoing management of the stocks and populations. Realizing that there is no ecologic, or economic, niche for hatchery salmon, hatcheries should be closed. The sustaining and rebuilding of wild populations of salmon, herring, and eulachon is impossible with ongoing releases of hatchery salmon. Hatcheries have no place in modern salmon management.

Michael Wachter: Using Saltwater to Mark Pink Salmon Otoliths

Kodiak Regional Aquaculture Association's (KRAA) Kitoi Bay Hatchery is a large and diverse Pacific salmon (Oncorhynchus spp.) production facility located on Afognak Island, AK. The facility is currently permitted to collect 215 million pink salmon (O. gorbuscha), 36 million chum salmon (O. keta), 2.3 million coho salmon (O. kisutch), and 850,000 sockeye salmon (O. nerka) eggs. Like many other hatcheries in Alaska, KBH otolith marks hatchery reared salmon, which allows for the later collection of otoliths from adult salmon, which are used for run reconstruction and the identification of hatchery contributions to commercial catches. KBH currently thermal marks all of the chum salmon using stratified lake water, and dry marks all of the coho and sockeye salmon. Prior to 2017, none of the pink salmon production was marked, due to infrastructure constraints. In 2017, initial trials were conducted to test the efficacy of saltwater as an alternative to thermal and dry marking. That year KBH marked 18 million pink salmon by alternating between periods of fresh and saltwater for 12 hours, 6 hours, and 4 hours. The marks were a success, and in 2018, 31 million pink salmon were marked using intervals of 8 hours of saltwater and 16 hours of freshwater. In 2019, and every subsequent year, the entire inventory of pink salmon, 191 to 204 million eggs, were marked using this technique. By using saltwater marking instead of thermal marking KRAA was able to reduce capital costs and long-term operational costs, as well as reduce its carbon footprint by avoiding the need to heat large volumes of water.

Peter Westley: Towards an understanding of site attractiveness to straying hatchery salmon: insights from the Columbia River Basin

Notwithstanding the well-known ability for salmon to return with high fidelity to natal sites for reproduction, the straying of individuals to non-natal sites is a fundamental aspect of salmon ecology, evolution, and conservation. Although the rates of straying have been well described and are known to vary in response to a host of drivers, comparatively little is known about what makes a site attractive or unattractive to strays. In this talk, I explore factors that may underpin the observation that some sites appear to be more attractive than others to hatchery strays. To do so, I analyzed mark and recapture data from 19 populations of hatchery-produced spring Chinook salmon (Oncorhynchus tshawytscha) across

three decades in the Columbia River Basin, USA, to estimate rates of emigration (donor stray rates) and immigration (recipient stray rates). Using published rates of donor and recipient straying we categorized each site in each year as: i) 'imprintably attractive' (characterized as low rates of donor and recipient straying), ii) 'inherently unattractive' (high rates of donor straying and low rates of recipient straying), iii) 'inherently attractive' (low rates of donor straying and high rates of recipient straying), or iv) 'ecological traps' (high rates of donor straying and high rates of recipient straying). Landscape and riverscape factors such as sub-basin size, distance to donor sources, migration distance, and water temperature were used in multinomial regression estimated in a Bayesian framework. Taken as a whole, results suggest a prominent of water temperature in site attractiveness. This finding is consistent with previous studies focused on donor rates of straying and suggests a role of climate warming in shaping source sink dynamics of freshwater systems.

Kellii Wood (She/Her): Utilizing remotely operated vehicles for yelloweye rockfish stock assessments in Southeast Alaska.

Yelloweye rockfish are an economically valuable species caught in the commercial, sport, and subsistence fisheries in Southeast Alaska. Like most rockfishes, the life history traits of yelloweye rockfish (slow growing, long lived, and late maturing) necessitate careful management to avoid over-exploitation of stocks. In addition, yelloweye rockfish suffer from barotrauma and experience high mortality rates when brought to the ocean surface. The Alaska Department of Fish and Game (ADF&G) has been annually assessing yelloweye rockfish using visual, non-invasive survey methods. Since 2012, ADF&G has been conducting these surveys by utilizing a remotely operated vehicle (ROV), fitted with paired stereo cameras, to record underwater video footage of rockfish along randomly selected transect lines in estimated yelloweye rockfish habitat. SeaGIS measurement software is used to obtain length of fish and distances to fish. Distance methods are used to estimate yelloweye rockfish density from these recorded observations, and the estimated density is used to determine the annual estimated demersal shelf rockfish biomass for fishery management purposes. This presentation will include the methodology and results from our most recent survey conducted in the Southern Southeast Outside management area.

Lauren Yancy: Utilizing morphometrics to validate sexual dimorphism of Arctic Grayling in the Chatanika River

Sexual dimorphism occurs in many salmonid species as the males and females each exhibit unique colors, features, and sizes. Morphological differences are often used to determine the sex of fishes in the field and provide a nonlethal technique to collect individual data. Graylings (Thymallus) possess an elongated dorsal fin that is generally assumed to be dimorphic, as males possess larger dorsal fins with more color. While sexual dimorphism such as color and various morphometrics have been frequently published on European grayling (Thymallus thymallus), such information is lacking for the Arctic Grayling (Thymallus arcticus). Literature on European Grayling reports statistically significant morphometric differences both between sexes and among the same sex across different locations. Most data on North American Arctic Grayling sexual dimorphism fails to report detailed sexing methodologies, and warns that external sex characteristics are only useful if individuals have a fork length larger than 350mm. Although, recent

publications have shown trends in sexually dimorphic characteristics across the entire Thymallus genus, sex validation of Thymallus arcticus throughout interior Alaska in particular is needed to ensure accurate and non-lethal individual data collection. Here, we utilize computer software imaging to quantitatively assess morphological characteristics of Arctic Grayling specimens of known sex collected from the Chatanika River basin in interior Alaska (n=50; FL ranges from 217-390mm). We use a discrimination analysis to determine those morphometric characteristics that best predict sex. Determining the most informative morphometric traits for sexing Arctic Grayling will be a useful tool for anglers and fisheries professionals.