Alaska Chapter
American Fisheries Society

47th Annual Virtual Meeting
March 22–25, 2021

The coronavirus (COVID-19) continues to be a health risk and, with concern for the most vulnerable in our communities, the Meeting Planning and Executive Committees decided to move our 2021 Alaska Chapter meeting into a virtual space. Although we are disappointed not to be gathering in Homer as anticipated, we are excited to create an engaging, inclusive and meaningful experience with active participation around the state.

For the most current information regarding the 2021 AFS Alaska Chapter Meeting, please check the meeting website:

https://cvent.me/D5XWxg

Many thanks to our Sponsors!

Artwork

Logo and artwork created by Kaitlin Vadla

website: https://vibrantalaska.com
Instagram: @vibrantalaska
email: kaitlinvadla@gmail.com
phone: 907.252.6525

Kaitlin Vadla is an artist from Clam Gulch. After spending a decade living in Washington, England and New Zealand, she returned home with an intensified appreciation for Alaska. She hopes her acrylic paintings, graphic illustrations, and community collaborations inspire people to see the beauty around them and to use their talents to protect what they love.

Table of Contents

Letter of Welcome

Greetings!

Welcome to the 47th Annual Meeting of the American Fisheries Society Alaska Chapter! This is our first virtual meeting due to the extraordinary circumstances surrounding the global pandemic. After our 2020 meeting in Fairbanks was cancelled last March, we expected to be together for a great meeting in Homer. Alas, it was not to be. However, as we have made the shift to a virtual space, we can now make the meeting available to more individuals dedicated to maintaining high standards for the fisheries profession and ensuring conservation of Alaska's fisheries.

Our meeting theme is "Coming Together for the Love of Fish". As fisheries professionals, we are well aware of the rapid change occurring in our marine and freshwater systems and the challenges that brings to sustainable management and conservation efforts. Yet, we continue to face these challenges by creating collaborative networks, exploring new technologies and seeking deeper understanding. Why? For the love of fish!

And while ecosystem changes are challenging our fisheries, we are also aware of the social change needed in the field of fisheries. The American Fisheries Society has recently made efforts to increase diversity and inclusion at annual meetings and among our membership. We invite you to lead by example and help the Alaska Chapter elevate the work of and opportunities for historically marginalized and underrepresented identities in fisheries. As Alaskans, our love of fish offers the common ground needed to bring scientists, policy makers, and resource users together to meet the challenges facing our marine and freshwater resources as well as tackle issues of equity and inclusion within our profession.

We invite you to join the virtual coffee breaks, affinity groups, and social events where you can say hi and chat with colleagues new and old. We are a 'society' and that requires making the time to stay connected.

Many thanks to all of the session organizers and presenters for their contributions and for their patience as we moved everything online. A very sincere thank you to all of the many volunteers who spent many months re-envisioning how we could make this an engaging and inclusive experience.

Special thanks to the North Pacific Research Board, GCI and the Alaska Seafood Marketing Institute for sponsoring our meeting and helping us keep registration costs low.

We thank you for attending this year's conference and for sharing your expertise with our network of dedicated fisheries professionals!

Sincerely,

Stephanie Quinn-Davidson
President
Alaska Chapter AFS

Sue Mauger
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 (sub unit/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.

2020-2021 Alaska Chapter AFS Executive Committee Members

Stephanie Quinn-Davidson
President

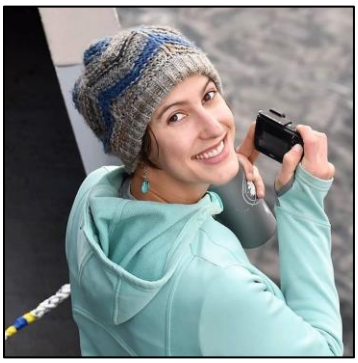
Sue Mauger
President-Elect

Joel Markis
Past President

Megan McPhee
Vice President

Scott Ayers
Secretary

Lee Ann Gardner
Treasurer



Elizabeth Hinkle
Student Representative

Annual Meeting Planning Committee

Planning Committee:
Sue Mauger, Chair
Cheryl Barnes
Jeff Falke
Elizabeth Hinkle
Kaitlyn Manishin
Megan McPhee
Sara Miller
Ted Otis
Stephanie Quinn-Davidson

Diversity, Equity and Inclusion Committee:
Cheryl Barnes, Chair
Lauren Divine
Janessa Esquible
Lisa Fox
Sara Gilk-Baumer
Jesse Gordon

Awards:
Jeff Falke, Chair & Student Presentation Awards
Erik Schoen, Wally Noerenberg Award
Ray Hander, Molly Ahlgren Scholarship

Environmental Concerns Committee:
Joel Markis (Co-Chair)
Sue Mauger (Co-Chair)

Finance:
Lee Ann Gardner, Chair
Trent Dodson

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

Schedule at a Glance

Date / Time	Activity / Event
Monday March 22	Student Auction opens @ 8:00 AM!
6:00 PM – 7:30 PM	Film Festival: Coming Together for the Love of Fish!
Tuesday March 23	
9:00 AM – 10:00 AM	Conference Welcome and Plenary Session with Barbara 'Wáahlaal Gíidaak Blake
10:00 AM – 10:15 AM	Coffee Break - Join the virtual coffee table
10:15 AM – 11:15 AM	Symposium: Adaptive Management
11:15 AM – 1:00 PM	Panel: Adaptive Management
1:00 PM – 2:00 PM	Lunch on your own
1:00 PM – 2:00 PM	Affinity Group: women and underrepresented genders in fisheries
2:00 PM – 3:15 PM	Symposium: Human Dimensions
3:15 PM – 3:45 PM	Coffee Break – Join the virtual coffee table
3:15 PM – 3:45 PM	Affinity Group: working caregivers
3:45 PM – 5:00 PM	Symposium: Human Dimensions
5:00 PM – 6:00 PM	Dinner on your own
5:00 PM – 6:00 PM	Affinity Group: BIPOC (black, indigenous, people of color)
6:00 PM – 8:00 PM	Poster Session
Wednesday March 24	
9:00 AM – 10:00 AM	Welcome and Plenary Session with Dr. Erika Eliason
10:00 AM – 10:15 AM	Coffee Break – join the virtual coffee table
10:15 AM – 1:15 PM	Symposium and Panel: Indigenous Fisheries and Issues of Equity
1:15 PM – 2:45 PM	Alaska Chapter Business Luncheon
2:45 PM – 3:15 PM	Awards Ceremony
3:15 PM – 4:30 PM	Contributed Papers: Marine Topics
4:30 PM – 5:30 PM	Environmental Concerns Meeting
5:30 PM – 6:30 PM	Dinner on your own
5:30 PM – 6:30 PM	Affinity Group: LGBTQIA+ (lesbian, gay, bi, trans, queer, intersex, asexual +)
6:30 PM – 8:30 PM	Trivia Night Social: need to pre-register to get in on the fun
Thursday March 25	*(NOTE: Concurrent sessions start at 10:15 AM)*
9:00 AM – 10:00 AM	Welcome and Plenary Session with Dr. Ivan Arismendi
10:00 AM – 10:15 AM	Coffee Break – join the virtual coffee table
10:15 AM – 11:45 AM	Symposium: eDNA
10:15 AM – 12:00 PM	Contributed Papers: Other Topics
12:00 PM – 1:00 PM	Student-Mentor Luncheon
1:00 PM – 1:45 PM	Contributed Papers: Other Topics
1:45 PM – 2:30 PM	Contributed Papers: Population Dynamics
1:00 PM – 4:00 PM	Symposium: Fisheries Genetics in Alaska
2:30 PM – 3:00 PM	Coffee Break – join the virtual coffee table
2:30 PM – 3:00 PM	Affinity Group: first generation college students
3:00 PM – 4:45 PM	Contributed Papers: Climate Change
4:00 PM – 5:30 PM	Fisheries Genetics Panel/Social
5:30 PM	Student Online Auction Closes

Pre-Conference Workshops

"Picture a Scientist" Film Screening and Discussion

Available to watch: February 26 – 28

Discussion: March 1 (4:00 – 5:30 pm)

Format: Presentation with discussion among attendees. Equipment demonstration.

Cost: FREE

The AK-AFS Diversity, Equity, and Inclusion Committee is hosting a free virtual screening and discussion of the documentary, "Picture a Scientist". This event will be held jointly with the AK-AFS Annual Meeting and Student Symposium but is open to anyone interested in participating!

Description: PICTURE A SCIENTIST chronicles the groundswell of researchers who are writing a new chapter for women scientists. Biologist Nancy Hopkins, chemist Raychelle Burks, and geologist Jane Willenbring lead viewers on a journey deep into their own experiences in the sciences, ranging from brutal harassment to years of subtle slights. Along the way, from cramped laboratories to spectacular field stations, we encounter scientific luminaries – including social scientists, neuroscientists, and psychologists – who provide new perspectives on how to make science itself more diverse, equitable, and open to all.

Discussion

A password-protected Zoom link will be emailed to registrants a few days prior to the event.

– Discuss reflections and reactions to the film.

– Brainstorm action items and compile a list of resources to make fisheries professions in Alaska more inclusive and accessible.

* Note: There will be numerous ways to share your thoughts and experiences anonymously (e.g., via whiteboard activities, Zoom chat, direct messaging).

Please contact deic@afs-alaska.org with additional questions, comments, and/or concerns.

How to Develop and Deliver an Engaging Virtual Conference Presentation

Course Date: March 3 (10 AM – 11:30 PM) OR March 4 (10 AM – 11:30 PM)

Instructor: Cathy Angell, Cathy Angel Communications; https://www.cathyangell.com/

Cost: FREE, space is limited

Description: What are the best practices for developing a presentation for a virtual conference? How do you engage an audience that you can't see? What if your presentation is pre-recorded? This 90-minute training specifically addresses the successful design and delivery of a science-based virtual

conference presentation. It covers best practices for slide design, as well as effective strategies for keeping a diverse audience involved and engaged. Zoom meeting information will be provided as well as supplemental materials to registrants in advance of the training. The training is being offered free of charge for the American Fisheries Society Alaska Chapter, is sponsored by NOAA's Coastal Training Program at the Kachemak Bay National Estuarine Research Reserve, and is delivered by Cathy Angell Communications.

Register for training on March 3, 2021 10:00-11:30 am:

https://www.eventbrite.com/e/139990779189

Register for training on March 4, 2021 10:00-11:30 am:

https://www.eventbrite.com/e/139995407031

R Workshop: Analyzing and Visualizing Data in R

Course Date: March 16 (9 AM – 12 PM) AND March 17 (9 AM – 12 PM)

Instructor: Greg Merrill, M.S., NSF Graduate Research Fellow, Duke University, Nowacek Laboratory; gregory.merrill@duke.edu

Cost: varies depending on registration type; minimum attendance is 10; maximum is 30

Description: This two half-day course will introduce students to R and R Studio with an emphasis on the tidyverse, a collection of packages designed for data science that share an underlying design philosophy, grammar, and data structure. Participants may sign up for one or both days of the course.

Day one will begin with an introduction on how to properly store and manage data (e.g. long format), how to read data into R (e.g., document.csv), checking datasets for errors ("NA", "NaN", variable information), and application and interpretation of statistical models (ANOVAs, multivariate linear models). Advanced topics for the day will transition to the tidyverse; how to use packages readr and dplyr, for example, to accomplish more complex data processing tasks that have more flexibility than base R functions. Additional topics will include functions spanning data input/output, data creation, data frame slicing and extracting, data selection and manipulation, variable conversion, and mathematical operations.

Day two will apply the tidyverse concepts to pursue an introduction into data visualization using ggplot2. More advanced topics will include mapping with an introduction to basic spatial analyses functions. Topics will be introduced in lecture format proceeded with worked examples/group exercises. Examples will be executed using built-in R datasets as well as publicly available fisheries data. Please download and install the latest version of R and R Studio from the R project website before class: https://www.r-project.org/. If you need guidance, please email the instructor prior to the class.

Students will require a laptop or desktop computer with an active internet connection. It is highly recommended that you have a mouse, wired or wireless; not required but laptop trackpads will slow down efficient navigation of the R environment.

Student Auction

Student Auction

Fundraising is a critical part of our annual meeting that helps fund student participation and travel. Don't miss this year's collection of amazing auction items! To bid on items or to make a monetary donation, you must register on our auction platform, GiveSmart. All auction items will be mailed to winners (shipping & handling (S&H) fees apply--see item description for more details). So, if you're participating in the auction, please provide a mailing address when you register with GiveSmart. For more information, contact Elizabeth Hinkle at ehinkle2@alaska.edu

Auction items can be viewed now at https://lota.givesmart.com/
Bidding opens: Monday March 22 @ 8 AM
Auction closes: Thursday March 25 @ 5:30 PM



Affinity Groups

Affinity Groups

Affinity groups bring shared identities together to increase one's sense of community and belonging within a particular field. The AK-AFS Diversity, Equity, and Inclusion Committee (DEIC) will host a suite of informal affinity group meetings during this year's lunch-time and coffee breaks.

- Tue (3/23) 1:00 - 2:00 PM | women and underrepresented genders in fisheries
- Tue (3/23) 3:15 - 3:45 PM | working caregivers
- Tue (3/23) 5:00 - 6:00 PM | BIPOC (black, indigenous, and people of color)
- Wed (3/24) 5:30 - 6:30 PM | LGBTQIA+ (lesbian, gay, bisexual, transgender, queer, intersex, asexual +)
- Thu (3/25) 2:30-3:00 PM | first generation college students

Questions and comments can be directed to deic@afs-alaska.org. Please let us know if you are interested in leading an affinity group not already listed (e.g., people with disabilities).

Monday, March 22

Film Festival

6:00 PM – 7:30 PM

A silver lining from this past year is how quickly and efficiently we are collectively embracing the virtual world – and one of the best ways to highlight the Love of Fish is through film. We are also in a time when many aquatic scientists and managers have added new tools to their tool box, including time-lapse photography, GoPro capacity and drones. The goal of this festival is to bring together a collection of films from the AFS membership to highlight ways we are 'Coming Together for the Love of Fish!'

	Film Festival: Coming Together For the Love of Fish!
Host:	**Deborah Hart**
6:00 PM	Introductions
6:05 PM	Chinook salmon declines related to changes in freshwater conditions **Rebecca Shaftel**
6:15 PM	Return to Us: Restoring Alaska's Eklutna River **Eric Booton**
6:35 PM	Shoreline Change and Impacts to Traditional and Cultural Gathering Patterns **Adelaide Johnson**
6:45 PM	Upriver and Down, Salmon are Common Ground **Shae Bowman and Lisa Docken**
7:25 PM	Closing Comments

Tuesday, March 23

Meeting Welcome & Announcements

9 AM – 9:10 AM

- Land Acknowledgment and AFS Meeting Code of Conduct
  Sue Mauger, Meeting Planning Committee Chair

Plenary

9:10 AM – 10:00 AM

Barbara 'Wáahlaal Gíidaak Blake

First Alaskans Institute

Barbara 'Wáahlaal Gíidaak Blake is from Prince of Wales Island and currently lives in Juneau. 'Wáahlaal Gíidaak is of Haida, Tlingit and Ahtna Athabascan descent and belongs to the Káat nay-st/Yahkw ’Láanaas (Shark House/Middle Town People) Clan. She currently serves as the Director of the Alaska Native Policy Center with First Alaskans Institute, where she promotes the self-determination of Alaska Native peoples through strengthening opportunities for indigenous voices to be at the forefront of leading, solving, confronting, and advocating for Indigenous communities. Her previous positions include working for Speaker of the House Bryce Edgmon and Governor Bill Walker where she served as policy staffer/advisor, where she was responsible for fisheries/marine resources and Tribal affairs. She received her Master’s degree from UAF in Rural Development focusing her thesis on Fisheries Development in Rural Alaska. She received her undergraduate degree(s) at the University of Alaska Fairbanks with a BA in Rural Economic Development and an AA in Tribal Management - University of Alaska Fairbanks.

Wednesday, March 24

Welcome & Announcements

9 AM – 9:10 AM

Plenary

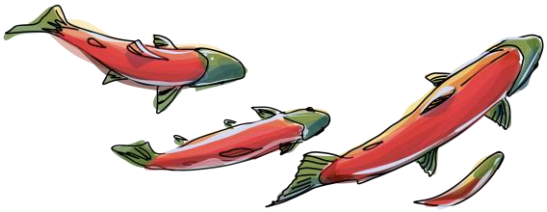
9:10 AM – 10:00 AM

Dr. Erika Eliason

Assistant Professor, Univ. of California-Santa Barbara

Erika Eliason is an Assistant Professor in the Department of Ecology, Evolution, and Marine Biology at the University of California, Santa Barbara. She received her PhD and MSc from the University of British Columbia and BSc from Simon Fraser University, Canada. Erika studies ecological and evolutionary physiology in aquatic animals. She is interested in how natural and anthropogenic stressors influence performance traits and species distributions. Much of the work in the Eliason lab has examined intraspecific variability and thermal tolerance in Pacific salmon. They are particularly interested in whether individual variation can enable salmon to survive and succeed in a changing world. Recent research has focused on how climate change affects physiological performance across populations, age, body size, and sex in salmon.

Talk: Lessons learned from rising temperatures in the Fraser River, BC (see abstract on page 41)



Wednesday, March 24 (Continued)

47th Annual Alaska Chapter AFS Business Meeting

1:15 PM – 2:45 PM

Agenda

1. Call to Order
2. Determination of a quorum
3. Approval of agenda
4. Approval of 2020 annual business meeting minutes
5. AFS Western Division report – Laurie Earley, Vice-President for WDAFS
6. May 2020 - March 2021 Chapter review:
    - Reports
        - Treasurer's Report – Lee Ann Gardner
        - Secretary's Report – Scott Ayers
        - Student Representative's Report – Elizabeth Hinkle
        - Past President's Report – Joel Markis
            - Bylaws
            - Procedures manual
        - Vice President's Report – Megan McPhee
            - Membership update
            - 2022 AFS-Alaska Annual Meeting
        - President-Elect – Sue Mauger
            - 2021 Annual Meeting program review
        - Standing Committees
            - Finance Assets Oversight
            - Molly Ahlgren Scholarship
                - 2021 Award Recipient: Kortney Birch
            - Diversity, Equity and Inclusion
            - Environmental Concerns
            - Continuing Education
            - Fisheries Communication and Education
            - Social Media
        - President's Report – Stephanie Quinn-Davidson
            - Student Endowment
            - ExCom Retreat Report
7. Farewell remarks from outgoing President – Stephanie Quinn-Davidson
8. Remarks from the new President – Sue Mauger
9. Special presentation – Stephanie Quinn-Davidson
10. New Business:
    - Appointment of new Executive Committee officers
11. Open forum
12. Adjourn

Wednesday, March 24 (Continued)

Award Ceremony

2:45 PM – 3:15 PM

Wally Noerenberg Award

The Wally Noerenberg Award for Fishery Excellence, the highest award of the Alaska Chapter, is bestowed as a special honor on individuals who have made great and outstanding contributions to Alaska fisheries. This award was established in 1981 by resolution of the membership.

Our 2020/21 winner is Catherine ("Kitty") Mecklenburg. As an Ichthyology Research Associate with the California Academy of Sciences, she has participated in ichthyological surveys in the Bering Sea and Arctic waters from Russia to Greenland, and is an internationally recognized authority on Arctic fishes. While Ms. Mecklenburg is well known in Alaska for her foundational book *Fishes of Alaska* (2002; along with co-authors Anthony Mecklenburg and Lyman Thorsteinson), her more recent work has culminated in the production of two seminal Arctic ichthyofauna atlases: *Pacific Arctic Marine Fishes* (2016) and *Marine Fishes of the Arctic Region* (two volumes; 2018). She is a member of the Fish Expert Network for the Arctic Council's Circumpolar Biodiversity Monitoring Program and leads efforts to develop genetic barcoding for northern fishes and increase accessibility of electronic taxonomic databases. The Chapter is proud to recognize Ms. Mecklenburg for her role in advancing ichthyological and fisheries science in Alaska and beyond.

Alaska Chapter Service Award

The Chapter Service Award (CSA) was established to award outstanding service to the Alaska Chapter of the American Fisheries Society.

Our 2021 Alaska Chapter Service Award goes to Toshihide “Hamachan” Hamazaki, who served on the Executive Committee (2007 – 2010) and continues to serve the chapter and the broader fisheries community in a huge way by managing the email listserve. This is a volunteer role that he has taken on and it has been crucial to the function of the chapter. It has also become a clearinghouse for information about chapter activities, seminars, workshops, and job opportunities. Thank you Hamachan for helping us all stay connected and informed!

Wednesday, March 24 (Continued)

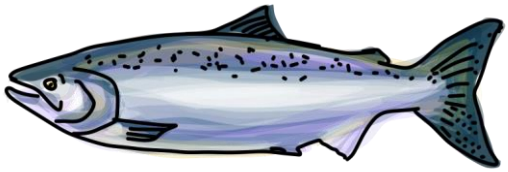
Environmental Concerns Committee Meeting

4:30 PM – 5:30 PM

The Environmental Concerns Committee was established to provide coordinated technical and policy analysis and Chapter input and comments on environmental issues that affect Alaska's fishery resources. We'll review recent Chapter efforts, discuss current and emerging Environmental Concerns, solicit input from members on issues and actions moving forward. All are welcome.

AGENDA

1. Brief Introductions
2. Overview of recent Chapter Initiatives
    - Alaska Chapter comments on Revised Waters of the US Definition (April 15, 2019)
    - Joint comment letter on Pebble Mine DEIS (June 13, 2019)
    - Alaska Chapter comments on changes to Tongass Roadless Rule (December 16, 2019)
3. Overview of Western Division Resource Policy and Environmental Concerns Committee (RPECC)
4. Issue Updates
    - Waters of the US
    - Pebble Mine
    - Instream Flow
    - Tongass Roadless
5. Ongoing or Emerging Issues
6. Future plans and projects



Fish Trivia

6:30 PM – 8:30 PM

The Alaska Chapter is hosting a specially-curated trivia social event. You can sign up through the meeting registration process - limited to the first 100 people. Check out what to expect from our zany host at https://www.elephinotrivia.com/. You'll need a stable internet connection, a device with a webcam, and you might want a paper & pen.

Once you book a spot you'll receive an email with a link to the main party room.

Thursday, March 25

Welcome and Announcement

9:00 AM – 9:10 AM

Plenary

9:10 AM – 10:00 AM

Dr. Ivan Arismendi

Assistant Professor, Oregon State University
Freshwater Ecology and Conservation Lab

Dr. Ivan Arismendi is an aquatic ecologist who currently holds an Assistant Professor position at Oregon State University. Growing up in southern Chile, his interest for aquatic ecology was sparked as he witnessed the invasion of trout and salmon in his native waters. He obtained a bachelor's degree in Fisheries Engineering and a Doctorate degree in Forest Sciences from Austral University in Chile. Currently, he leads scientific research to improve our understanding about the role of natural variability and human-related disturbances on aquatic ecosystems. Specifically, he focuses on global environmental change, invasion biology, and aquatic food webs. But, he is also interested in the people who use or study in natural resources, which has led to emergent research on diversity, equity, and inclusion in science. To date, Dr. Arismendi has led to over 70 scientific publications and has received various awards, including the "Savery Outstanding Young Faculty Award" in 2020 and the "Diversity Commitment Award" in 2021 from the College of Agricultural Sciences at Oregon State University. Ha also received the Emmeline Moore Prize from the American Fisheries Society (AFS) in 2020, a career achievement award that recognizes efforts in the promotion of demographic diversity in AFS. As a mentor and advisor, Dr. Arismendi helps students become the professionals they desire to be and he enhances the student diversity in his department by mentoring and advising both graduate and undergraduate students, including students from Chile, Argentina, Colombia, Malaysia, Pakistan, Russia, and Vietnam. His research lab includes members from a variety of identities and backgrounds including racial minorities, gender minorities, veterans, and international students. He has mentored 2 postdocs, advised 14 graduate students, and mentored 19 undergraduate students. He contributes to several DEI initiatives, including a summer camp to engage high school students from underserved communities, which received the Oregon State University Outreach and Engagement Vice-Provost Team Award for Excellence in 2020. He self-identifies as a LatinX scientist with a strong commitment to serve as an example to students that science is available to everyone.

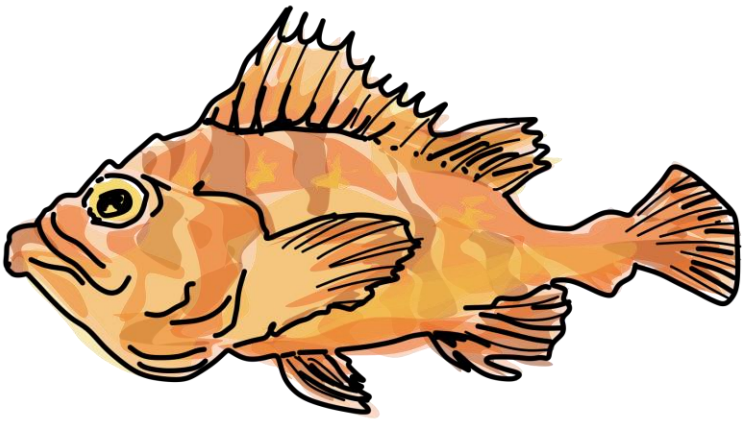
Talk: Collaboration networks in the era of diversity and inclusion (see abstract on page 30)

Thursday, March 25 (Continued)

Student-Mentor Lunch

12 PM – 1:00 PM

This lunch-time event provides an opportunity for attendees to discuss a variety of topics in small break-out groups. 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 prompting questions, but participants are encouraged to discuss anything that is of interest to students and early career professionals in their groups. Those interested in participating in an ongoing mentorship program may express interest here. Questions and comments can be directed to deic@afs-alaska.org.



REMINDER: Student Auction

https://lota.givesmart.com/
Auction closes: Thursday, March 25 @ 5:30 PM

Technical Session Schedule - Tuesday

	Incorporating adaptive management planning in aquatic habitat conservation efforts in Alaska
Chair(s):	Deborah Hart and Neil Stichert
10:15 AM	Arctic Grayling (*Thymallus arcticus*) distribution and movement in a boreal headwater tributary **Deanna Strohm-Klobucar**
10:30 AM	Premature mortality observations among Alaska's Pacific salmon during record heat and drought in 2019 **Vanessa von Biela**
10:45 AM	Sensitivity of salmon spawning habitat to instream wood loss and flood disturbance in Southeast Alaska **Matthew Sloat**
11:00 AM	Riverscape heterogeneity and food web diversity in Southeast Alaska **Matthew Dunkle***
11:15 AM – 1:00 PM	**PANEL DISCUSSION (1.75 HR)**

* Student Presentation

	Applied research and agency programs to advance the use of human dimensions science in fishery management
Chair(s):	Robert Murphy and Brad Harris
2:00 PM	Collaborating with fishers to better understand commercial fishery risks, behaviors, and fishery dynamics **Robert Murphy**
2:15 PM	Including fishers' knowledge in nearshore rockfish management in the Gulf of Alaska **Jesse Gordon***
2:30 PM	Beyond the seafood market: the role of non-market values in fisheries- and ecosystem-based management **Dan Lew**
2:45 PM	Two-eyed seeing in fisheries management: science, Indigenous knowledge and partnership **Karli Tyance Hassell**
3:00 PM	Vulnerabilities and resilience in Yukon River salmon-dependent communities: How human dimensions research can inform and improve fisheries management **Alida Trainor**
3:15 - 3:45 PM	**COFFEE BREAK**

3:45 PM	Best Available Science and the challenges and opportunities with broader inclusion of diverse knowledge systems *(Part 1)* **Kate Haapala**
4:00 PM	Best Available Science and the challenges and opportunities with broader inclusion of diverse knowledge systems *(Part 2)* **Sarah Wise**
4:15 PM	The evolving use of socioeconomic information in North Pacific fishery management decision-informing analyses **Mike Downs**
4:30 PM	Evolving approaches to support applied human dimensions research in Alaska *(Part 1)* **Mathew Baker**
4:45 PM	Evolving approaches to support applied human dimensions research in Alaska *(Part 2)* **Liza Mack**

* Student Presentation

Poster Session 6:00 PM – 8:00 PM	
Each poster presenter will give a 2-minute live introduction and then, around 6:30 pm, presenters and attendees will go into break out rooms to entertain questions and have conversation about the posters.	
Chair(s):	Kaitlyn Manishin
Laura Coleman	Viability assessment for the use of otolith symmetry to distinguish hatchery and wild Chinook Salmon in Southeast Alaska
Alexandra Reich*	An assessment of relaxed selection in hatchery populations of Pink and Coho Salmon by analysis of phenotypic markers
Anna Rix*	Genetic characterization of a kokanee population from Copper Lake, Alaska
Carolyn Hamman*	Detection of Arctic cod *Boreogadus saida* using eDNA in Prudhoe Bay, Alaska
Veronica Padula*	Including Alaskan coastal community voices in the marine debris conversation: perspectives from St. Paul Island
Garrett Dunne*	Improving stock assessments of Pacific Sleeper Shark and Pacific Spiny Dogfish in Alaska
Ashley Stanek	Contrasting terrestrial organic matter assimilation by fishes from two Beaufort Sea regions
Kevin Fitzgerald*	Implications of a changing flow paradigm on juvenile salmon growth in Southeast Alaska
Christopher Sergeant*	How will Pacific salmon in Alaska respond to changes in streamflow and water temperature?

* Student Presentation

Technical Session Schedule - Wednesday

	Indigenous Fisheries in Alaska and Issues of Equity
Chair(s):	Courtney Carothers, Jessica Black, and Stephanie Quinn-Davidson
10:15 AM	Perpetual relationships in a fractionalized world **Jonathan Samuelson**
10:30 AM	Tribal governance in fisheries: Yukon River Inter-Tribal Fish Commission **Brooke Woods***
10:45 AM	Tribal fisheries in Metlakatla, Alaska **Tazia Wagner***
11:00 AM	Indigenizing salmon science & management: Yup'ik and Athabascan insight from the Kuskokwim Region **Janessa Esquible**
11:15 AM	Tamamta (All of Us): transforming Western and Indigenous fisheries and marine sciences together **Courtney Carothers**
11:30 AM – 1:15 PM	**PANEL DISCUSSION (1.75 HRS)**

* Student Presentation

	Contributed Papers: Marine Topics
Chair(s):	Sue Mauger
3:15 PM	Alaskan Yelloweye Rockfish fecundity revealed through an automated egg counting and digital imagery method **Donald Arthur**
3:30 PM	ADF&G Statewide Rockfish Initiative **Janet Rumble**
3:45 PM	Reproductive Biology of a valuable groundfish species, lingcod *Ophiodon elongatus* in Prince William Sound **Katja Berghaus***
4:00 PM	Understanding behavior and stock structure of Pacific Halibut (*Hippoglossus stenolepis*) in the Northern Bering Sea **Austin Flanigan***
4:15 PM	How often do large Chinook Salmon occupy offshore waters? **Andrew Seitz**

* Student Presentation

Technical Session Schedule, **THURSDAY 3/25/2021, 10:15 AM – 1:00 PM (Concurrent Sessions)**

	eDNA: a versatile and increasingly useful tool for environmental survey and monitoring under challenging logistical conditions	**Contributed Papers: Other Topics**
	Concurrent Session #1	**Concurrent Session #2**
Chair(s):	Andrés López, Trey Simmons	Kevin Fraley
10:15 AM	Investigating the influence of habitat on nearshore fish communities using eDNA metabarcoding **Wes Larson**	Anadromous Waters Catalog revisions in the Brooks Range with a focus on the Ambler Road Corridor **Nate Cathcart**
10:30 AM	DNA analysis of merganser scat to determine presence of Chinook Salmon and other piscine prey species **Justin Hill**	Analysis of the Cripple Creek Project: assessing the effects of fish passage improvements and habitat enhancement **William Samuel***
10:45 AM	Detection of aquatic invasive species by metabarcoding of environmental DNA using multiple genetic markers **Trey Simmons**	An examination of Burbot life history strategies through use of radiotelemetry **Lisa Stuby**
11:00 AM	Investigating the use of eDNA metabarcoding as a method for monitoring aquatic biodiversity in tributaries of Lake Michigan **Willie Dokai***	Collaborative subsistence harvest monitoring efforts to sustain Kuskokwim River salmon **Katie Russell**
11:15 AM	Development and testing of environmental DNA assay for Arctic Lamprey *Lethenteron camtschaticum* **Anthony Thompson***	Juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) spring outmigration timing and fish size in the Chena River, Alaska **Olivia Edwards***
11:30 AM	Validation of qPCR assays to detect and distinguish congeneric salmonid species occurring in the Chena River **Daphne Mueller***	Morphology method of sex assignment is not effective for Chinook Salmon in the Yukon River **Randy Brown**
11:45 AM	**OPEN**	Trophic ecology and proximate composition of marine and diadromous fishes in Chukchi Sea coastal lagoons **Kevin Fraley**
12:00 – 1:00 PM	**STUDENT-MENTOR LUNCHEON**	**STUDENT-MENTOR LUNCHEON**

*Student Presentation

Technical Session Schedule, **THURSDAY 3/25/2021, 1:00 PM – 3:00 PM (Concurrent Sessions)**

	Fisheries Genetics in Alaska	**Contributed Papers: Other Topics (Continued)**
Chair(s):	Sara Gilk, Wes Larson, and Megan McPhee	Michael Carey
1:00 PM	Demographic and genetic estimators of effective population size for Sockeye Salmon in Auke Lake, Alaska **Patrick Barry***	Determining how *Elodea* spp. impacts fish performance in Subarctic food webs **Michael Carey**
1:15 PM	The thermotolerance of Broad Whitefish *Coregonus nasus* in Prudhoe Bay, Alaska **Carolyn Hamman***	Physiological performance of Northern Pike (*Esox lucius*): implications for management in invaded systems **Taylor Cubbage***
1:30 PM	Using genomics to improve stock structure resolution of Lake Whitefish (*Coregonus clupeaformis*) in Lake Michigan **Yue Shi**	Incorporating risk-tolerance scenarios in model predictions to support decision-making in stream restoration planning **Eric Walther***
	Fisheries Genetics in Alaska (Continued)	**Contributed Papers: Population Dynamics**
Chair(s):	Sara Gilk, Wes Larson, and Megan McPhee	Jeff Falke
1:45 PM	Altered gene expression in Rainbow Trout following exposure to harmful algal blooms **Morag Clinton**	Revealing stream attractiveness to stray hatchery Chum Salmon (*Oncorhynchus keta*) in Southeast Alaska **Molly Payne***
2:00 PM	Heterogeneous genetic basis of age at maturity in salmonid fishes **Charlie Waters**	Coastal migration characteristics and stock composition of Coho Salmon in eastern Norton Sound fisheries **Luke Henslee***
2:15 PM	Reduced fitness of stray hatchery-origin Pink Salmon in three streams in Prince William Sound **Kristen Gruenthal**	Effects of crude oil on juvenile Threespine Stickleback growth and development varies by population **Kelly Ireland***
2:30 – 3:00 PM	**COFFEE BREAK**	**COFFEE BREAK**

*Student Presentation

Technical Session Schedule, **THURSDAY 3/25/2021, 3:00 PM – 5:30 PM (Concurrent Sessions)**

	Fisheries Genetics in Alaska (Continued)	Contributed Papers: Climate Impacts on Aquatic Habitat
Chair(s):	Sara Gilk, Wes Larson, and Megan McPhee	Jeffrey Falke
3:00 PM	What can we learn about hatchery-wild interactions from sparse, multi-generational Pink Salmon pedigrees? **Kyle Shedd**	Wildfire in changing boreal stream ecosystems: a friend or foe for fishes? **Jeffrey Falke**
3:15 PM	Stock composition of subsistence harvests and total returns of Sockeye Salmon from the Kvichak River **Tyler Dann**	Predicting future effects of forest fire on aquatic habitat quality and juvenile Chinook Salmon growth in interior Alaska **Stephen Klobucar**
3:30 PM	Using population genomics to validate models of recruitment for the Gulf of Mexico Pink Shrimp, *Farfantepenaeus duorarum* **Laura Timm**	Aquatic food web and community response to wildfire in interior Alaska boreal streams **Elizabeth Hinkle***
3:45 PM	Seascape genomics of North Pacific forage fishes **Savannah Labua***	Short-term effects of wildfire on juvenile Chinook Salmon in the Chena River **Benjamin Meyer**
4:00 PM	**Fisheries Genetics Panel Discussion / Social**	Spatiotemporal and flow-related variability in invertebrate drift and Chinook Salmon growth in the Chena River, Alaska **Jason Neuswanger**
4:15 PM		Juvenile Coho Salmon growth in the Deshka River during the record-hot summer of 2019 **Bradley Nissen**
4:30 PM		AKTEMP: Understanding regional stream temperature patterns through collaborative data sharing **Marcus Geist**
4:45 – 5:30 PM		**OPEN**

*Student Presentation

Symposia Descriptions – Tuesday

Incorporating adaptive management planning in aquatic habitat conservation efforts in Alaska.

Organizer(s): Deborah Hart (SEAK Fish Habitat Partnership) and Neil Stichert (USFS)

Time: Tuesday, 10:15 AM – 11: 15 AM; Panel Discussion, 11:15 AM – 1:00 PM

Description: Aquatic ecosystems across Alaska are rapidly experiencing the impacts from large climatic variability events within short periods of time; for example, extreme drought conditions in southeast Alaska in 2019, followed by elevated precipitation events in 2020. Incorporating adaptive management planning is needed to help aquatic scientists and natural resource managers in addressing important aquatic habitat conservation needs under these extreme and variable climate conditions. The goal of this symposium is to bring together aquatic scientists and natural resource managers from across a broad range of disciplines and representing a diverse array of aquatic ecosystems to share their recent research on aquatic species and climate vulnerability in Alaska, how vulnerability assessments are informing management decisions, and facilitated group discussion leading to a set of recommendations and prioritized steps for incorporating adaptive management planning in the future.

Applied research and agency programs to advance the use of human dimensions science in fishery management

Organizer(s): Robert Murphy and Brad Harris (APU FAST Lab)

Time: Tuesday, 2:00 PM – 5:00 PM

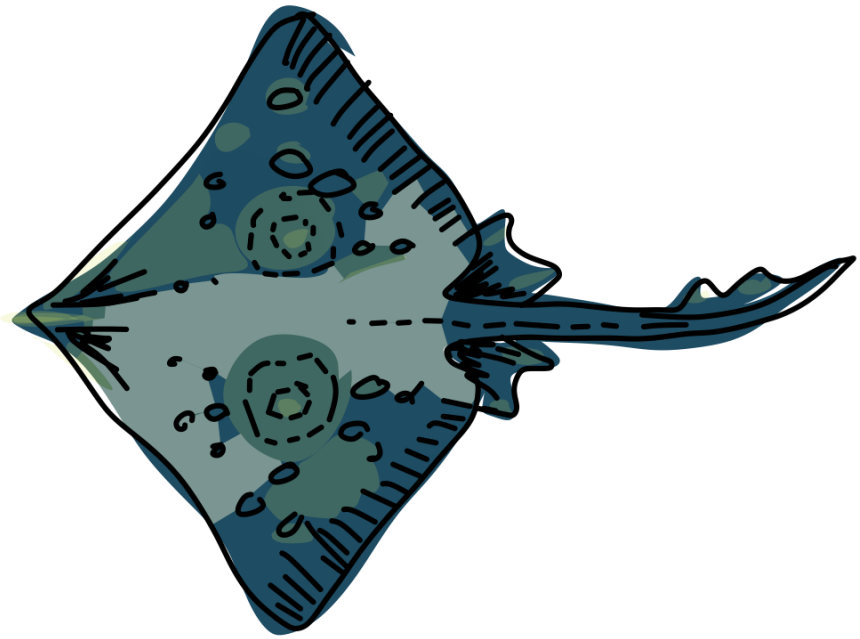
Description: We have historically managed fish populations primarily using biological data, including information on the population dynamics and characteristics of the fish itself. However, shifts in management strategies throughout the United States have led to a recent focus on better engaging fishery stakeholders, incorporating fisher knowledge, and developing pathways to assess stakeholders' perceptions and the ways in which regulatory strategies could impact fishers and fishing communities. Finding approaches to systematically incorporate the human dimensions of fisheries into management programs that are designed to utilize biological data presents many challenges, including the diversity of stakeholder interests and values that can exist even within a single fishery. Fortunately, advancements in human dimensions science have led to the development of new techniques for qualitatively and quantitatively synthesizing stakeholder perceptions and knowledge. State and federal agencies have also worked toward better engagement and structured pathways for the inclusion of social information. In this symposium, you will hear from researchers pushing the envelope with new techniques and from agency representatives that will discuss ways in which their agencies have worked to improve stakeholder participation in management. We will conclude with a panel session where the focus will be on the future of human dimensions science in fisheries management.

Indigenous Fisheries in Alaska and Issues of Equity

Organizer(s): Courtney Carothers (UAF), Jessica Black (UAF, Department of Alaska Native Studies and Rural Development and Tribal Governance), and Stephanie Quinn-Davidson (Yukon River Intertribal Fish Commission)

Time: Wednesday, 10:15 AM – 11:30 AM; Panel Discussion, 11:30 AM – 1:15 PM

Description: The fishery systems in Alaska are Indigenous fisheries. People and fish have been closely entwined here for at least 12,000 years, and by Indigenous accounts much longer. Deep knowledge and stewardship systems developed over millenia continue to guide respectful relationships and practices across the Indigenous communities of the state. And yet, in western fisheries education, science, and management systems, this stewardship and depth of knowledge is rarely acknowledged nor drawn upon. Indigenous fisheries are under great threat from exclusion and dispossession. This session features a panel of speakers and a hosted dialogue to follow exploring issues of equity for Indigenous peoples and fisheries. We also discuss equity and inclusion more generally as fundamentally central considerations in education, science, and management, greatly in need of amplification and attention.



Symposia Descriptions – Thursday

eDNA: a versatile and increasingly useful tool for environmental survey and monitoring under challenging logistical conditions

Organizer(s): Andrés López (UAF), Trey Simmons (NPS), and Deborah Hart (SEAK Fish Habitat Partnership)

Time: Thursday, 10:15 AM – 11:45 AM

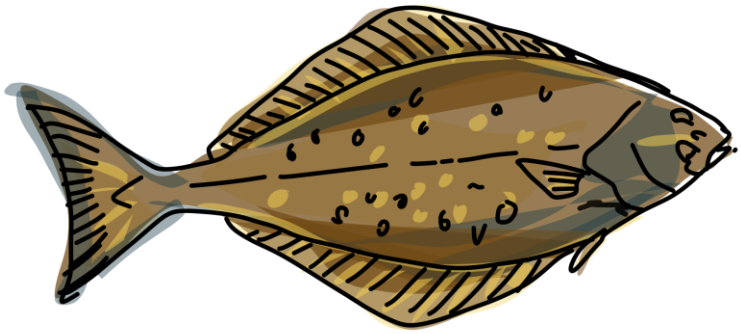
Description: The indirect detection of species in various habitats through analysis of environmental DNA (eDNA) is quickly becoming an important tool in natural resource research and management. Over the past 12 years, eDNA-based techniques have been continuously refined, extended and validated. These techniques are now sufficiently well developed to be considered for wide deployment in ecosystem surveying and monitoring efforts in Alaska, where remoteness and seasonal conditions commonly present special challenges. This symposium will highlight ongoing and future eDNA-based research taking place in Alaska. It will serve to engage the community of Alaska-focused eDNA research and monitoring groups in a conversation regarding present challenges and future opportunities for this approach.

Fisheries Genetics in Alaska

Organizer(s): Sara Gilk (ADF&G), Wes Larson (NOAA), and Megan McPhee (UAF)

Time: Thursday, 1:00 PM – 4:00 PM; Panel/Social, 4:00 PM - 5:30 PM

Description: In recent decades, significant advances have been made in the development and application of molecular and quantitative genetic methods. Meanwhile, genetic methods are being widely applied to address management and conservation issues, as well as contribute to our understanding of evolution and ecology of a variety species across Alaska. This symposium will highlight recent advances in fisheries genetics and genomics as applied to issues of interest in Alaska.



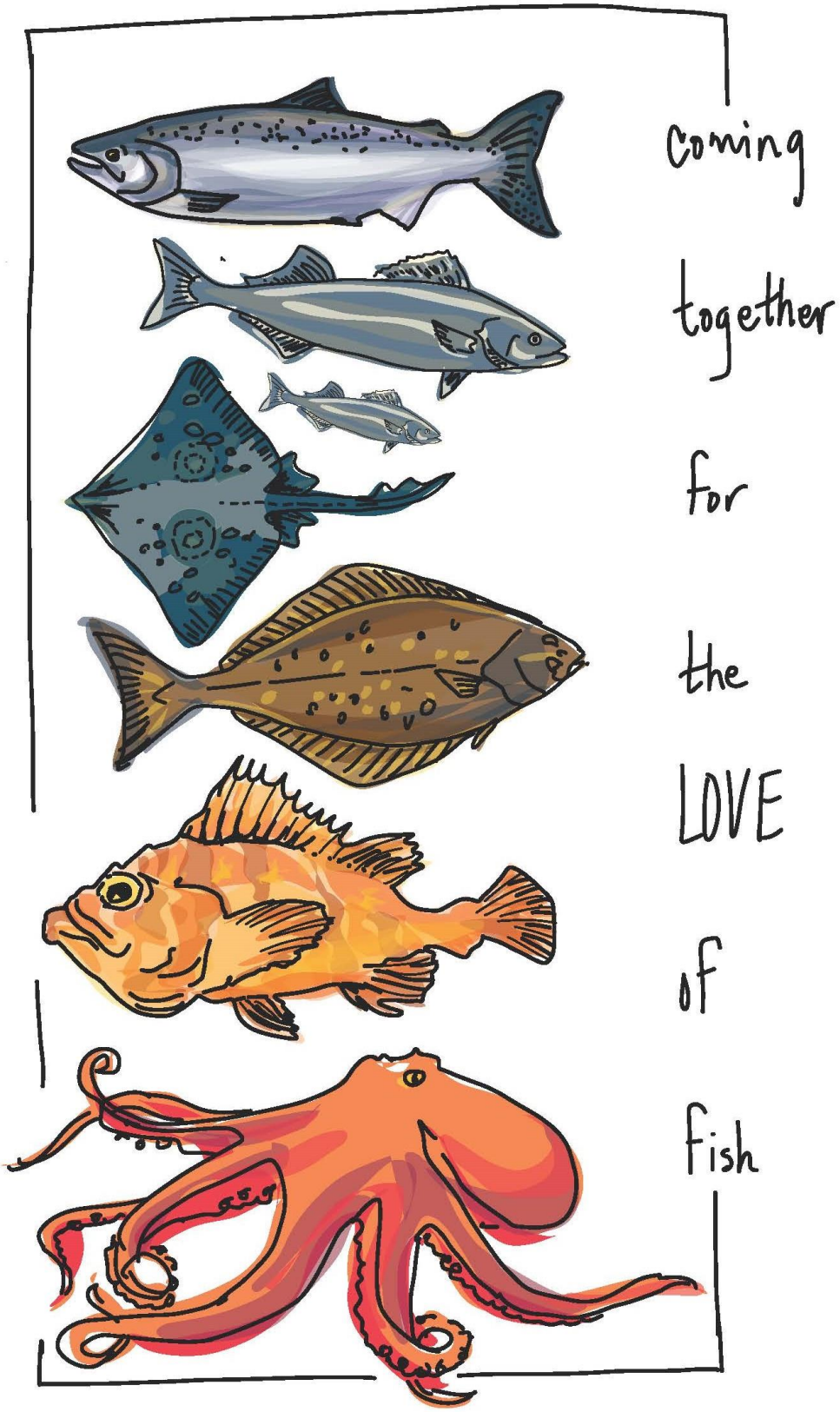
2021 National and Western Division AFS Meetings

Investing in People,
Habitat, and Science

https://afsannualmeeting.fisheries.org/

The American Fisheries Society, President Brian Murphy, and the Potomac and Tidewater Chapters are excited to host the 151st AFS Annual Meeting, now rescheduled for November 6-10, 2021. Baltimore, also known as "Charm City," is famous for its blue crabs and crab cakes, as well as a vibrant cargo port and numerous nearby fishing opportunities in the Chesapeake Bay, Patapsco River, and Gunpowder Falls State Park. Baltimore will be a fantastic location to continue to commemorate 150 years of fisheries science achievements, so be sure to join us for special celebrations throughout the conference. The past, present, and future of fisheries science will be on display as we bring together professionals from across North America and countries throughout the world under the theme of "Investing in People, Habitat, and Science." We will solicit symposia topics, contributed papers, and posters that exemplify the latest research in fisheries science and that will benefit a range of audiences with the aim of advancing the science of fisheries ecology, conservation, and management.

Western Division AFS May 10 -14, 2021 (More details here)


coming
together
for
the
LOVE
of
fish

Abstracts

(Abstracts are listed in alphabetical order by the first author's last name)

Collaboration networks in the era of diversity and inclusion

Arismendi, Ivan Oregon State University

Plenary Talk

The inclusion of diverse groups in ecological sciences has shown little progress over the last two decades for various reasons, including structural barriers within both society and academia. Collaboration networks are important for productivity, promotion, and scientific impact, yet the extent to which the structure of these networks affects the inclusion of minoritized groups remains unknown. Here, we evaluated trends in published research between 1965 and 2017 within the US fisheries science academic co-authorship network and evaluated its structural composition focused on gender and race/ethnicity. Although the number of publications, number of authors per article, and lead authorship by women and people of color have increased over time, white men still led more than 70% of published articles. Network analysis demonstrates a shift in the structure of the network over time from an initial concentration of research among a few fragmented clusters to a nearly completely connected network by 2016. However, centrality metrics for women and people of color consistently showed lower scores suggesting that their full integration into the network remains incipient. Our findings illustrate that although progress has been made towards the inclusion of diverse talent over time, continued progress require more explicit efforts to overcome barriers.

Alaskan Yelloweye Rockfish fecundity revealed through an automated egg counting and digital imagery method

Arthur, Donald ADFG/UAF; Falke, Jeffrey U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit; Blain-Roth, Brittany Alaska Department of Fish and Game; Sutton, Trent University of Alaska Fairbanks; Beaudreau, Anne University of Alaska Fairbanks

Contributed papers: Marine topics

Spawning stock biomass (SSB) is often used as an index for reproductive potential (RP) in stock assessments. The method assumes that mature female biomass is proportional to total egg production (TEP), and implies that the fecundity-length relationship follows an approximately cubic function and relative fecundity is constant with length. However, an understanding of such fecundity relationships is lacking for many fish species owing to small sample sizes and the difficulty associated with fecundity estimation. For example, only three fecundity estimates exist in the published literature for Yelloweye Rockfish (*Sebastes ruberrimus*), a commercially and recreationally important species. Our goal was to estimate fecundity for Yelloweye Rockfish and evaluate relationships of absolute and relative fecundity with size. We collected biological data and ovaries from 419 Yelloweye Rockfish in Prince William Sound and the Northern Gulf of Alaska during 2018-2019. Fecundity was estimated using the gravimetric method and eggs were counted using image analysis software from digital images. A subsample of

ovaries (n=30) were manually counted to evaluate the speed, accuracy, and precision of the automated counting procedure. Yelloweye Rockfish fecundity was estimated to range from 53,249 to 3.052 x 106 eggs (mean=896,762±699,504 SD) and relative fecundity increased by 6.7 eggs per gram per cm. Our results indicate that the assumption of proportionality between biomass and TEP was not met, therefore using SSB in a stock assessment for Yelloweye Rockfish would underestimate the contribution to RP by larger (>5.6kg) female Yelloweye Rockfish and provide biased biological reference points. This study provides critical information to more realistically model RP and improve stock assessment inputs for the development of harvest control rules for Yelloweye Rockfish. This study provides critical information to more realistically model RP of Yelloweye Rockfish for stock assessment input and provides a method for rapid estimation of fish fecundity.

Evolving approaches to support applied human dimensions research in Alaska

Baker, Matthew North Pacific Research Board; Mack, Liza Aleut International Association

Symposium: Advancement of the use of human dimensions science in fishery management

Marine systems and marine resource dynamics are best understood through the active integration of multiple perspectives and methodological approaches to investigate and observe marine ecosystems. Effective fishery management requires not only the integration of Indigenous and industry knowledge with applied science, but also mechanisms to solicit, formalize, and incorporate these informed perspectives, priorities, and experiences in management decision processes. The North Pacific Research Board supports human dimensions research and has developed programs to promote co-production of research and active engagement in research in two target stakeholder groups – industry and coastal communities (NPRB Science Plan). This presentation will provide a summary of past investments, successes, challenges, and opportunities for active engagement of resource users, coastal communities and Alaska Native communities through initiatives intended to promote cooperative research with industry, community involvement, and co-production of knowledge.

Demographic and genetic estimators of effective population size for Sockeye Salmon in Auke Lake, Alaska

Barry*, Patrick UAF SFOS

Symposium: Genetics in Fisheries

The conservation and management of salmon populations is often based on estimates of the census size (Nc). However, in small populations the rate of loss of genetic variation (heterozygosity), increase in inbreeding, and decrease in population fitness is a function of the effective population size (Ne), which can be much smaller than Nc. A long-term dataset on Sockeye Salmon *Oncorhynchus nerka* in Auke Creek, Alaska allowed us to estimate Ne with demographic methods over a 38-year time frame and the effective number of breeders (Nb) with genetic methods for three return years. Demographic estimates of Ne demonstrate substantial variability among the seven generations with initially low values peaking by the fourth generation, followed by a gradual decline. The major demographic factors that determined

Ne were variance in family size, variable contribution to the next generation by brood years within a generation, and fluctuations in population size. Freshwater productivity (adult to smolt) appeared to influence population fluctuations more than marine survival (smolt to adult) over the 38-year timeframe. Genetic estimates of Ne were smaller than demographic estimates. The lower-bound estimate for Ne/Nc was between 0.21 and 0.37, which is consistent with values reported for other salmonid species.

Reproductive Biology of a valuable groundfish species, lingcod - *Ophiodon elongatus* in Prince William Sound

Berghaus*, Katja University of Alaska Fairbanks; Sutton, Trent University of Alaska Fairbanks

Contributed papers: Marine topics

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.

“Return to Us”: Restoring Alaska’s Eklutna River

Booton, Eric Trout Unlimited

Film Festival: Coming Together for the Love of Fish!

"Return to Us" describes the effort to restore the Eklutna River. Produced by Ryan Peterson, award-winning filmmaker of Super Salmon, this 8-minute documentary film reveals the intertwined histories of the Eklutna Dena’ina and Pacific salmon. The beauty and tragedy of the Eklutna River, the dreams of the Eklutna people and the tenacity of salmon are revealed in this film. You can get the latest information on restoration of the Eklutna River at the website for the Eklutna River Restoration Coalition – eklutnariver.org This film was made possible by - The Conservation Fund, Alaskanist Stories, Trout

Unlimited, Resources Legacy Fund, Patagonia, the Rasmuson Foundation, and the Alaska Community Foundation.

Upriver and Down, Salmon are Common Ground

Bowman, Shae Copper River Watershed Project

Film Festival: Coming Together for the Love of Fish!

"Upriver and Down, Salmon are Common Ground" gives viewers a glimpse into life in the Copper River watershed and the work the Copper River Watershed Project (CRWP) is doing. The documentary features interviews and stories from community members, amazing scenery from the watershed, and explores the work the CRWP is doing to improve fish habitat in the region.

Morphology Method of Sex Assignment is not Effective for Chinook Salmon in the Yukon River

Brown, Randy U.S. Fish and Wildlife Service; Bradley, Catherine U.S. Fish and Wildlife Service

Contributed papers: Misc. Topics

Chinook Salmon *Oncorhynchus tshawytscha* are widely distributed in the Yukon River in the United States and Canada and are pursued in numerous fisheries. The species is managed to ensure escapement goals are met and surplus fish become available for harvest. Demographic data, including length, age, and sex composition of annual runs, are important components of management programs. Numerous sampling projects along the river collect these data each year, most without sacrificing fish. However, substantial error can occur when assigning sex based on external observations of morphology, particularly early in the spawning migration. We sought to develop a quantitative method of analyzing morphology of Chinook Salmon in the Yukon River similar to one developed in the Sacramento River that achieved ≥95% accuracy of sex assignment. We collected snout length (SL) and mid-eye to fork length (MEF) from over 2,300 fish in six sampling regions ranging from river km 40–2,000, including a collection from post-spawning fish. Sex was determined for these samples based on internal examination of gonads. We fit a logistic regression model to the full dataset using a binary response, female or male. The model included MEF, the ratio of SL/MEF, the interaction of both morphometric variables, and regional groups. Accuracy rates ranged from as low as 79% for a lower Yukon River sample to as high as 92% for the post-spawning sample, less than was achieved in the Sacramento River. We concluded that Yukon River Chinook Salmon allocate their energy reserves more to accomplish the long migrations they undertake and less to development of secondary sexual characteristics such as SL in males. Populations requiring less rigorous migrations, such as those in the Sacramento River, appear to allocate more of their energy to the development of secondary sexual characteristics.

Determining how *Elodea spp*. impacts fish performance in Subarctic food webs

Carey, Michael U.S. Geological Survey, Alaska Science Center; Reeves, Gordon USFS; Sethi, Suresh USGS; Tanner, Theresa USFS; Young, Dan NPS; Bartz, Krista NPS; Zimmerman, Christian USGS

Contributed papers: Misc. Topics

Invasive species introductions in high latitudes are accelerating and elevating the need to address questions of their effects on Subarctic and Arctic ecosystems. As a driver of ecosystem properties, submerged aquatic vegetation is one of the most harmful biological invasions to aquatic food webs. The aquatic plant *Elodea spp*. is a potential invader to Arctic and Subarctic ecosystems and is already established at a small suite of locations in Alaska, USA. *Elodea spp*. has been found to alter ecosystem processes through multiple pathways; yet, little is known about the impact of *Elodea spp*. on fish performance. A primary concern is the effect of Elodea spp. on juvenile Pacific salmon (*Oncorhynchus spp*.), because this invading plant can form dense stands in littoral zones, potentially impacting important freshwater rearing habitats used by juvenile fish for foraging and refuge from predators. We used a controlled experiment to test the effect of *Elodea spp*. on juvenile Coho Salmon (*O. kisutch*) growth in a lake near Cordova, AK. We found that *Elodea spp*. has the potential to reduce prey resources for juvenile fish resulting in lower growth for juvenile Coho Salmon over the summer compared to a native assemblage of aquatic plants. Using controlled experiments to determine the mechanisms by which *Elodea spp*. influences food webs provides insights on future impacts to fish communities and contributes to our understanding of invasion ecology in general by examining an aquatic invasive species in a high-latitude ecosystem.

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

Carothers, Courtney College of Oceans and Fisheries Science, UAF; Black, Jessica Department of Alaska Native Studies and Rural Development and Tribal Governance, UAF; Westley, Peter UAF

Symposium: Indigenous Fisheries in Alaska and Issues of Equity

Tamamta, a Yup'ik and Sugpiaq word meaning All of Us, is centered on elevating 14,000+ years of Indigenous stewardship and bridging Indigenous and Western sciences to transform graduate education and research in fisheries and marine sciences. This program is motivated by the deep inequities that persist in the education and resource management systems in Alaska. While Alaska Natives make up nearly 20% of the state's population, less than 3% of students and less than 1% of faculty in UAF's College of Fisheries and Ocean Sciences are Alaska Native. There is a near complete absence of Alaska Native people in state or federal resource management bodies, and a near complete absence of Indigenous knowledge being taught or guiding management. We want to change this! In the Tamamta Program we are trying to transform our whole approach to education, research, and management. Our team builds on years of cross-cultural and cross-disciplinary work to address pressing questions of equity and sustainability of life and relations in Alaska. Our fellows will use a co-production of knowledge (bridging Indigenous and Western knowledge) approach to explore key questions in our fisheries and marine and ocean systems.

Anadromous Waters Catalog Revisions in the Brooks Range with a Focus on the Ambler Road Corridor

Cathcart, Nate Alaska Department of Fish & Game

Contributed papers: Misc. Topics

Alaska is experiencing climate change and ongoing or proposed resource development, necessitating monitoring of affected ecosystems. More specifically, this is true for western and Arctic Alaska where subsistence communities and national park units exist among mines and the emerging effects of climate change, such as species range expansion. This region is also the corridor for the proposed 340 km Ambler Road that would support foreign mining operations. The remoteness of these ecosystems contributes to an incomplete documentation of fish communities that could be sensitive to changing environmental conditions or further habitat modifications from proposed development. In Alaska, site-specific, unambiguous observational records of fishes are needed to inform the Anadromous Waters Catalog (AWC), the regulatory atlas that guides protections of waterbodies supporting anadromous fishes such as Pacific salmon (*Oncorhynchus spp*.) and some whitefishes. To better understand this region's fish community and improve the AWC, the Alaska Freshwater Fish Inventory (AFFI) collaborated with the National Park Service to study an area from the upper Koyukuk River westward to the coast. In 2018 and 2019, AFFI staff based out of Bettles, Kobuk, and Kotzebue performed electrofishing, aerial, and angling surveys to document 17 fish species, including 7 anadromous fishes. These data informed 68 stream nominations to the AWC for a total of 972 km added. Chum Salmon *O. keta* comprised the majority of AWC additions. This documentation is important to provide adequate regulation of habitats to support migratory fishes (e.g., road crossings over rivers) as well as information on potential species range expansions (e.g., Sockeye Salmon *O. nerka*). However, this study is a narrow perspective of such a broad area. Local knowledge combined with further surveys and monitoring could refine our understanding of this regional fish community challenged by shifting climates and landscape-altering resource development.

Altered gene expression in rainbow trout following exposure to harmful algal blooms

Clinton, Morag University of Alaska Fairbanks

Symposium: Genetics in Fisheries

Toxin producing phytoplankton can negatively impact aquatic organism health in both the freshwater and marine environment. With harmful algal blooms (HABs) predicted to occur with increasing frequently in a warming climate, phytoplankton are of concern to both aquaculture producers and wild fisheries managers. Although the consequences of bloom events through altered environmental oxygen availability are relatively well understood, the mechanisms of the negative impact on fish from toxic products of phytoplankton is less well studied. This research explored the transcriptional changes triggered in rainbow trout (*Oncorhynchus mykiss*) gills induced by the golden algae *Prymnesium parvum* in controlled exposure trials designed to mimic an environmental challenge. Microarray analysis of gene expression relative to that of an untreated control demonstrated significantly differentially-expressed genes and pathways of response in multiple mechanisms, including immunological and cell death responses. These results provide insight not only into the fish response to biotoxin exposure, but also the mechanism of action of *P. parvum* toxic products. Based on the clear negative impacts of phytoplankton exposure, these results support the existing hypothesis of a role for harmful algae in impaired fish health and predisposition to subsequent gill disease. Although gill disease is currently

rarely reported in the waters of Alaska, there is concern that shifting geographic and temporal distribution of a range of infectious diseases will continue north as the climate alters. Reports of bloom events are a cause therefore for concern in their impairment of fish health, and further research will be required to monitor their sub-lethal impacts on stocks.

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

Coleman, Laura Southern Southeast Regional Aquaculture Association; Frost, Tessa Southern Southeast Regional Aquaculture Association; Scott, Sara Southern Southeast Regional Aquaculture Association

Symposium: Incorporating adaptive management planning in aquatic habitat conservation efforts in AK

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 otolith shape can be used to distinguish hatchery and wild Chinook Salmon. In the present study, we evaluated the symmetry of left and right otolith pairs among wild and hatchery Chinook Salmon captured in the spring troll fishery in Ketchikan, Alaska in 2019 and 2020. We used ShapeR in R Programming to extract the shape, length, perimeter, width, and area of each otolith. The squared coefficient of asymmetric variation deviance (CV2) was calculated to compare the symmetry of otoliths from wild and hatchery Chinook Salmon. Results showed that hatchery otoliths exhibited more asymmetry in three of the four otolith metrics examined, suggesting that these metrics may be useful when differentiating wild from hatchery Chinook Salmon. We then grouped the data by origin (i.e., hatchery and wild) and used a Wilcoxon signed-rank test to evaluate the symmetry of left and right otoliths by origin. We found a significant difference in otolith length between the right and left otoliths of hatchery fish, but for all other otolith metrics there were no significant difference. These results suggest that differences in otolith length may be used to distinguish hatchery and wild Chinook Salmon. Due to low encounter and tagging rates in the present study, increased sampling of known wild fish is needed to strengthen our statistical comparisons and further investigate the differences in otolith shape among hatchery and wild 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.

Physiological performance of northern pike (*Esox lucius*): implications for management in invaded systems

Cubbage*, Taylor University of Alaska Fairbanks - College of Fisheries and Ocean Sciences; Falke, Jeffrey U.S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit; Kappenman, Kevin U.S. Fish and Wildlife Service, Bozeman Fish Technology Center; Bradley, Parker Alaska Department of Fish and Game, Sport Fish Division, Palmer; Albert, Matthew Alaska Department of Fish and Game, Sport Fish Division, Fairbanks; Dunker, Kristine Alaska Department of Fish and Game, Sport Fish Division, Anchorage

Contributed papers: Misc. Topics

The spread of invasive species has caused drastic ecological and economic consequences on a global scale, including the expansion of northern pike (*Esox lucius*) throughout southcentral Alaska. Illegal introductions and subsequent establishment of pike in the region threaten native salmonid populations, along with the fisheries and ecosystems they support. Recent research indicates that trophic, morphological, and genetic plasticity exists between invasive and native pike populations in Alaska. This, along with potential variation in physiological traits that influence dispersal, may facilitate the success of invasive individuals in new habitats. Although current management methods in Alaska (e.g., rotenone and gillnetting) are effective to remove pike from isolated waterbodies, alternatives are needed in the greater Cook Inlet region where reinvasion risk following eradication is high due to abundant and highly interconnected lake and wetland habitats. A proposed method to prevent pike reestablishment following an eradication project is fish barrier construction; however, to confidently design and install such barriers, it is essential to quantify the maximum swimming and leaping capabilities of pike. We propose to 1) compare physiological metrics between invasive and native pike populations in Alaska to better understand mechanisms of invasion success, and 2) determine, across a range of water temperatures and pike size classes, waterfall height and plunge pool depth combinations of vertical drop structures that prevent pike ascent, using an adjustable waterfall apparatus built within an open channel flume system. As an opportunistic predator that is highly tolerant to a wide range of environmental conditions, invasive pike are a clear threat to native fish populations in the Mat-Su region. Incorporating the physiological limitations of pike into management tactics to prevent their spread throughout their invasive range and inhibit reintroduction to restored waters will ultimately help reduce impacts of pike on native species.

Stock Composition of Subsistence Harvests and Total Returns of Sockeye Salmon from the Kvichak River

Dann, Tyler Alaska Department of Fish and Game; Jones, Bronwyn Alaska Department of Fish and Game; Buck, Greg Alaska Department of Fish and Game

Symposium: Genetics in Fisheries

Historical returns of sockeye salmon to the Kvichak River are some of the largest in the world and are vital to subsistence and commercial harvests in Bristol Bay and the ecosystem they inhabit. We integrated information from stock assessment projects in 2012-2019 with genetic mixed stock analysis to reconstruct returns of sockeye salmon to four groups of populations throughout the drainage and address three primary questions: 1) Which of four stocks within the drainage (Lake Clark, Northeast Iliamna, Iliamna Islands, and Iliamna Tributaries) are important to subsistence harvests? 2) Are there temporal trends in stock-specific migration through the commercial fishery and escapement monitoring tower? and 3) How do relative abundances of stock-specific cohorts at the returning adult life stage compare to similar estimates at smolt outmigration? Stock composition estimates of 13 subsistence harvest strata in 2017-2019 were dominated by local stocks. Stock compositions of 43 commercial harvest strata from Eastside Districts in 2016-2019 varied widely among the four Kvichak groups, but no marked temporal patterns were observed. Stock compositions of 12 escapement strata from 2016-2019 were dominated by the Northeast Iliamna and Iliamna Tributaries groups but did not suggest temporal patterns in stock-specific migration. Stock composition estimates for each component of the returning

adult run (escapement and commercial and subsistence harvests) and similar components of historical smolt outmigrations were associated with abundance and age-composition estimates to reconstruct stock-specific cohort abundances for brood years 2012-2014. Relative abundances among stocks varied by cohort but were very similar between life history stages for each stock/cohort grouping (average difference = 1%, range 0-5%). Northeast Iliamna (32-50%) and Iliamna Tributaries (26-38%) were most abundant at both life stages, suggesting consistent patterns of freshwater production and marine survival in the cohorts we observed.

Investigating the use of eDNA metabarcoding as a method for monitoring aquatic biodiversity in tributaries of Lake Michigan

Dokai*, Willie University of Alaska- Fairbanks; Gruenthal, Kristen Alaska Department of Fish and Gamew; Klymus, Katie USGS; McPhee, Megan University of Alaska Fairbanks; Zanatta, Dave Central Michigan University; Tallmon, Dave University of Alaska Southeast; Larson, Wes NOAA

Symposium: eDNA - an increasingly useful tool for survey and monitoring

Tributaries of Lake Michigan are important habitat for fish species of significant ecological and recreational value, as well as for freshwater mussels (order *Unionida*), which are among the most endangered taxa in the world. Yet, distributional data for these types of species are often lacking or outdated. eDNA metabarcoding efficiently and accurately detects the presence of a wide range of species in aquatic habitats without high-effort, gear-biased, or destructive sampling. We developed an eDNA metabarcoding assay to assess the utility of this technique as a biological monitoring tool for unionid mussels in tributaries of Lake Michigan. The assay targets a 286 bp region of the mitochondrial cytochrome oxidase subunit I (COI) gene, and we expect it will uncover sufficient interspecific variability to determine the presence of at least 16 different unionid species potentially extant in the sampled region. Concurrently, we will also employ a previously developed eDNA assay that targets the mitochondrial 12S rRNA gene to detect the presence of fish species. In the summer of 2020, we collected 573 one-liter water samples for eDNA analysis from 38 tributaries of Lake Michigan. We expect sequencing of these samples to provide a more comprehensive understanding of the distributions of fish and mussels in Lake Michigan tributaries.

The Evolving Use of Socioeconomic Information in North Pacific Fishery Management Decision-Informing Analyses

Downs, Mike Wislow Research Associates LLC

Symposium: Advancement of the use of human dimensions science in fishery management

The use of socioeconomic information in the federal fishery management process in the North Pacific has historically been driven largely by requirements of National Standards 2 (Scientific Information) and 8 (Communities) of Magnuson-Stevens Fishery Conservation Act. This information has been utilized in a variety of contexts, including social impact assessments of proposed amendments to fishery management plans, often focused on a relatively narrow purpose and need statement and involving a single fishery or closely related group of fisheries, and the community impact components of similarly

narrowly defined or point-in-time program reviews. With a paradigm shift toward ecosystem management in recent years, however, the applications of socioeconomic information have broadened and the nature of socioeconomic information needs have evolved in tandem with the evolution of new fisheries management, stock assessment, and ecosystem/economic assessment products. In the North Pacific these relatively dynamic management-informing analytic products have included ecosystem and socioeconomic profiles, ecosystem status reports, and expanded stock assessment and fishery evaluation reports. This presentation highlights some of the challenges and opportunities involved in the use of socioeconomic data in this evolving fishery management context.

Riverscape heterogeneity and food web diversity in Southeast Alaska

Dunkle*, Matthew University of Idaho; Bellmore, Ryan USDA Forest Service Pacific Northwest Research Station; Fellman, Jason University of Alaska Southeast; Hood, Eran University of Alaska Southeast; Caudill, Christopher University of Idaho

Symposium: Incorporating adaptive management planning in aquatic habitat conservation efforts in AK

Variation in primary source water to streams can create heterogeneity in physical and chemical patterns, and in turn, biological communities, on multiple temporal and spatial scales. Across complex landscapes, the structure and dynamics of food webs can be diverse, particularly where water sources respond to seasonal forcing via air temperature or solar radiation in distinct ways. In coastal Southeast Alaska, juvenile salmon and other fish rear in streams derived primarily from summer glacialmelt, spring snowmelt, or variable surface runoff rainfall, creating distinct seasonal flow, thermal, and nutrient regimes. 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. 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. Here, we present empirical data that explores variation in productivity and feeding relationships of fish, benthic invertebrates, and primary producers in glacial-, snow- and rain-fed rivers in Southeast Alaska over an annual time scale. We use a combination of direct observation of standing biomass of periphyton, detritus, benthic invertebrates, and fish as well as fish diet analysis and stable isotope analyses of components of the food web over time. Our findings suggest that streams peak in optimal growth conditions for fish at different times of the year stemming from variation in thermal and invertebrate prey and primary-producer dynamics.

Improving Stock Assessments of Pacific Sleeper Shark and Pacific Spiny Dogfish In Alaska

Dunne*, Garrett University of Alaska Fairbanks

Contributed papers: Population and Community Dynamics

Pacific sleeper sharks (SS; *Somniosus pacificus*) and Pacific spiny dogfish (DF; *Squalus suckleyi*) are poorly understood, data-deficient species inhabiting Alaskan waters. While SS and DF have historically comprised a small portion of incidental catches in Alaskan commercial fisheries, they are at high risk for overexploitation due to two factors. First, SS and DF occupy the most data-limited groups of assessed

species managed by the North Pacific Fisheries Management Council, Tier 6 and Tier 5 depending on species and location. These data limitations pose challenges for determination of stock status, current and past exploitation levels, and future sustainable catch levels. Second, SS and DF, like many sharks, exhibit extended life history traits, attaining great age, starting reproduction late, and having few offspring. Key aspects of SS and DF ecology like spatial population pattern, movement, and reproductive capacity are necessary for advancing stock assessments, but are poorly understood or completely unknown. Maintaining the populations of SS and DF is important as they likely play ecologically significant roles as predators in maintaining the health of the marine ecosystem and must be managed under the Magnuson-Stevens Fishery Reauthorization Act. I propose to conduct the following research projects to confront the information gaps and improve the ability to determine stock status in these species: 1) meta-analysis of chondrichthyan age and length-at-50% maturity to create first estimates of age- and lenght-at-50% maturity for SS; 2) Bayesian hidden Markov movement models to explore movement within and among federal management areas by life stage; and 3) synthesizing new movement, population, and life history information to develop improved data-driven stock assessments for both species.

Juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) spring outmigration timing and fish size in the Chena River, Alaska

Edwards*, Olivia University of Alaska Fairbanks; Falke, Jeffrey U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit; Savereide, James Alaska Department of Fish and Game; Hander, Raymond United States Fish and Wildlife Service, Alaska Region, Fisheries & Habitat Restoration; Seitz, Andy University of Alaska Fairbanks

Contributed papers: Misc. Topics

Climate change in high-latitude systems has affected spring break-up timing, flow patterns, and temperature regimes, which could have implications for phenology, growth, and survival of fish in freshwaters. In order to track these changes, it will be necessary to establish baseline data sets and conduct annual monitoring. Juvenile Chinook Salmon habitat use, life history, and distribution in freshwater have been identified as critical data gaps in Yukon River Chinook Salmon stock dynamics and fisheries. This population was identified as a stock of concern in 2010 thus filling this gap is important to our overall understanding and the persistence of the fishery. We investigated spring outmigration timing, juvenile Chinook Salmon size distributions, and the effects of stream flow and temperature on sampling efficiency and outmigration patterns in the Chena River, Alaska. Across six years of minnow trapping, peak outmigration dates ranged from May 13th to 29th (mean = May 18th ± 2.6 d; 95% CI). Fish length (mm), weight (g), and body condition varied among years; fish were smallest on average in 2019 and largest in 2014. We found that CPUE varied with discharge and among years but not with temperature; fewer fish were typically caught on days with higher flows. Based on spring 2020 data, we compared daily sampling efficiency between a group of minnow traps set in close proximity to a screw trap that ran 24 h/d. We found that the screw trap caught more and larger fish during the sampling period and operated more efficiently during periods of high flow relative to minnow traps. Ultimately, the results of this study will help optimize sampling methods for future monitoring and provide a useful baseline to track interannual variability in peak outmigration timing and fish size.

Lessons learned from rising temperatures in the Fraser River, BC

Eliason, Erika Assistant Professor, University of California – Santa Barbara

Plenary Talk

Fraser river temperatures have increased by ~2C since the 1950s and are projected to continue to increase along the same trajectory. Peak river temperatures are consistently associated with high in-river mortality for adult migrating Pacific salmon, raising clear conservation concerns. Our research team has focused on intraspecific variability in thermal tolerance in Pacific salmon. Specifically, we have characterized how thermal tolerance varies across populations, life stages, and sex. We also examined the underlying physiological mechanisms that determine thermal tolerance and have identified the heart as the central limiting factor.

Indigenizing Salmon Science & Management: Yup'ik and Athabascan Insight from the Kuskokwim Region

Esquible, Janessa Orutsararmiut Native Council; Lowrey, Danielle ONC

Symposium: Indigenous Fisheries in Alaska and Issues of Equity

The Indigenizing Salmon Science and Management project is centered on Indigenous cosmologies and methodologies to better understand the historical and contemporary ways in which Alaska Native people stewarded salmon, incorporating values and providing ideas to improve current management practices and systems. Indigenous people have stewarded Alaska lands and waters for thousands of years, yet have been largely excluded from science and management systems that fail to advance Indigenous self-governance initiatives. This project uses a highly participatory approach through facilitating circle dialogues, conducting semi-directed interviews with individuals and multigenerational fishing families. Respect, reciprocity, responsibility, and relational accountability are used as some of the many guiding principles in this work. This talk will focus on research conducted along the Kuskokwim River, with the guidance of local Tribes and Indigenous community members. Yup'ik and Athabascan values, knowledge, management and Indigenous stewardship practices are documented and shared. This talk also identifies strengths and weaknesses of our current salmon management systems from the perspectives and experiences of Yup'ik and Athabascan people living in three distinct regions along the Kuskokwim River including, coastal, lower river and the headwater communities. Lastly, reflections on salmon, people and the future are shared as a way to provide a more equitable and sustainable path forward for salmon and people in Alaska.

Wildfire in changing boreal stream ecosystems: a friend or foe for fishes?

Falke, Jeffrey U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit; Rupp, T. Scott University of Alaska Fairbanks; Genet, Helene 0; Bennett, Alec 0; Klobucar, Stephen University of Alaska Fairbanks; Strohm-Klobucar, Deanna Institute of Arctic Biology, University of Alaska Fairbanks; Hinkle, Elizabeth University of Alaska Fairbanks

Contributed papers: Climate Change Impacts on Aquatic Habitat

Fire is the dominant ecological disturbance in interior Alaska boreal forests and a strong control on landscape characteristics that affect freshwater processes and stream fish habitats. Fire frequency, size, and severity are changing across Alaska as a result of climate and land use change. Evidence from other ecoregions suggests fire negatively impacts fishes and aquatic habitats through removal of hillslope and riparian vegetation resulting in increased water temperatures and turbidity, and facilitation of further disturbance effects such as flooding and erosion. However, such disturbances also contribute to the creation and maintenance of stream habitats that provide a mosaic of dynamic habitats that support resilient populations. The overall goal of the five-year Boreal Fish and Fire Project is to investigate the effects of fire on boreal stream fish and their habitats though a series of field, lab, and modeling studies focused on elucidating relationships among climate, fire, the physical environment, and biological responses at multiple spatial scales. Our study area encompasses a 20,000 km2 region in interior Alaska that includes four river basins: the Chatanika, Chena, Salcha, and Goodpaster Rivers. These basins are important spawning and rearing habitats for fishes including Chinook Salmon and Arctic Grayling, and nearly one-quarter of this area has burned since the early 1980s. Here we highlight initial results from a suite of integrated, spatially-explicit models to identify where and when aquatic populations may be vulnerable to fire across this broad landscape. For the contemporary landscape, we explore potential interactions among observed fires, stream network topology, geomorphic conditions, and fish habitat suitability with consideration of the ability of riparian forest and valley bottoms to buffer streams from fire effects. Additionally, we will use output from dynamic ecosystem models to forecast vulnerability of boreal stream habitats to changes in flammability and active layer depth under future climate scenarios.

Implications of a changing flow paradigm on juvenile salmon growth in Southeast Alaska

Fitzgerald*, Kevin University of Alaska Fairbanks; Delbecq, Claire University of Alaska Southeast; Fellman, Jason University of Alaska Southeast; Bellmore, Ryan USDA Forest Service Pacific Northwest Research Station; Falke, Jeffrey U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit

Contributed papers: Climate Change Impacts on Aquatic Habitat

Climate change is altering hydrologic regimes in the Gulf of Alaska (GOA) region. It is expected that coastal drainages will experience more dramatic low water events interspersed with larger and potentially more frequent high flows. This begs the question: how will salmon and their ecosystems respond? It is well-documented that the timing and magnitude of stream flows influence juvenile salmon growth through effects on food availability, water clarity, temperature, and predation risk. What is less understood is how interactions among the timing, duration, and sequence of flow events may influence salmon growth and survival. The interface between stream flow conditions and temporal patterns of primary and secondary trophic production may be key to understanding future resource availability. For example, high flow events that occur after prolonged drought may transport large fluxes of prey from the build-up of benthic organic matter. Our study area, Peterson Creek near Juneau, AK, is an ideal system in which to investigate the effects of flow patterns on juvenile salmon growth trajectories via a high-resolution mechanistic study. This drainage is characterized by high inter-annual

variation and seasonal stochasticity of flow events and supports healthy populations of Coho Salmon and Dolly Varden. The goal of this research is to investigate how hydrologic patterns influence material fluxes and, and in turn, the proportion of fish growth attributed to periods of high and low flow. We will collect high frequency (e.g., hourly to weekly) stream-flow, food availability, fish diet, and fish growth data in Peterson Creek. Additionally, we will collect detrital biomass and dissolved organic carbon, inorganic carbon, and nutrient samples. Results of this research will help parse out the complex relationships among stream flows, material fluxes, and juvenile salmon growth, with an ultimate goal to aid future research and management actions and navigate climate change impacts in important GOA drainages.

Understanding Behavior and Stock Structure of Pacific Halibut (*Hippoglossus stenolepis*) in the Northern Bering Sea

Flanigan*, Austin University of Alaska Fairbanks; Wehde, Dawn Norton Sound Economic Development Corporation; Loher, Tim International Pacific Halibut Commission; Seitz, Andy University of Alaska Fairbanks

Contributed papers: Marine topics

The Pacific halibut (*Hippoglossus stenolepis*) is a commercially important flatfish that has experienced precipitous population declines in past decades. Currently, the IPHC manages the Pacific halibut as a singular well-mixed stock, but recent studies indicate that Pacific halibut display population substructure and may require a more fine-scale management approach. Several recent studies have been conducted to understand Pacific halibut movement and population connectivity throughout this species' range; however, this information remains unknown in the Northern Bering Sea, where small-scale commercial fisheries represent an important source of income for rural Alaskans. The goal of this study is to address this data gap and obtain movement and stock connectivity information for the Pacific halibut in the northernmost reaches of its range. To accomplish this goal, satellite telemetry tags will be affixed to Pacific Halibut in the Northern Bering Sea, from which movement and behavior will be inferred. Recovered data will be used to construct movement tracks, identify and locate spawning behavior, and to quantify fish dispersal in relation to scales of management. A total of 69 fish have been tagged to date, with a further 50 tags to be deployed during 2021. Findings from these tags will be conveyed to the IPHC and the local Community Development Quota group, Norton Sound Economic Development Corporation, to help inform stakeholders and managers on the spatial dynamics and stock structure of Pacific halibut in the data deficient Northern Bering Sea.

Trophic ecology and proximate composition of marine and diadromous fishes in Chukchi Sea coastal lagoons

Fraley, Kevin Wildlife Conservation Society; Robards, Martin Wildlife Conservation Society; Jones, Tahzay U.S. National Park Service; Rogers, Matthew National Oceanic and Atmospheric Administration; Vollenweider, Johanna National Oceanic and Atmospheric Administration; Whiting, Alex Native Village of Kotzebue

Contributed papers: Misc. Topics

Chukchi Sea coastal lagoons are important habitats for unique assemblages of fishes, including marine and diadromous taxa. These fishes represent vital food resources for Alaska Native Peoples and other rural subsistence fishers. Anthropogenic and climate change-induced effects on coastal Arctic habitats may threaten ecosystem stability and the availability of these resources. Given these concerns, we linked habitat characteristics to fish assemblage trophic metrics in four lagoons within Cape Krusenstern National Monument, Alaska. To assess this, several stable isotope metrics were calculated from fish muscle tissue samples. Satellite imagery was utilized to characterize ocean connectivity, freshwater input, surface area, and length of channel to the ocean for the study lagoons. Associations between fish trophic metrics and habitat characteristics were evaluated. Model results showed that increased freshwater input resulted in longer duration of lagoon ocean connectivity. Freshwater influence was associated with a decrease in the mean and range of nitrogen isotope ratios across all fish species. Duration of connectivity to the ocean and length of channel to the sea also had species-specific effects on fish trophic ecology. Additionally, proximate composition and energy density surveys of lagoon fishes were conducted to identify relative utility for biota at higher trophic levels, and for subsistence harvesters. Diadromous *Coregoninae* species were found to be the most energy-rich taxa, with marine fishes exhibiting up to 30% lower energy density. Overall, freshwater input and ocean connectivity appear to be important drivers of fish trophic ecology in coastal lagoons. Furthermore, *Coregoninae* species are the highest in energy density among the diverse lagoon fishes, potentially representing the most utility for subsistence harvesters and biota at higher trophic levels that consume them.

AKTEMP: Understanding Regional Stream Temperature Patterns through Collaborative Data Sharing

Geist, Marcus Alaska Center for Conservation Science, UAA; Shaftel, Rebecca Alaska Center for Conservation Science, UAA; Mauger, Sue Cook Inletkeeper

Contributed papers: Climate Change Impacts on Aquatic Habitat

Over the last decade, we have seen a surge in stream temperature monitoring efforts across Alaska. The Alaska Online Aquatic Temperature Site (AKOATS) was developed in 2014 to capture the metadata for these water temperature monitoring locations and currently contains information on 1100 sites from 38 different organizations. Over the next year, AKOATS will be transitioning to a new database, AKTEMP, that will allow for storing temperature data measurements alongside site metadata. The goal of AKTEMP is to make water temperature data discoverable and publicly available for researchers in Alaska. Staff at the Alaska Center for Conservation Science have been aggregating stream temperature data from sites in AKOATS for projects that cover the Bristol Bay, Kodiak, Cook Inlet, Prince William Sound, and Copper River regions. These data provide a useful example of the spatial and temporal coverage of stream temperature data collection efforts across a large part of Alaska. Through this collaborative data sharing effort, we can show differences in thermal regimes for each of the regions and also explore how stream temperatures responded to the extreme weather conditions of 2019.

Including fishers' knowledge in nearshore rockfish management in the Gulf of Alaska

Gordon*, Jesse University of Alaska Fairbanks; Beaudreau, Anne University of Alaska Fairbanks; Williams, Ben NOAA; Carothers, Courtney College of Oceans and Fisheries Science, University of Alaska Fairbanks; Saas, Emma; Meyer, Scott ADF&G-Retired

Symposium: Advancement of the use of human dimensions science in fishery management

Over the past few decades, nearshore rockfishes (*Sebastes* spp.) have experienced increased pressure from multiple fisheries throughout the Gulf of Alaska. The unique life history traits of rockfish pose a host of challenges that make them difficult to monitor and vulnerable to overfishing. Rockfishes are ecologically and culturally important to coastal communities in the Gulf of Alaska. Therefore, the inclusion of fishers' knowledge in rockfish management is necessary to form regulations that address both the needs of the growing fishery and the biology of the fish. Our study brings together fishery data from Alaska Department of Fish & Game and fishermen's knowledge to 1) synthesize perspectives on the recent history of recreational and commercial rockfish fisheries in the Gulf of Alaska; and 2) highlight the strengths and challenges of stakeholder engagement and stewardship in Alaskan fisheries management. We will share results from our interviews with fishermen and agency staff and explore the complimentary attributes of fishers' knowledge and fishery data to create a more complete understanding of the rockfish fisheries in Sitka and Kodiak.

Reduced fitness of stray hatchery-origin Pink Salmon in three streams in Prince William Sound

Gruenthal, Kristen Alaska Department of Fish and Gamew; Shedd, Kyle Alaska Department of Fish & Game; Lescak, Emily Code for Science and Society; Knudsen, E. Eric Prince William Sound Science Center; Templin, William Alaska Department of Fish & Game; Habicht, Christopher Alaska Department of Fish & Game

Symposium: Genetics in Fisheries

Previous studies have generally found that hatchery-origin Pacific Salmon (*Oncorhynchus spp*.) have lower reproductive success (RS) – a proxy for fitness – than their natural-origin counterparts. However, these studies focused on salmon species with extended freshwater life histories, spawning or rearing in degraded habitats, and nearly complete sampling of pedigrees. Here, we estimated the relative RS (RRS) of Pink Salmon (*O. gorbuscha*) in Prince William Sound (PWS), Alaska, where large-scale, segregated hatchery programs were founded with local broodstock more than 15 generations ago. In contrast to the other RRS research, Pink Salmon have a short freshwater life history, with an alternating and non-overlapping two-year generation time, and freshwater habitats in PWS are largely unaltered by development. Critically, our work was also conducted without the aid of dams or weirs, resulting in incomplete sampling of spawning individuals and their offspring. Despite this limitation, we successfully used genetic parentage analysis to assign thousands of pink salmon offspring to at least one and occasionally two parents, enabling estimation of RRS for stray hatchery-origin pink salmon across 2-3 brood years in both odd- and even-year lineages in three streams. RS, measured as sampled adult offspring that returned to their natal stream, was significantly lower for hatchery- versus natural-origin parents, regardless of stream, brood year, lineage, or sex. RRS ranged from 0.03 to 0.85 for females and 0.05 to 0.86 for males. While RS tended to be higher for larger fish and lower in the middle of the

season, trends were inconsistent in direction and magnitude among streams and years. Our findings support the concept that hatchery straying may reduce wild stock productivity, but this project is far from complete. Moreover, the extent and persistence of these reductions in productivity depend on whether underlying mechanisms are environmentally driven, and likely ephemeral, or genetically driven, and potentially heritable.

Best Available Science and the challenges and opportunities with broader inclusion of diverse knowledge systems

Haapala, Kate North Pacific Fishery Management Council; Wise, Sarah Alaska Fisheries Science Center

Symposium: Advancement of the use of human dimensions science in fishery management

Federal fisheries managers rely on biophysical, economic, and increasingly, social sciences to inform management actions with the best available science. Historically, western science has dominated what constitutes authoritative knowledge within Federal fisheries management; however there is a growing realization that diverse knowledge systems provide legitimate and valuable information for effective fisheries management. Differing epistemologies inform and frame decision-making processes as well as the ways we value, use, and manage the ocean. In 2019, the North Pacific Fishery Management Council established the Local Knowledge, Traditional Knowledge, and Subsistence Taskforce to develop processes and protocols for identifying, analyzing, and including Local Knowledge, Traditional Knowledge, and Subsistence (LKTKS) information into the regional decision-making process. The Taskforce is in its second year offering some understanding into both the challenges and opportunities created through inclusion of diverse ways of knowing. Written by the co-chairs of this Taskforce, this paper provides initial insight into the process, on “how to” identify appropriate points of entry and navigate challenges. We also address some emerging questions such as, how is LKTKS perceived and represented among scientists, community members, and policy makers, and how does this intersect with questions of equity and representation? Whose knowledge is selected as representative of a group and whose knowledge may be obscured? Within a national fisheries management context, what are some of the mechanisms used to include multiple knowledge systems in decision-making? Is it possible to manage the sea based on multiple—and at times, conflicting—perspectives? The Taskforce and the insights presented herein are relevant to academics engaging applied fisheries social science as well as to broader spheres of fisheries management looking to include local and traditional knowledge systems into decision-making.

The thermotolerance of Broad Whitefish *Coregonus nasus* in Prudhoe Bay, Alaska

Hamman*, Carolyn University of Alaska Fairbanks; Sutton, Trent University of Alaska Fairbanks; López, Andrés University of Alaska Fairbanks, Museum of the North; Kelley, Amanda University of Alaska Fairbanks

Symposium: Genetics in Fisheries

Motivated by the dramatic rate of climate change in the Arctic, we aim to examine the thermotolerance of Broad Whitefish *Coregonus nasus* and the underlying molecular mechanisms driving it. Thermotolerance is what allows a species to survive outside of an optimal temperature, and its acquisition is through the expression of heat-shock proteins (HSPs). In teleosts, heat shock protein 70 (HSP70) is one of the most common HSPs expressed and was the primary protein targeted in this project. Here, we present initial results on the thermotolerance of Broad Whitefish as driven by HSP70 expression. This eurythermal coregonid was sampled from Prudhoe Bay, Alaska and lab acclimated to two different temperatures (5 and 15oC) to determine the plasticity of this species' thermotolerance. The upper-end of the thermotolerance (CTmax) was established by exposing the fish to an ecologically-relevant thermal ramping rate until a loss of equilibrium was observed. Hepatic, cranial, and muscle tissue were then harvested and preserved for further analysis. The CTmax value for Broad Whitefish acclimated at 5oC was significantly lower (p = 4.23 x 10-5) than the 15oC group by 3.6oC. This indicates that Broad Whitefish thermotolerance does change given different thermal parameters. These results show that Broad Whitefish has the ability to adjust their thermotolerance in response to climate change. However, it is unknown how Broad Whitefish will respond as climate change progresses. The potential for higher thermal-ramping rates and temperatures reaching points outside of what was tested could have negative effects on Broad Whitefish survivability. Ongoing work will determine whether the acclimation temperatures altered the level of HSP70 expression within and among the two groups as well as if there is any tissue-specific protein expression in this ecologically valuable species.

Detection of Arctic cod *Boreogadus saida* using eDNA in Prudhoe Bay, Alaska

Hamman*, Carolyn University of Alaska Fairbanks; Sutton, Trent University of Alaska Fairbanks; López, Andrés University of Alaska Fairbanks, Museum of the North; Green, Duncan Alaska Department of Fish and Game; Thompson, Anthony University of Alaska Fairbanks

Symposium: eDNA - an increasingly useful tool for survey and monitoring

Arctic cod *Boreogadus saida* are an ecologically important species that connect lower and upper trophic levels in Arctic marine ecosystems. The distribution of this species is well documented during the ice-free periods, but relatively little is known about their habitat requirements, distribution, and movement under the ice. This understanding is essential to improve information on the winter spawning activity of Arctic cod. In addition, increased oil-extraction infrastructure development in Prudhoe Bay could potentially disrupt spawning. We developed an environmental DNA (eDNA) assay as a tool to detect Arctic cod from water samples. The eDNA approach provides a non-invasive and species-specific means to assess species presence in a given area. It can complement or add to traditional species monitoring methods depending on the influence different environmental variables have on DNA distribution and preservation. Between December 2019 and February 2020, water samples were collected and preserved from seven locations across a transect in Foggy Island Bay, Alaska. Some sites were visited multiple times during the course of the study resulting in site replicates representing different sampling periods. We designed and evaluated a set of candidate Arctic cod eDNA assays targeting short segments of mitochondrial DNA. Species-specificity and the limits of detection and quantification were determined prior to employing the assay to evaluate Arctic cod presence in the water samples from Prudhoe Bay. Six

of the thirteen samples, representing five of the seven sampling sites, contained Arctic cod DNA. The results indicate that the eDNA assay we developed can be used to monitor the presence of Arctic cod. We provide recommendations and protocols for future Arctic cod eDNA studies that will further the understanding of the distribution and biology of this species.

Coastal migration characteristics and stock composition of coho salmon in eastern Norton Sound fisheries

Henslee*, Luke UAF CFOS

Contributed papers: Population and Community Dynamics

High spawning-site fidelity and reproductive isolation from conspecifics leads to homogenous population groups within Pacific salmon species which are often managed as "stocks." Multiple salmon stocks may be simultaneously vulnerable to capture within a fishery management area during migration from marine environments to natal spawning streams. The composition of these mixed stocks is often unknown, leading to indiscriminate harvest which can decrease interpopulation biodiversity. Evidence suggests that in the Norton Sound, AK, multiple coho salmon stocks migrate through coastal fisheries and into natal streams throughout the region and beyond. However, the unknown composition of accessible stocks has constrained managers' ability to direct stock-specific persecution. This has raised concern among stakeholders that some transitory stocks are being intercepted before they reach terminal fisheries in other subdistricts, and less productive stocks may be overexploited. This project will use acoustic telemetry to collect evidence for eastern Norton Sound coho salmon stock structure based on divergent coastal migration characteristics. Fish will be captured by mimicking commercial fishery methods and tagged coho salmon will be tracked into natal spawning streams, allowing stock assignment. Sequential tag detection by nearshore marine receiver arrays will be used to inform multistate mark-recapture models that will determine the significance of the effects of capture location, temporal strata, abiotic drivers, and demographics on stock membership predictions. Parsimonious models will be used to describe movement probabilities to identify stock-specific migration pathways. Results of this project are intended to provide insight on coastal movement characteristics of coho salmon so that terminal populations with a harvestable surplus can be targeted while minimizing impacts to transitory or less productive stocks.

DNA analysis of merganser scat to determine presence of Chinook salmon and other piscine prey species

Hill, Justin University of Alaska Fairbanks

Symposium: eDNA - an increasingly useful tool for survey and monitoring

Piscivorous diving ducks such as common merganser (*Mergus merganser*) and red-breasted merganser (*Mergus serrator*) can be important predators of juvenile salmonids. Mergansers are regularly observed feeding near important Chinook salmon rearing areas in the Yukon River Basin. Merganser predation in these areas may exacerbate the effect of ongoing Chinook salmon population declines. To determine the predation impact of mergansers on salmon populations, we are applying species-specific, quantitative

polymerase chain reaction (qPCR) assays on DNA isolated from merganser scat. We are collecting scat samples opportunistically by searching gravel bars in areas mergansers are known to occupy. Here we describe current results in the development of qPCR assays to 1) validate the avian species of origin of scat samples 2) quantify the percent composition of common Chena River fish species present in scat samples. We will also discuss procedures for obtaining the highest yields of isolated DNA from waterfowl scat. This DNA based approach will be paired with stomach content analyses of lethally harvested mergansers and point counts for all avian piscivores, in an effort to determine if mergansers consume enough salmon parr to represent a meaningful source of mortality and if this could be influenced by management action.

Aquatic food web and community response to wildfire in interior Alaska boreal streams

Hinkle*, Elizabeth University of Alaska Fairbanks; Falke, Jeffrey U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit; Strohm-Klobucar, Deanna Institute of Arctic Biology, University of Alaska Fairbanks

Contributed papers: Climate Change Impacts on Aquatic Habitat

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: 0-10 years, historic: 10-30, control: 40+). At each site, we measured physical habitat (e.g., fine sediment, 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. Mean species diversity, overall fish density, and mean fish biomass were higher at recently burned sites relative to control or historic sites. Analysis of habitat characteristics revealed that recently burned sites had more woody debris, less percent fines, lower mean percent canopy cover, and warmer water temperatures than 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.

Effects of Crude Oil on Juvenile Threespine Stickleback Growth and Development Varies by Population

Ireland*, Kelly University of Alaska Anchorage; Milligan-Myhre, Kathryn University of Connecticut

Contributed papers: Population and Community Dynamics

Oil has many harmful effects on fish, including growth and developmental delays or defects. However, the effect of crude oil on threespine stickleback (*Gasterosteus aculeatus*) is largely unknown. Oil toxicology studies in the species have only focused on adult fish and only looked at a single population. However, early life stages are the most sensitive to crude oil and lifelong impacts on survival can occur during this stage and should be researched. Stickleback may also have population specific responses to crude oil exposure as they exhibit high intra- and inter-population genetic diversity and have freshwater, anadromous, and marine phenotypes. We asked whether there are population-level effects of crude oil exposure on juvenile threespine stickleback development after a week-long exposure, and whether the fish could recover normal development after a two-week depuration period following exposure. We hypothesized that oil exposure would suppress growth, but less dramatically in the populations with a history of hydrocarbon exposure, primarily Big Lake, where there is known hydrocarbon pollution. Growth and development were assessed by measuring snout-vent length, eye diameter, swim bladder length and area, craniofacial and spinal deformities, and mortality. This study examined juveniles in three freshwater (Big Lake, Bear Paw, and Westchester Lagoon) and one anadromous population (Rabbit Slough) of Alaskan stickleback. The interaction between time and treatment affected almost all somatic markers measured in fish from Westchester Lagoon. However, the other three populations' somatic markers were unchanged by crude oil. Westchester Lagoon stickleback would be quite vulnerable if an oil spill were to occur in the Cook Inlet as the water body is directly connected via Chester Creek. Special considerations should be made for this population when considering oil development or spill response in the area, especially to further protect salmonid species that likely consume stickleback in Westchester Lagoon.

Shoreline Change and Impacts to Traditional and Cultural Gathering Patterns

Johnson, Adelaide USDA Forest Service, Pacific Northwest Research Station

Film Festival: Coming Together for the Love of Fish!

Our short animation highlights 225 youth-led discussions aimed for better understanding of relationships among climate change, coastal change (isostatic rebound and sea level rise), cultural use of species harvested and collected, and concerns about number and quality of species collected. Discussions were conducted by 25 youth in 14 communities in south central and southeast Alaska. Together, student interns documented 100 species that support multiple ways of life. Community members shared concerns including climate change, pollution, toxic shellfish poisoning, overharvesting, and species invasion. Species collected and harvested in marine, coastal, and forests are summarized. Also, messages to youth are described. The animation was narrated by Andrea Cook, Northwest Coast Art student at the University of Alaska Southeast. The animation was written and directed by Adelaide (Di) Johnson, Hydrologist at the USFS, Pacific Northwest Research Station, Juneau, Alaska.

Predicting future effects of forest fire on aquatic habitat quality and juvenile Chinook Salmon growth in interior Alaska

Klobucar, Stephen University of Alaska Fairbanks; Falke, Jeffrey U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit; Rupp, T. Scott University of Alaska Fairbanks; Bieniek, Peter University of Alaska Fairbanks

Contributed papers: Climate Change Impacts on Aquatic Habitat

Across a warmer and drier interior Alaska concomitant shifts in fire regimes (e.g., increased frequency, severity) are likely to alter stream-regulating biological, chemical, and physical processes. Understanding and predicting these effects will be important for the management and conservation of aquatic habitats and fish populations in the future. We integrated predictions from dynamically-downscaled climate models with stream temperature models to assess juvenile Chinook Salmon *Oncorhynchus tshawytscha* habitat and growth across a ~20,000 km2 boreal stream network (Chatanika, Chena, Salcha, and Goodpaster River basins) in interior Alaska. We predicted stream temperatures every 1 km throughout the stream network using aggregated 8-day remotely-sensed land surface temperature observations (years 2008 – 2017). We then coupled these predictions with mid- (2038 – 2047) and late- (2068-2077) century climate projections and riverscape bioenergetics to quantify juvenile salmon thermal habitat availability and growth potential under a range of fire and climate scenarios. Warming stream temperatures increased suitable habitat in headwater reaches two-fold by mid-century and three-fold by late-century. But, summer temperatures approached thermal limits (> 20 °C) of juvenile Chinook Salmon in downstream reaches. As such, predicted growth potential varied both temporally and spatially across our study area (up to seven-fold in any given year), but models generally indicated growth will increase in a warmer climate, as long as food is not limiting. Only in extreme scenarios of climate- and fire-induced warming did stream habitat in lower elevations of our study area become unsuitable (> 20 °C). Further, our results suggest potential stream reaches where expansion of Chinook Salmon into thermally suitable spawning and rearing habitats could warrant future investigation for inclusion in the Anadromous Waters Catalog. This predicted habitat expansion would be important to consider for fire management decisions (e.g., suppression) with respect to one of Alaska's most valuable commercial, sport, and subsistence fish species.

Seascape Genomics of North Pacific Forage Fishes

Labua*, Savannah Florida International University; Timm, Laura University of Alaska Fairbanks; Rix, Anna University of Alaska Fairbanks; Glass, Jessica University of Alaska Fairbanks; Tucker, Nicholas Florida International University; López, Andrés University of Alaska Fairbanks, Museum of the North; Boswell, Kevin Florida International University

Contributed papers: Fisheries Genetics in Alaska

In the face of climate change, our need to predict impacts on biodiversity of managed fish species is urgently increasing. Seascape genomics provides a powerful framework to examine interactions between environmental factors and population genetic structures, leading to assessments of adaptive potentials in marine environments. Such assessments improve our understanding of eco-evolutionary

processes, enable predictions of changes to species and ecosystem health, and identify genomic vulnerability. Physical properties of marine habitats (e.g., density, viscosity, temperature, salinity, pH and oxygen solubility) can place selective pressures on species, leading to adaptation and potentially resulting in changes to the ecosystem. North Pacific coastal ecosystems are oceanographically and climatically dynamic, containing some of the most productive, diverse, and valuable environments on the planet, but are exposed to high anthropogenic stressors (commercial fishing, tourism, oil and gas industries, and coastal development). Forage fishes in the North Pacific are ecologically important taxa, supporting economically valuable fisheries and occupying key trophic links. Previous studies demonstrated profound effects of temperature on reproduction, causing species-specific amplification and inhibition of spawning events most observable through variability in spawn times and offspring. Larval fishes are more sensitive than adults to environmental fluctuations due to direct pressures on embryonic and egg survival. Environmental conditions influence sizes at hatching, developmental rates, and pelagic larval durations. Many physiology tolerances have genetic underpinnings and understanding genetic variation in potentially adaptive alleles within populations is essential to predicting how these organisms may be influenced by physical, chemical and biological changes within the seascape. In service to this goal, we present a framework for meta-analysis of existing genomic data from North Pacific forage fishes to better understand the standing genetic structure and the potential for adaptation to environmental change.

Investigating the influence of habitat on nearshore fish communities using eDNA metabarcoding

Larson, Wes NOAA; Maselko, Jacek NOAA ABL; Barry, Pat UAF/NOAA; Dokai, Willie UAF

Symposium: eDNA - an increasingly useful tool for survey and monitoring

eDNA analysis is a powerful method for assessing biodiversity but studies in high latitude marine environments are still relatively rare. Here, we used eDNA metabarcoding to assess the influence of habitat and tidal stage on nearshore fish communities at nine sites near Juneau, AK. Habitat types were sand, eelgrass, and rock, and we sampled each of the nine sites at high and low tide. We then amplified eDNA with the MiFish 12S primer to obtain estimates of the fish communities at each site. We found that most sites shared a suite of common species such as salmon, herring, flatfish, gunnels, and sculpins. However, some species such as stickleback were only found in certain habitat types. Additionally, we found that commercially important pelagic species such as sablefish and cod were found sporadically but in high abundance when they were detected. Finally, we found that some low density species such as wolf eels and lingcod were rare across multiple habitat types. Tide did not appear to significantly influence community composition. This study represents an important first step for the eDNA program at NOAA ABL and the findings demonstrate that eDNA metabarcoding is an effective tool for assessing nearshore communities in Alaska.

Beyond the Seafood Market: The Role of Non-Market Values in Fisheries- and Ecosystem-Based Management

Lew, Dan NOAA

Symposium: Advancement of the use of human dimensions science in fishery management

Much of the focus in fisheries economics is on understanding market behavior and associated values that reflect consumer demand for seafood, commercial fishing and processor behavior, and economic impacts on fishing communities. Relatively less attention, in both fisheries economics research and in management, is given to non-market behavior and values associated with recreational fisheries and the public preferences for marine ecosystem services that are not reflected in explicit markets. However, recent efforts to move towards more inclusive system-level approaches to coastal and marine resource management suggest an understanding of non-market behavior and values for coastal and marine ecosystem services will be of increasing importance. In this presentation, I discuss the role that non-market values and valuation can play in fisheries management, and more generally within ecosystem-based management of coastal and marine ecosystems, and highlight some of the strengths and challenges associated with non-market valuation methods through a discussion of several Alaska-focused studies and the broader literature.

Short-term effects of wildfire on juvenile Chinook salmon in the Chena River

Meyer, Benjamin Kenai Watershed Forum; Schoen, Erik University of Alaska Fairbanks; Neuswanger, Jason South Fork Research; Volk, Carol South Fork Research; Wipfli, Mark U.S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, Institute of Arctic Biology; McKenna, Brian Tanana Chiefs Conference

Contributed papers: Climate Change Impacts on Aquatic Habitat

Wildfires are becoming more frequent and severe in Alaska's boreal forests, likely affecting salmon populations that support important fisheries. Yet the effects of changing wildfire regimes on the productivity of salmon and their habitats is not well understood, particularly within the context of other climate-driven changes. In the short term (0-5 years), wildfires can affect habitat quality for salmon through changes such as increases in water temperature, changes in invertebrate-based food supply, and increased erosion of fire scars. Erosion can lead to elevated sediment loads, turbidity, and fine drifting debris, which juvenile Chinook salmon spend energy pursuing instead of food prey. These changes may affect the survival of Chinook salmon directly, or indirectly through changes in juvenile growth rates, which can influence ocean survival due to size-selective mortality. The above-average fire year of 2019 in interior Alaska provided an opportunity to examine these questions when two large fires bisected the core juvenile Chinook salmon rearing habitat in the Chena River, a well-studied and accessible river that supports one of the largest populations of Chinook salmon within the Yukon River drainage. During 2020, we compared key habitat quality metrics between areas of the watershed influenced by these fires relative to nearby unburned areas. We deployed novel technologies including high-volume collection of drifting invertebrates, as well as rapid-assessment tools including digital image processing from underwater cameras and aerial drones to measure water quality parameters. We are incorporating these field data into a drift foraging model to estimate the sensitivity of juvenile feeding and growth rates to each factor, within the context of other climate-driven changes. Our approach ultimately aims to provide a basis for using remotely-sensed data to assess effects of wildfire on juvenile Chinook salmon rearing habitat at a landscape scale throughout Alaska.

Validation of qPCR assays to detect and distinguish congeneric salmonid species occurring in the Chena River

Mueller*, Daphne University of Alaska Fairbanks; Hill, Justin University of Alaska Fairbanks; López, Andrés University of Alaska Fairbanks, Museum of the North

Symposium: eDNA - an increasingly useful tool for survey and monitoring

Fish are a staple subsistence food for many Alaskan communities and monitoring their abundance is necessary, especially for species whose numbers are highly variable. Monitoring changes in the abundance of these populations is an important component of management practice. Fragments of DNA shed by organisms into their surroundings can be used as a monitoring tool through the application of molecular assays targeting this environmental DNA (eDNA). Analysis of eDNA as an aquatic monitoring tool has shown potential to reduce costs when compared with traditional methods. eDNA analysis presents challenges when differentiating closely related and sympatric fish species, such as members of the genus *Oncorhynchus* and *Coregonus*. We have replicated previously used quantitative polymerase chain reaction (qPCR) assays for Chinook salmon (*Oncorhynchus tshawaytscha*), chum salmon (*Oncorhynchus keta*), coho salmon (*Oncorhynchus kisutch*), least cisco (*Coregonus sardinella*), and humpback whitefish (*Coregonus pidschian*). For each assay, we optimized reaction conditions and tested species-specificity. Here we present the results of validation of these qPCR assays and assess limits of detection and quantification for each assay.

Collaborating with fishers to better understand commercial fishery risks, behaviors, and fishery dynamics

Murphy, Robert Alaska Pacific University; Harris, Bradley P. Fisheries, Aquatic Science, and Technology Laboratory, Alaska Pacific University; Wolf, Nathan Fisheries, Aquatic Science, and Technology Laboratory, Alaska Pacific University; Kroska, Anita Alaska Pacific University; Gray, Steven Michigan State University; Estabrooks, Austin Pollock Conservation Cooperative; Gauvin, John Alaska Seafood Cooperative

Symposium: Advancement of the use of human dimensions science in fishery management

Throughout the United States, managers are working to predict how fishers and fishing communities could be impacted by and respond to new regulations and management schemes before they are enacted. Grounded in a collaborative approach, we have worked with several large-scale fishing fleets in the North Pacific, U.S. to develop strategies for better understanding how future conditions could fundamentally change fishing effort and behavior. We used both previously established methods, such as Fuzzy Cognitive Mapping through the online program – Mental Modeler, and new tools to explore relationships in commercial fishery social-ecological systems. Our findings uncovered important linear and non-linear linkages between potential regulatory/environmental changes and the on-the-water decision-making of fishers, vessel/crew safety, company profits, and numerous other factors contributing to fishery health and sustainability. Overall, this work aims to develop methodologies for systematically incorporating the study of human behavior, perceptions, and knowledge into management.

Spatiotemporal and flow-related variability in invertebrate drift and Chinook Salmon growth in the Chena River, Alaska

Neuswanger, Jason South Fork Research; Schoen, Erik University of Alaska Fairbanks; Volk, Carol South Fork Research; Wipfli, Mark U.S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, Institute of Arctic Biology; Savereide, James Alaska Department of Fish and Game

Contributed papers: Climate Change Impacts on Aquatic Habitat

Climate change is likely to challenge Chinook Salmon in the Yukon River basin with increased water temperature and streamflow, which may affect population productivity via reduced juvenile prey consumption and growth. Because the optimal temperature for growth of juvenile Chinook is much lower when they are food-limited than when they are well-fed, anticipating the consequences of a warming climate requires understanding how streamflow affects conditions for prey consumption. Therefore, we aimed to understand Chinook growth in relation to spatiotemporal and streamflow-related variability in the concentrations of drifting prey and distracting debris in the Chena River basin, a major Chinook producer in interior Alaska. In 2019 and 2020, using a novel suction device with greater accuracy than conventional drift nets, we sampled invertebrate drift at least 52 times each at three sites spanning the primary Chinook rearing habitat and six times each at six additional sites throughout the basin. Total invertebrate drift concentration averaged 302 invertebrates/m3 across all samples, consisting overwhelmingly of Chironomid larvae. No conspicuous diel or seasonal trends were apparent. Drift concentrations increased with high flow, but the ratio of debris to prey also increased. Total invertebrate drift was similar throughout the watershed, including in tributaries. Air temperatures were unusually high and streamflows were unusually low during June and July 2019 across much of Alaska. Accordingly, juvenile Chinook Salmon grew faster during June and July than observed during prior years, but growth slowed during August and September, when prolonged heavy rains led to high streamflows, colder stream temperatures, and more debris in the drift. Fish grew slowly and were visibly less abundant during the cold, wet summer of 2020. Additional work will apply foraging models to evaluate habitat quality throughout the basin under current and future climatic conditions.

Juvenile Coho Salmon Growth in the Deshka River During the Record-Hot Summer of 2019

Nissen, Bradley US Fish and Wildlife Service; Rinella, Daniel US Fish and Wildlife Service; Benson, Anna-Marie US Fish and Wildlife Service; Shaftel, Rebecca Alaska Center for Conservation Science, UAA; Schoen, Erik University of Alaska Fairbanks

Contributed papers: Climate Change Impacts on Aquatic Habitat

The Deshka River is a major salmon-producing tributary to the Susitna River and, due to its flat topography and extensive wetland cover, water temperatures around the watershed routinely exceed the 18° C threshold commonly regarded as deleterious to rearing salmonids. Concurrent temperature logging and juvenile salmon monitoring over the summer of 2019 allowed us to model the relationship between a suite of variables reflecting thermal conditions in 72 stream reaches and the fork length of 5832 juvenile Coho Salmon during an especially hot and dry summer. Mean daily water temperature

(which ranged from 8.4 to 22.6° C) correlated positively with size and was by far the best predictor. Contrary to expectations, there was little evidence for diminished size at the warmest sites. Our model estimated that fish at the warmest sites were 9.1 mm longer than those at the coolest sites at the end of the growing season, which translated to weight differences of 1.1 and 2.3 g for age-0 and age-1 fish, respectively. These findings suggest that juvenile Coho Salmon in the Deshka River may be capable of growth at temperatures generally regarded as stressfully warm, although we cannot rule out other possible explanations like access to thermal refugia, size-selective mortality, or habitat partitioning. This project is ongoing, and subsequent years of sampling include measures of fish body composition, dietary ration, and recent growth (based on otolith daily growth increments) to directly assess the relationship between water temperature and salmon performance.

Including Alaskan Coastal Community Voices in the Marine Debris Conversation: Perspectives from St. Paul Island

Padula*, Veronica University of Alaska Fairbanks, College of Fisheries and Ocean Sciences; Beaudreau, Anne University of Alaska Fairbanks; Causey, Douglas University of Alaska Anchorage, Department of Biological Sciences

Symposium: Advancement of the use of human dimensions science in fishery management

Marine debris is ubiquitous in marine ecosystems and is an increasing threat to human health, economies, habitats, and wildlife. In the United States, action plans to address marine debris issues are being developed at local to national scales. While these proposals are a good first step, they do not necessarily reflect the needs of the island and coastal communities that are most heavily impacted, particularly those in Alaska. We need a collective approach to tackle the global issue of marine debris, support the creation of new knowledge through the inclusion of stakeholders, build capacity and good practice protocols, and celebrate achievements to stimulate further actions that protect the health of the oceans and marine resources. This project aims to take a step toward amplifying local knowledge of marine debris by documenting community members' historical and current observations of marine debris on and around St. Paul Island. We interviewed long-term residents of St. Paul Island to document their observations and perceptions about the types, amount, distribution, and impacts of marine debris over time and space. Research participants reported increases in plastic debris over time, particularly plastic bottles. Additionally, participants often identified fishing gear as a major type of marine debris found on shorelines and in the water. Overall, participants were generally aware that materials like plastics persist in the environment for multiple generations; nearly 80% expressed concern about impacts to subsistence resources, including entanglement and ingestion of plastic particles. Participants had varying views about the source of debris, but many noted the role of ocean currents in transporting debris from distant locations. This study will contribute to creation of locally relevant action plans to address the problem of marine debris and to development of educational materials to further community-wide understanding of marine debris.

Revealing stream attractiveness to stray hatchery Chum Salmon (*Oncorhynchus keta*) in Southeast Alaska

Payne*, Molly University of Alaska Fairbanks; Westley, Peter University of Alaska Fairbanks; Cunningham, Curry University of Alaska Fairbanks; McPhee, Megan University of Alaska Fairbanks

Contributed papers: Population and Community Dynamics

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 and describe a new project seeking to further elucidate patterns of dispersal within Southeast Alaska chum salmon metapopulations. I describe 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.

An Assessment of Relaxed Selection in Hatchery Populations of Pink and Coho Salmon by Analysis of Phenotypic Markers

Reich*, Alexandra University of Alaska Fairbanks; Adkison, Milo University of Alaska Fairbanks; McPhee, Megan University of Alaska Fairbanks; Waters, Charlie NOAA

Symposium: Genetics in Fisheries

The potential genetic risks to wild Pacific salmon stocks from hatchery salmon is an important consideration for fisheries management in Alaska. This project will investigate the domestication of hatchery salmon resulting from the relaxation of natural and/or sexual selection in the hatchery environment. To accomplish this, we will 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. Based on past research and established theory, we expect to observe larger kypes and humps in the wild male salmon and a higher relative egg mass and larger, more energy-dense eggs in the wild female salmon in comparison to the hatchery stocks. Divergence in wild and hatchery salmon phenotypes due to domestication selection would suggest underlying genetic differences.

Genetic characterization of a kokanee population from Copper Lake, Alaska

Rix*, Anna University of Alaska Fairbanks; López, Andrés University of Alaska Fairbanks, Museum of the North

Symposium: Genetics in Fisheries

The northernmost population of kokanee salmon inhabits Copper Lake within the boundaries of the Wrangell St Elias National Park. A stable population of kokanee salmon has been recorded in Copper Lake since the mid-1900s. Native kokanee salmon, like the ones in Copper Lake, are found from Japan to the western United States in river basins that support anadromous sockeye populations, however the kokanee salmon in Copper Lake are more northerly and larger than other populations. The population of kokanee salmon in Copper Lake is unique and little is known about its genetic diversity. For this study, kokanee and anadromous salmon carcasses were sampled following spawning. To examine the genetic differences between the anadromous sockeye and kokanee salmon in Copper Lake, high quality genomic DNA was extracted and used in double digest Restriction site Associated DNA sequencing (ddRAD-seq), a type of reduced representation sequencing. Data quality was ensured by trimming and removing reads failing length and base call quality criteria. Sequences were aligned to reference genomes from both coho and sockeye salmon. Single nucleotide polymorphisms (SNPs) and individual genotypes were identified within and between the populations. The populations of kokanee and anadromous salmon were distinct with lower nucleotide diversity in the kokanee salmon, but with many SNPs that were unique to the kokanee population. Little introgression is detected between the two groups. The extent of genetic differentiation between anadromous and kokanee salmon indicates that there are significant barriers to gene flow between the two populations despite breeding at approximately the same time. The divergence between kokanee and anadromous populations of Copper Lake appears to be older than that of other anadromous-kokanee pairs of sockeye salmon. Kokanee salmon represent unique diversity among sockeye salmon lineages and should be carefully monitored.

ADF&G Statewide Rockfish Initiative

Rumble, Janet Alaska Department of Fish and Game

Contributed papers: Marine topics

Over 40 species of rockfish inhabit Alaska waters and are extremely vulnerable to fishing pressure due to their slow growth, longevity, and late maturation. 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 rockfish fisheries in Alaska, addressing concerns over sustainable management have become a top priority for the Alaska Department of Fish and Game (ADF&G). Black (*Sebastes melanops*) and yelloweye rockfish (*S. ruberrimus*) comprise the largest proportion of rockfish species harvested in Alaska and have been prioritized in focusing research and improving management policies. The concerns about the status of rockfish in Alaska propelled ADF&G to initiate a statewide rockfish initiative (SRI, 2017–present) focused on developing long-term management strategies, focusing on yelloweye and black rockfish fisheries initially. 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. Sampling of sport and commercial rockfish removals for biological data, maturity work, age assessment, and comprehensive analyses of fishery removals, including modeling of fishing mortality levels to provide for sustainable fish populations, are integral components in developing long-term data driven management strategies for black and yelloweye rockfish in waters managed by the State of Alaska.

Collaborative Subsistence Harvest Monitoring Efforts to Sustain Kuskokwim River Salmon

Russell, Katie Orutsararmiut Native Council; Lowrey, Danielle ONC; Esquible, Janessa Orutsararmiut Native Council

Contributed papers: Misc. Topics

In the last decade, declines of Pacific salmon populations on the Kuskokwim River have brought challenges to salmon management and conservation efforts. Subsistence harvest of salmon is integrated into the way of life on the Kuskokwim River. Below average salmon returns have been unable to support the amount reasonably necessary for subsistence. Orutsararmiut Native Council (ONC) Partners for Fisheries Monitoring Program intends to sustain subsistence salmon fisheries on the Kuskokwim River and promote tribal capacity building through inseason and postseason harvest monitoring programs in collaboration with Alaska Department of Fish & Game (ADF&G), Yukon Delta National Wildlife Refuge (YDNWR), and Kuskokwim River Inter-Tribal Fish Commission (KRITFC). With the inception of these two programs over twenty years ago, ONC and KRITFC have been able to take on a greater role in conducting inseason harvest modeling estimates. These harvest estimates contribute to inseason fisheries management and are important as credible, near real-time indices of fish harvests. This demonstrates strong tribal presence in fisheries and the ability to influence management decisions while encouraging capacity building to preserve Kuskokwim salmon fisheries. These collaborative efforts have allowed ONC to collect critical data through age-sex-length (ASL) Chinook salmon sampling, Chinook salmon otolith and fecundity sampling, and by conducting harvest surveys, that are necessary for management of one of the largest subsistence salmon fisheries in Alaska. Collection of quantitative data are an important component in sustaining the livelihood of Alaskan Natives and maintaining salmon populations for future generations. These programs allow ONC to maintain long-standing contact with subsistence fishers and provide a meaningful opportunity for subsistence users to share their perspectives on the health of salmon runs, harvest needs, and personal impacts of management decisions. These connections also allow ONC to build strong relationships with community members of Bethel and gain a deeper understanding of salmon fisheries.

Analysis of the Cripple Creek Project: Assessing the Effects of Fish Passage Improvements and Habitat Enhancement

Samuel*, William University of Alaska Fairbanks (College of Fisheries and Ocean Sciences); Seitz, Andy University of Alaska Fairbanks; Fraley, Kevin Wildlife Conservation Society; Osborne, Mitch U.S. Fish and Wildlife Service

Contributed papers: Misc. Topics

The Cripple Creek Project restored fish habitat in a tributary of the Chena River near Fairbanks, Alaska as part of a multi-agency effort to improve and expand rearing habitat for juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) and other fishes. The restoration was completed in fall of 2020, including

multiple culvert replacements and habitat improvements such as riparian revegetation and channel modifications. In this undergraduate Senior Thesis project, fish catch and environmental data were analyzed and used to quantify the effectiveness of restoration efforts. Fish catch data gathered with minnow traps in Cripple Creek during the summers of 2018–2020 were analyzed for abundance, size trends, and relationships with environmental data including culvert replacements, with a focus on the two most abundant species, Lake Chub (*Couesius plumbeus*) and Longnose Sucker (*Catostomus catostomus*). Lake Chub abundance decreased significantly after a culvert replacement, which we believe to be caused by either oversaturation of sampling sites or high discharge in 2020. Mean Lake Chub length in the upper reaches of Cripple Creek was significantly longer than that in the lower sections, supporting the idea that the unrestored culverts acted as a barrier for smaller fishes. Linear regressions showed fish length and abundance were negatively correlated with discharge and water temperature. These analyses will help to inform managers about the efficacy of stream restoration efforts in Alaska and improve understandings of how small fishes use tributary habitats. This case study can be used for planning future restorations in the Chena River and beyond, and inform suburban watershed management for small stream fish habitat.

Perpetual Relationships in a Fractionalized World

Samuelson, Jonathan Kuskokwim River Inter Tribal Fish Commission

Symposium: Indigenous Fisheries in Alaska and Issues of Equity

For as long as the people of the Kuskokwim River have existed there have been Neqa. People and fish of this region are made to share the river as kin and cohabitants of the watershed. This presentation will explore the deep connection to the natural world, including salmon, maintained by Indigenous peoples of the Kuskokwim and highlight some of the challenges established through systems designed to take segmented approaches to education, management, and well-being.

How often do large Chinook salmon occupy offshore waters?

Seitz, Andy College of Fisheries and Ocean Sciences, University of Alaska Fairbanks; Courtney, Michael University of Alaska Fairbanks (College of Fisheries and Ocean Sciences)

Contributed papers: Marine topics

Chinook salmon are commonly thought to be primarily a coastal species, yet individuals are occasionally encountered offshore in waters of the continental slope and basin of the North Pacific Ocean. As a result, there is a general lack of consensus about the extent of offshore occupancy of this species, which precludes a full understanding of their preferred habitats and assessing potential impacts of human activities such as U.S. Navy exercises that occur in the North Pacific. To rectify this knowledge gap, we reconstructed individual movement trajectories of 61 Chinook salmon tagged with pop-up satellite tags in the Bering Sea (n = 21) and Gulf of Alaska (n = 40). Subsequently, we determined the proportion of tagged fish and aggregated fish days that demonstrated occupancy of shelf, slope, and ocean basin waters, and the U.S. Navy Gulf of Alaska Temporary Maritime Activities Area (TMAA). Of the tagged Chinook salmon, 97% occupied shelf, 54% occupied slope, 16% occupied ocean basin waters and 26% occupied the TMAA at some time while at-liberty. Of the aggregated fish-days (n = 4,105), 76% occurred

on the shelf, 17% occurred on the slope, 6% occurred in ocean basin waters and 5% in the TMAA. The tagged Chinook salmon affirm the idea that this species is primarily coastal, but occupancy of offshore waters was relatively common, particularly during assumed feeding over the continental slope and transiting across the basin to natal rivers in Southeast Alaska, British Columbia and the Pacific Northwest. The areas of occupation by Chinook salmon can be used in the analysis of potential impacts to Chinook salmon from Navy activities and to inform broader management decisions about their conservation.

How will Pacific salmon in Alaska respond to changes in streamflow and water temperature?

Sergeant*, Christopher College of Fisheries and Ocean Sciences, University of Alaska Fairbanks; Bellmore, Ryan USDA Forest Service Pacific Northwest Research Station; Bellmore, Rebecca Southeast Alaska Watershed Coalition; Falke, Jeffrey U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit

Contributed papers: Climate Change Impacts on Aquatic Habitat

Preserving habitat diversity across many watersheds supports healthy Pacific salmon populations by dampening the variability of inter-annual abundance. But, communities that depend on salmon for their way of life may only access one or two watersheds for harvest. It is important for these communities to better understand how future changes to streamflow and water temperature might impact salmon populations in their local rivers. In southern coastal Alaska, climate models predict continued warming air temperature, increased rainfall, diminishing snowpack, and rapid glacial recession. If realized, these trends will result in warmer water, lower summer discharge, and more frequent and severe winter floods. We constructed a mechanistic salmon life cycle model to simulate the cumulative effects of shifting streamflow and temperature regimes on freshwater life stages of Coho Salmon (*Oncorhynchus kisutch*). We hypothesized that daily fluctuations would reveal novel system behavior otherwise not observable across longer time scales. Our simulations suggest that salmon are most sensitive to acute events such as major flooding or drought. However, the influence of these extreme events disappears when flow and temperature data are aggregated into weekly and monthly time steps. These analyses demonstrate that citizen scientists collecting high resolution data are contributing greatly to our future understanding of Alaska's freshwater ecosystems. Our end goal is to create a user-friendly life cycle model for communities to explore the impact of various climate change scenarios on salmon.

Chinook salmon declines related to changes in freshwater conditions

Shaftel, Rebecca Alaska Center for Conservation Science, UAA; Jones, Leslie Alaska Department of Natural Resources; Schoen, Erik University of Alaska Fairbanks; Cunningham, Curry University of Alaska Fairbanks; Mauger, Sue Cook Inletkeeper; Rinella, Daniel US Fish and Wildlife Service; St. Saviour, Adam Alaska Department of Fish and Game

Film Festival: Coming Together for the Love of Fish!

Alaska Chinook salmon runs have decreased during the past decade, leading to fisheries closures and prolonged economic and cultural impacts to local communities. With Alaska's climate warming twice as

fast as the global average and experiencing changes in precipitation and streamflow, our research team set out to understand if changing conditions in fresh water — where salmon spawn and rear — played a role in recent declines of Chinook populations in the Cook Inlet basin of Southcentral Alaska. Our findings include that heavy rains in the late summer and fall — when adult salmon spawn and their eggs incubate — led to less production. However, above-average rainfall during juvenile rearing was beneficial. Productivity also declined substantially when stream temperatures rose above 64 degrees Fahrenheit for a week or longer during spawning. In particular, chinook productivity was very low during a period of poor freshwater conditions, including hot, dry summers and heavy fall rains, from 2003-2007. Salmon spawning during that five-year span produced 57% fewer surviving offspring than the previous long-term average, leading to population declines and fisheries closures in the late 2000s and early 2010s. Our 4-minute film summarizes these findings. The full paper: Watershed-scale Climate Influences Productivity of Chinook Salmon Populations Across Southcentral Alaska; by Leslie Jones, Erik Schoen, Rebecca Shaftel, Curry Cunningham, Sue Mauger, Daniel Rinella and Adam St. Saviour is available at: https://tinyurl.com/CookInletChinook.

What can we learn about hatchery-wild interactions from sparse, multi-generational Pink Salmon pedigrees?

Shedd, Kyle Alaska Department of Fish & Game; Gruenthal, Kristen Alaska Department of Fish and Game; Knudsen, E. Eric Prince William Sound Science Center; Templin, William Alaska Department of Fish & Game; Habicht, Christopher Alaska Department of Fish & Game

Symposium: Genetics in Fisheries

One of the primary objectives of the Alaska Hatchery Research Program (AHRP) is to determine the impact of straying hatchery Pink and Chum Salmon on the fitness of conspecific wild stocks. To address this objective, we have reconstructed multi-generational pedigrees of Pink Salmon from three streams in Prince William Sound to measure the relative reproductive success (RRS) of hatchery strays compared to natural-origin fish. While this work is ongoing, results to date indicate that stray hatchery-origin Pink Salmon have lower RRS than their natural-origin counterparts in the first generation. However, it is unclear what mechanism(s) may lead to the observed reductions in fitness and whether any of these patterns are heritable, persisting across generations. Here, we explore our multi-generational pedigrees to attempt to determine if the offspring of hatchery strays (F1) also exhibit fitness reductions when compared to the offspring of natural-origin Pink Salmon. In other words, do hatchery strays (F0) not only produce fewer offspring (F1) surviving to maturity but also fewer adult grandoffspring (F2). This work is complicated by the fact that our pedigrees are sparse, and thus not all parents or grandparents are known and neither are their origins – hatchery or natural. In addition, our current methodology does not support direct assignment of grandparentage (F0 -->F2); our multigeneration pedigrees require membership in all sampled generations (F0 --> F1 --> F2). Nevertheless, understanding how the introgression of hatchery strays into wild populations may be impacting wild fitness and productivity is critical to determining the long-term impacts of hatchery operations in PWS. Multigenerational pedigree reconstruction, despite its potential limitations in this system, is an important component in exploring questions surrounding the heritability of fitness reductions associated with straying.

Using Genomics to Improve Stock Structure Resolution of Lake Whitefish (*Coregonus clupeaformis*) in Lake Michigan

Shi, Yue College of Fisheries and Ocean Sciences, University of Alaska Fairbanks; Euclide, Peter Wisconsin Cooperative Fishery Research Unit, University of Wisconsin-Stevens Point; Homola, Jared Wisconsin Co-op Fishery Research Unit, University of Wisconsin-Stevens Point; McPhee, Megan University of Alaska Fairbanks; Larson, Wes NOAA

Symposium: Genetics in Fisheries

Sustainability of fisheries depends on an overall portfolio of population diversity. Fisheries management relies upon the ability of genetic stock identification (GSI) to differentiate stocks of interests. However, GSI can be difficult when spawning stocks are weakly differentiated. Previous efforts using 11 microsatellite loci identified six genetically distinct stocks of Lake Whitefish (*Coregonus clupeaformis*) within Lake Michigan with moderately high degree of correct stock self-assignment rate (average 75%). The main goal of this study is to assess how a population genomics framework could help delineate the genetic structure of Lake Whitefish in Lake Michigan and increase the assignment success of individuals to their location of origin. We genotyped 967 fishes collected from 17 spawning aggregates across Lake Michigan at 197,588 single-nucleotide polymorphisms (SNPs) using Rapture sequencing. Results of principal component analysis and ADMIXTURE largely support previous work using microsatellite loci, with additional fine-scale structure revealed in the southern Green Bay. Genome scans using pairwise FST across all population pairs showed the heterogeneity of population differentiation along the genome, with several genomic islands of differentiation identified. We will further (1) evaluate the assignment success and consistency of the six identified genetic stocks and how sample size and the number of SNPs will influence the assignment success; (2) investigate what genes are located within the identified genomic islands, and whether these islands are associated with structural variants, such as chromosomal inversions; These analyses will serve as a guidance to develop a robust GT-seq panel for Lake Whitefish in Lake Michigan. Our study highlights that the availability of genomic data makes it possible to incorporate adaptive genetic markers into fishery management plans in order to assess the capacity of populations to adapt to future environmental changes.

Detection of aquatic invasive species by metabarcoding of environmental DNA using multiple genetic markers

Simmons, Trey National Park Service; Menning, Damian US Geological Survey, Alaska Science Center; Talbot, Sandra US Geological Survey, Alaska Science Center

Symposium: eDNA - an increasingly useful tool for survey and monitoring

The use of environmental DNA (eDNA) to detect aquatic species without the need for physical observation has been growing rapidly over the last decade. eDNA persists in the environment and isolation from water samples is becoming routine. The application of sensitive molecular techniques to the analysis of eDNA allows for robust detection of species even when they are present at low abundance. These features of eDNA make it an attractive candidate for early detection of aquatic

invasive species (AIS), a growing ecological and economic threat in many parts of Alaska. We have been developing eDNA-based tools for the simultaneous detection of multiple AIS that are likely to arrive in Alaska in the near future. We are initially targeting 18 potential AIS, ranging from fish to crustaceans to plants. We have previously developed a metabarcoding assay for detection of multiple fish species, including potential invasive species and are now moving toward inclusion of additional species. The first of these is *Elodea*, an invasive aquatic plant that has recently begun to spread into water bodies across Alaska. To increase the specificity of detection of *Elodea*, we used multiple genetic markers, including 3 chloroplast markers (atpB-rbc, rps4, trnL-F) and one nuclear marker (5.8S). We have tested the assay using voucher specimens as well as replicate eDNA samples from 2 locations where *Elodea* was present, and also applied it to samples collected from 58 lakes as part of traditional rake surveys for *Elodea*. We successfully detected *Elodea* from both locations where it was known to be present, and did not detect it in any of the other samples. However, the signal strength we obtained suggests that the method may not yet be sufficiently sensitive to reliably detect *Elodea* when it is present at low abundance. By combining genetic markers targeting different taxa into a single metabarcoding assay, we will be able to simultaneously detect a variety of AIS in a single eDNA sample.

Sensitivity of salmon spawning habitat to instream wood loss and flood disturbance in southeast Alaska

Sloat, Matthew Wild Salmon Center; Reeves, Gordon USFS

Symposium: Incorporating adaptive management planning in aquatic habitat conservation efforts in AK

We estimate the influence of instream wood on Pacific salmon spawning habitat under contemporary and projected increases in mean annual flood magnitudes expected with climate-change for Tongass National Forest, Alaska streams. We parameterized predictive models of reach-average D50 with field data and digital elevation models to determine basin-scale spawning gravel availability for six combinations of flood magnitude and wood occurrence. Our simulations suggest that streambed coarsening as the result of wood loss from rivers could have a much greater effect on salmon spawning habitat availability than would increases in mean annual flood magnitudes of up to 30%. Our analysis provides a useful basin-scale perspective on the potential impact of wood loss (or benefit of wood restoration) for salmon spawning gravel availability relative to the effects of climate-induced increases in flood disturbance in southeast Alaska.

Contrasting terrestrial organic matter assimilation by fishes from two Beaufort Sea regions

Stanek, Ashley United States Geological Survey, Alaska Science Center; von Biela, Vanessa United States Geological Survey, Alaska Science Center; Laske, Sarah United States Geological Survey, Alaska Science Center; Dunton, Kenneth University of Texas at Austin, Marine Science Institute

Contributed papers: Marine topics

Fisheries in Alaska's Arctic are predominantly subsistence and include diadromous Dolly Varden (*Salvelinus malma*) and whitefish (*Coregonus spp*.). Most subsistence fishes feed in nearshore waters

with existing or planned natural resource development. We know little about how different energy pathways support subsistence fisheries and higher trophic-level predators for management information needs. Energy sources are likely complex as carbon and nutrient sources from the Beaufort Sea and terrestrial landscapes coalesce in the nearshore. We examined the relative importance of landscape features in structuring lagoon food webs by contrasting the use of terrestrial organic matter between a region with higher freshwater discharge and marine connectivity (central region near Prudhoe Bay) to a region with lower freshwater discharge and marine connectivity (eastern region near Kaktovik). We hypothesized that the use of terrestrial organic matter by fishes would be greater in the region with higher freshwater discharge. We estimated species-specific and community niche metrics to compare the trophic diversity between the two regions based on the stable isotopic composition (δ13C and δ15N) of fish muscle tissue collected during summer 2017–2019. Fishes captured in the protected lagoons of the eastern region had distinct isotopic niches, while those captured in the exposed central region had high overlap of isotopic niches. It appeared that protection from wind mixing in the eastern region allowed for micro-habitats with varying degrees of terrestrial organic matter assimilated by different fish species; in contrast, wind-mixing of organic matter resulted in homogenous sources of primary production in the exposed central region. These results suggest that our hypothesis was too simplistic and likely overlooked the role of wind-driven mixing on food web structure. Fundamental differences in the food web structure between regions suggests protection from wind-mixing maintains distinct isotopic niches and may provide the fish community with a greater resilience to bottom-up shifts in primary production.

Arctic Grayling (*Thymallus arcticus*) distribution and movement in a boreal headwater tributary

Strohm-Klobucar, Deanna Institute of Arctic Biology, University of Alaska Fairbanks; Falke, Jeffrey U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit; Stone, Jeremiah Institute of Arctic Biology, University of Alaska Fairbanks

Symposium: Incorporating adaptive management planning in aquatic habitat conservation efforts in AK

Climate change impacts are particularly prevalent in the Arctic where warming is occurring at an accelerated rate. Shifts in air temperature and precipitation patterns have altered hydrology that directly impact fish species with life history strategies synchronized with long-term timing of seasonal flow events. Juvenile and adult Arctic Grayling (*Thymallus arcticus*) rely on environmental cues to access seasonal rearing habitats (e.g., headwaters) necessary to complete their life histories. Headwater streams are strongly linked to the surrounding landscape, thus susceptible to climatic variability (e.g., snowmelt timing, precipitation) and disturbance (e.g., fire, flood, drought), and comprise 70-80% of the total stream length within a river network. With the imminent threat of climate change, the goal of our study is to better understand the extent tributary watersheds contribute to fish population viability and structure in boreal riverscapes via long-term population monitoring. During the summer 2020 pilot season, we determined the longitudinal distribution, quantified size and age structure, and evaluated movement and migratory patterns of Arctic Grayling in the Caribou-Poker Creek Watershed (CPCW), a small tributary to the Chatanika River. A temporary PIT antenna was installed near the tributary-mainstem confluence, and we sampled approximated 10 stream-km using hook and line sampling. We

PIT tagged, measured, weighed, and conducted bioelectrical impedance analysis (a measure of body condition) on all fish, and otoliths were collected from a subset of size classes to quantify age and growth. We caught 175 grayling that ranged from 69-380 mm FL, and recaptured 16 individuals. Fish were observed passing over the PIT antenna as late as October 2020. We will build upon these preliminary data via continued monitoring to evaluate relationships among movement patterns, demographics, and hydrology within the CPCW. Our study will advance the current understanding of Arctic Grayling life history and habitat use, allowing managers to adapt and prioritize habitat conservation needs.

An Examination of Burbot Life History Strategies through use of Radiotelemetry

Stuby, Lisa Alaska Department of Fish and Game

Contributed papers: Misc. Topics

A radiotelemetry study of burbot (*Lota lota*) conducted during 2017-2019 in the Yukon River mainstem in Alaska has expanded our understanding of their life history strategies. The primary objectives were to describe seasonal distributions and migration timing, identify probable spawning areas, and estimate mean travel distances. Overall, most radio-tagged burbot did not travel far from their tagging locations, although approximately 18% travelled over 500 miles and 5 travelled over 1,000 miles. A statistically significantly linear relationship was noted between length and travel distance. River burbot are known to spawn during late January/early February and it appears that they spawn throughout most of the mainstem Yukon River. Spawning concentrations were especially noted between the Rampart Rapids above Tanana to Fort Yukon. Burbot showed the largest net upstream travel during the time of spawning. Radiotagged burbot started to move to their spawning locations during late October-mid January (average 14 Dec). Post-spawning movement occurred during April-May (average 8 May). Summer movement was noted, but not to the degree noted by pre-and-post spawning fish. Twenty-four burbot were captured at a spawning location near the Dalton Highway during 5-7 Feb 2020. Half of these had post-spawning characteristics and the other half had not spawned. Overall, Yukon River burbot showed varying fidelities to their spawning and oversummering areas and yearly travel distances and migration directions.

Development and testing of environmental DNA assay for Arctic Lamprey *Lethenteron camtschaticum*

Thompson*, Anthony University of Alaska Fairbanks; López, Andrés University of Alaska Fairbanks, Museum of the North

Symposium: eDNA - an increasingly useful tool for survey and monitoring

Arctic Lamprey, *Lethenteron camtschaticum*, are an anadromous and parasitic species of lamprey with a broad distribution at medium and high latitudes in the Northern Hemisphere. Currently, little is known about the species abundance and distribution of *L. camtschaticum* in Alaskan rivers. *Lethenteron camtschaticum* plays an important ecological role in Alaska and supports subsistence fishing and a small

scale test commercial harvest on the Yukon River. Environmental DNA (eDNA) analysis is a non-invasive technique that can be used to detect and quantify DNA present in a system. Because of its relative cost-effectiveness and minimal disturbance to the system, eDNA sampling has the potential to be very beneficial to fisheries management. In this study, we designed and tested several assays targeting short regions from mitochondrial DNA of *L. camtschaticum* eDNA primers. We evaluated species-specificity, determined optimal conditions for replication via polymerase chain reaction (PCR) and quantitative polymerase chain reaction (qPCR), and determined the limits of detection and the limits of quantification for the assay. We tested the assay's performance against eDNA sampled from several Alaskan rivers.

Using population genomics to validate models of recruitment for the Gulf of Mexico pink shrimp, *Farfantepenaeus duorarum*

Timm, Laura University of Alaska Fairbanks; Jackson, Tom NOAA NMFS Southeast Fisheries Science Center; Browder, Joan NOAA NMFS Southeast Fisheries Science Center; Bracken-Grissom, Heather Florida International University

Symposium: Genetics in Fisheries

The Gulf of Mexico pink shrimp, *Farfantepenaeus duorarum*, supports large fisheries in the United States and Mexico, with nearly 7,000 tons harvested from the Gulf of Mexico in 2016. Given the commercial importance of this fishery, management is critical: in 1997, the pink shrimp fishery in the southern Gulf of Mexico was declared collapsed and mitigation strategies went into effect, with recovery efforts lasting over a decade. Fisheries management can be informed and improved through a better understanding of how factors associated with early life history impact genetic diversity and population structure in the recruited population. *Farfantepenaeus duorarum* are short-lived, but highly fecund, and display high variability in recruitment patterns. To date, modeling the impacts of ecological, physical, and behavioral factors on juvenile settlement has focused on recruitment of larval individuals of *F. duorarum* to nursery grounds in Florida Bay. Generating reduced representation library sequencing data for *F. duorarum* from spawning aggregations and nursery habitats around the Florida Peninsula, we take a population genomics approach to validate a larval recruitment model with this independent, molecular data type. We also articulate testable hypotheses stemming from these models of larval transport and evaluate support for each, elucidating the relationships between early life history and population structure. Our research represents the first and most molecular data-rich study of population genomics in *F. duorarum* in the Gulf of Mexico and reveals population differentiation within the study region. This approach, coupled with published models of larval transport, allows us to make management-informative inferences about the impacts of spawning location and recruitment patterns on intraspecific genetic diversity. Such inferences improve our understanding of the roles of non-genetic factors in generating and maintaining diversity in a commercially important shrimp.

Vulnerabilities and resilience in Yukon River salmon-dependent communities: how human dimensions research can inform and improve fisheries management

Trainor, Alida Alaska Department of Fish and Game, Division of Subsistence

Symposium: Advancement of the use of human dimensions science in fishery management

This presentation explores the ways in which Yukon River communities have experienced extreme declines of Chinook and fall chum salmon through two applied research applications. In the first project, combined statistical analysis and ethnographic methods explore patterns and trends in the Yukon River salmon fishery at the drainage, regional, community, and household levels. Taking managers own harvest database for the first time and pairing it with ethnographic methods allowing researchers to explore the human dimensions of a 30-year data set that has documented significant changes in abundance, harvest, and fishing patterns. The second example relied on social network analysis to investigate the unique role of sharing within Yukon River communities and the ways in which sharing is disrupted by various factors, such as low abundance and management restrictions. Results from these two studies draw attention to the reality that changes in a fishery are felt by more than just the fishermen. The well-being and livelihoods of individual fishermen and their families, fishing communities, and Alaskan regions are impacted by disruptions to traditional fishing patterns. In times of such rapid change, successful management of a fishery depends on understanding how fishermen and communities experience and respond to management decisions. Human dimensions research is a critical aspect of informed, supported, and successful decision-making in sustainable fisheries management.

Two-Eyed Seeing in Fisheries Management: Science, Indigenous Knowledge and Partnership

Tyance Hassell, Karli Fisheries, Aquatic Science, and Technology Laboratory, Alaska Pacific University; Harris, Bradley P. Fisheries, Aquatic Science, and Technology Laboratory, Alaska Pacific University; Murphy, Robert Fisheries, Aquatic Science, and Technology Laboratory, Alaska Pacific University; Wolf, Nathan Fisheries, Aquatic Science, and Technology Laboratory, Alaska Pacific University; Carothers, Courtney College of Oceans and Fisheries Science, University of Alaska Fairbanks

Symposium: Advancement of the use of human dimensions science in fishery management

This paper describes the collaborative process undertaken by interdisciplinary project partners, comprised of the Alaska Native Village of Nanwalek, the Fisheries, Aquatic Science, and Technology Laboratory at Alaska Pacific University, the Chugach Regional Resources Commission, and the Alaska Department of Fish and Game, to develop and address community driven concerns regarding fisheries science and management. We discuss our framework for collaboration, the critical methodology of storytelling, the reflexive positioning of the principal Indigenous researcher, and the Two-Eyed Seeing framework as a model for co-advancement within fisheries science and community self-determination. We utilized various environmental monitoring tools to assist both tribal entities and agency officials in managing the English Bay Lakes sockeye salmon fishery, provide recommendations on processes for building and sustaining collaborative partnerships with Alaska Native communities, and demonstrate the importance to meaningfully include Indigenous knowledge through tribal representation in research and fishery management. Through the creation of a Fishery Working Group, we aimed to improve information on the biological parameters controlling sockeye production in the system by utilizing the Two-Eyed Seeing approach to research. As a result, tribal entities and fishery managers are better able

to address barriers to inclusive fisheries management and make informed decisions to ensure that subsistence and escapement needs are met for future generations.

Premature mortality observations among Alaska's Pacific Salmon during record heat and drought in 2019

von Biela, Vanessa United States Geological Survey, Alaska Science Center; Sergeant, Christopher University of Alaska Fairbanks; Carey, Michael U.S. Geological Survey, Alaska Science Center; Liller, Zachary Alaska Department of Fish and Game; Russell, Charles Alaska Department of Fish and Game; Quinn-Davidson, Stephanie Tanana Chiefs; Rand, Pete Prince William Sound Science Center; Westley, Peter University of Alaska Fairbanks; and Zimmerman, Chris U.S. Geological Survey, Alaska Science Center

Symposium: Incorporating adaptive management planning in aquatic habitat conservation efforts in AK

This paper reports the first-documented widespread Pacific salmon mortality event in Alaska by compiling opportunistic observations of Pacific salmon (genus *Oncorhynchus*) premature mortality during record-breaking air temperatures and prolonged drought in summer 2019. Although Alaska is held up as a place of ideal freshwater habitat, here we share salmon observations during challenging environmental conditions that are expected to persist due to rapid climate change and predictions of more frequent heatwaves. The authors recognize 2019 as unusual given the number of premature mortality observations and variety of the locations and species involved. A total of 110 geographically widespread observations of premature mortality were collected among Pink Salmon (O. gorbuscha), Sockeye Salmon (*O. nerka*), Chum Salmon (*O. keta*), Chinook Salmon (*O. tshawytscha*), and Coho Salmon (*O. kisutch*). A separate dataset of observations from Prince William Sound (PWS) stream surveys revealed low water and limited evidence of spawning success in 87% of rain-driven streams (n=30), but only 52% of snow-driven streams (n=65) and 18% of glacier-driven streams (n=11). The juxtaposition of widespread synchronous mortality observations connected to atmospheric conditions and stream-to-stream variation in sensitivity to atmospheric conditions in PWS epitomizes the challenge of predicting Pacific salmon response to climate change in Alaska.

Tribal Fisheries in Metlakatla, Alaska

Wagner*, Tazia University of Alaska Fairbanks; Wagner, Louie Metlakatla Indian Community

Symposium: Indigenous Fisheries in Alaska and Issues of Equity

Annette Islands Reserve is unique in the fact that it is the only reservation in Alaska and the largest federal tribal run fishery in the United States. Fishing is integral to many Indigenous peoples of Alaska, and in Southeast AK, ooligan is not only a food source, but a sacred fish to all Indigenous peoples of Southeast AK. Louie and Tazia will speak on AIR's unique status and on the Unuk River ooligan.

Incorporating risk-tolerance scenarios in model predictions to support decision-making in stream restoration planning

Walther*, Eric University of Alaska Fairbanks

Contributed papers: Misc. Topics

The fragmentation of aquatic habitat is an on-going threat to the persistence of freshwater fishes. Stream restoration efforts are limited by knowledge gaps in fish distribution that might preclude from consideration locations that would benefit most from restoration. Species distribution models are useful tools for predicting locations of suitable habitats and decision makers would benefit from understanding how predictive model outputs vary across different risk-tolerance scenarios, i.e., willingness to accept false positives or false negatives in model predictions. In this study, we used generalized linear mixed models to predict the range of occurrence for coho salmon, steelhead trout, and chum salmon in the Chehalis River basin, Washington, across multiple risk-tolerance scenarios, compared these predicted ranges to the currently described distribution used in restoration planning, and quantified the amount of habitat inaccessible due to anthropogenic barriers. The difference in amount of habitat within predicted range of occurrence among risk-tolerance scenarios ranged from 60-74% among species. The predicted range of occurrence was similar or greater than the currently described distribution for coho salmon (1-109% change) and chum salmon (58-171% change). In contrast, our model identified a -14% to 34% change in steelhead trout distribution compared to the amount currently being included in restoration planning, indicating that the current method underestimates range of occurrence. Additionally, anthropogenic barriers impeded access to 19-31% of the predicted coho range, 11-19% of the predicted steelhead range, and 4-13% of the predicted chum range. Modelling species distributions at multiple risk-tolerance scenarios practitioners to weigh the ecological benefits and budgetary constraints when considering locations for restoration. The effective prioritization of restoration actions requires managers to recognize that not all actions will benefit each species of interest equally and that the likelihood of benefiting any given species varies among locations.

Heterogeneous genetic basis of age at maturity in salmonid fishes

Waters, Charlie University of Washington; Clemento, Anthony University of California, Santa Cruz; Aykanat, Tutku University of Helsinki, Finland; Garza, John Carlos University of California, Santa Cruz; Naish, Kerry University of Washington; Narum, Shawn Columbia River Inter-Tribal Fish Commission; Primmer, Craig National Oceanic and Atmospheric Administration

Symposium: Genetics in Fisheries

Understanding the genetic basis of repeated evolution of the same phenotype across taxa is a fundamental aim in evolutionary biology and has applications in conservation and management. However, the extent to which interspecific life-history trait polymorphisms share evolutionary pathways remains under-explored. We address this gap by studying the genetic basis of a key life-history trait, age at maturity, in four species of Pacific salmonids (genus *Oncorhynchus*) that exhibit intra- and interspecific variation in this trait – Chinook Salmon, Coho Salmon, Sockeye Salmon, and Steelhead Trout. We tested for associations in all four species between age at maturity and two genome regions, six6 and vgll3, that are strongly associated with the same trait in Atlantic Salmon (*Salmo salar*). We also conducted a genome-wide association analysis in Steelhead to assess whether additional regions were associated with this trait. We found the genetic basis of age at maturity to be heterogeneous across salmonid species. Significant associations between six6 and age at maturity were observed in two of the four species, Sockeye and Steelhead, with the association in Steelhead being particularly strong in both

sexes (p = 4.46×10-9 after adjusting for genomic inflation). However, no significant associations were detected between age at maturity and the vgll3 genome region in any of the species, despite its strong association with the same trait in Atlantic Salmon. We discuss possible explanations for the heterogeneous nature of the genetic architecture of this key life-history trait, as well as the implications of our findings for conservation and management.

Tribal Governance in Fisheries: Yukon River Inter-Tribal Fish Commission

Woods*, Brooke Tanana Chiefs Conference; Yukon River Inter-Tribal Fish Commission; Black, Jessica UAF, Department of Alaska Native Studies and Rural Development and Tribal Governance; Quinn-Davidson, Stephanie Tanana Chiefs; Stevens, Carrie UAF Tribal Governance Program

Symposium: Indigenous Fisheries in Alaska and Issues of Equity

The Yukon River Intertribal Fish Commission was formed in 2015 when tribes came together: “to commit to conserve, restore, and provide for tribal use of fisheries based on indigenous knowledge systems, and scientific principles. Founded on tribal unity, we form the Yukon River Inter-Tribal Fish Commission for the health and well-being of our tribal members, our future generations, and all Alaskans and Canadians who rely upon the health of the fisheries.’’ Of primary importance, the YRITFC works to unify Tribal Governments the Yukon River drainage for the purposes of stewarding salmon now and into the future. The YRITFC’s strength is the foundation of shared values amongst Tribal Leaders and fishermen from diverse Alaska Native cultures and communities: Self-Governance, Respect, Responsibility & Care. The YRITFC is actively building upon shared values as it engages in tribal stewardship planning, where Tribal leaders are recognizing traditional salmon protocols as they envision the health and well-being of salmon, and salmon peoples, now and into the future. This presentation will highlight the foundations of the YRITFC, Constitution and governance, stewardship planning process, and key learning outcomes to enact Tribal Governance for the well-being of salmon, and salmon peoples, now and into the future.